CORDELIO POWER

FLAT CREEK SOLAR

Permit Application No. 23-00054

§ 1100-2.8 Exhibit 7

Noise and Vibration

Contents

Tables

Figures

Appendices

Acronym List

ANSI	American National Standards Institute
ASA	Acoustical Society of America
ATV	all-terrain vehicle
BMP	best management practice
Cmet	meteorological correction
dBA	A-weighted decibel
EEI Noise Guide	Electric Power Plant Environmental Noise Guide
Epsilon	Epsilon Associates, Inc.
FHWA	Federal Highway Administration
G	ground absorption factor
GIS	Geographic Information System
HDD	horizontal directional drilling
Hz	Hertz
INCE	Institute of Noise Control Engineering
ISO	International Organization for Standardization
Leq	equivalent continuous sound level
M	meters
NED	National Elevation Dataset
NEMA	National Electrical Manufacturers Association
NYCRR	New York Codes, Rules and Regulations
ORES	Office of Renewable Energy Siting and Electric Transmission
POI	point of interconnection
RCNM	Roadway Construction Noise Model
ROW	right-of-way
SAE	Standard Automotive Engineering
WHO	World Health Organization

Glossary of Terms

Applicant:	Flat Creek Solar NY LLC, the entity seeking a siting permit for the Facility from the Office of Renewable Energy Siting (ORES) under Article VIII of the New York State Public Service Law.
Facility:	Flat Creek Solar, a 300 MW solar generating facility located in the Towns of Root and Canajoharie, NY. The proposed Facility components to be constructed for the generation, collection, and distribution of energy for Flat Creek Solar include solar panel modules, electrical collection system, collection substation, point of interconnection (POI) switchyard, access roads, laydown/staging areas, and other ancillary facilities.
Facility Site:	The participating parcels encompassing Facility components, which totals approximately 3,794 acres in the Towns of Canajoharie and Root, Montgomery County, New York (Figure 2-1).
Study Area:	The Study Area for the Facility includes a radius of five miles around the Facility Site boundary, unless otherwise noted for a specific resource study or Exhibit. The 5-mile Study Area encompasses approximately 108,667 acres, inclusive of the approximately 3,794-acre Facility Site.
Limits of Disturbance (LOD):	The area to which temporary construction impacts will occur, totaling approximately 1,637 acres.

Exhibit 7: Noise and Vibration

This Exhibit provides information required in accordance with the requirements of §1100-2.8 of the Article VIII Regulations.

7(a) Name of Preparer

This Exhibit includes a detailed analysis of the potential sound impacts associated with the construction and operation of the Facility. Exhibit 7 was prepared by Mr. Ryan Callahan of Epsilon Associates, Inc. (Epsilon). Mr. Callahan has over seventeen years of experience in the areas of community noise impacts, sound level data collection, and analyses. He is a full member of the Institute of Noise Control Engineering (INCE). The modeling performed by Epsilon for the Facility is sufficiently conservative in predicting sound impacts and includes all proposed inverters and the substation operating at their maximum capacities.

7(b) Noise Design Goals for the Facility

The design goals for the Facility are described below.

1. A maximum noise limit of forty-five (45) A-weighted decibel (dBA) equivalent continuous sound level (L_{eq}) (8-hour), at the outside of any existing non-participating residence, and fifty-five (55) dBA Leq (8-hour) at the outside of any existing participating residence. The Facility meets these limits as discussed in Section 7(l).
2. A maximum noise limit of forty (40) dBA Leq (1-hour) at the outside of any existing non-participating residence from the collector substation equipment. The Facility meets these limits as discussed in Section 7(l).
3. A prohibition on producing any audible prominent tones, as defined by using the constant level differences listed under American National Standards Institute (ANSI) S12.9-2005/Part 4 Annex C (sounds with tonal content), at the outside of any existing non-participating residence. Should a prominent tone occur, the broadband overall (dBA) noise level at the evaluated non-participating position shall be increased by 5 dBA for evaluation of compliance with subparagraph (i) and (ii) of this paragraph. The inverter currently under consideration for this Facility produces a tone at 3150 Hz and 6300 Hz. Even with the 5 dBA penalty, the Facility meets these limits as discussed in Section 7(e).

4. A maximum noise limit of fifty-five (55) dBA Leq (8-hour), short-term equivalent continuous average sound level from the facility across any portion of a non-participating property except for portions delineated as NYS-regulated wetlands pursuant to section 1100-1.3(e) of this Part and utility ROW to be demonstrated with modeled sound contours drawings and discrete sound levels at worst-case locations. No penalties for prominent tones will be added in this assessment. The Facility meets these limits as discussed in Sections 7(k) and 7(l).

7(c) Radius of Evaluation

All sensitive receptors within at least a one thousand five hundred (1,500) foot radius from any noise source (e.g., substation transformer(s), inverters) proposed for the Facility or within the thirty (30) dBA noise contour, whichever is greater, were included in the analysis. Each of these sensitive receptors are visible in Figure 7-1.

A cumulative analysis requires noise modeling to include any solar facility and substation existing and proposed by the time of filing the application, and any existing sensitive receptors within a 3,000-foot radius from any noise source proposed for this facility, or within the 30 dBA noise contour, whichever is greater. There are no other solar facilities within 3,000 feet of a Flat Creek Solar source or within the 30 dBA contour; therefore, no cumulative analysis is required.

7(d) Modeling Standards, Input Parameters, and Assumptions

1. An estimate of the noise level to be produced by the Facility was made using the following assumptions.

    i. Future sound levels associated with the Facility were predicted using the CadnaA noise calculation software developed by DataKustik GmbH. This software implements the International Organization for Standardization (ISO) 9613-2 international standard for sound propagation (Acoustics - Attenuation of sound during propagation outdoors - Part 2: General method of calculation) for full octave bands from 31.5 Hertz (Hz) to 8000 Hz. As per ISO 9613-2, all calculations 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. In addition, the ISO 9613-2 standard assumes all receptors are downwind of every sound source simultaneously. No meteorological correction (Cmet) was added to the results, pursuant to 16 New York Codes, Rules and Regulations (NYCRR) § 1100-2.8(d).

Elevation contours for the modeling domain were directly 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.

In addition to modeling at discrete points, sound levels were also modeled throughout a large grid of receptor points, each spaced 10 meters (M) apart to allow for the generation of sound level isolines. Tabular results and sound level isolines were calculated and generated for the entire study area.

1. All sound sources were assumed to be operating simultaneously at maximum sound power levels. The collector substation was also modeled by itself operating at maximum sound power level.

The sound power levels for each source used in the modeling are discussed below.

Inverters

The sound level analysis includes 79 inverters as provided to Epsilon by the Applicant. The source location coordinates, ground elevations, and heights above ground are summarized in Appendix 7-1. One inverter manufacturer (SMA) was evaluated for this analysis. All 79 of the proposed inverters will be SMA inverters with identical specifications. The inverter manufacturer, power ratings, and dimensions examined for this assessment are presented below in Table 7-1.

Table 7-1. Power Inverter Analyzed for Sound Level Assessment

Manufacturer	Inverter Model	Maximum Electrical Output [kVA]	Dimensions [WxHxD] [m]
SMA Solar Tech.	SC4xxx-UP	4,600	2.815x2.318x1.588

Broadband and one-third octave band sound power levels for the SMA inverter operating under typical (daylight) conditions were provided by the Applicant[1]. The octave band sound power levels are presented in Table 7-2.

Table 7-2. Inverter Octave Band Sound Power Levels

Inverter Type	Broadband Sound Power Level [dBA]	Sound Power Levels per Octave-Band Center Frequency1 [Hz]								
		31.52	63	125	250	500	1k	2k	4k	8k
		dB	dB	dB	dB	dB	dB	dB	dB	dB
SMA SC4xxx-UP	93	90	91	92	92	87	85	83	88	82

[1]Octave band sound powers were calculated from third-octave band sound powers at higher precision than reported values.

Collector Substation

In addition to the inverters, there will be a collector substation located within the Facility Site. The modeling inputs of the transformers -- coordinates, ground elevation, and height above ground -- are summarized in Appendix 7-1. Two step-up transformers rated at up to 100 MVA and 200 MVA are proposed for the collector substation. Epsilon estimated octave-band sound power levels using methods outlined in Table 4.5 of the Electric Power Plant Environmental Noise Guide[2] (EEI Noise Guide) and assuming the transformers will each have a National Electrical Manufacturers Association (NEMA)[3] rating of 74 dBA. Sound Power Levels of Transformers. Table 7-3 summarizes the sound power level data used in the modeling.

1 SMA Document - Sound Power Levels Third Octave Band Frequencies SC-UP
2 Bolt Beranek and Newman Inc. (1984). *Electric Power Plant Environmental Noise Guide* (2nd ed.). Edison Electric Institute.
3 National Electrical Manufacturers Association

Table 7-3. Collector Substation Transformer Sound Power Levels—per unit

Maximum Rating [MVA]	Broadband Sound Power Level [dBA]	Sound Power Levels per Octave-Band Center Frequency [Hz]								
		31.5	63	125	250	500	1k	2k	4k	8k
		dB	dB	dB	dB	dB	dB	dB	dB	dB
125	94	90	96	98	93	93	87	82	77	70
250	94	91	97	99	94	94	88	83	78	71

2. For all modeling scenarios, the ground absorption factor (G) was set to 0.5 for the ground and 0 for water bodies.

3. A temperature of 10 degrees Celsius and 70% relative humidity was used to calculate atmospheric absorption for the ISO 9613-2 model. These parameters were selected to minimize atmospheric attenuation in the 500 Hz and 1000 Hz octave bands where the human ear is most sensitive, and thus provide conservative results.

4. The maximum dBA Leq (1-hour or 8-hour) sound pressure levels, and the maximum linear/unweighted/Z dB (Leq 1-hour) sound pressure levels from the thirty-one and a half (31.5) Hz up to the eight thousand (8,000) Hz full-octave band, at all sensitive sound receptors within the radius of evaluation are discussed and presented in Section 7(I).

5. The maximum dBA Leq sound pressure levels (Leq (8-hour)) at the most critically impacted external property boundary lines of the facility site (e.g., non-participating boundary lines) are shown in Figure 7-2.

6. A summary of the number of receptors exposed to sound levels greater than thirty-five (35) dBA from the Facility are shown in Table 7-4 grouped in one (1)-dBA bins. Refer to Appendix 7-5: Collector Substation Modeled Sound Levels for information regarding noise levels at receptors from the collector substation equipment.

Table 7-4. Receptors Modeled at 35 dBA or Greater – Unmitigated Total Facility Sound L_{eq} (8-hour)

Modeled Leq Sound Level [dBA]	# of Receptors		
	Residential		Other
	Participating	Non-Participating	Non-Participating
41	0	0	1
40	0	2	2
39	1	6	2
38	0	5	2
37	0	6	3
36	2	10	8
35	0	19	21

7. Sound level contours as specified in 16 NYCRR § 1100-2.8(k) are shown in Figure 7-2.

8. This subsection is applicable to wind projects and the Facility is a solar facility.

9. The CadnaA model used a one and a half (1.5) meter assessment point above the ground. No uncertainty factor was added to the modeled results.

7(e) Prominent Tones

ANSI/ Acoustical Society of America (ASA) S12.9-2013 Part 3, Annex B, section B.1 (informative) presents a procedure for testing for the presence of a prominent discrete tone. According to the standard, a prominent discrete tone is identified as present if the time-average sound pressure level in the one-third octave band of interest exceeds the arithmetic average of the time-average sound pressure level for the two adjacent one-third octave bands by any of the following constant level differences:

- 15 dB in low-frequency one-third-octave bands (from 25 up to 125 Hz);
- 8 dB in middle-frequency one-third-octave bands (from 160 up to 400 Hz); or,
- 5 dB in high-frequency one-third-octave bands (from 500 up to 10,000 Hz).

Sound pressure level calculations using the CadnaA modeling software which incorporates the ISO 9613-2:1996 propagation standard is limited to octave band sound levels; therefore, a quantitative evaluation of one-third octave band sound levels using the modeling software was not possible. Instead, one-third octave band sound pressure levels due to the closest inverters were calculated at the nearest five (5) potentially impacted and representative receptor locations (both non-participants and participants) using equations accounting for hemispherical radiation and atmospheric absorption. The results presented in Table 7-5 show that received sound pressure levels due to the closest inverters at each of these locations are predicted to result in a prominent discrete tone at the 3150 Hz as well as the 6300 Hz one-third octave bands. Due to this prominent tone, a 5 dBA penalty is being applied on a short-term broadband basis to non-participating residential receptors. Despite the observed prominent tone and subsequent broadband penalty, short term broadband sound pressure levels do not exceed 45 dBA at any non-participating residences without any mitigation measures.

One-third octave band sound power levels for the collector substation transformer were not supplied by the vendor for the substation equipment; therefore, a quantitative evaluation of one-third octave band sound using the spreadsheet modeling approach was not possible. For this reason, the substation transformer was assumed to be tonal and prominent by default.

Table 7-5. Tonal Analysis & Compliance Evaluation: Modeled Sound Pressure Levels from Inverters

Receptor ID	One-Third Octave Band Center Frequency (Hz)	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
	Tonal Limit	-	15	15	15	15	15	15	15	8	8	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	-
538	Received Sound Pressure Level (dB)	37	40	37	38	40	39	37	43	36	38	40	41	37	34	32	34	31	30	30	27	31	38	19	18	25	11	3
	Average Sound Pressure Level of Contiguous Bands	-	37	39	38	39	38	41	36	40	38	40	38	37	34	34	31	32	30	29	30	32	25	28	22	14	14	-
	Difference between Sound Pressure Level and Contiguous Average	-	4	-3	0	1	1	-4	6	-5	1	0	3	0	-1	-2	3	-1	0	1	-3	-2	13	-8	-4	11	-3	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	-
570	Received Sound Pressure Level (dB)	36	39	35	37	38	38	35	41	34	37	38	40	36	32	31	33	29	29	28	25	29	36	17	15	22	7	0
	Average Sound Pressure Level of Contiguous Bands	-	36	38	37	37	37	40	35	39	36	38	37	36	33	33	30	31	29	27	29	31	23	26	19	11	11	-
	Difference between Sound Pressure Level and Contiguous Average	-	4	-3	0	1	1	-4	6	-5	1	0	3	0	-1	-2	3	-1	0	1	-3	-2	13	-8	-4	11	-4	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	-

Table 7-5. Tonal Analysis & Compliance Evaluation: Modeled Sound Pressure Levels from Inverters

Receptor ID	One-Third Octave Band Center Frequency (Hz)	25	31.5	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000
	Tonal Limit	-	15	15	15	15	15	15	15	8	8	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	-
571	Received Sound Pressure Level (dB)	34	38	34	36	37	36	34	40	33	35	37	38	34	31	29	31	28	27	27	24	27	34	15	12	18	2	0
	Average Sound Pressure Level of Contiguous Bands	-	34	37	35	36	35	38	33	38	35	37	35	34	32	31	28	29	27	25	27	29	21	23	16	7	9	-
	Difference between Sound Pressure Level and Contiguous Average	-	4	-3	0	1	1	-4	6	-5	1	0	3	0	-1	-2	3	-1	0	1	-3	-2	13	-8	-4	11	-7	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	-
572	Received Sound Pressure Level (dB)	34	38	34	36	37	36	34	40	33	35	37	38	34	31	29	31	28	27	27	24	27	33	14	12	18	2	0
	Average Sound Pressure Level of Contiguous Bands	-	34	37	35	36	35	38	33	38	35	37	35	34	32	31	28	29	27	25	27	29	21	23	16	7	9	-
	Difference between Sound Pressure Level and Contiguous Average	-	4	-3	0	1	1	-4	6	-5	1	0	3	0	-1	-2	3	-1	0	1	-3	-2	13	-8	-4	11	-7	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	-
472	Received Sound Pressure Level (dB)	35	38	34	36	37	37	34	40	33	36	37	38	34	31	29	32	28	27	27	24	27	34	15	13	19	3	0

Table 7-5. Tonal Analysis & Compliance Evaluation: Modeled Sound Pressure Levels from Inverters

Recept or ID	One-Third Octave Band Center Frequency (Hz)	25	**31.5**	40	50	**63**	80	100	**125**	160	200	**250**	315	400	**500**	630	800	**1000**	1250	1600	**2000**	2500	3150	**4000**	5000	6300	**8000**	10000
	Tonal Limit	-	15	15	15	15	15	15	15	8	8	8	8	8	5	5	5	5	5	5	5	5	5	5	5	5	5	-
	Average Sound Pressure Level of Contiguous Bands	-	34	37	36	36	36	38	34	38	35	37	36	35	32	31	29	29	27	26	27	29	21	23	17	8	9	-
	Difference between Sound Pressure Level and Contiguous Average	-	4	-3	0	1	1	-4	6	-5	1	0	3	0	-1	-2	3	-1	0	1	-3	-2	13	-8	-4	11	-6	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Yes	-

7(f) Low Frequency Noise for Wind Facilities

The proposed Facility is a solar facility; therefore, this section is not applicable.

7(g) Infrasound for Wind Facilities

The proposed Facility is a solar facility; therefore, this section is not applicable.

7(h) Sound Study Area

Figure 7-1 is a map of the sound study area showing the location of sensitive sound receptors in relation to the facility (including the collector substation and the point of interconnect).

1. In total, 764 discrete receptors were analyzed for the Facility. These include 560 residential receptors, eleven (11) public receptors, and 193 other receptors. Of the 764 receptors, ten (10) were participating, and 754 were non-participating, as defined in Section 7(h)(3) below. Of the 560 residential receptors, ten (10) were participating and 550 were non-participating. Of the eleven (11) public receptors, eleven (11) were non-participating. Of the 193 other receptors, 193 were non-participating. A detailed listing of all receptors including receptor ID, latitude/longitude, elevation, participation status, and receptor category is included as Appendix 7-2.
2. All residences were included as sensitive sound receptors regardless of participation in the facility (e.g., participating, potentially participating, and non-participating residences) or occupancy (e.g., year-round, seasonal use)
3. Only properties that have a signed contract with the applicant prior to the date of filing the application were identified as "participating." Other properties were designated as "non-participating."

7(i) Evaluation of Ambient Pre-Construction Baseline Noise Conditions

An evaluation of ambient pre-construction baseline noise conditions was conducted for eight (8) days by using the L_{90} statistical and the L_{eq} energy-based noise descriptors, and by following the recommendations included in ANSI/ASA S3/SC 1.100 -2014-ANSI/ASA S12.100-2014 American National Standard entitled Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas. The full details of the ambient pre-construction sound level measurement program are found in Appendix 7-3.

7(j) Evaluation of Future Noise Levels during Construction

1. Future construction noise modeling was performed for the main phases of construction and from activities at the proposed laydown area using the ISO 9613-2:1996 sound propagation standard as implemented in the CadnaA software package. Reference sound source information was obtained from either Epsilon's consulting files or the Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM).

2. The majority of the construction activity will occur around each of the inverter locations, at the location of the collector substation, at each of the solar arrays, and at the locations where Horizontal Directional Drilling (HDD) will occur. By its very nature, construction activity moves around the Facility Site. Full construction activity will generally occur at one location at a time, although there will be some overlap at adjacent construction locations for maximum efficiency. For modeling conservatism, it was assumed that full activity was occurring at the closest locations to their surrounding receptors. There are generally five phases of construction for a solar energy project – site preparation and grading, trenching and road construction, HDD, equipment installation, and commissioning. Table 7- 6 presents the equipment sound levels for the louder pieces of construction equipment expected to be used at this site along with their phase of construction.

Table 7-6. Sound Levels for Noise Sources Included in Construction Modeling

Phase	Equipment	Sound Level at 50 feet [dBA]
Site Preparation & Grading	Grader (174 hp)	85
Site Preparation & Grading	Rubber Tired Loader (164 hp)	85
Site Preparation & Grading	Scraper (313 hp)	89
Site Preparation & Grading	Water Truck (189 hp)	80
Site Preparation & Grading	Generator Set	81
Trenching & Road Construction	(2) Excavator (168 hp)	85
Trenching & Road Construction	Bar Trencher (600 hp)	89
Trenching & Road Construction	Grader (174 hp)	85
Trenching & Road Construction	Water Truck (189 hp)	80
Trenching & Road Construction	Trencher (63 hp)	83
Trenching & Road Construction	Rubber Tired Loader (164 hp)	85

Table 7-6. Sound Levels for Noise Sources Included in Construction Modeling

Phase	Equipment	Sound Level at 50 feet [dBA]
Trenching & Road Construction	Generator Set	81
Equipment Installation	Crane (399 hp)	83
Equipment Installation	Crane (165 hp)	83
Equipment Installation	(2) Forklift (145 hp)	85
Equipment Installation	(2) Vermeer PD10 Pile Driver	84
Equipment Installation	(6) Pickup Truck/ all-terrain vehicle (ATV)	55
Equipment Installation	(2) Water Truck (189 hp)	80
Equipment Installation	(2) Generator Set	81
HDD Entry	Excavator (168 hp)	85
HDD Entry	Auger Drill Rig	85
HDD Entry	Pickup Truck/ATV	55
Commissioning	(2) Pickup Truck/ATV	55

3. The operational modeling requirements included Sections 7(d)(1)(i) through 7(d)(1)(iii), and 7(d)(3) of this Exhibit were also used for modeling of construction noise.

4. Worst-case sound levels from construction activity are shown using sound level contours in Figure 7-4 and sound levels at the most critically impacted receptors are shown in Tables 7-7 to 7-8.

Construction sound levels at all residential receptors have been calculated. The results are shown as maximum 1-second Leq sound levels with all pieces of equipment for each phase operating at the locations. These results overstate expected real-world results, because under actual construction conditions, not all pieces of equipment will be operating at the same exact time, and the highest sound levels from every piece of equipment will not tend to occur at the same time as was assumed in the modeling. Additionally, sound levels were modeled in the vicinity of the closest HDD entry point to a receptor. Modeling assumed simultaneous construction activity at this HDD entry point. HDD work and commissioning work was modeled at this HDD entry point.

Construction Modeling Results

The cumulative impacts from site preparation and grading work, trenching and road construction work, equipment installation work, commissioning work, and HDD was calculated with the CadnaA model for all receptors. The loudest phase of construction within this area will be equipment installation work. A sound contour figure of equipment installation work occurring simultaneously across the Facility Site is presented in Figure 7-4. The highest sound level at a non-participating receptor within this area is 72 dBA during site preparation and grading (Receptor #676), 74 dBA during trenching and road construction (Receptor #676), 73 dBA during equipment installation (Receptor #676), and 38 dBA during commissioning (Receptor #676). Modeling results of construction sound levels for the ten (10) closest receptors to any construction work are summarized in Table 7-7, including worst-case simultaneous construction sound levels. Additionally, modeling results of construction sound levels for all receptors are found in Appendix 7-6.

Table 7-7. Construction Noise Modeling Results [dBA]

Receptor ID	Distance [m]	Participation Status	Site Preparation & Grading	Trenching & Road Construction	Equipment Installation	Commis-sioning	Worst -Case Total
676	69	Non-Participating	72	74	73	38	78
755	424	Non-Participating	59	61	60	25	65
565	622	Non-Participating	57	58	58	23	62
564	655	Non-Participating	56	58	58	23	62
562	833	Non-Participating	56	57	57	22	61
563	909	Non-Participating	55	57	56	21	61
560	918	Non-Participating	56	57	57	22	61

Table 7-7. Construction Noise Modeling Results [dBA]

Receptor ID	Distance [m]	Participation Status	Site Preparation & Grading	Trenching & Road Construction	Equipment Installation	Commis-sioning	Worst -Case Total
313	976	Non-Participating	51	53	52	17	57
310	981	Non-Participating	55	57	56	21	61
684	983	Non-Participating	52	53	53	18	57

The cumulative impacts from HDD work and commissioning work were calculated with the CadnaA model for the ten closest receptors to construction activities. The loudest phase of construction within this area will be HDD work. A sound contour figure of HDD work occurring at the HDD entry point is presented in Figure 7-5.

The highest sound level at a non-participating receptor is 78 dBA during the HDD (Receptor #763) and 53 dBA during the commissioning (Receptor #763). Modeling results of the construction sound levels within this area are summarized in Table 7-8.

Table 7-8. HDD Noise Modeling Results [dBA]

Receptor ID	Distance [m]	Participation Status	Site Preparation & Grading	Trenching & Road Construction	Equipment Installation	Commis-sioning	Worst -Case Total
763	17	Participating	56	58	78	53	78
477	63	Non-Participating	56	58	66	39	67
478	217	Non-Participating	55	57	55	28	60
480	254	Non-Participating	56	58	53	27	61

Table 7-8. HDD Noise Modeling Results [dBA]

Receptor ID	Distance [m]	Participation Status	Site Preparation & Grading	Trenching & Road Construction	Equipment Installation	Commis-sioning	Worst-Case Total
481	278	Non-Participating	56	58	53	26	61
482	323	Non-Participating	56	58	51	24	61
479	339	Non-Participating	56	58	51	24	61
472	394	Non-Participating	58	59	50	23	62
475	436	Non-Participating	57	59	49	22	61
474	441	Non-Participating	58	59	49	22	62

Construction Noise Conclusions

Noise due to construction is an unavoidable outcome of construction. The five major construction phases for this are: site preparation and grading, trenching and road construction, equipment installation, HDD, and commissioning. Most of the construction will occur at significant distances to sensitive receptors, and therefore noise from most phases of construction is not expected to result in impacts to sensitive receptors. There are a few instances where construction will be fairly close to residences (#676, #763, & #477) and coordination with these neighbors may be warranted. Construction noise will be minimized through the use of best management practices (BMP). A description of the BMPs planned for the Facility are provided in Section 7n.

7(k) Sound Levels in Graphical Format

1. Figure 7-2 presents future L_{eq} (8-hour) sound contour lines showing expected sound levels during worst-case operation of the Facility's inverters plus the collector substation using the methodology described above. Figure 7-3 presents future L_{eq} (1-hour) sound contour drawings showing expected sound levels during worst-case operation of the Facility's collector substation-only using the methodology described above.
2. The sound contour maps include all sensitive sound receptors, boundary lines (differentiating participating and non-participating), and all Facility noise sources.
3. Sound contours are rendered until the thirty (30) dBA noise contour is reached, in one (1)-dBA steps, with sound contour multiples of five (5) dBA differentiated.
4. Full-size hard copy maps (22" x 34") of these figures in 1:12,000 scale will be submitted to the Office.

7(l) Sound Levels in Tabular Format

A tabular comparison between the maximum sound impacts and any design goals, noise limits, and local requirements for the facility, and the degree of compliance at all sensitive sound receptors and at the most impacted non-participating boundary lines within the Study Area is presented below.

All sources operating--inverters plus the collector substation

Future L_{eq} (8-hour) sound levels during worst-case operation of the Facility's inverters plus the collector substation have been calculated using the methodology described above. Appendix 7-4 provides the predicted dBA and full octave band frequency (31.5 Hz to 8,000 Hz) sound pressure levels at all sensitive receptors. The results are sorted by receptor ID and sorted by A-weighted sound level high to low, and then are broken down by receptor type (Residential, Public and School) and participation (Non-Participating and Participating). In total, there are eight tables from Table 7-4.4.1a to Table 7-4.4.1h found in Appendix 7-4.

The highest sound levels at residential receptors, under this scenario are:

- Non-participating receptor = 40 dBA
- Participating receptor = 39 dBA

These sound levels are below the design goals of 45 dBA for a non-participating residence and 55 dBA for a participating residence, and also meet the adjusted design goal at the non-participating residences due to the observed prominent tone and subsequent 5 dBA penalty. Thus, the Facility complies with these design goals.

Sound level contours generated from the modeling grid are presented in an overview figure, (Figure 7-4), accompanied by a series of inset maps that provide a higher level of detail at all modeled receptors. As these figures show, sound levels will be below the design goal of 55 dBA at all non-participating property lines that are not utility Right of Ways. The highest sound level due to the Facility at a non-participating property line occurs, near Inverter 35. This property line boundary is predicted to be 51 dBA.

Collector Substation Only

Future L_{eq} (1-hour) sound levels during worst-case operation of the Facility's collector substation only have been calculated using the methodology described above. Appendix 7-5 provides the predicted A-weighted (dBA) and full octave band frequency (31.5 Hz to 8,000 Hz) sound pressure levels at all residences. The results are sorted by receptor ID and sorted by A-weighted sound level from high to low for all Non-Participating residences. In total, there are four tables from Table 7-5.1a to 7-5.1d found in Appendix 7-5. Sound level contours from the collector substation generated from the modeling grid are presented in Figure 7-3.

The highest sound level under this scenario is 35 dBA at a non-participating residence. This sound level meets the design goal of 40 dBA, after applying the 5 dBA tonal penalty, which is assumed for a substation transformer.

Local Requirements

The Towns of Root and Canajoharie have both adopted local laws regulating solar energy facilities such as the proposed Facility.

The Town of Root local law states “Noise levels from the solar energy system will comply with the noise limits for solar energy facilities contained in the New York Office of Renewable Energy Siting regulations at 16 NYCRR 1100 by following the limits laid out by 16 NYCRR 1100-2.8” (Town of Root §7.2(U)). The Facility complies with this requirement.

The Town of Root also includes a provision that states “A sound study providing details of the proposed noise that may be generated by inverter fans, or other noise-generating equipment that may be included in the project, including actual readings of existing daytime and nighttime ambient noise at the boundary of the participating properties; the sound study shall predict the potential increase in noise from the project over the existing ambient noise levels. The 1-hour average noise generated from the Solar Energy Equipment/System shall not exceed a noise level, as measured at the outside wall of any non-participating residence or occupied community building, based on current (45dBA) or future recommendations from the World Health Organization. Noise levels must not have adverse or unreasonable impacts on surrounding homes or properties.” Town of Root, Section 7.1(F)(15).

The Town of Canajoharie also includes a similar provision “Noise levels from the Solar Energy Equipment/System must be shown to not have adverse or unreasonable noise impacts on surrounding homes or other sensitive receptors. The 1-hour average noise generated from the Solar Energy Equipment/System shall not exceed a noise level, as measured at the outside wall of any non-participating residence or occupied community building, based on current (45dBA) or future recommendations from the World Health Organization. Equipment and component manufactures’ noise ratings may be submitted to demonstrated compliance. The Town may require Operating Sound Pressure Level measurements from a reasonable number of sampled locations at the perimeter of the Solar Energy Equipment/System in order to demonstrate compliance. Existing background noise levels shall be taken before there is any modeling of projected noise levels.” Town of Canajoharie, Section 8(B)(5)(j).

These sections of the local laws are procedural and therefore are not otherwise addressed in this Exhibit, as procedural laws are supplanted by the ORES regulations. Section 7.1(F)(15) and

Section 8(B)(5)(j) specify that for projects that apply for site plan approval under the local law, the methodology for the sound study to be conducted.

With respect to the Town of Root, the local procedural provision requires assessment of the ambient sound at all receptors and model changes over the background sound levels. The study must provide "actual readings of existing daytime and nighttime ambient noise at the boundary of the participating properties" and that "the sound study shall predict the potential increase in noise from the project over the existing ambient noise levels." Counter to this procedural requirement, the Applicant conducted the sound study consistent with the methodology specified in the Article VIII regulations at 16 NYCRR §1100-2.8. The remainder of the provision in Section 7.1(F)(15) creates a standard for the 1 hour average noise, which the Facility complies.

As to the requirement in both local laws for the Facility to adhere to future World Health Organization requirements, this requirement does not provide a clear, measurable standard with which the Applicant can demonstrate compliance. In addition to the fact that the WHO Guidelines for Community Noise (1999) and the more recent WHO Guidance on Environmental Noise (2022) do not provide sound pressure level recommendations applicable to solar facilities, requiring compliance with future WHO recommendations would be technically impossible to implement since noise limits are taken into consideration in facility design and it would be impossible at the design stage to account for unknown future WHO recommendations on noise limits. The numerical noise limit is also inconsistent with the noise limit requirement set by ORES. To the extent that this is applied to the Facility, the Applicant is seeking a waiver, and more details on the waiver request are contained in Exhibit 24.

The Applicant anticipates that, by designing the Facility to meet the ORES permitting noise standards, the Facility will be in compliance with the general requirement that noise levels must not have adverse or unreasonable impacts on surrounding homes or properties. The ORES limits include, among others, a maximum noise limit of forty-five (45) dBA Leq (8-hour) at the outside of any existing non-participating residence and a maximum noise limit of 40dBA Leq (1-hour) at the outside of any non-participating residence from the collector substation equipment. This Exhibit establishes that the Facility complies with these requirements.

7(m) Community Noise Impacts

(1) Hearing Loss for the Public

The Facility's potential to result in hearing loss to the public was evaluated against the 1999 "Guidelines for Community Noise" published by the World Health Organization (WHO). According to the WHO Guidelines, the threshold for hearing impairment is 70 dBA L_{eq} (24-hour), 110 dBA (Lmax, fast) or 120/140 dBA (peak at the ear) for children/adults. Operational noise will always be less than 55 dBA L_{eq} (8-hour) at any residence. This is well below the 70 dBA limit. The only construction noise source for this Facility capable of exceeding the WHO hearing impairment threshold is blasting, but no blasting is anticipated for this Facility. All other construction activities will produce noise below the WHO hearing impairment threshold. Therefore, no Facility activities have the potential to cause hearing loss to the public.

(2) Potential for Structural Damage

At this time, blasting is not planned as part of construction for the Facility. If blasting becomes necessary, a detailed discussion of the potential to produce structural damage on any existing proximal buildings is found in Exhibit 10. *Geology, Seismology and Soils*.

7(n) Noise Abatement Measures for Construction Activities

(1) Noise Abatement Measures

Noise due to construction is an unavoidable outcome of construction. The Applicant will communicate with the public to notify them of the beginning of construction of the Facility. Most of the construction will occur at significant distances to sensitive receptors, and therefore noise from most phases of construction is not expected to result in impacts to sensitive receptors. Nonetheless construction noise will be minimized through the use of BMPs such as those listed below.

- Blasting is not anticipated at this site. However, if necessary, blasting will be limited to daytime hours and conducted in accordance with an approved Blasting Plan.
- Post installation and HDD will be limited to daytime hours.
- Pursuant to 16 NYCRR § 6.2(k)(1), utilizing construction equipment fitted with exhaust systems and mufflers that have the lowest associated noise whenever those features are

available and maintaining functioning mufflers on all transportation and construction machinery.

- Maintaining equipment and surface irregularities on construction sites to prevent unnecessary noise.
- Configuring, to the extent feasible, the construction in a manner that keeps loud equipment and activities as far as possible from noise-sensitive locations.
- Using back-up alarms with a minimum increment above the background noise level to satisfy the performance requirements of the current revisions of Standard Automotive Engineering (SAE) J994 and OSHA requirements.
- Developing a staging plan that establishes equipment and material staging areas away from sensitive receptors when feasible.
- Contractors shall use approved haul routes to minimize noise at residential and other sensitive noise receptors.

(2) Complaint Management Plan

Complaints due to construction or operation of the Facility have the potential to occur. If complaints do arise, the Complaint Management Plan provides information on how and when the public may file a complaint, as well as an identification of any procedures or protocols that may be unique to each phase of the Facility or complaint type. In accordance with 16 NYCRR § 6.2(a), (c) and (d), the Applicant will provide notice of commencement of construction and completion of construction. The notice will include the procedure and contact information for registering a complaint. To minimize noise impacts during construction, the Applicant will comply with 16 NYCRR § 6.2(k)(2), which includes responding to noise and vibration complaints according to the complaint resolution protocol approved by the Office.

7(o) Noise Abatement Measures for Facility Design and Operation

(1) Wind Facilities

The proposed Facility is a solar facility; therefore, this section is not applicable.

(2) Solar Facilities

Adverse noise impacts will be avoided or minimized through careful siting of Facility components. The noise emitted by a solar project is limited to daytime periods only for the majority of the components. No mitigation is required at any of the central inverters across the Facility or the substation under the current design.

7(p) Software Input Parameters, Assumptions, and Associated Data for Computer Noise Modeling

1. Geographic Information System (GIS) files used for the computer noise modeling, including noise source and receptor locations and heights, topography, final grading, boundary lines, and participating status have been submitted to ORES by digital means.
2. The CadnaA computer noise modeling files have been submitted to the Office by digital/electronic means.
3. Site plan and elevation details of substations, as related to the location of all relevant noise sources are presented in Appendix 7-7.
4. The proposed Facility is a solar Facility; therefore, this section is not applicable.
5. The locations of all noise sources identified with GIS coordinates are presented in Appendix 7-1. The digital GIS files with that information have been submitted to the Office.
6. Sound information from the manufacturers for all noise sources included in this analysis are presented in Appendix 7-8.

7(q) Miscellaneous

1. A glossary of terminology, definitions, and abbreviations used throughout this Exhibit is included as Appendix 7-9.
2. All information has been reported in tabular, spreadsheet compatible or graphical format as follows:
    i. All data reported in tabular format has been clearly identified to include headers and summary footer rows. Headers include identification of the information contained in each column, such as noise descriptors; weighting; duration of

evaluation; time of the day; whether the value is a maximum or average value and the corresponding time frame of evaluation.

ii. Table titles identify whether the tabular or graphical information corresponds to the "unmitigated" or "mitigated" results, if any mitigation measures are evaluated, and “cumulative” or “non-cumulative” for cumulative noise assessments.

iii. Columns or rows with results related to a specific design goal, noise limit or local requirement, identify the requirement to which the information relates.

iv. Tables include rows at the bottom summarizing the results to report maximum and minimum values of the information contained in the columns. Sound receptors are separated in different tables according to their use (e.g., participating residences, non-participating residences, schools, parks, cemeteries, historic places, etc.).

v. This Exhibit reports estimates of the absolute number of sensitive sound receptors that will be exposed to noise levels that exceed any design goal or noise limit (in total as well as grouped in one (1)-dBA bins).

References

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American National Standard ANSI/ASA S1.11-2004 (R2009). 2004. *Specification for Octave-Band and Fractional-Octave-Band Analog and Digital Filters.*

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American National Standard ANSI S12.9-1992/Part 2 (R2018). 1992. *Quantities and Procedures for Description and Measurement of Environmental Sound. Part 2: Measurement of long-term, wide-area sound.*

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American National Standard ANSI/ASA S3/SC1.100-2014 & ANSI/ASA S12.100-2014. 2014. *Methods to Define and Measure the Residual Sound in Protected Natural and Quiet Residential Areas.*

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International Standard ISO 9613-2. 1996. *Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method of calculation.*

U.S. DOT, Federal Highway Administration (FHWA). 2006. *FHWA Roadway Construction Noise Model User's Guide.*

Village of Mayfield. (1998). Local Law No. 2 of 1998, titled "A Local Law Regulating Noise within the Village of Mayfield."

World Health Organization (WHO). 1999. *Guidelines for Community Noise.*