GARNET ENERGY CENTER

Case No. 20-F-0043

1001.19 Exhibit 19

Noise and Vibration

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Exhibit 19: Noise and Vibration

This Exhibit will track the requirements of Stipulation 19, dated March 5, 2021 and therefore, the requirements of 16 New York Codes, Rules and Regulations (NYCRR) § 1001.19.

This Exhibit includes a detailed analysis of the potential sound impacts associated with the construction and operation of the Project. Exhibit 19 was prepared by Christopher Hoyt and Robert O'Neal of Epsilon Associates, Inc. (Epsilon). Mr. Hoyt has over seven years of experience in the areas of community noise impacts, meteorological data collection, and analyses, while Mr. O'Neal has over thirty years of experience. Mr. O'Neal is Board Certified by the Institute of Noise Control Engineering (INCE) in Noise Control Engineering and is a Certified Consulting Meteorologist (CCM) by the American Meteorological Society. The modeling performed by Epsilon for the Project is sufficiently conservative in predicting sound impacts and includes all proposed inverters, battery storage, and the collector substation operating simultaneously at their maximum capacities.

The Project has been designed so that no sensitive non-participating receptors, as defined below, will exceed 45 dBA Leq_{1hr}, and no sensitive participating receptors will exceed 50 dBA Leq_{1hr}. In addition, sound levels from the collector substation will not exceed 35 dBA at a non-participating receptor assuming it is tonal in nature. These proposed design goals, based upon the limits adopted by the Siting Board in previous certificates, minimize any potential adverse impacts associated with the sound produced by the construction and operation of the Project to the maximum extent practicable.

19(a) Sensitive Sound Receptor Map

A map of the Noise Impact Study Area showing the location of sensitive sound receptors and participating receptors within one mile of the Facility components which generate noise (i.e., inverters, battery energy storage systems (BESS), collector substation, etc.) is provided in Figure 19-1 of Appendix 19-1. The distance of one mile is further than the requirements in Stipulation 19(a) (1,500 feet of the Project Area or extent of the 30 dBA sound contour line). Sensitive sound receptors include residences (participating, non-participating, full-time, and seasonal[1]), outdoor public facilities and areas, schools, hospitals, care centers, libraries, places of worship, cemeteries, public parks and public campgrounds, summer camps, and any historic resources

[1] Seasonal residences include cabins and hunting camps (identified by property tax codes) and any other seasonal residences with septic systems/running water.

listed or eligible for listing on the State or National Register of Historic Places, and Federal and New York State lands.

In total, 606[2] discrete receptors were analyzed for the Project. These include 596 year-round residences, 1 seasonal residence, 7 unknown structures, and 2 other structures. The "unknown" structures were conservatively assumed to be residences. Of the 606 receptors, 16 were participating, and 590 were non-participating. Of the 596 year-round residences, 15 were participating and 581 were non-participating. The one seasonal residence was non-participating. Of the 7 unknown structures, one was participating and 6 were non-participating.

A desktop analysis using aerial imagery and tax classification codes from the New York Office of Real Property database was used to develop and classify sensitive sound receptors within one mile of proposed inverter and substation sites. Field verification was completed to verify the findings of the desktop analysis. If access for field verification was not possible, and aerial imagery could not provide an obvious classification of a structure (i.e., residential vs. non-residential), then the structure was classified as "unknown" and considered a sensitive sound receptor. The receptor ID, tax code, participation status, type of receptor, receptor location coordinates, ground elevations, and heights above ground are summarized in Table 19-1.1 of Appendix 19-1.

19(b) Evaluation of Ambient Pre-Construction Baseline Noise Conditions at Receptors

An evaluation of ambient pre-construction baseline noise conditions, including A-weighted/dBA sound levels and prominent discrete (pure) tones, was conducted at representative potentially impacted noise receptors using actual measurement data. The measurements were made in both winter and summer, and during day and night as a function of time and frequency using a suitably calibrated sound level meter (SLM), and octave band frequency spectrum analyzer. The ambient pre-construction baseline sound levels were filtered to exclude seasonal and intermittent noise.

Both A-weighted and one-third octave band sound level data were collected day and night at five locations in the study area. The winter "leaf-off" measurements were conducted from November 10-19, 2020 and the summer "leaf-on" measurements were conducted from August 11-19, 2020. The ambient pre-construction baseline sound levels were filtered to exclude seasonal and intermittent noise by using a high-frequency natural sound (HFNS) filter and the L90 metric

[2] One receptor was not included in the analysis, as it is an abandoned farm complex and will be removed entirely during the construction of the Project.

respectively. The full details of the ambient pre-construction sound level measurement program are found in Appendix 19-2.

19(c) Evaluation of Future Noise Levels during Construction

Construction noise modeling was performed for the major phases of construction using the International Organization for Standardization (ISO) 9613-2 sound propagation standard as implemented in the Cadna/A software package (see Section 19.d for more discussion of the sound propagation standard). Reference sound source information was obtained from either the applicant or the Federal Highway Administration's (FHWA's) Roadway Construction Noise Model (RCNM). Modeling and analysis procedures generally followed the guidelines and recommendations of the FHWA Highway Construction Noise Handbook (FHWA-HEP-06-015, U.S. DOT, August 2006).

The majority of the construction activity will occur around each of the inverter sites, each of the battery energy storage system sites, at the site 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 site. Full construction activity will generally occur at one site at a time, although there will be some overlap at adjacent sites 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 19-1 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.

Construction is expected to last approximately 12 to 15 months and is expected to commence in late 2022. Construction is anticipated to occur 12 hours per day, 6 days per week for much of the Project. Previous Siting Board approved construction hours/days include 7:00 AM to 7:00 PM Monday through Saturday. No construction activity is expected on national holidays. Nighttime work is not expected. No blasting is planned for this Project, as is spelled out in the Blasting Plan, which can be found in Appendix 21-3 of Exhibit 21, as a part of this Application.

Two areas within the Project Area were chosen to calculate worst case construction sound levels. The areas and assumed sites of simultaneous construction are:

- Area 1 – This area includes the closest receptors to a solar array panel. Modeling assumed simultaneous construction activity at this solar array panel. Site Preparation and Grading work, Trenching and Road Construction work, Equipment Installation work, and Commissioning work were modeled at this site.
- Area 2 – This area includes all receptors 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 were modeled here.

For both of the areas, cumulative construction sound levels at the ten closest receptors have been calculated. These receptors included both non-participants and participants. The results are shown as maximum 1-second Leq sound levels with all pieces of equipment for each phase operating at the sites. These results overstate expected real-world results since, 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. At other areas of construction (i.e., substation, inverter pads), sound levels due to construction would be lower, because those locations are further from receptors than the two areas that were analyzed. Figure 19-3.1 in Appendix 19-3 shows the two representative areas of construction activity.

Table 19-1 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

Table 19-1 Sound Levels for Noise Sources Included in Construction Modeling

Phase	Equipment	Sound Level at 50 feet [dBA]
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
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) 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

Area 1 Modeling Results

The cumulative impacts from Site Preparation and Grading work, Trenching and Road Construction work, Equipment Installation work, and Commissioning work were calculated with the Cadna model for the ten closest receptors to construction activity within Area 1. The loudest phase of construction within this area will be Trenching and Road Construction work. A sound contour figure of Trenching and Road Construction work occurring at the solar array is presented in Figure 19-3.1 in Appendix 19-3.

The highest sound level at a non-participating receptor within this area is 66 dBA during trenching and road construction (Receptor #208), 64 dBA during site preparation and grading (Receptor #208), 64 dBA during equipment installation (Receptor #208), and 30 dBA during commissioning (Receptor #208). The highest sound level at a participating receptor within this area is 88 dBA during trenching and road construction (Receptor #4), 85 dBA during site preparation and grading (Receptor #4), 85 dBA during equipment installation (Receptor #4), and 52 dBA during commissioning (Receptor #4). The existing condition daytime L_{eq} sound levels measured for this area are 43 dBA for Monitoring Location 2 and 44 dBA for Monitoring Location 3 using the American National Standard (ANS)-weighted broadband sound level data. Modeling results of construction sound levels within this area are summarized in Table 19-2.

Table 19-2 Construction Noise Modeling Results – Area 1 Construction [dBA]

Receptor ID	Distance [m]	Participation Status	Site Prepar-ation & Grading	Trench-ing & Road Constr-uction	Equipment Installation	Commis s-ioning	Assigned Measure ment ID[1]	Daytime Ambient Leq[2]
4	26	Participating	85	88	85	52	2	43
5	71	Participating	75	78	76	42	2	43
208	243	Non-Participating	64	66	64	30	2	43
3	251	Participating	64	66	64	30	2	43
2	291	Participating	63	65	63	29	2	43

Table 19-2 Construction Noise Modeling Results – Area 1 Construction [dBA]

Receptor ID	Distance [m]	Participation Status	Site Prepar-ation & Grading	Trench-ing & Road Constr-uction	Equipment Installation	Commis s-ioning	Assigned Measure ment ID[1]	Daytime Ambient Leq[2]
207	305	Non-Participating	62	64	63	28	2	43
203	359	Non-Participating	61	63	61	27	2	43
561	370	Non-Participating	61	62	61	27	2	43
205	426	Non-Participating	59	61	60	25	2	43
6	458	Participating	58	60	59	24	3	44

1 = See Table 19-9.1 in Appendix 19-9.
2 = ANS-weighted values from Table 19-9.2 in Appendix 19-9.

Area 2 Modeling Results

The cumulative impacts from HDD work and Commissioning work were calculated with the Cadna model for the ten closest receptors to construction activity within Area 2. 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 19-3.1 of Appendix 19-3.

The highest sound level at a non-participating receptor within this area is 78 dBA during HDD (Receptor #240), and 48 dBA during commissioning (Receptor #240). The highest sound level at a participating receptor within this area is 63 dBA during HDD (Receptor #17), and 32 dBA during commissioning (Receptor #17). The existing condition daytime L_{eq} sound levels measured for this area are 52 dBA using the ANS-weighted broadband sound level data. Modeling results of construction sound levels within this area are summarized in Table 19-3, and a sound contour figure of results is shown in Appendix 19-3.

Table 19-3 Construction Noise Modeling Results – Area 2 Construction [dBA]

Receptor ID	Distance [m]	Participation Status	HDD	Commissioning	Assigned Measurement ID[1]	Daytime Ambient Leq[2]
240	39	Non-Participating	78	48	1	52
241	94	Non-Participating	69	39	1	52
239	147	Non-Participating	64	34	1	52
17	174	Participating	63	32	1	52
238	194	Non-Participating	62	32	1	52
567	196	Non-Participating	62	32	1	52
418	650	Non-Participating	51	21	1	52
417	736	Non-Participating	50	20	1	52
237	742	Non-Participating	50	20	1	52
274	770	Non-Participating	50	20	1	52

1 = See Table 19-9.1 in Appendix 19-9.
2 = ANS-weighted values from Table 19-9.2 in Appendix 19-9.

Construction Noise Conclusions

Noise due to construction is an unavoidable outcome of construction. 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. There are a few instances where construction will be fairly close to residences (#4, #240, #5, #241, #239, #17). However, this will be temporary, and work will only be performed during allowed daytime hours. The Complaint Resolution Plan provided with this Application, in Appendix 12-3 of Exhibit 12, contains the procedures to be followed in the event of a noise complaint during construction. Construction noise will be minimized through the use of best management practices (BMPs) as outlined in Section 19(i).

19(d) Future Operational Sound Levels from the Project

An estimate of the noise level to be produced by Project operation, related facilities, and ancillary equipment was made using the following assumptions.

(i) Future sound levels associated with the Project were predicted using the Cadna/A noise calculation software developed by DataKustik GmbH. This software implements the 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 8,000 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 equivalent downwind propagation. In addition, the ISO 9613-2 standard assumes all receptors are downwind of every sound source simultaneously.

Elevation contours for the modeling domain were directly imported into Cadna/A 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 apart to allow for the generation of sound level isolines. Tabular results and sound level isolines were calculated and generated for the entire Project area.

a. All sound sources were assumed to be operating simultaneously at maximum sound power levels during the daytime and nighttime to produce a 1-hour L_{eq}. Noise sources that will not produce sounds during the nighttime were turned-off for nighttime computer noise modeling. As described in detail in Appendix 19-4, the inverters will be able to operate during some “nighttime” hours in the summer since sunrise is before 7 AM. Therefore, to be conservative, daytime and nighttime modeling impacts can be the same. Thus, there is only one model scenario with all sound sources operating simultaneously (the inverters, along with the BESS and the collector substation) in this Application.

b. The collector substation was also modeled by itself, operating at maximum sound power level.

c. The BESS were also modeled by themselves, operating at maximum sound power level.

d. For all modeling scenarios, the ground absorption factor (G) was set to 0.5 for the ground and 0 for water bodies, with no meteorological correction (Cmet) in the ISO 9613-2 standard.

e. Ground absorption values used in the modeling are discussed in Section 19.d.1.iv above. The sound power levels used in the modeling are discussed below.

Inverters

The sound level analysis includes 68 inverters as provided to Epsilon by the Applicant in Layout 20210409. The source location coordinates, ground elevations, and heights above ground are summarized in Appendix 19-5. There is one inverter manufacturer (Power Electronics) evaluated for this analysis. All 68 of the proposed inverters will be Power Electronics Inverters with identical specifications. The inverter manufacturer, power ratings, and dimensions examined for this assessment are presented below in Table 19-4.

Table 19-4 Power Inverter Analyzed for Sound Level Assessment

Manufacturer	Inverter Model	Maximum Electrical Output [kVA]	Dimensions [WxHxD] [m]
Power Electronics	HEM-FS3350M	3,465	6.6 x 2.2 x 2.2

Broadband and one-third octave band sound power levels for the Power Electronics Inverter operating under typical (daylight) conditions were provided by the Applicant[3]. The octave band sound power levels are presented in Table 19-5.

Table 19-5 Inverter Octave Band Sound Power Levels

Inverter Type	Broadband Sound Power Level	Sound Power Levels per Octave-Band Center Frequency [Hz]									
		16	31.5	63	125	250	500	1k	2k	4k	8k
	[dBA]	dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
HEM	97	92	90	104	95	94	93	91	90	85	83

Collector Substation

In addition to the inverters, there will be a collector substation located within the Project Area. The modeling inputs of the transformer -- coordinates, ground elevation, and height above ground -- are summarized in Appendix 19-5. One step-up transformer rated at 220 MVA with a National Electrical Manufacturers Association (NEMA) sound rating of 75 dB is proposed for the substation. Epsilon estimated the broadband sound power level and octave band sound level emissions using the techniques in the Electric Power Plant Environmental Noise Guide (Edison Electric Institute), Table 4.5 Sound Power Levels of Transformers. Table 19-6 summarizes the sound power level data used in the modeling.

Table 19-6 Collector Substation Transformer Sound Power Levels

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
220	95	92	98	100	95	95	89	84	79	72

Battery Energy Storage Systems (BESS)

In addition to the inverters and the collection substation, a total of 11 battery storage energy systems were provided to Epsilon by the Applicant in Layout 20210401. The BESS will consist of two noise sources at each of the 11 locations. These two noise sources include the heating, ventilation, and air conditioning

[3] Noise Emissions Testing of Power Electronics HEM Inverter. On-Site Acoustic Testing, LLC June 2019.

(HVAC) units on the enclosures and the freestanding DC/DC converters. The manufacturer for the wall mounted air conditioners on each of the enclosures is expected to be Bard (W72AA). The manufacturer for the DC/DC converters, is expected to be SMA Solar Technology (DPS-500). Each of these were evaluated for this analysis. All 11 of these BESS are expected to contain four HVAC units and four DC/DC converters at each individual location. The modeling inputs for each of the HVAC units and the DC/DC converters -- coordinates, ground elevation, and height above ground -- are summarized in Appendix 19-5. Epsilon was provided the broadband sound power level for both the HVAC units and DC/DC converters. The estimate of the octave band sound power level on the HVAC units came from a similar installation provided by Marvair (Model Number AVPA42AC, ComPacI/II Air Conditioner). The estimate of the octave band sound power level on the DC/DC converters came from using the inverter manufacturer octave band sound power levels, as the components in the DC/DC converters and the inverters are of similar construction. Table 19-7 summarizes the BESS sound power level data used in the modeling.

Table 19-7 Battery Energy Storage Systems Octave Band Sound Power Levels

Unit Type	Broadband Sound Power Level [dBA]	Sound Power Levels per Octave-Band Center Frequency [Hz]									
		16	31.5	63	125	250	500	1k	2k	4k	8k
		dB	dB	dB	dB	dB	dB	dB	dB	dB	dB
Bard W72AA (HVAC)	78	73[1]	73	73	72	70	75	73	71	68	65
SMA DPS-500 (DC/DC Converter)	86	82	80	94	85	83	83	81	80	75	72

1 = No data provided by manufacturer. Octave-band sound level assumed to be equal to the 31.5 Hz band level.

f. The ISO 9613-2 standard, clause 9, contains an “Accuracy and limitations of the method" discussion. This standard provides estimated accuracy for broadband sound levels as a function of source height and distance from the source. For example, at a distance of 0 to 100 meters from the source, sound sources between 0 and 5 meters tall have an accuracy of +/- 3 dBA while sound sources between 5 and 30 meters tall have an accuracy of +/- 1 dBA. Clause 9 in ISO 9613-2 notes that at a distance of 100 to 1,000 meters from the source, sound sources between 0 and 30 meters tall have an accuracy of +/- 3 dBA. The meteorological conditions applicable to this standard hold under moderate downwind propagation.

g. Some of the modeling results (where mitigation is not applied) are above the design goals. Therefore, both mitigated and unmitigated model results are presented (see Section 19.e). Table 19-8 lists the substation and three inverters that are assumed to need mitigation, and shows the baseline sound power level, mitigated sound power level, and the corresponding sound level reduction needed for the substation and each inverter in the mitigated modeling. This mitigation can be achieved either through selection of a quieter inverter, installation of sound barriers, or enclosures around the identified inverters. Mitigation levels needed to achieve the design goals ranged from 0 to 8 dBA.

Table 19-8 Sound Power and Required Mitigation Levels

Sound Source	Unmitigated Broadband Sound Power Level [dBA]	Mitigated Broadband Sound Power Level [dBA]	Sound Level Reduction [dBA]
Collector Substation	95	87	8
Inverter #16	97	96	1
Inverter #32	97	91	6
Inverter #60	97	95	2

(ii) No attenuation of sound was assumed due to transient occurrences of weather or temperature. 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 1,000 Hz octave bands where the human ear is most sensitive, and thus provide conservative results.

(iii) A review of the surrounding area revealed there are no existing solar projects within 3,000 feet of a proposed noise source, therefore, cumulative sound level modeling was not necessary.

19(e) Evaluation of Future Noise Levels During Operation of the Project

(1) Modeled A-weighted/dBA Sound Levels at All Sensitive Receptors

All sources running—Inverters, BESS, plus the Collector Substation

Future 1-hour L_{eq} sound levels during worst-case operation of the Project's inverters, BESS, plus the collector substation have been calculated using the methodology described above in Section 19(d). Appendix 19-6 provides the predicted A-weighted (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 (Appendix 19-6 Table 19-6.1a) and sorted by A-weighted sound level high to low (Appendix 19-6 Table 19-6.1b). Corrections and mitigation have been assumed in the Project's modeling.

Collector Substation only

Future 1-hour L_{eq} sound levels during worst-case operation of the Project's collector substation have been calculated using the methodology described above in Section 19(d). Appendix 19-7 provides the predicted A-weighted (dBA) and full octave band frequency (31.5 Hz to 8,000 Hz) sound pressure levels at all sensitive receptors. The mitigated results are sorted by receptor ID (Appendix 19-7 Table 19-7.1a) and sorted by A-weighted sound level high to low (Appendix 19-7 Table 19-7.1b). The unmitigated results are sorted by receptor ID (Appendix 19-7 Table 19-7.1c) and sorted by A-weighted sound level high to low (Appendix 19-7 Table 19-7.1d).

BESS only

Future 1-hour L_{eq} sound levels during worst-case operation of the Project's BESS have been calculated using the methodology described above in Section 19(d). Appendix 19-8 provides the predicted A-weighted (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 (Appendix 19-8 Table 19-8.1a) and sorted by A-weighted sound level high to low (Appendix 19-8 Table 19-8.1b). No mitigation has been assumed in the BESS modeling.

(2) Tonal Evaluation

American National Standards Institute (ANSI) S12.9 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 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). A source of sound with a tone may be more annoying at the same A-weighted sound level than a source without a tone. Typically, the tone must be loud enough so that it is prominent, and thus annoying. The State of Illinois Pollution Control Board (IPCB) noise regulations recognize this fact by noting that their prominent discrete tone rule does not apply if the one-third octave band levels are 10 dB or more below the octave band limits in the IPCB regulations.

Sound pressure level calculations using the Cadna/A modeling software that incorporates the ISO 9613-2 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 ten (10) potentially impacted and representative receptor locations (both non-participants and participants) using equations that accounted for hemispherical radiation and atmospheric absorption. The results presented in Table 19-9 shows the predicted sound pressure levels received due to the closest inverters at each of these locations. The results show that no prominent discrete tones are expected.

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. In general, collector substation transformers have the potential to create a prominent discrete tone at nearby receptors, specifically during the Oil Natural Air Natural (ONAN), fans off condition. For this Project, the collector substation is modeled to be less than or equal to 35 dBA at all non-participating sensitive receptors with mitigation[4].

[4] For perspective, a quiet library is around 35 dBA.

Table 19-9 Tonal Analysis & Compliance Evaluation: Modeled Sound Pressure Levels

Rec. 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	-
7	Received Sound Pressure Level (dB)	35	36	38	42	54	46	42	39	42	41	39	38	40	39	37	37	37	35	35	35	33	30	24	20	17	13	0
	Average Sound Pressure Level of Contiguous Bands	-	36	39	46	44	48	43	42	40	40	39	40	38	38	38	37	36	36	35	34	32	28	25	20	16	9	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	1	0	2	-2	0	1	4	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
8	Received Sound Pressure Level (dB)	41	41	43	48	60	52	47	45	47	46	45	43	46	44	42	43	43	41	41	41	39	38	32	30	29	27	19
	Average Sound Pressure Level of Contiguous Bands	-	42	44	51	50	53	48	47	46	46	45	45	44	44	44	42	42	42	41	40	39	36	34	30	28	24	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	1	0	2	-2	-1	0	3	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
9	Received Sound Pressure Level (dB)	38	38	40	45	57	49	44	42	44	44	42	40	43	42	39	40	40	39	39	39	37	36	32	31	31	33	28
	Average Sound Pressure Level of Contiguous Bands	-	38.9	41.4	48.3	46.8	50.5	45.4	44.3	42.8	43.0	42.0	42.3	41.1	41.2	40.9	39.7	39.4	39.5	38.7	38.2	37.6	34.5	33.5	31.5	31.6	29.9	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	0	0	2	-2	-1	0	3	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
145	Received Sound Pressure Level (dB)	36	36	38	43	55	47	43	40	42	42	40	39	41	40	37	38	38	36	36	36	34	32	26	23	21	18	8
	Average Sound Pressure Level of Contiguous Bands	-	37	40	47	45	49	44	43	41	41	40	40	39	39	39	38	37	37	36	35	34	30	28	24	21	14	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	1	0	2	-2	0	1	4	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
155	Received Sound Pressure Level (dB)	37	37	39	44	56	48	44	41	43	43	41	40	42	41	39	39	39	38	38	37	35	34	28	26	25	24	18
	Average Sound Pressure Level of Contiguous Bands	-	38	41	48	46	50	45	44	42	42	41	42	40	40	40	39	38	38	37	37	35	32	30	26	25	22	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	1	0	2	-2	-1	0	2	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-

Table 19-9 Tonal Analysis & Compliance Evaluation: Modeled Sound Pressure Levels

Rec. 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	-
156	Received Sound Pressure Level (dB)	36	36	38	43	54	47	42	40	42	41	40	38	41	40	37	38	38	37	37	37	35	35	30	29	29	31	27
	Average Sound Pressure Level of Contiguous Bands	-	37	39	46	45	48	43	42	41	41	40	40	39	39	39	38	37	37	37	36	36	33	32	30	30	28	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	0	0	2	-2	-1	0	3	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
158	Received Sound Pressure Level (dB)	35	35	37	42	54	46	42	39	42	41	39	38	40	39	37	38	37	36	37	36	35	34	29	28	29	30	26
	Average Sound Pressure Level of Contiguous Bands	-	36	39	46	44	48	43	42	40	40	39	40	38	39	38	37	37	37	36	36	35	32	31	29	29	28	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	0	0	2	-2	-1	0	3	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
200	Received Sound Pressure Level (dB)	36	37	39	43	55	47	43	41	43	42	40	39	41	40	38	38	38	37	37	36	34	32	26	23	21	19	12
	Average Sound Pressure Level of Contiguous Bands	-	38	40	47	45	49	44	43	41	42	41	41	39	40	39	38	38	37	36	35	34	30	28	23	21	16	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	1	0	2	-2	-1	0	3	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
302	Received Sound Pressure Level (dB)	37	37	39	44	56	48	43	41	43	42	41	39	42	40	38	39	38	37	37	36	34	32	25	21	18	14	1
	Average Sound Pressure Level of Contiguous Bands	-	38	40	47	46	49	44	43	42	42	41	41	40	40	39	38	38	38	36	35	34	29	26	22	17	10	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	1	0	2	-1	0	1	4	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-
306	Received Sound Pressure Level (dB)	36	36	38	43	55	47	43	40	43	42	40	39	41	40	38	38	38	37	37	37	36	35	30	29	29	31	26
	Average Sound Pressure Level of Contiguous Bands	-	37	40	47	45	49	44	43	41	41	40	41	39	39	39	38	38	38	37	36	36	33	32	29	30	28	-
	Difference between Sound Pressure Level and Contiguous Average	-	-1	-1	-4	10	-2	-1	-2	1	1	0	-2	2	0	-1	0	1	-1	0	0	0	2	-2	-1	0	3	-
	Below Tonal Limit?	-	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	-

(3) Amplitude Modulation

Amplitude modulation is not an issue with solar projects. Therefore, an analysis was not included in the Application.

(4) An Evaluation of the Potential for Low Frequency and Infrasound

"Infrasound" is sound pressure fluctuations at frequencies below about 20 Hz. Sound below this frequency is only perceptible at relatively high magnitudes. "Low frequency sound" is in the nominal audible range of human hearing, that is, above 20 Hz, but below 200 Hz.

i) Low frequency sound levels for the full octave bands equal to or greater than 31.5 Hertz were calculated for each receptor by Cadna/A at all sensitive receptors. The results are presented in Appendix 19-6. No receptors with sound levels equal to or greater than 65 dB at 31.5 or 63 Hz were found.

ii) Solar projects do not produce significant levels of infrasound. Nonetheless, in order to answer Stipulation 19.k.5 about the potential for airborne vibration, 16 Hz sound levels were examined. Since the ISO 9613-2 standard does not include the 16 Hz frequency (infrasound), results for 16 Hz at each receptor were extrapolated from the 31.5 Hz results. The extrapolation is the difference between the inverter's sound power data at 16 Hz and the sound power data at 31.5 Hz as presented earlier in Table 19-5. The results are presented in Appendix 19-6. No receptors with sound levels equal to or greater than 65 dB at 16 Hz were found.

19(f) Tabular Sound Level Data

For Sections 19.f.4, 19.f.5, 19.f.6, and 19.f.9, measured ambient data were assigned to each modeling receptor based on proximity between measurement points and the similarity of the soundscape between the evaluated position and the location where the ambient noise levels were measured. Assumptions regarding the similarities of soundscapes were based on personal observations at each of the sound level measurement locations and on a review of the aerial imagery for the area. Table 19-9.1 in Appendix 19-9 presents the sound level modeling locations with their assigned ambient measurement location.

(1) Daytime Ambient Noise Level

The daytime ambient noise level was calculated from summer and winter background sound level monitoring data. This is equal to the lower tenth percentile (L90) of sound levels measured during the daytime (7:00 AM – 10:00 PM) at each of the monitoring locations. These results are provided in Table 19-10 below. Sound levels in this section are presented both "as measured" and "ANS-weighted" (dBA) which removes all sound energy above the 1,250 Hertz frequency band. The ANS methodology is as specified in ANSI/ Acoustical Society of America (ASA) S12.100-2014 and is primarily aimed at removing high-frequency insect noise.

Table 19-10 Daytime Ambient L90 (dBA) Sound Pressure Level Summary

Location	Overall (dBA)		Winter (dBA)		Summer (dBA)	
	Measured	ANS	Measured	ANS	Measured	ANS
Location 1	40	33	34	33	46	33
Location 2	38	28	30	29	45	26
Location 3	39	28	32	31	45	24
Location 4	35	27	29	28	40	26
Location 5	39	29	33	31	44	27

(2) Summer Nighttime Ambient Noise Level

The summer (leaf-on) nighttime ambient noise level was calculated from summer background sound level monitoring data. This was equal to the L_{90} of sound levels measured at night (10:00 PM – 7:00 AM) during the summer at each of the monitoring locations. These results are provided below in Table 19-11.

Table 19-11 Nighttime Ambient L90 (dBA) Sound Pressure Level Summary

Location	Overall (dBA)		Winter (dBA)		Summer (dBA)	
	Measured	ANS	Measured	ANS	Measured	ANS
Location 1	40	28	28	27	51	29
Location 2	39	23	26	24	52	22
Location 3	37	22	25	24	48	19
Location 4	37	23	27	26	47	19
Location 5	38	26	29	28	46	24

(3) Winter Nighttime Ambient Noise Level

The winter (leaf-off) nighttime ambient noise level was calculated from winter background sound level monitoring data. This was equal to the L_{90} of sound levels measured at night (10:00 PM – 7:00 AM) during the winter at each of the monitoring locations. These results are provided above in Table 19-11.

(4) Worst-Case Future Daytime Noise Level

The worst-case future operational noise level during the daytime period (7:00 AM – 10:00 PM) at all receptors was determined by logarithmically adding the daytime ambient sound level (L_{90}) (Table 19-10) as related to the use and soundscape of the location being evaluated, calculated from background sound level monitoring in the summer and winter, to the modeled upper 10^{th} percentile sound level (L_{10}) of the Facility. The L_{10} statistical noise descriptor corresponds to estimates for one year of operation using site-specific sunrise/sunset data coupled with monthly sunshine probabilities. In this case, the L_{10} is the same as the short-term sound power levels and thus the modeled L_{10} is the same as the modeled 1-hour L_{eq}. For a detailed description of the methodology used for this calculation see Appendix 19-4.

These worst-case future noise levels during the daytime period are presented in Table 19-9.2 in Appendix 19-9. Worst-case mitigated future total daytime noise levels range from 22 to 45 dBA for any non-participating receptor and from 27 to 50 dBA for any participating receptor. The highest L_{10} mitigated sound level at any sensitive non-participating receptor is 45 dBA. The highest L_{10} sound level at any sensitive participating receptor is 50 dBA.

(5) Worst-case Future Summer Nighttime Noise Levels

The worst-case future noise level during the summer leaf-on nighttime period at all receptors was determined by logarithmically adding the summer nighttime ambient sound level (L_{90}) (Table 19-11) as related to the use and soundscape of the location being evaluated, calculated from background sound level monitoring, to the modeled upper 10^{th} percentile sound level (L_{10}) of the Facility. The L_{10} statistical noise descriptor corresponds to estimates for one year of operation using site-specific sunrise/sunset data coupled with monthly sunshine probabilities. In this case, the L_{10} is the same as the short-term sound power levels and thus the modeled L_{10} is the same as the modeled 1-hour L_{eq}. For a detailed description of the methodology used for this calculation see Appendix 19-4.

These worst-case future noise levels during the summer nighttime period are presented in Table 19-9.2 in Appendix 19-9. Worst-case, mitigated future total summer nighttime noise levels range from 17 to 45 dBA for any non-participating receptor and from 26 to 50 dBA for any participating receptor. The highest L_{10} mitigated sound level at any sensitive non-participating receptor is 45 dBA. The highest L_{10} sound level at any sensitive participating receptor is 50 dBA. Mitigation is discussed below in Sections 19(h) and 19(j).

(6) Worst-case Future Winter Nighttime Noise Levels

The worst-case future noise level during the winter (leaf-off) nighttime period at all receptors was determined by logarithmically adding the winter nighttime ambient sound level (L_{90}) (Table 19-11) as related to the use and soundscape of the location being evaluated, calculated from background sound level monitoring, to the modeled upper 10th percentile sound level (L_{10}) of the Facility. The L_{10} statistical noise descriptor corresponds to estimates for one year of operation using site-specific sunrise/sunset data coupled with monthly sunshine probabilities. In this case, the L_{10} is the same as the short-term sound power levels and thus the modeled L_{10} is the same as the modeled 1-hour L_{eq}. For a detailed description of the methodology used for this calculation see Appendix 19-4.

These worst-case future noise levels during the winter nighttime period are presented in Table 19-9.2 in Appendix 19-9. Worst-case, mitigated future winter nighttime noise levels range from 18 to 45 dBA for any non-participating receptor and from 26 to 50 dBA for any participating receptor. The highest L_{10} mitigated sound level at any sensitive non-participating receptor is 45 dBA. The highest L_{10} sound level at any sensitive participating receptor is 50 dBA. Mitigation is discussed in Sections 19(h) and 19(j).

(7) Daytime Ambient Average Noise Level

Measured daytime average ambient levels are presented in Table 19-12 below. The daytime ambient average noise level was calculated by logarithmically averaging sound pressure levels (L_{eq}) (after exclusions) from the background sound level measurements over the daytime period at each monitoring location. These calculations include both summer and winter data combined.

Table 19-12 Daytime Ambient Leq (dBA) Sound Pressure Level Summary

Location	Overall (dBA)	
	Measured	ANS
Location 1	53	51
Location 2	45	33
Location 3	46	39
Location 4	43	37
Location 5	45	38

(8) Typical Facility Noise Levels

Typical Facility noise levels for each sensitive receptor were calculated as the median sound pressure level emitted by the Facility at each evaluated receptor (L_{50}). The median sound pressure level was calculated by determining the frequency of site-specific meteorological conditions during periods when the facility has the potential to be operating. The L_{50} statistical noise descriptor corresponds to estimates for one year of operation using site-specific sunrise/sunset data coupled with monthly sunshine probabilities. In this case, the L_{50} is marginally lower, in comparison to the short-term sound power levels, due to a 46.6% yearly calculation of expected sunshine. However, to be conservative, the median sound level from the project (L_{50}) was assumed to be the same as the highest short-term daytime sound level. Therefore, the L_{50} sound levels from the project are the same as the L_{10} sound levels from the project. For a detailed description of the methodology used for this calculation see Appendix 19-4. The typical Facility sound levels are presented in Table 19.9-2 in Appendix 19-9.

(9) Typical Facility Daytime Noise Levels

The typical Facility daytime (7:00 AM – 10:00 PM) noise level at all receptors was determined by logarithmically adding the daytime equivalent average sound level (L_{eq}) calculated from background sound level monitoring (Table 19-12) as related to the use and soundscape of the location being evaluated, to the modeled median Facility sound pressure level (L_{50}). The L_{50} statistical noise descriptor corresponds to estimates for one year of operation. These typical Project daytime noise levels are presented in Table 19.9-2 in Appendix 19-9. Typical mitigated Project daytime noise levels range from 43 to 53 dBA for any non-participating receptor and from 44 to 52 dBA for any participating receptor. These sound levels are mainly attributable to the existing sound sources in the Project Area and are not due to the Project.

19(g) Applicable Noise Standards, Local Requirements, and Noise Design Goals for the Facility

Noise standards applicable to the Project, as well as noise guidelines that are required by or recommended by various agencies, are described below. The input parameters, assumptions and standards that were used for purposes of predicting sound pressure levels from the Facility's collector substation and inverters are discussed in detail in Section 19(d) above. The compliance with these standards is discussed below and in Table 19-14 in Section 19(h).

A balance must be struck between avoiding or minimizing potential impacts to the maximum extent practicable from Project generated sound while not imposing regulatory standards that are so stringent that they do not afford additional benefits, but instead are prohibitive to Project viability. Regulatory limits for other power generation and mechanical processes never seek inaudibility, but rather to limit noise from a source to a reasonably acceptable level. Noise design goals were developed in order to balance reasonable development and minimize annoyance to the community.

Noise Standards—Federal

There are no federal community noise regulations applicable to solar facilities.

Noise Standards—New York State

This Project falls under the jurisdiction of the NY State Board on Electric Generation Siting and the Environment, Article 10, and its implementing regulations. Part 1001.19 "Exhibit 19: Noise and Vibration" contains the required elements of the regulation. These regulations do not list quantitative sound limits applicable to this Project, but rather all the factors that must be considered in the noise study. Standards and design goals have been established in this exhibit based on previous Article 10 projects approved by the Siting Board, and the Project's understanding of the expected DPS scope of studies.

Noise Standards--Local

There are no local community noise regulations applicable to solar facilities.

Noise Design Goals

At a minimum, the Application will consider the following guidelines and precedent from other recent New York State renewable energy projects.

i) 45 dBA L_{eq} 1-hour at a non-participating residence from daytime-only operational sound sources such as inverters, medium voltage transformers, and any battery storage facility (if applicable). If the sound emissions from these sources are found to contain a prominent discrete tone at any non-participating residence, then the sound levels at the receptors shall be subject to a 5 dBA penalty (i.e., a reduction in the permissible sound level to 40 dBA L_{eq} 1-hour). This is consistent with the limits adopted by the Siting Board in its certification of the two most recent Article 10 solar projects: High River Energy Center (Case 17-F-0597-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated March 11, 2021); and the East Point Energy Center (Case 17-F-0599-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated January 7, 2021).

ii) 50 dBA L_{eq} 1-hour sound level from the Facility outside any participating residence from daytime-only operational sound sources such as inverters, medium voltage transformers, and any battery storage facility (if applicable). No penalties for prominent tones will be added in this assessment. This is consistent with the limits adopted by the Siting Board in its certification of the two most recent Article 10 solar projects: High River Energy Center (Case 17-F-0597-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated March 11, 2021); and the East Point Energy Center (Case 17-F-0599-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated January 7, 2021).

iii) 55 dBA L_{eq} 1-hour sound level from the Project across any portion of non-participating property, except for portions delineated as wetlands or utility rights of way. No penalties for prominent tones will be added. This is consistent with the limits adopted by the Siting Board in its certification of the two most recent Article 10 solar projects: High River Energy Center (Case 17-F-0597-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated March 11, 2021); and the East Point Energy Center (Case 17-F-0599-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated January 7, 2021).

iv) Not produce any audible prominent tones, as defined under ANSI S12.9 Part 4-2005, Annex C at any non-participating residence from daytime-only operational sound sources such as inverters, medium voltage transformers, and any battery storage facility (if applicable). If the sound emissions from these sources are found to contain a prominent discrete tone at any non-participating residence, then the sound levels at the receptors shall be subject to a 5 dBA penalty (i.e., a reduction in the permissible sound level to 40 dBA L_{eq} 1-hour). This is consistent with the limits adopted by the Siting Board in its certification of the two most recent Article 10 solar projects: High River Energy Center (Case 17-F-0597-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated March 11, 2021); and the East Point Energy Center (Case 17-F-0599-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated January 7, 2021).

v) 40 dBA L_{eq} 1-hour at a non-participating residence from the collector substation equipment. If the sound emissions from these sources are found to contain a prominent discrete tone at any non-participating residence, then the sound levels at the receptors shall be subject to a 5 dBA penalty (i.e., a reduction in the permissible sound level to 35 dBA L_{eq} 1-hour). This is consistent with the limits adopted by the Siting Board in its certification of the two most recent Article 10 solar projects: High River Energy Center (Case 17-F-0597-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated March 11, 2021); and the East Point Energy Center (Case 17-F-0599-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated January 7, 2021).

19(h) Summary of Noise Standards and Compliance of the Facility

1) Design goals for the Facility are summarized below in Table 19-14. Based on the detailed analyses presented in this Exhibit and in Appendices 19-6, 19-7, 19-8, and 19-9, the future Project sound levels will meet all design goals.

<u>All sources running—inverters, BESS, plus the collector substation</u>

Future 1-hour L_{eq} sound levels during worst-case operation of the Project's inverters, BESS, plus the collector substation are listed in Appendix 19-6. The highest mitigated sound levels under this scenario are:

- Non-participating residence = 45 dBA
- Participating residence = 50 dBA

These sound levels are at or below the design goals of 45 dBA and 50 dBA, respectively.

Sound level contours generated from the modeling grid are presented in an overview figure in Appendix 19-6 (Figure 19-6.1), 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. Mitigation in the form of quieter inverters, sound barriers or enclosures are assumed to be added to the Project layout. Mitigation of 1 or 2 dBA is only required at four non-participating receptors. Sound barriers or enclosures can provide up to 8 dBA of mitigation. Details of the selected mitigation, based upon available technology during preparation of Project final design, will be presented in the Compliance Filing.

<u>Collector Substation only</u>

Future 1-hour L_{eq} sound levels during worst-case operation of the Project's collector substation are listed in Appendix 19-7. The highest sound levels under this scenario are 35 dBA at a non-participating residence assuming mitigation. These sound levels meet the design goal of 35 dBA, assuming the 5 dBA tonal penalty that is likely for a collector substation transformer. The highest worst-case sound level at a participating receptor is 6 dBA.

<u>BESS only</u>

Future 1-hour L_{eq} sound levels during worst-case operation of only the Project's BESS are listed in Appendix 19-8. The highest sound levels under this scenario are 36 dBA at a non-participating residence. The highest worst-case sound level at a participating receptor is 33 dBA.

2) The Town of Conquest does not have any noise regulations applicable to this facility.

3) All residences will meet the design goals for the Project with the necessary mitigation measures in place.

<u>All sources running—inverters, BESS, plus the collector substation</u>

Table 19-13 presents the number of sensitive noise receptors that have been modeled to experience a worst-case sound level of 40 dBA or greater (1-hour L_{eq}).

Table 19-13 Participating and Non-Participating Receptors Modeled at 40 dBA or Greater

Modeled Leq Sound Level [dBA]	# of Receptors							
	Year-Round Residence		Seasonal Residence		Unknown		Other	
	Partici-pating	Non-Partici-pating	Partici-pating	Non-Partici-pating	Partici-pating	Non-Partici-pating	Partici-pating	Non-Partici-pating
50	1	0	0	0	0	0	0	0
49	0	0	0	0	0	0	0	0
48	0	0	0	0	0	0	0	0
47	1	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	2
45	0	8	0	0	0	0	0	0
44	2	3	0	0	0	0	0	0
43	0	10	0	0	0	0	0	0
42	2	11	0	0	0	0	0	0
41	1	11	0	0	0	0	0	0
40	0	14	0	0	0	0	0	0

4) All non-participating property boundary lines meet the design goal as shown by the contour figures presented in Appendix 19-6. In these figures, participant and non-participant boundary lines are differentiated. Sensitive sound receptors are identified with unique ID numbers in the results tables and on the contour drawings.

Table 19-14 Summary of Compliance with Sound Standards and Design Goals – Garnet Energy Center

Design Goal (Not to exceed)	Assessment Location	Noise Descriptor	Period of Time	Participant Status	Meet?
45 dBA	At residence, Outdoor	Leq	1-hour; daytime or nighttime	Non-participant	Yes
50 dBA	At residence, Outdoor	Leq	1-hour; daytime or nighttime	Participant	Yes

Table 19-14 Summary of Compliance with Sound Standards and Design Goals – Garnet Energy Center

Design Goal (Not to exceed)	Assessment Location	Noise Descriptor	Period of Time	Participant Status	Meet?
55 dBA	Property line except for portions delineated as wetlands	Leq	1-hour; daytime or nighttime	Non-Participant	Yes
No audible prominent tones or 5 dBA penalty if they occur.	At residence, Outdoor	Leq	1-hour; daytime and nighttime	Non-participant	Yes
40 dBA from the collector substation; 5 dBA penalty if tonal	At residence, Outdoor	Leq	1-hour; daytime or nighttime	Non-participant	Yes

19(i) Noise Abatement Measures for Construction Activities

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. Therefore, noise from most phases of construction is not expected to result in impacts. 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 the Project's Preliminary Blasting Plan included as Appendix 21-3.
- Post installation and HDD will be limited to daytime hours. See the preliminary geotechnical report for more detail.
- Utilizing construction equipment fitted with exhaust systems and mufflers that have the lowest associated noise whenever those features are available.
- 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 Occupational Safety and Health Administration (OSHA) requirements.
- Develop a staging plan that establishes equipment and material staging areas away from sensitive receptors when feasible.

19(j) Noise Abatement Measures for Facility Design and Operation

(1) Noise Abatement Measures

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. If a source is identified as requiring noise control, a sound barrier may be installed around the source to reduce sound levels. The sound barrier would be a minimum sound transmission class (STC) level of 30, and would be at least as tall as the Project component (i.e., inverter). The barrier would be 2 or 3-sided depending on the final orientation of the inverter and proximity of nearby noise sensitive locations. Quieter equipment may also be considered, assuming it meets all technical requirements of the project.

(2) Alternatives Analysis

There are three Project inverters requiring sound mitigation. The necessary level of mitigation can be achieved through use of sound barriers or quieter inverters. Relocating these three inverters was also considered, which would eliminate the need for sound barriers. However, this would require that the inverters be sited in wetland areas, creating additional wetland impacts. The use of alternative designs, alternative technologies, and alternative facility arrangements is discussed in Exhibit 9: Alternatives.

19(k) Community Noise Impacts

(1) Potential for Hearing Damage

The Project's potential to result in hearing damage was evaluated against three guidelines established by the OSHA, United States Environmental Protection Agency (EPA), and World Health Organization (WHO). Comparison of sound propagation modeling to these guidelines shows that construction and operation of the Project will not result in potential for hearing damage. Each of the standards and the Facility's compliance with them is further described below.

OSHA protects against the effects of noise exposure in the workplace. Permissible noise exposure levels for an 8-hour day are 90 dBA. At sound levels above 85 dBA over an 8-hour workday, employers shall provide hearing protection to employees. Sound pressure levels as generated by Project construction and operation at sensitive sound receptors will be under this threshold, so the Project will be in compliance with OSHA standards. Therefore, based on the OSHA standard, the Project will not result in potential for hearing damage.

The USEPA established a noise guideline for protection against hearing loss in the general population (USEPA, 1974). The guideline identifies a sound level of 70 dBA over a 24-hour period as protective against hearing loss from intermittent sources of environmental noise. The highest predicted sound level at a non-participating residence is 45 dBA.

According to the WHO 1999 Guidelines, the threshold for hearing impairment is 110 dBA (Lmax, fast) or 120/140 dBA (peak at the ear) for children/adults. The only possible construction noise source for this Project capable of exceeding the WHO hearing impairment threshold is blasting, but no blasting is anticipated for this Project. All other construction activities will produce noise below the WHO hearing impairment threshold.

(2) Potential for Speech Interference

The Project's potential to result in indoor and outdoor speech interference was assessed using the framework provided in the WHO (1999) document Guidelines for Community Noise and in the USEPA (1974) document Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety.

The 1974 USEPA document states that for an outdoor level of 55 dBA (L_{dn}) there is 100% sentence intelligibility indoors, and 99% sentence intelligibility at 1 meter outdoors. These are the maximum sound levels below which there are no effects on public health and welfare due to interference with speech or other activity. This includes a 5 dBA margin of safety. An outdoor L_{dn} is equivalent to a 24-hour sound level of 49 dBA. Because all non-participating sensitive sound receptors were modeled to have the highest operational sound level less than or equal to 45 dBA, the Project will not result in interference with indoor or outdoor speech, as defined by USEPA guidelines.

The WHO recommends an indoor sound level of 35 dBA (L_{eq}) to protect speech intelligibility. This is equivalent to approximately 50 dBA L_{eq} outdoors based on reduction from outside to inside by approximately 15 dBA with windows open, and 25 dBA with windows closed (USEPA, 1974). Because all non-participating sensitive sound receptors were modeled to have the highest operational sound level of less than or equal to 45 dBA, the Project will not result in interference with indoor or outdoor speech, as defined by USEPA guidelines.

(3) Potential for Annoyance/Complaints

Sound produced by a solar facility is relatively low compared to other types of power generation facilities. The main components of a solar facility are the photovoltaic (PV) panel arrays, the power inverter units, the BESS, the DC collection system, the AC collection system, and the collector substation. The operational sounds from a solar facility include the inverters and BESS, which are typically located in the center of the solar panel arrays, and the transformer located at the collector substation. The main source of sound from the inverters, BESS and substation are their cooling fans, and the electrical components within the inverter cabinet, BESS and collector substation transformer. The inverters produce a low humming sound during time periods when sunlight is shining onto the panels when the array generates electricity. The BESS produce a similar low humming sound, during times when the DC/DC converters are operating and transferring electricity for the batteries. The substation has switching, control equipment, and a transformer.

As part of the Project, noise design goals were developed in part based on a literature review in order to balance reasonable development and minimize annoyance to the community, together with the Siting Board precedent. An extensive search was made of noise-related publications from professional organizations such as the INCE and the ASA along with their associated annual conference proceedings. Very few papers have been published on sound from solar energy facilities and none were located that analyzed potential annoyance from solar energy facilities. This is not surprising given that sound from PV solar systems is a very minor source of sound energy. Therefore, annoyance due to sound from solar energy is expected to be negligible to non-existent.

For some perspective, there has been a fair amount of research done into potential for complaints from wind turbines. Although the sound from wind turbines is not at all similar to the sound from a PV solar facility, a review of complaints at specific sound levels is illustrative. Adverse reactions to wind turbine noise between 40 and 45 dBA is still quite low, at roughly 2 percent of wind-park neighbors, even in rural environments with low background levels.[5] This would suggest that adverse reaction to a solar PV facility at these same levels would be even lower.

The number of non-participating receptors modeled at worst-case sound levels above 35 dBA was 90. All other non-participating receptors are expected to have worst-case sound levels of 35 dBA or less. These are almost exclusively daytime sound levels. Except for a few early morning hours in the summer, the sun will not be shining at night, and thus nighttime sound levels from the inverters will be zero. This suggests that the likelihood of sound complaints from this solar facility is very low to non-existent.

(4) Potential for Structural Damage

At this time, blasting is not planned as part of construction for the Project. If blasting becomes necessary, a Preliminary Blasting Plan is provided as Appendix 21-3 and the Preliminary Geotechnical Report is provided as Appendix 21-1. Summaries of these reports are in Exhibit 12 and Exhibit 21 of the Application. It is anticipated that post installation will be needed to construct the Project. The use of HDD during construction is discussed in Section 19.c. The potential for any cracks or structural damage due to impact activities during construction is analyzed in Exhibits 12 and 21.

(5) Potential for Interference with Technological, Industrial, or Medical Activities

Solar facilities do not produce significant levels of ground-borne vibration. Nonetheless, the potential for air-borne induced vibrations from the operation of the Project to generate annoyance, cause vibrations, rumbles or rattles in windows, walls or floors of sensitive receptor buildings was analyzed by applying the outdoor criteria established in annex D of ANSI standard S12.9 - 2005/Part 4 and applicable portions of ANSI 12.2 (2008). These recommend limits of 65 dB at the 16, 31.5, and 63 Hz octave bands.

Modeling results at the 31.5 Hz and 63 Hz low frequency octave bands have been calculated using Cadna/A acoustic model. Results at the 16 Hz octave band, for each receptor, were extrapolated from the 31.5 Hz results. The extrapolation is the difference between the inverter's sound power data at 16 Hz and the 31.5 Hz sound power data used for computer modeling. All receptors were modeled well below 65 dB at the 16, 31.5, and 63 Hz octave bands.

[5] Wind Energy & Wind Park Siting and Zoning Best Practices and Guidance for States, NARUC, prepared by National Regulatory Research Institute, January 2012.

The potential of low-frequency noise, including infrasound and vibration, from operation of the Project to cause interference with the closest seismological and infrasound stations within 50 miles of the Project site was investigated. The Preparatory Commission for the Comprehensive Nuclear Test Ban Treaty Organization (CTBTO) website was reviewed for the nearest location of any infrasound monitoring stations. The closest locations are in Bermuda (IS51) and Lac du Bonnet, Manitoba, Canada (IS10). Bermuda (IS51) is approximately 990 miles from the Garnet Energy Center, while Lac du Bonnet, Manitoba, Canada (IS10) is approximately 1,040 miles from the Garnet Energy Center. There are also some auxiliary seismic stations to monitor shock waves in the Earth as part of the CTBTO program. The nearest seismic monitor to the Garnet Solar Energy Center is located in Sadowa, Ontario, Canada (AS014) which is approximately 170 miles away. Given these large distances and the relatively low levels of infrasound emissions from this Project, we conclude there will be no impact to the CTBTO's ability to monitor infrasound. There are no United States Geological Survey (USGS) seismological stations within 50 miles of the site. The nearest station is located at Binghamton, New York, approximately 75 miles to the south-southeast. The closest hospital to the project is Auburn Community Hospital in Auburn, NY, approximately 12 miles south of the nearest inverter. Distances are "as the crow flies."

19(l) Post-Construction Noise Evaluation Studies

Recent experience with other Article 10 solar projects has seen the Siting Board not require post-construction sound level testing as part of the certificate conditions (see High River Energy Center (Case 17-F-0597-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated March 11, 2021); and the East Point Energy Center (Case 17-F-0599-Order Granting Certificate of Environmental Compatibility and Public Need, With Conditions, dated January 7, 2021).

Consistent with Siting Board precedent, the post-construction noise evaluation will therefore be accomplished by a Compliance Filing using the final specifications of equipment selected for the project and the final project layout. Modeling will be conducted in accordance with the details in the Site Engineering and Environmental Plan (SEEP) expected to be issued with the Certificate.

19(m) Post-Construction Operational Controls and Mitigation Measures to Address Complaints

The Applicant takes seriously any complaints that it receives from members of the public. The Complaint Resolution Plan for the Project includes a complaint response protocol specific to noise during Project construction and operation. Should a resident feel the Project is creating noise levels above those specified in the Project's Certificate Conditions, the resident may issue a complaint. Complaints will be able to be made in person, via phone, or by email. If necessary, the Applicant will contact the individual within 72 hours of the complaint. The Applicant will implement a comprehensive response for all registered, reasonable complaints, which will include community engagement, gathering information, response to the complaint, a follow up after the response has been issued, and further action if the complainant believes that the issue continues to exist. Should noise levels exceed those established in the Facility's Certificate, post-construction operational measures could be utilized to reduce noise, including noise barriers. Complaint filing methods are described in greater detail in Appendix 12-3.

19(n) Software Input Parameters, Assumptions, and Associated Data for Computer Noise Modeling

Specific modeling parameters are included in Appendices 19-1 and 19-5. Geographic Information System (GIS) files containing modeled topography, modeled inverter and substation locations, participating and non-participating sound receptors, and all external boundary lines identified by Parcel ID number are being provided to DPS under separate cover in digital format. The digital Cadna/A input files will not be provided, unless requested by DPS.