

Appendix E

Noise Study

North Star Battery Energy Storage System

Noise Impact Assessment

Prepared for:

North Star Energy Storage LLC
c/o DESRI Renewables, L.L.C.
575 Fifth Avenue, 24th Floor
New York, NY 10017

Prepared by:



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1.0 INTRODUCTION

Merjent, Inc. (Merjent) conducted a noise impact assessment for the North Star Battery Energy Storage System (BESS) Project (Project) in the City of North Branch, Chisago County, Minnesota. The Project is being developed by North Star Energy Storage LLC (North Star Storage), a wholly owned subsidiary of DESRI Renewables, L.L.C. (DESRI) and requires a Site Permit from the Minnesota Public Utilities Commission (MPUC or Commission) pursuant to the Minnesota Power Plant Siting Act (Minnesota Statutes Chapter 216E) and Minnesota Rules (Minn. R.) Chapter (Ch.) 7850.

The Project will be adjacent to the existing North Star Solar Facility (Solar Facility), which is owned and operated by North Star Solar PV LLC (North Star Solar), an affiliate of North Star Storage. The Project will be sited directly adjacent to North Star Solar's existing Collector Substation. Collectively, the easements for which North Star Storage has site control in Section 36 cover about 77.5 acres; this 77.5-acre area is herein referred to as the Land Control Area. Of the Land Control Area, approximately 26.1 acres will be subject to construction activities, and is herein referred to as the Preliminary Development Area. Of the approximately 26.1 acres, approximately 5.5 acres will be required to host BESS facility components for the life of the Project (approximately 30 years). Noise-generating activities associated with the operation of the Project will be restricted to these 5.5 acres, herein referred to as the BESS.

Merjent performed an operational noise impact assessment in support of the SPA for the Project. Merjent conducted noise calculations for the preliminary Project design, analyzing the noise levels at Noise Sensitive Areas (NSAs) within 3,200 feet of the BESS, as specified in Minnesota Rules Chapter 7030.

The noise propagation calculations used noise data for a typical BESS unit, as specific equipment and manufacturer noise data were not available. The calculations assume that BESS equipment comprises integrated units with power conversion systems (inverters), cooling systems, and batteries.

2.0 SOUND CRITERIA

This section provides a summary discussion of the sound criteria applicable to the Project. For more information about the terminology in this report and description of typical metrics used to measure and regulate environmental noise, see Section 6.0 of the report.

2.1 APPLICABLE NOISE REGULATIONS

The Minnesota Pollution Control Agency (MPCA) adopts noise standards under Minnesota Statute Section 116.07, subd. 2, establishing rules in Minn. R. Ch. 7030. These standards use A-weighted noise measurements and differentiate between daytime (7:00 a.m. to 10:00 p.m.) and nighttime (10:00 p.m. to 7:00 a.m.) hours. The Minnesota state noise standards limit noise volumes to specified levels for 10 percent (L_{10}) and 50 percent (L_{50}) of any hour. Household units, including farmhouses, belong to Noise Area Classification 1, with specific standards detailed in Table 2.1-1. Since the operational noise associated with the Project is continuous and steady-state in nature, with BESS units, inverters, and transformers producing relatively uniform sound emissions, the L_{50} noise limit of 50 dB is the most appropriate parameter for this assessment.

Table 2.1-1				
Minnesota State Noise Standards - Hourly A-Weighted Decibels				
Noise Area Classification	Daytime (7:00 a.m. – 10:00 p.m.)		Nighttime (10:00 p.m. – 10:00 a.m.)	
	L ₁₀	L ₅₀	L ₁₀	L ₅₀
1 – Residential	65	60	55	50
2 – Commercial	70	65	70	65
3 – Industrial	80	75	80	75

Source: Minn. R. § 7030.0040

3.0 SITE DESCRIPTION

The proposed Project will be located in the outskirts of the City of North Branch in Chisago County, Minnesota, and will include a BESS, Operations and Maintenance (O&M) facility, and associated infrastructure. Existing land use within the Land Control Area is agricultural and rural residential. Additional noise sources in the Project vicinity include, but are not limited to, road traffic, agricultural production, birds, and insects. Rural residences are the nearest Noise Sensitive Areas (NSAs) to the Project. As part of this assessment, Merjent identified NSAs within 3,200 feet of the planned BESS Facility based on review of current aerial imagery. Table 3.0-1 shows the 25 NSAs nearest to the Project.

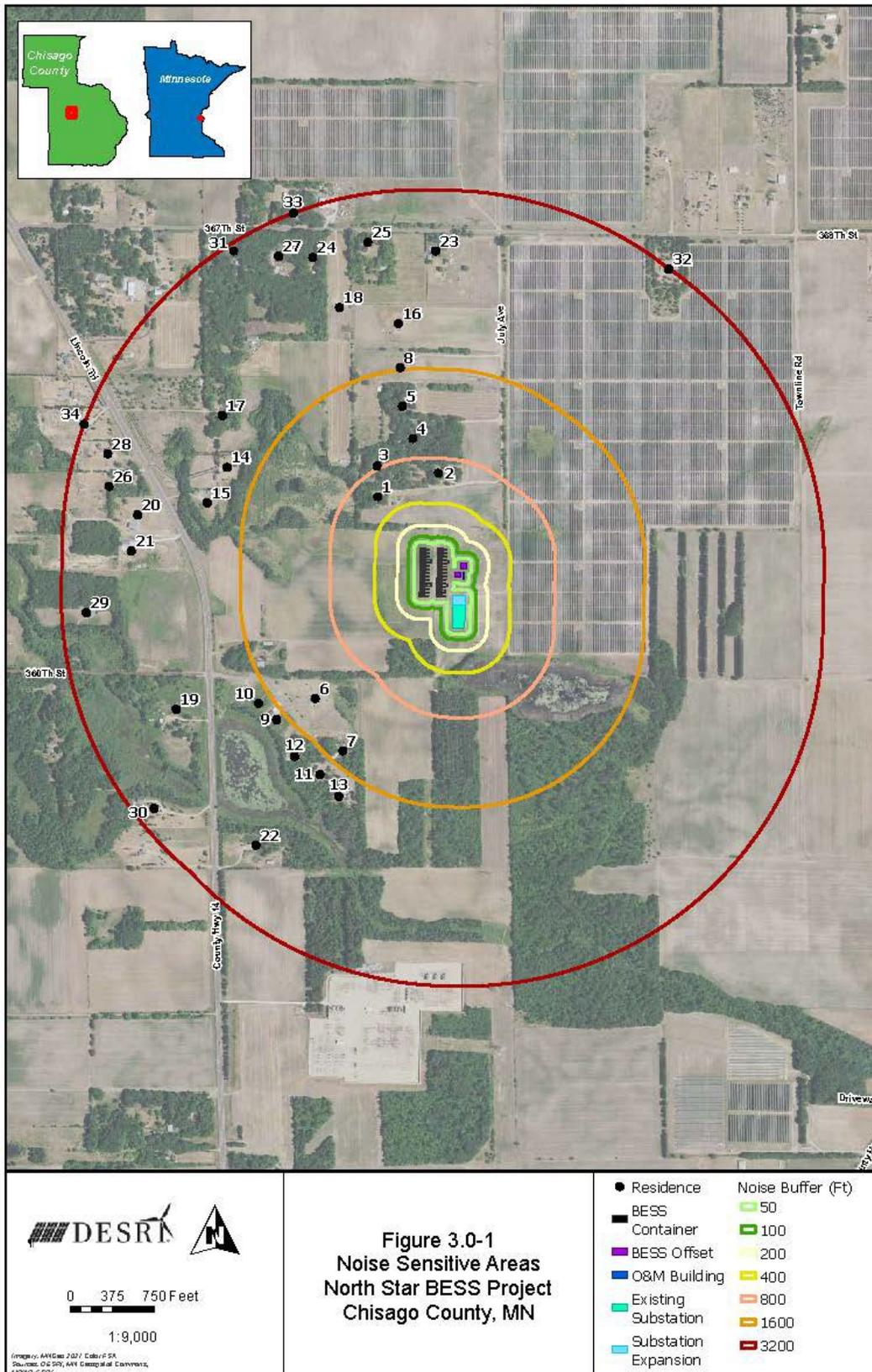
Table 3.0-1			
Proximity of the 25 Nearest NSAs within the North Star BESS			
NSA	NSA Description	Distance from BESS Facility (feet)	Direction from Project Boundary
1	Residence	593	NW
2	Residence	669	N
3	Residence	826	NW
4	Residence	979	N
5	Residence	1275	N
6	Residence	1301	SW
7	Residence	1470	SW
8	Residence	1620	N
9	Residence	1684	SW
10	Residence	1725	SW
11	Residence	1766	SW
12	Residence	1813	SW
13	Residence	1816	SW
14	Residence	1868	NW
15	Residence	1946	W
16	Residence	2015	N
17	Residence	2128	NW
18	Residence	2264	N
19	Residence	2395	SW
20	Residence	2541	W
21	Residence	2581	W
22	Residence	2617	SW
23	Residence	2657	N
24	Residence	2765	N
25	Residence	2769	N

Table 3.0-1			
Proximity of the 25 Nearest NSAs within the North Star BESS			
NSA	NSA Description	Distance from BESS Facility (feet)	Direction from Project Boundary
26	Residence	2835	W
27	Residence	2897	NW
28	Residence	2916	W
29	Residence	2981	W
30	Residence	3033	SW
31	Residence	3134	NW
32	Residence	3195	NE
33	Residence	3198	N
34	Residence	3199	W

Additionally, NSAs were grouped by the distance from the BESS, shown in Table 3.0-2.

Table 3.0-2	
Proximity of NSAs within 3,200 feet of the North Star BESS	
Distance from site to NSAs (feet)	Number of NSAs
<50	0
50 - 100	0
100 - 200	0
200 - 400	0
400 - 800	2
800 - 1,600	5
1,600 - 3,200	27

The Project area and all identified NSAs are shown on Figure 3.0-1. The Project will use the existing substation transformer for the North Star Solar Facility (Solar Facility), located adjacent to the BESS. Since operational noise attributable to the substation transformer may increase due to the operation of the BESS, the existing substation transformer has been included in this noise impact assessment.



4.0 ACOUSTICAL ANALYSIS

Merjent performed this noise impact assessment using ISO 9613-2¹ standard sound propagation calculations to conservatively estimate the sound levels attributable to operation of the Project at the NSAs. The assessment involved generating sound propagation calculations that simulated sound attenuation across varying distances to the identified NSAs, which included nearby rural residences. The sound calculations are provided in Appendix A of this report. Merjent considered critical factors such as source sound power levels, hemispherical radiation, atmospheric absorption, and foliage where appropriate. Typically, foliage attenuation increases with higher frequencies and greater vegetation density, where sound reduction is expressed in terms of decibels per meter of foliage depth.² The calculations assumed a ground absorption factor of 0, and meteorological conditions of 15 degrees Celsius and 70 percent humidity.

Since the BESS will be operating 24 hours per day, the L_{dn} (Day-Night Noise Level) metric was used to describe overall noise attributable to the operation of the Project. The L_{dn} is a metric used to assess environmental noise levels over a 24-hour period, taking into account the variations in noise during the day and night. It is a weighted average of sound levels, where noise occurring during the nighttime (from 10:00 p.m. to 7:00 a.m.) is penalized by adding a 10-decibel penalty to reflect its greater potential impact on human health and well-being. For more information on how L_{dn} is calculated, see section 6.1.7 of this report.

In order to estimate the operational noise of the BESS and associated equipment, Merjent used manufacturers' noise specifications from a similar project. These noise specifications are based on sound pressure levels established during manufacturer testing, using a noise transducer positioned at a distance of 1 meter. The noise specifications provided by equipment manufacturers represent a conservative, worst-case scenario, and typical operational noise associated with the Project will be lower than the provided sound power levels.

Table 4.0-1 lists the assumed noise generating activities for operation of the Project in A-weighted decibels (dBA). The current noise estimates for the Project have been developed to include the existing noise profile of the existing substation transformer, located adjacent to the BESS. By integrating the noise generated by the existing substation in the acoustic assessment, this report provides a complete and conservative sound estimate of the total site noise levels associated with the Project.

¹ ISO 9613-2:2024 - Acoustics — Attenuation of sound during propagation outdoors — Part 2: Engineering method for the prediction of sound pressure levels outdoors

² ISO 9613-2:2024 – Table A.1

Table 4.0-1

Anticipated Operational Noise Levels for the Project

Type	Equipment Model	Distance to 50 dBA (feet)	dBA at 50 feet	Number of Units
BESS Unit	LG DC Link Battery	104	56.6	120
Auxiliary Skid	Unknown	12	37.3	4
Medium Voltage Transformer	EPC M Series	113	57.3	30
O&M Building HVAC	Unknown	107	56.8	1
Substation Transformer	Unknown	312	66.2	1

Note: Noise estimates from the manufacturer are preliminary and conservative; therefore, the estimated distance to a dBA of 50 and dBA at 50 feet represent the worst-case scenario.

Table 4.0-2 summarizes the estimated sound levels (L_{dn}) from Project operations at the identified NSAs. The analysis assumes an ambient noise level of 45 dBA L_{dn} , based on average sound level ranges in ANSI/ASA S12.9-2013 Part 3³. Table 4.0-2 shows predicted noise levels due to the operation of the Project.

Table 4.0-2

Operational Noise Level at NSAs within 3,200 feet of the Project

NSA	Background Sound Level L_{dn} (dBA)	Sound Level L_{dn} Attributable to Project (dBA)	Total Calculated Sound Level (dBA)	Calculated Potential Increase at NSA (dB)
1	45	55.1	55.5	10.5
2	45	60.4	60.5	15.5
3	45	56.0	56.3	11.3
4	45	53.8	54.4	9.4
5	45	47.2	49.2	4.2
6	45	52.3	53.0	8.0
7	45	47.5	49.4	4.4
8	45	44.9	48.0	3.0
9	45	48.1	49.8	4.8
10	45	48.1	49.8	4.8
11	45	45.2	48.1	3.1
12	45	47.4	49.4	4.4
13	45	47.9	49.7	4.7
14	45	43.6	47.4	2.4
15	45	44.6	47.8	2.8
16	45	42.9	47.1	2.1
17	45	44.7	47.9	2.9
18	45	47.8	49.6	4.6
19	45	47.5	49.5	4.5
20	45	44.4	47.7	2.7
21	45	47.7	49.6	4.6
22	45	45.6	48.3	3.3
23	45	47.4	49.4	4.4
24	45	47.0	49.1	4.1
25	45	46.9	49.1	4.1

³ ANSI S12.9-Part 3-1993 (R2003) - Quantities and Procedures for Description and Measurement of Environmental Sound - Part 3: Short-Term Measurements with an Observer Present

Table 4.0-2					
Operational Noise Level at NSAs within 3,200 feet of the Project					
NSA	Background Sound Level L _{dn} (dBA)	Sound Level L _{dn} Attributable to Project (dBA)	Total Calculated Sound Level (dBA)	Calculated Potential Increase at NSA (dB)	
26	45	43.9	47.5	2.5	
27	45	46.4	48.7	3.7	
28	45	45.3	48.2	3.2	
29	45	44.4	47.7	2.7	
30	45	42.7	47.0	2.0	
31	45	45.6	48.3	3.3	
32	45	45.5	48.3	3.3	
33	45	45.4	48.2	3.2	
34	45	45.3	48.2	3.2	

Based on the unmitigated operational noise data in Table 4.0-2, the Minnesota state nighttime noise limit of 50 dBA is not exceeded at most NSAs, with exceptions occurring at NSAs 1, 2, 3, 4, and 6. However, the calculations utilized the most conservative sound estimates for Project components, deliberately creating a worst-case scenario analysis. In practice, the Project will likely generate significantly less operational noise than these conservative calculations suggest. North Star Storage will perform a noise analysis after establishing the final Project design to re-evaluate the noise attributable to Project operations. If the evaluation reveals that operational noise levels exceed the guideline of 50 dBA, sound mitigation measures will be implemented to bring the noise levels into compliance with state regulations.

5.0 SOUND MITIGATION MEASURES

To address potential noise level exceedances from Minnesota state nighttime limits, North Star Storage will implement targeted noise mitigation strategies. These may include installing equipment silencers, landscaping interventions, constructing noise barriers, equipment modifications, operational adjustments, or using a combination of methods. BESS units will be strategically positioned away from property boundaries and equipped with sound-absorbing enclosures. As an example, Merjent prepared noise calculations to estimate the effects of strategically placing noise barriers made of dense, sound-absorbing material along the northern and southern boundaries of the North Star BESS. For the purpose of these calculations, Merjent selected a noise reducing acoustic fence with a Sound Transmission Class (STC) rating of 28. Merjent used the manufacturer-provided Sound Transmission losses to determine the mitigated noise levels at the five NSAs where the anticipated noise from the Project exceeds 50 dB (NSAs 1, 2, 3, 4, and 6). These barriers should rise high enough to block the direct sound path from the noise-generating equipment and eliminate the line of sight between the North Star BESS and these NSAs. The results are listed in Table 5.0-1.

Table 5.0-1			
Mitigated Operational Noise Level at NSAs With Acoustic Barrier			
NSA	Sound Level L _{dn} Attributable to Project (dBA) Without Mitigation	Sound Level L _{dn} Attributable to Project With Acoustic Barrier (dBA)	
1	55.1	46.2	
2	60.4	45.8	
3	56.0	42.4	
4	53.8	39.2	
6	52.3	41.8	

The use of acoustic barriers reduced the Project's operational noise levels below the 50 dBA threshold, demonstrating one potential strategy for mitigating the acoustic impacts of the Project. The specific mitigation approach will depend on final equipment selection and may require comprehensive noise analysis to ensure effective noise reduction.

6.0 SOUND PRINCIPLES

6.1 SUMMARY OF TYPICAL METRICS AND ACOUSTICAL TERMINOLOGY

6.1.1 Decibels

Sound is typically regulated based on the unit of measure called a decibel (dB). A decibel represents a logarithmic correlation between a sound pressure and a reference pressure (0.00002 Newtons/meter²) as shown in the equation below.

$$dB = 20 \text{ Log}_{10} \left(\frac{P}{P_0} \right)$$

where:

P = sound pressure

P₀ = reference sound pressure (0.00002 N/m²)

6.1.2 A-weighting

Sound is composed of varying pressure at specific frequencies. Because the human ear is more sensitive to pressure at some frequencies and less at others, an A-weighting is often applied to dB sound levels to represent A-weighted decibels (dBA). Most environmental noise standards are written in terms of dBA because the primary purpose of the regulations is to limit impacts to human beings.

6.1.3 Decibel Calculations

In general, the predicted A-weighted sound level contributed by operating equipment was supplied by the manufacturer. The sound pressure levels generally reduce over distance following the logarithmic function shown below.

$$L_2 = L_1 - \left| 20 \text{ LOG} \left(\frac{r_1}{r_2} \right) \right|$$

Where:

L₁ = sound pressure level (dB) at distance r₁ from source

L₂ = sound pressure level (dB) at distance r₂ from source

All noise levels are in dBA.

6.1.4 Daytime Equivalent Sound Level (L_d)

The daytime equivalent sound level is the level determined to represent the equivalent (average) sound level (in dB) for the time period between 7 a.m. and 10 p.m. for a given location.

6.1.5 Nighttime Equivalent Sound Level (L_n)

The nighttime equivalent sound level is the level determined to represent the equivalent (average) sound level (in dB) for the time period between 10 p.m. and 7 a.m. for a given location.

6.1.6 Equivalent Sound Level (L_{eq})

The equivalent sound level (L_{eq}) quantifies the sound as a single value to represent the sound level at a specific location for a specific duration. The L_{eq} is sometimes referred to as the “average” sound level.

6.1.7 Day-Night Equivalent Sound Level (L_{dn})

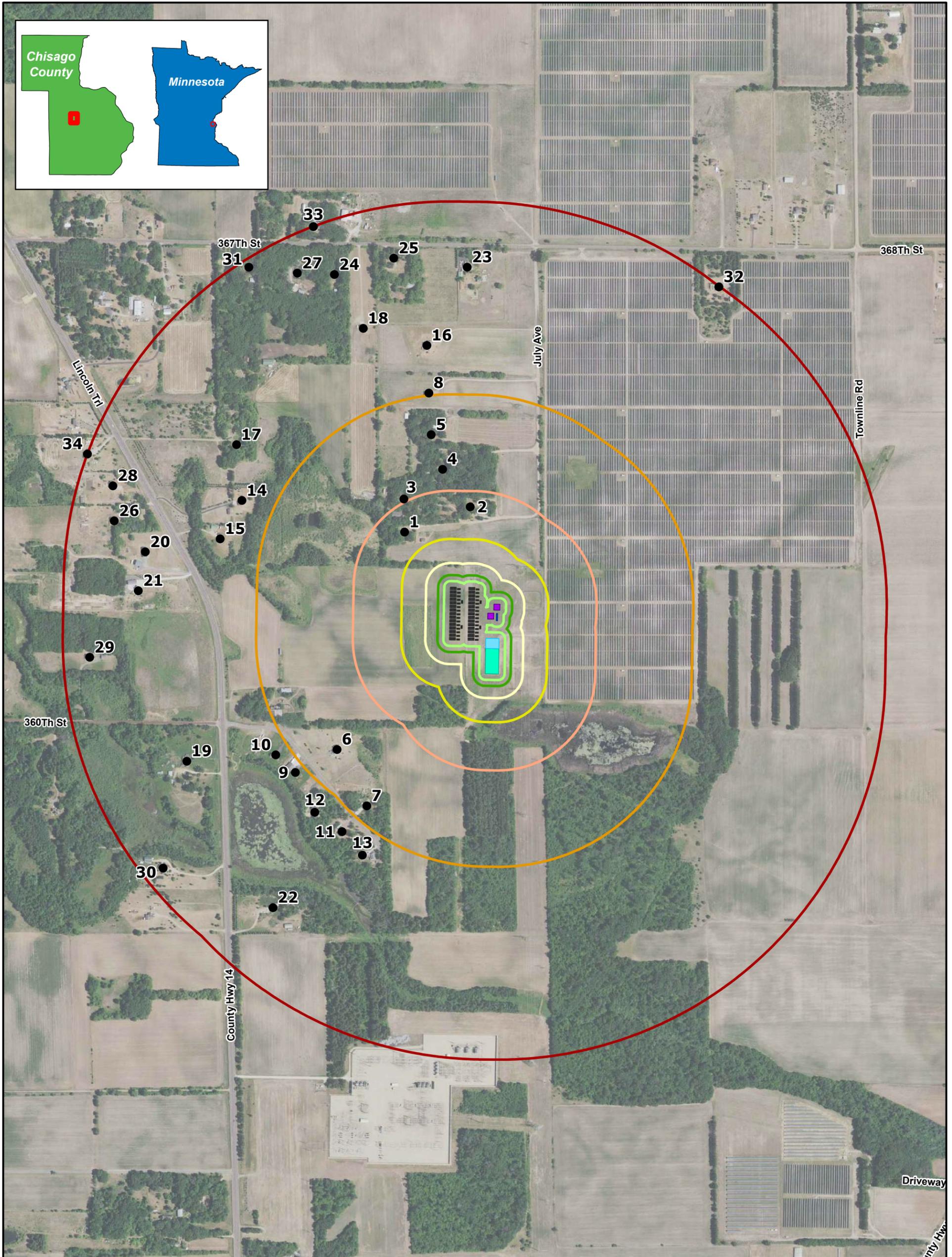
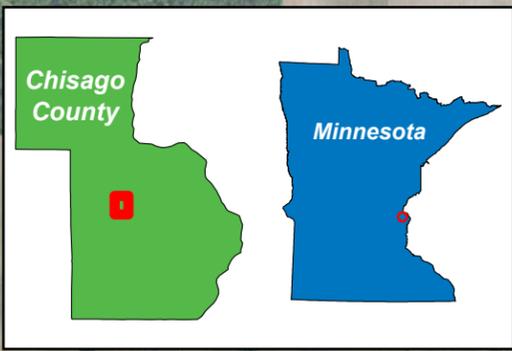
The day-night equivalent sound level (L_{dn}) is a 24-hour average A-wt. L_{eq} of the measured L_d and L_n with 10 dB added to the sound levels occurring during the nighttime hours between 10 p.m. and 7 a.m. to compensate for enhanced receptor sensitivity during the nighttime. For a source that operates at a continuous sound level over a 24-hour period, such as a compressor station, the L_{dn} is approximately 6.4 dB above the measured L_{eq} .

$$L_{dn} = 10 \log_{10} \left(\frac{15}{24} 10^{L_d/10} + \frac{9}{24} 10^{(L_n+10)/10} \right)$$

6.1.8 Sound Power Level (L_w or PWL)

Sound power is the total sound energy radiated by a source, in all directions indexed to a reference power. A reference power of a picowatt or 10⁻¹² watt is conventionally used.

Figures



0 375 750 Feet

1:9,000

Figure 3.0-1
Noise Sensitive Areas
North Star BESS Project
Chisago County, MN

Noise Buffer (Ft)	
● Residence	50
■ BESS	100
■ Container	200
■ BESS Offset	400
■ O&M Building	800
■ Existing Substation	1600
■ Substation Expansion	3200

Appendix A – Calculations

Type	Dist_Range	ID	Distance to BESS	Noise Attributable to the Project	Total Calculated Sound Level	Estimated Ambient Noise Level (dBA)	Total Increase
Residence	400'-800'	1	593	55.1	55.5	45	10.5
Residence	400'-800'	2	669	60.4	60.5	45	15.5
Residence	400'-800'	3	826	56.0	56.3	45	11.3
Residence	800'-1600'	4	979	53.8	54.4	45	9.4
Residence	800'-1600'	5	1275	47.2	49.2	45	4.2
Residence	200'-400'	6	1301	52.3	53.0	45	8.0
Residence	400'-800'	7	1470	47.5	49.4	45	4.4
Residence	800'-1600'	8	1620	44.9	48.0	45	3.0
Residence	400'-800'	9	1684	48.1	49.8	45	4.8
Residence	200'-400'	10	1725	48.1	49.8	45	4.8
Residence	800'-1600'	11	1766	45.2	48.1	45	3.1
Residence	400'-800'	12	1813	47.4	49.4	45	4.4
Residence	800'-1600'	13	1816	47.9	49.7	45	4.7
Residence	400'-800'	14	1868	43.6	47.4	45	2.4
Residence	200'-400'	15	1946	44.6	47.8	45	2.8
Residence	1600'-3200'	16	2015	42.9	47.1	45	2.1
Residence	800'-1600'	17	2128	44.7	47.9	45	2.9
Residence	1600'-3200'	18	2264	47.8	49.6	45	4.6
Residence	400'-800'	19	2395	47.5	49.5	45	4.5
Residence	400'-800'	20	2541	44.4	47.7	45	2.7
Residence	400'-800'	21	2581	47.7	49.6	45	4.6
Residence	800'-1600'	22	2617	45.6	48.3	45	3.3
Residence	1600'-3200'	23	2657	47.4	49.4	45	4.4
Residence	1600'-3200'	24	2765	47.0	49.1	45	4.1
Residence	1600'-3200'	25	2769	46.9	49.1	45	4.1
Residence	400'-800'	26	2835	43.9	47.5	45	2.5
Residence	1600'-3200'	27	2897	46.4	48.7	45	3.7
Residence	800'-1600'	28	2916	45.3	48.2	45	3.2
Residence	800'-1600'	29	2981	44.4	47.7	45	2.7
Residence	800'-1600'	30	3033	42.7	47.0	45	2.0
Residence	1600'-3200'	31	3134	45.6	48.3	45	3.3
Residence	1600'-3200'	32	3195	45.5	48.3	45	3.3
Residence	1600'-3200'	33	3198	45.4	48.2	45	3.2
Residence	800'-1600'	34	3199	45.3	48.2	45	3.2

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 1

593	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1125	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
15	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
593	Hemispherical Radiation	-53	-53	-53	-53	-53	-53	-53	-53	-53	
593	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-17	
	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to BESS Unit (dBA)	0	2	16	36	30	28	24	15	0	33.2
		Sound Level Attributable to BESS Unit (dBA Ldn)									39.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									46.1

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
593	Hemispherical Radiation	-53	-53	-53	-53	-53	-53	-53	-53	-53	
593	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-17	
	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to Auxiliary Skid (dBA)	0	18	20	14	14	8	2	0	0	14.6
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									21.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
593	Hemispherical Radiation	-53	-53	-53	-53	-53	-53	-53	-53	-53	
593	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-17	
	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to O&M HVAC (dBA)	0	36	36	29	29	29	26	17	0	33.2
		Sound Level Attributable to O&M HVAC (dBA Ldn)									39.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									46.1

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
593	Hemispherical Radiation	-53	-53	-53	-53	-53	-53	-53	-53	-53	
593	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-17	
	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	13	27	30	29	27	19	4	33.5
		Sound Level Attributable to Solar Inverter (dBA Ldn)									39.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									46.2
		0	101	103	98	98	92	87	82	75	

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1125	Hemispherical Radiation	-59	-59	-59	-59	-59	-59	-59	-59	-59	
1125	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-9	-32	
	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to Substation Transformer (dBA)	0	0	44	38	37	30	24	12	0	37.2
		Sound Level Attributable to Substation Transformer (dBA Ldn)									43.6
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	55.1
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	55.5
Calculated Potential Increase at NSA - dB	10.5

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 2

668	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1120	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
17	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 20-200 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to BESS Unit (dBA)	0	1	15	35	29	27	23	13	0	32.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									38.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.9

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to Auxiliary Skid (dBA)	0	17	19	13	13	7	1	0	0	13.6
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									20.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to O&M HVAC (dBA)	0	35	35	28	28	28	25	15	0	32.1
		Sound Level Attributable to O&M HVAC (dBA Ldn)									38.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.9

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	12	26	29	28	26	17	1	32.3
		Sound Level Attributable to Solar Inverter (dBA Ldn)									38.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.9
		0	101	103	98	98	92	87	82	75	

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1120	Hemispherical Radiation	-59	-59	-59	-59	-59	-59	-59	-59	-59	
1120	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-9	-32	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to Substation Transformer (dBA)	0	0	44	38	37	31	24	12	0	37.3
		Sound Level Attributable to Substation Transformer (dBA Ldn)									43.7
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	60.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	60.5
Calculated Potential Increase at NSA - dB	15.5

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 3

		Number of BESS Units
825	Distance from NSA to Nearest BESS Unit	120
		Number of Auxiliary Skids
		4
1330	Distance from NSA to Substation Transformer	Number of O&M HVAC Units
		1
60	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers
		1
		Number of Inverters
		30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to BESS Unit (dBA)	0	0	11	31	25	22	17	7	0	27.8
		Sound Level Attributable to BESS Unit (dBA Ldn)									34.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.3

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to Auxiliary Skid (dBA)	0	14	16	10	9	2	0	0	0	10.4
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									16.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to O&M HVAC (dBA)	0	31	32	25	24	24	19	9	0	27.4
		Sound Level Attributable to O&M HVAC (dBA Ldn)									33.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.3

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	8	22	25	23	20	11	0	27.4
		Sound Level Attributable to Solar Inverter (dBA Ldn)									33.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.3

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1330	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1330	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-4	-11	-38	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to Substation Transformer (dBA)	0	0	40	35	33	26	18	5	0	33.5
		Sound Level Attributable to Substation Transformer (dBA Ldn)									39.9
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	56.0
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	56.3
Calculated Potential Increase at NSA - dB	11.3

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 4

979	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1448	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
70	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to BESS Unit (dBA)	0	0	9	29	23	20	14	3	0	25.6
		Sound Level Attributable to BESS Unit (dBA Ldn)									32.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Auxiliary Skid (dBA)	0	13	14	8	7	0	0	0	0	9.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									15.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to O&M HVAC (dBA)	0	30	30	23	22	21	16	5	0	25.1
		Sound Level Attributable to O&M HVAC (dBA Ldn)									31.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	6	20	23	21	17	7	0	25.1
		Sound Level Attributable to Solar Inverter (dBA Ldn)									31.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2
		0	101	103	98	98	92	87	82	75	

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1448	Hemispherical Radiation	-61	-61	-61	-61	-61	-61	-61	-61	-61	
1448	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-4	-12	-41	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Substation Transformer (dBA)	0	0	39	33	32	25	16	3	0	32.2
		Sound Level Attributable to Substation Transformer (dBA Ldn)									38.6
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	53.8
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	54.4
Calculated Potential Increase at NSA - dB	9.4

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 5

1274	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1735	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
150	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1274	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1274	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-36	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to BESS Unit (dBA)	0	0	5	24	17	13	5	0	0	19.0
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1274	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1274	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-36	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Auxiliary Skid (dBA)	0	9	9	2	0	0	0	0	0	7.3
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1274	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1274	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-36	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to O&M HVAC (dBA)	0	26	25	17	15	14	7	0	0	18.2
		Sound Level Attributable to O&M HVAC (dBA Ldn)									24.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1274	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1274	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-36	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	2	15	17	14	8	0	0	17.8
		Sound Level Attributable to Solar Inverter (dBA Ldn)									24.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1735	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1735	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-50	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Substation Transformer (dBA)	0	0	35	29	26	18	8	0	0	26.7
		Sound Level Attributable to Substation Transformer (dBA Ldn)									33.1
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	47.2
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.2
Calculated Potential Increase at NSA - dB	4.2

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 6

1300	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1330	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
50	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Sound Attributable to BESS Unit (dBA)	0	0	7	28	22	18	13	0	0	23.9
		Sound Level Attributable to BESS Unit (dBA Ldn)									30.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Sound Attributable to Auxiliary Skid (dBA)	0	11	12	6	5	0	0	0	0	8.4
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									14.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Sound Attributable to O&M HVAC (dBA)	0	28	28	21	20	20	15	2	0	23.4
		Sound Level Attributable to O&M HVAC (dBA Ldn)									29.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	4	19	22	19	16	4	0	23.4
		Sound Level Attributable to Solar Inverter (dBA Ldn)									29.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1330	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1330	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-4	-11	-38	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Sound Attributable to Substation Transformer (dBA)	0	39	41	35	34	27	19	6	0	34.0
		Sound Level Attributable to Substation Transformer (dBA Ldn)									40.4
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	52.3
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	53.0
Calculated Potential Increase at NSA - dB	8.0

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 7

1469	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1469	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
120	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)									Total A-Wt
		31.5	63	125	250	500	1000	2000	4000	8000	
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1469	Hemispherical Radiation	-61	-61	-61	-61	-61	-61	-61	-61	-61	
1469	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-12	-42	
120	Foliage Attenuation (Between 20-200m)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to BESS Unit (dBA)	0	0	4	24	17	13	5	0	0	19.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)									Total A-Wt
		31.5	63	125	250	500	1000	2000	4000	8000	
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1469	Hemispherical Radiation	-61	-61	-61	-61	-61	-61	-61	-61	-61	
1469	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-12	-42	
120	Foliage Attenuation (Between 20-200m)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to Auxiliary Skid (dBA)	0	8	9	2	1	0	0	0	0	7.3
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)									Total A-Wt
		31.5	63	125	250	500	1000	2000	4000	8000	
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1469	Hemispherical Radiation	-61	-61	-61	-61	-61	-61	-61	-61	-61	
1469	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-12	-42	
120	Foliage Attenuation (Between 20-200m)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to O&M HVAC (dBA)	0	25	25	17	15	14	7	0	0	18.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									24.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)									Total A-Wt
		31.5	63	125	250	500	1000	2000	4000	8000	
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1469	Hemispherical Radiation	-61	-61	-61	-61	-61	-61	-61	-61	-61	
1469	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-12	-42	
120	Foliage Attenuation (Between 20-200m)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	1	15	17	14	8	0	0	18.0
		Sound Level Attributable to Solar Inverter (dBA Ldn)									24.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)									Total A-Wt
		31.5	63	125	250	500	1000	2000	4000	8000	
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1469	Hemispherical Radiation	-61	-61	-61	-61	-61	-61	-61	-61	-61	
1469	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-12	-42	
120	Foliage Attenuation (Between 20-200m)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to Substation Transformer (dBA)	0	37	38	31	30	22	12	0	0	29.7
		Sound Level Attributable to Substation Transformer (dBA Ldn)									36.1
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	47.5
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.4
Calculated Potential Increase at NSA - dB	4.4

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 8

1619	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
2072	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
150	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1619	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1619	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-13	-46	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to BESS Unit (dBA)	0	0	2	22	14	10	2	0	0	16.8
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1619	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1619	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-13	-46	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Auxiliary Skid (dBA)	0	7	7	0	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1619	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1619	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-13	-46	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to O&M HVAC (dBA)	0	24	23	15	13	11	4	0	0	15.8
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1619	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1619	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-13	-46	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	13	14	11	5	0	0	15.4
		Sound Level Attributable to Solar Inverter (dBA Ldn)									21.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2072	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2072	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-3	-6	-17	-59	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Substation Transformer (dBA)	0	34	34	27	25	16	5	0	0	25.0
		Sound Level Attributable to Substation Transformer (dBA Ldn)									31.4
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	44.9
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.0
Calculated Potential Increase at NSA - dB	3.0

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 9

1683	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1757	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
80	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1683	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1683	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-14	-48	
80	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to BESS Unit (dBA)	0	0	4	24	18	14	7	0	0	19.8
		Sound Level Attributable to BESS Unit (dBA Ldn)									26.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1683	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1683	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-14	-48	
80	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to Auxiliary Skid (dBA)	0	8	9	3	1	0	0	0	0	7.4
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1683	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1683	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-14	-48	
80	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to O&M HVAC (dBA)	0	25	25	18	16	15	9	0	0	19.1
		Sound Level Attributable to O&M HVAC (dBA Ldn)									25.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1683	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1683	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-4	-14	-48	
80	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	1	15	18	15	10	0	0	18.9
		Sound Level Attributable to Solar Inverter (dBA Ldn)									25.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1757	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1757	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-50	
80	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to Substation Transformer (dBA)	0	36	37	31	30	22	13	0	0	29.9
		Sound Level Attributable to Substation Transformer (dBA Ldn)									36.3
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	48.1
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.8
Calculated Potential Increase at NSA - dB	4.8

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA **10**

1724	Distance from NSA to Nearest BESS Unit	Number of BESS Units 120
1847	Distance from NSA to Substation Transformer	Number of Auxiliary Skids 4
75	Foliage Thickness (meters) [if applicable]	Number of O&M HVAC Units 1 Number of Substation Transformers 1 Number of Inverters 30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1724	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1724	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-49	
75	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-9	
	Sound Attributable to BESS Unit (dBA)	0	0	4	24	18	14	7	0	0	19.8
		Sound Level Attributable to BESS Unit (dBA Ldn)									26.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
1724	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1724	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-49	
75	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-9	
	Sound Attributable to Auxiliary Skid (dBA)	0	8	9	3	1	0	0	0	0	7.4
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
1724	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1724	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-49	
75	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-9	
	Sound Attributable to O&M HVAC (dBA)	0	25	25	18	16	15	9	0	0	19.1
		Sound Level Attributable to O&M HVAC (dBA Ldn)									25.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1724	Hemispherical Radiation	-62	-62	-62	-62	-62	-62	-62	-62	-62	
1724	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-49	
75	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-9	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	1	15	18	15	10	0	0	18.9
		Sound Level Attributable to Solar Inverter (dBA Ldn)									25.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1847	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1847	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-53	
75	Foliage Attenuation (Between 20-200 meters)	0	-2	-2	-3	-4	-5	-6	-7	-9	
	Sound Attributable to Substation Transformer (dBA)	0	36	37	31	30	22	13	0	0	29.6
		Sound Level Attributable to Substation Transformer (dBA Ldn)									36.0
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	48.1
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.8
Calculated Potential Increase at NSA - dB	4.8

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 11

1766	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1766	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
130	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1766	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1766	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-50	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Sound Attributable to BESS Unit (dBA)	0	0	2	22	15	10	2	0	0	16.9
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1766	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1766	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-50	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Sound Attributable to Auxiliary Skid (dBA)	0	6	7	0	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1766	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1766	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-50	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Sound Attributable to O&M HVAC (dBA)	0	23	23	15	13	12	4	0	0	16.0
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1766	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1766	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-50	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	13	15	11	5	0	0	15.6
		Sound Level Attributable to Solar Inverter (dBA Ldn)									22.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1766	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1766	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-14	-50	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Sound Attributable to Substation Transformer (dBA)	0	35	36	29	27	19	9	0	0	27.5
		Sound Level Attributable to Substation Transformer (dBA Ldn)									33.9
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	45.2
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.1
Calculated Potential Increase at NSA - dB	3.1

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA **12**

1812	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1812	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
80	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1812	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1812	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
80	Foliage Attenuation (Between 20-200m)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to BESS Unit (dBA)	0	0	4	23	17	13	6	0	0	19.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1812	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1812	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
80	Foliage Attenuation (Between 20-200m)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to Auxiliary Skid (dBA)	0	7	8	2	0	0	0	0	0	7.2
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1812	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1812	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
80	Foliage Attenuation (Between 20-200m)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to O&M HVAC (dBA)	0	24	24	17	15	14	8	0	0	18.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									24.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1812	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1812	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
80	Foliage Attenuation (Between 20-200m)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	1	14	17	14	9	0	0	18.1
		Sound Level Attributable to Solar Inverter (dBA Ldn)									24.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1812	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1812	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
80	Foliage Attenuation (Between 20-200m)	0	-2	-2	-3	-4	-5	-6	-7	-10	
	Sound Attributable to Substation Transformer (dBA)	0	36	37	31	29	22	13	0	0	29.6
		Sound Level Attributable to Substation Transformer (dBA Ldn)									36.0
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	47.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.4
Calculated Potential Increase at NSA - dB	4.4

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 13

1815	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1815	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
70	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1815	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1815	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to BESS Unit (dBA)	0	0	4	24	17	14	7	0	0	19.5
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1815	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1815	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Auxiliary Skid (dBA)	0	7	8	2	1	0	0	0	0	7.3
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1815	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1815	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to O&M HVAC (dBA)	0	24	24	17	16	15	9	0	0	18.8
		Sound Level Attributable to O&M HVAC (dBA Ldn)									25.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1815	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1815	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	1	15	17	15	10	0	0	18.7
		Sound Level Attributable to Solar Inverter (dBA Ldn)									25.1
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1815	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1815	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-52	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Substation Transformer (dBA)	0	36	37	31	30	22	13	0	0	30.0
		Sound Level Attributable to Substation Transformer (dBA Ldn)									36.4
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	47.9
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.7
Calculated Potential Increase at NSA - dB	4.7

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 14

1868	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
2330	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
150	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1868	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1868	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-53	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to BESS Unit (dBA)	0	0	1	20	13	9	0	0	0	15.4
		Sound Level Attributable to BESS Unit (dBA Ldn)									21.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
1868	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1868	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-53	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	6	0	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
1868	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1868	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-53	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to O&M HVAC (dBA)	0	23	22	14	11	10	2	0	0	14.5
		Sound Level Attributable to O&M HVAC (dBA Ldn)									20.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1868	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1868	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-15	-53	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	11	13	10	3	0	0	14.0
		Sound Level Attributable to Solar Inverter (dBA Ldn)									20.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2330	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2330	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-3	-6	-19	-67
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Substation Transformer (dBA)	0	32	33	26	23	15	3	0	0	23.8
		Sound Level Attributable to Substation Transformer (dBA Ldn)									30.2
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	43.6
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.4
Calculated Potential Increase at NSA - dB	2.4

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 15

1945	Distance from NSA to Nearest BESS Unit	Number of BESS Units 120
		Number of Auxiliary Skids 4
2320	Distance from NSA to Substation Transformer	Number of O&M HVAC Units 1
120	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers 1
		Number of Inverters 30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1945	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1945	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-16	-56	
120	Foliage Attenuation (Between 20-200 meters)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to BESS Unit (dBA)	0	0	2	21	14	10	2	0	0	16.4
		Sound Level Attributable to BESS Unit (dBA Ldn)									22.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
1945	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1945	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-16	-56	
120	Foliage Attenuation (Between 20-200 meters)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to Auxiliary Skid (dBA)	0	6	6	0	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
1945	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1945	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-16	-56	
120	Foliage Attenuation (Between 20-200 meters)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to O&M HVAC (dBA)	0	23	22	15	13	11	4	0	0	15.5
		Sound Level Attributable to O&M HVAC (dBA Ldn)									21.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
1945	Hemispherical Radiation	-63	-63	-63	-63	-63	-63	-63	-63	-63	
1945	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-5	-16	-56	
120	Foliage Attenuation (Between 20-200 meters)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	14	11	5	0	0	15.2
		Sound Level Attributable to Solar Inverter (dBA Ldn)									21.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2320	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2320	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-19	-66	
120	Foliage Attenuation (Between 20-200 meters)	0	-2	-4	-5	-6	-7	-10	-11	-14	
	Sound Attributable to Substation Transformer (dBA)	0	33	34	27	25	17	6	0	0	25.2
		Sound Level Attributable to Substation Transformer (dBA Ldn)									31.6
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	44.6
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.8
Calculated Potential Increase at NSA - dB	2.8

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 16

		Number of BESS Units
2014	Distance from NSA to Nearest BESS Unit	120
		Number of Auxiliary Skids
		4
2470	Distance from NSA to Substation Transformer	Number of O&M HVAC Units
		1
150	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers
		1
		Number of Inverters
		30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2014	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2014	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-3	-5	-16	-58	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to BESS Unit (dBA)	0	0	1	20	12	8	0	0	0	14.8
		Sound Level Attributable to BESS Unit (dBA Ldn)									21.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2014	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2014	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-3	-5	-16	-58	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	5	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2014	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2014	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-3	-5	-16	-58	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to O&M HVAC (dBA)	0	22	21	13	11	9	1	0	0	13.7
		Sound Level Attributable to O&M HVAC (dBA Ldn)									20.1
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2014	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2014	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-3	-5	-16	-58	
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	11	12	9	2	0	0	13.3
		Sound Level Attributable to Solar Inverter (dBA Ldn)									19.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2470	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2470	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-1	-2	-3	-7	-20	-71
150	Foliage Attenuation (Between 20-200 meters)	0	-3	-5	-6	-8	-9	-12	-14	-18	
	Sound Attributable to Substation Transformer (dBA)	0	32	32	25	23	14	2	0	0	23.3
		Sound Level Attributable to Substation Transformer (dBA Ldn)									29.7
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	42.9
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.1
Calculated Potential Increase at NSA - dB	2.1

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA

17

2127	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
2578	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
100	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2127	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2127	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-17	-61	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to BESS Unit (dBA)	0	0	2	21	14	10	2	0	0	16.5
		Sound Level Attributable to BESS Unit (dBA Ldn)									22.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
2127	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2127	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-17	-61	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	6	0	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
2127	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2127	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-17	-61	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to O&M HVAC (dBA)	0	22	22	15	13	11	4	0	0	15.6
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2127	Hemispherical Radiation	-64	-64	-64	-64	-64	-64	-64	-64	-64	
2127	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-17	-61	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	14	11	5	0	0	15.3
		Sound Level Attributable to Solar Inverter (dBA Ldn)									21.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2578	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2578	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-74	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to Substation Transformer (dBA)	0	33	33	27	25	16	6	0	0	25.1
		Sound Level Attributable to Substation Transformer (dBA Ldn)									31.5
		Existing Sound Level at NSA									45

Total Sound Contribution at NSA (Ldn) - dBA	44.7
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.9
Calculated Potential Increase at NSA - dB	2.9

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA **18**

2264	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
2750	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
25	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2264	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2264	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-18	-65	
25	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-1	-2	-2	-2	-3	
	Sound Attributable to BESS Unit (dBA)	0	0	3	23	17	14	7	0	0	19.5
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2264	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2264	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-18	-65	
25	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-1	-2	-2	-2	-3	
	Sound Attributable to Auxiliary Skid (dBA)	0	6	8	2	1	0	0	0	0	7.3
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2264	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2264	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-18	-65	
25	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-1	-2	-2	-2	-3	
	Sound Attributable to O&M HVAC (dBA)	0	23	24	17	16	15	9	0	0	18.9
		Sound Level Attributable to O&M HVAC (dBA Ldn)									25.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2264	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2264	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-18	-65	
25	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-1	-2	-2	-2	-3	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	14	17	15	10	0	0	18.8
		Sound Level Attributable to Solar Inverter (dBA Ldn)									25.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2750	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2750	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
25	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-1	-2	-2	-2	-3	
	Sound Attributable to Substation Transformer (dBA)	0	34	35	29	28	20	11	0	0	27.9
		Sound Level Attributable to Substation Transformer (dBA Ldn)									34.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.4

Total Sound Contribution at NSA (Ldn) - dBA	47.8
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.6
Calculated Potential Increase at NSA - dB	4.6

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA **19**

	Number of BESS Units	120
2395 Distance from NSA to Nearest BESS Unit	Number of Auxiliary Skids	4
2550 Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
20 Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2395	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2395	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-19	-68	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to BESS Unit (dBA)	0	0	3	23	17	14	7	0	0	19.2
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2395	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2395	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-19	-68	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Auxiliary Skid (dBA)	0	6	7	2	1	0	0	0	0	7.2
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2395	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2395	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-19	-68	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to O&M HVAC (dBA)	0	23	23	17	15	15	9	0	0	18.5
		Sound Level Attributable to O&M HVAC (dBA Ldn)									24.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2395	Hemispherical Radiation	-65	-65	-65	-65	-65	-65	-65	-65	-65	
2395	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-6	-19	-68	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	14	17	15	10	0	0	18.5
		Sound Level Attributable to Solar Inverter (dBA Ldn)									24.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2550	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2550	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-73	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Substation Transformer (dBA)	0	34	36	30	29	21	12	0	0	28.9
		Sound Level Attributable to Substation Transformer (dBA Ldn)									35.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.4

Total Sound Contribution at NSA (Ldn) - dBA	47.5
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.5
Calculated Potential Increase at NSA - dB	4.5

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA **20**

2540	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
2900	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
70	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2540	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2540	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-20	-73	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to BESS Unit (dBA)	0	0	1	21	14	10	2	0	0	16.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									22.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2540	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2540	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-20	-73	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	5	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2540	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2540	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-20	-73	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to O&M HVAC (dBA)	0	21	21	14	12	11	4	0	0	15.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									21.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2540	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2540	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-20	-73	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	14	11	5	0	0	15.1
		Sound Level Attributable to Solar Inverter (dBA Ldn)									21.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2900	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2900	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Substation Transformer (dBA)	0	32	33	27	25	17	6	0	0	25.2
		Sound Level Attributable to Substation Transformer (dBA Ldn)									31.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	44.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.7
Calculated Potential Increase at NSA - dB	2.7

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA

21

2580	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
2890	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
0	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2580	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2580	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-74	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to BESS Unit (dBA)	0	0	3	23	17	14	7	0	0	19.4
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2580	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2580	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-74	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Auxiliary Skid (dBA)	0	6	7	2	1	0	0	0	0	7.2
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2580	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2580	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-74	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to O&M HVAC (dBA)	0	23	23	17	16	15	9	0	0	18.8
		Sound Level Attributable to O&M HVAC (dBA Ldn)									25.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2580	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2580	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-74	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	14	17	15	10	0	0	18.8
		Sound Level Attributable to Solar Inverter (dBA Ldn)									25.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2890	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2890	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Substation Transformer (dBA)	0	34	35	30	29	21	12	0	0	28.6
		Sound Level Attributable to Substation Transformer (dBA Ldn)									35.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.4

Total Sound Contribution at NSA (Ldn) - dBA	47.7
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.6
Calculated Potential Increase at NSA - dB	4.6

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA

22

2617	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
2578	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
40	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2617	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2617	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-75	
40	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-2	-2	-2	-3	-4	-5	
	Sound Attributable to BESS Unit (dBA)	0	0	1	21	15	11	4	0	0	17.3
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2617	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2617	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-75	
40	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-2	-2	-2	-3	-4	-5	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	6	0	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2617	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2617	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-75	
40	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-2	-2	-2	-3	-4	-5	
	Sound Attributable to O&M HVAC (dBA)	0	22	22	15	13	13	6	0	0	16.5
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2617	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2617	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-75	
40	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-2	-2	-2	-3	-4	-5	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	15	12	7	0	0	16.4
		Sound Level Attributable to Solar Inverter (dBA Ldn)									22.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
2578	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2578	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-74	
40	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-2	-2	-2	-3	-4	-5	
	Sound Attributable to Substation Transformer (dBA)	0	34	35	29	28	20	11	0	0	27.9
		Sound Level Attributable to Substation Transformer (dBA Ldn)									34.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.4

Total Sound Contribution at NSA (Ldn) - dBA	45.6
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.3
Calculated Potential Increase at NSA - dB	3.3

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA

23

2656	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3035	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
0	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2656	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2656	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-76	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to BESS Unit (dBA)	0	0	3	23	17	14	7	0	0	19.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
2656	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2656	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-76	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	7	2	1	0	0	0	0	7.2
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
2656	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2656	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-76	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to O&M HVAC (dBA)	0	22	23	17	15	15	9	0	0	18.5
		Sound Level Attributable to O&M HVAC (dBA Ldn)									24.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2656	Hemispherical Radiation	-66	-66	-66	-66	-66	-66	-66	-66	-66	
2656	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-21	-76	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	14	17	15	10	0	0	18.4
		Sound Level Attributable to Solar Inverter (dBA Ldn)									24.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3035	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
3035	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-87	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Substation Transformer (dBA)	0	33	35	29	28	21	11	0	0	28.0
		Sound Level Attributable to Substation Transformer (dBA Ldn)									34.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.4

Total Sound Contribution at NSA (Ldn) - dBA	47.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.4
Calculated Potential Increase at NSA - dB	4.4

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 24

2765	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3240	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
60	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2765	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2765	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
60	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to BESS Unit (dBA)	0	0	2	23	16	13	6	0	0	18.7
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.1
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
2765	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2765	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
60	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	7	1	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
2765	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2765	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
60	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to O&M HVAC (dBA)	0	22	23	16	15	14	8	0	0	18.0
		Sound Level Attributable to O&M HVAC (dBA Ldn)									24.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2765	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2765	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
60	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	14	16	14	9	0	0	18.0
		Sound Level Attributable to Solar Inverter (dBA Ldn)									24.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3240	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3240	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-93	
60	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to Substation Transformer (dBA)	0	33	34	29	27	20	10	0	0	27.3
		Sound Level Attributable to Substation Transformer (dBA Ldn)									33.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.3

Total Sound Contribution at NSA (Ldn) - dBA	47.0
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.1
Calculated Potential Increase at NSA - dB	4.1

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 25

2769	Distance from NSA to Nearest BESS Unit	Number of BESS Units 120
3227	Distance from NSA to Substation Transformer	Number of Auxiliary Skids 4
0	Foliage Thickness (meters) [if applicable]	Number of O&M HVAC Units 1
		Number of Substation Transformers 1
		Number of Inverters 30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2769	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2769	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to BESS Unit (dBA)	0	0	2	23	16	13	6	0	0	18.7
		Sound Level Attributable to BESS Unit (dBA Ldn)									25.1
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
2769	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2769	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	7	1	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
2769	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2769	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to O&M HVAC (dBA)	0	22	23	16	15	14	8	0	0	18.0
		Sound Level Attributable to O&M HVAC (dBA Ldn)									24.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2769	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2769	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-3	-7	-22	-79	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	14	16	14	9	0	0	18.0
		Sound Level Attributable to Solar Inverter (dBA Ldn)									24.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3227	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3227	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-92	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Substation Transformer (dBA)	0	33	34	29	27	20	10	0	0	27.4
		Sound Level Attributable to Substation Transformer (dBA Ldn)									33.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.3

Total Sound Contribution at NSA (Ldn) - dBA	46.9
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	49.1
Calculated Potential Increase at NSA - dB	4.1

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA **26**

2834	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3580	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
55	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2834	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2834	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-81	
55	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-3	-4	-5	-7	
	Sound Attributable to BESS Unit (dBA)	0	0	0	20	13	9	1	0	0	15.7
		Sound Level Attributable to BESS Unit (dBA Ldn)									22.1
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2834	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2834	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-81	
55	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-3	-4	-5	-7	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	5	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2834	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2834	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-81	
55	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-3	-4	-5	-7	
	Sound Attributable to O&M HVAC (dBA)	0	21	21	14	12	11	3	0	0	14.9
		Sound Level Attributable to O&M HVAC (dBA Ldn)									21.3
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2834	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2834	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-81	
55	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-3	-4	-5	-7	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	11	13	10	4	0	0	14.6
		Sound Level Attributable to Solar Inverter (dBA Ldn)									21.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3580	Hemispherical Radiation	-69	-69	-69	-69	-69	-69	-69	-69	-69	
3580	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-3	-4	-10	-29	-102	
55	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-3	-4	-5	-7	
	Sound Attributable to Substation Transformer (dBA)	0	31	32	25	24	15	4	0	0	23.7
		Sound Level Attributable to Substation Transformer (dBA Ldn)									30.1
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.1

Total Sound Contribution at NSA (Ldn) - dBA	43.9
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.5
Calculated Potential Increase at NSA - dB	2.5

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 27

2896	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
4250	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
100	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2896	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2896	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to BESS Unit (dBA)	0	0	2	22	16	12	5	0	0	18.2
		Sound Level Attributable to BESS Unit (dBA Ldn)									24.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
2896	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2896	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to Auxiliary Skid (dBA)	0	5	6	1	0	0	0	0	0	7.1
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
2896	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2896	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to O&M HVAC (dBA)	0	22	22	16	14	14	7	0	0	17.5
		Sound Level Attributable to O&M HVAC (dBA Ldn)									23.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2896	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2896	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	13	16	13	8	0	0	17.4
		Sound Level Attributable to Solar Inverter (dBA Ldn)									23.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
4250	Hemispherical Radiation	-70	-70	-70	-70	-70	-70	-70	-70	-70	
4250	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-3	-5	-11	-34	-121	
100	Foliage Attenuation (Between 20-200 meters)	0	-2	-3	-4	-5	-6	-8	-9	-12	
	Sound Attributable to Substation Transformer (dBA)	0	30	32	26	24	16	5	0	0	24.3
		Sound Level Attributable to Substation Transformer (dBA Ldn)									30.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	46.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.7
Calculated Potential Increase at NSA - dB	3.7

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA **28**

2915	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3780	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
20	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2915	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2915	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to BESS Unit (dBA)	0	0	1	21	15	11	4	0	0	17.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2915	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2915	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	6	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2915	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2915	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to O&M HVAC (dBA)	0	21	22	15	13	13	6	0	0	16.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2915	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2915	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-23	-83	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	15	12	7	0	0	16.2
		Sound Level Attributable to Solar Inverter (dBA Ldn)									22.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3780	Hemispherical Radiation	-69	-69	-69	-69	-69	-69	-69	-69	-69	
3780	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-3	-5	-10	-30	-108	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Substation Transformer (dBA)	0	31	32	26	25	16	6	0	0	24.7
		Sound Level Attributable to Substation Transformer (dBA Ldn)									31.1
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	45.3
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.2
Calculated Potential Increase at NSA - dB	3.2

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA

29

2980	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3250	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
35	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
2980	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2980	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-85	
35	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-2	-2	-3	-3	-4	
	Sound Attributable to BESS Unit (dBA)	0	0	0	20	14	10	2	0	0	16.2
		Sound Level Attributable to BESS Unit (dBA Ldn)									22.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
2980	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2980	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-85	
35	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-2	-2	-3	-3	-4	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	5	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
2980	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2980	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-85	
35	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-2	-2	-3	-3	-4	
	Sound Attributable to O&M HVAC (dBA)	0	21	21	14	12	11	4	0	0	15.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									21.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
2980	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
2980	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-85	
35	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-2	-2	-3	-3	-4	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	11	14	11	5	0	0	15.2
		Sound Level Attributable to Solar Inverter (dBA Ldn)									21.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3250	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3250	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-93	
35	Foliage Attenuation (Between 20-200 meters)	0	-1	-1	-1	-2	-2	-3	-3	-4	
	Sound Attributable to Substation Transformer (dBA)	0	32	33	27	26	18	7	0	0	25.6
		Sound Level Attributable to Substation Transformer (dBA Ldn)									32.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	44.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.7
Calculated Potential Increase at NSA - dB	2.7

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 30

3032	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3032	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
70	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
3032	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
3032	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-87	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to BESS Unit (dBA)	0	0	0	19	12	8	0	0	0	14.4
		Sound Level Attributable to BESS Unit (dBA Ldn)									20.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
3032	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
3032	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-87	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Auxiliary Skid (dBA)	0	3	4	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
3032	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
3032	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-87	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to O&M HVAC (dBA)	0	20	20	12	10	9	1	0	0	13.4
		Sound Level Attributable to O&M HVAC (dBA Ldn)									19.8
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
3032	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
3032	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-87	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	10	12	9	2	0	0	13.1
		Sound Level Attributable to Solar Inverter (dBA Ldn)									19.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3032	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
3032	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-24	-87	
70	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-3	-4	-4	-6	-6	-8	
	Sound Attributable to Substation Transformer (dBA)	0	32	33	26	25	16	6	0	0	24.8
		Sound Level Attributable to Substation Transformer (dBA Ldn)									31.2
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	42.7
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	47.0
Calculated Potential Increase at NSA - dB	2.0

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 31

3134	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3620	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
200	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
3134	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3134	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-25	-90	
200	Foliage Attenuation (Between 20-200 meters)	0	-4	-6	-8	-10	-12	-16	-18	-24	
	Sound Attributable to BESS Unit (dBA)	0	0	1	21	15	12	4	0	0	17.3
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
3134	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3134	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-25	-90	
200	Foliage Attenuation (Between 20-200 meters)	0	-4	-6	-8	-10	-12	-16	-18	-24	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	6	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
3134	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3134	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-25	-90	
200	Foliage Attenuation (Between 20-200 meters)	0	-4	-6	-8	-10	-12	-16	-18	-24	
	Sound Attributable to O&M HVAC (dBA)	0	21	22	15	14	13	6	0	0	16.6
		Sound Level Attributable to O&M HVAC (dBA Ldn)									23.0
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
3134	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3134	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-25	-90	
200	Foliage Attenuation (Between 20-200 meters)	0	-4	-6	-8	-10	-12	-16	-18	-24	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	15	13	7	0	0	16.5
		Sound Level Attributable to Solar Inverter (dBA Ldn)									22.9
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3620	Hemispherical Radiation	-69	-69	-69	-69	-69	-69	-69	-69	-69	
3620	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-3	-5	-10	-29	-103	
200	Foliage Attenuation (Between 20-200 meters)	0	-4	-6	-8	-10	-12	-16	-18	-24	
	Sound Attributable to Substation Transformer (dBA)	0	32	33	27	26	18	8	0	0	26.1
		Sound Level Attributable to Substation Transformer (dBA Ldn)									32.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	45.6
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.3
Calculated Potential Increase at NSA - dB	3.3

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 32

3195	Distance from NSA to Nearest BESS Unit	Number of BESS Units 120
3050	Distance from NSA to Substation Transformer	Number of Auxiliary Skids 4
20	Foliage Thickness (meters) [if applicable]	Number of O&M HVAC Units 1 Number of Substation Transformers 1 Number of Inverters 30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
3195	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3195	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to BESS Unit (dBA)	0	0	1	21	15	11	4	0	0	17.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
3195	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3195	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	5	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
3195	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3195	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to O&M HVAC (dBA)	0	21	21	15	13	13	6	0	0	16.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
3195	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3195	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	15	12	7	0	0	16.3
		Sound Level Attributable to Solar Inverter (dBA Ldn)									22.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3050	Hemispherical Radiation	-67	-67	-67	-67	-67	-67	-67	-67	-67	
3050	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-8	-25	-87	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Substation Transformer (dBA)	0	33	35	29	28	20	11	0	0	28.0
		Sound Level Attributable to Substation Transformer (dBA Ldn)									34.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.4

Total Sound Contribution at NSA (Ldn) - dBA	45.5
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.3
Calculated Potential Increase at NSA - dB	3.3

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 33

3198	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
3660	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
20	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
3198	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3198	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to BESS Unit (dBA)	0	0	1	21	15	11	4	0	0	17.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
3198	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3198	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	5	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
3198	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3198	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to O&M HVAC (dBA)	0	21	21	15	13	13	6	0	0	16.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
3198	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3198	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	15	12	7	0	0	16.2
		Sound Level Attributable to Solar Inverter (dBA Ldn)									22.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
3660	Hemispherical Radiation	-69	-69	-69	-69	-69	-69	-69	-69	-69	
3660	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-3	-5	-10	-29	-105	
20	Foliage Attenuation (Between 20-200 meters)	0	0	-1	-1	-1	-1	-2	-2	-2	
	Sound Attributable to Substation Transformer (dBA)	0	32	33	27	26	18	8	0	0	26.0
		Sound Level Attributable to Substation Transformer (dBA Ldn)									32.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	45.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.2
Calculated Potential Increase at NSA - dB	3.2

**DESRI North Star BESS Project - Chisago County, MN
Noise Calculations**

NSA 34

3199	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
4000	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
		Number of Substation Transformers	1
0	Foliage Thickness (meters) [if applicable]	Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
3199	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3199	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to BESS Unit (dBA)	0	0	1	21	15	11	4	0	0	17.1
		Sound Level Attributable to BESS Unit (dBA Ldn)									23.5
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
3199	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3199	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Auxiliary Skid (dBA)	0	4	5	0	0	0	0	0	0	7.0
		Sound Level Attributable to Auxiliary Skid (dBA Ldn)									13.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
3199	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3199	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to O&M HVAC (dBA)	0	21	21	15	13	6	0	0	0	16.3
		Sound Level Attributable to O&M HVAC (dBA Ldn)									22.7
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1
3199	Hemispherical Radiation	-68	-68	-68	-68	-68	-68	-68	-68	-68	
3199	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-2	-4	-9	-26	-91	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	12	15	12	7	0	0	16.2
		Sound Level Attributable to Solar Inverter (dBA Ldn)									22.6
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
4000	Hemispherical Radiation	-70	-70	-70	-70	-70	-70	-70	-70	-70	
4000	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	-1	-3	-5	-11	-32	-114	
0	Foliage Attenuation (Between 20-200 meters)	0	0	0	0	0	0	0	0	0	
	Sound Attributable to Substation Transformer (dBA)	0	31	32	27	25	17	6	0	0	25.0
		Sound Level Attributable to Substation Transformer (dBA Ldn)									31.4
		Existing Sound Level at NSA									45
		Total Sound Level at NSA									45.2

Total Sound Contribution at NSA (Ldn) - dBA	45.3
Ambient A-Wt Sound Level (Ldn) - dBA	45.0
Total Calculated Sound Level (Ldn) at NSA - dBA	48.2
Calculated Potential Increase at NSA - dB	3.2

DESRI North Star BESS Project - Chisago County, MN
Noise Calculations with Acoustic Barrier

NSA

2

668	Distance from NSA to Nearest BESS Unit	Number of BESS Units	120
		Number of Auxiliary Skids	4
1120	Distance from NSA to Substation Transformer	Number of O&M HVAC Units	1
17	Foliage Thickness (meters) [if applicable]	Number of Substation Transformers	1
		Number of Inverters	30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 20-200 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to BESS Unit (dBA)	0	0	0	17	6	0	0	0	0	11.1
											11.1
											Sound Level Attributable to BESS Unit (dBA Ldn) 17.5
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to Auxiliary Skid (dBA)	0	6	1	0	0	0	0	0	0	7.0
											7.0
											Sound Level Attributable to Auxiliary Skid (dBA Ldn) 13.4
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

NSA#7 - O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to O&M HVAC (dBA)	0	35	35	28	28	28	25	15	0	32.1
											32.1
											Sound Level Attributable to O&M HVAC (dBA Ldn) 38.5
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.9

Solar Inverters

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	44	51	66	81	85	84	83	79	77	89.1
668	Hemispherical Radiation	-54	-54	-54	-54	-54	-54	-54	-54	-54	
668	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-2	-5	-19	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	8	6	0	0	0	1	8.7
											8.7
											Sound Level Attributable to Solar Inverter (dBA Ldn) 15.1
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

NSA#7 - Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1120	Hemispherical Radiation	-59	-59	-59	-59	-59	-59	-59	-59	-59	
1120	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	-1	-3	-9	-32	
17	Foliage Attenuation (Between 10-20 meters)	0	0	0	-1	-1	-1	-1	-2	-3	
	Sound Attributable to Substation Transformer (dBA)	0	0	44	38	37	31	24	12	0	37.3
											37.3
											Sound Level Attributable to Substation Transformer (dBA Ldn) 43.7
											Existing Sound Level at NSA 45
											Increase 2.4

Total Sound Contribution at NSA (Ldn) - dBA	45.8
Ambient A-Wt Sound Level (Ldn) - dBA	45.0

DESRI North Star BESS Project - Chisago County, MN
Noise Calculations with Acoustic Barrier

NSA

3

825	Distance from NSA to Nearest BESS Unit	Number of BESS Units 120
1330	Distance from NSA to Substation Transformer	Number of Auxiliary Skids 4
60	Foliage Thickness (meters) [if applicable]	Number of O&M HVAC Units 1
		Number of Substation Transformers 1
		Number of Inverters 30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to BESS Unit (dBA)	0	0	0	13	2	0	0	0	0	9.1
											9.1
											Sound Level Attributable to BESS Unit (dBA Ldn) 15.5
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to Auxiliary Skid (dBA)	0	3	0	0	0	0	0	0	0	7.0
											7.0
											Sound Level Attributable to Auxiliary Skid (dBA Ldn) 13.4
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to O&M HVAC (dBA)	0	31	32	25	24	24	19	9	0	27.4
											27.4
											Sound Level Attributable to O&M HVAC (dBA Ldn) 33.8
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.3

Solar Inverters

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	44	51	66	81	85	84	83	79	77	89.1
825	Hemispherical Radiation	-56	-56	-56	-56	-56	-56	-56	-56	-56	
825	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-2	-7	-24	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	4	2	0	0	0	0	7.5
											7.5
											Sound Level Attributable to Solar Inverter (dBA Ldn) 13.9
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1330	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1330	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-4	-11	-38	
60	Foliage Attenuation (Between 20-200m)	0	-1	-2	-2	-3	-4	-5	-5	-7	
	Sound Attributable to Substation Transformer (dBA)	0	0	40	35	33	26	18	5	0	33.5
											33.5
											Sound Level Attributable to Substation Transformer (dBA Ldn) 39.9
											Existing Sound Level at NSA 45
											Increase 1.2

Total Sound Contribution at NSA (Ldn) - dBA	42.4
Ambient A-Wt Sound Level (Ldn) - dBA	45.0

DESRI North Star BESS Project - Chisago County, MN
Noise Calculations with Acoustic Barrier

NSA **4**

979	Distance from NSA to Nearest BESS Unit	Number of BESS Units 120
1448	Distance from NSA to Substation Transformer	Number of Auxiliary Skids 4
130	Foliage Thickness (meters) [if applicable]	Number of O&M HVAC Units 1
		Number of Substation Transformers 1
		Number of Inverters 30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to BESS Unit (dBA)	0	0	0	9	0	0	0	0	0	7.7
											7.7
											Sound Level Attributable to BESS Unit (dBA Ldn) 14.1
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to Auxiliary Skid (dBA)	0	0	0	0	0	0	0	0	0	7.0
											7.0
											Sound Level Attributable to Auxiliary Skid (dBA Ldn) 13.4
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Sound Attributable to O&M HVAC (dBA)	0	29	28	21	19	18	11	0	0	21.7
											21.7
											Sound Level Attributable to O&M HVAC (dBA Ldn) 28.1
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.1

Solar Inverters

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	44	51	66	81	85	84	83	79	77	89.1
979	Hemispherical Radiation	-57	-57	-57	-57	-57	-57	-57	-57	-57	
979	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-1	-3	-8	-28	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	0	0	0	0	0	0	7.0
											7.0
											Sound Level Attributable to Solar Inverter (dBA Ldn) 13.4
											Existing Sound Level at NSA 45
											Total Sound Level at NSA 45.0

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	1	103	98	98	92	87	82	75		98.0
1448	Hemispherical Radiation	-61	-61	-61	-61	-61	-61	-61	-61	-61	
1448	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-4	-12	-41	
130	Foliage Attenuation (Between 20-200 meters)	0	-3	-4	-5	-7	-8	-10	-12	-16	
	Sound Attributable to Substation Transformer (dBA)	0	0	38	31	29	21	11	0	0	29.3
											29.3
											Sound Level Attributable to Substation Transformer (dBA Ldn) 35.7
											Existing Sound Level at NSA 45
											Increase 0.5

Total Sound Contribution at NSA (Ldn) - dBA	39.2
Ambient A-Wt Sound Level (Ldn) - dBA	45.0

DESRI North Star BESS Project - Chisago County, MN
Noise Calculations with Acoustic Barrier

NSA

6

1300	Distance from NSA to Nearest BESS Unit	Number of BESS Units 120
1330	Distance from NSA to Substation Transformer	Number of Auxiliary Skids 4
50	Foliage Thickness (meters) [if applicable]	Number of O&M HVAC Units 1
		Number of Substation Transformers 1
		Number of Inverters 30

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to BESS Unit (dBA)	0	0	0	10	0	0	0	0	0	7.9
											7.9
											Sound Level Attributable to BESS Unit (dBA Ldn)
											Existing Sound Level at NSA
											Total Sound Level at NSA

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46	69.0	
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Sound Attributable to Auxiliary Skid (dBA)	0	11	12	6	5	0	0	0	0	8.4
											8.4
											Sound Level Attributable to Auxiliary Skid (dBA Ldn)
											Existing Sound Level at NSA
											Total Sound Level at NSA

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73	88.6	
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to O&M HVAC (dBA)	0	17	10	3	0	0	0	0	0	7.4
											7.4
											Sound Level Attributable to O&M HVAC (dBA Ldn)
											Existing Sound Level at NSA
											Total Sound Level at NSA

Solar Inverters

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	44	51	66	81	85	84	83	79	77	89.1
1300	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1300	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-3	-10	-37	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Acoustic Barrier Transmission Loss	0	-11	-18	-18	-23	-29	-34	-37	0	
	Sound Attributable to Nearest Solar Inverter (dBA)	0	0	0	1	0	0	0	0	0	7.0
											7.0
											Sound Level Attributable to Solar Inverter (dBA Ldn)
											Existing Sound Level at NSA
											Total Sound Level at NSA

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of Substation Transformer	0	101	103	98	98	92	87	82	75	98.0
1330	Hemispherical Radiation	-60	-60	-60	-60	-60	-60	-60	-60	-60	
1330	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	-1	-2	-4	-11	-38	
50	Foliage Attenuation (Between 20-200 meters)	0	-1	-2	-2	-3	-3	-4	-5	-6	
	Sound Attributable to Substation Transformer (dBA)	0	39	41	35	34	27	19	6	0	34.0
											34.0
											Sound Level Attributable to Substation Transformer (dBA Ldn)
											Existing Sound Level at NSA
											Increase
											1.3

Total Sound Contribution at NSA (Ldn) - dBA	41.8
Ambient A-Wt Sound Level (Ldn) - dBA	45.0

DESRI North Star BESS Project - Chisago County, MN
Equipment Sound Power

BESS UNIT

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt	
		31.5	63	125	250	500	1000	2000	4000		8000
	Sound Power Level of BESS UNIT	45	55	69	90	85	83	80	75	64	88.2
	Total Sound Attributable to Nearest Solar Inverter	45	55	69	90	85	83	80	75	64	88.2

BESS Unit

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt		
		31.5	63	125	250	500	1000	2000	4000		8000	
	Sound Power Level of BESS Unit	45	55	69	90	85	83	80	75	64	88.2	
103	Hemispherical Radiation	-38	-38	-38	-38	-38	-38	-38	-38	-38		
103	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	0	0	-1	-3		
	Sound Attributable to BESS Unit (dBA)	7	17	31	52	47	45	42	36	23	50.1	
	Sound Level Attributable to BESS Unit (dBA Ldn)											56.5
	Existing Sound Level at NSA											45
	Total Sound Level at NSA											56.8
	Increase											11.8

Auxiliary Skid

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt		
		31.5	63	125	250	500	1000	2000	4000		8000	
	Sound Power Level of Auxiliary Transformer	72	74	69	69	63	58	53	46		69.0	
11.6	Hemispherical Radiation	-19	-19	-19	-19	-19	-19	-19	-19	-19		
11.6	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	0	0	0	0		
	Sound Attributable to Nearest Solar Inverter (dBA)	0	53	55	50	50	44	39	34	26	50.0	
	Sound Level Attributable to Transformer (dBA Ldn)											56.4

O&M HVAC

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt		
		31.5	63	125	250	500	1000	2000	4000		8000	
	Sound Power Level of O&M HVAC	89	90	84	83	84	82	77	73		88.6	
50	Hemispherical Radiation	-32	-32	-32	-32	-32	-32	-32	-32	-32		
50	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	0	0	0	-1		
	Sound Attributable to O&M HVAC (dBA)	0	57	58	52	52	53	50	45	40	56.8	
	Sound Level Attributable to O&M HVAC (dBA Ldn)											63.2
	Existing Sound Level at NSA											45
	Total Sound Level at NSA											63.2
	Increase											18.2

Medium Voltage Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt		
		31.5	63	125	250	500	1000	2000	4000		8000	
	Sound Power Level of Medium Voltage Transformer	44	51	66	81	85	84	83	79	77	89.1	
112	Hemispherical Radiation	-39	-39	-39	-39	-39	-39	-39	-39	-39		
112	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	0	0	-1	-3		
	Sound Attributable to Solar Inverter (dBA)	5	12	27	42	46	45	44	39	35	50.1	
	Sound Level Attributable to Solar Inverter (dBA Ldn)											56.5
	Existing Sound Level at NSA											45
	Total Sound Level at NSA											56.8
	Increase											11.8

Substation Transformer

Dist. (ft) & Direction	Noise Source and Other Conditions/Factors associated with Acoustical Analysis	SPL or PWL in dB Per Octave-Band Center Freq. (Hz)								Total A-Wt		
		31.5	63	125	250	500	1000	2000	4000		8000	
	Sound Power Level of Substation Transformer	101	103	98	98	92	87	82	75		98.0	
312	Hemispherical Radiation	-48	-48	-48	-48	-48	-48	-48	-48	-48		
312	Atm. Absorption (70% R.H., 15 deg C)	0	0	0	0	0	0	-1	-3	-9		
	Sound Attributable to Substation Transformer (dBA)	0	53	55	50	50	44	38	32	18	50.1	
	Sound Level Attributable to Substation Transformer (dBA Ldn)											56.5
	Existing Sound Level at NSA											45
	Total Sound Level at NSA											56.8
	Increase											11.8

SPL or PWL in dB Per Octave-Band Center Freq. (Hz)									
31.5	63	125	250	500	1000	2000	4000	8000	
-11	-18	-18	-23	-29	-34	-37			

Acoustic Barrier Transmission Loss