Borealis Energy Storage Project

Acoustical Assessment

December 2022

Borealis ESS, LLC

Borealis Energy Storage Project

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Acronyms and Abbreviations

APN	Assessor Parcel Number
Borealis	Borealis ESS, LLC
dBA	decibel(s) at an A-weighted sound pressure (noise) level
FHWA	Federal Highway Administration
FTA	Federal Transit Administration
gen-tie	generation intertie overhead electric line
ISO	International Organization for Standardization
Jacobs	Jacobs Engineering Group Inc.
PG&E	Pacific Gas and Electric
Project	Borealis Energy Storage Project

1. Introduction

Jacobs Engineering Group Inc. (Jacobs) has prepared this acoustical assessment to document predicted sound levels from the Borealis Energy Storage Project (Project) proposed for development by Borealis ESS, LLC (Borealis) in an unincorporated area of Sonoma County, California (Figure 1). The assessment evaluates Project sound levels at the nearest residences to the Project and the Petaluma Adobe Historic Landmark, a federal and State of California landmark.

1.1 Project Description

The Project involves construction of an approximately 300-megawatt, 4-hour battery energy storage system to be located on an approximately 20-acre facility footprint within a larger, approximately 140-acre parcel situated at 3571 Old Adobe Road, in unincorporated Sonoma County. The Project site is located near the intersection of Adobe Road and Frates Road, north of the existing Petaluma Adobe State Historic Park. The site has no street address and is identified as Assessor Parcel Number (APN) 017-130-008. Current uses of the property consist of agricultural fields, several barns, structures, and buildings that support agricultural operations, and utilities including overhead electrical transmission lines and a Pacific Gas and Electric (PG&E) gas valve yard (Figure 1).

The Project will interconnect to the existing PG&E 115-kilovolt Lakeville Substation located south of the Project and across Old Adobe Road (Figure 1). The interconnection will occur by way of a new, approximately 0.5-mile, generation intertie (gen-tie) overhead electric line. Figure 1 identifies a potential trenchless crossing underneath Old Adobe Road. The Project's batteries will be charged from the California Independent System Operator grid using the Project's interconnection to the Lakeville Substation. Energy stored in the Project's battery modules will then be discharged back into the grid when the energy is needed, providing important electrical reliability services to the local area.

1.2 Fundamentals of Acoustics

Acoustics is the study of sound, and noise is defined as unwanted sound. Airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. Acoustical terms used in this section are summarized in Table 1.

Table 1. Definitions of Acoustical Terms

Term	Definition
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location. The ambient noise level is typically defined by the L_{eq} level.
Background Noise Level	The underlying ever-present lower level noise that remains in the absence of intrusive or intermittent sounds. Distant sources, such as traffic, typically make up the background. The background level is generally defined by the L_{90} percentile noise level.
Intrusive	Noise that intrudes over and above the existing ambient noise level at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, tonal content, the prevailing ambient noise level as well as the sensitivity of the receiver. The intrusive level is generally defined by the L_{10} percentile noise level.

Table 1. Definitions of Acoustical Terms

Sound Pressure (Noise) Level Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to the reference pressure, which is 20 micropascals (20 micronewtons per square meter).
A-Weighted Sound Pressure (Noise) Level (dBA)	The sound level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound (noise) levels in this report are A-weighted.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level, on an equal energy basis, during the measurement period.
Percentile Noise Level (L_n)	The noise level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (for example, L_{90})
Day-Night Noise Level (L_{dn} or DNL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels from 10:00 p.m. to 7:00 a.m.

The most common metric is the overall A-weighted sound level measurement adopted by regulatory bodies worldwide. The A-weighting network measures sound to the way in which a person perceives or hears sound. There is consensus that A-weighting is appropriate for estimating the hazard of noise-induced hearing loss. With respect to other effects, such as annoyance, A-weighting is acceptable if largely middle-and high-frequency noise is present; however, if the noise is unusually high, at low frequencies, or contains prominent low-frequency tones, the A-weighting may not give a valid measure.

A-weighted sound levels are typically measured or presented as equivalent noise level (L_{eq}), which is defined as the average noise level, on an equal energy basis for a stated period of time, and is commonly used to measure steady-state sound or noise that is usually dominant. Statistical methods are used to capture the dynamics of a changing acoustical environment. Statistical measurements are typically denoted by L_{xx}, where xx represents the percentile of time the sound level is exceeded. The L_{90} measurement represents the noise level that is exceeded during 90 percent of the measurement period. Similarly, L_{10} represents the noise level exceeded for 10 percent of the measurement period.

Some metrics used in determining the impact of environmental noise consider the different response that people have to daytime and nighttime noise levels. During the nighttime, exterior background noises are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes more noticeable. Furthermore, most people sleep at night and are sensitive to intrusive noises. To account for human sensitivity to nighttime noise levels, the day-night sound level (L_{dn} or DNL) was developed. L_{dn} is a noise index that accounts for the greater annoyance of noise during the nighttime hours.

L_{dn} values are calculated by averaging hourly L_{eq} sound levels for a 24-hour period, and apply a weighting factor to nighttime L_{eq} values. The weighting factor, which reflects the increased sensitivity to noise during nighttime hours, is added to each hourly L_{eq} sound level before the 24-hour L_{dn} is calculated. For the purposes of assessing noise, the 24-hour day is divided into two time periods, with the following weightings:

- Daytime: 7:00 a.m. to 10:00 p.m. (15 hours) weighting factor of 0 dB
- Nighttime: 10:00 p.m. to 7:00 a.m. (9 hours) weighting factor of 10 dB

The two time periods are averaged to compute the overall L_{dn} value. For a continuous noise source, the L_{dn} value is easily computed by adding 6.4 dBA to the overall 24-hour noise level (L_{eq}). For example, if the expected continuous noise level from a facility was 60.0 dBA, the resulting L_{dn} from the facility would be 66.4 dBA.

The effects of noise on people can be listed in three general categories:

1) Subjective effects of annoyance, nuisance, and dissatisfaction
2) Interference with activities such as speech, sleep, and learning
3) Physiological effects such as startling and hearing loss

In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial plants may experience noise effects in the third category. No completely satisfactory way exists to measure the subjective effects of noise or to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is primarily due to the wide variation in individual thresholds of annoyance and habituation to noise.

Table 2 shows the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

Table 2. Typical A-weighted Sound Levels

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	— 110 —	Rock band
Jet fly-over at 1,000 feet		
	— 100 —	
Gas lawn mower at 3 feet		
	— 90 —	
Diesel truck at 50 feet at 50 mph		Food blender at 3 feet
	— 80 —	Garbage disposal at 3 feet
Noisy urban area, daytime		
Gas lawn mower, 100 feet	— 70 —	Vacuum cleaner at 10 feet
Commercial area		Normal speech at 3 feet
Heavy traffic at 300 feet	— 60 —	
		Large business office
Quiet urban daytime	— 50 —	Dishwasher next room
Quiet urban nighttime	— 40 —	Theater, large conference room (background)
Quiet suburban nighttime		
	— 30 —	Library
Quiet rural nighttime		Bedroom at night, concert hall (background)
	— 20 —	
		Broadcast/recording studio
	— 10 —	
Lowest threshold of human hearing	— 0 —	Lowest threshold of human hearing

Source: Caltrans 2013.

2. Regulatory and Environmental Setting

This section describes the laws, ordinances, regulations, and standards that apply to construction and operational sound levels attributable to the Project.

2.1 Construction

Sonoma County's *Guidelines for the Preparation of Noise Analysis* (2019 Guidelines) (Sonoma County 2019) states that "Temporary construction noise generally needs to be evaluated at a qualitative level, given its temporary and short-term nature. Construction noise may be considered significant if it occurs in the early morning or evening hours and requires a qualitative analysis." The 2019 Guidelines specify that the Sonoma County General Plan "Noise Element Policies and Thresholds" would need to be evaluated if construction occurred between 10 pm and 7 am or would "occur for a period of more than one year." Construction of the Project will not occur between 10 pm and 7 am nor last more than one year.

2.2 Operations

The Sonoma County General Plan identifies goals, objectives, and policies to limit sound levels and facilitate land use compatibility between adjacent uses. Relevant goals and policies are summarized in the 2019 Guidelines and excerpted as follows:

> ***Goal NE-1:*** *Protect people from the adverse effects of exposure to excessive noise and to achieve an environment in which people and land uses may function without impairment from noise.*
>
> ***Policy NE-1A:*** *[Identifies noise impact thresholds and references requirements of Table NE-2 for point sources (non-transportation noise sources.]*
>
> ***Policy NE-1B:*** *[Recommends limiting development of additional noise sensitive uses in noise impacted areas.]*
>
> ***Policy NE-1C:*** *Control non-transportation related noise from new projects. The total noise level resulting from new sources shall not exceed the standards in Table NE-2 as measured at the exterior property line of any adjacent noise sensitive land use.*

Table NE-2 Maximum Allowable Exterior Noise Exposures for Non-Transportation Noise Sources

Hourly Noise Metric[1], dBA	***Daytime (7 am to 10 pm)***	***Nighttime (10 pm to 7 am)***
L50 (30 minutes in any hour)	*50*	*45*
L25 (15 minutes in any hour)	*55*	*50*
L08 (4 minutes 48 seconds in any hour)	*60*	*55*
L02 (72 seconds in any hour)	*65*	*60*

1. The sound level exceeded n% of the time in any hour. For example, the L50 is the value exceeded 50% of the time or 30 minutes in any hour; this is the median noise level.

(1) If the ambient noise level exceeds the standard in Table NE-2, adjust the standard to equal the ambient level, up to a maximum of 5 dBA above the standard, provided that no measurable increase (i.e. +/-1.5 dBA) shall be allowed;

(2) [Imposes a 5 dB penalty for simple tone noises, speech, music or recurring impulse noise]

(3) Reduce the applicable standards in Table NE-2 by 5 decibels if the proposed use exceeds the ambient level by 10 or more decibels;

(4) [Addresses short term noise sources]

(5) Noise levels may be measured at the location of the outdoor activity area of the noise sensitive land use, instead of the exterior property line of the adjacent noise sensitive land use where:

(a) the property on which the noise sensitive use is located has already been substantially developed pursuant to its existing zoning, and

(b) there is available open land on those noise sensitive lands for noise attenuation.

This exception may not be used on vacant properties which are zoned to allow noise sensitive uses.

The 2019 Guidelines provide the following guidance regarding Policy NE-1C(5):

"Substantially developed" means parcels where the density has been exhausted. If this exception is requested, the Noise Analysis must identify the appropriate location where noise standards must be met, and evaluate both the property line and the outdoor activity area of the noise sensitive land use.

"Available open land" means areas with limited or no regular human activity, such as grazing lands, vineyards, or forested areas, or a minimum of 300 feet from a residential structure or other sensitive land use.

All residential structures near the Project are greater than 300 feet from the Project boundary and have available open land (defined in the 2019 Guidelines as "areas with limited or no regular human activity, such as grazing lands, vineyard, or forested areas") between the Project and the structures. Each residence is on the opposite side of a thick, vegetated riparian corridor located between the Project boundary and the residence.

The *Sonoma Mountain Area Plan* (Sonoma County 2012) contains the following policy addressing the Petaluma Adobe:

"The Petaluma Adobe Historic Monument is the only designated historic site within the Sonoma Mountain Plan area. The State Park is surrounded by 50 acres of open grazing land to preserve the view and atmosphere of the Petaluma Adobe similar to what it once was. The immediate vicinity of this site should be recognized as sensitive to the integrity of the monument."

When evaluating Project sound levels at the Petaluma Adobe Historic Landmark, the following factors were considered:

1) The Petaluma Adobe State Historic Park is not open at night; thus it is appropriate to focus on daytime hours.
2) The Petaluma Adobe structure is located adjacent to Old Adobe Road. The closest portion of the Adobe structure is approximately 60 feet from the centerline of Old Adobe Road while the farthest portion is 280 feet away (Figure 2).
3) The portion of Old Adobe Road between East Washington Road and Frates Road was identified in the 2019 Guidelines as having a sound level of 60 dB L_{dn} at 190 feet and 65 L_{dn} at 88 feet. (Average daytime sound levels are expected to be similar to the stated Ldn value while average nighttime levels are expected to be 10 dB less than the L_{dn} value.)
4) The Project parcel boundary adjoins a parcel containing parking, restrooms, trash receptables, and picnic tables (APN 017-130-044) serving visitors to the Petaluma Adobe during daytime hours only. The Petaluma Adobe structure itself is on a separate parcel (APN 017-130-002) that does not adjoin the Project parcel. The closest portion of the Petaluma Adobe structure is located approximately 810 feet from the Project, on the opposite side of a thick, vegetated riparian corridor. The farthest portion of the Petaluma Adobe structure is located 1,040 feet from the Project (Figure 2).
5) Additional development of noise-sensitive uses on both the Petaluma Adobe Historic Landmark parcel and parking lot parcel is highly unlikely; therefore, this area can be appropriately identified as “substantially developed” consistent with NE-1C(5)(a). Available open land is also not required for noise attenuation (NE-1C(5)(b)) as the attenuation has been incorporated into the Project.

Given the above considerations, Goal NE-1 as well as Policy NE-1 may be satisfied by evaluating the Project sound level at the Petaluma Adobe Historic Landmark.

3. Methods and Results

This section describes the methodology followed to conduct the assessment and the corresponding results derived for construction and operations, respectively.

3.1 Construction

Construction activities will utilize equipment commonly employed for site grading and equipment installation (such as bulldozers, compactors, scrapers, trucks, and cranes).

Decibels cannot be directly added arithmetically (for example, 50 dBA plus 50 dBA does not equal 100 dBA). When two sources of equal level are added together, the result will always be 3 dB greater (for example, 50 dBA plus 50 dBA equals 53 dBA, and 70 dBA plus 70 dBA equals 73 dBA). If the difference between the two sources is 10 dBA, the level (when rounded to the nearest whole dB) will not increase (for example: 40 dBA plus 50 dBA equals 50 dBA, and 60 dBA plus 70 dBA equals 70 dBA) (Caltrans 2013).

The decrease in sound level caused by distance from any single sound source normally follows the inverse square law; that is, the sound pressure level changes in inverse proportion to the square of the distance from the sound source. In a large, open area without obstructive or reflective surfaces, a general rule is that at distances greater than approximately the largest dimension of the noise-emitting surface, the sound pressure level from a single source of sound drops off at a rate of 6 dB with each doubling of the distance from the source. Sound energy is absorbed in the air as a function of temperature, humidity, and sound frequency; this attenuation can be up to 2 dB over 1,000 feet (Caltrans 2013). The drop-off rate will also vary based on terrain conditions and the presence of obstructions in the sound’s propagation path.

As described in the Federal Transit Administration's (FTA's) *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018), the average noise level from each piece of equipment is determined by the following equation for geometric spreading:

$$\text{Typical Noise Level at 50 feet} + 10 \times \log(\text{Adj}_{usage}) - 20 \times \log(\text{distance to receptor}/50) - 10 \times G \times \log(\text{distance to receptor}/50)$$

Because specific construction methods or daily schedules for the Project have not been determined, and construction is, by its nature, a dynamic activity, the following scenario was evaluated.

Where:

Usage factor (Adj_{usage}) = 1 (equipment is operating continuously)

Ground effect factor (G) = 0, representing hard ground (such as a ground condition that does not result in additional attenuation)

The total noise level then becomes solely a function of the type of equipment operating and the distance from the equipment to the noise receptor.

Noise levels from construction equipment operations were estimated based on data from the Federal Highway Administration's (FHWA's) *Roadway Construction Noise Model User's Guide* (FHWA 2006) and the *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018). These data represent the most recent and comprehensive tabulation of noise from common pieces of heavy equipment. Table 3 tabulates the construction equipment noise levels reported by FHWA. The Project will not utilize all equipment listed and neither impact nor vibratory pile driving are anticipated; rather, the list is presented in whole for context.

Table 3. Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)	Specified Lmax at 50 feet (dBA)	Actual Measured Lmax at 50 feet (dBA)	Actual Data Samples (No.)
All other equipment > 5 hp	50	85	-	0
Auger drill rig	20	85	84	36
Backhoe	40	80	78	372
Bar bender	20	80	-	0
Blasting	-	94	-	0
Boring jack power unit	50	80	83	1
Chain saw	20	85	84	46
Clam shovel (dropping)	20	93	87	4
Compactor (ground)	20	80	83	57
Compressor (air)	40	80	78	18
Concrete batch plant	15	83	-	0
Concrete mixer truck	40	85	79	40
Concrete pump truck	20	82	81	30
Concrete saw	20	90	90	55
Crane	16	85	81	405

Table 3. Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)	Specified Lmax at 50 feet (dBA)	Actual Measured Lmax at 50 feet (dBA)	Actual Data Samples (No.)
Dozer	40	85	82	55
Drill rig truck	20	84	79	22
Drum mixer	50	80	80	1
Dump truck	40	84	76	31
Excavator	40	85	81	170
Flatbed truck	40	84	74	4
Front end loader	40	80	79	96
Generator	50	82	81	19
Generator (less than 25 kVA, VMS signs)	50	70	73	74
Gradall	40	85	83	70
Grader	40	85	-	0
Grapple (on backhoe)	40	85	87	1
Horizontal boring hydraulic jack	25	80	82	6
Hydra break ram	10	90	-	0
Impact pile driver	20	95	101	11
Jackhammer	20	85	89	133
Person lift	20	85	75	23
Mounted impact hammer (hoe ram)	20	90	90	212
Pavement scarifier	20	85	90	2
Paver	50	85	77	9
Pickup truck	40	55	75	1
Pneumatic tools	50	85	85	90
Pumps	50	77	81	17
Refrigerator unit	100	82	73	3
Rivet buster and chipping gun	20	85	79	19
Rock drill	20	85	81	3
Roller	20	85	80	16
Sand blasting (single nozzle)	20	85	96	9
Scraper	40	85	84	12
Shears (on backhoe)	40	85	96	5
Slurry plant	100	78	78	1
Slurry trenching machine	50	82	80	75
Soil mix drill rig	50	80	-	0

Table 3. Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)	Specified Lmax at 50 feet (dBA)	Actual Measured Lmax at 50 feet (dBA)	Actual Data Samples (No.)
Tractor	40	84	-	0
Vacuum excavator (Vac-truck)	40	85	85	149
Vacuum street sweeper	10	80	82	19
Ventilation fan	100	85	79	13
Vibrating hopper	50	85	87	1
Vibratory concrete mixer	20	80	80	1
Vibratory pile driver	20	95	101	44
Warning horn	5	85	83	12
Welder or torch	40	73	74	5

Source: FHWA 2006

- = not available

hp = horsepower

kVA = kilovolt(s)-ampere

Lmax = maximum sound level

VMS = variable message signs

A review of the equipment noise levels presented in Table 3 indicates that the loudest equipment generally emits noise in the range of 80 to 90 dBA at 50 feet. Noise at any specific receptor is dominated by the closest and loudest equipment. The types, numbers, and duration of equipment anticipated to be used near any specific receptor location will vary over time. Therefore, a typical noise estimate was developed based on the general assumption of multiple pieces of loud equipment operating near each other with the exception of impact or vibratory pile driving, which are not anticipated. Specifically, the scenario evaluated uses five pieces of general construction equipment working near each other, as follows:

- One piece of equipment generating a reference noise level of 85 dBA at 50 feet at the edge of the construction or work area
- Two pieces of equipment generating 85 dBA reference noise levels located 50 feet farther away from the edge of the construction or work area
- Two more pieces of equipment generating 85 dBA reference noise levels located 100 feet farther away from the edge of the construction or work area

Table 4 summarizes the expected average equipment noise levels at various distances, based on this scenario.

Table 4. Average Equipment Noise Levels Versus Distance

Distance from Activity (feet)	Average Noise Level (dBA)
50	87
100	83
200	78

Table 4. Average Equipment Noise Levels Versus Distance

Distance from Activity (feet)	Average Noise Level (dBA)
400	73
800	67
1,600	62
3,200	56

The noise-sensitive uses in the vicinity of the Project site are between approximately 500 and 800 feet from the primary construction area, the battery energy storage system site. The resulting sound levels are therefore expected to vary from approximately 67 to 73 dBA. The potential trenchless crossing is approximately 800 feet from the closest sensitive use (the picnic area) and the resulting sound level is expected to be approximately 67 dBA.

The 2019 Guidelines (Sonoma County 2019) acknowledge that noise levels generated by construction may be difficult to reduce. Nonetheless, the Project will implement the following typical noise minimization measures, as feasible:

- Limit hours of noisy construction activities to 7 am to 7 pm weekdays, and 7 am to 5 pm weekends.
- Limit work to nonmotorized equipment on Sundays and holidays.
- Ensure equipment is well maintained and equipped with manufacturers mufflers.
- Use sound blankets or other shielding methods around unusually loud stationary equipment.
- Use broadband or self-adjusting backup alarms when consistent with CalOSHA requirements.

3.2 Operations

Battery energy storage systems consist of a battery charging and discharging system. Inverters convert the direct current from and to the battery to alternating current for transmission from and to the step-up transformers. The step-up transformers in turn modify the voltage to be consistent with electrical grid requirements.

An acoustical model of the proposed Project was developed using source input levels derived from data supplied by manufacturers, Borealis, or information found in the technical literature. The sound levels presented represent the anticipated steady-state level from the Project with essentially all equipment operating during the day or night.

Standard acoustical engineering methods were used in the noise analysis. The acoustical model, CadnaA by DataKustik GmbH of Munich, Germany (DataKustik 2022), is a sophisticated tool that enables one to fully model complex industrial plants. The sound propagation factors used in the model have been adopted from International Organization for Standardization (ISO) 9613-2 *Acoustics—Sound Attenuation During Propagation Outdoors*. Atmospheric absorption was estimated for conditions of 10 degrees Celsius and 70 percent relative humidity (conditions that favor propagation) and computed in accordance with ISO 9613-1. The model divides the proposed Project into a list of individual sound sources representing each piece of sound-emitting equipment. The sound power levels representing the standard performance of each of these components are assigned based on data supplied by manufacturers or information found in the technical literature. Using these sound power levels as a basis, the model calculates the sound pressure level that would occur at each receptor from each source after losses from distance, air absorption, and other factors are considered. The sum of all these individual levels is the total plant level at the modeling point.

The ISO 9613-2 method is based on an omnidirectional downwind condition. That is, the sound prediction algorithms assume every point at which sound level is calculated is downwind of all sound-emitting equipment simultaneously. In essence, the prediction assumes each receiver or prediction point is a "black hole" and the wind is blowing from each source and into this black hole. While this is physically impossible, the ISO 9613-2 model has been widely and successfully used to develop acoustical models for power facilities. Numerous agencies and regulatory bodies rely on properly conducted ISO 9613-2 modeling. The ISO 9613-2 parameters used in this assessment are a receptor height of 1.5 meters and mixed ground factor of G=0.5 (where G may vary between 0 for hard pavement or water and 1 for acoustically absorptive ground such as plowed earth).

While final equipment selection will occur as design progresses, a representative acoustical model was developed based on an approximate 300-megawatt, 4-hour system consisting of 384 battery energy storage containers, 96 inverters, two step-up transformers, and miscellaneous electrical cabinets and equipment. As is typical at this stage of a project design, these data are representative and detailed vendor specifications will ultimately be developed to ensure the Project complies with the applicable requirements.

Modeled sound pressure level contours[1] based on the preliminary equipment layout are presented on Figure 3. As is typical at this stage of a project, final detailed design information is still under development. Therefore, these results are indicative, based on an early layout developed to support Project permitting. Noise generated during the testing and commissioning phase of the Project is not expected to substantially differ from that produced during normal full-load operation. Operational traffic is anticipated to be minimal, primarily pickup trucks used by a small operation and maintenance staff for periodic maintenance. The approximate distances to the nearest residential structures from the Project boundary are 620 feet to the Caretaker Residence (R1) for the Petaluma Adobe, 675 feet to the residence northwest of the Project boundary (R2), and 1,290 feet to the farthest residence (R3). As shown on Figure 3, all residences are predicted to comply with the 45 dBA nighttime criteria. Additionally, picnic tables are available for public use only during park hours, which are 10 a.m. to 5 p.m. The picnic tables are located adjacent to the parking lot serving the Petaluma Adobe State Park, approximately 500 feet from the battery energy storage area. This picnic area is not open at night and, as shown on Figure 3, it is predicted to comply with the 50 dBA daytime criteria.

4. Discussion

Predicted operational sound levels at all nearby residences are less than the most restrictive nighttime limit established in Table NE-2 of 45 dBA at night. The 45 dBA sound level contour extends over the northwestern property line of R2 but not beyond the thick, vegetated riparian corridor nor into the outdoor use area of the residences, as depicted on Figure 3. Considering that (1) the Petaluma Adobe Historic Landmark, parking lot/picnic area parcel, and residences are "substantially developed" consistent with Policy NE-1C(5)(a) and (2) additional land is not required for noise attenuation to meet the County's noise standards consistent with Policy NE-1C(5)(b), it is appropriate, as allowed by Policy NE-1C(5), to evaluate the Project sound levels at the outdoor use areas (the Petaluma Adobe Historic Landmark, parking lot/picnic area, and beyond the vegetated riparian corridor for the dwellings) rather than at the Project parcel boundary.

[1] Modeling is based on all Project components operating at their rated sound level. This steady-state sound level is evaluated against the most conservative sound level, L_{50} from Table NE-2 of Sonoma County's 2019 Guidelines.

Additionally, the predicted Project sound levels at the Petaluma Adobe Historic Landmark are less than the daytime limit established in Table NE-2 of 50 dBA and in fact, the Project is anticipated to comply with the more restrictive nighttime criterion of 45 dBA at both the Petaluma Adobe Historic Landmark (which is closed at night) and the outdoor use area surrounding both of the nearest residences. The Petaluma Adobe itself is located in close proximity to Old Adobe Road where the existing sounds from passing vehicles will exceed those of the Project. Thus, the portions of the Sonoma County noise requirements applicable to nearby residences and the Petaluma Adobe Historic Landmark, namely Goal NE-1 and Policy NE-1, are anticipated to be satisfied by the Project.

5. References

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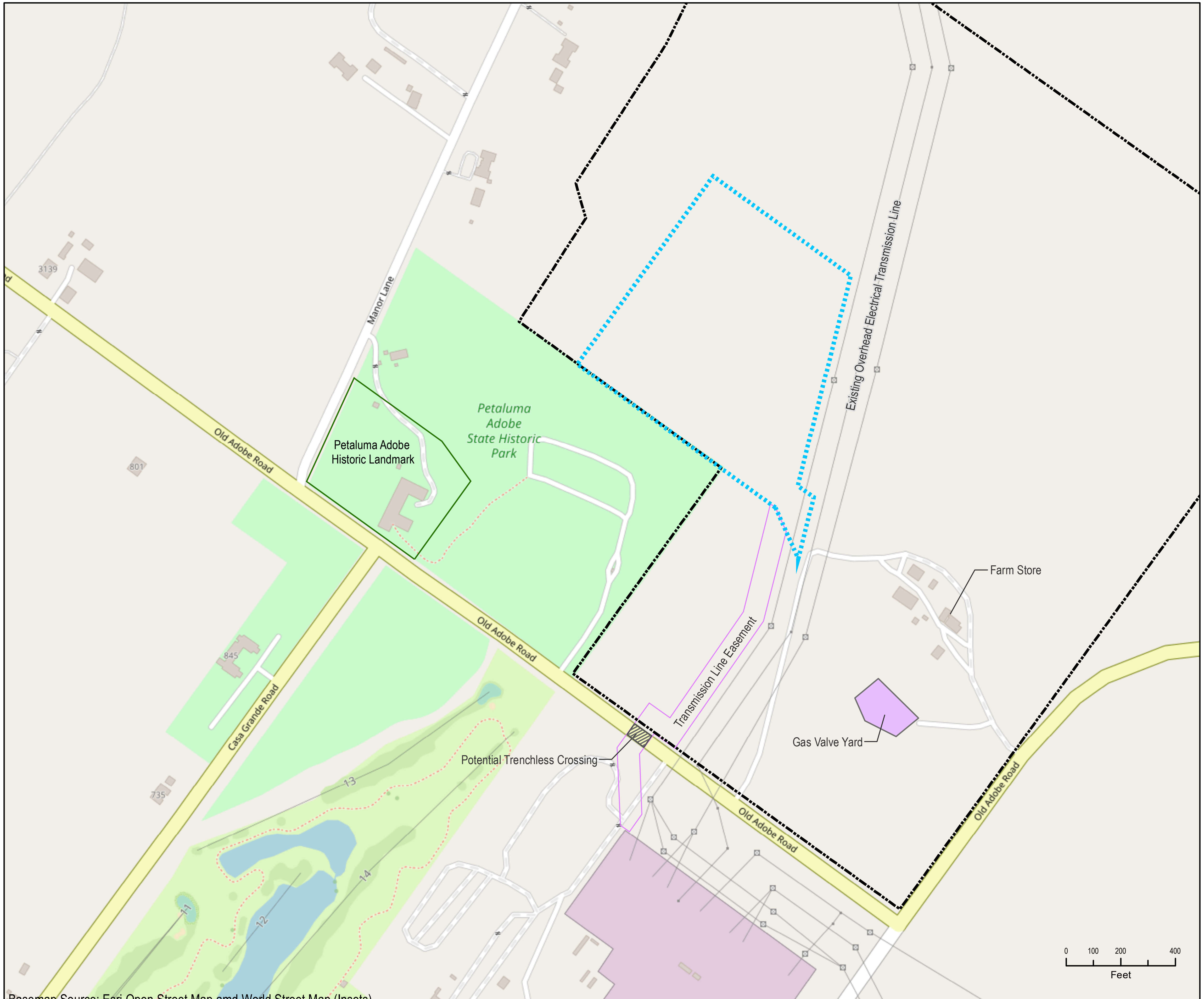
Figures



Basemap Source: Esri Open Street Map amd World Street Map (Insets)

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LEGEND

- Approximate Project Boundary
- Parcel Boundary
- Petaluma Adobe Historic Landmark
- Petaluma Adobe State Historic Park

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Figure 1
Vicinity Map
Acoustical Assessment
Borealis Energy Storage Project

Jacobs

Figure 2
Distances from Petaluma Adobe Historic Landmark to Road Centerline and Proposed Sound Barrier
Acoustical Assessment
Borealis Energy Storage Project

Jacobs

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Predicted Sound Level (dBA)

- 5 dBA (Typical)
- 1 dBA (Typical)
- Project Sound Barrier
- Residence
- Petaluma Adobe Historic Landmark
- Picnic Area
- Approximate Project Boundary
- Parcel Boundary

N

0 100 200 400

Feet

Figure 3
Predicted Sound Level (dBA)
with 10-foot-tall Sound Barrier
Acoustical Assessment
Borealis Energy Storage Project

Jacobs

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