APPENDIX D
NOISE ASSESSMENT

NOISE ASSESSMENT

Campo Verde Battery Storage System for Campo Verde Solar Facility
County of Imperial

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GLOSSARY OF TERMS

Sound Pressure Level (SPL): a ratio of one sound pressure to a reference pressure (L_{ref}) of 20 µPa. Because of the dynamic range of the human ear, the ratio is calculated logarithmically by 20 log (L/L_{ref}).

A-weighted Sound Pressure Level (dBA): Some frequencies of noise are more noticeable than others. To compensate for this fact, different sound frequencies are weighted more.

Minimum Sound Level (L_{min}): Minimum SPL or the lowest SPL measured over the time interval using the A-weighted network and slow time weighting.

Maximum Sound Level (L_{max}): Maximum SPL or the highest SPL measured over the time interval the A-weighted network and slow time weighting.

Equivalent sound level (L_{eq}): the true equivalent sound level measured over the run time. Leq is the A-weighted steady sound level that contains the same total acoustical energy as the actual fluctuating sound level.

Day Night Sound Level (Ldn): Representing the Day/Night sound level, this measurement is a 24 –hour average sound level where 10 dB is added to all the readings that occur between 10 pm and 7 am. This is primarily used in community noise regulations where there is a 10 dB "Penalty" for night time noise. Typically Ldn is measured using A weighting.

Community Noise Exposure Level (CNEL): The accumulated exposure to sound measured in a 24-hour sampling interval and artificially boosted during certain hours. For CNEL, samples taken between 7 pm and 10 pm are boosted by 5 dB; samples taken between 10 pm and 7 am are boosted by 10 dB.

Octave Band: An octave band is defined as a frequency band whose upper band-edge frequency is twice the lower band frequency.

Third-Octave Band: A third-octave band is defined as a frequency band whose upper band-edge frequency is 1.26 times the lower band frequency.

Response Time (F,S,I): The response time is a standardized exponential time weighting of the input signal according to fast (F), slow (S) or impulse (I) time response relationships. Time response can be described with a time constant. The time constants for fast, slow and impulse responses are 1.0 seconds, 0.125 seconds and 0.35 milliseconds, respectively.

EXECUTIVE SUMMARY

This noise study has been completed to determine the noise impacts associated with the development of the proposed Campo Verde Battery Energy Storage Project which would be designed to store up to 105 Megawatt hours (MWh). The project site exists within the existing site footprint of the Campo Verde Solar site. The project would be constructed in two phases on roughly 16,775 SF of land. The Project consists of installing a 424 SF metal modular battery system container on a concrete foundation for Phase 1 and constructing a 12,300 SF metal building with a battery rack on a concrete foundation for phase 2. The ancillary equipment for each phase would consist of power conversion systems, electrical cabinets, transformers, HVAC equipment, and electric switchgear.

Based on the empirical data, manufactures specifications and the distances to the property lines the unshielded noise levels from the proposed equipment were found to be below the County's most restrictive nighttime property line standard of 45 dBA. No impacts are anticipated and no mitigation is required.

At a distance of 800 feet from the nearest property line the point source noise attenuation from construction activities is -24 dBA. This would result in an anticipated worst case eight-hour average combined noise level of well below 75 dBA at the property line. Given this, the noise levels will comply with the County of Imperial's 75 dBA standard at all Project property lines and no impacts are anticipated.

There are no vibration-sensitive uses located adjacent to the proposed construction. The nearest offsite uses are agricultural and located over 800 feet from any construction activities. Project construction activities would not result in vibration induced structural damage or vibration induced annoyance to adjacent land uses. Therefore, vibration impacts would be less than significant.

The Project does not create a short-term noise increases during the Phase 1 or Phase 2 peak construction of more than 5 dBA CNEL on any roadway segment. The noise levels are below the 60 dBA CNEL threshold and in the "normally acceptable" category. No sensitive receptors would be directly or cumulatively impacted by construction traffic noise due to the proposed Project's construction traffic and no mitigation would be required.

The post construction operations and maintenance of the Battery Energy Storage Facility will be monitored by existing six operators currently on-site as part of the existing Campo Verde Solar Facility operations. No additional full time staff is anticipated as part of the Battery Energy Storage Facility; however, technicians will be brought in if necessary, thus there is no anticipated new trip generation for the maintenance and project operations.

1.0 INTRODUCTION

The purpose of this Noise study is to determine potential noise impacts (if any) that may be created during the construction, decommissioning or operation of the proposed Campo Verde Energy Storage Project which would be designed to store up to 105 Megawatt hours (MWh). The project site exists within the existing site footprint of the Campo Verde Solar site. The project would be constructed in two phases on roughly 16,775 SF of land. The Project consists of installing a 424 SF metal modular battery system container on a concrete foundation for Phase 1 and constructing a 12,300 SF metal building with a battery rack on a concrete foundation for Phase 2. The ancillary equipment for each phase would consist of power conversion systems, electrical cabinets, transformers, HVAC equipment, and electric switchgear.

1.1 Project Location

The Project is a proposed battery storage facility will be located onsite to the Campo Verde photovoltaic (PV) energy-generating facility located in the County approximately 7 miles southwest of the community of El Centro, California. The Project site is south of I-8 and west of Drew Road and northeast of Westside Main Canal. The general location of the Project will be within the existing fenced solar plant site, just west of the existing Campo Verde substation, which is west of Liebert Road, south of Wixom Road and north of Mandrapa Road. Phase 2 will be just south of the Phase 1 part of the battery energy storage system. A Project vicinity map and aerial image of the existing site is provided in Figures 1-A and –B, respectively.

1.2 Project Description

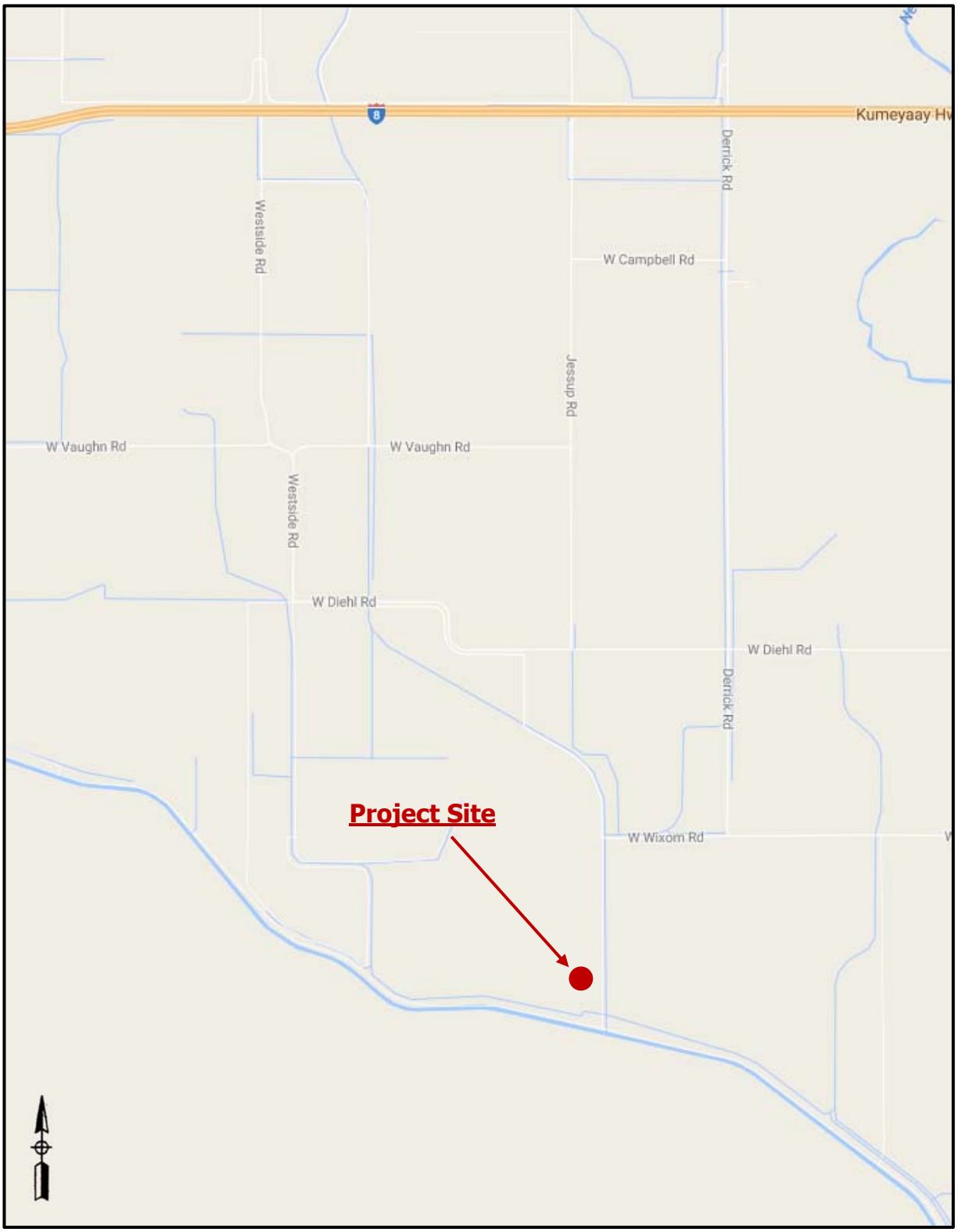
California's investor-owned electric utilities are required to add energy storage to the grid. To help meet this storage mandate, Campo Verde Solar, LLC, wishes to install a utility-scale Battery Energy Storage System on the existing site of the Campo Verde Solar Facility and contract with a customer who will buy the electricity. Campo Verde Solar, LLC wishes to amend CUP 11-0007 to allow for the lithium Ion battery storage system to be located on land previously disturbed.

The battery energy storage system is expected to be constructed in two phases:

- Phase 1- up to 5 MWh to begin commissioning in the fourth quarter of 2016
- Phase 2- up to 100 MWh to begin commissioning by third quarter of 2018.

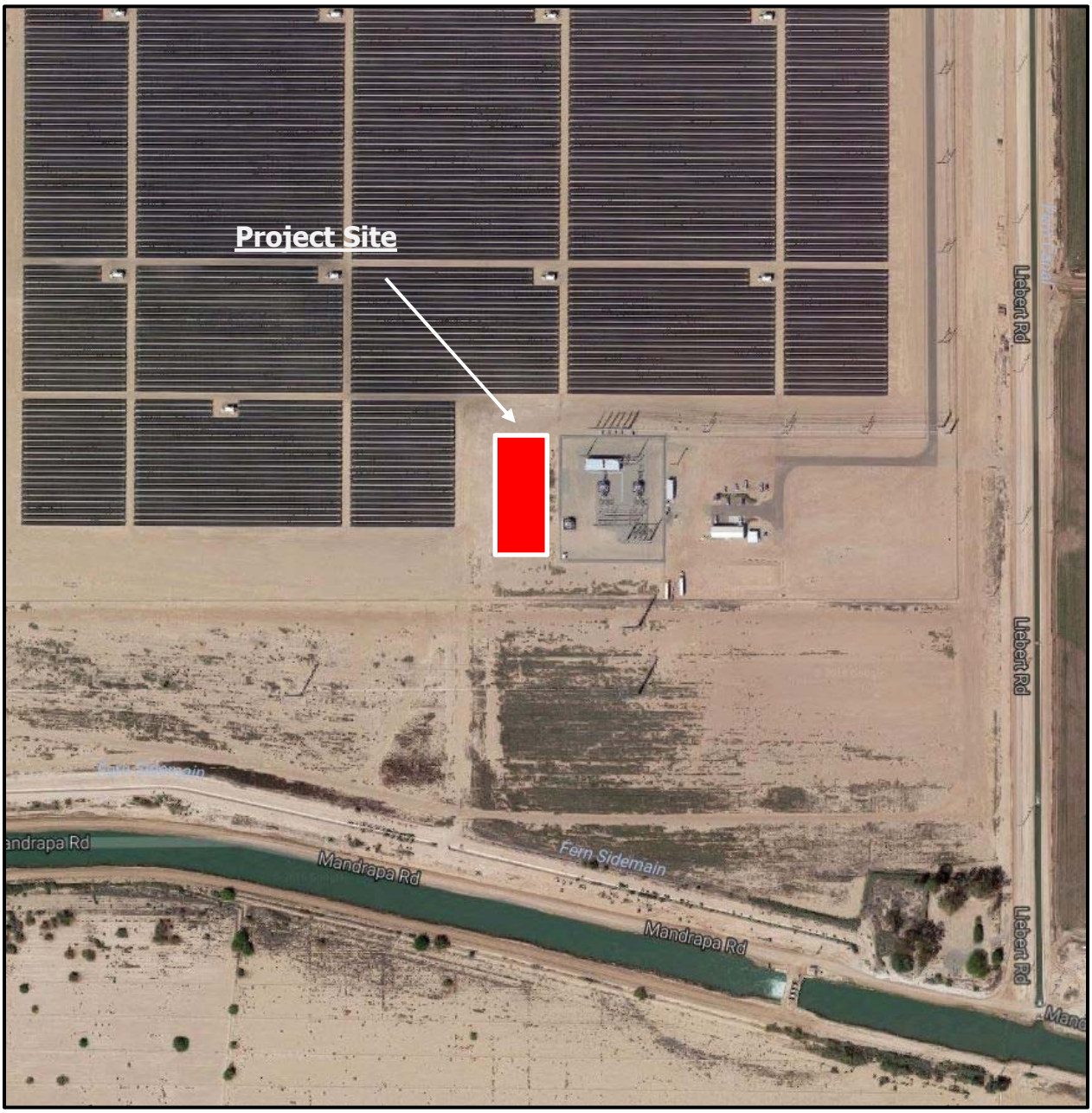
The battery energy storage system will charge from electricity generated by the Campo Verde Solar Facility and connect to the existing onsite Campo Verde substation, which interconnects to the existing Imperial Valley Substation. The battery energy storage system will be capable of charging off the grid, although at this time, that is not anticipated to occur.

Figure 1-A: Project Vicinity Map and Project Footprint



Source: Google Maps, 8/16

Figure 1-B: Project Area Overview Map



Source: Google Maps, 8/16

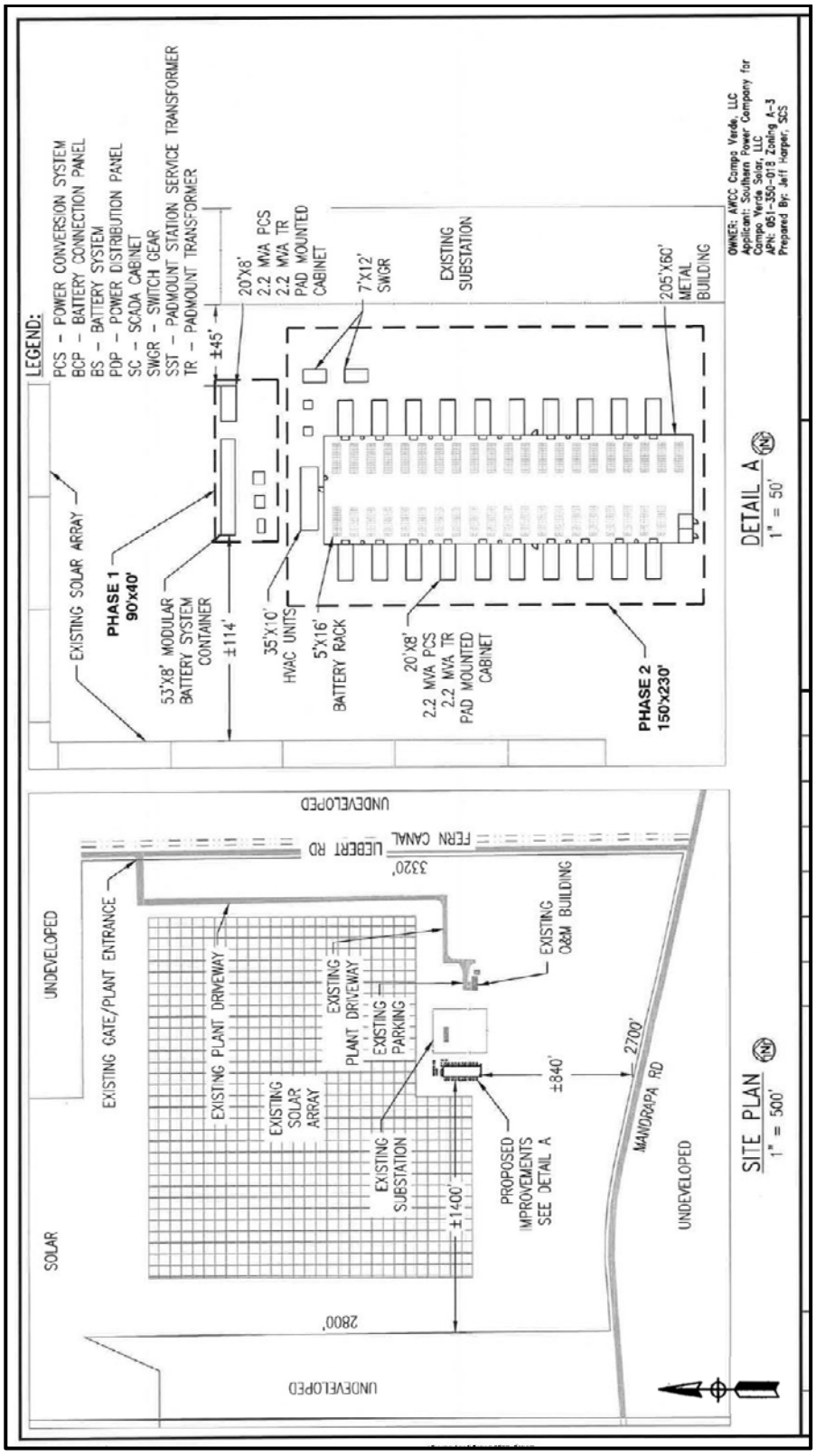
Phase 1 will consist of a 424-square-foot metal modular battery system container placed on a concrete foundation. The container may possibly be covered by a shade structure made of metal or solar panels. Adjacent to the container are: power conversion system (PCS) cabinets and transformer, SCADA cabinet, power distribution panel, and station service transformer. The components will be spaced to provide isolation as well as access. They will occupy approximately 707 square feet of ground space. No offices or staffed control centers will be located within the container or other components. The wiring- from the battery containers to the PCS, to the transformers and finally to the substation- will most likely be run underground in trenches, but could be overhead for the short distance. The wiring will not cross any roads or canals.

Phase 2 will consist of an approximately 12,300-square-foot metal building with battery racks on a concrete foundation. No offices or staffed control centers will be located within the building. Adjacent to the building are: power conversion system (PCS) cabinets and transformers, HVAC units, power distribution panel, station service transformer, and electric switch gear. The building and components will occupy approximately 16,068 square feet of ground space. Phase 2 wiring will be similar to Phase 1. A site development plan is shown in Figure 1-C on the following Page.

Construction activities for Phase 1 will have a relatively short duration. Most of the equipment will arrive at the site pre-assembled. Approximately 12 workers will be on site for 6-8 weeks to install the foundations and connect the components to the existing controls system and project substation; work hours will be approximately from sunrise to 2:30p.m. Three technicians will work an additional 3-6 weeks to commission and debug the system integration; work hours will be approximately from 8 p.m. to 5 a.m. to avoid interference with the facility when solar power is being generated. Construction of Phase 2 will take up to six months. Construction will require approximately 30 workers to install and integrate the equipment; work hours will be similar to Phase 1.

The battery systems are designed to operate seamlessly and automatically within the existing photovoltaic (PV) system architecture. Both phases will be designed to receive, per their program instructions, solar-generated electricity during times of excess generation or times of less desirable generation and store that power for release when the customer deems it to be more valuable. The system thus becomes a valuable tool in allowing the customer and system operators to manage intermittent renewable generation and convert it into reliable, dispatchable generation.

Figure 1-C: Site Development Plan



Source: Southern Company Generation Engineering and Construction Services, 2016

The post construction operations and maintenance of the Battery Energy Storage Facility will be monitored by existing six operators currently on-site as part of the existing Campo Verde Solar Facility operations. No additional full time staff is anticipated as part of the Battery Energy Storage Facility; however, technicians will be brought in if necessary, thus there is no anticipated new trip generation for the maintenance and project operations.

The on-site staff will be responsible for routine visual inspections and normal housekeeping tasks. The staff will also have the responsibility for coordinating routine HVAC service and physical building maintenance. Physical maintenance on the battery internal infrastructure will be infrequent and highly specialized so focused maintenance teams will be brought in for those tasks.

1.3 On-site Ambient Noise

To determine the existing noise environment and to assess potential noise impacts, measurements were taken on the project having a direct line of site to the adjacent roadways. The noise measurements were recorded on September 15, 2016 by Ldn Consulting between approximately 3:30 p.m. and 3:45 p.m. The noise monitoring location is provided graphically in Figure 1-D. Noise measurements gathered at the Project site were taken using a Larson-Davis Model LxT Type 1 precision sound level meter, programmed, in "slow" mode, to record noise levels in "A" weighted form. The sound level meter and microphone were mounted on a tripod, five feet above the ground and equipped with a windscreen during all measurements. The sound level meter was calibrated before and after the monitoring using a Larson-Davis calibrator, Model CAL 200.

The noise measurement location was determined based on site access and noise impact potential. Monitoring location 1 (M1) was located roughly 30-feet from Lebert Road east of the site. The results of the noise measurements are presented in Table 1-1 on the following Page. The noise measurements were monitored for a time period of 15 minutes. The ambient Leq noise levels measured in the area of the project during the mid-day were found to be between below 50 dBA Leq and 90% (L90) the noise levels was 36 dBA. The existing noise levels in the project area consisted primarily of existing agricultural operations near the site and on-site operations of the Campo Verde Solar Facility.

Figure 1-D: Project Site Noise Measurement Locations

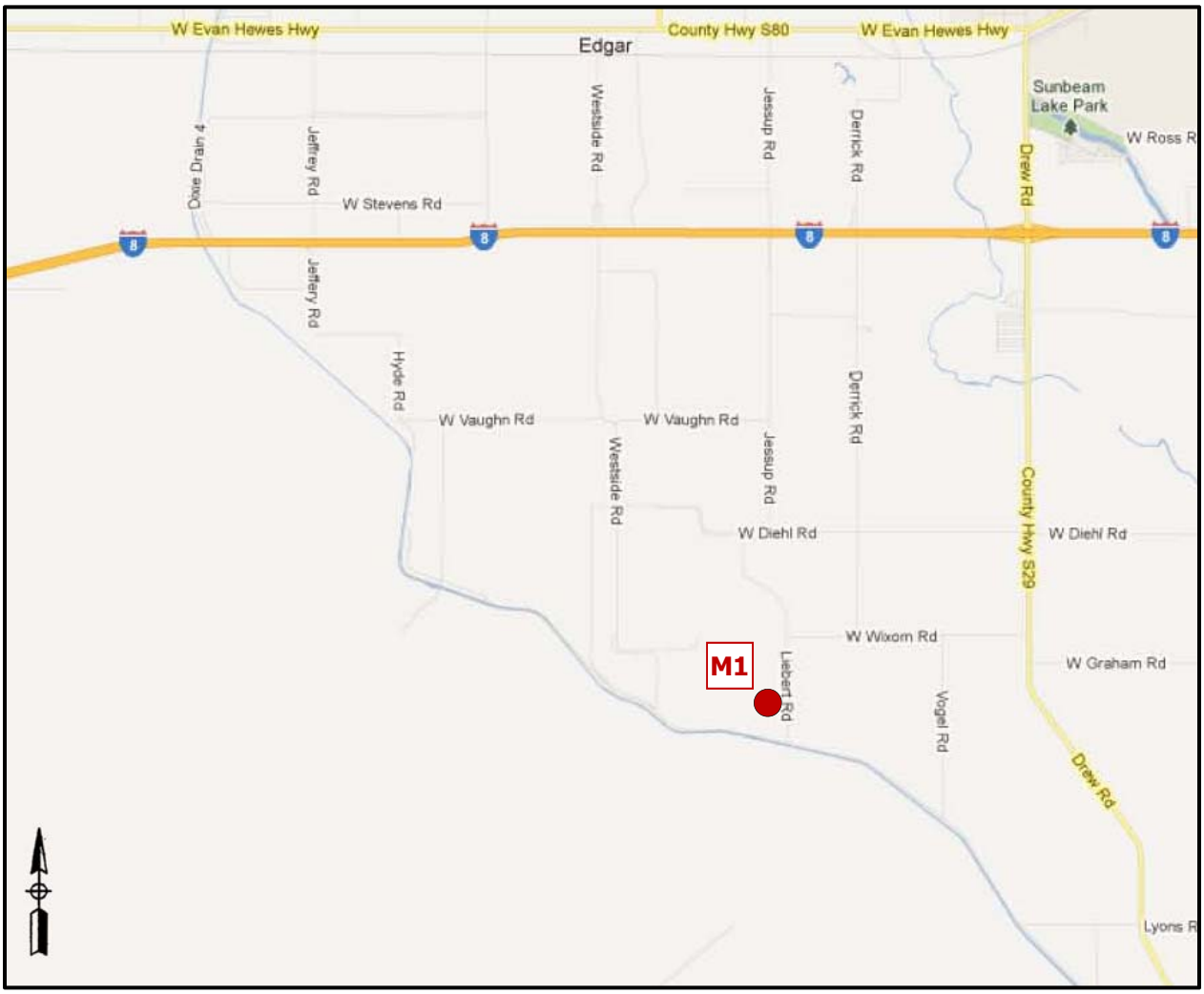


Table 1-1: Project Site Ambient Noise Levels

Location	Description	Time	Noise Levels (dBA)					
			Leq	Lmin	Lmax	L10	L50	L90
M1	East of Site	3:30 p.m. – 3:45 p.m.	46.3	33.4	68.9	48.6	38.7	35.5
Source: Ldn Consulting, Inc. September 15, 2016								

2.0 SIGNIFICANCE CRITERIA

2.1 Operational Standards

The Property Line Noise Limits listed in Table 9 of the County's General Plan Noise Element and the County's Ordinance, Title 9, Division 7 (Noise Abatement and Control) Section 90702.00 Subsection A provides acceptable Sound level limits based on the property zoning. The applicable property line sound level limits are provided in Table 2-1 below and shall apply to noise generation from one property to an adjacent property. The standards imply the existence of a sensitive receptor on the adjacent, or receiving, property. In the absence of a sensitive receptor, an exception or variance to the standards may be appropriate. These standards do not apply to construction noise.

Table 2-1: Property Line Noise Level Limits

Zone	Time	Applicable Limit One-hour Average Sound Level (Decibels)
Residential Zones	7 a.m. to 10 p.m.	50
	10 p.m. to 7 a.m.	45
Multi-residential Zones	7 a.m. to 10 p.m.	55
	10 p.m. to 7 a.m.	50
Commercial Zones	7 a.m. to 10 p.m.	60
	10 p.m. to 7 a.m.	55
Light Industrial/Industrial Park Zones	Anytime	70
General Industrial Zones	Anytime	75
When the noise-generating property and the receiving property have different uses, the more restrictive standard shall apply. When the ambient noise level is equal to or exceeds the Property Line noise standard, the increase of the existing or proposed noise shall not exceed 3 dB L_{eq}. The sound level limit between two zoning districts (different land uses) shall be measured at the property line between the properties. Fixed-location public utility distribution or transmission facilities located on or adjacent to a property line shall be subject to the noise level limits of subsection A of this section, measured at or beyond six feet from the boundary of the easement upon which the equipment is located. This section does not apply to noise generated by helicopters at heliports or helistops authorized by a conditional use permit. This section does not apply to noise generated by standard agricultural field operating practices such as planting and harvesting of crops. The County of Imperial has a Right to Farm Ordinance (1031) which serves as recognition to agricultural practices to new development. Agricultural/industrial operations shall comply with the noise levels prescribed under the general industrial zones.		

Source: County of Imperial Ordinance, Title 9, Division 7 (Noise Abatement and Control)

These standards are intended to be enforced through the County's code enforcement program on the basis of complaints received from persons impacted by excessive noise. It must be acknowledged that a noise nuisance may occur even though an objective measurement with a sound level meter is not available. In such cases, the County may act to restrict disturbing, excessive, or offensive noise which causes discomfort or annoyance to reasonable persons of normal sensitivity residing in an area.

2.2 Construction Noise Standards

Based on the County of Imperial's Noise Element of the General Plan, construction noise from a single piece of equipment or a combination of equipment, shall not exceed 75 dB L_{eq}, when averaged over an eight (8) hour period, and measured at the nearest sensitive receptor. This standard assumes a construction period, relative to an individual sensitive receptor of days or weeks. In cases of extended length construction times, the standard may be tightened so as not to exceed 75 dB L_{eq} when averaged over a one (1) hour period.

Construction equipment operation shall be limited to the hours of 7 a.m. to 7 p.m., Monday through Friday, and 9 a.m. to 5 p.m. Saturday. No commercial construction operations are permitted on Sunday or holidays. In cases of a person constructing or modifying a residence for himself/herself, and if the work is not being performed as a business, construction equipment operations may be performed on Sundays and holidays between the hours of 9 a.m. and 5 p.m. Such non-commercial construction activities may be further restricted where disturbing, excessive, or offensive noise causes discomfort or annoyance to reasonable persons of normal sensitivity residing in an area.

2.3 Significant Increase of Ambient Noise Levels

The increase of noise levels generally results in an adverse impact to the noise environment. The Noise/Land Use Compatibility Guidelines are not intended to allow the increase of ambient noise levels up to the maximum without consideration of feasible noise reduction measures. The following guidelines are established by the County of Imperial for the evaluation of significant noise impact.

a. If the future noise level after the Project is completed will be within the "normally acceptable" noise levels shown in the Noise/Land Use Compatibility Guidelines, but will result in an increase of 5 dB CNEL or greater, the Project will have a potentially significant noise impact and mitigation measures must be considered.

b. If the future noise level after the Project is completed will be greater than the "normally acceptable" noise levels shown in the Noise/Land Use Compatibility Guidelines, a noise increase of 3 dB CNEL or greater shall be considered a potentially significant noise impact and mitigation measures must be considered.

2.4 Vibration Standards

The City has not yet adopted vibration criteria. The United States Department of Transportation Federal Transit Administration (FTA) provides criteria for acceptable levels of groundborne vibration for various types of special buildings that are sensitive to vibration. For purposes of identifying potential project-related vibration impacts, the FTA criteria will be used. The human reaction to various levels of vibration is highly subjective. The upper end of the range shown for the threshold of perception, or roughly 65 VdB, may be considered annoying by some people. Vibration below 65 VdB may also cause secondary audible effects, such as a slight rattling of doors, suspended ceilings/fixtures, windows, and dishes, any of which may result in additional annoyance. Table 2-2 on the following page shows the FTA groundborne vibration and noise impact criteria for human annoyance.

In addition to the vibration annoyance standards presented above, the FTA also applies the following standards for construction vibration damage. Table 2-3 on the following page, structural damage is possible for typical residential construction when the peak particle velocity (PPV) exceeds 0.2 inch per second (in/sec). This criterion is the threshold at which there is a risk of damage to normal dwellings.

Table 2-2: Vibration and Noise Impact Criteria (Human Annoyance)

	Groundborne Vibration Impact Levels (VdB re 1 microinch/second)			Groundborne Noise Impact Levels (dB re 20 micropascals)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where low ambient vibration is essential for interior operations.	65 VdB[4]	65 VdB[4]	65 VdB[4]	N/A[4]	N/A[4]	N/A[4]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: United States Department of Transportation Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment,* June 2006.

[1] "Frequent Events" are defined as more than 70 vibration events per day. Most rapid transit projects fall into this category.

[2] "Occasional Events" are defined as between 30 and 70 vibration events of the same source per day. Most commuter truck lines have this many operations.

[3] "Infrequent Events" are defined as fewer than 30 vibration events of the same kind per day. This category includes most commuter rail branch lines

[4] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. Vibration-sensitive manufacturing or research will require detailed evaluation to define the acceptable vibration levels. Ensuring lower vibration levels in a building often requires special design of the HVAC systems and stiffened floors.

[5] Vibration-sensitive equipment is not sensitive to groundborne noise.

Table 2-3: Vibration Impact Criteria (Structural Damage)

Building Category	PPV (in/sec)	VdB
I. Reinforced-concrete, steel, or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: United States Department of Transportation Federal Transit Administration (FTA), *Transit Noise and Vibration Impact Assessment,* June 2006.
Notes: RMS velocity calculated from vibration level (VdB) using the reference of one microinch/second.

3.0 OPERATIONAL ACTIVITIES

3.1 Guidelines for the Determination of Significance

The County Ordinance, Title 9, Division 7 (Noise Abatement and Control) states it is unlawful for any person to make or cause any noise to the extent that the one-hour average sound level, at any point on or beyond the boundaries of their property exceeds the applicable limits provided above in Table 2-1. The Project and surrounding properties are zoned as A-2 - General Agriculture, A-2-R - General Agriculture, Rural Zone, and A-3 - Heavy Agriculture.

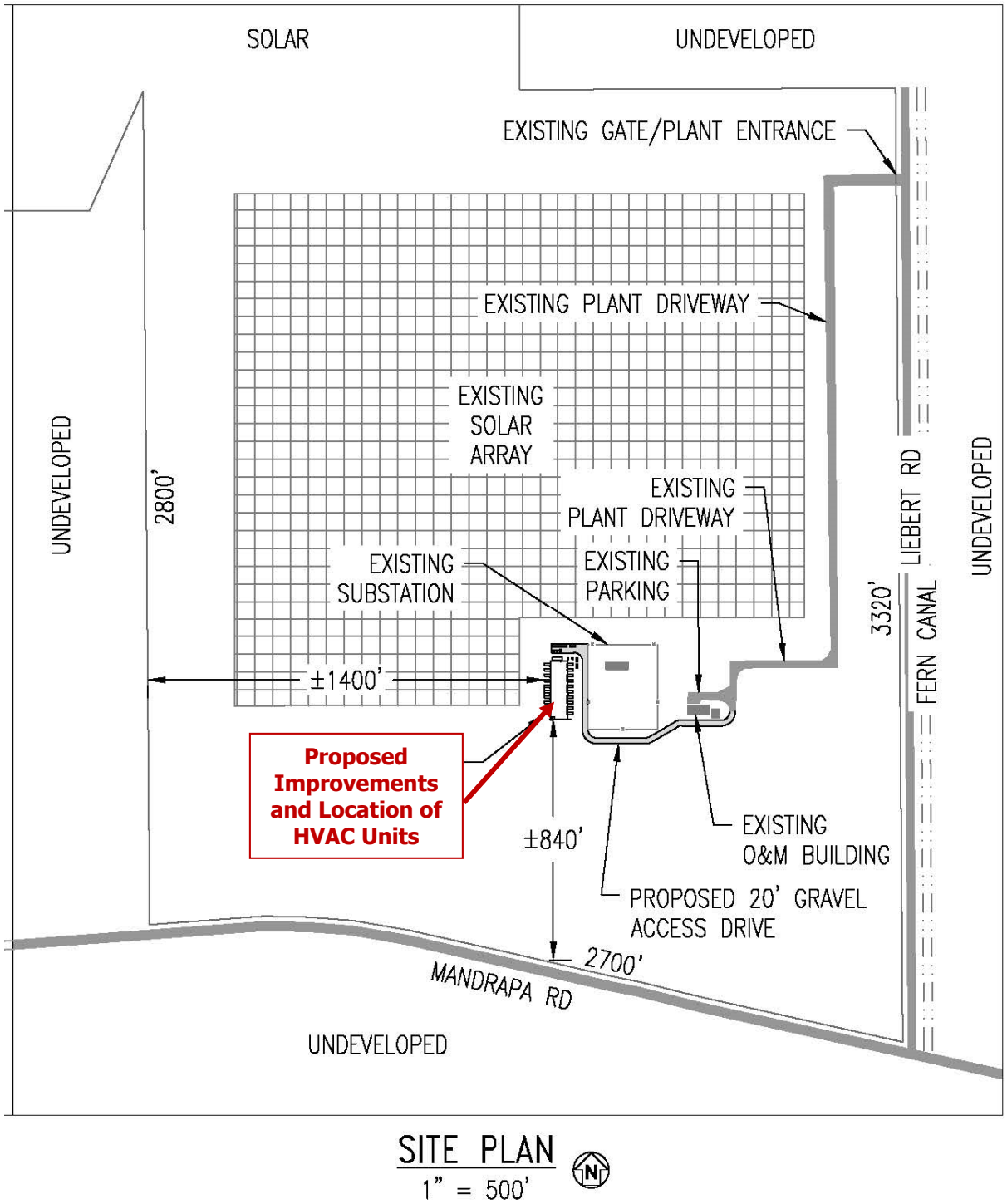
To be conservative, for the purposes of this analysis the most restrictive applicable sound limits identified in Section 90702.00 of the Noise Ordinance will be applied to accommodate the planning of not just existing but potential future residential uses that could be adjacent to the proposed Project. Section 90702.00 of the Noise Ordinance sets a sound level limit of 50 dBA Leq for daytime hours of 7 a.m. to 10 p.m. and 45 dBA Leq during the noise sensitive nighttime hours of 10 p.m. to 7 a.m. for residential noise sensitive land uses. Most of the proposed Project components will only operate during the daytime hours but a few may operate during nighttime or early morning hours and therefore the most restrictive and conservative approach is to apply the 45 dBA Leq nighttime standard at the property lines.

3.2 Potential Operational Noise Impacts

This section examines the potential stationary noise source impacts associated with the operation of the proposed Project. The battery system does not generate noise. The only noticeable noise will be from operation of HVAC equipment. Phase 1 will have two 50 ton units and Phase 2 will have up to eight 50 ton HVAC units for climate control. These units would consist of York, or equivalent, having a noise level of 65 dBA at a distance of 7 meters (23 feet) with the manufacture's enclosure. The proposed location of the HVAC units can be seen in Figure 3-A below.

Sound from a small localized source (a "point" source) radiates uniformly outward as it travels away from the source. The sound level attenuates or drops-off at a rate of 6 dBA for each doubling of distance. A drop-off rate of 6 dBA per doubling of distance was used for all operational pieces of equipment. Using a point-source noise prediction model, calculations of the expected operational noise levels and potential impacts were completed. The essential model input data for these performance equations include the source levels of each type of equipment, relative source to receiver horizontal and any vertical separations, the amount of time the equipment is operating in a given day, also referred to as the duty-cycle and any transmission loss from topography or barriers. To determine the worst-case noise levels for the operations no topographic attenuation, duty-cycle reductions or barrier reductions were utilized.

Figure 3-A: Proposed Equipment Locations



The proposed Project's HVAC units will be located at least 840 feet from the nearest property line to the south (please refer to Figure 3-A above). As stated above, the HVAC units have a noise level of 65 dBA at a distance of 23 feet. Cumulatively, the ten units would have a combined noise level of 75 dBA at 23 feet. The units typically not all operate at the same or for the entire hour. To be conservative, it was assume this could occur. The reduction in the noise level at a distance of 840 feet is -31.3 dBA resulting in a noise level of 43.7 dBA at the nearest property as can be seen in Table 3-1. Therefore, the proposed HVAC units will comply with the County's most restrictive property line standard of 45 dBA Leq and no additional analysis is needed for the Substation.

Table 3-1: Transformer/Inverter and Tracker Noise – Nearest Property Line

Source	Cumulative Noise Level @23-Feet (dBA)[1]	Distance to Nearest Property Line (Feet)	Noise Reduction due to distance (dBA)	Resultant Noise Level @ Property Line (dBA Leq)	Property Line Standard (dBA Leq)	Impact?
HVAC	75	840	-31.3	43.7	45	**No**

3.3 Conclusions

Based on the empirical data, manufactures specifications and the distances to the property lines the unshielded noise levels from the proposed equipment were found to be below the County's most restrictive nighttime property line standard of 45 dBA. No impacts are anticipated and no mitigation is required.

4.0 CONSTRUCTION ACTIVITIES

4.1 County of Imperial Construction Standards

Construction noise, from a single piece of equipment or a combination of equipment, shall not exceed 75 dB L_{eq}, when averaged over an eight (8) hour period, and measured at the nearest sensitive receptor. This standard assumes a construction period, relative to an individual sensitive receptor of days or weeks. In cases of extended length construction times, the standard may be tightened so as not to exceed 75 dB L_{eq} when averaged over a one (1) hour period. Construction equipment operation shall be limited to the hours of 7 a.m. to 7 p.m., Monday through Friday, and 9 a.m. to 5 p.m. Saturday. No commercial construction operations are permitted on Sunday or holidays.

4.2 Potential Project Construction Noise Impacts

Construction noise represents a short-term impact on the ambient noise levels. Noise generated by construction equipment includes haul trucks, water trucks, graders, dozers, loaders and scrapers can reach relatively high levels. Grading activities typically represent one of the highest potential sources for noise impacts and little or no grading will be necessary for this Project. The most effective method of controlling construction noise is through local control of construction hours and by limiting the hours of construction to normal weekday working hours.

The U.S. Environmental Protection Agency (U.S. EPA) has compiled data regarding the noise generating characteristics of specific types of construction equipment. Noise levels generated by heavy construction equipment at a distance of 50 feet can range from 60 dBA for a small tractor up to 100 dBA for rock breakers. However, these noise levels diminish rapidly with distance from the construction site at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 87 dBA measured at 50 feet from the noise source would be reduced to 81 dBA at 100 feet from the source and be further reduced to 75 dBA at 200 feet from the source.

Using a point-source noise prediction model, calculations of the expected construction noise impacts were completed. The essential model input data for these performance equations include the source levels of each type of equipment, relative source to receiver horizontal and vertical separations, the amount of time the equipment is operating in a given day, also referred to as the duty-cycle and any transmission loss from topography or barriers. To determine the worst-case noise levels for the grading operations no topographic attenuation or barrier reductions were utilized.

The Project construction dates are estimated to begin late 2016 for Phase 1 and Phase 2 will be completed in 2018. The Project construction includes all site preparation, installation structures,

equipment and all supporting utilities. The noise levels utilized in this analysis for the construction are based upon the anticipated list of equipment proved by the Project Applicant and is shown in Table 4-1 below. Most of the construction activities will consist of clearing the site and the trenching of utilities for the preparation of the structures and batteries. The equipment is anticipated to be spread out over the site with all the equipment located over 800 feet from the same property line.

Table 4-1: Construction Noise Levels

Construction Equipment	Quantity	Duty Cycle (Hours/Day)	Source Level @ 50-Feet (dBA)	Cumulative Noise Level @ 50-Feet (dBA Leq-8h)
Tractors/Loaders/Backhoes	2	6.5	73	75.1
Water Truck	1	6.5	70	69.1
Crane	2	6.5	75	77.1
Rough Terrain Forklifts	2	1.6	72	68.3
			Cumulative Levels @ 50 Feet (dBA)	79.9
			Distance To Property Line	800
			Noise Reduction Due To Distance	-24.0
			NEAREST PROPERTY LINE NOISE LEVEL	55.9
			County of Imperial Threshold	75
			IMPACT?	**NO**

4.3 Construction Vibration

The County has not yet adopted vibration criteria. The United States Department of Transportation Federal Transit Administration (FTA) provides criteria for acceptable levels of groundborne vibration for various types of special buildings that are sensitive to vibration. For purposes of identifying potential project-related vibration impacts, the FTA criteria will be used.

The FTA has determined vibration levels that would cause annoyance to a substantial number of people and potential damage to building structures. The FTA criterion for vibration induced structural damage is 0.20 in/sec for the peak particle velocity (PPV). Project construction activities would result in PPV levels below the FTA's criteria for vibration induced structural damage. The FTA criterion for infrequent vibration induced annoyance is 80 Vibration Velocity (VdB) for residential uses. Construction activities would generate levels of vibration that would not exceed the FTA criteria for nuisance for nearby residential uses.

There are no vibration-sensitive uses located adjacent to the proposed construction. The nearest offsite uses are agricultural and located over 800 feet from any construction activities. Table 4-2 lists the average vibration levels that could be experienced at adjacent land uses from the temporary construction activities. Therefore, project construction activities would not result in vibration induced structural damage or vibration induced annoyance to adjacent land uses. Therefore, vibration impacts would be less than significant.

Table 4-2: Vibration Levels from Construction Activities

Equipment	Approximate Velocity Level at 25 Feet (VdB)	Approximate RMS Velocity at 25 Feet (in/sec)	Approximate Velocity Level at 800 Feet (VdB)	Approximate RMS Velocity at 800 Feet (in/sec)
Small bulldozer	58	0.003	12.8	0.0000
Jackhammer	79	0.035	33.8	0.0002
Loaded trucks	86	0.076	40.8	0.0004
Large bulldozer	87	0.089	41.8	0.0005
		FTA Criteria	80	0.2
		Significant Impact?	**No**	**No**

[1] PPV at Distance D = PPVref x $(25/D)^{1.5}$

4.4 Construction Conclusions

As can be seen in Table 4-1, if all the equipment was operating in the same location, which is not physically possible, at a distance of 800 feet from the nearest property line the point source noise attenuation from construction activities is -24 dBA. This would result in an anticipated worst case eight-hour average combined noise level of well below 75 dBA at the property line. Given this, the noise levels will comply with the County of Imperial's 75 dBA standard at all Project property lines and no impacts are anticipated.

There are no vibration-sensitive uses located adjacent to the proposed construction. The nearest offsite uses are agricultural and located over 800 feet from any construction activities. Therefore, project construction activities would not result in vibration induced structural damage or vibration induced annoyance to adjacent land uses. Therefore, vibration impacts would be less than significant.

5.0 TRAFFIC RELATED NOISE

5.1 Off-site Traffic Related Noise Impacts

The off-site Project related roadway segment noise levels Projected in this report were calculated using the methods in the Highway Noise Model published by the Federal Highway Administration (FHWA Highway Traffic Noise Prediction Model, FHWA-RD-77-108, December, 1978). The FHWA Model uses the traffic volume, vehicle mix and speed to compute the equivalent noise level. A spreadsheet calculation was used which computes equivalent noise levels for each of the time periods used in the calculation of CNEL. Weighting these equivalent noise levels and summing them gives the CNEL for the traffic Projections. The noise contours are then established by extrapolating the noise levels until the distance to the desired noise contour(s) are found.

Because mobile/traffic noise levels are calculated on a logarithmic scale, a doubling of the traffic noise or acoustical energy results in a noise level increase of 3 dBA. Therefore the doubling of the traffic volume, without changing the vehicle speeds or mix ratio, results in a noise increase of 3 dBA. Mobile noise levels radiates in an almost oblique fashion from the source and drop off at a rate of 3 dBA for each doubling of distance under hard site conditions and at a rate of 4.5 dBA for soft site conditions.

Hard site conditions consist of concrete, asphalt and hard pack dirt while soft site conditions exist in areas having slight grade changes, landscaped areas and vegetation. Soft site conditions, based on the existing ground conditions and agricultural use, were used to develop the noise contours and analyze noise impacts along all roadway segments. The future traffic noise model utilizes a typical, conservative vehicle mix of 95% Autos, 3% Medium Trucks and 2% Heavy Trucks for all analyzed roadway segments. The vehicle mix provides the hourly distribution percentages of automobile, medium trucks and heavy trucks for input into the FHWA Model.

Based on the County's Guidelines, project related roadway noise levels would be considered significant if the future noise level with the Project will be within the "normally acceptable" noise levels shown in the Noise/Land Use Compatibility Guidelines, but will result in an increase of 5 dBA CNEL or greater. Or, if the future noise levels with the Project will be greater than the "normally acceptable" noise levels shown in the Noise/Land Use Compatibility Guidelines, a noise increase of 3 dBA CNEL or greater shall be considered a potentially significant noise impact and mitigation measures must be considered.

5.2 Direct Project Related Traffic Noise Impacts

Phase 1 (2016) Construction Traffic Noise Impacts

To determine if roadway noise level increases associated during the construction of Phase 1 of the of the proposed project, planned to occur in the year 2016, will create noise impacts, the noise levels for the existing year conditions were compared with the noise level increase from the Project' peak related construction traffic. The worst case construction related noise increases would occur when comparing the existing conditions prior to construction to the beginning of construction. To be conservative, the construction phase's peak traffic volume was utilized. Utilizing the Project's traffic assessment (Source: LOS Engineering, Inc. 2016) noise contours were developed for the following traffic scenarios:

Existing Year 2016: Current noise conditions without the construction of the Project.

Existing Year 2016 Plus Project Phase 1: Current noise conditions plus the peak construction related traffic of the Project.

Existing Year 2016 vs. Existing Year 2016 Plus Project Phase 1: Comparison of the Project construction traffic related noise level increases in the vicinity of the Project site.

The noise levels and the distances to the 60 dBA CNEL contours for the roadways in the vicinity of the Project site are given in Table 5-1 for the Existing Year 2016 Scenario without Project construction traffic and in Table 5-2 for the Existing Year 2016 Plus Project constriction traffic Scenario. Note that the values given do not take into account the effect of any noise barriers or topography that may affect ambient noise levels. Table 5-3 presents the comparison of the Existing Year 2016 with and without Project related noise levels. The overall roadway segment noise levels will increase from 0.1 dBA CNEL to 1.4 dBA CNEL during the construction of the Phase 1 based on the anticipated Project related construction traffic.

Table 5-1: 2016 Traffic Noise Levels (Without Project)

Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 100-Feet (dBA CNEL)	60 dBA CNEL Contour Distance (Feet)
Drew Road				
North of Wixom Road	381	55	52.7	33
South of Wixom Road	334	55	52.1	30
Wixom Road				
From Liebert Road to Drew Road	174	40	46.2	12
[1] Source: Project Traffic study prepared by LOS Engineering, Inc. 2016				

Table 5-2: 2016 + Project Phase 1 Traffic Noise Levels

Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 100-Feet (dBA CNEL)	60 dBA CNEL Contour Distance (Feet)
Drew Road				
North of Wixom Road	400	55	52.9	34
South of Wixom Road	341	55	52.2	30
Wixom Road				
From Liebert Road to Drew Road	240	40	47.6	15
[1] Source: Project Traffic study prepared by LOS Engineering, Inc. 2016				

Table 5-3: 2016 vs. 2016 + Project Phase 1 Traffic Noise Levels

Roadway Segment	Existing Noise Level @ 100-Feet (dBA CNEL)	Existing Plus Project Noise Level @ 100-Feet (dBA CNEL)	Project Related Noise Increase (dBA CNEL)	County Noise Increase Threshold	Potential Impact?
Drew Road					
North of Wixom Road	52.7	52.9	0.2	5	No
South of Wixom Road	52.1	52.2	0.1	5	No
Wixom Road					
From Liebert Road to Drew Road	46.2	47.6	1.4	5	No
Sound Levels provided are worst-case and do not take into account topography or shielding from barriers.					

The Project does not create a short-term noise increases during the Phase 1 peak construction of more than 5 dBA CNEL on any roadway segment as can be seen in the last column of Table 5-3 below. The noise levels are below the 60 dBA CNEL threshold and in the "normally acceptable" category. No sensitive receptors would be directly impacted by construction traffic noise due to the proposed Project's construction traffic and no mitigation would be required.

Phase 2 (2018) Construction Traffic Noise Impacts

To determine if roadway noise level increases associated during the construction of Phase 2 of the of the proposed project, planned to occur in the year 2018, will create noise impacts, the noise levels for the year 2018 conditions were compared with the noise level increase from the Project' peak related construction traffic. The worst case construction related noise increases would occur when comparing the existing conditions prior to construction to the beginning of construction. To be conservative, the construction phase's peak traffic volume was utilized. Utilizing the Project's traffic assessment (Source: LOS Engineering, Inc. 2016) noise contours were developed for the

following traffic scenarios:

Year 2018: Current noise conditions without the construction of the Project.

Year 2018 Plus Project Phase 2: Current noise conditions plus the peak construction related traffic of the Project.

Year 2018 vs. 2018 Plus Project Phase 2: Comparison of the Project construction traffic related noise level increases in the vicinity of the Project site.

The noise levels and the distances to the 60 dBA CNEL contours for the roadways in the vicinity of the Project site are given in Table 5-4 for the Year 2018 Scenario without Project construction traffic and in Table 5-5 for the Year 2018 Plus Project constriction traffic Scenario. Note that the values given do not take into account the effect of any noise barriers or topography that may affect ambient noise levels. Table 5-6 presents the comparison of the Year 2018 with and without Project related noise levels. The overall roadway segment noise levels will increase from 0.1 dBA CNEL to 2.3 dBA CNEL during the construction of Phase 2 based on the anticipated Project related construction traffic.

Table 5-4: 2018 Traffic Noise Levels (Without Project)

Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 100-Feet (dBA CNEL)	60 dBA CNEL Contour Distance (Feet)
Drew Road				
North of Wixom Road	402	55	52.9	34
South of Wixom Road	353	55	52.4	31
Wixom Road				
From Liebert Road to Drew Road	184	40	46.4	12
[1] Source: Project Traffic study prepared by LOS Engineering, Inc. 2016				

Table 5-5: 2018 + Project Phase 2 Traffic Noise Levels

Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 100-Feet (dBA CNEL)	60 dBA CNEL Contour Distance (Feet)
Drew Road				
North of Wixom Road	515	55	54.0	40
South of Wixom Road	366	55	52.5	32
Wixom Road				
From Liebert Road to Drew Road	310	40	48.7	18
[1] Source: Project Traffic study prepared by LOS Engineering, Inc. 2016				

Table 5-6: 2018 vs. 2018 + Project Phase 2 Traffic Noise Levels

Roadway Segment	Existing Noise Level @ 100-Feet (dBA CNEL)	Existing Plus Project Noise Level @ 100-Feet (dBA CNEL)	Project Related Noise Increase (dBA CNEL)	County Noise Increase Threshold	Potential Impact?
Drew Road					
North of Wixom Road	52.9	54.0	1.1	5	No
South of Wixom Road	52.4	52.5	0.1	5	No
Wixom Road					
From Liebert Road to Drew Road	46.4	48.7	2.3	5	No
Sound Levels provided are worst-case and do not take into account topography or shielding from barriers.					

The Project does not create a short-term noise increases during the Phase 2 peak construction of more than 5 dBA CNEL on any roadway segment as can be seen in the last column of Table 5-6 below. The noise levels are below the 60 dBA CNEL threshold and in the "normally acceptable" category. No sensitive receptors would be directly impacted by construction traffic noise due to the proposed Project's construction traffic and no mitigation would be required.

5.3 Cumulative Project Related Traffic Noise Impacts

Phase 1 (2016) Construction and Cumulative Traffic Noise Impacts

To determine if cumulative off-site noise level increases associated with the peak construction of Phase 1 of the proposed project, planned to occur in the year 2016, and other planned or permitted projects in the vicinity will create noise impacts, the noise levels for the peak construction period of the Project and other planned and permitted projects were compared with the existing year 2016 conditions. To be conservative, the construction phase's peak traffic volume was utilized. Utilizing the project's traffic assessment (Source: LOS Engineering, Inc. 2016) noise contours were developed for the following traffic scenarios:

Existing Year 2016 Plus Project Phase 1 Plus Cumulative Projects: Current day noise conditions plus the peak construction period of the project and other permitted or planned projects.

Existing Year 2016 vs. Existing Year 2016 Plus Project Phase 1 Plus Cumulative: Comparison of the existing noise levels and the related noise level increases from the combination of the proposed project peak construction traffic and all other planned or permitted projects in the vicinity of the site.

The existing noise levels and the distances to the 60 dBA CNEL contours for the roadways in the vicinity of the Project site are given in Table 5-1 above for the Existing Year 2016 Scenario. The cumulative noise conditions are provided in Table 5-7 below. No noise barriers or topography that may affect noise levels were incorporated in the calculations. Table 5-8 presents the comparison of the Existing Year 2016 and the Existing Year 2016 plus Project and Cumulative noise levels.

Table 5-7: 2016 + Project Phase 1+ Cumulative Traffic Noise Levels

Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 100-Feet (dBA CNEL)	60 dBA CNEL Contour Distance (Feet)
Drew Road				
North of Wixom Road	858	55	56.2	56
South of Wixom Road	759	55	55.7	52
Wixom Road				
From Liebert Road to Drew Road	240	40	47.6	15
[1] Source: Project Traffic study prepared by LOS Engineering, Inc. 2016				

Table 5-8: 2016 vs. 2016 + Project Phase 1+ Cumulative Traffic Noise Levels

Roadway Segment	Existing 2016 Noise Level @ 100-Feet (dBA CNEL)	2016 Plus Project Plus Cumulative Noise Level @ 100-Feet (dBA CNEL)	Cumulative Related Noise Level Increase (dBA CNEL)	County Noise Increase Threshold	Potential Impact?
Drew Road					
North of Wixom Road	52.9	56.2	3.5	5	No
South of Wixom Road	52.4	55.7	3.6	5	No
Wixom Road					
From Liebert Road to Drew Road	46.4	47.6	1.4	5	No
Sound Levels provided are worst-case and do not take into account topography or shielding from barriers.					

The Project does not create a short-term noise increases during the Phase 1 peak construction of more than 5 dBA CNEL on any roadway segment as can be seen in the last column of Table 5-8 below. The noise levels are below the 60 dBA CNEL threshold and in the "normally acceptable" category. No sensitive receptors would be cumulatively impacted by construction traffic noise due to the proposed Project's construction traffic and no mitigation would be required.

Phase 2 (2018) Construction and Cumulative Traffic Noise Impacts

To determine if cumulative off-site noise level increases associated with the peak construction of Phase 2 of the proposed project, planned to occur in the year 2018, and other planned or permitted projects in the vicinity will create noise impacts, the noise levels for the peak construction period of the Project and other planned and permitted projects were compared with the year 2018 conditions. To be conservative, the construction phase's peak traffic volume was utilized. Utilizing the project's traffic assessment (Source: LOS Engineering, Inc. 2016) noise contours were developed for the following traffic scenarios:

Year 2018 Plus Project Phase 1 Plus Cumulative Projects: Current day noise conditions plus the peak construction period of the project and other permitted or planned projects.

Year 2018 vs. Year 2018 Plus Project Phase 1 Plus Cumulative: Comparison of the existing noise levels and the related noise level increases from the combination of the proposed project peak construction traffic and all other planned or permitted projects in the vicinity of the site.

The existing noise levels and the distances to the 60 dBA CNEL contours for the roadways in the vicinity of the Project site are given in Table 5-4 above for the without project Year 2018 Scenario. The cumulative noise conditions are provided in Table 5-9 below. No noise barriers or topography that may affect noise levels were incorporated in the calculations. Table 5-10 presents the comparison of the Year 2018 and the Year 2018 plus Project and Cumulative noise levels.

Table 5-9: 2018 + Project Phase 2+ Cumulative Traffic Noise Levels

Roadway Segment	ADT[1]	Vehicle Speeds (MPH)[1]	Noise Level @ 100-Feet (dBA CNEL)	60 dBA CNEL Contour Distance (Feet)
Drew Road				
North of Wixom Road	515	55	54.0	40
South of Wixom Road	366	55	52.5	32
Wixom Road				
From Liebert Road to Drew Road	310	40	48.7	18
[1] Source: Project Traffic study prepared by LOS Engineering, Inc. 2016				

Table 5-10: 2018 vs. 2018 + Project Phase 2+ Cumulative Traffic Noise Levels

Roadway Segment	Existing 2018 Noise Level @ 100-Feet (dBA CNEL)	2018 Plus Project Plus Cumulative Noise Level @ 100-Feet (dBA CNEL)	Cumulative Related Noise Increase (dBA CNEL)	County Noise Increase Threshold	Potential Impact?
Drew Road					
North of Wixom Road	52.9	54.0	1.1	5	No
South of Wixom Road	52.4	52.5	0.1	5	No
Wixom Road					
From Liebert Road to Drew Road	46.4	48.7	2.3	5	No
Sound Levels provided are worst-case and do not take into account topography or shielding from barriers.					

The Project does not create a short-term noise increases during the Phase 2 peak construction of more than 5 dBA CNEL on any roadway segment as can be seen in the last column of Table 5-8 below. The noise levels are below the 60 dBA CNEL threshold and in the "normally acceptable" category. No sensitive receptors would be cumulatively impacted by construction traffic noise due to the proposed Project's construction traffic and no mitigation would be required.

5.4 Operational Project Related Traffic Noise Impacts

The post construction operations and maintenance of the Battery Energy Storage Facility will be monitored by existing six operators currently on-site as part of the existing Campo Verde Solar Facility operations. No additional full time staff is anticipated as part of the Battery Energy Storage Facility; however, technicians will be brought in if necessary, thus there is no anticipated new trip generation for the maintenance and project operations.

5.5 Conclusions

The Project does not create a short-term noise increases during the Phase 1 or Phase 2 peak construction of more than 5 dBA CNEL on any roadway segment. The noise levels are below the 60 dBA CNEL threshold and in the "normally acceptable" category. No sensitive receptors would be directly or cumulatively impacted by construction traffic noise due to the proposed Project's construction traffic and no mitigation would be required.

The Project does not create a short-term noise increases during the Phase 1 peak construction of more than 5 dBA CNEL on any roadway segment as can be seen in the last column of Table 5-10 below. The noise levels are below the 60 dBA CNEL threshold and in the "normally acceptable" category. No sensitive receptors would be directly impacted by construction traffic noise due to the proposed Project's construction traffic and no mitigation would be required.

The post construction operations and maintenance of the Battery Energy Storage Facility will be monitored by existing six operators currently on-site as part of the existing Campo Verde Solar Facility operations. No additional full time staff is anticipated as part of the Battery Energy Storage Facility; however, technicians will be brought in if necessary, thus there is no anticipated new trip generation for the maintenance and project operations.

6.0 CERTIFICATIONS

The contents of this report represent an accurate depiction of the noise environment and impacts within and surrounding the Campo Verde Solar Energy Storage Project. The information contained in this report was based on the best available data at the time of preparation.

DRAFT

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