4.8 NOISE

4.8.1 Environmental Setting

The following information is based primarily and summarized from the East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report completed by Behrens and Associates, Inc. (2014) (Appendix N). The purpose of the report was to identify and analyze the potential noise and vibration impacts associated with the Project.

4.8.1.1 General Characteristics of Noise and Vibration

Fundamentals of Noise. Noise is defined as unwanted sound that may be disturbing or annoying. The character of noise is defined by its loudness, pitch, and by the way the noise varies with time.

Sound is most commonly experienced by people as pressure waves passing through air. These rapid fluctuations in air pressure are processed by the human auditory system to produce the sensation of sound. The rate at which sound pressure changes occur is called the frequency. Frequency is usually measured as the number of oscillations per second or Hertz. Frequencies that can be heard by a healthy human ear range from 20 Hertz to 20,000 Hertz. Toward the lower end of this range are low-pitched sounds, including those that might be described as a “rumble” or “boom”. At the higher end of the range are high-pitched sounds that might be described as a “screech” or “hiss”.

Environmental noise generally derives, from a combination of distant noise sources. Such sources may include distant traffic, wind in trees, and distant industrial or farming activities. These distant sources create a low-level "background noise" in which no particular individual source is identifiable. Background noise is often relatively constant from moment to moment, but varies slowly from hour to hour as natural forces change or as human activity follows its daily cycle.

Superimposed on this low-level, slowly varying background noise is a succession of identifiable noisy events of relatively brief duration. These events may include the passing of single-vehicles, aircraft flyovers, screeching of brakes, and other short-term events. The presence of these short-term events causes the noise level to fluctuate.

Human perception of loudness is logarithmic rather than linear. For this reason, sound level is usually measured on a logarithmic decibel scale, which is calculated from the ratio of the sound pressure to a reference pressure level. Specifically, the sound pressure level is calculated as follows:

$$SPL = 20\ log_{10} \frac{p}{p_{ref}}$$

Where:
SPL = sound pressure level in decibels
p = root mean square sound pressure
P_{ref} = reference sound pressure (20 microPascals)

The reference pressure for sound in the air is 20 microPascals, which is represented as zero on the decibel scale. This value is used because it approximates the lowest pressure level detectable by a healthy human ear.

A-Weighting. Humans are more sensitive to some sound frequencies than others. It is therefore common practice to apply an audio filter to measured sound levels to approximate the frequency sensitivity of the human ear. One such filter is called the A-weighted decibel scale, which emphasizes sounds between 500 and 5,000 Hertz and attenuates the frequencies outside of that range. Measurements conducted utilizing the A-weighted decibel scale are denoted with an "(A)" or "A" after the decibel abbreviation (dB(A) or dBA). The A-weighted scale is nearly universally used when assessing noise impact on humans. Table 4.8-1 – Common Sound Levels/Sources and Subjective Human Responses shows typical A-weighted decibel noise levels that can be found in both outdoor and indoor environments.

It is generally accepted that a change of three decibels is perceptible to the average healthy human ear. A change of five decibels is generally regarded as a readily perceptible increase/decrease in noise level.

Table 4.8-1. Common Sound Levels/Sources and Subjective Human Responses

Sound Level (A-weighted decibel)	Typical Outdoor Noise Source	Typical Indoor Noise Sources	Typical Human Response/Effects
140	Carrier Jet takeoff (50 ft)		--Threshold for Pain--
130	Siren (100 ft) Live Rock Band		---Hearing Damage---
120	Jet takeoff (200 ft) Auto horn (3 ft)		
110	Chain Saw Snow Mobile		---Deafening---
100	Lawn Mower (3 ft) Motorcycle (50 ft)		
90	Heavy Duty Truck (50 ft)	Food Blender (3 ft)	---Very Loud---
80	Busy Urban Street, Daytime	Garbage Disposal (3 ft)	
70	Automobile (50 ft)	Vacuum Cleaner (9 ft)	---Loud---
60	Small plane at ¾ mile	Conversation (3 ft)	
50	Quiet Residential Daytime	Dishwasher Rinse (10 ft)	---Moderate---
40	Quiet Residential Nighttime	Quiet Home Indoors	---Quiet---
30	Slight Rustling of Leaves	Soft Whisper (15 ft)	---Very Quiet---
20		Broadcasting Studio	
10		Breathing	--Barely Audible--
0			--Threshold of Hearing--

Modified from City of Carpinteria, 2007

Equivalent Sound Level (Leq). Some sources (e.g., air-conditioning equipment) produce continuous noise with a steady level that does not change with time. Other sources may be transient in nature, such as a train or aircraft passing-by. Between these two extremes are constant sources that vary gradually with time (e.g., distant freeway traffic), and intermittent sources that vary rapidly with time (e.g., surface street traffic). A location may receive noise contributions from a number of sources that fall into some or all of these categories, resulting in a complex time-varying noise environment. For this reason, meaningful measurement and analysis of environmental noise usually requires time-dependent noise descriptors. The equivalent sound level, or Leq, is a sound energy average, calculated over a stated time period. 1-hour, A-weighted Leq values are used commonly in environmental noise assessments.

Maximum Noise Level (Lmax). The maximum noise level is defined as the highest instantaneous noise level over a specified time interval. A one-hour Lmax level would be the highest observed noise level over the one-hour period.

Minimum Noise Level (Lmin). The minimum noise level is defined as the lowest instantaneous noise level over a specified time interval. A one-hour Lmin level would be the lowest observed noise level over the one-hour period.

Community Noise Equivalent Level (CNEL). The community noise equivalent level is an A-weighted average noise level calculated over 24 hours, with a five A-level decibel weighting added to sound levels during evening hours (7 p.m. to 10 p.m.) and a ten A-level decibel weighting added to sound levels during nighttime hours (10 p.m. to 7 a.m.) to reflect the increased annoyance of noise at night.

Fundamentals of Vibration. Vibration is acoustic energy transmitted as waves through a solid medium, such as soil or concrete. Like noise, the rate at which pressure changes occur is called the frequency of the vibration, measured in Hertz. Vibration may be the form of a single pulse of acoustical energy, a series of pulses, or a continuous oscillating motion.

Ground-borne vibration is the ground motion about some equilibrium position that can be described in terms of displacement, velocity, and acceleration. It can be generated by transportation systems, construction activities, and other large mechanical systems. The way that vibration is transmitted through the ground depends on the soil type, the presence of rock formations or man-made features and the topography between the vibration source and the receptor location. As a general rule, vibration waves tend to dissipate and reduce in magnitude with distance from the source. Also, the high frequency vibrations are generally attenuated rapidly as they travel through the ground, so that the vibration received at locations distant from the source tends to be dominated by low-frequency vibration. The frequencies of ground-borne vibration most perceptible to humans are in the range from less than 1 Hertz to 100 Hertz.

When ground-borne vibration arrives at a building, a portion of the energy will be reflected or refracted away from the building, and a portion of the energy will typically continue to penetrate through the ground-building interface. However, once the vibration energy is in the building structure, it can be amplified by the resonance of the walls and floors. Occupants can perceive vibration as motion of the building elements (particularly floors) and also rattling of lightweight components, such as windows, shutters, or items on shelves. At very high amplitudes (energy levels), low-frequency vibration can cause damage to buildings.

Peak Particle Velocity. The peak particle velocity is defined as the maximum instantaneous velocity of a particle as it transmits a vibration wave. The accepted unit for measuring peak particle velocity is inches per second. Peak particle velocity is appropriate for evaluating the potential for building damage and for evaluating human response to ground-borne vibration. When reporting measured peak particle velocity values, a time interval is generally specified over which the peak particle velocity values were recorded during the measurement process.

Table 4.8-2 – Structural Guideline Vibration Criteria displays typical vibration exposure in peak particle velocity for various types of structures. Table 4.8-3 – Human Guideline Structural Criteria categorizes typical human responses to exposure of varying vibration levels.

Table 4.8-2. Structural Guideline Vibration Criteria

Structure and Condition	Maximum Peak Particle Velocity (inches per second)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely Fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structure	0.5	0.3
New residential structure	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

Source: Behrens and Associates, Inc. (2014) (Appendix N).
Note: Transient sources create a single isolated vibration event. Continuous/frequent intermittent sources include impact pile drivers, vibratory pile drivers, and vibratory compaction equipment.

Table 4.8-3. Human Guideline Structural Criteria

Structure and Condition	Maximum Peak Particle Velocity (inches per second)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

Source: Behrens and Associates, Inc. (2014) (Appendix N).
Note: Transient sources create a single isolated vibration event. Continuous/frequent intermittent sources include impact pile drivers, vibratory pile drivers, and vibratory compaction equipment.

4.8.1.2 Existing Noise and Vibration Environment

A noise and vibration measurement study was conducted in 2014 by Behrens and Associates, Inc. to measure and document the existing ambient noise and vibration levels in the Project vicinity and along the travel routes (Appendix N). The study consisted of 24-hour noise measurements and 20-minute vibration measurements at 11 locations. Six of the 24-hour noise measurement locations were in the vicinity of the Project site and were selected to document the ambient noise levels at the noise sensitive receivers identified (Location 1 through Location 6 in Figure 4.8-1 – Ambient Noise Measurement Locations and Noise Sensitive Receivers). The remaining two 24-hour noise measurement locations were along the travel routes (Location 7 and Location 8 in Figure 4.8-2 – Ambient Noise Measurement Locations and Noise Sensitive Receivers Along Project Travel Routes). Additionally, 20-minute noise and vibration measurements were conducted at three locations along the Project travel routes (Location T1 through Location T3 in Figure 4.8-2).

A summary of results of the 24-hour ambient survey results are shown in Table 4.8-4 – 24-Hour Ambient Survey Results. This table presents the daytime and nighttime average sound levels, the calculated community noise equivalent level, as well as the maximum peak particle velocity recorded at each location over a 20-minute measurement period. The noise sensitive receiver associated with each ambient measurement location is also indicated in Table 4.8-4 - 24-Hour Ambient Survey Results. Detailed measurement results from the 24-hour measurements are located in Appendix N.

The results of the 20-minute traffic noise measurements are shown in Table 4.8-5 – 20-Minute Traffic Measurement Results. This table includes the measured 20-minute average sound level, the maximum peak particle velocity measured over the 20-minute measurement period, the measurement time, and the approximate distance between the measurement point and road.

Table 4.8-4. 24-Hour Ambient Survey Results

Measurement Location	Representative Noise Sensitive Receivers (NSRs)	Daytime Leq (7 a.m. to 9 p.m.) (A-weighted decibel)	Nighttime Equivalent Sound Level (9 p.m. to 7 a.m.) (A-weighted decibel)	Community Noise Equivalent Level (A-weighted decibel)	Max Peak Particle Velocity (inches per second)
1	NSR 1	57.4	51.4	59.4	0.010
2	NSR 2	54.5	57.7	59.9	0.011
3	NSR 3	38.4	30.4	39.3	0.007
4	NSRs 4, 5, and 6	40.4	30.3	40.3	0.006
5	NSR 7	38.0	32.6	40.3	0.001
6	NSR 8	38.4	33.7	41.3	0.001
7	--	64.2	60.4	67.9	0.017
8	--	66.9	63.1	40.5	0.074

Table 4.8-5. 20-Minute Traffic Measurement Results

Measurement Location	Approximate Distance to Road[1] (feet)	Approximate Measurement Time	20-Min Equivalent Sound Level (A-weighted decibel)	Max Peak Particle Velocity (inches per second)
T1	15	1:37 p.m.	67.9	0.059
T2	24	12:58 p.m.	72.5	0.017
T3	15	12:30 p.m.	68.5	0.014

[1]Distance from measurement point to center of nearest lane

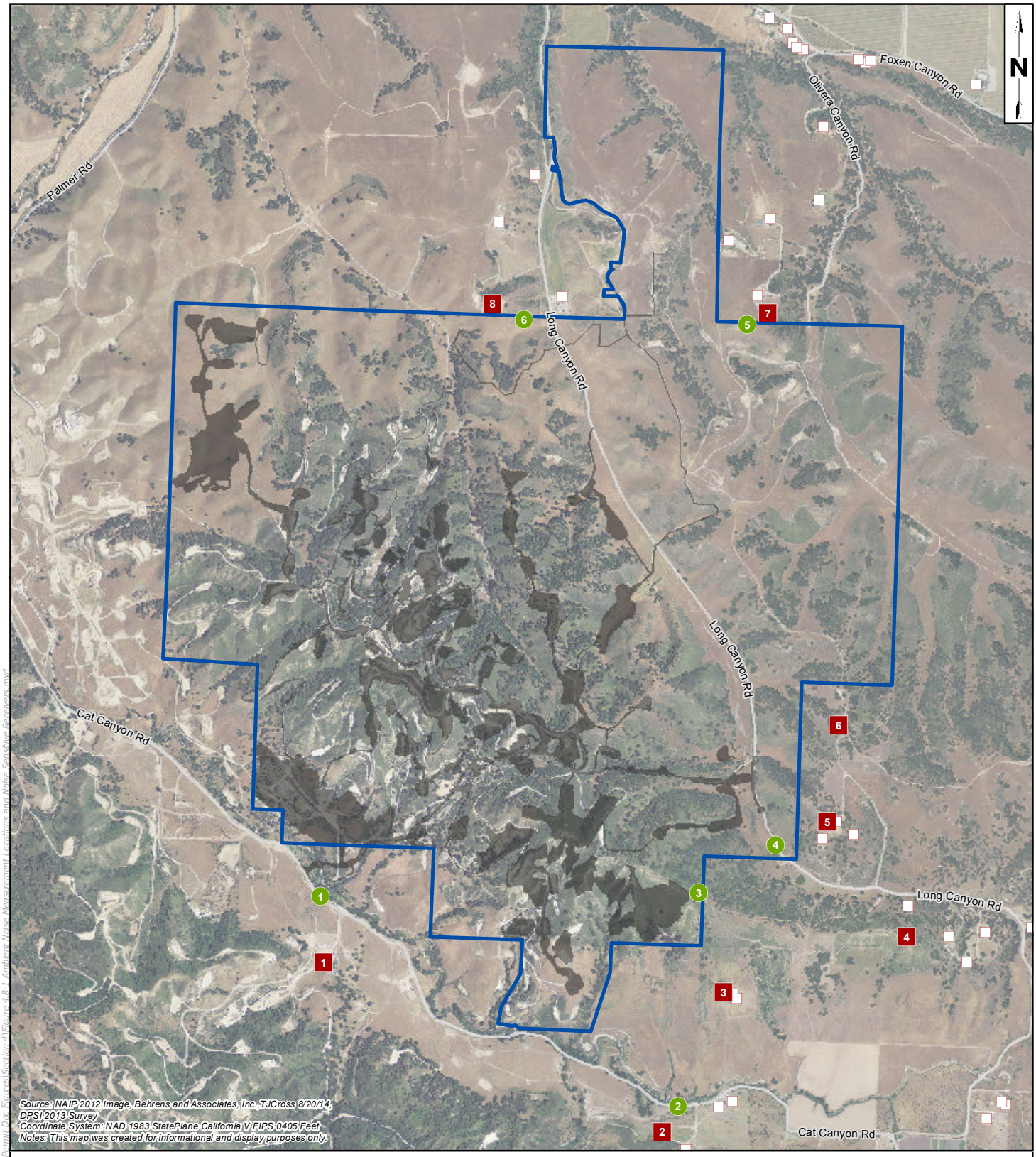
4.8.2 Regulatory Setting

There are three primary documents that address noise thresholds within the County of Santa Barbara. These include the County of Santa Barbara Comprehensive General Plan Noise Element (2009), the County of Santa Barbara Thresholds and Guidelines Manual (2008) Noise Section, and the County of Santa Barbara County Land Use and Development Code. In addition to County requirements, the State of California, under the California Environmental Quality Act outlines thresholds of significance for identifying noise impacts for discretionary actions. The following section includes a summary of each of these requirements.

4.8.2.1 County of Santa Barbara Comprehensive General Plan Noise Element

As required by California law, a Noise Element is one of nine elements to be part of a city's or county's general plan. The "Conclusions and Recommendations" section of the County of Santa Barbara Comprehensive General Plan Noise Element contains the following recommendations which are relevant to the Project:

> Controlling the impact of transportation noise must be approached both by quieting vehicles and by protecting sensitive land uses in locations where noise impact is excessive. The first of these approaches is beyond the legal jurisdiction of the County; Federal and State legislation is preemptive in the field of noise source control. The County's primary opportunities to manage transportation noise impact lie in:
>
> 1. Planning for compatible uses near existing transportation facilities;
> 2. Imposing design standards on proposed sensitive development near existing transportation facilities; and
> 3. Incorporating noise control features into the design of new or expanded trafficways to protect existing sensitive areas.



Aera Energy LLC Property

Project Footprint

Ambient Noise Measurement

Noise Sensitive Receiver (analysis point from Noise and Vibration Impact Analysis [Behrens, 2014])

Other Potential Noise Sensitive

0 1,000 2,000

FEET

Noise sensitive receivers were identified on all sides of the Project site with the exception of the west and northwest property boundary which is occupied by oil and gas facilities similar to those planned at the Project site. All identified noise sensitive receivers were included in the noise and vibration impact analysis. In locations where a cluster of residences exists, the residence with the highest potential for impact was selected for inclusion in the analysis and reporting of results.

PROJECT NAME:
EAST CAT CANYON
OIL FIELD REDEVELOPMENT PROJECT

PROJECT NUMBER: 1002-0455

DATE: December 2014

AMBIENT NOISE MEASUREMENT LOCATIONS AND NOISE SENSITIVE RECEIVERS

FIGURE
4.8-1

Z:\Kleinfelder\GIS Maps\Map Projects\East Cat Canyon\Permit Doc Figures\Section 4\Figure 4.8-1 Ambient Noise Measurement Locations and Noise Sensitive Receivers.mxd

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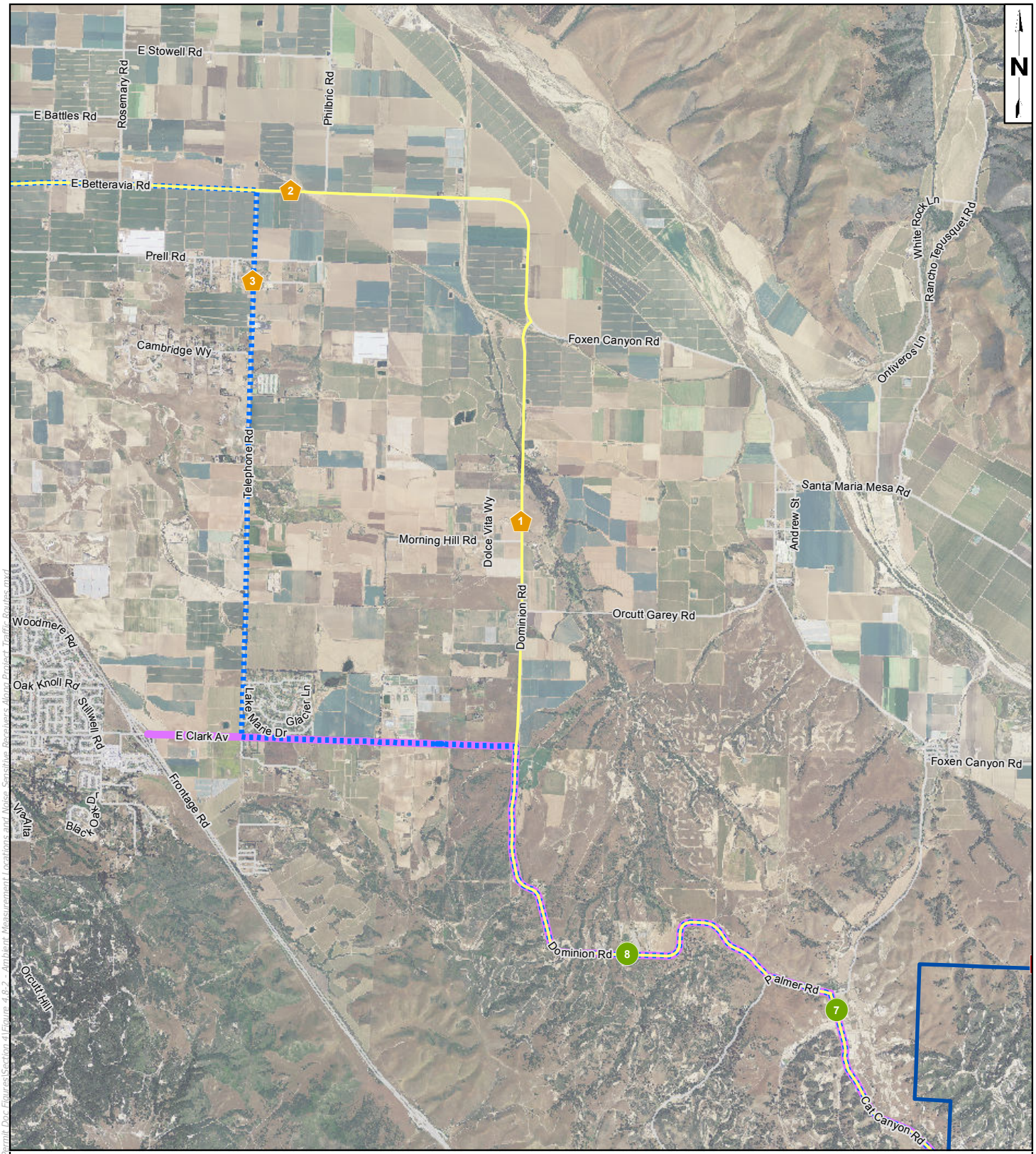

Aera Energy LLC Property Boundary

Ambient Noise Measurement Locations (24-hour measurements)

Traffic Route Ambient Noise Measurement Location (20-minute measurements)

Noise Sensitive Receiver

Traffic Routes

Project Option 1

Project Option 2

Project Option 3

0 0.5 1

MILES

Source: NAIP 2012 Image, Behrens and Associates, Inc., Santa Barbara County
Coordinate System: NAD 1983 StatePlane California V FIPS 0405 Feet
Notes: This map was created for informational and display purposes only.

PROJECT NAME:
EAST CAT CANYON OIL FIELD REDEVELOPMENT PROJECT

PROJECT NUMBER: 1002-0455

DATE: September 2014

AMBIENT NOISE MEASUREMENT LOCATIONS AND NOISE SENSITIVE RECEIVERS ALONG PROJECT TRAFFIC ROUTES

FIGURE 4.8-2

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The following recommended County policies concentrate in these areas.

1. In the planning of land use, 65 decibel Day-Night Average Sound Level should be regarded as the maximum exterior noise exposure compatible with noise-sensitive uses unless noise mitigation features are included in project designs.
2. Noise-sensitive land uses should be considered to include:
    a) Residential, including single and multifamily dwellings, mobile home parks, dormitories, and similar uses;
    b) Transient lodging, including hotels, motels, and similar uses;
    c) Hospitals, nursing homes, convalescent hospitals, and other facilities for long-term medical care; and,
    d) Public or private educational facilities, libraries, churches, and places of public assembly.

4.8.2.2 County of Santa Barbara Environmental Thresholds and Guidelines Manual

The Environmental Thresholds and Guidelines Manual was prepared by the County of Santa Barbara to assist the public and County decision makers in understanding the application of various environmental impact thresholds in the implementation of California Environmental Quality Act requirements.

Part B, “Noise Threshold Criteria” of Section 12, “Noise Thresholds” states the following:

“2. Planning policies.

a) In the planning of land use, 65 dB(A) Day-Night Average Sound Level is regarded as the maximum exterior noise exposure compatible with noise-sensitive uses unless noise mitigation features are included in project designs.

b) Noise-sensitive land uses are considered to include:

1. Residential, including single- and multi-family dwellings, mobile home parks, dormitories, and similar uses.
2. Transient lodging, including hotels, motels, and similar uses.
3. Hospitals, nursing homes, convalescent hospitals, and other facilities for long-term medical care.
4. Public or primate educational facilities, libraries, churches, and places of public assembly.

3. Noise thresholds. The following are thresholds of significance for assisting in the determination of significant noise impacts. The thresholds are intended to be used with flexibility, as each project must be viewed in its specific circumstances.

a) A proposed development that would generate noise levels in excess of 65 dB(A) CNEL and could affect sensitive receptors would generally be presumed to have a significant impact.

b) Outdoor living areas of noise sensitive uses that are subject to noise levels in excess of 65 dB(A) CNEL would generally be presumed to be significantly impacted by ambient noise. A significant impact would also generally occur where interior noise levels cannot be reduced to 45 dB(A) CNEL or less.

c) A project will generally have a significant effect on the environment if it will increase substantially the ambient noise levels for noise-sensitive receptors adjoining areas. Per item a., this may generally be presumed when ambient noise levels affecting sensitive receptors are increased to 65 dB(A) CNEL or more. However, a significant effect may also occur when ambient noise levels affecting sensitive receptors increase substantially but remain less than 65 dB(A) CNEL, as determined on a case-by-case level.

d) Noise from grading and construction activity proposed within 1,600 feet of sensitive receptors, including schools, residential development, commercial lodging facilities, hospitals or care facilities, would generally result in a potentially significant impact. According to EPA guidelines…average construction noise is 95 dB(A) at a 50' distance from the source. A 6 dB drop occurs with a doubling of the distance from the source. Therefore, locations within 1,600 feet of the construction site would be affected by noise levels over 65 dB(A). To mitigate this impact, construction within 1,600 feet of sensitive receptors shall be limited to weekdays between the hours of 8 a.m. to 5 p.m. only. Noise attenuation barriers and muffling of grading equipment may also be required. Construction equipment generating noise levels above 95 dB(A) may require additional mitigation."

4.8.2.3 County of Santa Barbara Land Use and Development Code

The Santa Barbara County Land Use and Development Code is a component of Chapter 35 of the Santa Barbara County Code. The Land Use and Development Code provides standards and guidelines classified by uses of land within the County. Chapter 35.52 "Oil and Gas Facilities – Inland Area" Section 35.52.050 "Oil Drilling and Production" Part B contains the following limits on oil drilling and production related noise levels:

"B. Development standards for oil and gas drilling and production.

1. Standards applicable to all drilling and production. The following standards shall apply to all projects:

g. Noise. Drilling or production operations that are within or adjacent to a lot zoned residential or commercial shall not exceed a maximum daytime noise level of 65 dB(A) and shall not be conducted between the hours of 9 p.m. and 7 a.m. of the next day, unless noise generating facilities are sufficiently insulated to reduce the outside night time level to 50 dB(A) at or beyond the project property boundary.

h. Noise sensitive locations. Production facilities shall be designed and housed to ensure the noise generated by the facilities as measured at any noise sensitive location shall be equal to or below the existing noise level of the that noise sensitive location. Measures to reduce adverse impacts (due to noise,

vibration, etc.) to the maximum extent feasible shall be used for facilities located adjacent to noise sensitive locations as identified in the Noise Element of the Comprehensive Plan (e.g., use of electrical hydraulic surface pumping units).

2. Additional standards applicable to production operations. In addition, the following development standards may be applied to production operations to the extent deemed necessary by the review authority:

c. Monitoring system. A monitoring system to measure off-site impacts, including noise, vibration, odor, and air or water quality degradation, may be required as a condition of approval."

Additionally, Section 35.52.060 "Treatment and Processing Facilities" Part B contains the following noise limits on treatment and processing facilities:

"B. Development standards. In addition to the regulations in Article 35.2 (Zones and Allowable Land Uses) for the applicable zone in which treatment and processing facilities are allowed, the following standards shall apply.

1. Noise. The level of noise generated by the facility at or beyond the property boundary shall not exceed 70 dB(A)."

Lastly, Section 35.52.080 "Oil and Gas Pipelines – Inland Area" Part B contains the following noise limits on treatment and processing facilities:

"B. Development standards.

2. Additional development standards as deemed necessary by Commission. In addition, the following standards may be applied to the extent deemed necessary by the Commission:

a. Noise. Proposed facilities shall be designed and housed so that the noise generated by the facilities as measured at the property boundaries shall be equal to or below the existing noise level of the surrounding area except under temporary testing or emergency situations. Measures to reduce adverse impacts (e.g., due to noise, vibration) to the maximum extent feasible shall be used for facilities located adjacent to noise sensitive locations as identified in the Comprehensive Plan."

4.8.2.4 California Environmental Quality Act Guidelines

The California Environmental Quality Act of 1970 contains guidelines for establishing thresholds of significance for a proposed Projects' noise and vibration impact potential. Specifically, the California Environmental Quality Act guidelines in Appendix G, Section XII present the following questions related to project noise and vibration impact potential relevant to the Project:

- Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

- Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?
- A substantial permanent increase in ambient noise levels in the Project vicinity above levels existing without the Project?
- A substantial temporary or periodic increase in ambient noise levels in the Project vicinity above levels existing without the Project?

4.8.3 Impact Assessment Standards

Overall, considering the California Environmental Quality Act guidelines, local standards, and industry standards, for purposes of this assessment, the following thresholds of significance were established to assess the potential noise and vibration impacts of the Project. The County of Santa Barbara Comprehensive General Plan Noise Element describes a community noise equivalent level of 65 A-weighted decibels as "the maximum exterior noise exposure compatible with noise-sensitive uses unless noise mitigation features are included in project designs." Therefore, for activities such as oil and gas related traffic and construction that are not specifically mentioned in the codes and standards, a community noise equivalent level of 65 A-weighted decibels was utilized as a threshold of significance.

The duration of the planned activities was considered when developing the thresholds of significance. Temporary activities, or those that are of limited duration, were assigned less stringent thresholds than permanent activities of indefinite duration.

During temporary construction activities, a significant impact would occur if:

1. Noise from temporary construction activities causes the CNEL to exceed 65 dB(A) at sensitive receivers in which the current ambient noise level is below 65 dB(A) CNEL;
2. Noise from temporary construction activities exceeds the ambient average noise level over the entire daytime period by more than 5 dB sensitive receivers. Project construction activities are not expected to occur at night.

With regards to a permanent increase in traffic associated with the Project, a significant impact would occur if:

3. Noise from an increase in traffic causes the CNEL to exceed 65 dB(A) at sensitive receivers in which the current ambient noise level is below 65 dB(A) CNEL.
4. Noise from an increase in traffic causes the CNEL to increase by more than 3 dB at sensitive receivers.

During temporary drilling activities, a significant impact would occur if:

5. Noise from drilling activities exceeds 65 dB(A) between 7:00 a.m. and 9:00 p.m. or 50 dB(A) between 9:00 p.m. and 7:00 a.m. at or beyond the Project property line per the Santa Barbara Land Use and Development Code.
6. The noise impact from drilling activities exceeds the ambient average noise level over the entire daytime period by more than 5 dB or the average noise level over the entire nighttime period by more than 3 dB at sensitive receivers.

During permanent production activities, a significant impact would occur if:

7. Noise from long-term production activities exceeds 65 dB(A) between 7:00 a.m. and 9:00 p.m. or 50 dB(A) between 9:00 p.m. and 7:00 a.m. at or beyond the Project property line per the Santa Barbara Land Use and Development Code.
8. Noise from long-term production operations exceed the ambient average noise level over the entire daytime period during daytime hours or the ambient average noise level over the entire nighttime period during nighttime hours at sensitive receivers. This threshold of significance is more stringent than the thresholds of significance for temporary activities and reflects the low noise levels desired for the permanent, long-term production operations at the Project site.

During construction, drilling, or production activities, a significant impact would occur if:

9. PPV ground-borne vibration levels caused by construction, drilling, or production activities exceeds 0.1 ips at the nearest off-site structures.
10. PPV ground-borne vibration levels caused by construction, drilling, or production activities exceeds 0.01 ips at the nearest off-site occupied structures.

4.8.4 Impact Analysis

4.8.4.1 Construction Noise Impact Analysis

To evaluate the potential noise impacts associated with Project activities, Behrens and Associates identified the construction periods with the greatest noise-generating potential by reviewing the Project construction schedule and equipment lists provided in Section 3.0 – Construction Procedures. A period from both Phase I and Phase II construction activities was selected for analysis (Table 4.8-6 – Worst-Case Noise Scenario for Construction Activities).

Table 4.8-6. Worst-Case Noise Scenario for Construction Activities

Phase I Year -1, Month 6	Phase II Year 4, Month 8
• Central processing facility construction • Steam generation site construction • Well pad and roadway grading • Installation of gathering & distribution pipeline • Installation of Electrical Power Distribution • Well Hook-Ups.	• Central processing facility construction • Steam generation site construction • Well pad and roadway grading

The central processing facility and steam generation site construction activities are confined to very specific areas of the Project site. The well pad grading, installation of gathering and distribution pipelines, installation of electrical power distribution, and well hook-ups construction activities will take place in various locations within the Project site at different times for different and relatively brief durations. For these more transient construction activities, worst-case noise locations, i.e., the locations closest to sensitive receivers and property lines, were used in the construction noise modeling. Project construction activities are not expected to occur at night.

In addition to cumulative construction models, individual well pad grading models were created for well pads close to the Project property line and/or noise sensitive receivers. The modeled

well pads include: WP3A, WP17A, WP10A, WP46, WP11A, WP47, WP12A, WP52, WP13A, WP54, WP14A, WP55, WP15A, WP56, and WP16A.

Construction Activities. Construction activities are scheduled to occur during daytime hours. Accordingly, the daytime requirement of less than a five decibel increase at the noise sensitive receivers as well as a limit of a community noise level equivalent of 65 A-weighted decibels was used in the construction noise impact assessment. As shown in Table 4.8-7 – Phase I, Year -1 Construction Noise Levels and Table 4.8-8 – Phase II, Year -4 Construction Noise Levels, modeling by Behrens and Associates indicate that construction activities at well pads will not generate noise levels in exceedance of five decibels over the existing daytime ambient noise levels at nearby sensitive receivers. No grading or construction activities are anticipated to occur during nighttime hours. No significant noise impacts to nearby sensitive receivers will result from construction activities.

Well Pad Grading Activities. Well pad grading activities are scheduled to occur during daytime hours. Accordingly, the daytime requirement of less than a five decibel increase at the noise sensitive receivers as well as a limit of a community noise level equivalent of 65 A-weighted decibels was used in the well pad grading noise impact assessment. Table 4.8-9 – Unmitigated Well Pad Grading Noise Levels shows the predicted average well pad grading noise levels at the closest or most affected noise sensitive receiver to each of the modeled well pads. The well pad grading noise levels are compared to the existing daytime ambient noise levels.

Daytime grading activities at well pads WP16A and WP17A will exceed the ambient daytime noise levels by five decibels at noise sensitive receiver three (NSR 3). Due to the terrain surrounding these well pads, the installation of a temporary sound wall around the well pads during grading activities is not feasible and the grading noise impact from these two well pads will exceed the five decibel daytime threshold. However, grading activities are expected to be a short-term operation, resulting in a less than significant impact at noise sensitive receiver three.

Table 4.8-7. Phase I, Year -1 Construction Noise Levels

Location (Nearest Sensitive Receiver)	Construction Community Noise Equivalent Level (A-weighted decibel)	Existing Average Daytime Ambient Noise Level (A-weighted decibels)	Average Construction Noise Level (A-weighted decibels)	Construction Noise Exceedance over Ambient Daytime Levels (decibels)
NSR 1	56.4	57.4	49.7	--
NSR 2	40.9	54.5	34.3	--
NSR 3	37.1	38.4	30.4	--
NSR 4	34.0	40.4	27.4	--
NSR 5	39.4	40.4	32.8	--
NSR 6	39.0	40.4	32.4	--
NSR 7	28.3	38.0	21.7	--
NSR 8	36.9	38.4	30.2	--

Table 4.8-8. Phase II, Year -4 Construction Noise Levels

Location (Nearest Sensitive Receiver)	Construction Community Noise Equivalent Level (A-weighted decibel)	Existing Average Daytime Ambient Noise Level (A-weighted decibels)	Average Construction Noise Level (A-weighted decibels)	Construction Noise Exceedance over Ambient Daytime Levels (decibels)
NSR 1	53.4	57.4	46.7	--
NSR 2	38.3	54.5	31.6	--
NSR 3	34.3	38.4	27.6	--
NSR 4	34.2	40.4	27.5	--
NSR 5	37.9	40.4	31.2	--
NSR 6	37.8	40.4	31.1	--
NSR 7	33.0	38.0	26.3	--
NSR 8	36.5	38.4	29.8	--

Table 4.8-9. Unmitigated Well Pad Grading Noise Levels

Well Pad	Closest Noise Sensitive Receiver	Existing Average Daytime Ambient Noise Level at Noise Sensitive Receiver (A-weighted decibels)	Average Grading Noise Level at Noise Sensitive Receiver (A-weighted decibels)	Grading Noise Exceedance over Ambient Daytime Levels (decibels)
WP3A	6	40.4	32.9	--
WP10A	7	38.0	29.6	--
WP11A	5	40.4	27.4	--
WP12A	5	40.4	39.5	--
WP13A	5	40.4	43.4	3.0
WP14A	3	38.4	31.7	--
WP15A	3	38.4	40.9	2.5
WP16A	3	38.4	45.2	6.8
WP17A	3	38.4	45.7	7.3
WP46	5	40.4	38.8	--
WP47	5	40.4	26.7	--
WP52	3	38.4	29.9	--
WP54	3	38.4	23.7	--
WP55	3	38.4	40.9	2.5
WP56	3	38.4	42.0	3.6

4.8.4.2 Drilling Noise Impact Analysis

In an effort to ensure the drilling noise assessment would be as accurate as possible, actual drilling operation noise measurements were conducted at and around the Golden State Rig #14. Golden State Rig #14 drilling rig, or an equivalent drilling rig, is planned for use at the Project site. The noise level survey was conducted on February 17, 2014, while the drilling rig was operational at the Aera Belridge Producing Complex. Noise measurements were conducted around all noise emitting equipment on the drilling site. A worst-case scenario was simulated by revving up the variable equipment such as the drawworks and mud pumps while the measurements were being conducted.

Using the worst case noise signature from the operation noise survey, four of the Project well pads were selected to assess the drilling noise impact. The pads were selected because they are the closest to the Project site property line and/or noise sensitive receivers and thus have the highest potential to create a significant impact. For each modeled pad, the loudest drilling equipment (drawworks and generators) were positioned on the side of the drilling rig with the shortest distance to the Project property line and closest noise sensitive receivers. The four pads assessed were WP1, WP50, WP56, and WP17A. During the Project design phase, production wells located at WP16A were relocated; therefore, WP16A was not assessed within the drilling noise impact analysis.

Drilling activities are scheduled to occur 24 hours per day. Since nighttime noise levels are lower than daytime averages at each measurement location, nighttime modeling was considered a worst-case scenario for the nearest sensitive receivers during drilling activities. Accordingly, the nighttime requirements of 50 A-weighted decibels at the Project site property line and less than a three decibel exceedance over ambient levels at the nearest noise sensitive receivers were used to determine impact significance for drilling activities.

Modeling of the unmitigated drilling activities at well pads WP1, WP50, WP56, and WP17A indicated that unmitigated noise levels would exceed the 50 A-weighted decibels nighttime property line limit at all four well pads. Additionally, unmitigated drilling operations at two of the modeled well pads (WP56 and WP17A) were determined to result in a greater than three decibels increase at nearby sensitive receivers. As such, Aera will implement measures recommend by Behrens and Associates within the Noise and Vibration Impact Analysis Report (2014), or equivalent measures, to reduce drilling noise impacts at these four well pads.

Table 4.8-10 – Drilling Noise Levels at Well Pads with Project-Incorporated Measures shows the anticipated noise levels associated with well pads WP1, WP50, WP56 and WP17A following the implementation of Project-incorporated avoidance and minimization measures NOISE-1, NOISE-2, NOISE-3, and NOISE-4. The implementation of these measures at the four worst-case well pads will reduce impacts associated with drilling nose to a less than significant level.

The four pads with the greatest potential to cause a significant impact can be mitigated such that drilling operations will create a less than significant impact at the nearby sensitive receivers. This demonstrates that all other well pads at the Project site are capable of causing a less than significant impact with equivalent or less mitigation measures than those detailed above. In addition to the Project-incorporated measures for well pads WP1, WP50, WP56 and

WP17A, Aera will implement NOISE-5, which requires modeling of the drilling operations at the remaining well pads prior to the commencement of drilling to determine the appropriate minimization measures to ensure a less than significant impact to nearby sensitive receivers.

4.8.4.3 Production Noise Impact Analysis

In an effort to ensure the production noise impact assessment would be as accurate as possible, noise measurements were conducted at and around the same (or equivalent) steam generators, pumps, and motors that are planned for use at the Project site. The noise measurements were conducted on February 17, 2014, at the Aera Midway Sunset Field and February 18, 2014, at the Aera Belridge Producing Complex. The equipment sound levels used in the Project production modeling were derived from the results of the operational sound level survey, Brüel & Kjær's Source dB equipment sound level library, and manufacturers' data.

Production activities at the central processing facility, steam generation site, and wellhead production equipment were included in the construction of two production noise models. The first production model includes all Phase I production equipment at the central processing facility, three 85 million British thermal units per hour steam generators at the steam generation site, and one wellhead pump per well pad scheduled to be drilled in Phase I. The second production model includes all equipment in the first production model with the addition of Phase II equipment at the central processing facility, three additional 85 million British thermal units per hour stream generators at the steam generation site, and wellhead pumps at all planned well pads. The modeled central processing facility and steam generation site layouts can be found in Appendix N.

Table 4.8-10. Drilling Noise Levels at Well Pads with Project-Incorporated Measures (NOISE-1 through NOISE-5)

Location (Nearest Noise Sensitive Receiver)	Existing Average Nighttime Ambient Noise Level (A-weighted decibels)	Average Predicted Drilling Noise Levels (A-weighted decibels)	Drilling Noise Exceedance over Ambient Nighttime Levels (decibels)
Drilling Noise Levels at Well Pad 1 (WP1) (Highest average drilling noise level at Project property line: 49.6 dBA)			
NSR 1	51.4	14.1	--
NSR 2	52.9	15.1	--
NSR 3	30.4	9.3	--
NSR 4	30.3	20.6	--
NSR 5	30.3	22.6	--
NSR 6	30.3	24.7	--
NSR 7	32.6	23.4	--
NSR 8	33.7	35.1	1.4
Drilling Noise Levels at Well Pad 50 (WP50) (Highest average drilling level noise at Project property line : 47.0 dBA)			
NSR 1	51.4	29.2	--
NSR 2	52.9	26.7	--
NSR 3	30.4	19.1	--
NSR 4	30.3	21.0	--
NSR 5	30.3	20.9	--
NSR 6	30.3	21.6	--
NSR 7	32.6	10.8	--
NSR 8	33.7	16.4	--

Location (Nearest Noise Sensitive Receiver)	Existing Average Nighttime Ambient Noise Level (A-weighted decibels)	Average Predicted Drilling Noise Levels (A-weighted decibels)	Drilling Noise Exceedance over Ambient Nighttime Levels (decibels)
Drilling Noise Levels at Well Pad 56 (WP56) (Highest average drilling level noise at Project property line : 47.0 dBA)			
NSR 1	51.4	35.7	--
NSR 2	52.9	31.8	--
NSR 3	30.4	30.8	0.4
NSR 4	30.3	25.9	--
NSR 5	30.3	20.2	--
NSR 6	30.3	17.3	--
NSR 7	32.6	8.9	--
NSR 8	33.7	10.6	--
Drilling Noise Levels at Well Pad 17A (WP17A) Highest average drilling noise level at Project property line : 63.4 dBA			
NSR 1	51.4	33.9	--
NSR 2	52.9	28.4	--
NSR 3	30.4	32.3	1.9
NSR 4	30.3	23.4	--
NSR 5	30.3	24.0	--
NSR 6	30.3	21.0	--
NSR 7	32.6	10.6	--
NSR 8	33.7	12.7	--

Production activities are scheduled to occur 24 hours per day. Since nighttime noise levels are lower than daytime averages at each measurement location, nighttime modeling was considered a worst-case scenario for the nearest sensitive receivers during construction activities. As shown in Table 4.8-11 – Anticipated Production Noise Levels, modeling indicates that production activities will not generate noise levels that exceed three decibels over the existing nighttime ambient noise levels at nearby sensitive receivers. No significant noise impacts to nearby sensitive receivers will result from production activities.

Table 4.8-11. Anticipated Production Noise Levels

Location (Nearest Noise Sensitive Receiver)	Existing Average Nighttime Ambient Noise Level (A-weighted decibels)	Predicted Average Production Noise Levels (A-weighted decibels)	Production Noise Exceedance over Ambient Nighttime Levels (decibels)
Phase I Anticipated Production Noise Levels[1]			
NSR 1	51.4	33.0	--
NSR 2	52.9	23.8	--
NSR 3	30.4	22.1	--
NSR 4	30.3	22.7	--
NSR 5	30.3	26.1	--
NSR 6	30.3	26.8	--
NSR 7	32.6	22.7	--
NSR 8	33.7	25.9	--
Phase II Anticipated Production Noise Levels[2]			
NSR 1	51.4	34.1	--
NSR 2	52.9	25.9	--
NSR 3	30.4	24.9	--
NSR 4	30.3	25.9	--
NSR 5	30.3	29.1	--
NSR 6	30.3	29.9	--
NSR 7	32.6	26.8	--
NSR 8	33.7	28.7	--

Notes:
1. Highest average production noise level at Project property line : 47.2 A-weighted decibels
2. Highest average production noise level at Project property line : 47.6 A-weighted decibels

4.8.4.4 Traffic Noise Impact Analysis

An analysis of the potential traffic noise impact associated with the Project was conducted for the three travel routes proposed for the Project (Option 1, Option 2, and Option 3). A noise sensitive receiver with the greatest potential for impact was selected along key segments of each of the proposed travel routes for assessment. The assessed routes are shown in Figure 4.8-2 – Ambient Noise Measurement Locations and Noise Sensitive Receivers Along Project Travel Routes.

Four scenarios, Existing, Existing + Project, Future, and Future + Project were modeled. The traffic counts used in all scenarios were derived from the Traffic and Circulation Study for the East Cat Canyon Oil Field Redevelopment Project (Associated Transportation Engineers, 2014). Three 20-minute and two of the 24-hour noise measurements were used to calibrate the Existing scenario model and determine a car to truck ratio that accurately reflects existing conditions on the proposed travel routes. To assess the potential traffic noise impact, community noise level equivalent noise levels were predicted at the property lines of the noise sensitive receivers for each of the modeled scenarios.

As shown in Table 4.8-12 - Project Traffic Impact on Existing and Future Conditions, modeling by Behrens and Associates indicates that Project traffic will not generate noise levels that exceed three decibels over the existing and project future ambient noise levels at nearby sensitive receivers. No significant noise impacts to nearby noise sensitive receivers will result from Project traffic.

Table 4.8-12. Project Traffic Impact on Existing and Future Conditions

Location	Project Travel Route Option with Largest Potential Impact[1]	Existing Conditions Community Noise Level Equivalent (A-weighted decibels)	Existing Conditions + Project Community Noise Level Equivalent (A-weighted decibels)	Change Due to Project Traffic (decibels)
Project Traffic Impact on Existing Conditions				
Nearby Sensitive Receiver T1; Dominion Road south of Clark Avenue	Options 1, 2 & 3	58.7	61.6	+2.9
Nearby Sensitive Receiver T2; Clark Avenue east of Telephone Road	Options 1 & 2	65.7	68.1	+2.4
Nearby Sensitive Receiver T3; Dominion Road north of Clark Avenue	Option 3	66.7	69.1	+2.4
Nearby Sensitive Receiver Location 7; Telephone Road north of Clark Avenue	Option 2	66.3	68.1	+1.8
Nearby Sensitive Receiver Location 8; Betteravia Road east of Telephone Avenue	Option 3	68.3	69.3	+1.0
Project Traffic Impact on Future Conditions				
Nearby Sensitive Receiver T1; Dominion Road south of Clark Avenue	Options 1, 2 & 3	59.4	61.7	+2.3
Nearby Sensitive Receiver T2; Clark Avenue east of Telephone Road	Options 1 & 2	66.4	68.5	+2.1
Nearby Sensitive Receiver T3; Dominion Road north of Clark Avenue	Option 3	66.9	69.6	+2.7
Nearby Sensitive Receiver Location 7; Telephone Road north of Clark Avenue	Option 2	66.4	68.1	+1.7
Nearby Sensitive Receiver Location 8; Betteravia Road east of Telephone Avenue	Option 3	68.8	69.6	+0.8

Notes:

1: Travel Route Options are based on the Traffic and Circulation Study for the East Cat Canyon Oil Field Redevelopment Project, County of Santa Barbara as discussed in Section 4.9 Transportation and Circulation.

2. dB, decibels; dBA, A-weighted decibels

4.8.4.5 Vibration Impact Analysis

Construction and drilling activities during the proposed Project involve the use of equipment and machinery with the potential to cause vibration outside the immediate area of the activities. The human and structural response to the projected vibration levels at the nearest structures to the construction and drilling activities were evaluated by Behrens and Associates within the East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report (2014). Typical vibration levels produced by the analyzed construction and drilling equipment are provided in Table 4.8-13 – Vibration Analysis Results at a reference distance of 25 feet. According to Behrens and Associates (2014), the reference vibration levels are derived from a combination of field vibration measurements and data made available by the Federal Transportation Authority. Equipment utilized in the construction and drilling activities not capable of producing substantial vibration levels have been omitted from the analysis.

As shown in Table 4.8-13 - Vibration Analysis Results, vibration produced by the Project is anticipated to be “barely perceptible” by the time it reaches a distance of 51 to 398 feet from the Project equipment. Since the nearest vibration sensitive receiver is located over 1,315 feet away, vibration impacts will be less than significant.

4.8.4.6 Construction, Drilling, and Production Combined Impact Analysis

As construction, drilling, and production activities may be occurring at the same time, the possibility arises that the noise impact from the combined activities could create a significant impact at the noise sensitive receivers. However, the results of the production modeling demonstrate that the production noise will not be loud enough to combine with noise from construction or drilling activities to create a significant impact and thus only a combination of drilling and construction noise have the potential to create a significant impact.

Furthermore, construction activities are only planned for daytime hours, so the only potential significant combined impact could occur between construction and drilling activities during daytime hours. As grading and drilling activities will not take place concurrently on the same pad, the highest potential for a combined significant impact would be if drilling and grading activities take place on adjacent pads close to a noise sensitive receiver.

With implementation of Project-incorporated minimization and avoidance measures detailed in the drilling noise impact analysis section, the drilling noise impact will meet the nighttime drilling noise requirements which are significantly stricter than the daytime drilling requirements. The results of the drilling noise modeling demonstrate that the drilling noise will not be loud enough to cause a significant impact when combined with construction noise at noise sensitive receivers that don’t already experience a significant impact during construction activities alone. To avoid increasing the impact of construction noise at noise sensitive receiver 3 during daytime construction activities at WP16A and WP17A, Aera will implement Project-incorporated measure NOISE-6, which ensures that construction and drilling operations will not be conducted concurrently at these well pads.

Table 4.8-13. Vibration Analysis Results

Equipment	Typical Peak Particle Velocity at 25 feet (inches per second)	Distance to Nearest Structure	Distance to Vibration Limit for Fragile Buildings	Distance to "Barely Perceptible" Level
Well Pad and Roadway Grading				
Dozer	0.089	1,315 feet	22 feet	182 feet
Grader	0.089	1,315 feet	22 feet	182 feet
Compactor	0.21	1,315 feet	49 feet	398 feet
Water Truck	0.076	1,315 feet	19 feet	158 feet
Install Electrical Power Distribution				
Compactor	0.21	1,600 feet	49 feet	398 feet
Backhoe/Loader	0.089	1,600 feet	22 feet	182 feet
Boomtruck	0.076	1,600 feet	19 feet	158 feet
Install Electrical Power Distribution				
Boomtruck	0.076	1,315 feet	19 feet	158 feet
Work Trucks	0.076	1,315 feet	19 feet	158 feet
Well Hook-ups				
Backhoe/Loader	0.089	1,315 feet	22 feet	182 feet
Work Trucks	0.076	1,315 feet	19 feet	158 feet
Crane	0.031	1,315 feet	9 feet	70 feet
Central Processing Facility Construction				
Crane	0.031	1,550 feet	9 feet	70 feet
Compactor	0.21	1,550 feet	49 feet	398 feet
Backhoe/Loader	0.089	1,550 feet	22 feet	182 feet
Welding Truck	0.076	1,550 feet	19 feet	158 feet
Steam Generation Site Construction				
Welding Truck	0.076	3,900 feet	19 feet	158 feet

Table 4.8-13. Vibration Analysis Results

Equipment	Typical Peak Particle Velocity at 25 feet (inches per second)	Distance to Nearest Structure	Distance to Vibration Limit for Fragile Buildings	Distance to "Barely Perceptible" Level
Crane	0.031	3,900 feet	9 feet	70 feet
Backhoe	0.089	3,900 feet	22 feet	182 feet
Compactor	0.21	3,900 feet	49 feet	398 feet
Well Drilling				
Drilling Rig	0.022	1,315 feet	6 feet	51 feet

4.8.5 Project-Incorporated Avoidance and Minimization Measures

Based on the recommendations by Behrens and Associates within the East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report (2014), the following measures have been incorporated into the Project design to reduce the potential for noise impacts to nearby noise sensitive receivers. With the implementation of the recommended avoidance and minimization measures, impacts will be avoided.

- **NOISE-1. Temporary Acoustical Barriers at WP1.** During drilling operations at WP1, a temporary acoustical barrier at least 16 feet in height should be installed along the north and west sides of the pad. In addition, 16 foot high acoustical barriers should be installed along the north, south, and west sides of the generator, along four sides of the drawworks, and the north, south, and west sides of the mud pumps.
- **NOISE-2. Temporary Acoustical Barriers at WP50.** During drilling operations at WP50, temporary acoustical barriers at least 16 feet in height should be installed along the northwest and southwest sides of the generator and drawworks, and the southwest and southeast sides of the mud pumps.
- **NOISE-3. Temporary Acoustical Barriers at WP56.** During drilling operations at WP56, a temporary acoustical barrier at least 16 feet in height should be installed along the south and east sides of the pad. In addition, 16 foot high acoustical barriers should be installed along the south and east sides of the generator and mud pumps, and the four sides of the drawworks.
- **NOISE-4. Temporary Acoustical Barriers at WP17A.** During drilling operations at WP17A, a temporary acoustical barrier at least 16 feet in height should be installed along the south and east sides of the pad. In addition, 16 foot high acoustical barriers should be installed along the south and east sides of the generator, the south, east and west sides of the drawworks, and the south side of the mud pumps.
- **NOISE-5. Pre-Drilling Noise Modeling.** Before the commencement of drilling operations at the remaining well pads, create drilling noise models to determine the mitigation measures, if any, required at each pad to ensure a less than significant impact.
- **NOISE-6. WP16A and WP17A Drilling/Construction.** Avoid concurrent grading operations at WP16A and drilling operations at WP17A.

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