# Appendix L

Noise and Vibration Supporting Information

# East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report

**February 5, 2015**

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**Behrens and Associates, Inc.**
*Environmental Noise Control*

# East Cat Canyon Oil Field Redevelopment Project
# Noise and Vibration Impact Analysis Report

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February 5, 2015

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# 1. Introduction

## 1.1 Purpose and Study Objectives

The purpose of this study is to identify and analyze the potential noise and vibration impacts associated with the proposed Aera Energy LLC (Aera) East Cat Canyon Oil Field Redevelopment Project (Project).

The following is provided in this report:

- Information regarding the fundamentals of noise and vibration
- A description of local noise standards and development of noise and vibration thresholds of significance
- The existing ambient noise and vibration levels in the Project area
- An analysis of the potential noise and vibration impacts of construction, drilling, production operations and traffic associated with the proposed Project and measures required to mitigate significant impacts.

The noise impact analysis was aided through the use of three-dimensional computer noise impact modeling. All models in this report were developed with SoundPLAN 7.3 software which predicts noise levels based on the locations, noise levels and frequency spectra of the noise sources, and the geometry and reflective properties of the local terrain, buildings and barriers. The SoundPLAN software simulates light downwind conditions in all directions to ensure a conservative assessment.

## 1.2 Project Description

The East Cat Canyon Oil Field Redevelopment Project will re-establish oil production in an existing oil field by implementing a thermal enhanced oil recovery process that is technically, economically, and environmentally feasible for oil recovery. Project plans include construction and restoration of approximately 72 well pads, construction and restoration of over nine miles of field access roads, and drilling of up to 296 wells (Figure 1-1). Planned wells include oil/gas production wells, steam injection wells, observation wells, water production wells, water injection wells, and fresh groundwater wells.

New processing facilities and field systems will be constructed. Processing facilities will include: 1) a production group station for bulk separation of produced gas and liquids, 2) a central processing facility for oil cleaning, water cleaning, water softening, oil storage, and oil sales, and 3) a steam generation site (up to six once through steam generators rated at 85 million BTU/hour each) for production of saturated steam to be used for thermal enhanced oil recovery. An additional 62.5 MMBTU/hr steam generator will be used to generate steam from the Project's produced gas. No fresh water will be used to generate steam; only non-potable water will be used. Field systems will include 1) a production gathering network, 2) a steam distribution network and 3) electrical power distribution and supervisory control and data acquisition (SCADA) networks. Project infrastructure will also include an office building, a multipurpose building, a warehouse and maintenance building, and a facility control building. A fresh water system with a 3,000 barrel tank and water distribution pipelines is planned for ancillary purposes including drinking water, fire protection, lavatories, showers, equipment cleaning, dust control, and minor landscape irrigation.

The Project has been designed to minimize grading and land disturbance by maximizing the use of existing roads, well pads, cleared areas, and contours wherever possible. Out of the approximate total 2,108-acre Project site,

approximately 300 acres, or 14 percent will be graded. Earthwork volumes will be balanced across the Project site in order to minimize the need for import or export of significant amounts of soil.

The primary Project site entrance is located at 6516 Cat Canyon Road. Vehicles and equipment entering the Project site travel across Cat Canyon Creek via an existing culvert crossing located just outside of the Aera Energy LLC property boundary. As proposed, the Project would utilize the existing crossing during the initial Project construction, while concurrently constructing a new Project site entrance located approximately 300 feet north (upstream) of the existing entrance. The Project will also include construction of a secondary access located along Long Canyon Road, on the eastern boundary of the Project site along with two smaller east side entrances from Long Canyon Road, which will be constructed to provide adequate access to new well pads. Project site entrances will be connected via a primary site access road, which will be graded and paved concurrently with site entrance construction activities.

The Project will be implemented in two phases. Phase I will include the construction of the production group station, central processing facility, steam generation site, fresh water distribution system, office building, main roadways and a beneficial reuse facility for soil and sand. Four of the seven steam generators will be installed. Some of the project's well pads and wells will be restored/developed during Phase I, along with the roadways, electrical distribution lines, and gathering and distribution pipelines to support those wells. Phase I activities will last approximately four years.

During Phase II, the remaining well pads will be restored/developed, the remaining wells will be drilled, along with associated roadways, electrical distribution lines, and gathering and distribution pipelines. Phase II will also expand the processing facility capacities, and add three additional steam generators. Phase II construction will start approximately three years after Phase I completion and is expected to take up to two years. Phase II well drilling, along with the construction of roadways, electrical distribution lines, and gathering and distribution pipelines to support those wells, is planned to take place over a period of up to ten years. Production from the project is expected to continue 30 years or more.

## 1.3 Project Location and Study Area

The Project site is located approximately 10 miles southeast of Santa Maria, California in Santa Barbara County, California. The site is located in a low population density area in hilly terrain within the Cat Canyon Oil Field.

Noise sensitive receivers (NSR's) 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 NSR's 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. Figure 1-2 identifies eight NSR's in the vicinity of the Project site that will be used as points of analysis throughout this study. A summary of the points is included in Table 1-1.

**Table 1-1 Project Site Adjacent Noise Sensitive Receivers**

| Location | Description | Approximate distance to Aera property (ft) |
|---|---|---|
| NSR 1 | Residence located southwest of the Project site | 1,500 ft |
| NSR 2 | Residence located south of the Project site | 1,825 ft |
| NSR 3 | Residence located south of the Project site | 850 ft |
| NSR 4 | Residence located southeast of the Project site | 1,900 ft |
| NSR 5 | Residence located east of the Project site | 400 ft |
| NSR 6 | Residence located east of the Project site | 550 ft |
| NSR 7 | Residence located north of the Project site | 450 ft |
| NSR 8 | Residence located north of the Project site | 350 ft |

The proposed travel routes associated with the Project include highways, arterial streets and collector streets. All routes reach Highway 101 where they continue either to the north or south. The traffic noise analysis in this study considers the travel routes up to their intersection with Highway 101. Figure 1-3 identifies five NSR's along the proposed travel routes that will be used as points of analysis in the traffic noise analysis section. The traffic NSR's were selected because they were close to the road and/or exposed to traffic noise from the road. A summary of the traffic NSR's is included in Table 1-2.

**Table 1-2 Traffic Noise Sensitive Receivers**

| Location | Description | Street Segment | Approximate Distance to Center of Nearest Lane |
|---|---|---|---|
| NSR T1 | Residence | Dominion Road s/o Clark Avenue | 90 ft |
| NSR T2 | Residence | Clark Avenue e/o Telephone Road | 27 ft |
| NSR T3 | Residence | Dominion Road n/o Clark Avenue | 40 ft |
| NSR T4 | Residence | Telephone Road n/o Clark Avenue | 34 ft |
| NSR T5 | Residence | Betteravia Road e/o Telephone Avenue | 25 ft |

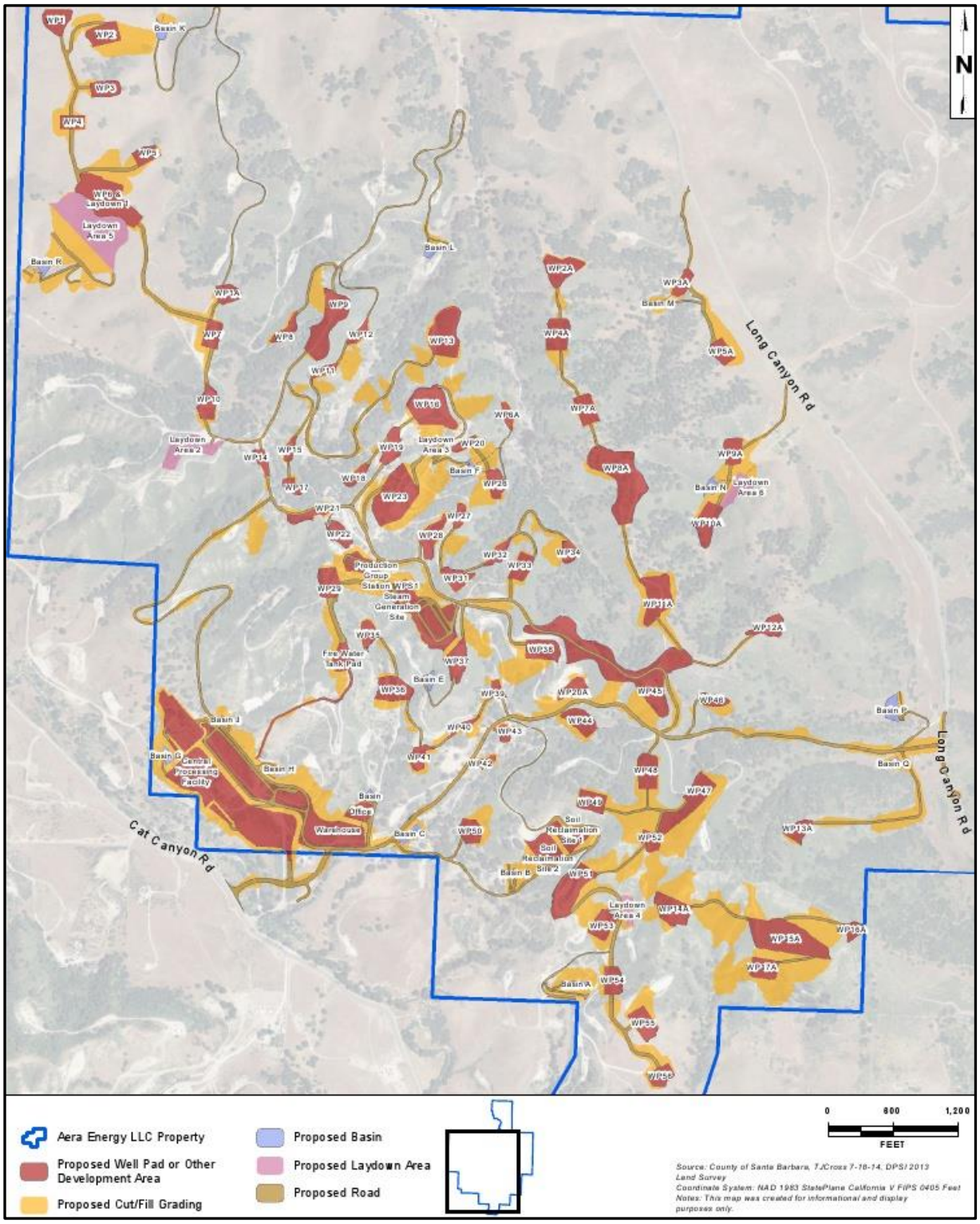


**Figure 1-1 Proposed Project Overview**
Source: Padre Associates, Inc., August 2014

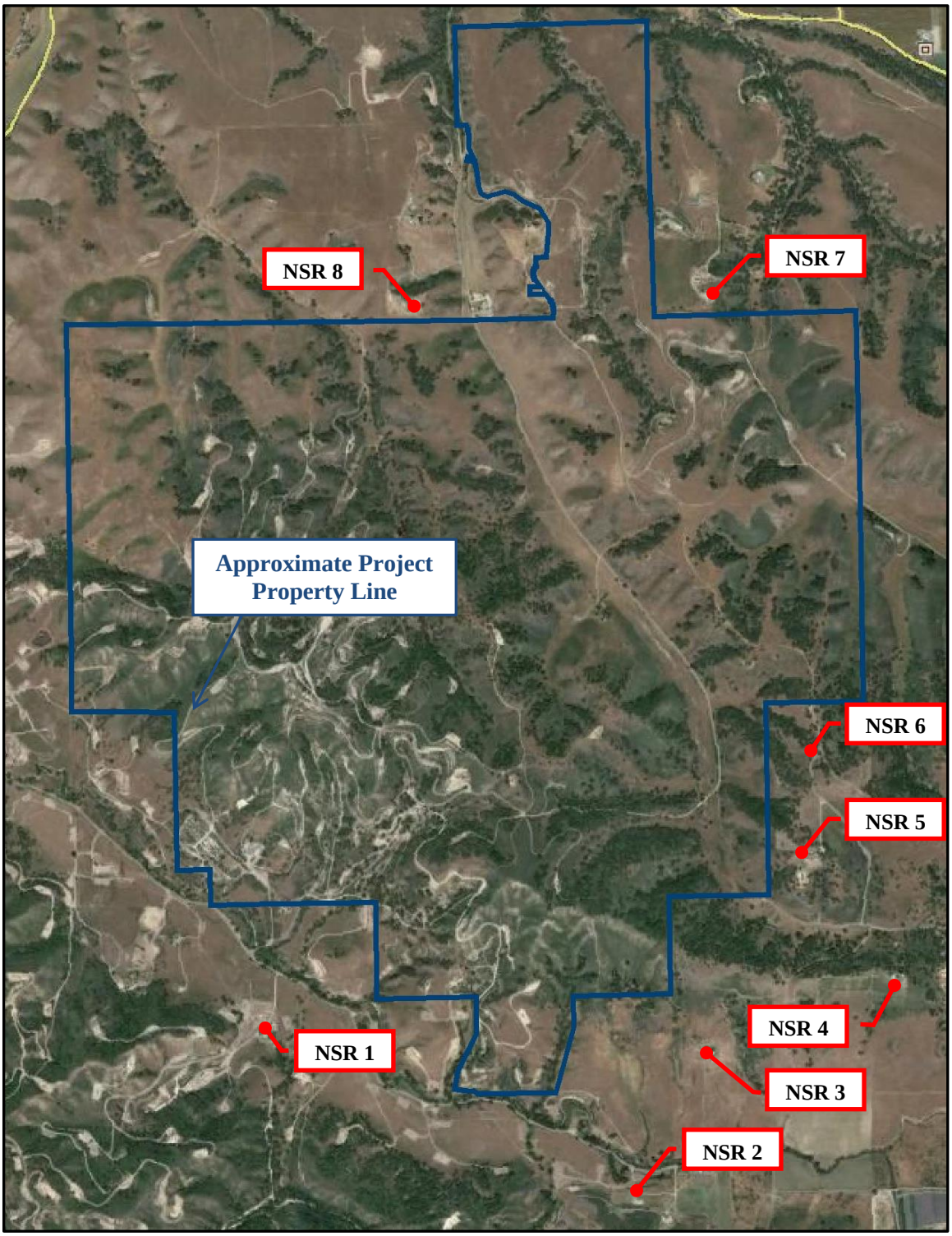


**Figure 1-2 Noise Sensitive Receivers in Vicinity of Project Site**

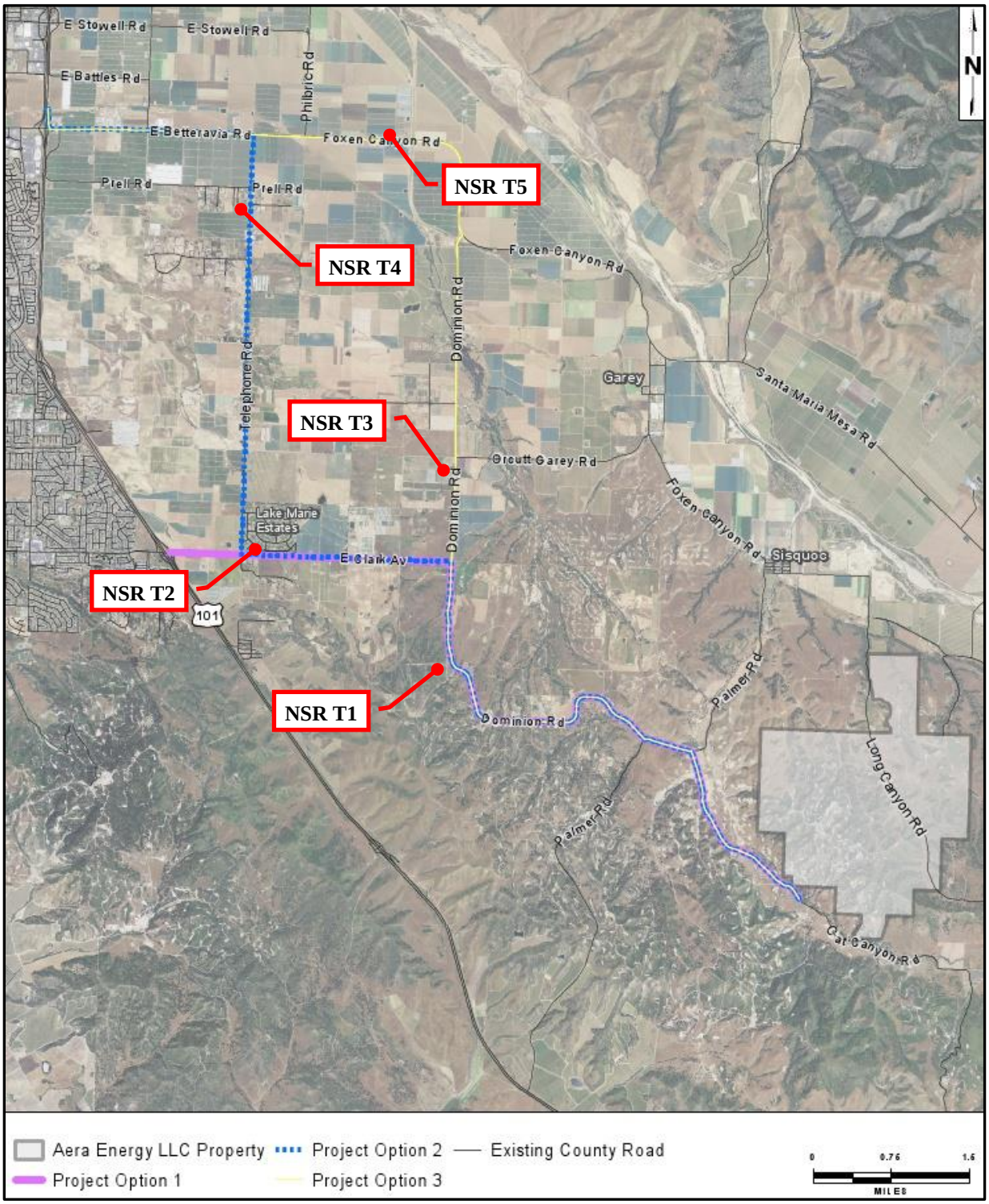


**Figure 1-3 Traffic Noise Sensitive Receivers on Travel Routes**
Source: Padre Associates, Inc., August 2014

# 2. Noise Fundamentals

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 (Hz). Frequencies that can be heard by a healthy human ear range from 20 Hz to 20,000 Hz. 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, in part, from a combination of distant noise sources. Such sources may include common experiences such as 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.

## 2.1 Noise Descriptors

The following section identifies and describes the noise descriptors that will be used in this study.

### Decibels

Human perception of loudness is logarithmic rather than linear. For this reason, sound level is usually measured on a logarithmic decibel (dB) 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
$p$ = rms sound pressure
$p_{ref}$ = reference sound pressure (20 microPascals)

The reference pressure for sound in the air is 20 microPascals (µPa), 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.

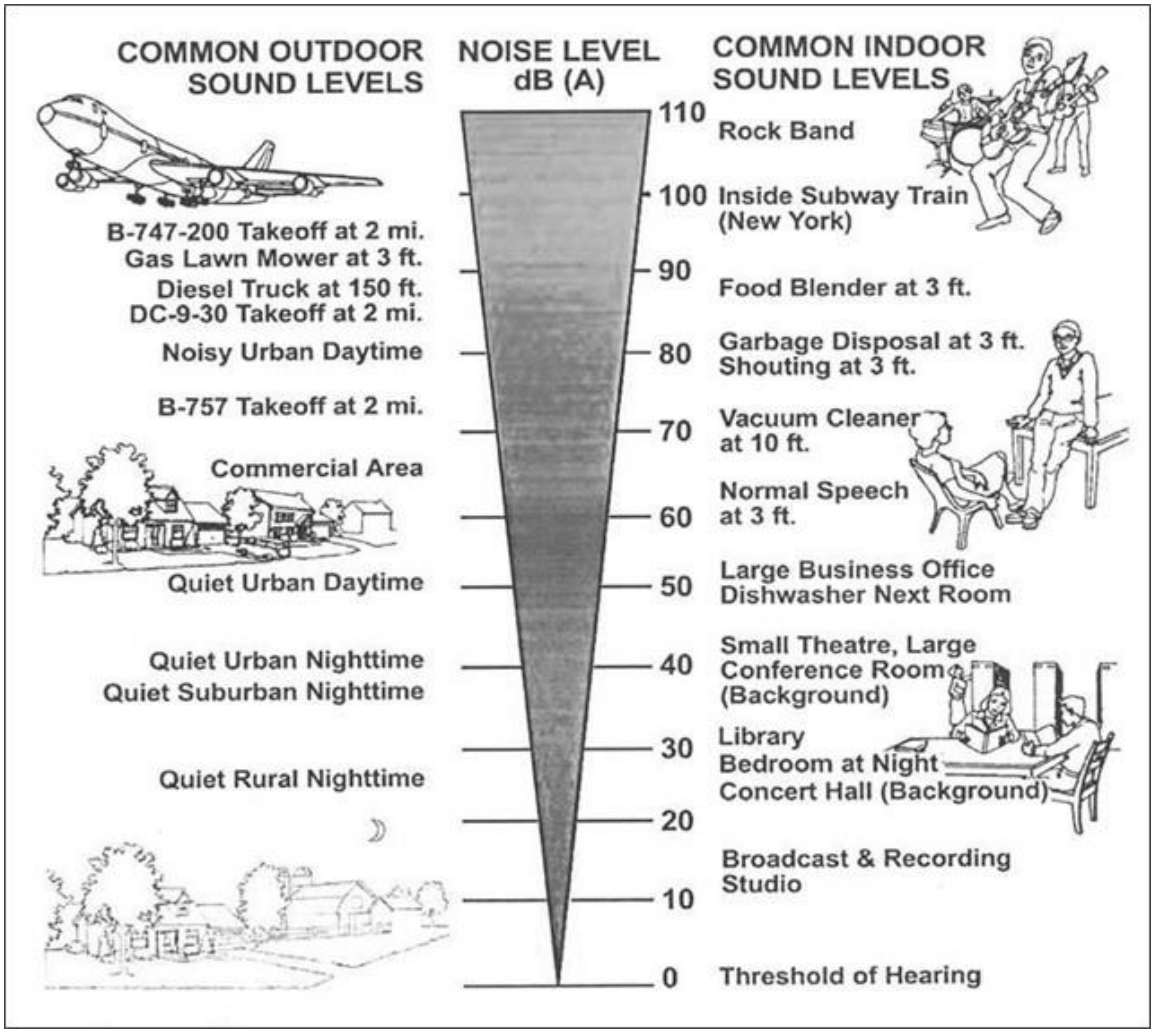


**Figure 2-1 Typical Indoor and Outdoor Sound Levels**

## 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 Hz 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. Figure 2-1 shows typical dBA noise levels that can be found in both outdoor and indoor environments.

It is generally accepted that a change of 3 dB is perceptible to the average healthy human ear. A change of 5 dB is generally regarded as a readily perceptible increase/decrease in noise level.

### Equivalent Sound Level ($L_{eq}$)

Some sources, such as 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, such as distant freeway traffic, and intermittent sources that vary rapidly with time, such as traffic on a surface street. 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 $L_{eq}$, is a sound energy average, calculated over a stated time period. 1-hour, A-weighted $L_{eq}$ values are used commonly in environmental noise assessments.

### Maximum Noise Level ($L_{max}$)

The maximum noise level is defined as the highest instantaneous noise level over a specified time interval. A one-hour $L_{max}$ level would be the highest observed noise level over the one-hour period.

### Minimum Noise Level ($L_{min}$)

The minimum noise level is defined as the lowest instantaneous noise level over a specified time interval. A one-hour $L_{min}$ level would be the lowest observed noise level over the one-hour period.

### Community Noise Equivalent Level (CNEL)

The Community Noise Equivalent Level (CNEL) is an A-weighted average noise level calculated over 24 hours, with a 5 dBA weighting added to sound levels during evening hours (7 p.m. to 10 p.m.) and a 10 dBA weighting added to sound levels during nighttime hours (10 p.m. to 7 a.m.) to reflect the increased annoyance of noise at night.

# 3. Ground-Borne Vibration Fundamentals

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 Hz. 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. Vibration motion moves in the X, Y and Z axes.

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 Hz to 100 Hz.

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.

## 3.1 Vibration Descriptors

The following section describes the vibration descriptors that will be used in this study.

### Peak Particle Velocity

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

Table 3-1 displays typical vibration exposure guidelines for various types of structures and Table 3-2 categorizes typical human responses to exposure of varying vibration levels.

**Table 3-1 Structural Guideline Vibration Criteria**

| Structure and Condition | Maximum PPV (ips) | |
|---|---|---|
| | 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 |

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 3-2 Human Guideline Vibration Criteria**

| Human Response | Maximum PPV (ips) | |
|---|---|---|
| | 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 |

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. Existing Noise and Vibration Environment

A noise and vibration measurement program was conducted to measure and document the existing ambient noise and vibration levels in the vicinity of the Project site and along the proposed travel routes. The measurement program consisted of 24-hour noise measurements and 20-minute vibration measurements at eight locations. Additionally, 20-minute noise and vibration measurements were conducted at an additional three locations.

The 24-hour noise measurements were conducted between February 11 and February 12, 2014. Six of the eight locations were in the vicinity of the Project site and were selected to document the ambient noise levels at the NSR's identified in Figure 1-2. The remaining two 24-hour noise measurement locations were along the proposed travel routes.

The 20-minute noise measurements were conducted on February 12, 2014. All three of the locations were along the proposed travel routes and were selected to document existing traffic noise levels along different sections of the proposed routes. Figure 4-1 shows the locations of the measurements conducted in the vicinity of the Project site and Figure 4-2 shows the locations of the measurements conducted along the proposed travel routes. The prefix "T" has been used to denote the 20-minute ambient measurement locations associated with the travel routes.

The ambient noise measurements were conducted with model 2250 Hand-held Analyzer sound level meters manufactured by Brüel & Kjaer and SoundPro DL sound level meters manufactured by Quest Technologies. The sound level meters were programmed to continuously measure and calculate hourly sound levels. The instruments were calibrated with a Quest QC-10 calibrator immediately prior to deployment for the ambient measurements.

Vibration levels were measured with a factory calibrated Profound VMS systems. The vibration meters were programmed to continuously measure and record the three-axis peak particle velocity over five-second intervals.

The results of the 24-hour ambient measurements are shown in Table 4-1. The table presents the daytime and nighttime average sound levels, the calculated CNEL level, as well as the maximum PPV recorded at each location over a 20-minute measurement period. The NSR associated with each ambient measurement location is also indicated in the table. Detailed measurement results from the 24-hour measurements can be found in Appendix I.

**Table 4-1 24-Hour Ambient Survey Results**

| Measurement Location | Representative NSR's | Daytime $L_{eq}$ (7 a.m. to 9 p.m.) (dBA) | Nighttime $L_{eq}$ (9 p.m. to 7 a.m.) (dBA) | CNEL (dBA) | Max PPV (ips) |
|---|---|---|---|---|---|
| 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 | NSR's 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 |

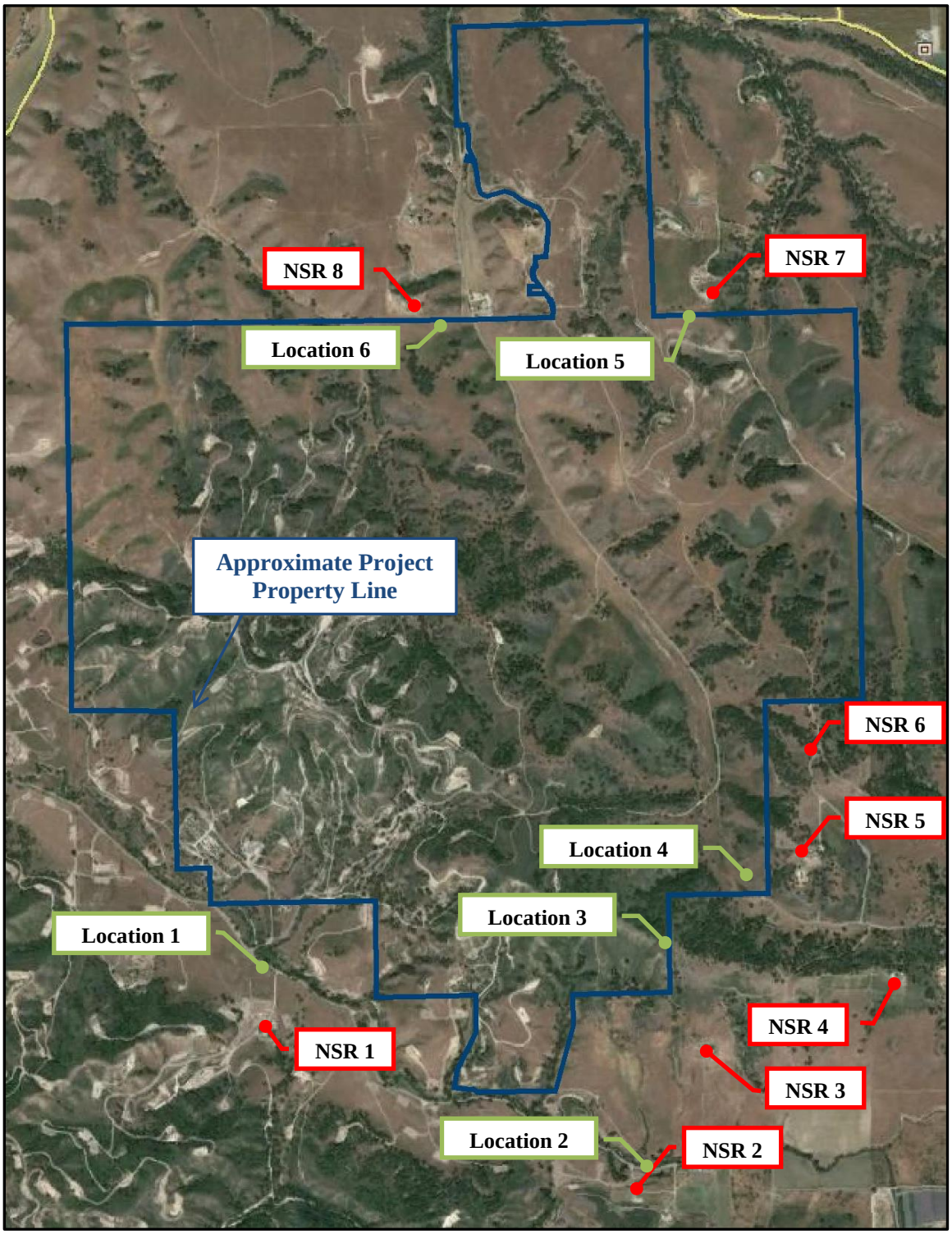


**Figure 4-1 Ambient Measurement Locations in Vicinity of Project Site**

**Figure 4-2 Ambient Measurement Locations on Travel Routes**

The results of the 20-minute traffic measurements are shown in Table 4-2. The table includes the measured 20-minute average sound level, the maximum PPV measured over the 20-minute measurement period, the measurement time, and the approximate distance between the measurement point and road.

**Table 4-2 20-Minute Traffic Measurement Results**

| Measurement Location | Approximate Distance to Road[1] (ft) | Approximate Measurement Time | 20-Min Leq (dBA) | Max PPV (ips) |
|---|---|---|---|---|
| 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

# 5. Noise and Vibration Standards and Thresholds of Significance

This section summarizes various standards and ordinances that apply to different planned activities to be carried out during the Project. Additionally, thresholds of significance are established to assess the potential noise and vibration impacts created by the Project.

## 5.1 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 cities' or counties' 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.
> 3. Incorporating noise control features into the design of new or expanded trafficways to protect existing sensitive areas.
>
> The following recommended County policies concentrate in these areas.
>
> 1) In the planning of land use, 65 dB 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.
>
> d) Public or private educational facilities, libraries, churches, and places of public assembly.

## 5.2 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 CEQA requirements. Part B, "Noise Threshold Criteria" of Section 12, "Noise Thresholds" presents the following guidelines which are relevant to the Project:

**B. Noise Threshold Criteria.**

**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 private 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 AM to 5 PM 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.

## 5.3 Santa Barbara County 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 *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.

## 5.4 California Environmental Quality Act Guidelines

The California Environmental Quality Act of 1970 (CEQA) contains guidelines for establishing thresholds of significance for a proposed Projects' noise and vibration impact potential. Specifically, the CEQA 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?

## 5.5 Project Thresholds of Significance

Overall, considering the CEQA guidelines, local standards, and industry standards, for purposes of this report 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 (CNEL) 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 level of 65 dBA CNEL 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 receptors 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 receptors. 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:

1) Noise from an increase in traffic causes the CNEL to exceed 65 dB(A) at sensitive receptors in which the current ambient noise level is below 65 dB(A) CNEL.

2) Noise from an increase in traffic causes the CNEL to increase by more than 3 dB at sensitive receptors.

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

3) 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.

4) 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 receptors.

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

5) 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.

6) 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 receptors. 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:

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

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

## 6. Construction Noise Impact Analysis

To evaluate the potential Project construction noise impact, Behrens and Associates identified the construction periods with the greatest noise-generating potential by reviewing the Project construction schedule and equipment lists provided by the applicant. A period from both Phase I and Phase II construction activities was selected for analysis. The periods with the most construction equipment/activities and thus the greatest potential to cause a significant impact were Year -1, month 6 during Phase I and Year 4, month 8 during Phase II. The construction activities taking place during each period were identified as follows:

**Table 6-1 Worst-Case Scenario Construction Activities**

| Phase I Year -1, Month 6 | Phase II Year 4, Month 8 |
|---|---|
| Central Processing Facility Construction | Central Processing Facility Construction |
| Steam Generation Site Construction | Steam Generation Site Construction |
| Well Pad and Roadway Grading | Well Pad and Roadway Grading |
| Installation of Gathering & Distribution Pipelines | |
| Installation of Electrical Power Distribution | |
| Well Hook-ups | |

The construction equipment associated with each construction activity and included in the construction noise modeling is shown in Table 6-2 and Table 6-3. Each table includes the quantity of equipment included in the modeling, the associated sound level of the equipment, and the estimated acoustical usage factor. The acoustical usage factor is the percentage of time the equipment is expected to be in operation. The acoustical usage factor and noise level of each equipment item included in the modeling were derived from a combination of file data, field measurements, and external sources such as the *Federal Highway Administration Construction Noise Handbook*.

**Table 6-2 Phase I, Year -1, Month 6 Modeled Construction Equipment**

| Equipment | Quantity | Individual Equipment Item Sound Level at 50 ft (dBA) | Acoustical usage Factor (%) |
|---|---|---|---|
| **Central Processing Facility Construction** | | | |
| Compressor | 4 | 78.0 | 40 |
| Tamper | 1 | 85.2 | 40 |
| Compactor | 2 | 86.0 | 40 |
| Backhoe/Loader | 4 | 85.2 | 40 |
| Generator | 4 | 73.0 | 50 |
| Lifts | 4 | 76.1 | 20 |
| Cranes | 5 | 86.0 | 20 |
| Forklifts | 4 | 80.2 | 25 |
| Welders | 9 | 80.5 | 40 |

| | | | |
|---|---|---|---|
| Work Trucks | 8 | 72.5 | 40 |
| **Steam Generation Site Construction** | | | |
| Compressor | 1 | 78.0 | 40 |
| Tamper | 2 | 86.0 | 20 |
| Compactor | 1 | 86.0 | 40 |
| Power Trowel | 1 | 86.0 | 40 |
| Trowel | 1 | 79.1 | 40 |
| Concrete Vibrator | 1 | 80.0 | 20 |
| Backhoe/Loader | 1 | 85.2 | 40 |
| Generator | 1 | 82.0 | 50 |
| **Well Pad and Roadway Grading** | | | |
| Challenger | 1 | 86.0 | 100[1] |
| Dozer | 1 | 86.0 | 100[1] |
| Grader | 1 | 85.0 | 100[1] |
| Compactor | 4 | 86.0 | 100[1] |
| Water Truck | 1 | 72.5 | 100[1] |
| **Install Gathering & Distribution Pipelines** | | | |
| Compactor | 2 | 86.0 | 40 |
| Backhoe/Loader | 5 | 85.2 | 40 |
| Boomtruck | 4 | 85.1 | 16 |
| Welders | 8 | 80.5 | 40 |
| **Install Electrical Power Distribution** | | | |
| Boomtruck | 1 | 85.1 | 16 |
| Trailer, Pole | 1 | 80.1 | 40 |
| Trailer, Cable Puller | 1 | 80.1 | 40 |
| Work Trucks | 5 | 72.5 | 40 |
| **Well Hook-ups** | | | |
| Backhoe/Loader | 1 | 85.2 | 40 |
| Work Trucks | 3 | 72.5 | 40 |
| Cranes | 1 | 86.0 | 20 |
| Welders | 1 | 80.5 | 40 |
| Tractor | 1 | 84.0 | 40 |

Notes: 1) During well pad grading, it was assumed that only one type of equipment will be in use at a time. The well pad grading was therefore modeled assuming four compactors operating simultaneously.

**Table 6-3 Phase II, Year 4, Month 8 Modeled Construction Equipment**

| Equipment | Quantity | Individual Equipment Item Sound Level at 50 ft (dBA) | Acoustical usage Factor (%) |
|---|---|---|---|
| **Central Processing Facility Construction** | | | |
| Compressor | 1 | 78.0 | 40 |
| Tamper | 1 | 85.2 | 40 |
| Compactor | 1 | 86.0 | 40 |
| Backhoe/Loader | 1 | 85.2 | 40 |
| Generator | 1 | 73.0 | 50 |
| Lifts | 2 | 76.1 | 20 |
| Cranes | 3 | 86.0 | 20 |
| Forklifts | 2 | 80.2 | 25 |
| Welders | 5 | 80.5 | 40 |
| Work Trucks | 6 | 72.5 | 40 |
| **Construct Steam Generation Site** | | | |
| Compressor | 1 | 78.0 | 40 |
| Cranes | 1 | 86.0 | 20 |
| Compactor | 1 | 86.0 | 40 |
| Work Trucks | 3 | 86.0 | 40 |
| Generator | 1 | 82.0 | 50 |
| **Well Pad and Roadway Grading** | | | |
| Challenger | 1 | 86.0 | 100[1] |
| Dozer | 1 | 86.0 | 100[1] |
| Grader | 1 | 85.0 | 100[1] |
| Compactor | 4 | 86.0 | 100[1] |
| Water Truck | 1 | 72.5 | 100[1] |

Notes: 1) During well pad grading, it was assumed that only one type of equipment will be in use at a time. The well pad grading was therefore modeled assuming four compactors operating simultaneously.

The central processing facility construction 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 a worst-case noise location (i.e., the locations closest to sensitive receivers and property lines) were used in the construction modeling. Project construction activities are not expected to occur at night.

In addition to the cumulative construction models, individual well pad grading models were created for well pads close to the Project property line and/or NSR's. The modeled well pads include:

- WP3A
- WP10A
- WP11A
- WP12A
- WP13A
- WP14A
- WP15A
- WP16A
- WP17A
- WP46
- WP47
- WP52
- WP54
- WP55
- WP56

Construction activities are scheduled to operate during daytime hours. Accordingly, the daytime requirement of less than a 5 dB increase at the NSR's as well as a limit of 65 dBA CNEL was used in the construction noise impact assessment.

Table 6-4 shows the predicted average well pad grading noise levels at the closest or most affected NSR to each of the modeled well pads. The well pad grading noise levels are compared to the existing daytime ambient noise levels. Figure 6-3 and Figure 6-4 show noise contour maps of grading operations at the WP16A and WP17A pads, respectively.

**Table 6-4 Unmitigated Well Pad Grading Noise Levels**

| Well Pad | Closest NSR | Existing Average Daytime Ambient Noise Level at NSR($L_{eq}$, dBA) | Average Grading Noise Level at NSR ($L_{eq}$, dBA) | Grading Noise Exceedance over Ambient Daytime Levels (dB) |
|---|---|---|---|---|
| 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 |

Table 6-5 and Table 6-6 show the predicted Phase I and Phase II average construction noise levels and assess the construction noise impact. Noise contour maps for the Phase I and Phase II modeled construction scenarios are provided in Figure 6-1 and Figure 6-2.

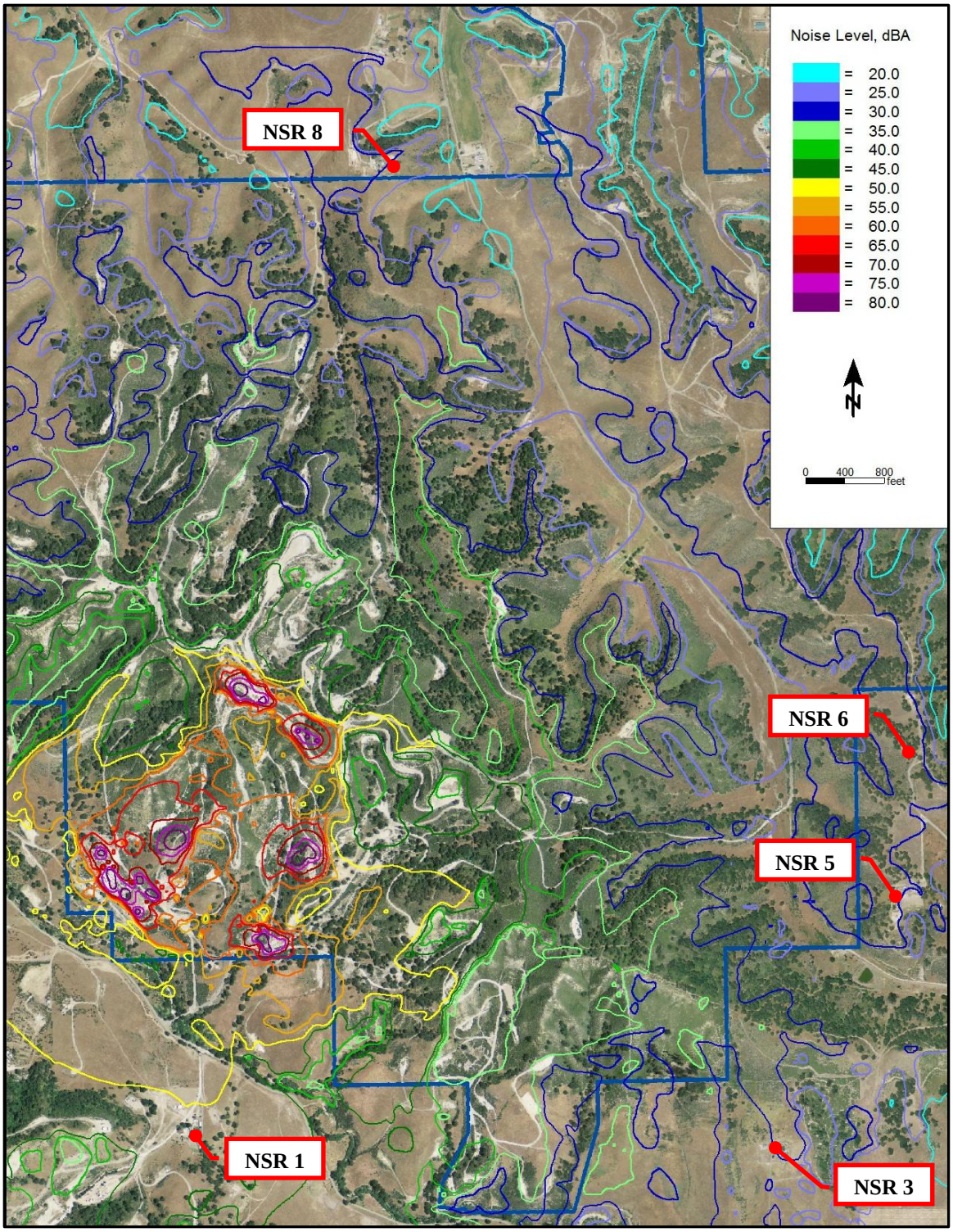


**Figure 6-1 Phase I, Year -1 Unmitigated Construction Noise Contour Map**

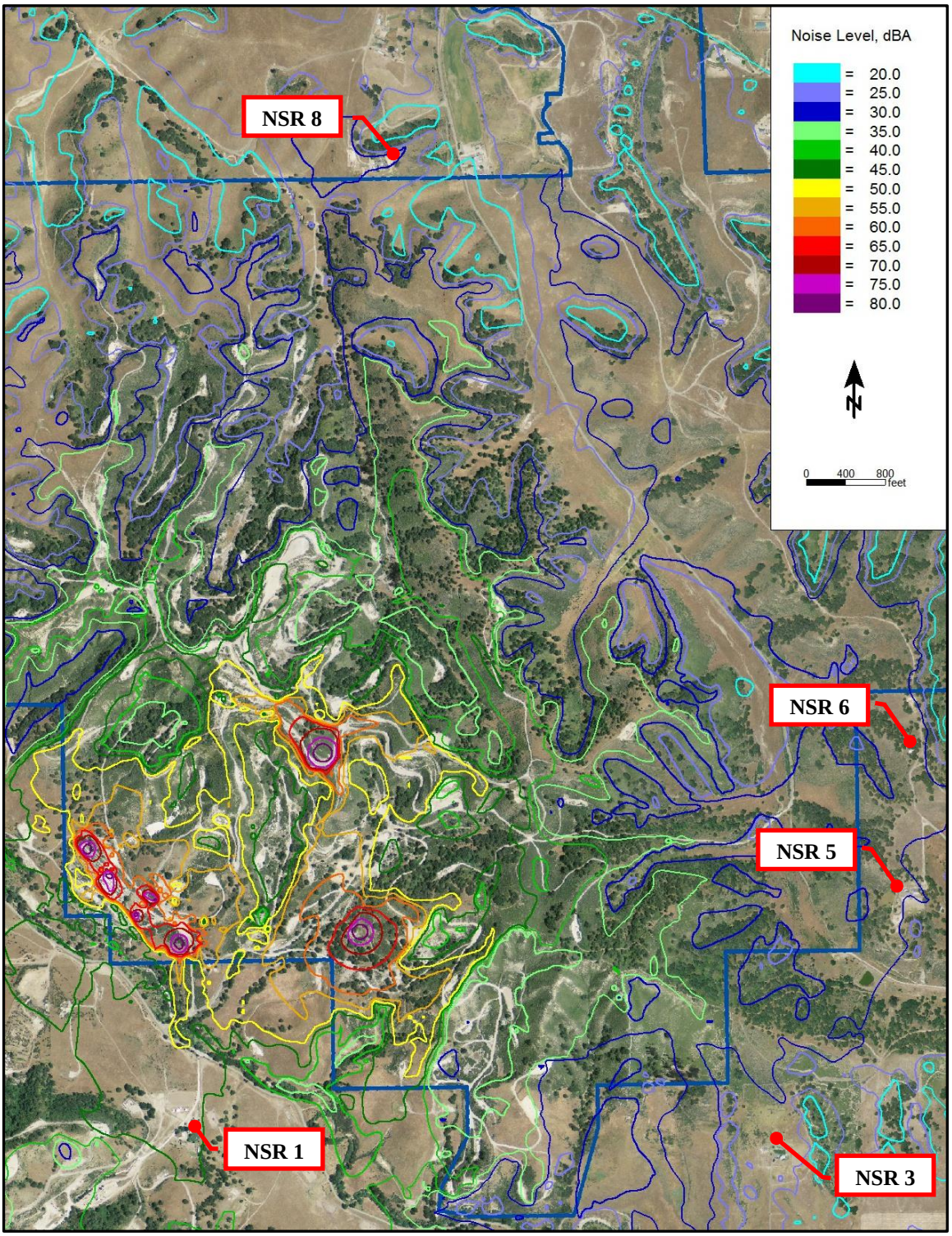


**Figure 6-2 Phase II, Year 4 Unmitigated Construction Noise Contour Map**

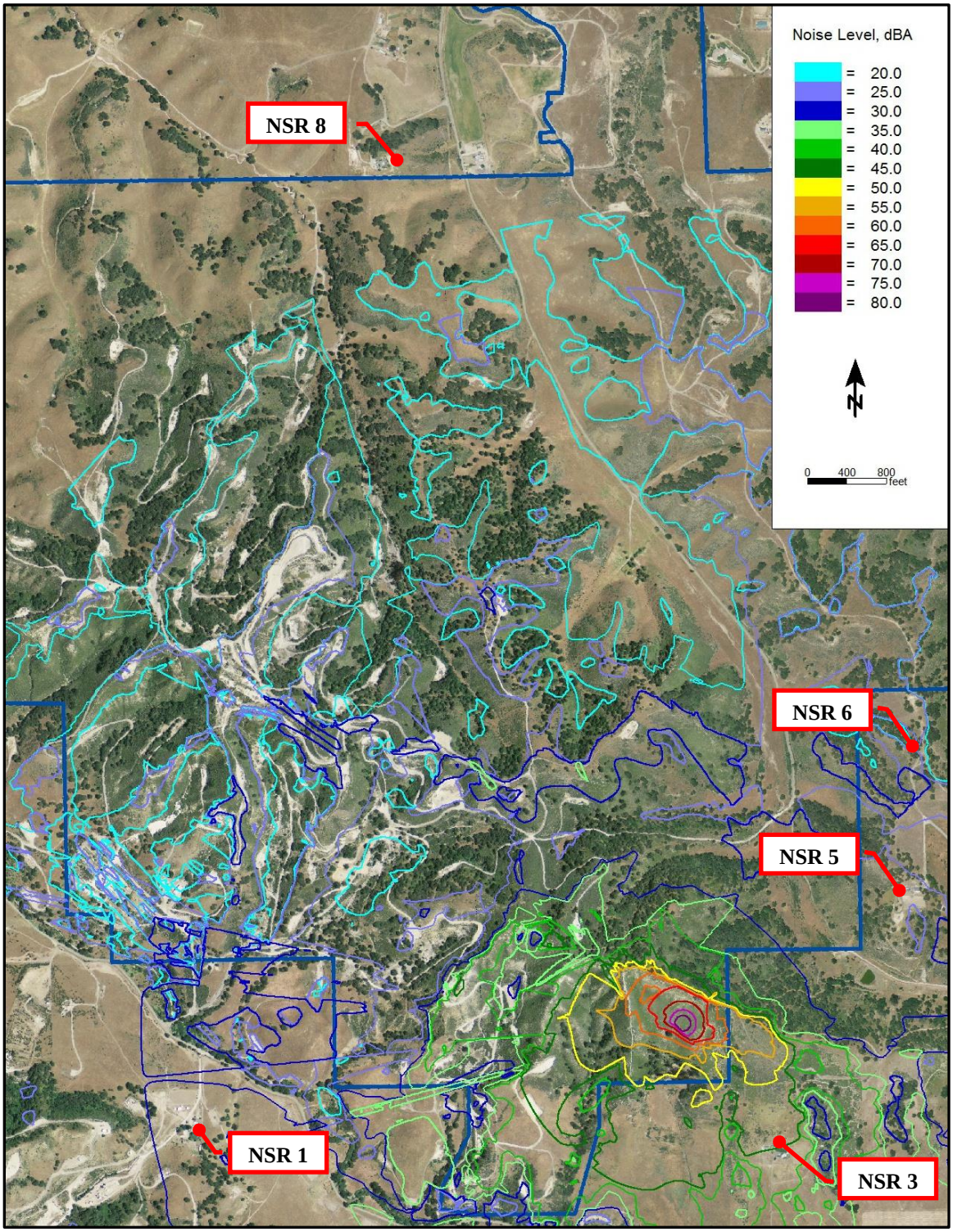


**Figure 6-3 Unmitigated WP16A Pad Grading Noise Contour Map**

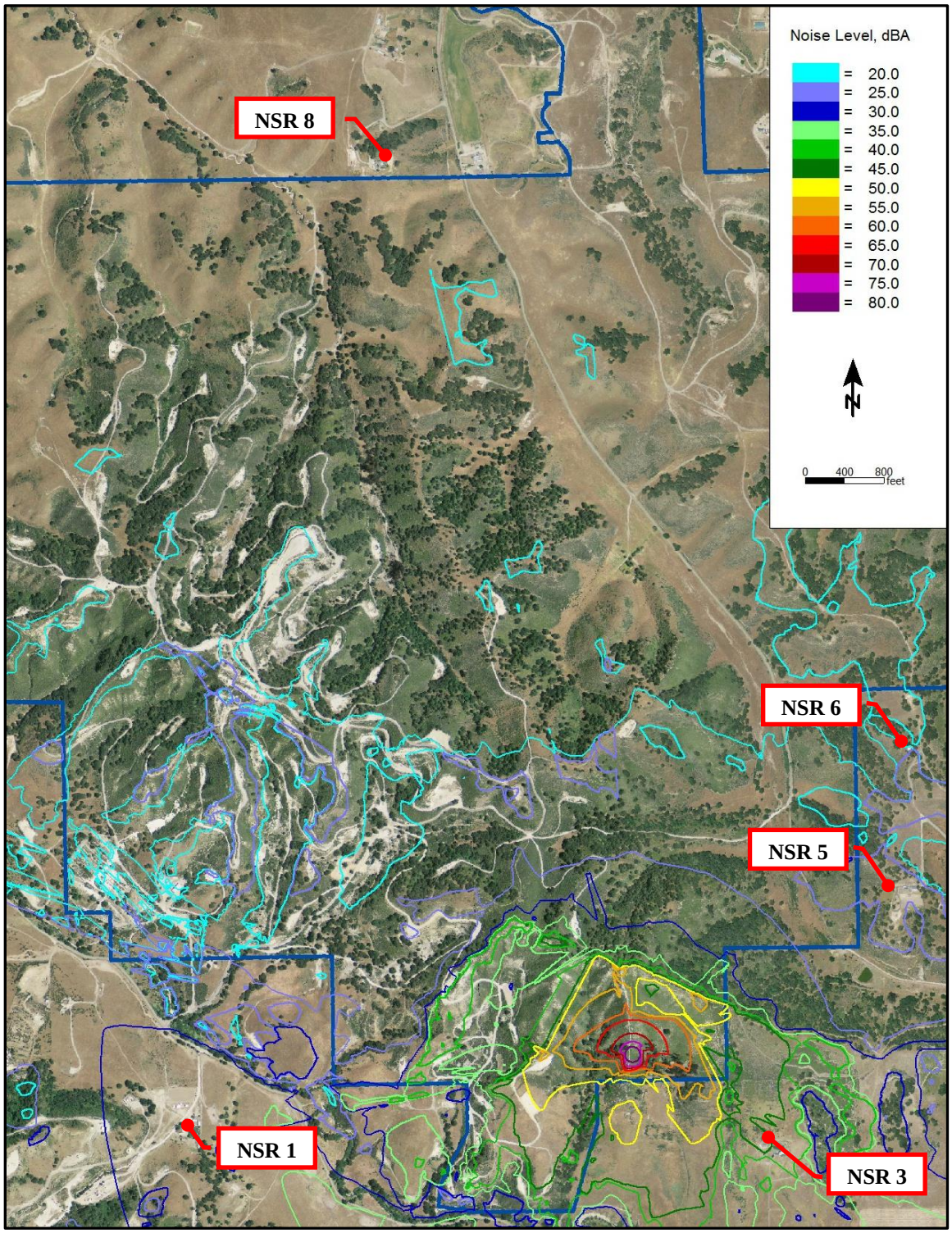


**Figure 6-4 Unmitigated WP17A Pad Grading Noise Contour Map**

**Table 6-5 Phase I, Year -1 Construction Noise Levels**

| Location | Construction CNEL (dBA) | Existing Average Daytime Ambient Noise Level ($L_{eq}$, dBA) | Average Construction Noise Level ($L_{eq}$, dBA) | Construction Noise Exceedance over Ambient Daytime Levels (dB) |
|---|---|---|---|---|
| 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 6-6 Phase II, Year 4 Construction Noise Levels**

| Location | Construction CNEL (dBA) | Existing Average Daytime Ambient Noise Level $L_{eq}$, (dBA) | Average Construction Noise Level ($L_{eq}$, dBA) | Construction Noise Exceedance over Ambient Daytime Levels (dB) |
|---|---|---|---|---|
| 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 | -- |

## 6.1 Construction Noise Conclusions and Recommendations

Table 6-5 and Table 6-6 demonstrate a less than significant impact for the NSR's during the modeled cumulative Phase I and Phase II construction activities. As a result, no noise mitigation measures are necessary during construction activities at the central processing facility and steam generation site.

However, unmitigated well pad grading activities at WP16A and WP17A will generate noise levels that exceed 5 dB over the existing daytime ambient noise levels at NSR 3. Due to the terrain surrounding the pads, the installation of a temporary sound wall around the pads during grading activities may not be feasible and the grading noise impact from these two pads will exceed the 5 dB daytime threshold; however, grading activities are expected to be a short-term operation, resulting in a short-term, temporary impact at NSR 3.

# 7. Drilling Noise Impact Analysis

In an effort to ensure the drilling noise assessment would be as accurate as possible, noise measurements were conducted at and around the Golden State Rig #14 drilling rig. Golden State Rig #14 drilling rig, or an equivalent drilling rig, is planned for use at the Project site. The operational 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 loader and mud pumps while the measurements were being conducted.

The results of the sound level survey were used for calibration during the drilling modeling. The resulting equipment noise levels used in the modeling are shown in Table 7-1.

**Table 7-1 Modeled Drilling Rig Equipment**

| Equipment | Quantity in model | Sound Level at 50 Feet (dBA) |
|---|---|---|
| Drawworks Loader | 1 | 86.7 |
| Generator | 1 | 84.3 |
| Mud pumps | 2 | 77.7 |
| Shaker | 2 | 56.4 |
| Air Valve | 1 | 68.9 |

Four 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 NSR's and thus have the highest potential to create a significant impact. For each modeled pad, the loudest drilling equipment (drawworks loader and generators) were positioned on the side of the drilling rig with the shortest distance to the Project property line and closest NSR's. The four pads assessed were:

- WP1
- WP50
- WP56
- WP17A

During drilling operations, the drilling rig is scheduled to operate 24 hours per day. Since the existing nighttime average ambient sound levels are lower than the daytime average ambient sound levels at each measurement location, the potential for significant impacts is highest during nighttime hours. The mitigation of significant impacts at night would ensure that significant impacts do not occur during the daytime. Accordingly, the nighttime requirements of 50 dBA at the Project property line and less than a 3 dB exceedance over ambient levels at the NSR's were used in the drilling noise impact assessment.

Table 7-2 through Table 7-5 show the predicted drilling noise levels and assess the drilling noise impact. Noise contour maps for each well pad are provided in Figure 7-1 through Figure 7-4.

**Table 7-2 Unmitigated WP1 Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ( $L_{eq}$, dBA) | Average Predicted Drilling Noise Levels ( $L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| NSR 1 | 51.4 | 27.7 | -- |
| NSR 2 | 52.9 | 20.4 | -- |
| NSR 3 | 30.4 | 21.7 | -- |
| NSR 4 | 30.3 | 20.2 | -- |
| NSR 5 | 30.3 | 22.6 | -- |
| NSR 6 | 30.3 | 24.6 | -- |
| NSR 7 | 32.6 | 22.2 | -- |
| NSR 8 | 33.7 | 33.8 | 0.1 |
| Highest average drilling noise level at Project property line: 57.1 dBA | | | |

**Table 7-3 Unmitigated WP50 Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level $L_{eq}$, (dBA) | Average Predicted Drilling Noise Levels ( $L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| NSR 1 | 51.4 | 43.4 | -- |
| NSR 2 | 52.9 | 26.5 | -- |
| NSR 3 | 30.4 | 17.7 | -- |
| NSR 4 | 30.3 | 18.8 | -- |
| NSR 5 | 30.3 | 19.5 | -- |
| NSR 6 | 30.3 | 19.6 | -- |
| NSR 7 | 32.6 | 9.7 | -- |
| NSR 8 | 33.7 | 18.8 | -- |
| Highest average drilling noise level at Project property line : 62.0 dBA | | | |

**Table 7-4 Unmitigated WP56 Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ( $L_{eq}$, dBA) | Average Predicted Drilling Noise Levels ( $L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| NSR 1 | 51.4 | 40.2 | -- |
| NSR 2 | 52.9 | 43.4 | -- |
| NSR 3 | 30.4 | 45.7 | 15.3 |
| NSR 4 | 30.3 | 36.3 | 6.0 |
| NSR 5 | 30.3 | 34.0 | 3.7 |
| NSR 6 | 30.3 | 33.5 | 3.2 |
| NSR 7 | 32.6 | 12.4 | -- |
| NSR 8 | 33.7 | 15.4 | -- |
| Highest average drilling level noise at Project property line : 63.6 dBA | | | |

**Table 7-5 Unmitigated WP17A Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ( $L_{eq}$, dBA) | Average Predicted Drilling Noise Levels ( $L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| NSR 1 | 51.4 | 33.7 | -- |
| NSR 2 | 52.9 | 44.8 | -- |
| NSR 3 | 30.4 | 50.0 | 19.6 |
| NSR 4 | 30.3 | 38.2 | 7.9 |
| NSR 5 | 30.3 | 32.7 | 2.4 |
| NSR 6 | 30.3 | 34.0 | 3.7 |
| NSR 7 | 32.6 | 9.2 | -- |
| NSR 8 | 33.7 | 9.8 | -- |
| Highest average drilling noise level at Project property line : 63.4 dBA | | | |

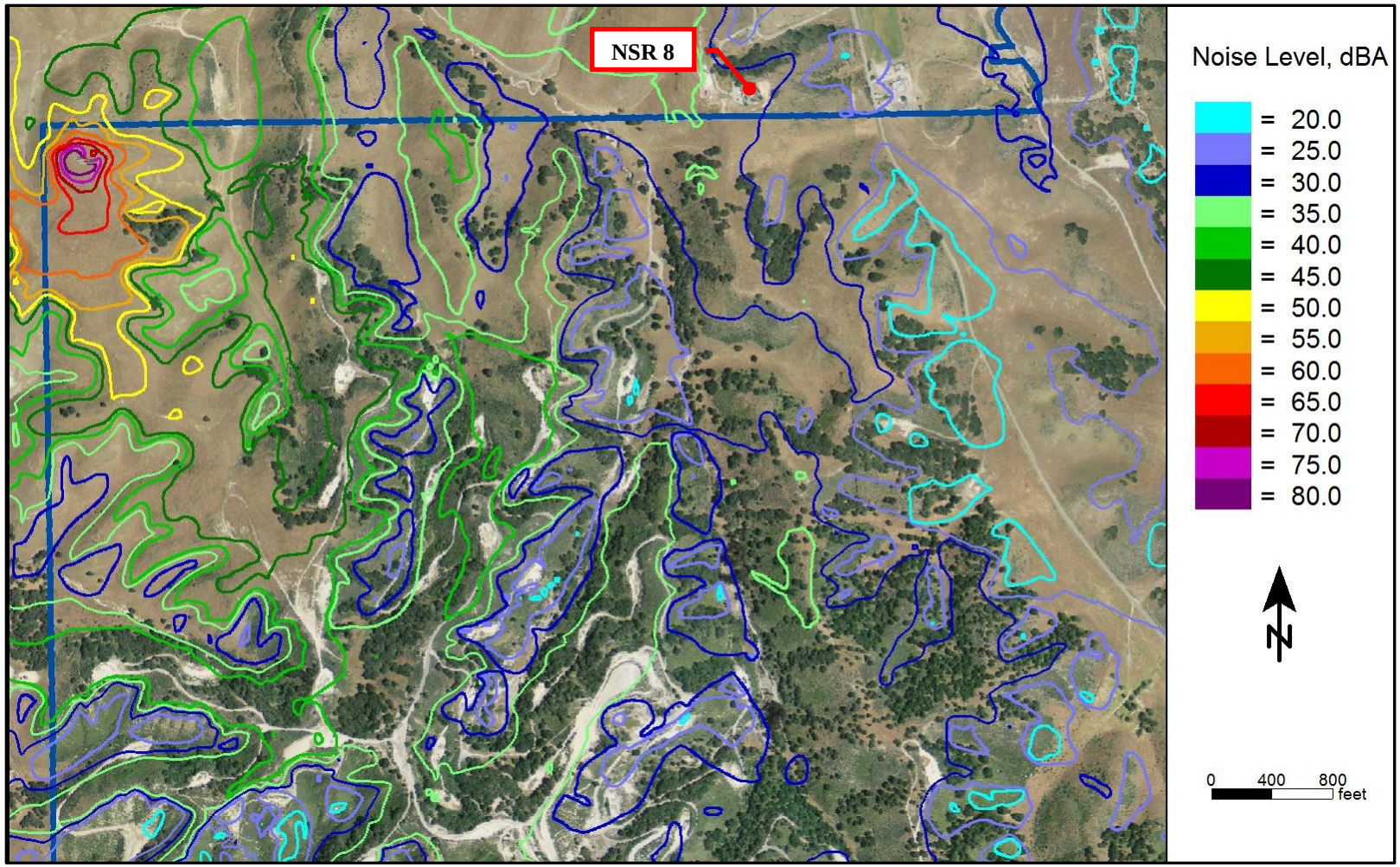


**Figure 7-1 Unmitigated WP1 Drilling Noise Contour Map**

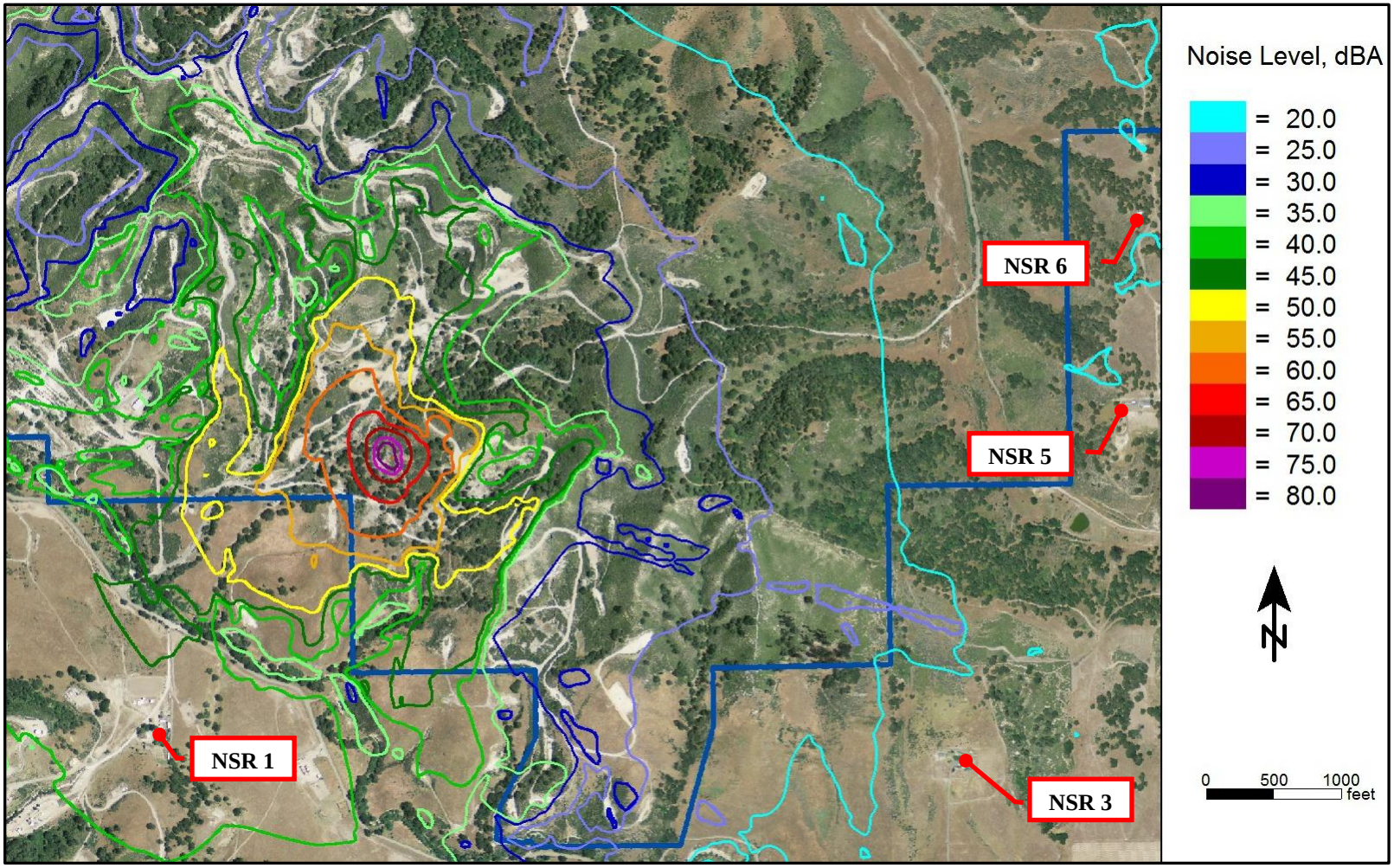


**Figure 7-2 Unmitigated WP50 Drilling Noise Contour Map**

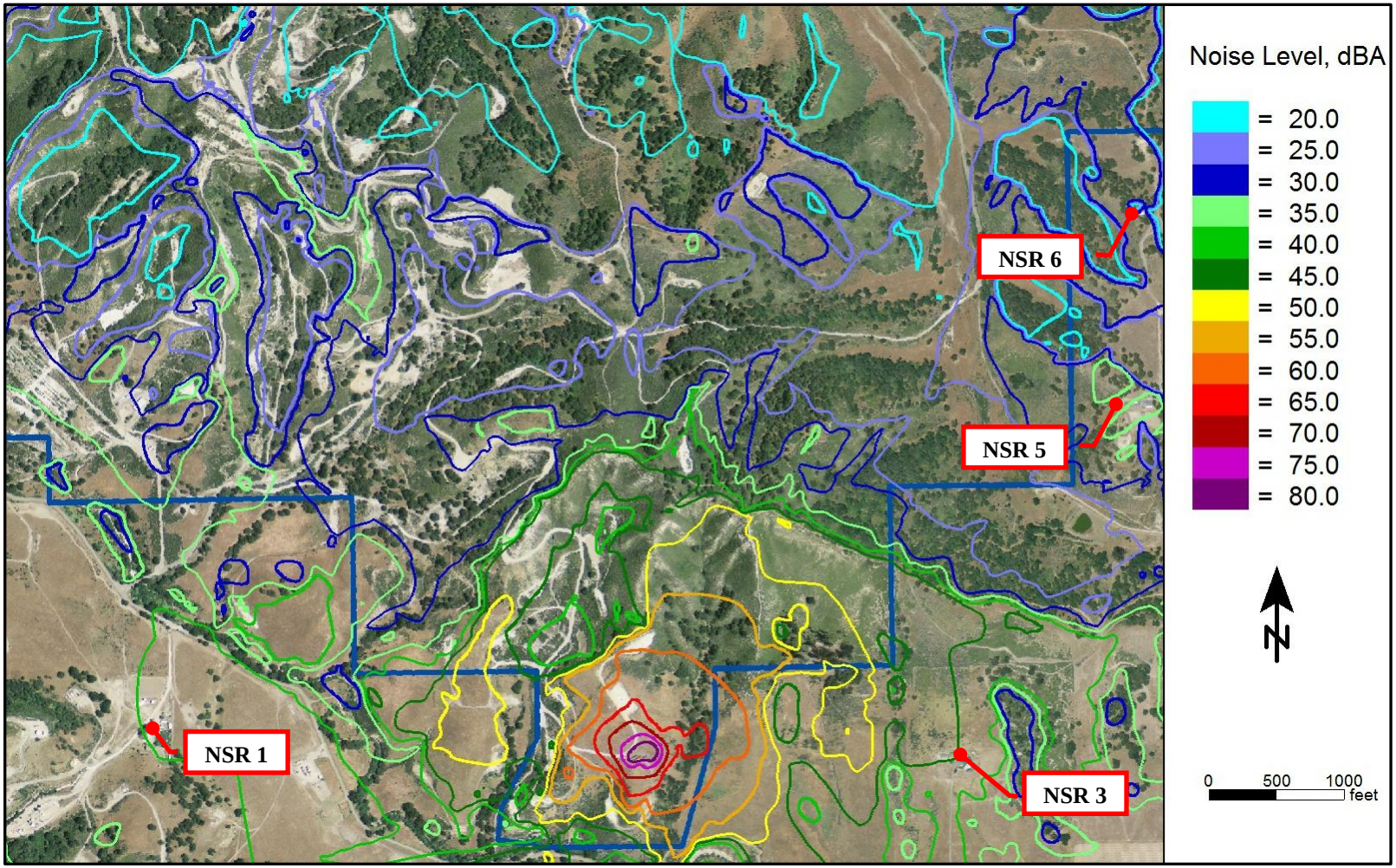


**Figure 7-3 Unmitigated WP56 Drilling Noise Contour Map**

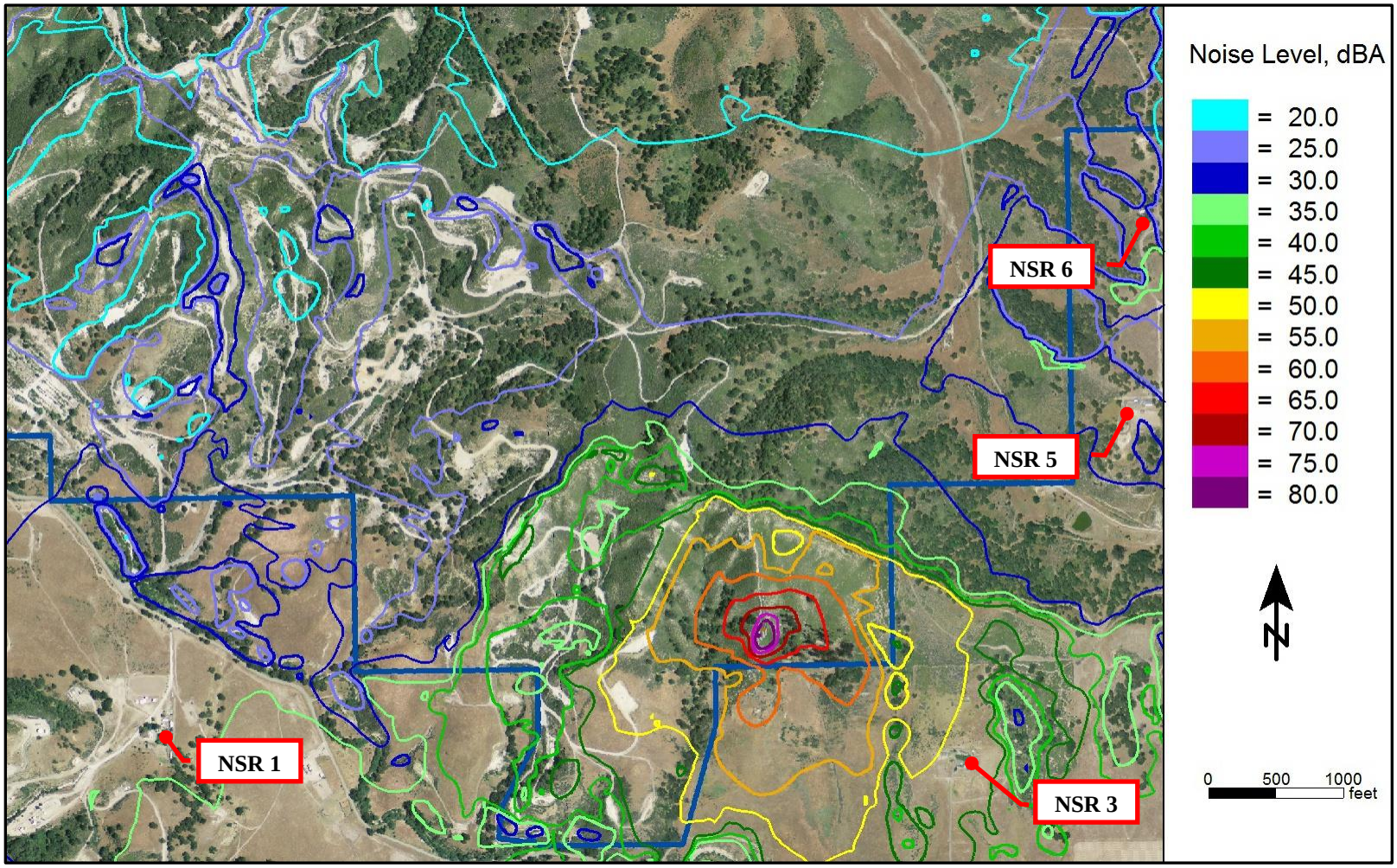


**Figure 7-4 Unmitigated WP17A Drilling Noise Contour Map**

## 7.1 Drilling Noise Conclusions and Recommendations

The predicted noise levels indicate drilling operations will exceed the 50 dBA nighttime property line limit at all four well pads. Additionally, a greater than 3 dB increase at NSR's is expected during drilling operations at two of the modeled well pads (WP56 and WP17A) constituting a significant increase in nighttime noise levels. Implementation of the following recommended noise mitigation measures will reduce drilling noise impacts at all four pads to a level that is less than significant:

**N-1**: 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 loader, and the north, south, and west sides of the mud pumps. Alternate mitigation measures are acceptable if demonstrated to be equivalent to the mitigation measures detailed above.

**N-2**: 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 loader, and the southwest and southeast sides of the mud pumps. Alternate mitigation measures are acceptable if demonstrated to be equivalent to the mitigation measures detailed above.

**N-3**: 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 loader. Alternate mitigation measures are acceptable if demonstrated to be equivalent to the mitigation measures detailed above.

**N-4**: 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 loader, and the south side of the mud pumps. Alternate mitigation measures are acceptable if demonstrated to be equivalent to the mitigation measures detailed above.

Table 7-6 through Table 7-9 show the predicted drilling noise levels at each pad with the implementation of the mitigation measures N-1 through N-4. The resulting mitigated noise contour maps are shown in Figure 7-5 through Figure 7-8.

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 NSR's. This demonstrates that all other well pads at the Project site are capable of causing a less than significant impact with equal or less mitigation measures than those detailed above. Implementation of the following procedures will ensure the remaining well pads create drilling noise impacts that are less than significant:

**N-5**: 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.

It is noted that the noise mitigation measures detailed above represent one possible solution to ensure a less than significant drilling noise impact. Alternate mitigation measures should be considered acceptable if future noise modeling demonstrates the alternate measures can ensure a less than significant impact.

**Table 7-6 Mitigated WP1 Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ( $L_{eq}$, dBA) | Average Predicted Drilling Noise Levels ( $L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| 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 |
| Highest average drilling noise level at Project property line : 49.6 dBA | | | |

**Table 7-7 Mitigated WP50 Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ($L_{eq}$, dBA) | Average Predicted Drilling Noise Levels ($L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| 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 | -- |
| Highest average drilling noise level at Project property line: 47.0 dBA | | | |

**Table 7-8 Mitigated WP56 Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ($L_{eq}$, dBA) | Average Predicted Drilling Noise Levels ($L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| 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 | -- |
| Highest average drilling noise level at Project property line: 47.0 dBA | | | |

**Table 7-9 Mitigated WP17A Drilling Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ($L_{eq}$, dBA) | Average Predicted Drilling Noise Levels ($L_{eq}$, dBA) | Drilling Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| 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 | -- |
| Highest average drilling noise level at Project property line: 49.3 dBA | | | |

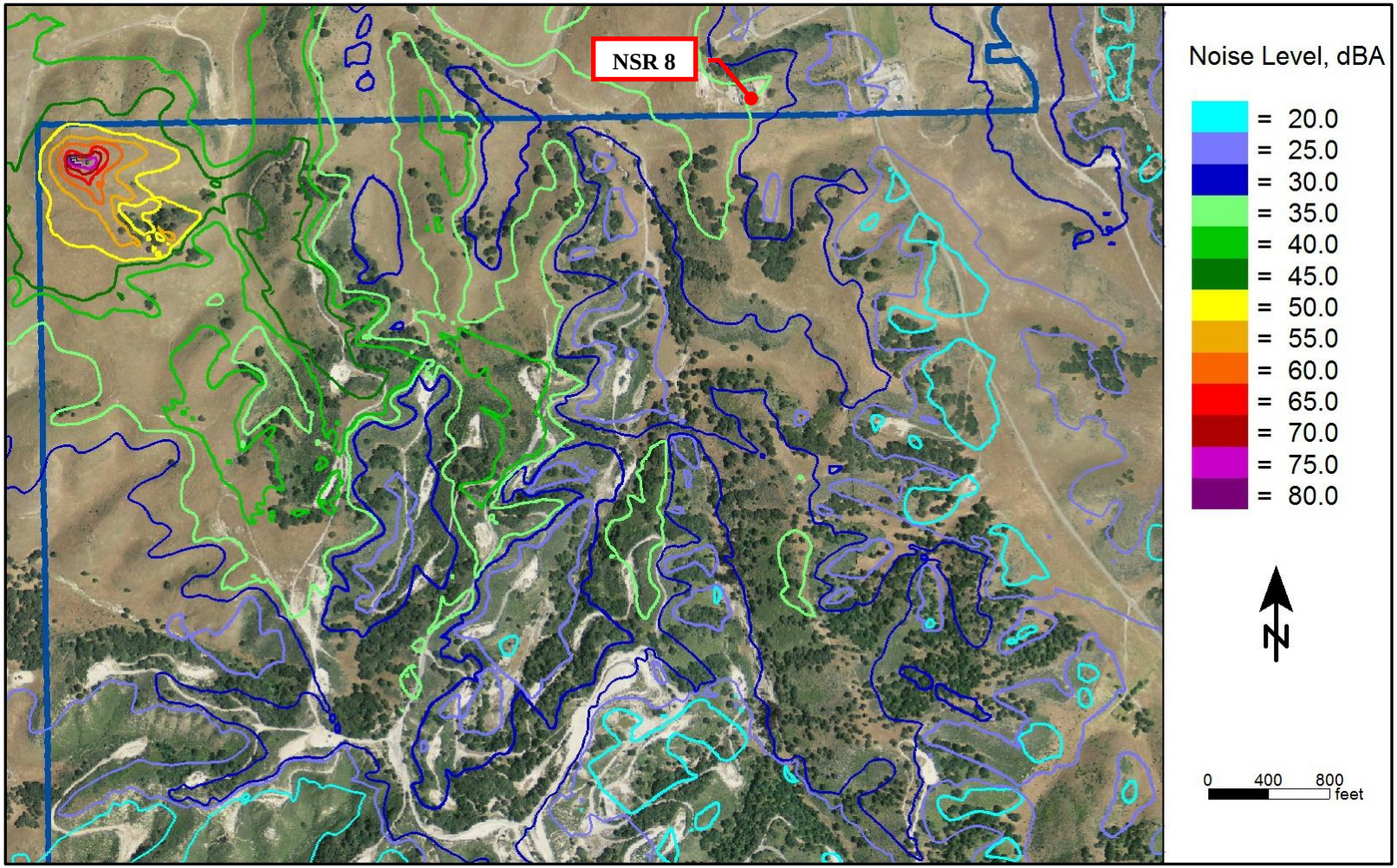


**Figure 7-5 Mitigated WP1 Drilling Noise Contour Map**

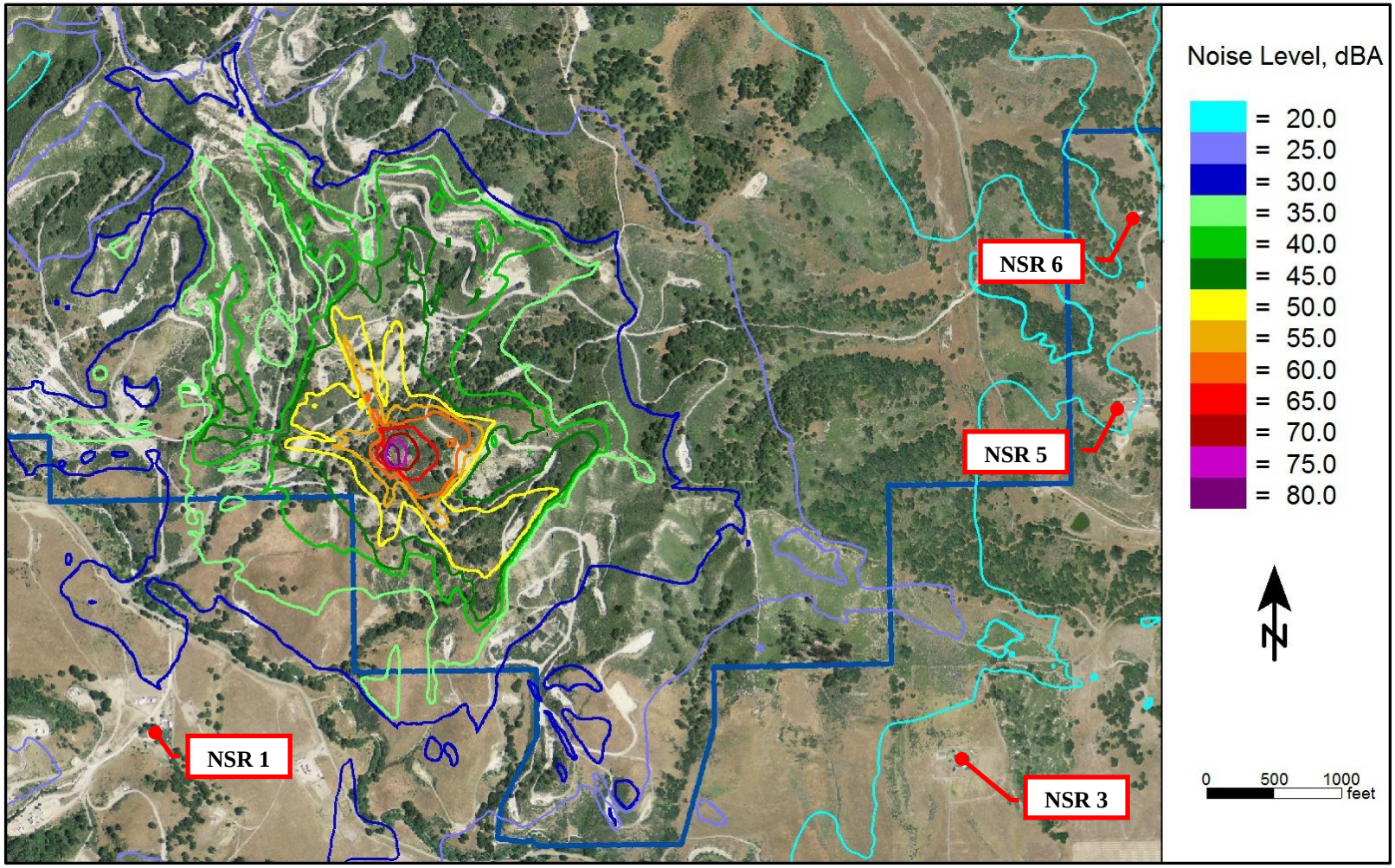


**Figure 7-6 Mitigated WP50 Drilling Noise Contour Map**

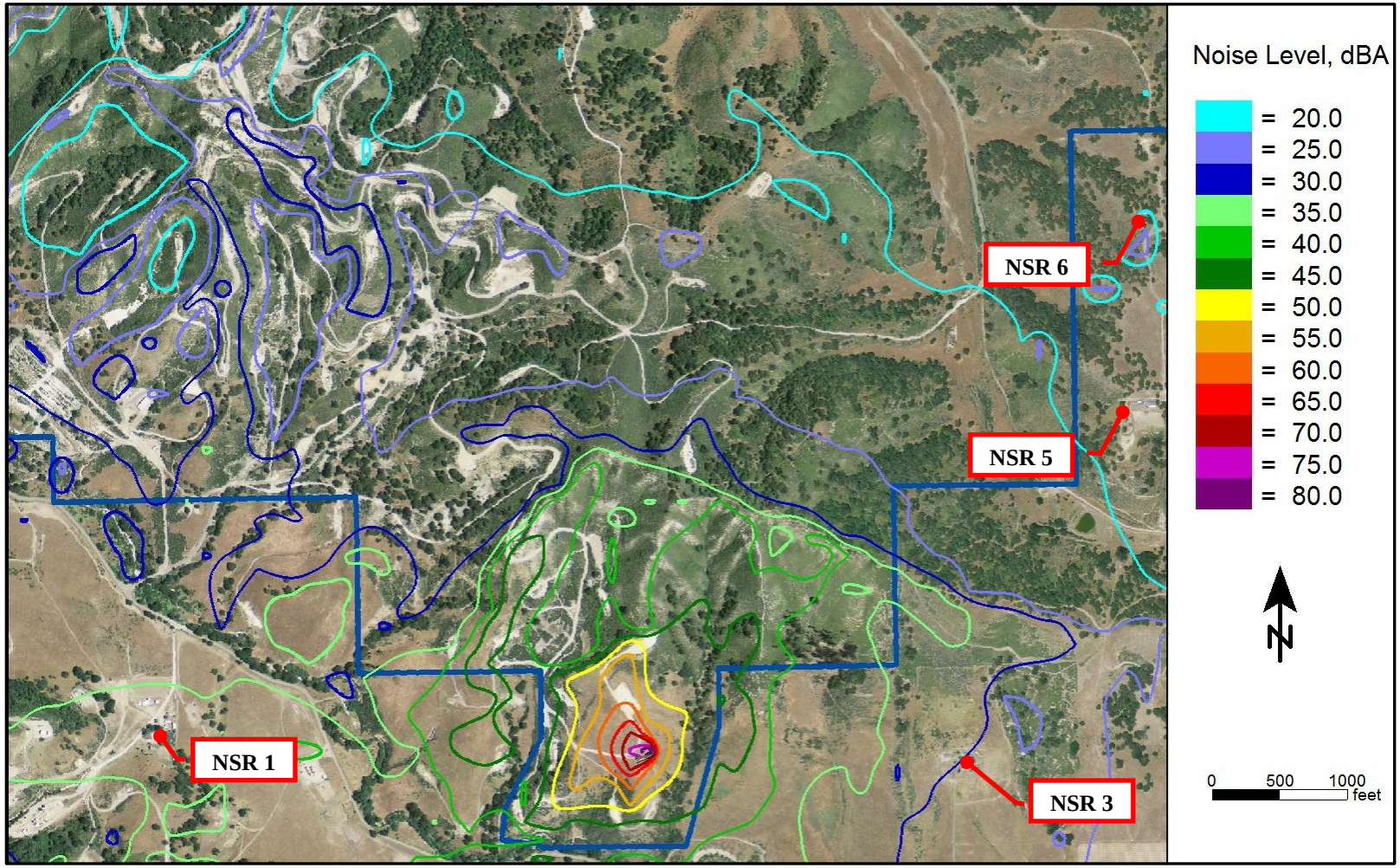


**Figure 7-7 Mitigated WP56 Drilling Noise Contour Map**

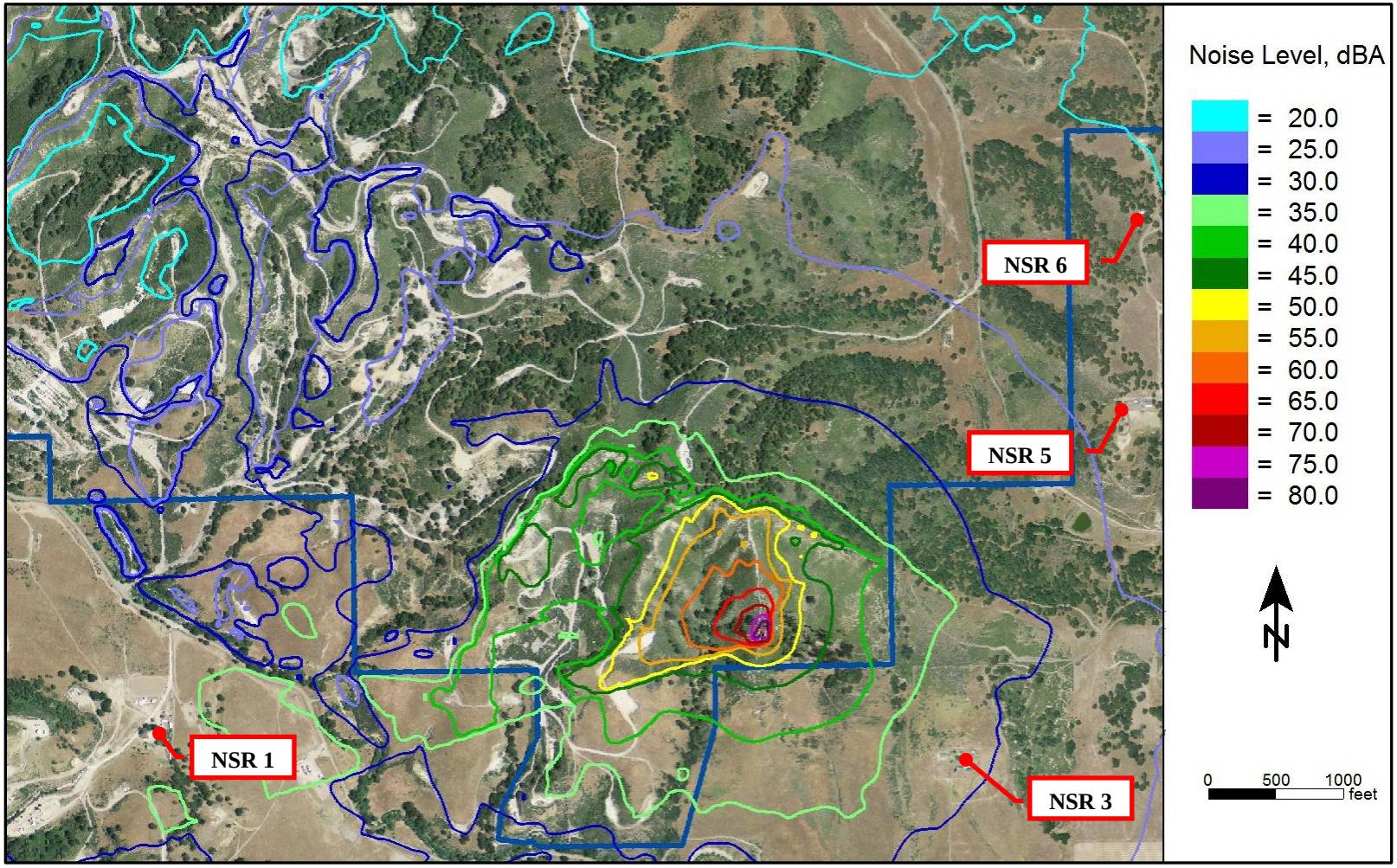


**Figure 7-8 Mitigated WP17A Drilling Noise Contour Map**

# 8. 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 similar to those 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 SourceDB 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 MMBTU/hr 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 MMBTU/hr 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 II.

**Table 8-1 Phase I Modeled Production Equipment**

| Sound Level at 50 ft per Each Equipment Item (dBA) | Quantity of Central Processing Facility Production Equipment | | | | | | | | Quantity of Steam Generator Equipment | | | | | | Well Eqpt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Air compressors | Blowers | Centrifuges | Compressors | Filters | Fin Fans | Pumps | Trucks | Housings | Blowers | Pumps | Rear Pumps | Generators | Valves | Wellhead Pumps |
| 46.1 | | | | | | | 2 | | | | | | | | |
| 50.1 | | | | | | | 20 | | | | | | | | |
| 51.4 | | | | | | | | | 6 | | | | | | |
| 53.4 | | | | | | | | | | | | | | | 20 |
| 55.0 | | | | | | | | | 6 | | | | | | |
| 55.1 | | | 1 | | 2 | | 19 | | | | | | | | |
| 56.7 | | | | 2 | | | | | | | | | | | |
| 59.1 | | | | | | | 5 | | | | | | | | |
| 59.6 | | | | | | 8 | | | | | | | | 3 | |
| 61.4 | | | | | | | 3 | | | | | 3 | | | |
| 63.7 | | | | | | | | | | 1 | | | | | |
| 64.1 | 4 | | | | | | 4 | | | | | | | | |
| 64.7 | | | | | | | 2 | | | | | | 1 | | |
| 66.0 | | | | | | | 3 | | | | 3 | | | | |
| 67.8 | | | | | | 2 | | | | | | | | | |
| 69.5 | | | | | | | | 2 | | | | | | | |
| 74.0 | | 1 | | | | | | | | | | | | | |
| 77.6 | | | | | | | | | | 3 | | | | | |

The modeled production equipment is assumed to operate 24 hours a day. Table 8-1 and Table 8-2 show the quantity and noise levels of the production equipment included in the Phase I and Phase II production models, respectively. The type of equipment is shown across the top of each table. The quantity of each equipment item at a corresponding sound level is given in the column below the listed equipment. The individual equipment item sound level at 50 feet is provided in the left column. Differences in size/power of some of the proposed equipment is reflected by varying sound levels for some of the listed equipment

**Table 8-2 Phase II Modeled Production Equipment**

| Sound Level at 50 ft per Each Equipment Item (dBA) | Quantity of Central Processing Facility Production Equipment | | | | | | | | Quantity of Steam Generator Equipment | | | | | | Well Eqpt. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Air compressors | Blowers | Centrifuges | Compressors | Filters | Fin Fans | Pumps | Trucks | Housings | Blowers | Pumps | Rear Pumps | Generators | Valves | Wellhead Pumps |
| 46.1 | | | | | | | 2 | | | | | | | | |
| 50.1 | | | | | | | 53 | | | | | | | | |
| 51.4 | | | | | | | | | 12 | | | | | | |
| 53.4 | | | | | | | | | | | | | | | 64 |
| 55.0 | | | | | | | | | 12 | | | | | | |
| 55.1 | | | 2 | | 4 | | 30 | | | | | | | | |
| 56.7 | | | | 4 | | | | | | | | | | | |
| 59.1 | | | | 4 | | | 11 | | | | | | | | |
| 59.6 | | | | | | 15 | | | | | | | | 6 | |
| 61.4 | | | | | | | 6 | | | | | 6 | | | |
| 63.7 | | | | | | | | | | 1 | | | | | |
| 64.1 | 4 | 1 | | | | | 8 | | | | | | | | |
| 64.7 | | | | | | | 2 | | | | | | 1 | | |
| 66.0 | | | | | | | 6 | | | | 6 | | | | |
| 67.8 | | | | | | 2 | | | | | | | | | |
| 69.5 | | | | | | | | 2 | | | | | | | |
| 74.0 | | 1 | | | | | | | | | | | | | |
| 77.6 | | | | | | | | | | 6 | | | | | |

Noise contour maps of the predicted Phase I and Phase II production noise models are shown in Figure 8-1 and Figure 8-2. Table 8-3 and Table 8-4 provide the predicted production noise levels at the NSR's for each modeled scenario.

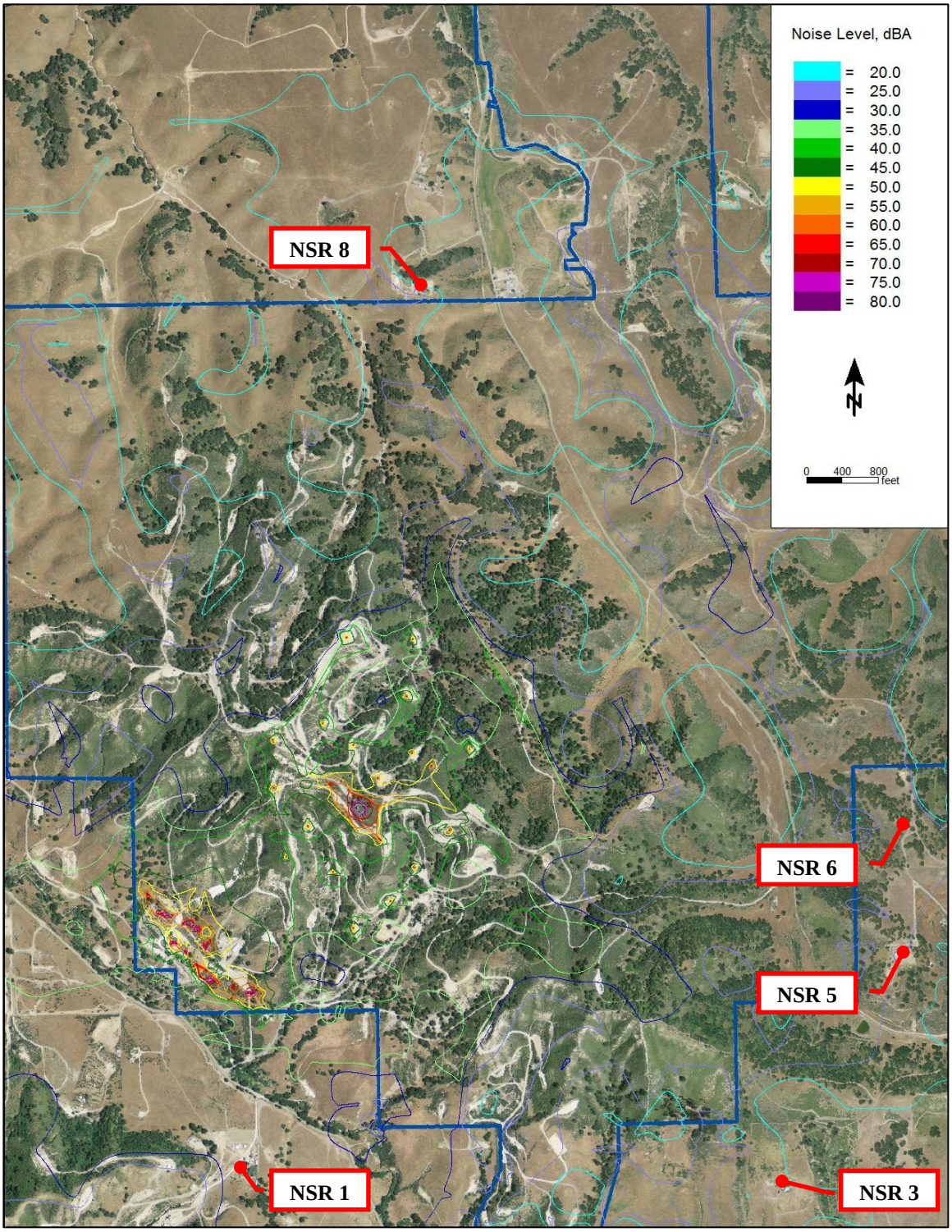


**Figure 8-1 Unmitigated Phase I Production Noise Contour Map**

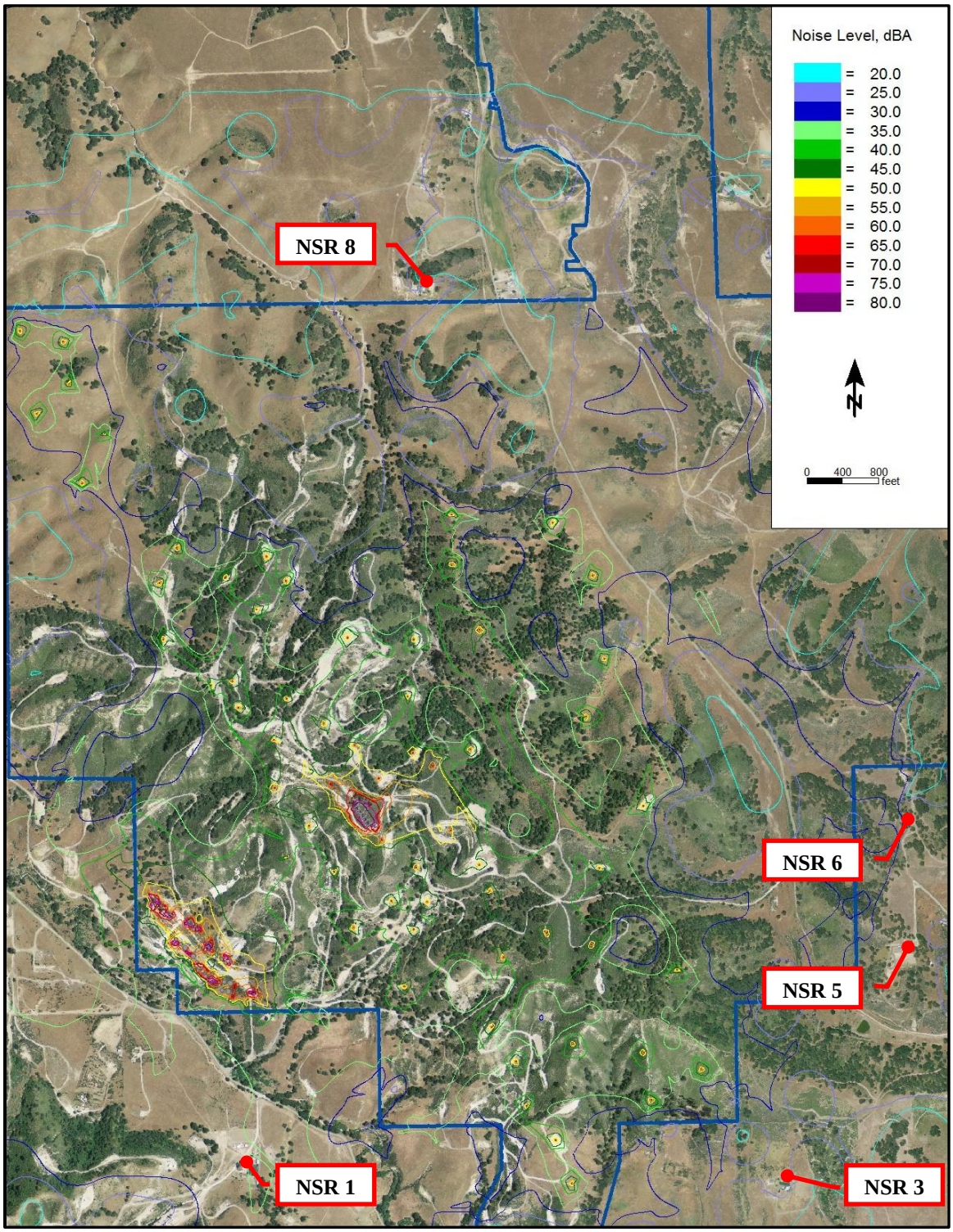


**Figure 8-2 Unmitigated Phase II Production Noise Contour Map**

**Table 8-3 Unmitigated Phase I Production Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ( $L_{eq}$, dBA) | Predicted Average Production Noise Levels ( $L_{eq}$, dBA) | Production Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| 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 | -- |
| Highest average production noise level at Project property line : 47.2 dBA | | | |

**Table 8-4 Unmitigated Phase II Production Noise Levels**

| Location | Existing Average Nighttime Ambient Noise Level ( $L_{eq}$, dBA) | Predicted Average Production Noise Levels ($L_{eq}$, dBA) | Production Noise Exceedance over Ambient Nighttime Levels (dB) |
|---|---|---|---|
| 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 | -- |
| Highest average production noise level at Project property line : 47.6 dBA | | | |

## 8.1 Production Noise Conclusions and Recommendations

Table 8-3 and Table 8-4 demonstrate that the Phase I and Phase II production noise levels will be less than the 50 dBA threshold at the property line and less than the nighttime average ambient noise levels at the NSR's indicating a less than significant impact during the modeled production operations. As a result, no noise mitigation measures are recommended during production operations.

# 9. 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. A NSR with the greatest potential for impact was selected along key segments of each of the proposed travel routes for assessment (Table 1-2). The assessed routes are shown in Figure 1-3.

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, County of Santa Barbara* (the *Traffic Study*) prepared by Associated Transportation Engineers (June 2014). The 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.

The Existing scenario represents current, existing traffic conditions as measured in January 2014. The Existing + Project scenario represents current traffic conditions with the inclusion projected traffic generated by the Project. The Project traffic was projected in the *Traffic Study* based on peak project trip data provided by the applicant.

The Future scenario includes current conditions with a growth factor of ½ percent each year over 20 years and the cumulative traffic effects of other approved and pending projects as detailed in the *Traffic Study*. The Future + Project scenario adds the Project traffic volume into the Future scenario.

To assess the potential traffic noise impact, CNEL noise levels were predicted at the property lines of the NSR's for each of the modeled scenarios. A significant impact would occur if the addition of the Project traffic to either the Existing or Future scenarios causes the CNEL noise level to increase above 65 dBA or by more than 3 dB at any of the NSR's. Table 9-1 shows the projected traffic noise levels for the Existing and Existing + Project scenarios and Table 9-2 shows the projected traffic noise levels for the Future and Future + Project scenarios.

**Table 9-1 Project Traffic Impact on Existing Conditions**

| Location | Project Option with Largest Potential Impact | Existing Conditions CNEL (dBA) | Existing Conditions + Project CNEL (dBA) | Change Due to Project Traffic (dB) |
|---|---|---|---|---|
| NSR T1; Dominion Rd s/o Clark Ave | Options 1, 2 & 3 | 58.7 | 61.6 | +2.9 |
| NSR T2; Clark Ave e/o Telephone Rd | Options 1 & 2 | 65.7 | 68.1 | +2.4 |
| NSR T3; Dominion Rd n/o Clark Ave | Option 3 | 66.7 | 69.1 | +2.4 |
| NSR T4; Telephone Rd n/o Clark Ave | Option 2 | 66.3 | 68.1 | +1.8 |
| NSR T5; Betteravia Rd e/o Telephone Ave | Option 3 | 68.3 | 69.3 | +1.0 |

**Table 9-2 Project Traffic Impact on Future Conditions**

| Location | Project Option with Largest Potential Impact | Future Conditions CNEL (dBA) | Future Conditions + Project CNEL (dBA) | Change Due to Project Traffic (dB) |
|---|---|---|---|---|
| NSR T1; Dominion Rd s/o Clark Ave | Options 1, 2 & 3 | 59.4 | 61.7 | +2.3 |
| NSR T2; Clark Ave e/o Telephone Rd | Options 1 & 2 | 66.4 | 68.5 | +2.1 |
| NSR T3; Dominion Rd n/o Clark Ave | Option 3 | 66.9 | 69.6 | +2.7 |
| NSR T4; Telephone Rd n/o Clark Ave | Option 2 | 66.4 | 68.1 | +1.7 |
| NSR T5; Betteravia Rd e/o Telephone Ave | Option 3 | 68.8 | 69.6 | +0.8 |

## 9.1 Traffic Noise Conclusions and Recommendations

Table 9-1 and Table 9-2 demonstrate a less than significant impact for the NSR's along Project Options 1, 2, and 3. As a result, no noise mitigation measures are recommended for these routes.

## 10. 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. Accordingly, the following analysis evaluates the potential human and structural response to the projected vibration levels at the nearest structures to the construction and drilling activities.

The condition of the nearest structures to the Project site is unknown. A vibration limit of 0.1 ips, which Table 3-1 shows as the maximum continuous vibration level for fragile buildings, was established as a threshold in Section 5.4 to minimize the potential for damage to the structures. Furthermore, a limit of 0.01 ips was established at the nearest occupied structures to minimize the potential for human annoyance.

Typical vibration levels produced by the analyzed construction and drilling equipment are provided in Table 10-1 at a reference distance of 25 feet. The reference vibration levels are derived from a combination of field vibration measurements and data made available by the Federal Transportation Authority (1995). Equipment utilized in the construction and drilling activities not capable of producing substantial vibration levels have been omitted from the analysis.

Table 10-1 also shows the results of the vibration analysis. The 'Distance to Exposure Limit of Fragile Buildings' column shows the approximate closest distance at which each piece of equipment can operate without generating vibration levels above 0.1 ips at the structures. The 'Distance to "Barely Perceptible" Level' shows the approximate closest distance at which each equipment item can operate without generating vibration levels perceptible to humans.

The approximate distance to the closest occupied residential structure for each construction phase is provided in the table. A comparison of the distances to the nearest structures and the calculated distances at which the equipment would generate 0.1 ips and 0.01 ips reveals the structures are located far beyond the area of potential damage and the area for potential human annoyance.

Based on the vibration thresholds of significance defined in Section 5.4 of this report, vibration produced by the Project will be less than significant. As a result, no vibration mitigation measures are recommended.

**Table 10-1 Vibration Analysis Results**

| Activity | Typical PPV at 25 ft (ips) | Distance to Nearest Structure (ft) | Distance to Vibration Limit for Fragile Buildings (ft) | Distance to "Barely Perceptible" Level (ft) |
|---|---|---|---|---|
| **Well Pad and Roadway Grading** | | | | |
| Dozer | 0.089 | 1,315 | 22 | 182 |
| Grader | 0.089 | 1,315 | 22 | 182 |
| Compactor | 0.21 | 1,315 | 49 | 398 |
| Water Truck | 0.076 | 1,315 | 19 | 158 |
| **Install Electrical Power Distribution** | | | | |
| Compactor | 0.21 | 1,600 | 49 | 398 |
| Backhoe/Loader | 0.089 | 1,600 | 22 | 182 |
| Boomtruck | 0.076 | 1,600 | 19 | 158 |
| **Install Electrical Power Distribution** | | | | |
| Boomtruck | 0.076 | 1,315 | 19 | 158 |
| Work Trucks | 0.076 | 1,315 | 19 | 158 |
| **Well Hook-ups** | | | | |
| Backhoe/Loader | 0.089 | 1,315 | 22 | 182 |
| Work Trucks | 0.076 | 1,315 | 19 | 158 |
| Crane | 0.031 | 1,315 | 9 | 70 |
| **Central Processing Facility Construction** | | | | |
| Crane | 0.031 | 1,550 | 9 | 70 |
| Compactor | 0.21 | 1,550 | 49 | 398 |
| Backhoe/Loader | 0.089 | 1,550 | 22 | 182 |
| Welding Truck | 0.076 | 1,550 | 19 | 158 |
| **Steam Generation Site Construction** | | | | |
| Welding Truck | 0.076 | 3,900 | 19 | 158 |
| Crane | 0.031 | 3,900 | 9 | 70 |
| Backhoe | 0.089 | 3,900 | 22 | 182 |
| Compactor | 0.21 | 3,900 | 49 | 398 |
| **Well Drilling** | | | | |
| Drilling Rig | 0.022 | 1,315 | 6 | 51 |

## 11. 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 NSR's. 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, 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 NSR.

With the noise mitigation 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 NSR's that don't already experience a significant impact during construction activities alone.

In an effort to avoid increasing the significant impact at NSR 3 during grading at WP16A and WP17A, the Project should incorporate the following mitigation measure:

**N-6** Avoid conducting concurrent grading operations at WP16A and drilling operations at WP17A.

# 12. Cumulative Impacts

During review of a cumulative project list compiled in February, 2014 four future projects were identified (Figure 12-1) within proximity to the Project site that could potentially cause a cumulative noise impact if combined with the noise impacts described in this study. Cumulative noise impacts are expected to be less than significant due to the following:

- Each project will be required to incorporate mitigation measures to meet County noise thresholds
- Due to the staggered timelines for each project, there is a low likelihood that project operations will occur on adjacent/nearby well pads simultaneously
- In some instances, steep topography would prevent noise from adjacent projects from creating a cumulative effect at the NSR's considered for the Project

**Table 12-1 Adjacent Cumulative Projects**

| Project Site | Location | Proposed Activity | Permit Status |
|---|---|---|---|
| ERG Resources, LLC - Pre-Application | North section of ECC property | 20 wells | Proposed |
| ERG Resources Fulgar Lease | Southwest of ECC property | 20 wells | Proposed |
| ERG Resources Gwinn Fee Lease | Southwest of ECC property | 4 wells | In Process |
| ERG Resources Los Alamos Fee | South/southwest of ECC property | No information available | In Process |

For the traffic noise analysis, projected future average daily traffic volumes including proposed projects were added to the Project-generated traffic. The traffic noise analysis is therefore already cumulative.

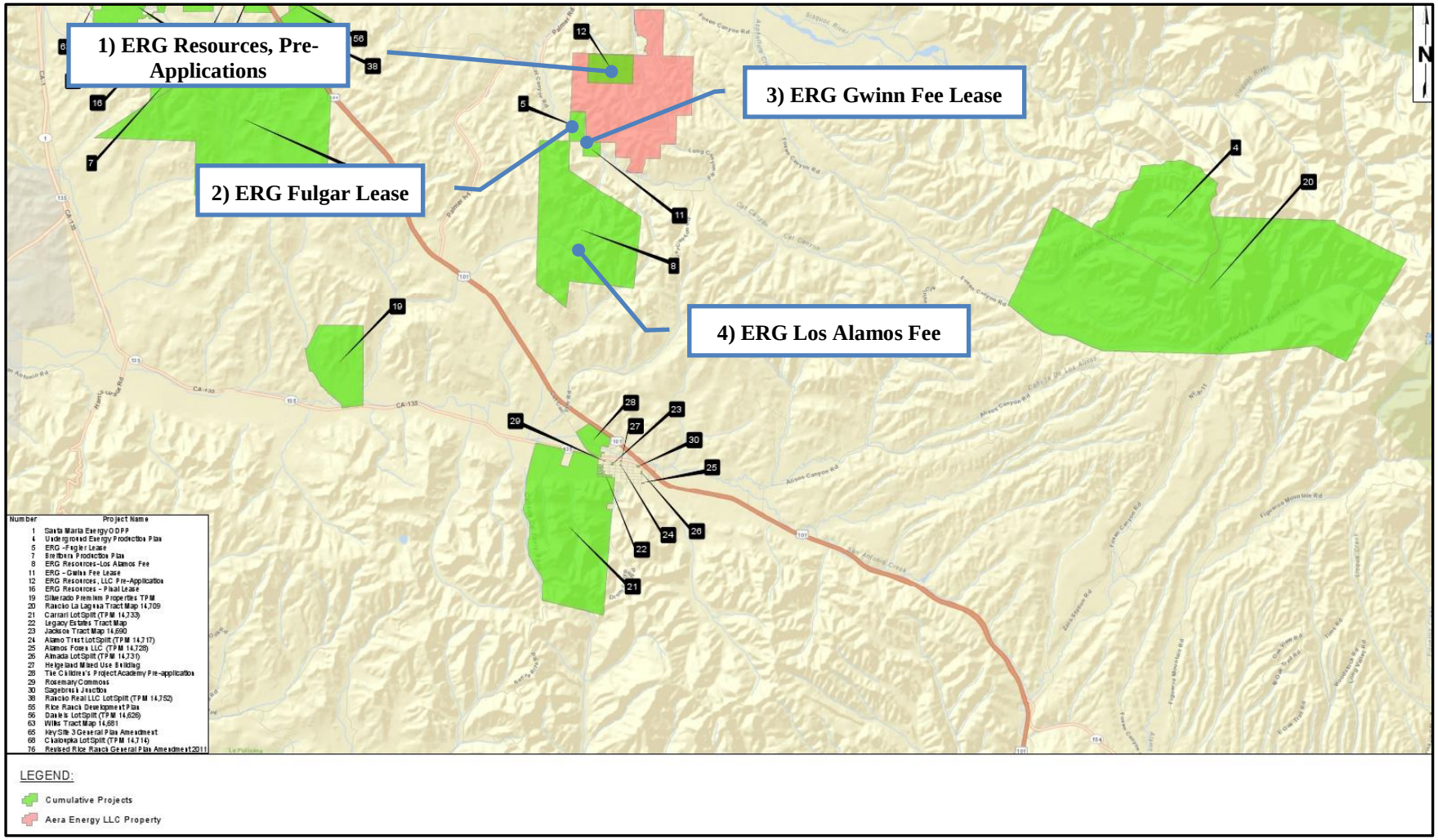


**Figure 12-1 Cumulative Project Map**
Source: Padre Associates, Inc., August 2014

## 13. References

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# Appendix I - Measured Ambient Sound Level Data

## Ambient Noise Measurement Summary

| | |
|---|---|
| **Measurement Location:** | Location 1 |
| **Location Description:** | Near intersection of East Cat Canyon Rd. and Long Canyon Rd. |
| **Project:** | East Cat Canyon Oil Field Redevelopment Project |
| **Start Time:** | 2:00 PM 2/11/2014 |
| **Run Time:** | 24 hrs |

**1-Hr Leq Sound Levels**

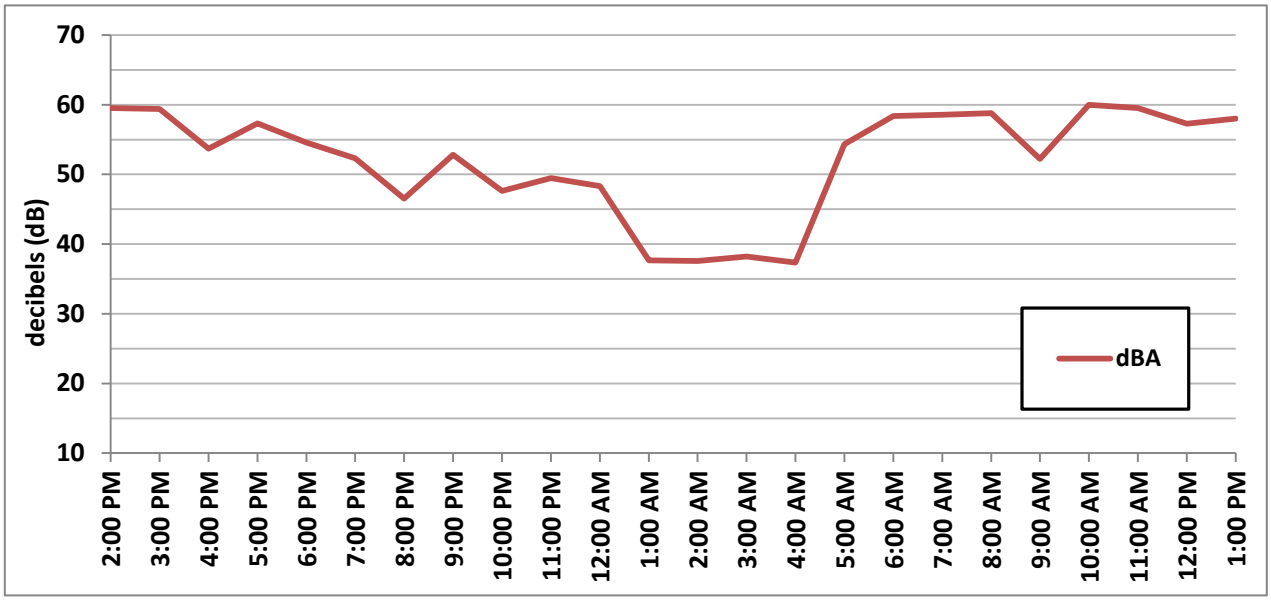
| Time | dBA | Time | dBA |
|---|---|---|---|
| 2:00 PM | 59.5 | 2:00 AM | 37.6 |
| 3:00 PM | 59.4 | 3:00 AM | 38.2 |
| 4:00 PM | 53.7 | 4:00 AM | 37.4 |
| 5:00 PM | 57.3 | 5:00 AM | 54.4 |
| 6:00 PM | 54.6 | 6:00 AM | 58.4 |
| 7:00 PM | 52.3 | 7:00 AM | 58.6 |
| 8:00 PM | 46.5 | 8:00 AM | 58.8 |
| 9:00 PM | 52.8 | 9:00 AM | 52.2 |
| 10:00 PM | 47.6 | 10:00 AM | 60.0 |
| 11:00 PM | 49.5 | 11:00 AM | 59.5 |
| 12:00 AM | 48.3 | 12:00 PM | 57.3 |
| 1:00 AM | 37.7 | 1:00 PM | 58.0 |

**Measurement Statistics**

| | | |
|---|---|---|
| **Daytime Leq:** | 57.4 | dBA |
| **Nighttime Leq:** | 51.4 | dBA |
| **24-Hr Leq:** | 55.8 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

| | | |
|---|---|---|
| **CNEL:** | 59.4 | dBA |



## Ambient Noise Measurement Summary

| | |
|---|---|
| **Measurement Location:** | Location 2 |
| **Location Description:** | On Cat Canyon Rd., south of site |
| **Project:** | East Cat Canyon Oil Field Redevelopment Project |
| **Start Time:** | 2:00 PM 2/11/2014 |
| **Run Time:** | 24 hrs |

**1-Hr Leq Sound Levels**

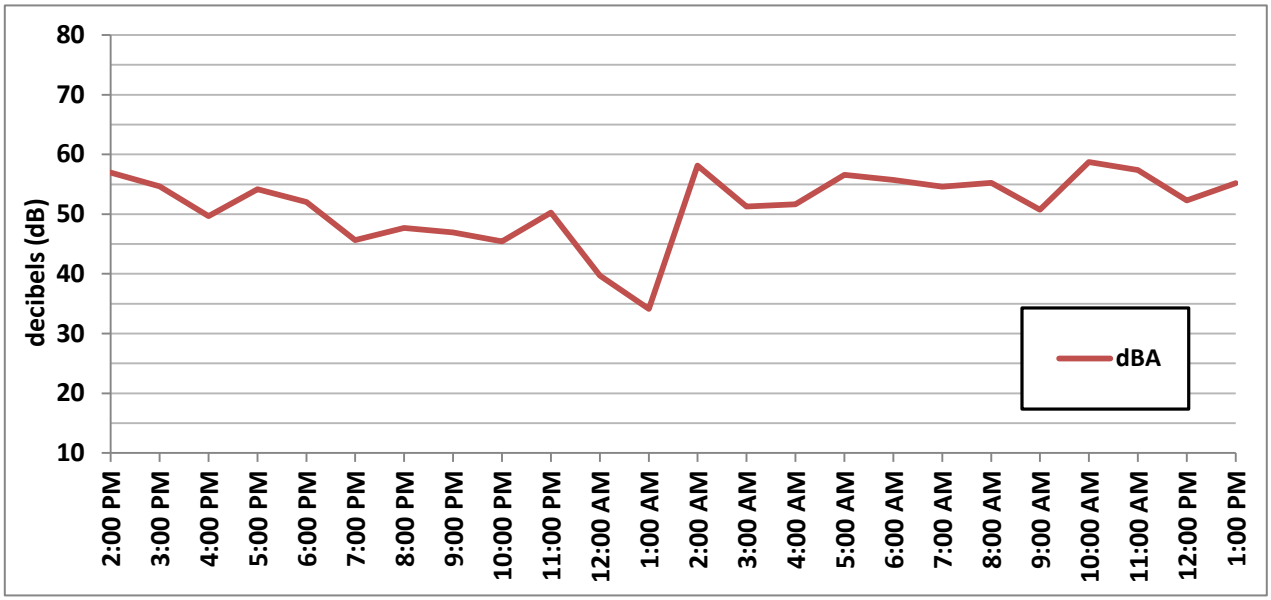
| Time | dBA | Time | dBA |
|---|---|---|---|
| 2:00 PM | 57.0 | 2:00 AM | 58.2 |
| 3:00 PM | 54.7 | 3:00 AM | 51.3 |
| 4:00 PM | 49.7 | 4:00 AM | 51.7 |
| 5:00 PM | 54.1 | 5:00 AM | 56.6 |
| 6:00 PM | 52.0 | 6:00 AM | 55.7 |
| 7:00 PM | 45.6 | 7:00 AM | 54.6 |
| 8:00 PM | 47.7 | 8:00 AM | 55.3 |
| 9:00 PM | 47.0 | 9:00 AM | 50.8 |
| 10:00 PM | 45.5 | 10:00 AM | 58.7 |
| 11:00 PM | 50.3 | 11:00 AM | 57.4 |
| 12:00 AM | 39.7 | 12:00 PM | 52.3 |
| 1:00 AM | 34.1 | 1:00 PM | 55.2 |

**Measurement Statistics**

| | | |
|---|---|---|
| **Daytime Leq:** | 54.5 | dBA |
| **Nighttime Leq:** | 52.9 | dBA |
| **24-Hr Leq:** | 53.9 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

| | | |
|---|---|---|
| **CNEL:** | 59.9 | dBA |



## Ambient Noise Measurement Summary

| | |
|---|---|
| **Measurement Location:** | Location 3 |
| **Location Description:** | On southeast property line |
| **Project:** | East Cat Canyon Oil Field Redevelopment Project |
| **Start Time:** | 2:00 PM 2/11/2014 |
| **Run Time:** | 24 hrs |

**1-Hr Leq Sound Levels**

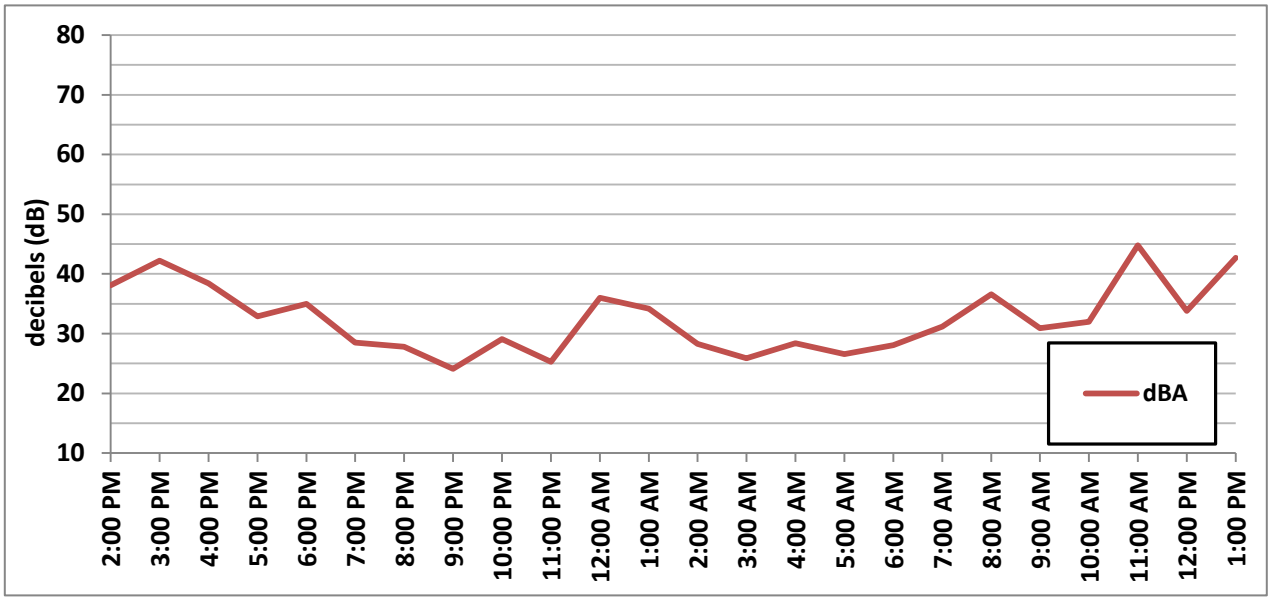
| Time | dBA | Time | dBA |
|---|---|---|---|
| 2:00 PM | 38.1 | 2:00 AM | 28.3 |
| 3:00 PM | 42.2 | 3:00 AM | 25.9 |
| 4:00 PM | 38.4 | 4:00 AM | 28.4 |
| 5:00 PM | 32.9 | 5:00 AM | 26.6 |
| 6:00 PM | 35.0 | 6:00 AM | 28.1 |
| 7:00 PM | 28.5 | 7:00 AM | 31.2 |
| 8:00 PM | 27.8 | 8:00 AM | 36.6 |
| 9:00 PM | 24.1 | 9:00 AM | 30.9 |
| 10:00 PM | 29.1 | 10:00 AM | 32.0 |
| 11:00 PM | 25.3 | 11:00 AM | 44.8 |
| 12:00 AM | 36.0 | 12:00 PM | 33.8 |
| 1:00 AM | 34.2 | 1:00 PM | 42.7 |

**Measurement Statistics**

| | | |
|---|---|---|
| **Daytime Leq:** | 38.4 | dBA |
| **Nighttime Leq:** | 30.4 | dBA |
| **24-Hr Leq:** | 36.5 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

| | | |
|---|---|---|
| **CNEL:** | 39.3 | dBA |



## Ambient Noise Measurement Summary

| | |
|---|---|
| **Measurement Location:** | Location 4 |
| **Location Description:** | Off Long Canyon Rd. near southeast property line |
| **Project:** | East Cat Canyon Oil Field Redevelopment Project |
| **Start Time:** | 12:00 PM 2/11/2014 |
| **Run Time:** | 24 hrs |

**1-Hr Leq Sound Levels**

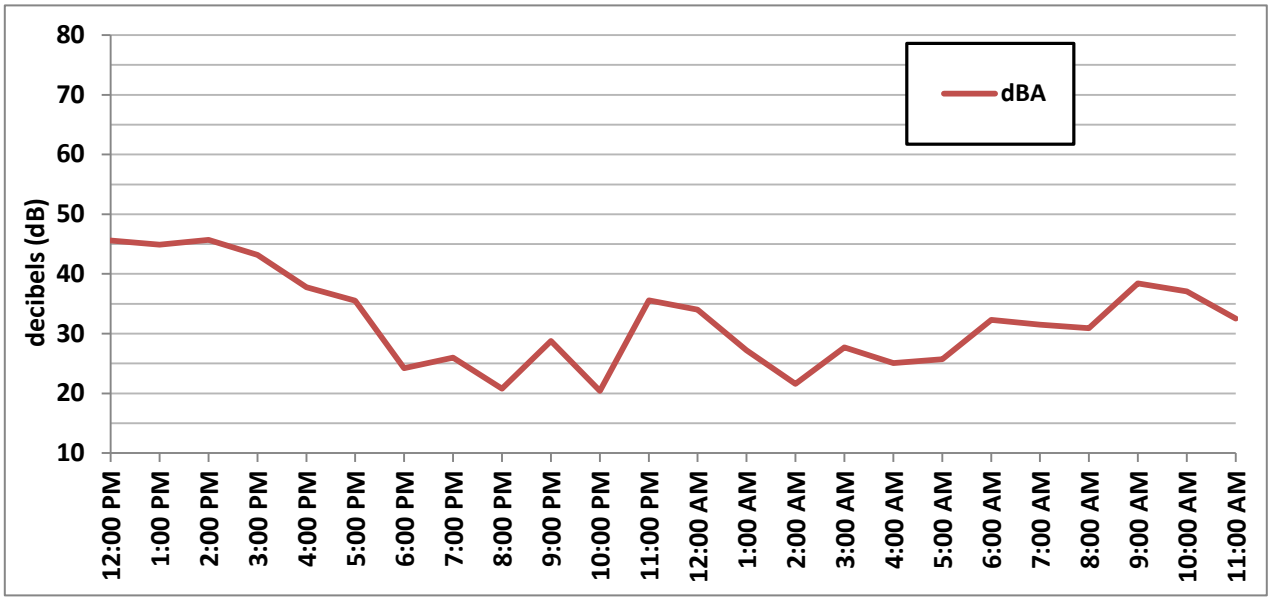
| Time | dBA | Time | dBA |
|---|---|---|---|
| 12:00 PM | 45.6 | 12:00 AM | 34.0 |
| 1:00 PM | 44.9 | 1:00 AM | 27.2 |
| 2:00 PM | 45.7 | 2:00 AM | 21.6 |
| 3:00 PM | 43.2 | 3:00 AM | 27.7 |
| 4:00 PM | 37.8 | 4:00 AM | 25.1 |
| 5:00 PM | 35.5 | 5:00 AM | 25.7 |
| 6:00 PM | 24.2 | 6:00 AM | 32.3 |
| 7:00 PM | 26.0 | 7:00 AM | 31.5 |
| 8:00 PM | 20.8 | 8:00 AM | 30.9 |
| 9:00 PM | 28.8 | 9:00 AM | 38.4 |
| 10:00 PM | 20.4 | 10:00 AM | 37.1 |
| 11:00 PM | 35.6 | 11:00 AM | 32.5 |

**Measurement Statistics**

| | | |
|---|---|---|
| **Daytime Leq:** | 40.4 | dBA |
| **Nighttime Leq:** | 30.3 | dBA |
| **24-Hr Leq:** | 38.3 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

| | | |
|---|---|---|
| **CNEL:** | 40.3 | dBA |



## Ambient Noise Measurement Summary

**Measurement Location:** Location 5
**Location Description:** Near Olivera Canyon Rd. on northern property line
**Project:** East Cat Canyon Oil Field Redevelopment Project
**Start Time:** 11:00 AM 2/11/2014
**Run Time:** 24 hrs

**1-Hr Leq Sound Levels**

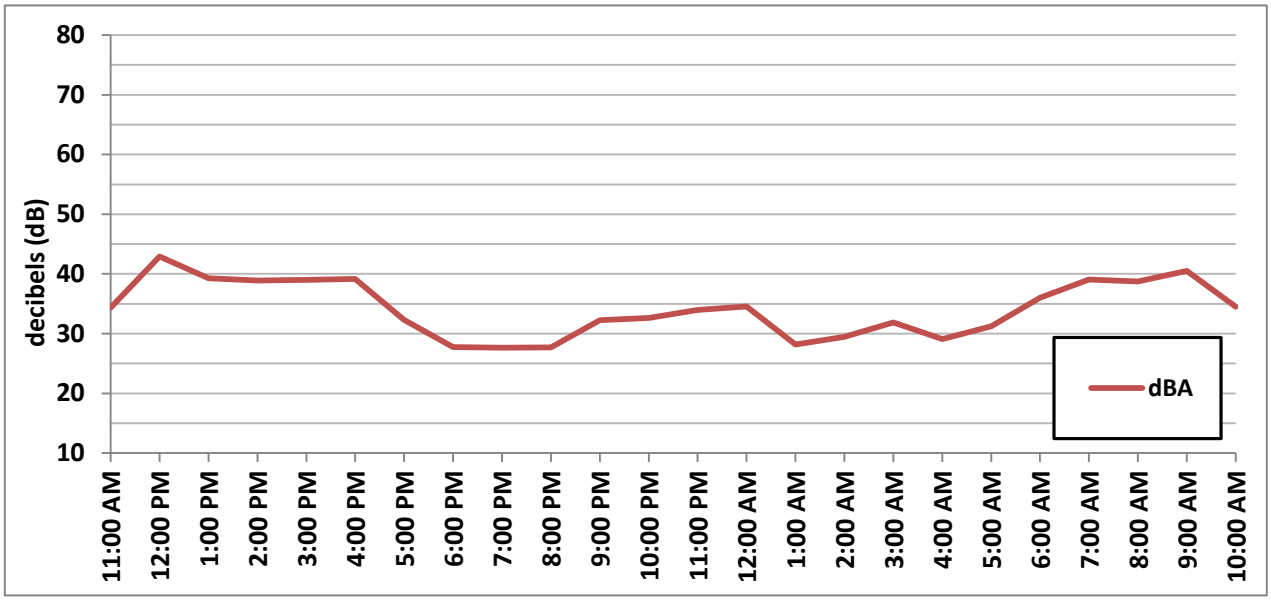
| Time | dBA | Time | dBA |
|---|---|---|---|
| 11:00 AM | 34.3 | 11:00 PM | 34.0 |
| 12:00 PM | 42.9 | 12:00 AM | 34.6 |
| 1:00 PM | 39.3 | 1:00 AM | 28.2 |
| 2:00 PM | 38.9 | 2:00 AM | 29.5 |
| 3:00 PM | 39.0 | 3:00 AM | 31.9 |
| 4:00 PM | 39.2 | 4:00 AM | 29.1 |
| 5:00 PM | 32.3 | 5:00 AM | 31.2 |
| 6:00 PM | 27.8 | 6:00 AM | 36.0 |
| 7:00 PM | 27.7 | 7:00 AM | 39.0 |
| 8:00 PM | 27.7 | 8:00 AM | 38.7 |
| 9:00 PM | 32.2 | 9:00 AM | 40.5 |
| 10:00 PM | 32.7 | 10:00 AM | 34.5 |

**Measurement Statistics**

| | | |
|---|---|---|
| **Daytime Leq:** | 38.0 | dBA |
| **Nighttime Leq:** | 32.6 | dBA |
| **24-Hr Leq:** | 36.4 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

| | | |
|---|---|---|
| **CNEL:** | 40.3 | dBA |



## Ambient Noise Measurement Summary

**Measurement Location:** Location 6
**Location Description:** West of Long Canyon Rd. on northern property line
**Project:** East Cat Canyon Oil Field Redevelopment Project
**Start Time:** 11:00 AM 2/11/2014
**Run Time:** 24 hrs

**1-Hr Leq Sound Levels**

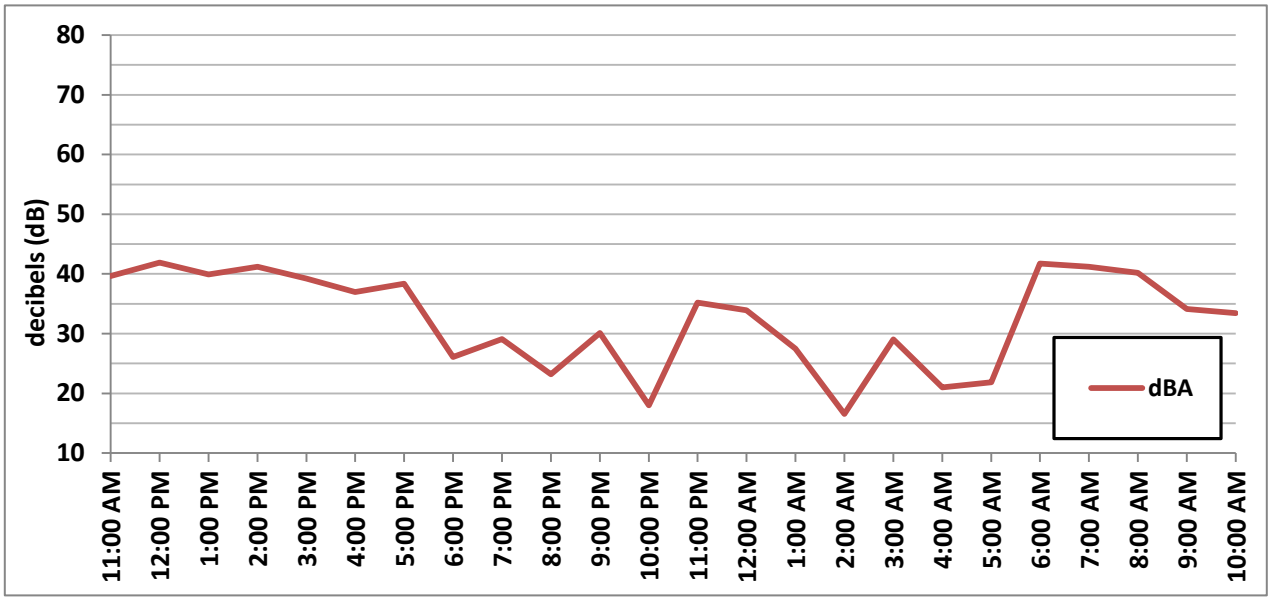
| Time | dBA | Time | dBA |
|---|---|---|---|
| 11:00 AM | 39.7 | 11:00 PM | 35.2 |
| 12:00 PM | 41.9 | 12:00 AM | 33.9 |
| 1:00 PM | 39.9 | 1:00 AM | 27.5 |
| 2:00 PM | 41.2 | 2:00 AM | 16.6 |
| 3:00 PM | 39.2 | 3:00 AM | 29.0 |
| 4:00 PM | 37.0 | 4:00 AM | 21.0 |
| 5:00 PM | 38.4 | 5:00 AM | 21.9 |
| 6:00 PM | 26.1 | 6:00 AM | 41.7 |
| 7:00 PM | 29.1 | 7:00 AM | 41.2 |
| 8:00 PM | 23.2 | 8:00 AM | 40.2 |
| 9:00 PM | 30.1 | 9:00 AM | 34.2 |
| 10:00 PM | 18.0 | 10:00 AM | 33.5 |

**Measurement Statistics**

| | | |
|---|---|---|
| **Daytime Leq:** | 38.4 | dBA |
| **Nighttime Leq:** | 33.7 | dBA |
| **24-Hr Leq:** | 37.0 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

| | | |
|---|---|---|
| **CNEL:** | 41.3 | dBA |



## Ambient Noise Measurement Summary

| | |
|---|---|
| **Measurement Location:** | Location 7 |
| **Location Description:** | On Cat Canyon Rd. |
| **Project:** | East Cat Canyon Oil Field Redevelopment Project |
| **Start Time:** | 3:00 PM 2/11/2014 |
| **Run Time:** | 24 hrs |

**1-Hr Leq Sound Levels**

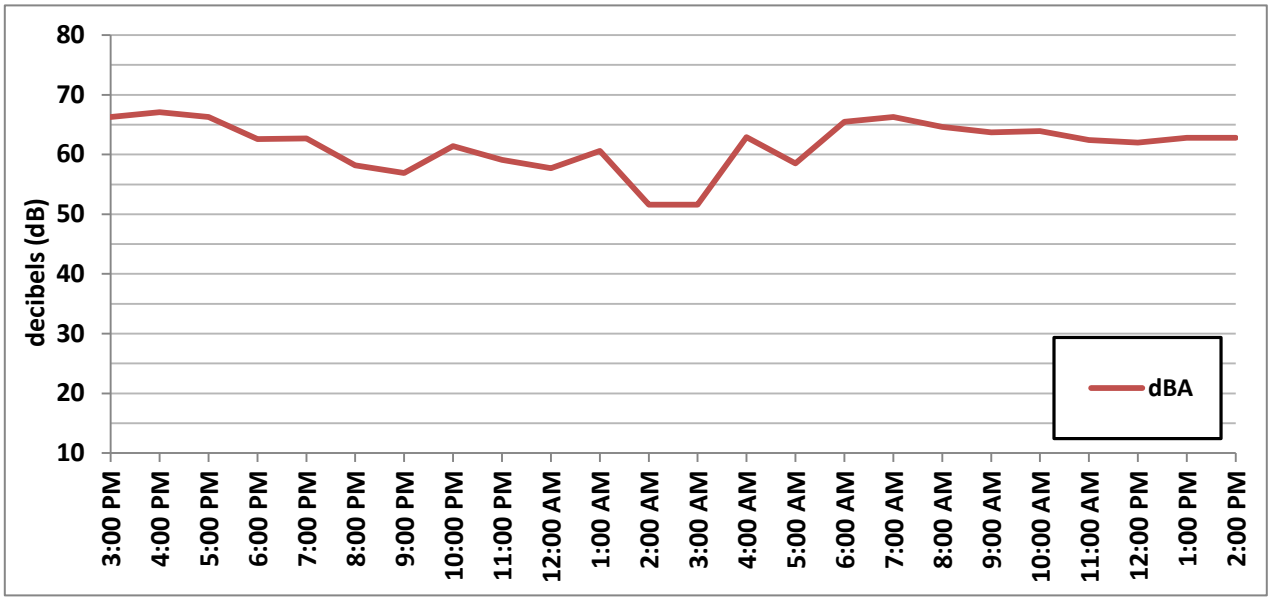
| Time | dBA | Time | dBA |
|---|---|---|---|
| 3:00 PM | 66.3 | 3:00 AM | 51.6 |
| 4:00 PM | 67.1 | 4:00 AM | 62.9 |
| 5:00 PM | 66.3 | 5:00 AM | 58.5 |
| 6:00 PM | 62.6 | 6:00 AM | 65.5 |
| 7:00 PM | 62.7 | 7:00 AM | 66.3 |
| 8:00 PM | 58.2 | 8:00 AM | 64.6 |
| 9:00 PM | 56.9 | 9:00 AM | 63.7 |
| 10:00 PM | 61.4 | 10:00 AM | 63.9 |
| 11:00 PM | 59.1 | 11:00 AM | 62.4 |
| 12:00 AM | 57.7 | 12:00 PM | 62.0 |
| 1:00 AM | 60.6 | 1:00 PM | 62.8 |
| 2:00 AM | 51.6 | 2:00 PM | 62.8 |

**Measurement Statistics**

| | | |
|---|---|---|
| **Daytime Leq:** | 64.2 | dBA |
| **Nighttime Leq:** | 60.4 | dBA |
| **24-Hr Leq:** | 63.0 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

| | | |
|---|---|---|
| **CNEL:** | 67.9 | dBA |



## Ambient Noise Measurement Summary

| | |
|---|---|
| **Measurement Location:** | Location 8 |
| **Location Description:** | On Dominion Rd. |
| **Project:** | East Cat Canyon Oil Field Redevelopment Project |
| **Start Time:** | 3:00 PM 2/11/2014 |
| **Run Time:** | 24 hrs |

**1-Hr Leq Sound Levels**

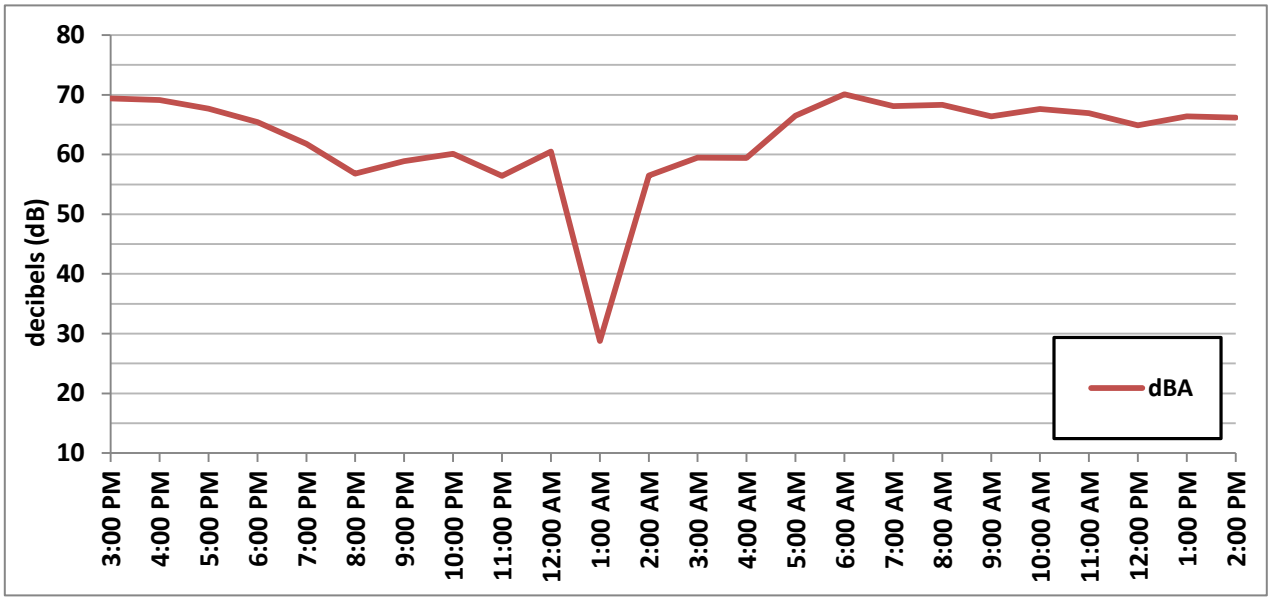
| Time | dBA | Time | dBA |
|---|---|---|---|
| 3:00 PM | 69.4 | 3:00 AM | 59.5 |
| 4:00 PM | 69.1 | 4:00 AM | 59.4 |
| 5:00 PM | 67.7 | 5:00 AM | 66.5 |
| 6:00 PM | 65.4 | 6:00 AM | 70.1 |
| 7:00 PM | 61.8 | 7:00 AM | 68.1 |
| 8:00 PM | 56.8 | 8:00 AM | 68.3 |
| 9:00 PM | 58.9 | 9:00 AM | 66.4 |
| 10:00 PM | 60.1 | 10:00 AM | 67.6 |
| 11:00 PM | 56.4 | 11:00 AM | 66.9 |
| 12:00 AM | 60.5 | 12:00 PM | 64.9 |
| 1:00 AM | 28.8 | 1:00 PM | 66.4 |
| 2:00 AM | 56.5 | 2:00 PM | 66.2 |

**Measurement Statistics**

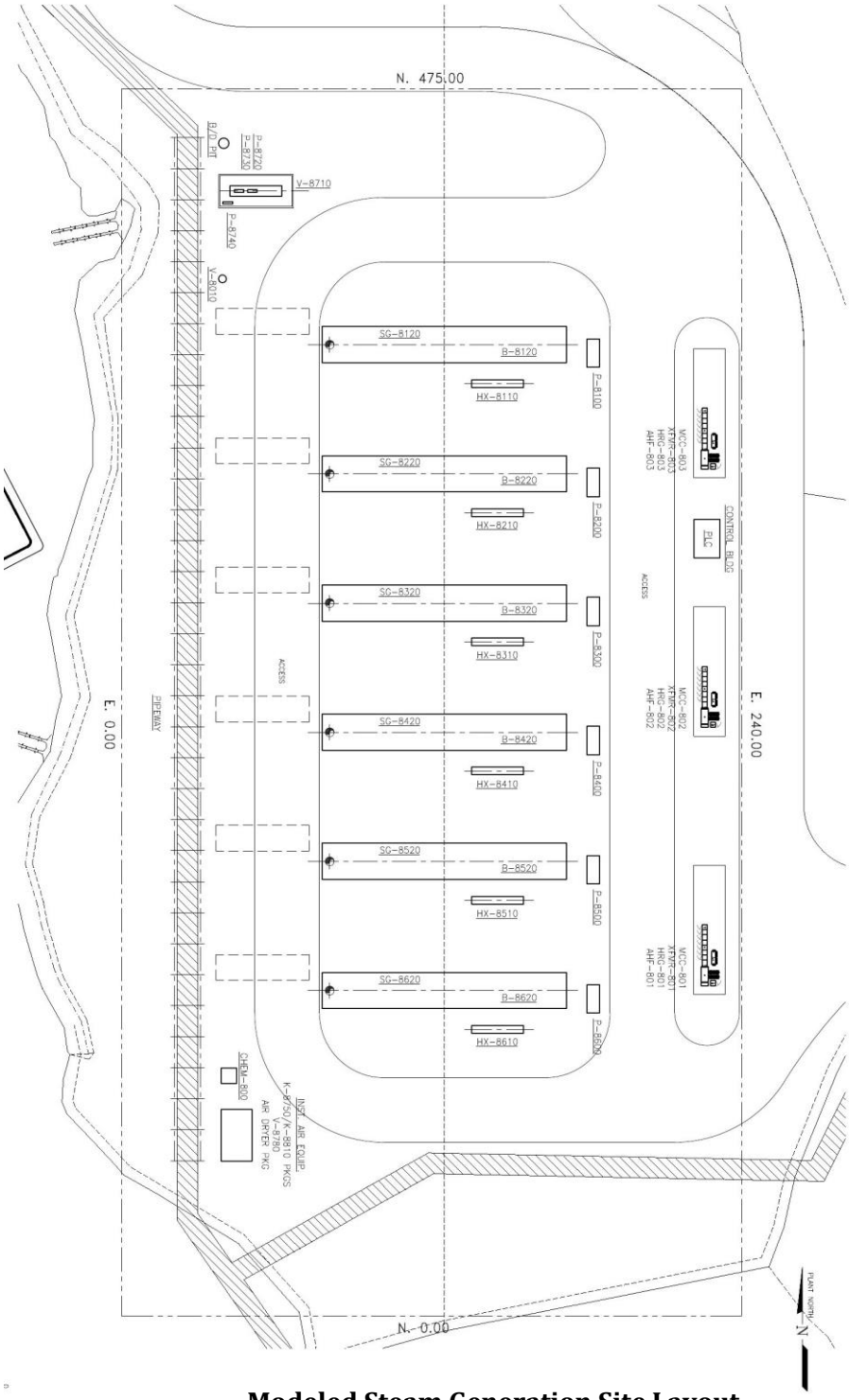
| | | |
|---|---|---|
| **Daytime Leq:** | 66.9 | dBA |
| **Nighttime Leq:** | 63.1 | dBA |
| **24-Hr Leq:** | 65.7 | dBA |

*Note: Daytime hours are from 7:00 AM to 9:00 PM

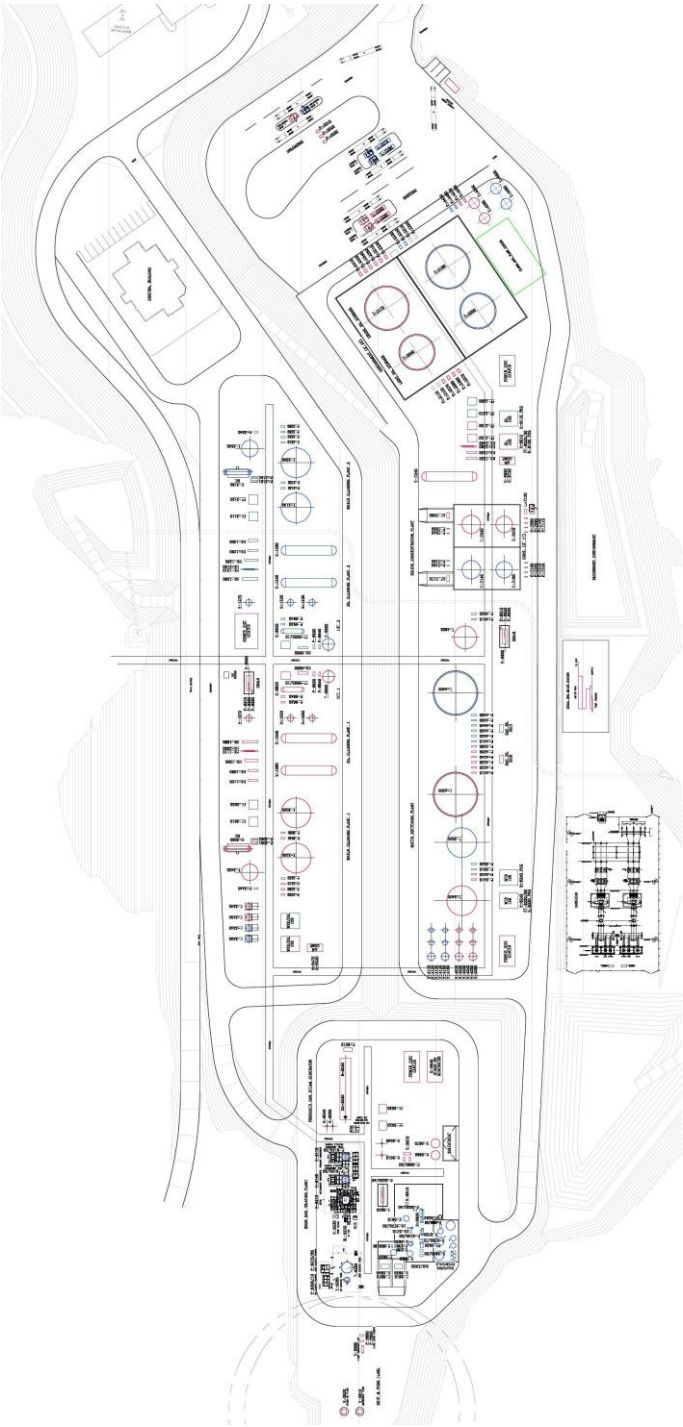
| | | |
|---|---|---|
| **CNEL:** | 70.5 | dBA |



# Appendix II – Production Modeling




**Modeled Steam Generation Site Layout**
Source: Padre Associates, Inc., August 2014



**Modeled Central Processing Facility Layout**
Source: Padre Associates, Inc., August 2014

# Appendix III - Traffic Data

**Modeled ADT**

| **Route A** | | | | |
|---|---|---|---|---|
| **Roadway Segment** | **Existing ADT** | **Existing + Project ADT** | **Cumulative** | **Cumulative + Project** |
| Clark Avenue e/o U.S. 101 | 5180 | 5712 | 5700 | 6232 |
| Clark Avenue e/o Telephone Road | 3000 | 3532 | 3300 | 3832 |
| Dominion Road s/o Clark Avenue | 1050 | 1582 | 1200 | 1732 |
| Cat Canyon Road s/o Palmer Road | 850 | 1382 | 950 | 1482 |

| **Route B** | | | | |
|---|---|---|---|---|
| **Roadway Segment** | **Existing ADT** | **Existing + Project ADT** | **Cumulative** | **Cumulative + Project** |
| Clark Avenue e/o U.S. 101 | 5180 | 5513 | 5700 | 6033 |
| Clark Avenue e/o Telephone Road | 3000 | 3532 | 3300 | 3832 |
| Dominion Road s/o Clark Avenue | 1050 | 1582 | 1200 | 1732 |
| Cat Canyon Road s/o Palmer Road | 850 | 1382 | 950 | 1482 |
| Betteravia Road e/o U.S. 101 | 10250 | 10449 | 11300 | 11499 |
| Telephone Road n/o Clark Avenue | 1400 | 1599 | 1550 | 1749 |

| **Route C** | | | | |
|---|---|---|---|---|
| **Roadway Segment** | **Existing ADT** | **Existing + Project ADT** | **Cumulative** | **Cumulative + Project** |
| Clark Avenue e/o U.S. 101 | 5180 | 5513 | 5700 | 6033 |
| Clark Avenue e/o Telephone Road | 3000 | 3333 | 3300 | 3633 |
| Dominion Road s/o Clark Avenue | 1050 | 1587 | 1200 | 1732 |
| Cat Canyon Road s/o Palmer Road | 850 | 1382 | 950 | 1482 |
| Betteravia Road e/o U.S. 101 | 10250 | 10449 | 11300 | 11499 |
| Betteravia Road e/o Telephone Road | 3700 | 3899 | 4100 | 4299 |
| Dominion Road n/o Clark Avenue | 950 | 1149 | 1050 | 1249 |

| **Route D** | | | | |
|---|---|---|---|---|
| **Roadway Segment** | **Existing ADT** | **Existing + Project ADT** | **Cumulative** | **Cumulative + Project** |
| Clark Avenue e/o U.S. 101 | 5180 | 5513 | 5700 | 6033 |
| Clark Avenue e/o Telephone Road | 3000 | 3333 | 3300 | 3633 |
| Dominion Road s/o Clark Avenue | 1050 | 1582 | 1200 | 1732 |
| Cat Canyon Road s/o Palmer Road | 850 | 1382 | 950 | 1482 |
| Betteravia Road e/o U.S. 101 | 10250 | 10449 | 11300 | 11499 |
| Betteravia Road e/o Telephone Road | 3700 | 3899 | 4100 | 4299 |
| Foxen Canyon Road e/o Dominion Road | 2900 | 3099 | 3200 | 3399 |
| Foxen Canyon Road s/o Orcutt Garey Road | 1750 | 1949 | 1950 | 2149 |
| Palmer Road n/o Cat Canyon Road | 400 | 599 | 450 | 649 |

**Assumed Existing 24-Hour Traffic Distribution**

| | Day | Eve | Night |
|---|---|---|---|
| **Automobiles** | 58.5 | 7.9 | 4.6 |
| **Medium Trucks** | 1.44 | 0.06 | 1.5 |
| **Heavy Trucks** | 13 | 5.1 | 7.5 |

**Assumed Peak Trip Generation Table from Traffic Study**

| Component | Number Per Day | Shift | Trip Generation | | | | |
|---|---|---|---|---|---|---|---|
| | | | | A.M. Peak | | P.M. Peak | |
| | | | ADT | In | Out | In | Out |
| **Employees – Operations** | | | | | | | |
| Aera 9/80 Employees(1) | 48 | 6:30 AM-4:15 PM | 144 | 0 | 0 | 0 | 48 |
| Aera 12H Employees(2) | 5 | 6:00 AM/PM-6:00 PM/AM | 15 | 0 | 0 | 0 | 0 |
| Contract 9/80 Employees(1) | 25 | 6:30 AM-4:15 PM | 75 | 0 | 0 | 0 | 25 |
| Contract 12H Employees(2) | 14 | 6:00 AM/PM-6:00 PM/AM | 42 | 0 | 0 | 0 | 0 |
| Subtotal | | | 276 | 0 | 0 | 0 | 73 |
| **Employees – Drilling** | | | | | | | |
| Aera 9/80 Employees(1) | 6 | 6:30 AM-4:15 PM | 18 | 0 | 0 | 0 | 6 |
| Contract 12H Employees(2) | 7 | 6:00 AM/PM-6:00 PM/AM | 21 | 0 | 0 | 0 | 0 |
| Subtotal | | | 39 | 0 | 0 | 0 | 6 |
| Bulk Material & Waste Deliveries(3) | 4 | NA | 8 | 0 | 1 | 1 | 0 |
| Miscellaneous Material Deliveries(3) | 5 | NA | 10 | 0 | 1 | 1 | 0 |
| Light Crude Oil Import/Produced Crude Oil Export(4) | 99.5 | NA | 199 | 4 | 4 | 4 | 4 |
| **Totals** | | | **532** | **4** | **6** | **6** | **83** |

(1) 9/80 workers. Shift starts at 6:30 A.M. and ends at 4:15 P.M. ADT assumes 50% of employee leave site for lunch break.
(2) 12-hour shift workers. Shifts = 6:00 A.M. to 6:00 P.M.; and 6:00 P.M. to 6:00 A.M. ADT assumes 50% of employees leave site for lunch break.
(3) Deliveries assumes one inbound + one outbound trip per delivery. A.M. and P.M. peak hour trip generation assumes 10% of trips during each peak hour.
(4) Light Crude Oil Import/Produced Crude Oil Export assumes one inbound + one outbound trip per truck. A.M. and P.M. peak hour trip generation assumes 4 trucks inbound and outbound per hour.

Source: Associated Transportation Engineers, February 2015

**Behrens and Associates, Inc.**
*Environmental Noise Control*

March 4, 2016

Padre Associates, Inc.
369 Pacific Street
San Luis Obispo, California 93401

Attention: Crystahl Taylor, Senior Project Manager

Subject: Effects of the proposed East Cat Canyon Oil Field Redevelopment Project equipment layout change on the reported noise impact

Dear Ms. Taylor:

Per your request, we have reviewed the documents provided by Padre Associates, Inc. regarding the proposed equipment layout changes for the Aera Energy (LLC) East Cat Canyon Oil Field Redevelopment Project (Project). The following analysis reviews the proposed changes in an effort to determine if the proposed changes in the equipment layout are significant enough to necessitate a revision of the noise impact analysis reported in the *East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report* (Behrens and Associates, Inc., February 5, 2015).

**Proposed Equipment Layout Changes**

The proposed layout changes include the relocation of equipment from the Central Processing Facility (CPF) to the Group Station and Steam Generator Site area (GS/SGS). The majority of the equipment being moved is non-noise emitting equipment (e.g., tanks, vessels) and low-noise emitting equipment (e.g., small pumps, small compressors). The significant noise emitting equipment being moved includes a 62.5 MMBTU/hr steam generator and an emergency flare from the CPF to the GS/SGS area.

In addition to the above equipment, the truck rack configuration at the CPF will change. Four loading racks will be shifted to the north end of the truck loading area. Also, two unloading racks will be merged with the loading rack skids.

It is noted that no new noise emitting equipment is being added to the Project as a result of the equipment layout changes. The layout change includes only the relocation of equipment that was previously assessed in the *East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report*. Additionally, there are no proposed changes to the grading plan that was utilized in the noise impact analysis provided in report.

For convenience, Figure 1 below shows a section of the Project area that is relevant to the proposed changes. The CPF and GS/SGS areas are marked on the map. Also, the nearest noise sensitive receiver (NSR 1) utilized in the noise impact report is marked on the map. The Project property line is shown in blue.

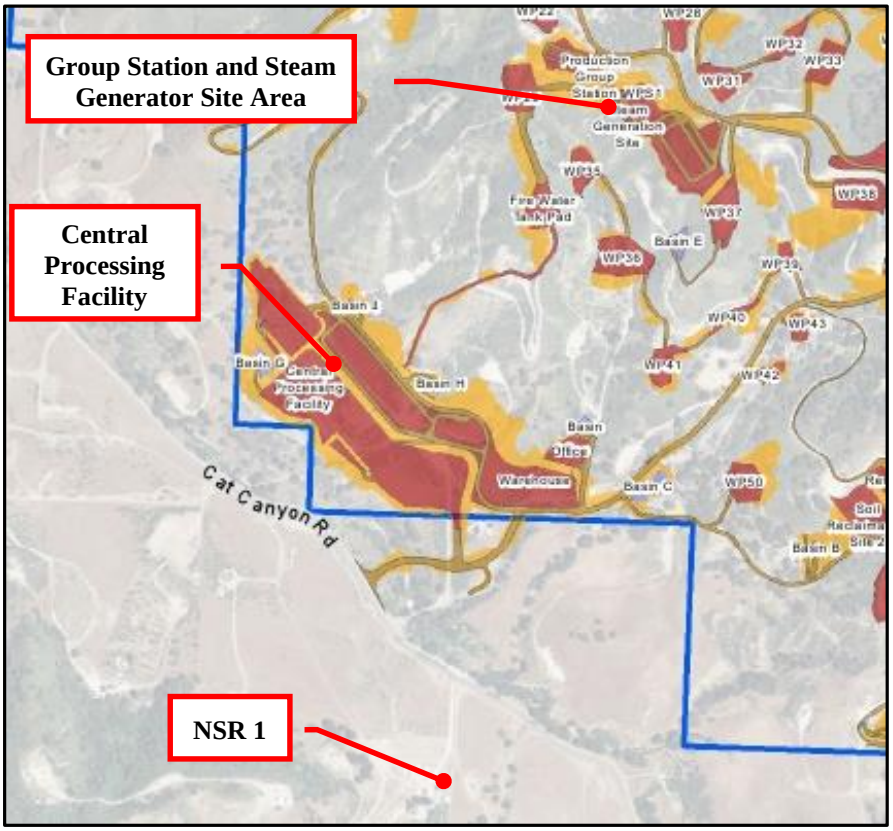



**Figure 1 Project CPF and GS/SGS Areas**
Source: Padre Associates, Inc., August 2014

## Effects of Equipment Layout Changes on Project Noise Impact

To assess the production noise impact of the Project, predicted production noise levels were compared to measured ambient noise levels as reported in the *East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report*. It was concluded that the predicted production noise levels would create a less than significant impact at the project property line and noise sensitive receivers.

As can be seen in Figure 1, relocating the equipment from the CPF to the GS/SGS area will increase the distance between the equipment in question and both the Project property line and NSR 1. Additionally, shifting the truck rack configurations to the north end of the truck loading area at the CPF will increase the distance between idling trucks and both the Project property line and NSR 1. As noise attenuation increases with distance, it follows that the noise impact of the equipment in question would decrease at the Project property line and at NSR 1.

Considering the equipment that will remain at the CPF, the predicted production noise levels reported in the *East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report* would either remain unchanged or slightly decrease due to the relocation of the equipment in question. As a result, the conclusion of a less than significant production noise impact at the property line and noise sensitive receivers will not be affected by the proposed equipment layout change.

**Conclusions**

The proposed equipment layout changes were reviewed and it was determined that the distance between the relocated equipment in question would increase in relation to both the Project property line and noise sensitive receivers resulting in a decrease in noise impact from the equipment. As a result, the conclusion reported in the *East Cat Canyon Oil Field Redevelopment Project Noise and Vibration Impact Analysis Report* of a less than significant production noise impact at the property line and noise sensitive receivers will not be affected by the proposed equipment layout change and further noise modeling and analysis of the Project production operations is not recommended.

Please contact me with any questions or comments.

Regards,

Jason Peetz
Senior Acoustic Consultant