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8.5 Noise

The project site is located in the unincorporated portion of Sacramento County. Generally, the controlling criterion in the design of the noise control features of the project is the minimum, or most stringent, noise level required by any of the applicable laws, ordinances, regulations, and standards (LORS). Noise impacts have been analyzed with respect to the County noise regulations and the California Energy Commission's (CEC) California Environmental Quality Act (CEQA) significance standard. The existing ambient noise levels are used as the baseline against which project noise impacts are assessed.

Section 8.5.1 presents the fundamentals of acoustics. A description of the LORS is provided in Section 8.5.2. The affected environment is described in Section 8.5.3, and environmental consequences (i.e., the project impacts from both construction and operation) are described in Section 8.5.4. Mitigation measures proposed to reduce potential impacts below the level of significance are provided in Section 8.5.5. The involved agencies and agency contacts are presented in Section 8.5.6. The permits and permitting schedule are discussed in Section 8.5.7. Section 8.5.8 lists the references used in preparation of this section.

8.5.1 Fundamentals of Acoustics

Acoustics is the study of sound and noise is defined as unwanted sound. Airborne sound is a rapid fluctuation or oscillation of air pressure above and below atmospheric pressure creating a sound wave. Acoustical terms used in this subsection are summarized in Table 8.5-1.

TABLE 8.5-1
Definitions of Acoustical Terms

Term	Definitions
Ambient Noise Level	The composite of noise from all sources near and far. The normal or existing level of environmental noise or sound at a given location.
Intrusive	Noise that intrudes over and above the existing ambient noise at a given location. The relative intrusiveness of a sound depends upon its amplitude, duration, frequency, time of occurrence, tonal content, the prevailing ambient noise level as well as the sensitivity of the receiver.
Decibel (dB)	A unit describing the amplitude of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure sound pressure, which is 20 micropascals (20 micronewtons per square meter).
A-Weighted Sound Level (dBA)	The sound level in decibels as measured on a sound level meter using the A-weighted filter network. The A-weighted filter de-emphasizes the very low and very high frequency components of the sound in a manner similar to the frequency response of the human ear and correlates well with subjective reactions to noise. All sound levels in this report are A-weighted.
Equivalent Noise Level (L_{eq})	The average A-weighted noise level, on an equal energy basis, during the measurement period.
Percentile Noise Level (Ln)	The noise level exceeded during n percent of the measurement period, where n is a number between 0 and 100 (e.g., L_{90}).
Day-Night Noise Level (Ldn or DNL)	The average A-weighted noise level during a 24-hour day, obtained after addition of 10 decibels from 10 p.m. to 7 a.m.

The most common metric is the overall A-weighted sound level measurement that has been adopted by regulatory bodies worldwide. The A-weighting network measures sound in a similar fashion to how a person perceives or hears sound, thus achieving good correlation in terms of how to evaluate acceptable and unacceptable sound levels. Other metrics include equivalent sound pressure level (L_{eq}), which is defined as the average noise level on an equal energy basis for a stated period of time, and statistical methods that capture the dynamics of a changing acoustical environment.

The L_{eq} is commonly used to measure steady state sound or noise that is usually dominant. Statistical measurements are typically denoted by L_n where "n" represents the percentile of time the sound level is exceeded. The L_{90} is a measurement that represents the noise level that is exceeded during 90 percent of the measurement period. Similarly, the L_{10} represents the noise level exceeded for 10 percent of the measurement period.

Another measure used in determining the impact of environmental noise is the difference in people's responses to daytime and nighttime noise levels. During the night, exterior background noise levels are generally lower than the daytime levels. However, most household noise also decreases at night and exterior noise becomes more noticeable. Furthermore, most people sleep at night and are sensitive to noise intrusion. To account for human sensitivity to nighttime noise levels, the Day-Night Sound Level (L_{dn} or DNL) was developed.

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

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

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

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

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

In most cases, environmental noise produces effects in the first two categories only. However, workers in industrial plants typically experience noise effects in the last category. No completely satisfactory way exists to measure the subjective effects of noise, or to measure the corresponding reactions of annoyance and dissatisfaction. This lack of a common standard is primarily due to the wide variation in individual thresholds of annoyance and habituation to noise. Thus, an important way of determining a person's subjective reaction to a new noise is by comparing it to the existing or "ambient" environment to which that person has adapted. In general, the more the level or the tonal (frequency) variations of a noise exceed the previously existing ambient noise level or tonal quality, the less acceptable the new noise will be, as judged by the exposed individual.

With regard to increases in A-weighted noise level, knowledge of the following relationships will be helpful in understanding this subsection:

- Except in carefully controlled laboratory experiments, the human ear cannot perceive a change of 1 dB.
- Outside the laboratory, a 3-dB change is considered a just-perceivable difference.
- A change in level of at least 5 dB is required before a change in community response would be expected.
- A 10-dB change is subjectively heard as approximately a doubling in loudness, and would generally cause an adverse community response.

Table 8.5-2 shows the relative A-weighted noise levels of common sounds measured in the environment and in industry for various sound levels.

TABLE 8.5-2
Typical Sound Levels Measured in the Environment and Industry

Noise Source At a Given Distance	A-Weighted Sound Level (dBA)	Noise Environments	Subjective Impression
Shotgun	140	Carrier flight deck	
Civil defense siren (100 ft)	130		
Jet Takeoff (200 ft)	120		Threshold of pain
Loud rock music	110	Rock music concert	
Pile driver (50 ft) Ambulance siren (100 ft)	100		Very loud
 Freight cars (50 ft)	90	Boiler room Printing press plant	
Pneumatic drill (50 ft) Freeway (100 ft)	80	Noisy restaurant	
Busy traffic; hair dryer	70		Moderately loud
Normal conversation (5 ft) Air conditioning unit (100 ft)	60	Data processing center Department store	
Light traffic (100 ft); rainfall Large transformer (200 ft)	50	Private business office	
Bird calls (distant)	40	Average living room library	Quiet

TABLE 8.5-2
Typical Sound Levels Measured in the Environment and Industry

Noise Source At a Given Distance	A-Weighted Sound Level (dBA)	Noise Environments	Subjective Impression
Soft whisper (5 ft); rustling leaves	30	Quiet bedroom	
	20	Recording studio	
Normal breathing	10		
	0-1		Threshold of hearing

Source: Peterson and Gross, 1974.

8.5.2 Laws, Ordinances, Regulations, and Standards

The following are the applicable regulations that apply to noise generated by CPP.

8.5.2.1 Federal

8.5.2.1.1 USEPA

The federal government has no standards or regulations applicable to off-site noise levels from the project. However, guidelines are available from the U.S. Environmental Protection Agency (USEPA 1974) to assist state and local government entities in development of state and local LORS for noise. The recommended level for protection against activity interference and annoyance at rural residences is a DNL of 55 A-Weighted Sound Level (dBA). This is equivalent to a continuous noise level of 49 dBA. The project noise level will comply with the USEPA guideline level at the nearest residence.

8.5.2.1.2 OSHA

On-site noise levels are regulated, in a sense, through the Occupational Health and Safety Act of 1970. The noise exposure level of workers is regulated at 90 dBA over an 8-hour work shift to protect hearing (29 Code of Federal Regulations [CFR] 1910.95). On-site noise levels will generally be in the 70- to 85-dBA range. Areas above 85 dBA will be posted as high noise level areas and hearing protection will be required. The power plant will implement a hearing conservation program for applicable employees and maintain exposure levels below 90 dBA.

8.5.2.2 State of California

8.5.2.2.1 Cal-OSHA

The California Department of Industrial Relations, Division of Occupational Safety and Health enforces California Occupational Safety and Health Administration (Cal-OSHA) regulations, which are the same as the federal OSHA regulations described previously. The regulations are contained in Title 8 California Code of Regulations (CCR), General Industrial Safety Orders, Article 105, Control of Noise Exposure, Sections 5095, et seq.

8.5.2.2.2 California Vehicle Code

Noise limits for highway vehicles are regulated under the California Vehicle Code, Sections 23130 and 23130.5. The limits are enforceable on the highways by the California Highway Patrol and the County Sheriff's Office.

8.5.2.2.3 Local

The California State Planning Law (California Government Code Section 65302) requires that all cities, counties, and entities (such as multi-city port authorities) prepare and adopt a general plan to guide community change. Both the local city and county general plans contain noise provisions.

Table 8.5-3 summarizes the applicable local noise regulations. The project site is located in the County of Sacramento. The most restrictive design standard applicable to CPP is the 45 dBA L50 residential standard set forth in the general plan.

TABLE 8.5-3
Summary of Applicable Local Noise Regulations, County of Sacramento

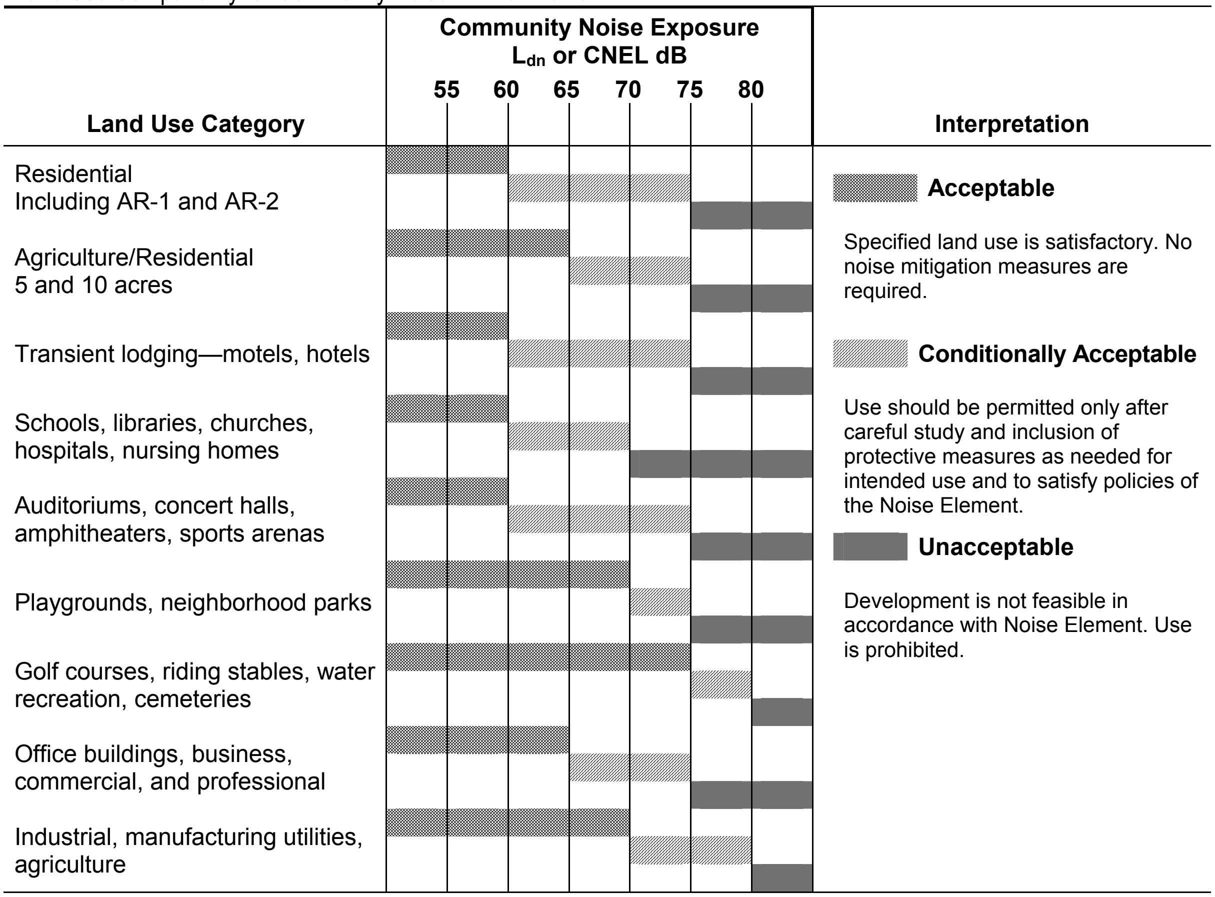
<table>
<tr><th>Regulatory Body</th><th colspan="3">General Standard</th></tr>
<tr><td rowspan="6">Noise Element
Sacramento County
General Plan
December 1993
(rev. 5/97)</td><td colspan="3">Policy NO-2: Noise levels shall not exceed the levels specified below at the property line of any affected residentially designated lands or residential land use situated in unincorporated areas.</td></tr>
<tr><td>Statistic</td><td>7 a.m. to 10 p.m.</td><td>10 p.m. to 7 a.m.</td></tr>
<tr><td>L50</td><td>50</td><td>45</td></tr>
<tr><td>Lmax</td><td>70</td><td>65</td></tr>
<tr><td colspan="3">The above levels shall be decreased by 5 dBA for simple tone noises, noises consisting primarily of speech or music, or for recurring impulsive noises. These levels do not apply to residential units established in conjunction with industrial or commercial uses (e.g., caretaker dwellings).</td></tr>
<tr><td colspan="3">Policy NO-3: Where noise sources are likely to produce noise levels exceeding the performance standards above at existing or planned residential uses, an acoustical analysis shall be required as part of the environmental review process so that noise mitigation may be included in the project design.</td></tr>
</table>

Source: County of Sacramento, 1993.

In addition to the above standards, the County has developed the following guidelines (Table 8.5-4) for Land Use Compatibility for Community Noise Environments. This table is to be used to determine the necessity for an acoustical study based on the exterior, premitigation noise exposure level. Any mitigation must achieve noise levels that are in compliance with the policies of the Noise Element.

A summary of these various LORS is presented in Table 8.5-5.

TABLE 8.5-4
Land Use Compatibility for Community Noise Environments



Noise Source: All noise except airport.
Source: County of Sacramento, 1993.

TABLE 8.5-5
Applicable Laws, Ordinances, Regulations, and Standards

LORS	Applicability	Conformance (Sec. No.)
Federal Off-site: USEPA	Guidelines for state and local governments.	Not Applicable
Federal On-site: OSHA	Exposure of workers over 8-hour shift limited to 90 dBA.	Section 8.5.2.1.2, 8.5.4.2.1 and 8.5.4.3.1. Also see Worker Safety section of AFC.
State On-site: Cal/OSHA 8 CCR Article 105 Sections 95 et seq.	Exposure of workers over 8-hour shift limited to 90 dBA.	Section 8.5.2.2.1, 8.5.4.2.1 and 8.5.4.3.1. Also see Worker Safety section of AFC.
State Off-site: Calif. Vehicle Code Sections 23130 and 23130.5	Regulates vehicle noise limits on California highways.	Delivery trucks and other vehicles will meet Code requirements.
Local California Government Code Section 65302	Requires local government to prepare plans that contain noise provisions.	County of Sacramento conforms (Section 8.5.2.2.3)
County of Sacramento General Plan	Establishes a nighttime 45 dBA L50 standard for residential uses.	Section 8.5.2.2.3

8.5.3 Affected Environment

The site (Figure 8.4-1) is located in southeastern Sacramento County on a 35-acre parcel approximately 1.75 miles east of the intersection of Twin Cities and Clay East roads. The site exists on District property. Within the vicinity of the project site, row crops and vineyards are cultivated, and a cattle stockyard operation is found. The site area is generally flat, but is surrounded by gently rolling terrain. The land-use designation for the site is Public/Quasi-Public with a resource conservation overlay.

The proposed project is part of 2,480 acres purchased by the District in the 1960s to establish Rancho Seco Plant. Over the years, other power generating sources have been established on the property. Approximately 40 acres is currently used for four photovoltaic farms that produce about 2.5 MW of electricity. According to Rancho Seco Plant documents produced in the 1960s, a portion of the site chosen for the current project was to be used for Rancho Seco Plant Unit 2. Therefore, power plant siting is consistent with past and present activities on the property.

A recreational area surrounds the manmade Rancho Seco Reservoir that was established for Rancho Seco Plant’s emergency water supply. Also included on the property are areas set aside for a wildlife refuge and a permanent conservation easement area used for mitigating sensitive habitat.

Noise-sensitive land uses closest to the site are primarily isolated residential buildings located in farmlands surrounding the site. The property line of the closest sensitive receptor is located approximately 200 feet southwest of the site. The nearest residence on this property is approximately 800 feet from the site.

Sources of environmental noise in the vicinity of the site primarily include vehicular traffic and noise associated with the Rancho Seco Plant.

8.5.3.1 Ambient Noise Survey Methodology

Measurements were made at one location (M1) along the southern property line of the proposed project. The precise positions are shown in Figure 8.5-1.

Continuous noise level measurements were conducted using two Bruel & Kjaer (B&K) Type 2236 integrating sound level meters equipped with B&K Type 4188 0.5-inch microphones. The 37-hour monitoring period encompassed two nights beginning at 6 p.m. on Wednesday, May 23 and ending at 7 p.m. on Friday, May 25, 2001. Noise level data were recorded in terms of 10-minute L_{eq}, L_{10}, and L_{90}.To ensure the accuracy of the measurements, the sound level meter was calibrated prior to use with a B&K Type 4231 acoustical calibrator. All equipment used in the survey complies with the requirements of the American National Standards Institute (ANSI) and the International Electrotechnical Commission (IEC) for Type 1 precision sound level measurement instrumentation. In all cases, the microphones were placed at a position of about 5 feet above local ground elevation using tripods.

Weather conditions during the noise measurement periods generally consisted of clear skies, warm temperatures, and a slight breeze.

8.5.3.2 Noise Survey Results

The nighttime (10 p.m. - 7 a.m.) average L_{90} was 41 and 37 dBA for the first and second nights, respectively; or 39 dBA average for both nights. Tables 8.5A-1 and 8.5A-2 and Figures 8.5A-1 and 8.5A-2 in Appendix 8.5A present the hourly values and 10-minute interval data.

8.5.4 Environmental Consequences

Noise will be produced at the site during both the construction and operation phases of the project. Potential noise impacts from both activities are assessed in this section.

8.5.4.1 Significance Criteria

8.5.4.1.1 CEQA

Appendix G of the California Environmental Quality Act (CEQA) Guidelines states that a project would normally be considered to have a significant noise impact if the project results in:

- Exposure of persons to, or generation of, noise levels in excess of standards established in the local general plan or noise ordinances or applicable standards of other agencies
- Exposure of persons to, or generation of, excessive ground-borne vibration or ground-borne 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

8.5.4.1.2 California Energy Commission

Although there are no regulatory limits set by the state of California or the county of Sacramento regarding an allowable increase in noise above background caused by industrial projects, the California Energy Commission has historically considered a 5-dBA increase over the nighttime L_{90} at the nearest sensitive receptor as a standard over which additional noise analysis is required to determine whether a significant adverse impact occurs. An increase of less than 5 dBA over the nighttime L_{90} at the nearest sensitive receptor would generally be presumed to result in no significant impact.

The 5-dBA threshold of significance is especially relevant in cases where the noise environment is already impacted, and any incremental noise level increase would result in an adverse effect. In some such instances, the noise environment already exceeds the standards set by local LORS, so that a new project cannot comply with the local LORS; in these cases a 5-dBA sound level increase provides a guideline for acceptable impacts where local LORS are already exceeded. For project sites that are located away from population centers and major transportation corridors, a 5-dBA sound level increase would likely occur over a large area given the existing quiet noise environment. However, an increase of more than 5-dBA in noise levels in a very quiet environment may not necessarily result in a significant adverse effect. This is because the overall background and project noise levels could still be low enough not to cause much annoyance. In such a case, the most restrictive absolute noise levels as established by the LORS would provide an appropriate means of determining impact significance.

The applicant believes that any potential CEQA impacts resulting from increased noise levels that are in compliance with the applicable local noise standards (as is the case for this project) were approved by the local jurisdictions when the site was zoned public/quasi-public for the Rancho Seco Plant. Furthermore, the historical use and purpose of the site is the generation of power.

8.5.4.1.3 Applicable Laws, Ordinances, Regulations and Standards

A detailed description of the applicable LORS can be found in Section 8.5.2. The following is a brief summary of the guidelines used to assess the potential impacts from CPP.

The most restrictive local design standard applicable to CPP is the 45 dBA L_{50} nighttime residential standard set forth in the County's General Plan. The closest residential receptor, R1, lies approximately 800 feet from the southwest corner of the project site.

8.5.4.2 Construction Impacts

This section addresses the various components of construction noise and vibration. General impacts from linear facilities are briefly discussed.

8.5.4.2.1 Worker Exposure to Noise

Worker exposure levels during construction of CPP will vary depending on the phase of the project and the proximity of the workers to the noise-generating activities. Hearing protection will be available for workers and visitors to use as needed throughout the duration of the construction period. A hearing protection plan, which complies with Cal-OSHA requirements, will be incorporated into the Health and Safety Plan for both the plant site and the linear facilities.

8.5.4.2.2 Plant Construction Noise

Construction of CPP is expected to be typical of other power plants in terms of schedule, equipment used, and other types of activities. The noise level will vary during the construction period, depending upon the construction phase. Construction of power plants can generally be divided into five phases that use different types of construction equipment. The five phases are: 1) site preparation and excavation; 2) concrete pouring; 3) steel erection; 4) mechanical; and 5) clean-up (Miller et al., 1978). The typical high-pressure steam blow activity is generally assessed separately because of the high noise levels and potential for short-term significant noise impacts.

Both the USEPA Office of Noise Abatement and Control and the Empire State Electric Energy Research Company have extensively studied noise from individual pieces of construction equipment as well as from construction sites of power plants and other types of facilities (USEPA, 1971; Barnes et al., 1976). Since specific information on types, quantities, and operating schedules of construction equipment is not available at this point in project development, information from these documents for similarly sized industrial projects will be used. Use of this data, which is between 21 and 26 years old, is conservative since the evolution of construction equipment has been toward quieter designs as the country becomes more urbanized and the population becomes more aware of the adverse effects of noise.

The loudest equipment types generally operating at a site during each phase of construction are presented in Table 8.5-6. The long term composite average or equivalent site noise level, representing noise from all equipment, is also presented in the table for each phase. The composite levels are sometimes lower than the individual levels since the loudest pieces of equipment will not be operating continuously throughout the construction phase.

TABLE 8.5-6
Construction Equipment and Composite Site Noise Levels

Construction Phase	Loudest Construction Equipment	Equipment Noise Level (dBA) at 50 feet	Composite Site Noise Level (dBA) at 50 feet
Site Clearing and Excavation	Dump Truck Backhoe	91 85	89
Concrete Pouring	Truck Concrete Mixer	91 85	85
Steel Erection	Derrick Crane Jack Hammer	88 88	89
Mechanical	Derrick Crane Pneumatic Tools	88 86	84
Cleanup	Rock Drill Truck	98 91	79

Source: USEPA, 1971; Barnes et al., 1976.

Average or equivalent construction noise levels projected to the nearest residences from the site are presented in Table 8.5-7. These results only take into account the divergence of the sound waves in open air. Average noise levels during the construction activities are projected to be between 54 dBA and 65 dBA at the nearest home south of Clay East Road. The construction noise will be audible and will exceed current exposure levels at this location. However, the noisiest construction activities will be confined to the daytime hours.

TABLE 8.5-7
Average Construction Noise Levels at Various Receptors (dBA)

Construction Phase	R1 (Nearest Home on Clay East Rd. @ 800 feet)	R2 (Closest Home on Kirkwood St. @ 5,100 feet)
Site clearing and excavation	65	49
Concrete pouring	61	45
Steel erection	65	49
Mechanical	60	44
Clean-up	55	39

Table 8.5-8 summarizes noise levels from individual pieces of construction equipment.

TABLE 8.5-8
Noise Levels from Common Construction Equipment and Resultant Receptor Noise Levels (dBA)

Construction Equipment	Typical Sound Pressure Level at 50 feet	Expected Sound Pressure Level at R1 (800 feet)	Expected Sound Pressure Level at R2 (5,100 feet)
Unsilenced steam blow (4-8” Line)	129	105	89
Silenced steam blow (4-8” Line)	89	65	49
Unsilenced air blow (4-8” Line)	125	101	85
Pile drivers (20,000-32,000 ft-lbs./blow)	104	80	64
Dozer (250-700 hp)	88	64	48
Front end loader (6-15 cu. yds.)	88	64	48
Trucks (200-400 hp)	86	62	46
Grader (13-16 ft. blade)	85	61	45
Shovels (2-5 cu. yds.)	84	60	44
Portable generators (50-200 kW)	84	60	44
Derrick crane (11-20 tons)	83	59	43
Mobile crane (11-20 tons)	83	59	43
Concrete pumps (30-150 cu. yds.)	81	57	41
Tractor (3/4 to 2 cu. yds.)	80	56	40
Unquieted paving breaker	80	56	40
Quieted paving breaker	73	49	33

Unsilenced steam blows would greatly exceed current noise levels; consequently, a temporary blowout silencer, such as a Fluid Kinetics Model TBS 16-AC, or similar, will be used. Such a silencer has an overall noise reduction of 40 to 45 dBA and would reduce the estimated steam blow noise level at the closest residence southwest of the site (R1) to 60-65 dBA, putting it in the same category as normal conversation sound levels (refer to Table 8.5-2). Low-pressure steam blow techniques are also being evaluated. Since it is common practice to only carry out these blows during the day, silenced blows should produce no significant disturbance.

Pile driving is not currently anticipated but if necessary would likely impact the closest residence (R1). Small blows or sonic piling would reduce the impacts and as with all noisy construction activities pile driving would be limited to daytime hours.

Noise generated during the testing and commissioning phase of the project is not expected to be substantially different from that produced during normal full load operation. Starts and abrupt stops are more frequent during this period, but on the whole they are usually short-lived. The steam releases associated with these starts and stops should not be problematic since they will be vented through permanent vent silencers.

8.5.4.2.3 Construction Vibration

Construction vibrations can be divided into three classes, based on the wave form and its source:

- Wave form: Impact — Example source: impact pile driver or blasting
- Wave form: Steady state — Example source: vibratory pile driver
- Wave form: Pseudo steady state — Example source: double acting pile hammer

While pile driving is not expected on this project, the pile driver imparts a relatively limited energy to the surrounding soil and this activity would occur at a significant distance from neighborhood structures and facilities. Therefore, it is not expected that there will be any significant vibration effect during construction of the proposed project.

8.5.4.2.4 Horizontal Directional Drilling

Construction of portions of the gas line will require the use of horizontal directional drilling (HDD) to avoid wetlands or other land features. Unlike typical construction noises, HDD requires that the drilling continue 24 hours/day until the operation is completed. Most of the HDD required for the gas line will take place in areas of no, or sparse, habitation.

8.5.4.3 Operational Impacts

This section describes the expected noise impacts from operation of the plant.

8.5.4.3.1 Worker Exposure to Operational Noise

During operations, in addition to far-field noise limits, nearly all components will also be specified with near-field maximum noise levels of 90 dBA at 3 feet (or 85 dBA at 3 feet where available as a vendor standard). Since there are no permanent or semi-permanent workstations located near any piece of noisy plant equipment, no worker's time-weighted average exposure to noise should approach the level allowable under OSHA guidelines. Nevertheless, signs requiring the use of hearing protection devices will be posted in all areas where noise levels commonly exceed 85 dBA, such as inside acoustical enclosures. Outdoor levels throughout the plant will typically range from 90 dBA near certain equipment to roughly 65 dBA in areas more distant from any major noise source.

8.5.4.3.2 Transmission Line and Switchyard Noise Levels

The electrical output of the plant will be connected to the existing Rancho Seco Plant switchyard via a 230-kV transmission line about 0.4 mile long. The line will be located within District property, and will parallel an existing 230-kV double circuit transmission line. The project will not require the construction of new transmission line near residential properties. Consequently, no impact is expected from either the construction or the operation of the electrical transmission line. Also, the low-frequency hum emitted by the switchyard will be inaudible at all of the receptors because of the relatively large intervening distances.

8.5.4.3.3 Plant Operation Noise Levels

A noise model of the proposed CPP facility has been developed using source input levels derived from manufacturers' data and field surveys of similar equipment. The noise emission contours from the plant have been calculated and mapped over the site and the surrounding areas as shown in Figure 8.5-2. The noise levels presented represent the anticipated steady-state level from the plant with essentially all equipment operating.

Since pressurized systems requiring safety relief valves operate infrequently, their emissions are not included in the noise model. At times, process-related intermittent (but relatively long duration) venting of process gasses (e.g., steam) may occur. A silencer would be used during this venting process to reduce noise levels below significant levels.

The model divides the proposed facility into a list of individual point noise sources representing each piece of equipment that produces a significant amount of noise. The sound power levels representing the standard performance of each of these components are assigned based either on first-hand field measurements of similar equipment made at other existing plants, or on data supplied by manufacturers. Using these standard power levels as a basis, the model calculates the sound pressure level that would occur at each receptor from each source after losses from distance, air absorption, blockages, etc. are considered. The sum of all these individual levels is the total plant level at the modeling point. The sound propagation factors used in the model have been adopted from the *Electric Power Plant Environmental Noise Guide* published by the Edison Electric Institute (Miller et al., 1978), and ISO 9613-2 *Acoustics - Sound Attenuation During Propagation Outdoors*. Values for internal blockage between sources within the proposed and existing plant and the buildings within the facilities have been included conservatively.

The following design measures were included in the project design to minimize the potential noise impacts from the project.

- Combustion turbines enclosed in an acoustical enclosure designed to limit near field noise levels to 85 dBA at 3 feet.
- Silencers on relief valve stacks. Total Enclosed Water/Air Cooled (TEWAC) motors on circulation water pumps to reduce motor noise.
- Design of major components to limit near field maximum noise levels to less than 90 dBA at 3 feet (or 85 dBA at 3 feet where available as a vendor standard).
- Location of cooling towers on east side of site, farthest from nearby receptors.

In general, the initial baseline power levels used are representative of the normal in-situ performance of standard equipment; i.e., equipment that has not been upgraded or specially improved to reduce noise. Only noise abatement measures that are always supplied as a part of the standard system are assumed to be present. Examples would be combustion turbine inlet silencers, turbine weather enclosures, etc.

The conversion from the sound power level of a given source to the sound pressure level it produces at what is normally a considerable distance away involves the consideration of a number of processes and phenomena. The following loss factors are calculated or conservatively estimated in the model.

Distance Loss

For sources that radiate more or less uniformly in all directions, hemispherical wave front spreading is assumed. For sources that are planar in nature, like the sides of large buildings or boilers, noise is assumed to radiate outward over a quarter-spherical surface. Beyond the immediate near field of the source the reduction in sound level, or acoustic energy, is inversely proportional to the square of the wave-front surface area. The only variable in the equation is the radius of the sphere or the distance from the piece of equipment to the receptor location of interest. This distance is calculated using the actual location of the component within the plant relative to the receptor point.

Internal Mutual Shielding Within the Plant and Directivity

There are many instances when one plant component is significantly blocked by another structure within the plant with respect to a particular receptor direction. As an example, the main transformers are typically open and free to radiate noise on three sides, but the fourth side is always completely obstructed by a large masonry firewall. A significant loss, on the order of 18 to 20 dBA, would be assigned to such a transformer if the receptor direction of interest were behind the unit, or on the firewall side. Almost all components are blocked in some way by other equipment.

In addition to directionally dependent blockage, many sources in the plant are directional in nature (i.e., they radiate noise more strongly in some directions than in others). A one-sided, front-facing combustion turbine inlet is a good example. The noise emissions are at a maximum directly off the front of such an inlet but diminish with lateral angle. Behind the filter house inlet, noise can essentially be neglected. Loss factors based on direction are also conservatively estimated for each source where this situation clearly exists.

Minor Losses

The reduction in noise level for a typical hemispherically radiating noise source at a distance of 1,000 feet is 57 dBA. The losses from all other factors combined, neglecting any internal blockage within the plant, at this distance would normally amount to no more than 5 dBA. Consequently, these losses are considered “minor” relative to the noise reduction that occurs with distance. The minor losses considered in the model are ground absorption, air absorption, and “anomalous” attenuation. A temperature of 60 degrees Fahrenheit (°F)and a relative humidity of 50 percent were assumed for calculation of air absorption effects.

Table 8.5-9 summarizes the expected plant noise levels in dBA at two receptor locations representing the closest noise-sensitive receptors in the project vicinity.

TABLE 8.5-9
Predicted Plant Noise Levels (dBA) at Nearby Receptors

Receptor	Location Description	Plant Noise Level (dBA)
R1	Closest residential structure south of site	56
R2	Nearest home on Kirkwood Street	42

Source: CH2M HILL.

Comparison of predicted plant noise levels to typical sound levels shown in Table 8.5-2 reveals that the plant noise levels at R2 would be near the quiet range. Furthermore, the predicted plant level of 42 dBA complies with the General Plan requirement of 45 dBA and would not exceed the current nighttime ambient L_{90} (37 or 41 dBA) by more than 5 dBA. Therefore, the noise impacts at R2 are not significant.

At the nearest residential location (R1), noise impacts are significant because the noise levels exceed the General Plan requirements of 45 dBA.

8.5.4.3.4 Tonal Noise

Field measurements of comparable combined-cycle plants have shown that the frequency spectrum produced by this type of plant is broad-band in nature and generally lacking in any prominent or identifiable tones, which are commonly sources of community disturbance. Special attention will be given to sources that do tend to be tonal in nature, such as the combustion turbine inlets, to ensure that any tones are sufficiently attenuated.

8.5.4.3.5 Ground and Airborne Vibration

Ground and airborne induced vibration from operation of the proposed project will not affect the local area. The proposed project is primarily driven by gas turbines exhausting into a heat recovery steam generator (HRSG), which is contiguous with a selective catalytic reduction (SCR) unit. These very large ducts greatly reduce low frequency noise, which is mainly the source of airborne induced vibration of structures.

The equipment that would be used in the proposed project is well balanced and is designed to produce very low vibration levels throughout the life of the proposed project. An imbalance could contribute to ground vibration levels in the vicinity of the equipment. However, vibration-monitoring systems installed in the equipment are designed to ensure that the equipment remains balanced. Should an imbalance occur, the event would be detected and the machines would automatically shut down.

8.5.4.3.6 Structural Vibration Induced by Airborne Noise Emissions

Gas turbines in simple-cycle operation commonly produce airborne low frequency noise emissions that are capable of inducing perceptible vibration in nearby structures with lightweight frame construction. The CPP will be a combined-cycle operation. Gas turbines that exhaust into HRSGs (combined cycle), on the other hand, rarely, if ever, cause this type of problem. The expansion of the combustion turbine exhaust gases inside the relatively large cavity of the HRSG and the subsequent contraction in the exhaust stack act to dissipate acoustic energy. The ability of HRSGs to attenuate turbine exhaust noise, even when no specific silencing measures are incorporated into the design, is a well-established phenomenon. The HRSG ducting and SCR unit are anticipated to eliminate any structural vibration induced by airborne noise in a similar manner.

8.5.5 Mitigation Measures

The Applicant will provide additional sound attenuation at receptors where post-project sound levels would exceed 5 dBA above the nighttime ambient levels (i.e., R1) and residents complain of disturbance from increased noise due to the generating facility. The sound attenuation program would provide residents wishing to participate in the program with upgrades to their residences to reduce the noise levels. The specific upgrades would be specific to each participant of the sound attenuation program. However, the program could include some or all of the following upgrades to the participant's residences: replacement of single-pane windows with dual-pane windows; upgrade hollow-core exterior with solid-core doors; and provide additional sound insulation in walls. Based on actual post-project sound level readings, residents who are within an area that experiences noise level increases of 5 dBA or greater as a result of the project, would be eligible for the sound attenuation program. Residents could participate in the sound attenuation program by filing an affidavit with the project owner stating they are being disturbed by increased noise levels and wish to participate in the program.

8.5.6 Involved Agencies and Agency Contacts

Agency contacts relative to noise issues are presented in Table 8.5-10.

TABLE 8.5-10
Agency Contacts

Agency	Contact	Telephone
County of Sacramento, Planning Department	Tricia Stevens, Principal Planner	(916) 874-6141

8.5.7 Permits Required and Permit Schedule

No permits are required; therefore, there is no permit schedule.

8.5.8 References

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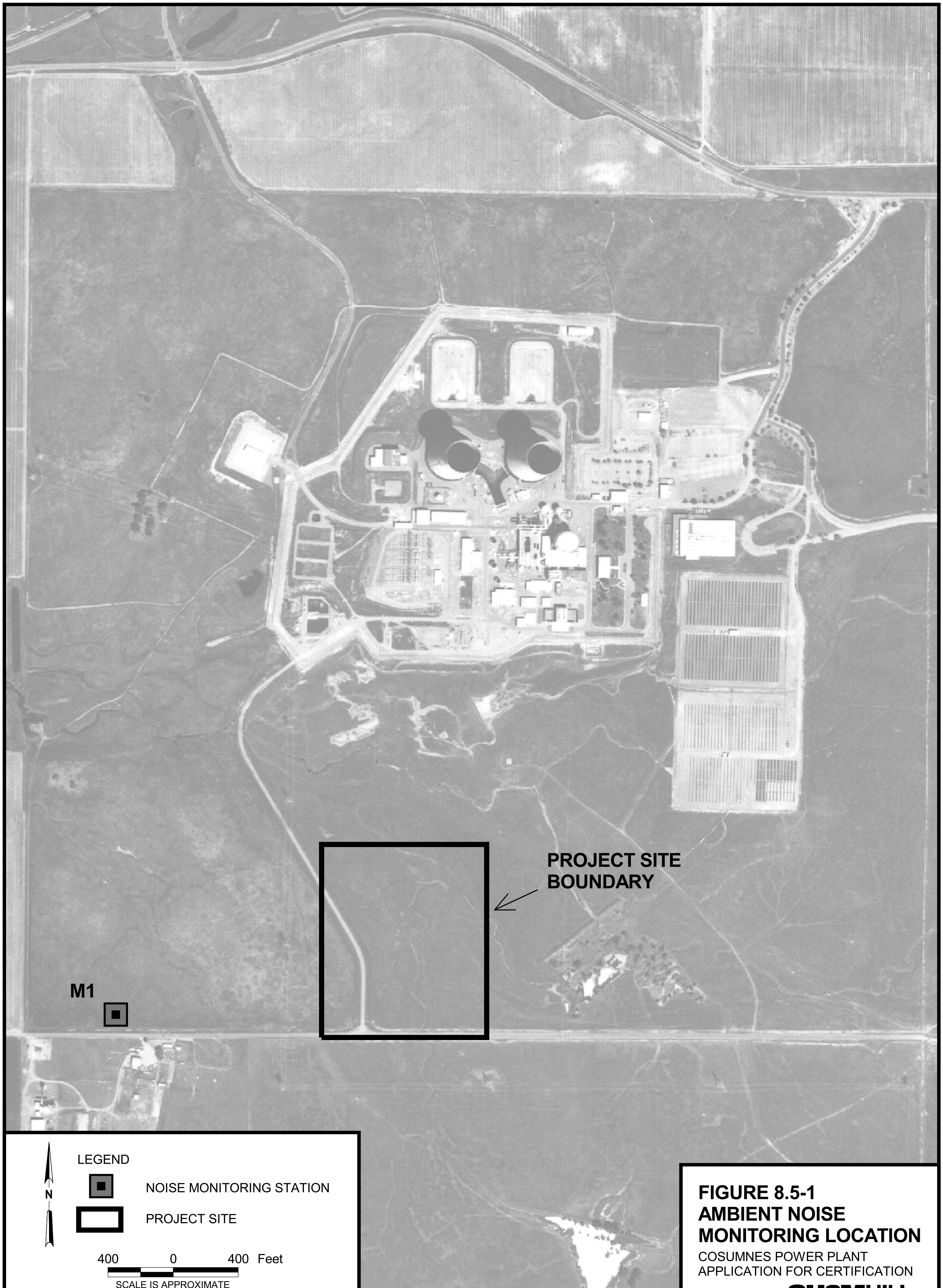

FIGURE 8.5-1
AMBIENT NOISE MONITORING LOCATION
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

CH2MHILL

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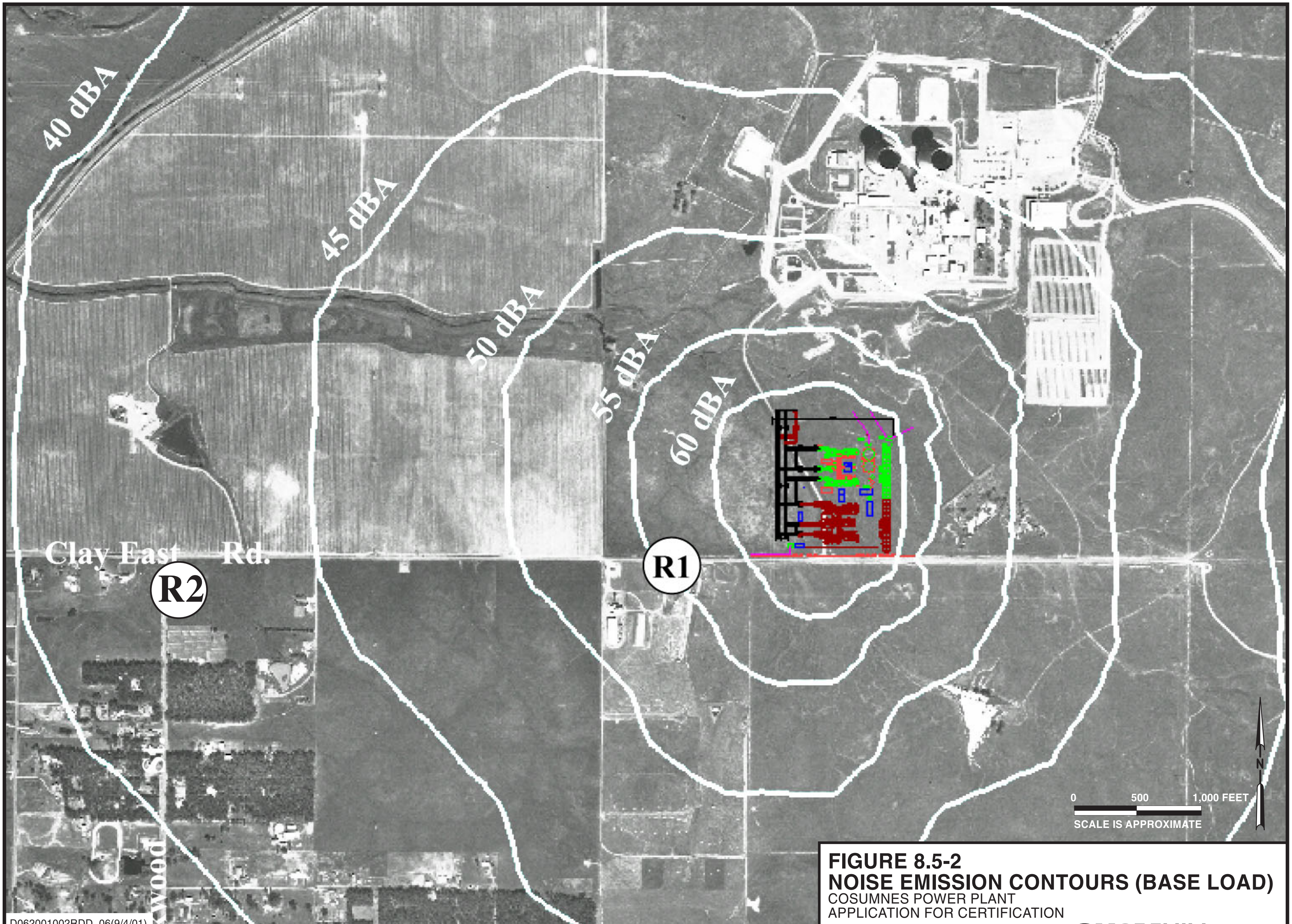

FIGURE 8.5-2
NOISE EMISSION CONTOURS (BASE LOAD)
COSUMNES POWER PLANT
APPLICATION FOR CERTIFICATION

CH2MHILL