

APPENDIX 8

Acoustical Impact Analysis

ACOUSTICAL IMPACT ANALYSIS
MS-257 MISSION SPRINGS WATER DISTRICT PROJECT
DESERT HOT SPRINGS AND RIVERSIDE COUNTY, CALIFORNIA

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NOISE SETTING

NOISE DESCRIPTORS

Sound is mechanical energy transmitted by pressure waves in a compressible medium such as air. Noise is generally defined as unwanted sound. Sound is characterized by various parameters that describe the rate of oscillation of sound waves, the distance between successive troughs or crests, the speed of propagation, and the pressure level or energy content of a given sound wave. In particular, the sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level.

The unit of sound pressure expressed as a ratio to the lowest sound level detectable by a young person with good auditory acuity is called a decibel (dBA). Because sound or noise can vary in intensity by over one million times within the range of human hearing, decibels are a logarithmic progression used to keep sound intensity numbers at a convenient and manageable level. Since the human ear is not equally sensitive to all sound frequencies within the entire spectrum, noise levels at maximum human sensitivity are factored more heavily into sound descriptions in a process called "A-weighting" written as dBA. Any further reference to decibels written as "dB" should be understood to be A-weighted.

Time variations in noise exposure are normally expressed in terms of a steady-state energy level equal to the energy content of the time varying period (called Leq), or, alternately, as a statistical description of the sound level that is exceeded over some fraction of a given observation period. Finally, because community receptors are more sensitive to unwanted noise intrusion during the evening and at night, state law requires that, for planning purposes, an artificial dBA increment be added to quiet time noise levels in a 24-hour noise descriptor called the Community Noise Equivalent Level (CNEL).

CNEL also differs from Leq in that it applies a time-weighted factor designed to emphasize noise events that occur during the evening and nighttime hours (when quiet time and sleep disturbance is of particular concern). Noise occurring during the daytime period (7:00 AM to 7:00 PM) receives no penalty. Noise produced during the evening time period (7:00 PM to 10:00 PM) is penalized by 5 dBA, while nighttime noise (10:00 PM to 7:00 AM) is penalized by 10 dBA.

Because this project is within the City of Desert Hot Springs as well as Riverside County, noise ordinances for both municipalities are provided.

NOISE STANDARDS

Riverside County

The Riverside County noise standards applicable for a water reclamation project are found in the General Plan Noise Element in Table N-2 and are shown in Table 2 of this report. These noise standards must be met at the nearest sensitive receptors in the vicinity of any stationary or operational source of noise originating from the project. The policy applies to any on-site activities such as mechanical equipment. The policy allows maximum property line noise level

of 65 dBA Leq from 7 a.m. to 10 p.m. and 45 dBA Leq from 10 p.m. to 7 a.m. for 10-minute periods at any sensitive receiver.

Table 1

Stationary Source Land Use Exterior Noise Standards	
7 a.m. – 10 p.m.	65 dB Leq (10 minute)
10 p.m. – 7 a.m.	45 dB Leq (10 minute)

Source: Noise Element Table N-2

Construction activity noise is restricted by ordinance to occur during hours of lesser sensitivity. In addition, grading permits require use of properly operating mufflers on all combustion equipment. Materials stockpiling and equipment and vehicle staging areas are also encouraged to be placed as far away from existing homes as is reasonably feasible.

Ordinance 457.90, Section 1G of the Riverside County Building and Safety Department, states the following:

- Whenever a construction site is within one-quarter (1/4) mile of an occupied residence(s), no construction activities shall be undertaken between the hours of 6:00 p.m. and 6:00 a.m. during the months of June through September and between the hours of 6:00 p.m. and 7:00 a.m. during the months of October through May.

City of Desert Hot Springs

The City of Desert Hot Springs noise standards are found in section 17-040.180 of the Municipal Code which states:

- In residential areas, no exterior noise level shall exceed 65 dBA and no interior noise level shall exceed 45 dBA.

Construction noise is exempt from these standards as long as work is limited to the hours of 7 am to 5 pm Monday thru Saturday. During daylight savings time the permissible hours are 6 am to 6 pm. Construction is not permitting on Sundays.

PROJECT DESCRIPTION

The proposed West Valley Water Reclamation Facility (WVWRF) will be located in a remote area close to the I-10 Freeway, more than a mile from any sensitive use. The areas to be converted from septic to sewer (Area M-2) will require new collection pipeline installed on area roadways and new conveyance pipeline will carry the wastewater to the proposed WVWRF. Existing sewer lines would also be routed to the new facility.

PROJECT NOISE IMPACTS

THRESHOLDS OF SIGNIFICANCE

According to the current CEQA Appendix G guidelines, noise impacts are considered potentially significant if they cause:

- a. 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. Noise levels exceeding the City of Desert Hot Springs or Riverside County Noise Standards would be considered significant.
- b. Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.
- c. A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project.
- d. A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project.

The noise impact assessment evaluates short-term (temporary) impacts associated with project construction as well as long-term (permanent) impacts resulting from project operation. For construction noise, the potential for impacts is assessed by considering several factors, including the proximity of construction-related noise sources to sensitive receptors, typical noise levels associated with construction equipment (including construction-related vehicles), the potential for construction noise levels to interfere with adjacent residential activities, the duration that sensitive receptors would be affected, and whether proposed activities would occur outside the construction time limits specified in the Riverside County and City of Desert Hot Springs noise ordinances. For operational noise, the potential for impact resulting from the new plant or pipeline operational activities will be evaluated.

Construction noise is typically governed by ordinance limits on allowable times of equipment operations.

For Desert Hot Springs Construction noise is exempt from noise standards as long as work is limited to the hours of 7 am to 5 pm Monday thru Saturday. During daylight savings time the permissible hours are 6 am to 6 pm. Construction is not permitting on Sundays.

For Riverside County, whenever a construction site is within one-quarter (1/4) mile of an occupied residence(s), no construction activities shall be undertaken between the hours of 6:00 p.m. and 6:00 a.m. during the months of June through September and between the hours of 6:00 p.m. and 7:00 a.m. during the months of October through May.

However, it may be that even if allowable hours of construction are limited to hours of lesser noise sensitivity, a noise nuisance may nevertheless be created by virtue of the type of noise, heightened sensitivity or other site-specific features. Ordinance compliance alone is therefore not a sufficient basis to guarantee a less-than-significant noise impact. Neither the County or City Code establish numeric maximum for acceptable construction source noise levels at potentially affected receivers, which would allow for a quantified determination of what CEQA constitutes a *substantial temporary or periodic noise increase*.

To evaluate whether the project will generate potentially significant construction noise levels at off-site sensitive receiver locations, a construction-related noise level threshold is adopted from the *Criteria for Recommended Standard: Occupational Noise Exposure* prepared by the National Institute for Occupational Safety and Health (NIOSH). A division of the U.S. Department of Health and Human Services, NIOSH identifies a noise level threshold based on the duration of exposure to the source. The construction related noise level threshold starts at 85 dBA for more than eight hours per day, and for every 3-dBA increase, the exposure time is cut in half. This results in noise thresholds of 88 dBA for more than four hours per day, 92 dBA for more than one hour per day, 96 dBA for more than 30 minutes per day, and up to 100 dBA for more than 15 minutes per day. Since this construction-related noise level threshold represents the energy average of the noise source over a given time, they are expressed as Leq noise levels. Therefore, the noise level threshold of 85 dBA Leq over a period of eight hours, or 88 dBA for four hours, or 92 dBA for one hour or more is used to evaluate the potential project-related construction noise level impacts at nearby sensitive receivers.

SENSITIVE RECEPTORS

The M-2 mainline sewer will be installed near the roadway centerline. The sewer laterals going to each property on both sides of the street will be installed generally perpendicular off the mainline up to the property line (or where the public right of way stops). In area M-2. The closest residences will have an approximate 40-foot separation distance.

The treatment plant is in a remote location and has a 1.8-mile separation distance to the closest sensitive use.

CONSTRUCTION NOISE IMPACTS

Construction noise levels would vary at any given receptor depending on the construction phase, equipment type, duration of use, distance between the noise source and receptor, and the presence or absence of barriers between the noise source and receptor. For this analysis, construction noise levels were estimated for proposed daytime construction. Construction noise is unavoidable though noise would be temporary and limited to the duration of the construction in any one location.

Table 3 identifies the highest (L_{max}) noise levels associated with each type of equipment identified for use, then adjusts this noise level for distance to the closest sensitive receptors and the extent of equipment usage (usage factor), which is represented as an hourly average Leq.

Quantitatively, the primary noise prediction equation is expressed as follows for the hourly average noise level (Leq) at distance D between the source and receiver (dBA):

$$Leq = L_{max} @ 50' - 20 \log (D/50') + 10 \log (U.F\%/100) - I.L.(bar)$$

Where:

Lmax @ 50' is the published reference noise level at 50 feet

U.F.% is the usage factor for full power operation per hour

I.L.(bar) is the insertion loss for intervening barriers

For the proposed project, heavy equipment will likely be used for the new treatment plant construction. The collection pipeline being installed within the narrow local roadways such as area M-2 will use much smaller equipment. The modeled construction equipment fleet is shown in Table 3.

**Table 3
WVWRF Construction Activity Equipment Fleet**

Phase Name and Duration	Equipment	Usage Factor	Reference Noise Level @ 50 feet (dBA)	Hourly Average Noise Level @ 50 feet (dBA)
Excavation and Grading	Excavator	40%	81	78
	Dozer	40%	85	82
	Grader	40%	85	81
	Loader/Backhoe	37%	78	74
Building and Equipping	Crane	16%	81	73
	Loader/Backhoe	37%	78	74
	Generator Set	50%	81	78
	Welder	46%	74	71
	Forklift	20%	75	69
Finish and Clean	Paver	42%	77	74
	Compactor	20%	80	72
	Rollers	38%	80	73

Pipeline Installation

Phase Name and Duration	Equipment	Usage Factor	Reference Noise Level @ 50 feet (dBA)	Cumulative Noise Level @ 50 feet (dBA)
Prep and Concrete Removal	Concrete Saw	20%	90	83
	Loader/Backhoe	37%	78	74
Trenching and Pipeline Install	Trencher	50%	82	79
	Crane	16%	81	73
	Forklift	20%	75	69
	Trencher	50%	85	82
	Loader/Backhoe	37%	78	74

Backfill and Paving	Mixer	40%	80	76
	Paver	42%	77	74
	Roller	38%	80	73
	Loader/Backhoe	37%	78	74
	Compactor	20%	80	72

Point sources of noise emissions are attenuated by a factor of 6 dBA per doubling of distance through geometrical (spherical) spreading of sound waves. The closest receptor to the proposed WVWRF has more than a 1.8 mile separation distance. This would translate to -46 dBA of noise attenuation. As shown in Table 4, it is unlikely that construction equipment related to the treatment plant would be heard at the closest sensitive use.

The sewage pipeline will be installed near the center of the public roadway in area M-2. As shown in Table 4, at the closest residential setback of 40 feet, noise levels along the various pipeline alignments are estimated to range between 71 and 85 dBA (Leq). The noisiest activities occur during pavement removal, which can include jackhammering and sawing. These maximal noise levels are limited to the time it takes to remove pavement adjacent to any residence which would be brief and would affect a given sensitive receptor for only a short period of time. While such noise levels will be noticeable at times, these exceedances would be sporadic (not continuous) in nature, limited in duration, and would occur only when equipment is typically operated in close proximity of a receptor. Because of the nature of a pipeline installation, construction noise near any single residence becomes quieter as installation progresses down the alignment. Additionally, activities are limited to daytime hours when most people are away.

**Table 4
WVWRF Construction Activity Noise – Adjusted for Distance**

Phase Name and Duration	Equipment	Noise at Nearest Home (dBA)
Excavation and Grading	Excavator	32
	Dozer	36
	Grader	35
	Loader/Backhoe	28
Building and Equipping	Crane	27
	Loader/Backhoe	28
	Generator Set	32
	Welder	25
	Forklift	23
Finish and Clean	Paver	28
	Compactor	26
	Rollers	27

Pipeline Installation Noise – Adjusted for Distance

Phase Name and Duration	Equipment	Noise at Nearest Home (40 feet) (dBA)
Prep and Concrete	Concrete Saw	85

Removal	Loader/Backhoe	76
Trenching and Pipeline Install	Trencher	81
	Crane	73
	Forklift	71
	Trencher	81
	Loader/Backhoe	76
Backfill and Paving	Mixer	78
	Paver	76
	Roller	75
	Loader/Backhoe	76
	Compactor	74

Construction noise resulting from the WVWRF will be negligible at the closest sensitive use. The highest noise level of 36 dBA Leq would be less than ambient noise. For the pipeline installation, the highest construction noise levels at the maximally impacted residential receiver location could approach 85 dBA Leq during concrete sawing and removal. However, concrete sawing will last only a few minutes at the closest distance to any home and will lessen as the cutter moves farther away. A noise level of 92 dBA is permitted for more one hour per day and will satisfy the NIOSH significance threshold during temporary construction activities. The noise impact due to unmitigated construction noise levels is, therefore, considered a less than significant impact at all nearby sensitive receiver locations.

For Desert Hot Springs construction noise is allowed only during the hours of 7 am to 5 pm Monday thru Saturday. During daylight savings time the permissible hours are 6 am to 6 pm. Construction is not permitting on Sundays.

For Riverside County, whenever a construction site is within one-quarter (1/4) mile of an occupied residence(s), no construction activities shall be undertaken between the hours of 6:00 p.m. and 6:00 a.m. during the months of June through September and between the hours of 6:00 p.m. and 7:00 a.m. during the months of October through May.

Construction is not permitted on any national holiday. These hours are included as conditions on any project construction permits and these limits will serve to minimize any adverse construction noise impact potential

CONSTRUCTION ACTIVITY VIBRATION

Project-related pavement cutting, excavation, and repaving activities could result in vibration that could disturb nearby residents and/or cause cosmetic damage to existing adjacent buildings or structures.

Ground-borne vibration occurs when heavy equipment travels over unpaved surfaces or when it is engaged in soil movement. The effects of ground-borne vibration include discernable movement of building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Vibration related problems generally occur due to resonances in the structural components of a building because structures amplify groundborne vibration. Within

the “soft” sedimentary surfaces of much of Southern California, ground vibration is quickly damped out. Groundborne vibration is almost never annoying to people who are outdoors (FTA 2006).

Groundborne vibrations from construction activities rarely reach levels that can damage structures. Because vibration is typically not an issue, very few jurisdictions have adopted vibration significance thresholds. Vibration thresholds have been adopted for major public works construction projects, but these relate mostly to structural protection (cracking foundations or stucco) rather than to human annoyance.

The vibration descriptor commonly used to determine structural damage is the peak particle velocity (ppv) which is defined as the maximum instantaneous positive or negative peak of the vibration signal, usually measured in in/sec. The range of such vibration is as follows in Table 5:

**Table 5
Human Response To Transient Vibration**

Average Human Response	ppv (in/sec)
Severe	2.00
Strongly perceptible	0.90
Distinctly perceptible	0.24
Barely perceptible	0.03

Source: Caltrans Transportation and Construction Vibration Guidance Manual, 2013.

Over the years, numerous vibration criteria and standards have been suggested by researchers, organizations, and governmental agencies. There are no Caltrans or Federal Highway Administration standards for vibration.

According to Caltrans, the threshold for structural vibration damage for modern structures is 0.5 in/sec for intermittent sources, which include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment. The American Association of State Highway and Transportation Officials (AASHTO) (1990) identifies maximum vibration levels for preventing damage to structures from intermittent construction or maintenance activities for residential buildings in good repair with gypsum board walls to be 0.4–0.5 in/sec. The damage threshold criterion of 0.2 in/sec is appropriate for fragile buildings. For the purpose of this analysis because adjacent residences can be older, the 0.2 in/sec damage threshold for older fragile/historic buildings is used as the evaluation criteria. Below this level there is virtually no risk of building damage. Table 6 shows the predicted vibration levels generated by construction equipment.

Table 5
Estimated Vibration Levels During Project Construction

Equipment	PPV at 25 ft (in/sec)	PPV at 50 ft (in/sec)	PPV at 75 ft (in/sec)	PPV at 100 ft (in/sec)
Large Bulldozer	0.089	0.031	0.017	0.011
Loaded trucks	0.076	0.027	0.015	0.010
Jackhammer	0.035	0.012	0.007	0.004
Small Bulldozer	0.003	0.001	0.001	<0.001

Source: FHWA Transit Noise and Vibration Impact Assessment

The calculation to determine PPV at a given distance is:

$$PPV_{distance} = PPV_{ref} * (25/D)^{1.5}$$

Where:

PPV_{distance} = the peak particle velocity in inches/second of the equipment adjusted for distance,

PPV_{ref} = the reference vibration level in inches/second at 25 feet, and

D = the distance from the equipment to the receiver.

Pipeline installation along narrow roadways such as in area M-2 will use small equipment, not bulldozers. Bobcats and skid steer loaders have a much lower vibration potential than the equipment shown above. Jackhammers may be used to open trenches, but even at a 25 foot distance jackhammer operation could be within the level of human perception but is far below any possible cosmetic damage level. Most trenching will be 40 feet from any sensitive use. In addition, jackhammers would only operate for a very limited amount of time in the vicinity of any single household.

OPERATIONAL NOISE

Operation of the pipeline facilities would not result in significant noise impacts, since these facilities would be located below ground surface.

The distance and associated noise attenuation from the WWRF and the closest residences ensure associated operational noise will not be noticeable.

SUMMARY

Short-term construction noise intrusion and vibration impacts will be limited by conditions on construction permits requiring compliance with the following hours:

- For Desert Hot Springs construction noise is allowed only during the hours of 7 am to 5 pm Monday thru Saturday. During daylight savings time the permissible hours are 6 am to 6 pm. Construction is not permitting on Sundays.
- For Riverside County, whenever a construction site is within one-quarter (1/4) mile of an occupied residence(s), no construction activities shall be undertaken between the hours of 6:00 p.m. and 6:00 a.m. during the months of June through September and between the hours of 6:00 p.m. and 7:00 a.m. during the months of October through May.

In addition, the following standard construction practices are required:

- All construction equipment shall use properly operating mufflers.
- Stockpiling and staging activities must be located as far as practicable from dwellings.
- All mobile equipment shall have properly operating and maintained mufflers.

Construction vibration would not exceed any damage thresholds at the nearest sensitive uses even applying the more stringent threshold for older, fragile structures.

Operation of the pipeline facilities would not result in significant noise impacts, since these facilities would be located below ground surface.

Noise from construction or operation of the WWRWF will be minimal due to the 1.8 mile distance separation to the closest residence. Noise levels will typically be lower than background ambient noise and will not be sleep-disturbing at the closest homes.