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MEMORANDUM

DATE: May 25, 2023

TO: Megan Rupard, EPD Solutions

FROM: J.T. Stephens, Principal
Moe Abushanab, Noise Engineer

SUBJECT: Noise and Vibration Construction Impact Analysis for the Proposed North Glendora Water Tank Project in the City of Glendora, California

INTRODUCTION AND PROJECT DESCRIPTION

This noise and vibration construction impact analysis has been prepared to evaluate the potential construction impacts associated with the proposed North Glendora Water Tank Project (project) in Glendora, California. This report is intended to satisfy the City of Glendora's (City) requirements for a project-specific noise and vibration impact analysis and examines the impacts of the construction of the proposed project to the existing noise-sensitive uses adjacent to the project site.

Location and Description

The project site is located at 1145 North Glendora Avenue in Glendora, California. The project site is surrounded primarily by single-family homes and vacant land. Local access to the project site is provided by North Glendora Avenue. Figure 1 shows the project location, and Figure 2 shows the project's site plan (figures are provided in Attachment B).

The project site is presently developed with an existing 295,000-gallon water tank. It is reported that the tank has been leaking for some time. In 2014, the State Water Resources Control Board (SWRCB), Division of Drinking Water (DDW) conducted a sanitary survey of the tank, which identified streams of water running down the side of the tank, water streaks, and rust on the bolts. Following the 2014 sanitary survey, the City was asked to address these problems.

The project proposes to replace the existing 295,000-gallon water tank with two new 295,000-gallon water tanks, for a total capacity of approximately 590,000 gallons. The reservoirs would discharge into City potable water lines and provide service to the City's water customers for municipal purposes throughout the reservoir's approximately 156-acre service area. Project operation would require intermittent maintenance servicing.

In addition, the existing antennas and electrical equipment located south of the existing reservoir would be relocated to the southwest corner of the newly constructed pad. Electric service would be provided via the single-phase pole mounted meter to provide power to the tank mixers, site lighting,

security camera system, instrumentation, intrusion alarms, a Programmable Logic Controller/ Supervisory Control and Data Acquisition (PLC/SCADA) system, and the gate controller. Additionally, the project would include a 10-kilowatt (kW) diesel generator and an automatic transfer switch to provide power to the reservoirs during power outages.

Construction of the proposed project is anticipated to commence in the first quarter of 2024 and occur for approximately 14 months, ending in 2025. Construction activities would occur over two phases and include demolition, site preparation, grading, construction, and coating activities. Based on the preliminary grading plans, 9,500 cubic yards (CY) of soil would be cut and approximately 1,000 CY of soil would be fill. Thus, a net export of 8,500 CY of soil would be associated with the project. In addition, demolition of the proposed project is expected to result in approximately 2,538.5 tons of debris that would be off hauled. The proposed project is expected to have approximately 7 to 10 construction workers on site and would require a crane, welding machine, skip loader, excavator, and an air compressor. Other construction details are not yet known.

Sensitive Receptors in the Project Vicinity

Sensitive receptor locations include residences, schools, daycare centers, hospitals, parks, and similar uses that are sensitive to noise. The project site is surrounded primarily by single-family homes and vacant land. The closest sensitive receptors to the project site include single-family residences located approximately 150 feet (ft) southwest of the center of the project site where construction activities will mainly occur (construction of water tanks), and approximately 33 ft from the approximate limits of disturbance.

METHODOLOGY

The evaluation of noise impacts associated with the proposed project includes the following.

- A determination of the short-term construction noise and vibration levels at off-site noise-sensitive uses and comparison to the City's General Plan and Municipal Code Ordinance requirements; and

- If necessary, a determination of required mitigation measures, such as noise barriers, to reduce short-term noise impacts from all sources.

CHARACTERISTICS OF SOUND

Noise is usually defined as unwanted sound. Noise consists of any sound that may produce physiological or psychological damage and/or interfere with communication, work, rest, recreation, and sleep.

To the human ear, sound has two significant characteristics: pitch and loudness. Pitch is generally an annoyance, while loudness can affect the ability to hear. Pitch is the number of complete vibrations, or cycles per second, of a wave resulting in the tone's range from high to low. Loudness is the strength of a sound that describes a noisy or quiet environment and is measured by the amplitude of the sound wave. Loudness is determined by the intensity of the sound waves combined with the

reception characteristics of the human ear. Sound intensity refers to how hard the sound wave strikes an object, which in turn produces the sound's effect. This characteristic of sound can be precisely measured with instruments. The analysis of a project defines the noise environment of the project area in terms of sound intensity and its effect on adjacent sensitive land uses.

Measurement of Sound

Sound intensity is measured through the A-weighted scale to correct for the relative frequency response of the human ear. That is, an A-weighted noise level de-emphasizes low and very high frequencies of sound similar to the human ear's de-emphasis of these frequencies. Unlike linear units (e.g., inches or pounds), decibels are measured on a logarithmic scale representing points on a sharply rising curve.

For example, 10 decibels (dB) is 10 times more intense than 1 dB, 20 dB is 100 times more intense than 1 dB, and 30 dB is 1,000 times more intense than 1 dB. Thirty decibels (30 dB) represent 1,000 times as much acoustic energy as 1 dB. The decibel scale increases as the square of the change, representing the sound pressure energy. A sound as soft as human breathing is about 10 times greater than 0 dB. The decibel system of measuring sound gives a rough connection between the physical intensity of sound and its perceived loudness to the human ear. A 10 dB increase in sound level is perceived by the human ear as only a doubling of the loudness of the sound. Ambient sounds generally range from 30 dB (very quiet) to 100 dB (very loud).

Sound levels are generated from a source, and their decibel level decreases as the distance from that source increases. Sound dissipates exponentially with distance from the noise source. For a single-point source, sound levels decrease approximately 6 dB for each doubling of distance from the source. This drop-off rate is appropriate for noise generated by stationary equipment. If noise is produced by a line source (e.g., highway traffic or railroad operations), the sound decreases 3 dB for each doubling of distance in a hard site environment. Similarly, line sources with intervening absorptive vegetation or line sources that are located at a great distance to the receptor would decrease 4.5 dB for each doubling of distance.

There are many ways to rate noise for various time periods, but an appropriate rating of ambient noise affecting humans also accounts for the annoying effects of sound. The equivalent continuous sound level (L_{eq}) is the total sound energy of time-varying noise over a sample period. However, the predominant rating scales for human communities in the State of California are the L_{eq} and Community Noise Equivalent Level (CNEL) or the day-night average noise level (L_{dn}) based on A-weighted decibels (dBA). CNEL is the time-varying noise over a 24-hour period, with a 5 dBA weighting factor applied to the hourly L_{eq} for noises occurring from 7:00 p.m. to 10:00 p.m. (defined as relaxation hours), and a 10 dBA weighting factor applied to noises occurring from 10:00 p.m. to 7:00 a.m. (defined as sleeping hours). L_{dn} is similar to the CNEL scale but without the adjustment for events occurring during the evening hours. CNEL and L_{dn} are within 1 dBA of each other and are normally interchangeable. The City of Glendora uses the CNEL noise scale for long-term noise impact assessment.

Other noise rating scales of importance when assessing the annoyance factor include the maximum instantaneous noise level (L_{max}), which is the highest exponential time-averaged sound level that occurs during a stated time period. The noise environments discussed in this analysis for short-term noise impacts are specified in terms of maximum levels denoted by L_{max}, which reflects peak operating conditions and addresses the annoying aspects of intermittent noise. L_{max} is often used together with another noise scale or noise standards in terms of percentile noise levels in noise ordinances for enforcement purposes. For example, the L_{10} noise level represents the noise level exceeded 10 percent of the time during a stated period. The L_{50} noise level represents the median noise level (i.e., half the time the noise level exceeds this level, and half the time it is less than this level). The L_{90} noise level represents the noise level exceeded 90 percent of the time and is considered the background noise level during a monitoring period. For a relatively constant noise source, the L_{eq} and L_{50} are approximately the same.

Noise impacts can be described in three categories. The first category is audible impacts that refer to increases in noise levels noticeable to humans. Audible increases in noise levels generally refer to a change of 3 dB or greater because this level has been found to be barely perceptible in exterior environments. The second category, potentially audible, refers to a change in the noise level between 1 and 3 dB. This range of noise levels has been found to be noticeable only in laboratory environments. The last category is changes in noise levels of less than 1 dB, which are inaudible to the human ear. Only audible changes in existing ambient or background noise levels are considered potentially significant.

Physiological Effects of Noise

Physical damage to human hearing begins at prolonged exposure to noise levels higher than 85 dBA. Exposure to high noise levels affects the entire system, with prolonged noise exposure in excess of 75 dBA increasing body tensions, thereby affecting blood pressure and functions of the heart and the nervous system. In comparison, extended periods of noise exposure above 90 dBA would result in permanent cell damage. When the noise level reaches 120 dBA, a tickling sensation occurs in the human ear even with short-term exposure. This level of noise is called the threshold of feeling. As the sound reaches 140 dBA, the tickling sensation is replaced by the feeling of pain in the ear. This is called the threshold of pain. A sound level of 160–165 dBA will result in dizziness or loss of equilibrium. The ambient or background noise problem is widespread and generally more concentrated in urban areas than in outlying less developed areas.

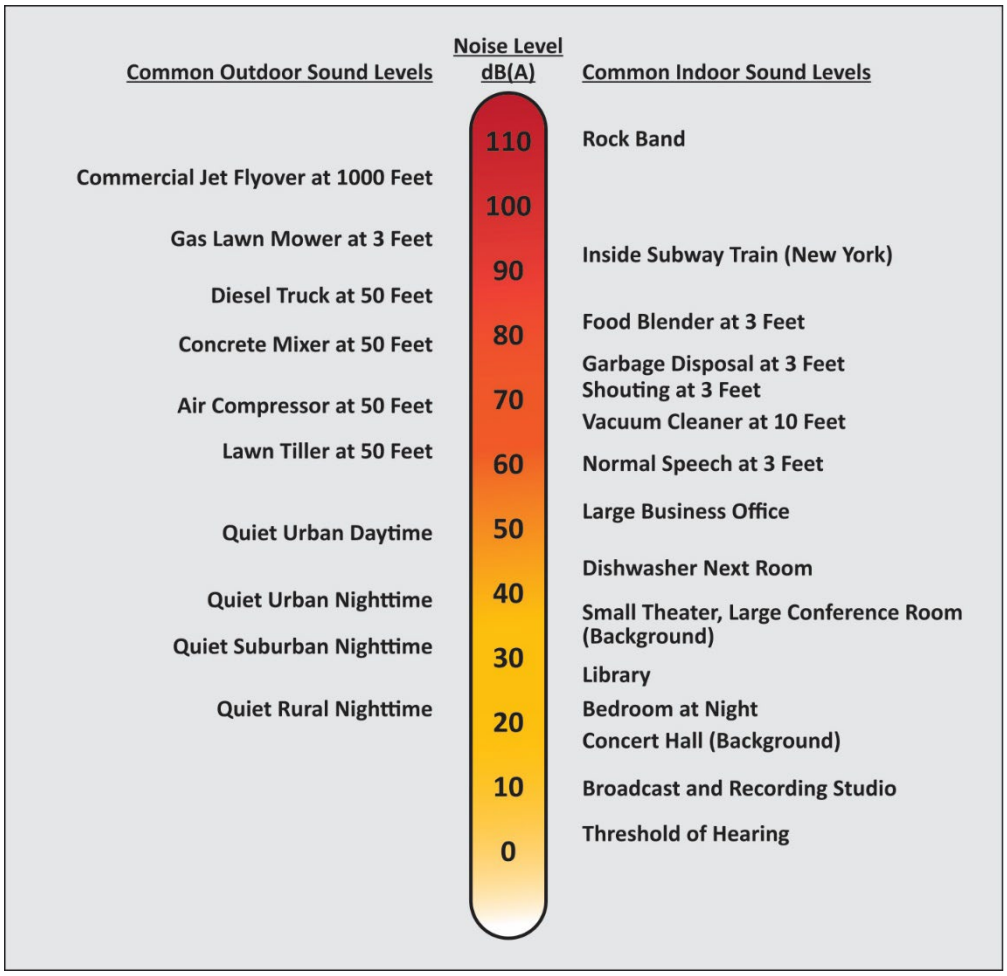
Table A lists full definitions of acoustical terms, and Table B shows common sound levels and their sources.

Table A: Definitions of Acoustical Terms

Term	Definitions
Decibel, dB	A unit of level that denotes the ratio between two quantities proportional to power, the number of decibels is 10 times the logarithm (to the base 10) of this ratio.
Frequency, Hz	Of a function periodic in time, the number of times that the quantity repeats itself in one second (i.e., number of cycles per second).
A-Weighted Sound Level, dBA	The sound level obtained by use of A-weighting. The A-weighting filter deemphasizes the very low and very high frequency components of the sound in a manner similar to the 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 assessment are A-weighted, unless reported otherwise.
L_{01}, L_{10}, L_{50}, L_{90}	The fast A-weighted noise levels equaled or exceeded by a fluctuating sound level for 1 percent, 10 percent, 50 percent, and 90 percent of a stated time period.
Equivalent Continuous Noise Level, L_{eq}	The level of a steady sound that, in a stated time period and at a stated location, has the same A-weighted sound energy as the time varying sound.
Community Noise Equivalent Level, CNEL	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 5 dB to sound levels occurring in the evening from 7:00 p.m. to 10:00 p.m. and after the addition of 10 dB to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
Day/Night Noise Level, L_{dn}	The 24-hour A-weighted average sound level from midnight to midnight, obtained after the addition of 10 dB to sound levels occurring in the night between 10:00 p.m. and 7:00 a.m.
L_{max}, L_{min}	The maximum and minimum A-weighted sound levels measured on a sound level meter, during a designated time interval, using fast time averaging.
Ambient Noise Level	The all-encompassing noise associated with a given environment at a specified time, usually a composite of sound from many sources at many directions, near and far; no particular sound is dominant.
Intrusive	The 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, and time of occurrence and tonal or informational content, as well as the prevailing ambient noise level.

Source: *Handbook of Acoustical Measurements and Noise Control* (Harris, Cyril M., 1991).

Table B: Common Sound Levels and Noise Sources



Source: LSA (2016).

CHARACTERISTICS OF VIBRATION

Vibration refers to ground-borne noise and perceptible motion. Ground-borne vibration is almost exclusively a concern inside buildings and is rarely perceived as a problem outdoors, where the motion may not be discernible. Typically, there is more adverse reaction to effects associated with the shaking of a building. Vibration energy propagates from a source through intervening soil and rock layers to the foundations of nearby buildings. The vibration then propagates from the foundation throughout the remainder of the structure. Building vibration may be perceived by occupants as the motion of building surfaces, the rattling of items on shelves or hanging on walls, or a low-frequency rumbling noise. The rumbling noise is caused by the vibration of walls, floors, and ceilings that radiate sound waves. Annoyance from vibration often occurs when the vibration exceeds the threshold of perception by 10 dB or less. This is an order of magnitude below the damage threshold for normal buildings.

Typical sources of ground-borne vibration are construction activities (e.g., blasting, pile driving, and operating heavy-duty earthmoving equipment), steel-wheeled trains, and occasional traffic on rough roads. Problems with both ground-borne vibration and noise from these sources are usually localized to areas within approximately 100 ft of the vibration source, although there are examples of ground-borne vibration causing interference out to distances greater than 200 ft (Federal Transit Administration [FTA] 2018 [references are provided in Attachment A]). When roadways are smooth, vibration from traffic, even heavy trucks, is rarely perceptible. It is assumed for most projects that the roadway surface will be smooth enough that ground-borne vibration from street traffic will not exceed the impact criteria; however, the construction of the project could result in ground-borne vibration that may be perceptible and annoying.

Ground-borne vibration has the potential to disturb people and damage buildings. Although it is very rare for typical construction activities to cause even cosmetic building damage, it is not uncommon for construction processes such as blasting and pile driving to cause vibration of sufficient amplitudes to damage nearby buildings (FTA 2018). Ground-borne vibration is usually measured in terms of vibration velocity, either the root-mean-square (RMS) velocity or peak particle velocity (PPV). The RMS is best for characterizing human response to building vibration, and PPV is used to characterize potential for damage. Decibel notation acts to compress the range of numbers required to describe vibration. Vibration velocity level in decibels is defined as:

$$L_v = 20 \log_{10} [V/V_{ref}]$$

where L_v is the vibration velocity in decibels (VdB), "V" is the RMS velocity amplitude, and "V_{ref}" is the reference velocity amplitude, or 1 x 10^{-6} inches/second (in/sec) used in the United States.

APPLICABLE NOISE STANDARDS

The following information provides standards to which potential noise impacts will be compared. Where exceedances are been identified, impacts will be described, and mitigation will be recommended.

City of Glendora General Plan

The Noise Element of the City of Glendora General Plan (Community Plan 2025) (2008) is intended to identify sources of noise and provide objectives and policies that ensure that noise from various sources does not create an unacceptable noise environment. Overall, the City's Noise Element describes the noise environment (including noise sources) in the City; addresses noise mitigation regulations, strategies, and programs; and delineates federal, State, and City jurisdiction relative to rail, automotive, aircraft, and nuisance noise.

The City has adopted goals and policies to consider noise sources in the planning process to minimize the impacts of noise on residents. The goals and policies applicable to the project include the following:

Planning Consideration: Non-transportation noise sources, including those generated from commercial/industrial activities, construction equipment and various community activities, have the potential of introducing undesirable impacts within the City. Development policy and regulatory standards should consider the reduction of these non-transportation noise impacts and mitigate them to a less than significant level.

Goal N-2: Reduced noise impacts from non-transportation sources.

Policy N-2.2: Strive to resolve existing and potential conflicts between noise generating uses and human activities.

Policy N-2.3: Prohibit significant noise generating activities from locating adjacent to residential neighborhoods and near schools.

Policy N-2.4: Ensure that construction noise does not cause an adverse impact to the residents of the City by requiring that noise mitigation techniques be incorporated into all construction-related activities.

City of Glendora Municipal Code

The City of Glendora Municipal Code Chapter 9.44, Noise Regulation (2023), establishes criteria and noise standards for the regulation of noise levels within the community. Section 9.44.110, *Construction of buildings and projects*, states that:

> "it is unlawful for any person within a residential zone, or within a radius of five hundred feet therefrom, to operate equipment or perform any outside construction or repair work on buildings, structures or projects or to operate any pile driver, power shovel, pneumatic hammer, derrick, power hoist or any other construction type device (between the hours of 9 p.m. of one day and 7 a.m. of the next day) in such a manner that a reasonable person of normal sensitiveness residing in the area is caused discomfort or annoyance unless beforehand a permit therefor has been duly obtained from the city."

Federal Transit Administration

Although the City does not have daytime construction noise level limits for activities that occur with the specified hours of Section 9.44.110 to determine potential California Environmental Quality Act (CEQA) noise impacts, construction noise was assessed using criteria from the FTA's 2018 *Transit Noise and Vibration Impact Assessment Manual* (FTA Manual). Table C shows the FTA's Detailed Assessment Construction Noise Criteria based on the combined noise levels per construction phase.

Table C: Detailed Assessment Daytime Construction Noise Criteria

Land Use	Daytime 1-hour L_{eq} (dBA)
Residential	80
Commercial	85
Industrial	90

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
dBA = A-weighted decibels
FTA = Federal Transit Administration
L_{eq} = equivalent continuous sound level

APPLICABLE VIBRATION STANDARDS

The following information provides standards to which potential vibration impacts will be compared.

Federal Transit Administration

Vibration standards included in the FTA Manual (2018) are used in this analysis for ground-borne vibration impacts on human annoyance. Table D provides the criteria for assessing the potential for interference or annoyance from vibration levels in a building.

Table D: Criteria for Potential Vibration Annoyance

Land Use	Max L_v (VdB)[1]	Description of Use
Workshop	90	Distinctly feelable vibration. Appropriate to workshops and non-sensitive areas.
Office	84	Feelable vibration. Appropriate to offices and non-sensitive areas.
Residential Day	78	Feelable vibration. Appropriate for computer equipment and low-power optical microscopes (up to 20X).
Residential Night and Operating Rooms	72	Vibration not feelable, but ground-borne noise may be audible inside quiet rooms. Suitable for medium-power microscopes (100X) and other equipment of low sensitivity.

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
[1] As measured in 1/3-octave bands of frequency over the frequency range 8 to 80 Hz.
FTA = Federal Transit Administration
Hz = hertz
L_V = velocity in decibels
Max = maximum
VdB = vibration velocity decibels

The criteria for potential damage impacts resulting from ground-borne vibration and noise are based on the maximum levels for a single event. The City's Municipal Code does not include specific criteria for assessing vibration impacts associated with damage. Therefore, for the purpose of determining the significance of vibration impacts experienced at sensitive uses surrounding the project site, the guidelines within the 2018 FTA Manual have been used to determine vibration impacts (refer to Table E, below).

Table E: Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
Reinforced concrete, steel, or timber (no plaster)	0.50
Engineered concrete and masonry (no plaster)	0.30
Non-engineered timber and masonry buildings	0.20
Buildings extremely susceptible to vibration damage	0.12

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).
FTA = Federal Transit Administration
in/sec = inches per second PPV = peak particle velocity

The FTA Manual (2018) guidelines show that a vibration level of up to 0.2 in/sec in PPV is considered safe for non-engineered timber and masonry buildings and would not result in any construction vibration damage. Therefore, to be conservative, the 0.2 in/sec in the PPV threshold has been used when evaluating vibration impacts at the nearest structures to the site.

THRESHOLDS OF SIGNIFICANCE

Based on the *Guidelines for the Implementation of the California Environmental Quality Act* (CEQA), Appendix G, Public Resources Code, Sections 15000–15387, a project will normally have a significant effect on the environment related to noise if it will substantially increase the ambient noise levels for adjoining areas or conflict with adopted environmental plans and the goals of the community in which it is located.

The *State CEQA Guidelines* indicate that a project would have a significant impact on noise if it would result in:

- Generation of a substantial temporary or permanent increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies;
- Generation of excessive ground-borne vibration or ground-borne noise levels; or
- For a project located within the vicinity of a private airstrip or an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, expose people residing or working in the project area to excessive noise levels.

PROJECT IMPACT ANALYSIS

The proposed project would result in short-term construction noise and vibration impacts and long-term mobile source noise and vibration impacts as described below.

Short-Term Construction-Related Impact Analysis

Project construction would result in short-term noise and vibration. Maximum construction noise would be short-term, generally intermittent depending on the construction phase, and variable

depending on receiver distance from the active construction zone. The duration of various types of construction noise and vibration would vary from 1 day to several weeks, depending on the phase of construction. The following describes levels and types of impacts that may occur during construction.

Construction Noise Analysis

Two types of short-term noise would occur during project construction including (1) equipment delivery and construction worker commutes, and (2) project construction operations.

The first type of short-term construction noise would result from the transport of construction equipment and materials to the project site and construction worker commutes. These transportation activities would incrementally raise noise levels on access roads leading to the site. It is expected that larger trucks used in equipment delivery would generate higher noise impacts than trucks associated with worker commutes. The single-event noise from equipment trucks passing at a distance of 50 ft from a sensitive noise receptor would reach a maximum level of 84 dBA L_{max}. For the purposes of delivering necessary construction equipment, the pieces of heavy equipment for construction activities would be moved on site just one time and would remain on site for the duration of each construction phase. This one-time trip, when heavy construction equipment is moved on and off site, would not add to the daily traffic noise in the project vicinity.

During the demolition phase, the passenger count equivalent (PCE) volumes associated with haul trucks would be 212. The total number of daily vehicle trips would be minimal when compared to existing traffic volumes on the affected streets, and the long-term noise level changes associated with these trips would not be perceptible. Therefore, equipment transport noise and construction-related worker commute impacts would be short term and would not result in a significant off-site noise impact. No mitigation is required.

The second type of short-term noise impact is related to noise generated during construction at the project site. Construction is undertaken in discrete steps, each of which has its own mix of equipment, and consequently, its own noise characteristics. These various sequential phases would change the character of the noise generated on the project site. Therefore, the noise levels vary as construction progresses. Despite the variety in the type and size of construction equipment, similarities in the dominant noise sources and patterns of operation allow construction-related noise ranges to be categorized by work phase. Table F lists the maximum noise levels recommended for noise impact assessments for typical construction equipment based on a distance of 50 ft between the construction equipment and a noise receptor. Typical operating cycles for these types of construction equipment may involve 1–2 minutes of full power operation followed by 3–4 minutes at lower power settings.

Table F: Typical Construction Equipment Noise Levels

Equipment Description	Acoustical Usage Factor (%)	Maximum Noise Level (L_{max}) at 50 ft
Compressor	100	81
Concrete Mixer	40	85
Concrete Pump	40	85
Crane	16	83
Dozer	40	80
Forklift	20	75
Front [End] Loader	40	79
Generator	100	78
Grader	8	85
Impact Pile Drivers	20	95
Scraper	40	88
Welder	40	74

Sources: *Noise from Construction Equipment and Operations, Building Equipment, and Home Appliances* (USEPA 1971); Roadway Construction Noise Model (FHWA 2006).
FHWA = Federal Highway Administration
ft = foot/feet
L_{max} = maximum instantaneous sound level
USEPA = United States Environmental Protection Agency

In addition to the reference maximum noise level, the usage factor provided in Table F is used to calculate the hourly noise level impact for each piece of equipment based on the following equation:

$$L_{eq}(equip) = E.L. + 10\log(U.F.) - 20\log\left(\frac{D}{50}\right)$$

where: $L_{eq}(equip)$ = L_{eq} at a receiver resulting from the operation of a single piece of equipment over a specified time period

E.L. = Noise emission level of the particular piece of equipment at a reference distance of 50 ft

U.F. = Usage factor that accounts for the fraction of time that the equipment is in use over the specified period of time

D = Distance from the receiver to the piece of equipment

Each piece of construction equipment operates as an individual point source. Using the following equation, a composite noise level can be calculated when multiple sources of noise operate simultaneously:

$$Leq\ (composite) = 10 * \log_{10}\left(\sum_{1}^{n} 10^{\frac{Ln}{10}}\right)$$

Table G shows the composite noise levels of the pieces of equipment at a distance of 50 ft from the construction area. Once composite noise levels are calculated, reference noise levels can then be adjusted for distance using the following equation:

$$Leq\ (at\ distance\ X) = Leq\ (at\ 50\ feet) - 20 * \log_{10}\left(\frac{X}{50}\right)$$

In general, this equation shows that doubling the distance would decrease noise levels by 6 dBA while halving the distance would increase noise levels by 6 dBA.

Table G: Potential Construction Noise Impacts at Nearest Receptor

Receptor (Location)	Composite Noise Level (dBA L_{eq}) at 50 ft[1]	Distance (ft)	Composite Noise Level (dBA L_{eq})
Residence (Southwest)	88	150	78

Source: Compiled by LSA (2023).

[1] The composite construction noise level represents the demolition of 19B phase which is expected to result in the greatest noise level as compared to other phases.

dBA L_{eq} = average A-weighted hourly noise level

ft = foot/feet

Table G shows the nearest sensitive use to the project site, their distance from the center of construction activities, and composite noise levels expected during construction. These noise level projections do not consider intervening topography or barriers. Construction equipment calculations are provided in Attachment C.

While construction noise will vary, it is expected that composite noise levels during construction at the nearest off-site sensitive residential uses to the southwest would approach 78 dBA L_{eq} during daytime hours. These predicted noise levels would only occur when all construction equipment is operating simultaneously and, therefore, are assumed to be rather conservative in nature. While construction-related short-term noise levels have the potential to be higher than existing ambient noise levels in the project area under existing conditions, the noise impacts would no longer occur once project construction is completed.

As stated above, the City's Noise Ordinance regulates noise impacts associated with construction activities. The proposed project would comply with the construction hours specified in the City's Noise Ordinance, which states that construction activities are not allowed between the hours of 9:00 p.m. of one day and 7:00 a.m. of the following day.

As it relates to off-site uses, construction-related noise impacts would remain below the 80 dBA L_{eq} 1-hour construction noise level criteria for daytime construction noise level criteria as established by the FTA for residential land uses; therefore, the impact would be considered less than significant. No mitigation is required.

Construction Vibration Reference Information

Ground-borne noise and vibration from construction activity would be low. Table H provides reference PPV values and vibration levels (in terms of in/sec) from typical construction vibration sources at 25 ft. While there is currently limited information regarding vibration source levels specific to the equipment that would be used for the project, to provide a comparison of vibration levels expected for a project of this size, a large bulldozer would generate 0.089 PPV (in/sec) or 87 VdB of ground-borne vibration when measured at 25 ft, based on the FTA Manual.

Table H: Vibration Source Amplitudes for Construction Equipment

Equipment	Reference PPV/L_V at 25 ft	
	PPV (in/sec)	L_V (VdB)[1]
Pile Driver (Impact), Typical	0.644	104
Pile Driver (Sonic), Typical	0.170	93
Vibratory Roller	0.210	94
Hoe Ram	0.089	87
Large Bulldozer	0.089	87
Caisson Drilling	0.089	87
Loaded Trucks	0.076	86
Jackhammer	0.035	79
Small Bulldozer	0.003	58

Source: *Transit Noise and Vibration Impact Assessment Manual* (FTA 2018).

[1] RMS VdB re 1 µin/sec.

µin/sec = micro-inches per second
ft = foot/feet
FTA = Federal Transit Administration
in/sec = inches per second
L_V = velocity in decibels
PPV = peak particle velocity
RMS = root-mean-square
VdB = vibration velocity in decibels

The distance to the nearest buildings for vibration impact analysis is measured between the nearest off-site buildings and the project construction boundary (assuming the construction equipment would only be used at or near the project setback line). The formula for vibration transmission is provided below:

$$L_vdB\ (D) = L_vdB\ (25\ feet) - 30\ Log\ (D/25)$$

$$PPV_{equip} = PPV_{ref} \times (25/D)^{1.5}$$

Construction Vibration Building Damage Potential Assessment

As shown previously in Table E, it would take a minimum of 0.2 PPV (in/sec) to cause any potential building damage to non-engineered timber and masonry buildings. The closest structures to the project site include the residential uses located approximately 33 ft from the approximate limits of disturbance. At this distance, the closest structure would experience vibration levels of 0.059 PPV (in/sec) with the use of heavy equipment at the limits of disturbance Based on this analysis, vibration levels would not exceed the established guidelines considered for damage potential.

Vibration levels at all other buildings would be lower than 0.059 PPV (in/sec). Therefore, construction would result in a less than significant impact, and no mitigation would be required.

Construction Vibration Human Annoyance Potential

As stated above, the existing residential use to the southwest of the project site is the nearest receptor at approximately 150 ft from the center of the project site and would experience vibration levels approaching 64 VdB based on the equation above.

Based on the standards provided previously in Table D, this level of ground-borne vibration is below the threshold of distinctly perceptible, which is approximately 78 VdB for residential uses during the day and would not exceed the FTA vibration threshold for human annoyance at the nearest sensitive uses. Project construction would not result in vibration levels that would typically result in human annoyance. Therefore, this level of ground-borne vibration would be less than significant for human annoyance. No mitigation is required.

Construction Related Ground-Borne Noise and Vibration from Vehicular Traffic

The proposed project would not generate off-site traffic related vibration levels. Vibration levels generated from project-related traffic on the adjacent roadways are unusual for on-road vehicles because the rubber tires and suspension systems of on-road vehicles provide vibration isolation. Based on a reference vibration level of 0.076 in/sec PPV, structures greater than 20 ft from the roadways which contain project trips would experience vibration levels below the most conservative standard of 0.12 in/sec PPV, and therefore, vibration levels generated from project-related traffic on the adjacent roadways would be less than significant, and no mitigation measures are required.

Attachments: A: References
B: Figures 1 and 2
C: Construction Noise Calculations

ATTACHMENT A

REFERENCES

City of Glendora. 2008. Glendora Community Plan 2025 Chapter 4 – Noise Element.

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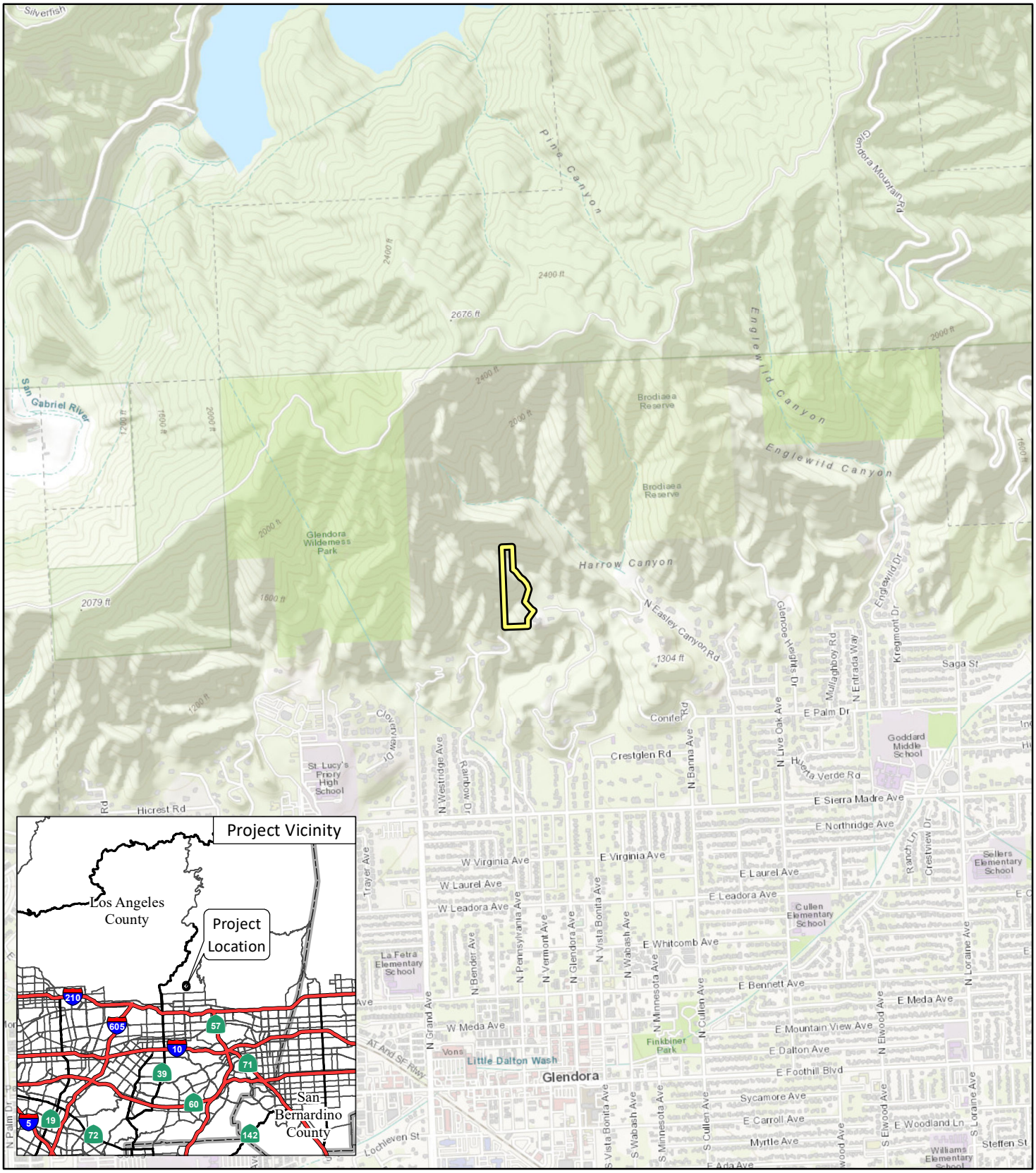
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ATTACHMENT B

FIGURES

Figure 1: Project Location and Vicinity
Figure 2: Site Plan



LSA

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Project Location

FIGURE 1

N

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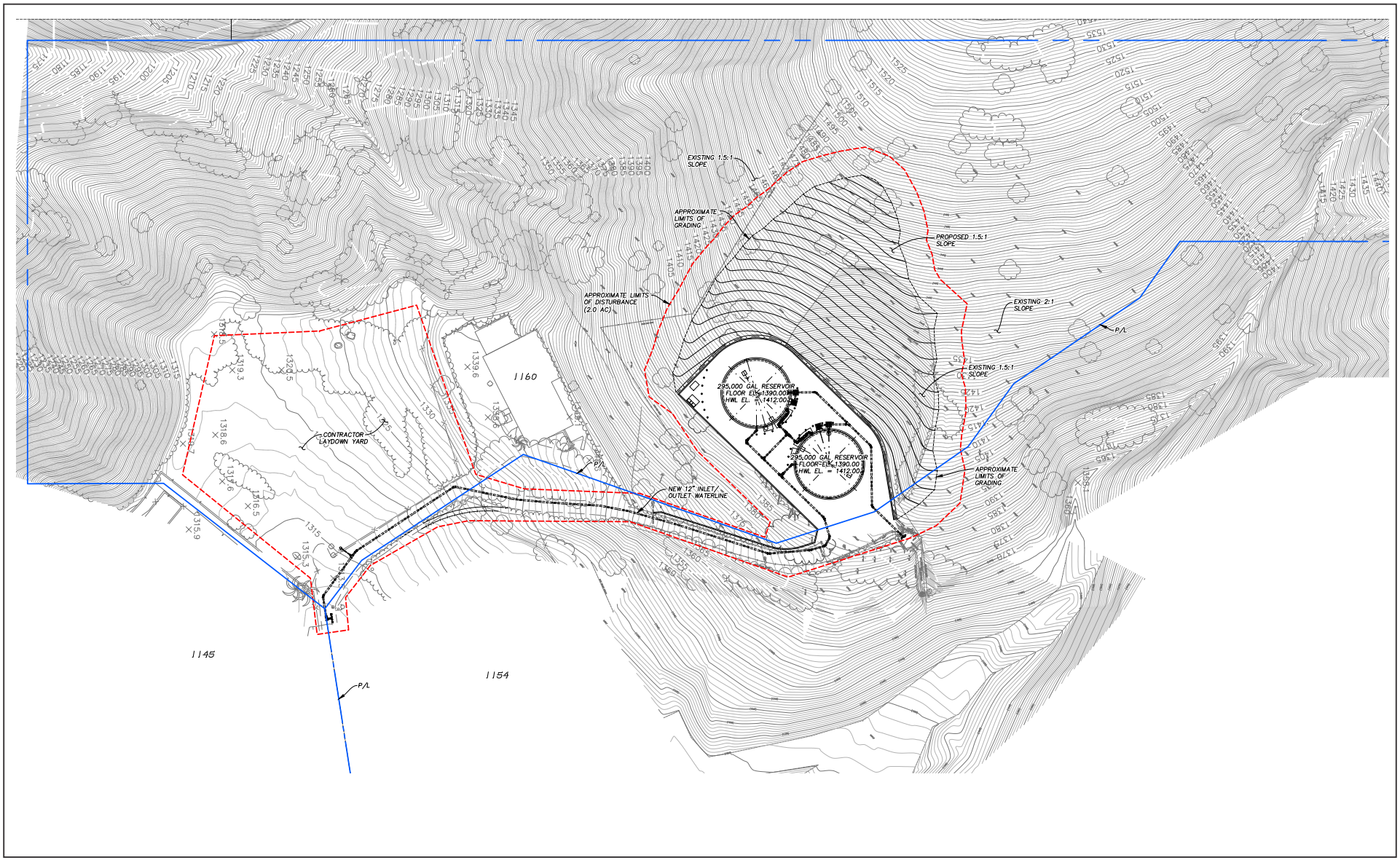
FEET

North Glendora Water Tank Project

Project Location and Vicinity

SOURCE: USGS 7.5' Quad - *San Luis Rey* (1975), *Oceanside* (1975), CA

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FIGURE 2

0 50 100
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SOURCE: AKM Consulting Engineers

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North Glendora Water Tank Project

Site Plan

ATTACHMENT C

CONSTRUCTION NOISE CALCULATIONS

Construction Calculations

Phase: Demolition of 19B

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Tractor	3	84	40	50	0.5	84	85
Dozer	1	82	40	50	0.5	82	78
Concrete Saw	1	90	20	50	0.5	90	83
					Combined at 50 feet	**91**	**88**
					Combined at Receptor 150 feet	**82**	**78**

Phase: Site Preparation

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Tractor	1	84	40	50	0.5	84	80
					Combined at 50 feet	**89**	**85**
					Combined at Receptor 150 feet	**79**	**75**

Phase: Grading

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Grader	1	85	40	50	0.5	85	81
Dozer	1	82	40	50	0.5	82	78
Tractor	2	84	40	50	0.5	84	83
					Combined at 50 feet	**89**	**86**
					Combined at Receptor 150 feet	**79**	**76**

Phase: Construction of 19C

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Crane	1	81	16	50	0.5	81	73
Man Lift	1	75	20	50	0.5	75	68
Generator	1	81	50	50	0.5	81	78
Tractor	1	84	40	50	0.5	84	80
Welder / Torch	3	74	40	50	0.5	74	75
Compressor (air)	1	78	40	50	0.5	78	74
					Combined at 50 feet	**88**	**84**
					Combined at Receptor 150 feet	**78**	**74**

Phase: Construction of 19BR

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Crane	1	81	16	50	0.5	81	73
Man Lift	1	75	20	50	0.5	75	68
Generator	1	81	50	50	0.5	81	78
Tractor	1	84	40	50	0.5	84	80
Welder / Torch	3	74	40	50	0.5	74	75
Compressor (air)	1	78	40	50	0.5	78	74
					Combined at 50 feet	**88**	**84**
					Combined at Receptor 150 feet	**78**	**74**

Phase: Below Ground Piping

Equipment	Quantity	Reference (dBA) 50 ft Lmax	Usage Factor[1]	Distance to Receptor (ft)	Ground Effects	Noise Level (dBA) Lmax	Noise Level (dBA) Leq
Front End Loader	2	79	40	50	0.5	79	78
Slurry Trenching Machine	2	80	50	50	0.5	80	80
					Combined at 50 feet	**83**	**82**
					Combined at Receptor 150 feet	**73**	**73**

Sources: RCNM

[1]- Percentage of time that a piece of equipment is operating at full power.
dBA – A-weighted Decibels
Lmax- Maximum Level
Leq- Equivalent Level