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Subject: **Shell Alameda Distribution Center Remediation Project Noise and Vibration Impact Analysis**

1.0 Introduction

Wood Environment & Infrastructure Solutions, Inc. (Wood) has prepared this noise and vibration impact analysis to independently evaluate the potential for the proposed Shell Alameda Distribution Center Remediation Project (Project) to affect nearby noise-sensitive receptors including, but not limited to, residences, schools, libraries, churches, and hospitals.

The proposed Project involves the demolition of existing pavements, buildings, and other infrastructure (e.g., aboveground storage tanks [ASTs], buried pipelines, and other appurtenances) as well as excavation and removal of contaminated soils and groundwater generated during excavation activities (see Section 3.0, *Project Description*). Upon completion of demolition, excavation, and backfilling, the entire Project site would be cleared of equipment and regraded. No redevelopment or other operational use is considered as a part of the proposed Project.

2.0 General Noise and Ground-borne Vibration Background

Overview

Sound is mechanical energy transmitted by pressure waves through a medium such as air. Noise is defined as unwanted sound. The sound pressure level has become the most common descriptor used to characterize the loudness of an ambient sound level. Sound pressure level is measured in decibels (dB), with 0 dB corresponding roughly to the threshold of human hearing, and 120 to 140 dB corresponding to the threshold of pain. Because sound pressure can vary greatly within the range of human hearing, a logarithmic loudness scale is used to keep sound intensity numbers at a convenient and manageable level.

Sound pressure fluctuations can be measured in units of hertz (Hz), which correspond to the frequency of a particular sound. Typically, sound does not consist of a single frequency, but rather a broad band of frequencies varying in levels of magnitude (i.e., sound power). When all the audible frequencies of a sound are measured, a sound spectrum is plotted consisting of a range of frequency spanning 20 to 20,000 Hz.

The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. When assessing potential noise impacts, sound is measured using an electronic filter that deemphasizes the frequencies below 1,000 Hz and above 5,000 Hz in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies. This method of frequency weighting is referred to as A-weighting and is expressed in units of A-weighted decibels (dBA).[1] Frequency A-weighting is typically applied to community noise measurements. Table 1 shows some representative noise sources and their corresponding noise levels in dBA.

Table 1. dBA Sound Pressure Levels in Daily Life

Source	Sound Level	Human Perception
Threshold of hearing	0 dBA	Do not hear anything
Broadcast studio interior or rustling leaves	10 dBA	1/32nd as loud as conversation
Quiet house interior or rural nighttime	20 dBA	1/16th as loud
Quiet office interior or watch ticking	30 dBA	1/8th as loud
Quiet rural area or small theater	40 dBA	1/4th as loud
Quiet suburban area or dishwasher in next room	50 dBA	1/2 as loud
Office interior or ordinary conversation	60 dBA	Ordinary Conversation
Vacuum cleaner at 10 feet	70 dBA	Twice as loud
Passing car at 10 feet or garbage disposal at 3 feet	80 dBA	4 times as loud
Passing bus or truck at 10 feet or food blender at 3 feet	90 dBA	8 times as loud
Passing subway train at 10 feet or gas lawn mower at 3 feet	100 dBA	16 times as loud
Night club with band playing	110 dBA	32 times as loud
Threshold of pain	120 dBA	64 times as loud as conversation (twice as loud as night club)

Source: University of Maryland 2016.

Noise Exposure and Community Noise

Noise exposure is a measure of the noise experienced by an individual over a period of time. A sound level is a measure of noise at a given instant in time. However, sound levels rarely persist consistently over a long period of time. Rather, community noise varies continuously with time with respect to the contributing sound sources in the environment. Community noise is primarily the product of many distinct noise sources that constitute a relatively stable background noise exposure, with the individual contributors unidentifiable. The background sound level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources such as traffic and changes in atmospheric conditions. What makes community noise constantly variable throughout a day, besides the slowly changing background noise, is the addition of short duration single event noise sources (e.g., aircraft flyovers, motor vehicles, sirens, etc.), which are readily identifiable to the individual. Community noise is commonly described in terms of the "ambient" noise level, which is defined as the all-encompassing noise level associated with a given noise environment.

These successive additions of sound make the community noise level variable from instant to instant, requiring the measurement of noise exposure over a period of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. This time-varying characteristic of environmental noise is described using statistical noise descriptors. The most frequently used noise descriptors are summarized below:

- **L_{eq}:** The equivalent sound level is used to describe noise over a specified period of time, typically 1 hour, in terms of a single numerical value. The L_{eq} is the constant sound level, which would contain the same acoustic energy as the varying sound level, during the same time period (i.e., the average noise exposure level for the given time period).

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[1] The most common weighting that is used in noise measurement is A-Weighting. Like the human ear, this effectively cuts off the lower and higher frequencies that the average person cannot hear. Weighted measurements are expressed as dBA or dB(A).

- **L_{max}:** The instantaneous maximum noise level measured during the measurement period of interest.
- **L_x:** The sound level that is equaled or exceeded x percent of a specified time period.
- **L_{50}:** The median sound level, or the sound level exceeded 50 percent of the time of the measurement period.
- **DNL:** The day-night average noise level (DNL or L_{dn}) or energy average of the A-weighted sound levels occurring during a 24-hour period, and which accounts for the greater sensitivity of most people to nighttime noise by weighting noise levels at night (i.e., "penalizing" night-time noises). Noise between 10:00 p.m. and 7:00 a.m. is weighted (i.e., "penalized") by adding 10 dBA to take into account the greater annoyance of night-time noises.
- **CNEL:** Similar to the DNL, the Community Noise Equivalent Level (CNEL) adds a 5-dBA "penalty" for the evening hours between 7:00 p.m. and 10:00 p.m. in addition to a 10-dBA penalty between the hours of 10:00 p.m. and 7:00 a.m.

Effects of Noise on People

The effects of noise on people can be placed into three categories:

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

Environmental noise typically produces effects in the first two categories. Workers in industrial plants generally experience noise in the last category. There is no satisfactory way to completely measure the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction. A wide variation exists in the individual thresholds of annoyance, and different tolerances to noise tend to develop based on an individual's past experiences with noise.

Thus, an important way of predicting a human reaction to a new noise environment is the way it compares to the existing background environment to which one has adapted (i.e., the "ambient" noise level). In general, the more a new noise exceeds the previously existing ambient noise level, the less acceptable the new noise will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA cannot be perceived;
- Outside of the laboratory, a 3-dBA change is considered a just-perceivable difference;
- A change in level of at least 5 dBA is required before any noticeable change in human response would be expected; and
- A 10-dBA change is subjectively heard as approximately a doubling in loudness and can cause adverse response.

These relationships occur in part because of the logarithmic nature of sound and the decibel system. The human ear perceives sound in a non-linear fashion; hence the decibel scale was developed. Because the decibel scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but instead combine logarithmically. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA. When combining sound levels, the relationships presented in Table 2 may be used as an approximation.

Table 2. Decibel Addition Relationships

When Two Decibel Values Differ by:	Add This Amount to the Higher Value	Example:
0 or 1 dB	3 dB	70 + 69 = 73 dB
2 or 3 dB	2 dB	71 + 71 = 76 dB
4 to 9 dB	1 dB	66 + 60 = 67 dB
10 dB or more	0 dB	65 + 55 = 65 dB

Source: California Department of Transportation (Caltrans) 2013.

Noise Attenuation

Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate or lessen, at a rate of 6 to 7.5 dBA per doubling of distance from the source, depending on the topography of the area and environmental conditions (i.e., atmospheric conditions, existing noise barriers, etc.). Widely distributed noise, such as a large industrial facility spread over many acres or a street with moving vehicles, would typically attenuate at a lower rate, approximately 3 to 4.5 dBA per doubling of distance from the source.

Ground-borne Vibration

Vibration is an oscillatory motion through a solid medium in which the motion's amplitude can be described in terms of displacement, velocity, or acceleration. Several different methods can be used to quantify vibration including the peak particle velocity (PPV), and the root mean square (RMS). The PPV is defined as the maximum instantaneous peak of the vibration signal and is discussed in terms of inches per second. The PPV is most frequently used to describe vibration impacts to buildings. The RMS amplitude is most frequently used to describe the effect of vibration on the human body. The RMS amplitude is the average of the squared amplitude of the signal. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration (Federal Transit Administration [FTA] 2006).

The FTA has adopted vibration standards that are used to evaluate potential building damage impacts related to construction activities. While the FTA's criteria were primarily developed to assess construction vibration impacts from transit operations (e.g., bus, commuter rail, etc.), the criteria can be broadly applicable to all types of construction activities that could generate vibration.

Table 3. Construction Vibration Damage Criteria

Building Category	PPV (in/sec)
I. Reinforced-concrete, steel, or timber (no plaster)	0.5
II. Engineered concrete and masonry (no plaster)	0.3
III. Non-engineered timber and masonry buildings	0.2
IV. Buildings extremely susceptible to vibration damager	0.12

Source: FTA 2006a.

In addition, the FTA has also adopted standards associated with human annoyance for ground borne vibration impacts for the following three land-use categories:

- Vibration Category 1 – High Sensitivity;
- Vibration Category 2 – Residential; and
- Vibration Category 3 – Institutional.

The FTA defines Category 1 as buildings where vibration would interfere with operations within the building, including vibration-sensitive research and manufacturing facilities, hospitals with vibration-sensitive equipment, and university research operations. Vibration-sensitive equipment includes, but is not limited to, electron microscopes, high-resolution lithographic equipment, and normal optical microscopes. Category 2 refers to all residential land uses and any buildings where people sleep, such as hotels and hospitals. Category 3 refers to institutional land uses such as schools, churches, other institutions, and quiet offices that do not have vibration-sensitive equipment but still have the potential for activity interference. The vibration thresholds associated with human annoyance for these three land use categories are shown in Table 4. No thresholds have been identified or recommended specific to commercial and office uses, although Category 3 standards may be applied as they are defined as land uses with primarily daytime and evening use.

Table 4. Ground-borne Vibration Impact Criteria for General Assessment

Land Use Category	Frequent Events[a]	Occasional Events[b]	Infrequent Events[c]
Category 1: Buildings where vibration would interfere with interior operations	65 VdB[d]	65 VdB[d]	65 VdB[d]
Category 2: Residences and buildings where people normally sleep	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use	75 VdB	78 VdB	83 VdB

Source: FTA 2006a.
Notes:
Vibration Decibel (VdB) = The RMS velocity level in VdB units relative to 1 micro-inch per second.
[a] "Frequent Events" is defined as more than 70 vibration events of the same source per day.
[b] "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day.
[c] "Infrequent Events" is defined as fewer than 30 vibration events of the same kind per day.
[d] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes.

3.0 Project Site and Surrounding Land Uses

The 4.1-acre Project site is located at 2015 Grand Street within the northeastern portion of Alameda Island in the City of Alameda, Alameda County, California. The Project site is designated for "Specified Mixed Use" (MU-6) in the 2016 City of Alameda General Plan (City of Alameda 2016). This land use designation covers the northern waterfront between Grand Street to Sherman Street. Permitted land uses in the MU-6 district include residential, commercial, and office and retail uses. Areas to the east of the Project site are designated as "Specified Mixed Use" (MU-4) and "Medium Density Residential." Permitted land uses in the MU-4 district include residential, office, and industry uses. Areas to the south of the Project site are designated as "Medium Density Residential." The Project site is zoned as "R-4 Neighborhood Residential" within the "Planned Development" Combining District (R-4-PD) pursuant to the City of Alameda Zoning Ordinance and Zoning Map (City of Alameda 2019).

The Project site is generally bounded by residential neighborhoods to the northeast and southwest (which appear to have been constructed in 2011 based on a review of aerial photographs). Single-family residences are located approximately 55 feet northeast of the Project site across Fortmann Way and approximately 40 feet southwest of the Project site across Ellen Crag Avenue. Three marinas are also located in close proximity of the Project site. The Fortman Marina is located approximately 400 feet northwest, the Grand Marina is located approximately 600 feet north, and the Alameda Marina is located approximately 650 feet northeast. These marinas may include house boats (boats that people live on), which would also be considered noise-sensitive receptors.

There are no schools, libraries, churches, hospitals, or other noise-sensitive receptors located within a 0.25-mile radius of the Project site. The nearest public school is Love Elementary School, located approximately 0.4 miles southeast of the Project site. The nearest public library is the Alameda Free Library, located approximately 0.9 miles southeast of the Project site. The nearest church is First Baptist Church, located approximately 0.3 miles southwest of the Project site. The nearest hospital is Alameda Hospital, located approximately 0.9 miles south of the Project site.

4.0 Existing Noise and Vibration in the Project Vicinity

Noise Environment

Transportation sources, such as automobiles, trucks, trains, and aircraft, are the principal sources of noise in most urban environments. Along major transportation corridors, noise levels can reach 80 DNL, while along arterial streets noise levels typically range from 65 to 70 DNL.

The existing ambient noise environment within the Project site vicinity is dominated by vehicle traffic from surrounding local streets including Clement Avenue, Grand Street, and Fortmann Way. Existing noise from the Project site is limited to trucks entering and exiting the Project site on Grand Street and use of forklifts at the loading docks. Adjacent land uses – including residential, commercial, and light industrial development – also contribute to the existing ambient noise environment (e.g., periodic back up beepers from delivery trucks, etc.). Secondary noise sources in the vicinity consist of distant traffic noise from State Route (SR-) 61, located approximately 0.6 miles south of the Project and Interstate (I-) 880, located approximately 0.8 miles north of the Project. Oakland International Airport (OAK) is located approximately 4.8 miles to the southeast of the Project site and the Project site is not located within the OAK Airport Influence Area (Alameda Community Development Agency 2012). Also, at this distance, OAK does not substantially influence the ambient noise level at the Project site and within the surrounding vicinity.

The most recently available ambient noise monitoring data in the vicinity of the Project site was collected in August 2017 during the preparation of the Alameda Marina Master Plan Environmental Impact Report (EIR). Short-term (i.e., 15-minute) noise monitoring was conducted at noise sensitive land uses surrounding the Alameda Marina Master Plan site, including 1627 Red Sails Lane, located approximately 110 feet north of the Project site (City of Alameda 2017). The Daytime L_{eq} at this location was 56 dBA (City of Alameda 2017). This Daytime L_{eq} is generally consistent with the noise levels expected along arterial streets (e.g., Clement Avenue and Grand Street). This Daytime L_{eq} is also consistent with the normally acceptable CNEL for residential land uses (i.e., up to 60 dBA CNEL) and the normally acceptable CNEL for office buildings, business commercial, and professional land uses (i.e., up to 70 dBA CNEL) as designated by the 2016 City of Alameda General Plan (City of Alameda 2017).

Vibration Environment

As described in the Alameda Marina Master Plan EIR, sources of substantial vibration in the vicinity of the Project site are minimal and are generally restricted to vibration and shaking caused by the occasional passing of heavy vehicles, such as dump trucks and semi-trailer end dump trucks, a portion of which originate from the Alameda Distribution Center. There are no sources of substantial vibration on the Project site itself, nor are there any amongst the adjacent land uses.

5.0 Project Description

Project Background

The Project site and its facilities has been owned and operated by Pennzoil-Quaker State Company dba SOPUS Products (SOPUS) since 1951. The facilities were originally used as a blending, packaging, and distribution center for bulk and packaged petroleum-based lubricant products (i.e., motor oil). In 1995, SOPUS ceased blending and packaging operations and currently only distributes bulk and pre-packaged industrial lubricants.

Former underground storage tanks (USTs) containing gasoline and diesel fuel contributed to shallow soil and subsequent groundwater contamination in the northeastern portion of the Project site. Accidental product spills associated with leaking and overfilling aboveground storage tanks (ASTs) also contributed to shallow soil contamination and groundwater impacts in the tank farm area in the southwestern portion of the Project site. While small scale excavations removed impacted soil within the vicinity of the tank farm in 2002, impacted soil contamination and groundwater consisting of total petroleum hydrocarbons as gas, diesel, and motor oil (TPHg, TPHd, TPHmo); and benzene, ethylbenzene, and xylenes (BTEX) remain throughout the Project site within the shallow soils approximately 2 to 4 feet below ground surface (bgs) (Consulting Engineers 1985; Arcadis G&M, Inc [ARCADIS] 2005; Conestoga-Rovers & Associates 2015). Limited groundwater contamination consisting of TPHg, TPHd, TPHmo; and BTEX is present due to the high groundwater levels in the vicinity that range from approximately 1 to 4 feet bgs. There were also numerous groundwater monitoring wells installed throughout the Project site.

Proposed Project

The proposed Project would involve the demolition of existing pavements, buildings, and other infrastructure on the Project site, abandonment of existing groundwater monitoring wells, soil excavation and offsite disposal, and backfill with clean fill. The San Francisco Bay Regional Water Quality Control Board (RWQCB) issued Site Cleanup Requirements Order No. 98-121 for the Project site, which included a categorical exemption from the California Environmental Quality Act (CEQA), but did not consider source removal activities such as soil excavation that are part of the proposed Project.

Prior to remediation activities, soil testing pits were excavated across the Project site to determine groundwater depths and infiltration rates, and to conduct waste profiling sampling according to the Sampling and Analysis Plan (SAP) developed for the Site. Soil pit testing and waste profiling were conducted to inform the design and sequencing of the remedial excavation and on-site dewatering, if required.

Once soil pit testing and waste profiling are completed, construction activities associated with remediation of the contaminated soil and groundwater would consist of mobilization and staging of construction equipment; demolition and removal of existing on-site pavements, buildings, and other infrastructure (e.g., ASTs); excavation and removal of contaminated soils, dewatering during excavation, import and compaction of clean backfill, re-grading to pre-excavation levels; and demobilization. The proposed Project activities would occur in the following five phases:

- **Phase 1:** Mobilization;
- **Phase 2:** Limited demolition of existing pavement, buildings, and other infrastructure;
- **Phase 3:** Excavation, dewatering, backfilling, and grading;
- **Phase 4:** Demolition of remaining on-site buildings and warehouses; and
- **Phase 5:** Demobilization of post-remediation equipment.

Mobilization

The first phase would involve mobilization and staging of demolition/construction equipment and materials. All equipment and materials would be delivered and staged within the concrete slab and asphalt parking area within the northwestern portion of the Project site near the existing loading dock area. These materials are expected to be delivered to the Project site within 1 month prior to the initiation of demolition activities. Construction access to the Project site would be provided at the entrance along Grand Street.

Prior to mobilization, existing on-site monitoring wells were removed according to the requirements of the Well Destruction Work Plan. Additionally, the construction limits of work for the entire northeastern portion of the Project site would be fenced and signage would be installed to maintain site security. Mobilization would require a total of 6 construction workers for construction equipment staging, traffic control, and health and safety oversight. Table 5 lists the type and amount of equipment that would be staged at the Project site during mobilization and used during the demolition and excavation activities.

Table 5. Construction Equipment

Construction Equipment	Units	Duration (weeks)
Operated Dump Truck (with flatbed trailers)	2	3
Torch and Acetylene Tanks	2	3
60-Foot Articulating Boom Lift	1	2
Excavator Sheer Attachment	1	3
Excavator Hydraulic Hammer	1	3
815 Compactor	1	2
Mobile Concrete Crushing/Screen Unit	1	2
18,000-lb Excavator	1	2
85,000-lb Excavator	2	10
4-CY Loader	1	7
Motor Grader	1	2
12K Reach Forklift	1	1
D6 Dozer	1	1
Skip Loader	1	2
Track Skid Steer	1	3
4,000-gallon Water Truck	1	10
2,000-gallon Water Truck	1	3
Pick-Up Truck	2	10
185 CFM Air Compressor	1	3
Pressure Washer	2	4
21,000-gallon Frac Tank	2	10

Source: ICS 2020.

Limited Demolition of Existing On-Site Buildings and AST Removal

The second phase would involve the removal and demolition of the maintenance building and carport located within the northeastern portion of the Project site. Once this portion of the Project site is cleared of vegetation and debris, the maintenance building and covered carport would be removed, including the surrounding asphalt pavement. The demolition sequence would involve a top-down technique that first removes roofing, followed by the structure and foundation. Debris and construction waste would be temporarily stockpiled near the loading docks prior to removal. All demolition and construction waste would be removed and handled according to the requirements of a Waste Management and Transportation Plan (WMTP). The WMTP would summarize procedures for managing waste during the proposed demolition and excavation activities, including ensuring the proposed Project meets the City's diversion rate of 77 percent.

Once demolition in the northeastern portion of the Project site is complete, the compounding building and the remaining 11 active ASTs in the southwestern portion of the Project site would be removed. The compounding building would be demolished first, but a portion of the building's outer perimeter concrete wall would remain to reduce dust and noise generation during the removal of the ASTs. Once the 11 ASTs are cleaned and removed from the Project site, the outer perimeter concrete wall of the compounding building would be removed using an excavator, grapple, and concrete pulverizing equipment.

The demolition and removal activities during this phase would require 5 to 10 construction workers. Construction equipment would demolish buildings and heavy haul trucks would remove demolition debris and building waste over a 1-month period. Heavy haul trucks and other construction vehicles would limit travel to designated truck routes, such as Clement Avenue and Park Street within the City of Alameda. Table 6 indicates the duration of each construction phase and the corresponding truck trips associated with project construction equipment staging, limited demolition, excavation and soil removal, and final demolition.

Table 6. Daily Truck Trip Generation by Construction Activity

Construction Phase	Duration	# Worker Commute Trips (/day)[1,2]	# Off-Haul Trips (/day)[3]	# Import Trips (/day)	Total Trips (/day)
Mobilization	2 weeks	6	0	12	18
Limited Demolition and AST Removal	1 month	10	50	5	65
Excavation, Export/Import, Grading	2 months	12	16	16	44
Demolition of Remaining On-site Buildings	1 month	15	13	0	28
Demobilization of Post-Remediation Equipment	1 week	6	6	0	12

Sources: ICS 2020; Wood 2020

Notes:

[1] Expressed in round trips; one trip equals one vehicle going to and leaving form the Project site. Assumes each worker arrives in their personal vehicle each day and generates one inbound trip during the morning peak hour and one outbound trip during the evening peak hour. Average commute distances are anticipated to consist of 40 mile round trips within the Bay Area.

[2] Assumes each average daily trip is associated with excavation off-haul and import. The debris sorting and disposal facility is assumed to be Republic's Keller Canyon Landfill in Pittsburgh (approximately 35 miles to the northeast).

[3] Assumes an additional 5 trips would be required to off-haul approximately 20,000 gallons of residual oily water associated with the clean-out of the ASTs and piping. These residual oily water would be exported in a 5,000-gallon vac truck to either a transfer station in Richmond or Rio Vista, California.

Excavation, Import/Export, and Backfilling

The third phase would involve excavation of contaminated soils. Excavation, backfilling, compaction, and grading operations would be completed in accordance with the City of Alameda Grading Permit. Heavy equipment would be utilized for the excavation of contaminated soil and backfilling and compaction with clean soil. This equipment would likely include track mounted excavators, front end loaders, compaction equipment, breaker hammer equipment (possibly vibratory to remove concrete slabs and asphalt areas), and trucks (end dump trucks and possibly transfer dumps) for soil disposal. Up to 11,400 banked cubic yards (bcy) of soil may be excavated (6,500 bcy in the northeast area and 4,900 bcy in the tank farm area). Excavated soil and debris would be removed, sorted, and handled according to the requirements of the WMTP and SAP, which would describe the results of the soil investigation to pre-profile soil for disposal, the procedures required to sample and analyze soil for direct burial (if required), and the procedures required to verify the backfill material meets the criteria for clean soil import.

The extent of excavation at the Project site would be focused in three locations: the tank farm area, northeast area, and the former wash area in the Taylor Warehouse. The entire excavation area includes approximately 2 acres (approximately 49 percent) of the 4.1-acre Project site. Approximately 11,400 bcy of clean fill would be imported to the Project site to backfill the remedial excavations. Backfilling would use a loader, dozer, excavator, vibratory compactor, and water truck.

The excavation activities would begin in the tank farm area and then move to the northeast area. The excavation extent in the former tank farm area excludes the vacated portion of Clement Avenue, a portion of Hibbard Street, and the railroad tracks, where proposed construction would occur along Clement Avenue between Hibbard Street and Grand Street. The tank farm area would include up to 3 feet of soil excavation based on cleanup goals for the Project site COCs. This would result in a total of approximately 4,900 bcy of soil excavation, however, preliminary soil sampling at the bottom of the 3-foot excavation depth would determine whether excavation below 3 feet bgs would be required. Excavation is not expected to extend deeper than 5 feet bgs (anticipated depth of groundwater). Off-site hauling of the contaminated soil and import of fill material would require approximately 460 truck trips and the equivalent of 460 import trips of clean fill deliveries over a 2-month construction period. Average tandem axel commercial dump trucks hold between 12 to 14 cy of soil.[2]

Excavation activities would then proceed with the excavation of approximately 100 bcy of soil and fill within the former UST and wash area in the Taylor Warehouse. Removal of the contaminated fill would require approximately 8 additional truck trips and the equivalent of 8 import truck trips of clean fill deliveries for a total of 16 truck trips over the same 2-month period.

Once excavation is complete within the former wash area, excavation would occur within the northeast portion of the Project site. The excavation extent in the northeastern area excludes the loading dock area, as there is no indication the extent of contamination extends into this area. The northeastern excavation area would include up to 6 feet of soil excavation (up to anticipated depth of groundwater) for a total of approximately 6,500 bcy of soil. Soil confirmation sampling at the base of the 6-foot excavation depth would determine whether excavation below 6 feet bgs is required. Off-hauling the contaminated soil would require approximately 483 truck trips and the equivalent of 483 import trips of clean fill deliveries over the same 2-month construction period for the other two excavation areas, for a total of 966 truck trips.

Excavation activities would require a total of 10 construction workers, including 6 construction workers for excavation and backfilling, and approximately 4 additional construction workers for traffic control, street sweeping and maintenance, as well as health and safety oversight. Excavation equipment would include excavators equipped with a bucket attachment, rubber-tired loaders, and semi-end dump trucks for hauling contaminated soil off site and importing clean soil for backfilling. If dewatering is required during excavation, water would be pumped from the excavation into a tank with secondary containment. Water removed during excavation would be treated onsite (if necessary) and discharged into the East Bay Municipal Utility District's (EBMUD) sanitary sewer. If treated groundwater is tested and found to contain concentrations in excess of the EBMUD discharge limits, it would be disposed at an off-site, SOPUS-approved, local treatment, storage, and disposal facility (TSDF) as non-hazardous waste.

Demolition of Remaining On-Site Buildings

[2] Truck trips were estimated by ICS in March 2020. Tandem axel dump trucks with an average capacity of 12 cy per load would off-haul contaminated soil and demolition debris, and import clean backfill. The tank farm would require a total of 920 trips (460 export/460 import). The UST and washrack area in the Taylor Warehouse would require a total of 16 truck trips (8 export/8 import). The northeast excavation area would require a total of 966 truck trips (483 export/483 import). These trips would occur over a 2-month period.

The final phase of site work would involve the demolition of the administrative building and connecting warehouses located within the central portion of the Project site. Small building and concrete pad demolition would likely be conducted using excavators equipped with a breaking hammer and pulverizers to demolish concrete and break it up into smaller more manageable pieces. This would allow building components to be broken into smaller pieces that are safer to remove and reduce fugitive dust generation. Based on the approximate square footage of the existing buildings on site (i.e., 68,100 square feet), over 5,500 tons of construction debris is anticipated to be stockpiled and removed from the Project site.[3]

Construction waste would be temporarily stockpiled within the staging area near the loading docks in the northeastern portion of the Project site and designated as non-hazardous or hazardous waste, depending on the waste type, building, or Project site origin. The staging area would store construction equipment near the former maintenance building and carport. The construction waste would then be transferred to a sorting location. Based on the size and construction of the existing on-site buildings, off-site hauling of the demolition construction waste would require approximately 392 truck trips over a 1-month period, or approximately 13 trips per day during the demolition phase (see Table 7).

Table 7. Estimated Loads of Construction Waste from On-Site Building Demolition

Demolition of Remaining On-Site Buildings	Truck Loads of Debris
Debris	85
Recycled Metals	52
Recycled Concrete	207
Recycled Asphalt	42
Universal Waste, ACM, Other	6
Total	**392**

Source: ICS 2020

Demobilization of Post-Remediation Equipment

Upon completion of demolition, excavation, and backfilling activities, the entire Project site would be cleared of equipment, regraded, and restored with a final layer of clean fill soil. Construction crews would demobilize the Project site over a 1-week period by removing construction equipment. The Project site would then be fenced, screened, and temporarily closed.

Post-excavation groundwater monitoring would be dependent on groundwater concentrations observed during excavation dewatering, but is not anticipated. At this time, there are no plans to reinstall the abandoned groundwater monitoring wells.

Construction Schedule

Remediation activities associated with the proposed Project would begin in August 2020, lasting for approximately 5 to 6 months, with completion anticipated in early 2021. Approximately 5 to 10 construction workers would work during construction activities. All construction activities would occur between 7:00 a.m. and 7:00 p.m., Monday through Friday, consistent with the City of Alameda Municipal Code (AMC) Chapter 4-10 - *Noise Control*. Construction is not proposed on the weekends.

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[3] Assumes average building demolition yields 155 pounds of waste per square foot.

3.0 Noise Screening Criteria and Sensitive Receptors

City of Alameda Municipal Code (AMC) Chapter 4-10 Noise Control

The City of Alameda regulates exterior noise levels and ground-borne vibration through its Noise Ordinance as codified in AMC Chapter 4-10 - *Noise Control*.

Construction Exterior Noise

Section 4-10.4 contains maximum permissible sound levels for stationary sources in proximity of sensitive land uses (e.g., single- or multi-family residential, school, library, church, hospital) and commercial properties. The maximum permissible sound level is determined by the land use of the adjacent/nearby properties, time of day, and duration of noise. Section 4-10.4, *Exterior Noise Standards* states it is unlawful for any person to operate any stationary source of sound at or adjacent to a single- or multi-family residence, school, library, church, or hospital, which causes the noise level when measured on the receiving land use to exceed:

1. A noise level of 55 dBA during the hours of 7:00 a.m. to 10:00 p.m. or 50 dbA during the hours of 10:00 p.m. to 7:00 a.m. for more than 30 minutes out of any one 1-hour time period;
2. A noise level of 60 dBA during the hours of 7:00 a.m. to 10:00 p.m. or 55 dbA during the hours of 10:00 p.m. to 7:00 a.m. for more than 15 minutes out of any one 1-hour time period;
3. A noise level of 65 dBA during the hours of 7:00 a.m. to 10:00 p.m. or 60 dbA during the hours of 10:00 p.m. to 7:00 a.m. for more than 5 minutes out of any one 1-hour time period;
4. A noise level of 70 dBA during the hours of 7:00 a.m. to 10:00 p.m. or 65 dbA during the hours of 10:00 p.m. to 7:00 a.m. for more than 1 minute out of any one 1-hour time; or
5. A noise level or 75 dBA during the hours of 7:00 a.m. to 10:00 p.m. or 70 dbA during the hours of 10:00 p.m. to 7:00 a.m. for any period of time.

Ground-borne Vibration

Subsection 4.10-5(b)(8) states that the operation of any device that creates a vibration which is above the vibration perception threshold of an individual at or beyond the property boundary of the source, if on private property or at 150 feet from the source if on a public space or public right-of-way, is prohibited. Vibration levels become perceptible to humans at 65 vibration decibels (VdB) (FTA 2006).

Construction Noise Exceptions

The City's Noise Ordinance also contains special provisions in Section 4-10.7, *Special Provisions (Exceptions)*. Subsection 4-10.7(e) states the provisions listed in Section 4-10.4 shall not apply to noise sources associated with construction, provided that construction activities take place between the hours of 7:00 a.m. to 7:00 p.m. Monday through Fridays or 8:00 a.m. to 5:00 p.m. on Saturdays. Notwithstanding the provisions of Subsection 4-10.7(e), no exceptions to the provisions shall apply to activities where equipment used for those activities, including mufflers, is not maintained in the condition for which it was designed or intended and thereby unnecessarily increases noise levels so as to cause a noise disturbance or exceed the standards set forth in Subsection 4-10.4, as stated by Subsection 4-10.4-7(h).

Further, prohibition of construction activities outside of standard construction hours does not apply to:

1. Construction that does not require a City-issued permit (e.g., minor renovations, landscaping, etc.);
2. Construction where the City Manager or his/her designee grants an exception upon a showing of significant financial hardship;
3. Emergency work to protect or restore safe conditions where immediate construction is required (e.g., following a flood event, etc.); or

4. Construction by any person on his/her principal place of residence or rental property.

All construction activities for the proposed Project would occur within the standard construction hours identified in Subsection 4-10.7(e), *Special Provisions (Exceptions)* of the City's Noise Ordinance - between the hours of 7:00 a.m. to 7:00 p.m. Monday through Fridays or 8:00 a.m. to 5:00 p.m. on Saturdays. Therefore, the proposed Project would be consistent with the City's Noise Ordinance.

Thresholds of Significance

For the purpose of this noise and vibration analysis, the proposed Project would result in significant impacts on the environment if it would generate noise or ground-borne vibration levels in excess of the following thresholds:

Construction Noise. The proposed Project would result in a significant construction impact if construction activity would occur outside of the allowable daytime hours specified by the Noise Ordinance.

Vibration. Since the City does not have any regulations pertaining to vibration, the FTA thresholds are applied to the proposed Project (FTA 2006a). The proposed Project would result in a significant vibration impact if buildings would be exposed to the FTA vibration threshold level of 0.2 PPV for building damage (refer to Table 3), or if sensitive individuals would be exposed to the FTA vibration threshold level of 72 VdB for human annoyance (refer to Table 4) outside of the allowable daytime hours specified by the City's Noise Ordinance.

Stationary Noise. The proposed Project would result in operational sound levels that exceed those described in Municipal Code Section 4-10.4, *Exterior Noise Standards*. For the nearest sensitive receptors, a resulting offsite noise level from stationary non-transportation sources that exceeds 55 dBA L_{eq} in the daytime (7:00 a.m. to 10:00 p.m.) or 50 dBA L_{eq} in the night-time (10:00 pm to 7:00 a.m.) for more than 30 minutes out of any one 1-hour time period at the receiving land use would be considered significant.

Traffic Noise. The significance of Project-related traffic noise impacts can be determined by comparing estimated traffic noise levels with the proposed Project to existing noise levels without the proposed Project. Per Policy SN-57 of the City of Alameda General Plan Health and Safety Element (1991), the significance criteria for changes in noise from operational traffic are as follows:

1. A 4-dBA increase in CNEL as a result of project operations if the resulting noise level would exceed that described as normally acceptable for the affected land use (60 dBA DNL or less for residential uses).
2. Any CNEL increase of 6 dBA or more, due to the potential for adverse community response.

6.0 Project Noise Impacts

Exterior Noise

Two types of temporary construction-related noise impacts would occur during construction activities associated with the proposed Project: 1) on-site noise from heavy construction equipment used for demolition, excavation, etc.; and 2) off-site noise from construction worker commutes and heavy haul truck trips.

As described in Section 5.0, *Project Description*, construction activities would be divided into five phases that would occur over a period of 5 to 6 months beginning in August 2020 and ending in early 2021. The first phase, mobilization, would involve mobilization and staging of construction equipment and materials and would occur over a 2-week period. The second phase, limited demolition of existing on-site buildings and AST removal, would involve limited demolition and AST removal and would occur over a 1-month period. Construction equipment used during this phase would include cranes, an excavator, a dry vacuum truck, backhoe, a frac tank, dump trucks and flatbed trailers. The third phase; excavation, dewatering, backfilling, and grading; would occur over a 2-month period and involve excavation of contaminated soil, soil export and import, and backfill and compaction of soil. Construction equipment used during this phase would include track mounted excavators, front end loaders, trucks (i.e., end dump trucks and possibly transfer dumps) for soil disposal, dozers, a vibratory compactor, and a water truck. The fourth phase, demolition of remaining on-site buildings and warehouses, would occur over a 1-month period and would involve demolition of remaining structures and would use breaking hammers, pulverizers, and dump trucks. The final phase, demobilization of post-remediation equipment, would occur over the period of 1 week. In general, the loudest types of construction equipment to be used during the proposed construction activities would include dozers, cranes, front end loaders, excavators, dump trucks, hydraulic hammers, backhoes, air compressors, and forklifts (refer to Table 5). This construction equipment would most commonly be used during demolition and excavation activities.

Construction access to the Project site would be provided by the entrance along Grand Street. Heavy haul trucks and other construction vehicles would limit travel to designated truck routes, such as Clement Avenue and Park Street within the City of Alameda, which would avoid residential neighborhoods to the maximum extent feasible. As described in Table 6, the total trips to the Project site would range from 12 to 65 trips per day over the 5- to 6-month duration of construction activities. Noise levels associated with heavy haul trucks are commonly 81 dBA L_{max} at 50 feet from the centreline of a roadway (Hendriks 1985). Noise associated with heavy haul truck trips would act as single-event noise levels and as the trucks pass through the Project vicinity, they would not occur at a frequency that would substantially impact average noise levels (e.g., CNEL) of the area. Although these worker commuter trips and heavy haul truck trips are expected to result in intermittent noise increases on local roads, they are not expected to measurably effect short- or long-term ambient noise levels.

To determine noise levels associated with temporary, short-term construction activities (i.e., demolition, excavation, paving) and the corresponding noise levels that would be experienced at the nearest sensitive receptor(s), it is general industry practice to combine the two loudest pieces of equipment that would be operating simultaneously during a specific construction phase and then calculate the attenuation of the construction noise level based on the distance to the nearest noise-sensitive receptor(s) (FTA 2006b). Maximum construction equipment noise levels at the nearby noise-sensitive receptors during construction are shown in Table 8.

Table 8. Typical Noise Levels from Construction Equipment

Construction Equipment	Noise Level (dBA L_{max}[1] at 50 feet)
Crane	81
Excavator	81
Dry Vacuum	85
Backhoe	78
Frac Tank	85
Compactor	83
Loader	79
Dump Truck	76
60-Foot Articulating Boom Lift	75
Excavator Sheer Attachment	96
Mobile Concrete Crushing/Screen Unit	85
12K Reach Forklift	85
Track Skid Steer	85
4,000-gallon Water Truck	85
2,000-gallon Water Truck	85
Pressure Washer	85
Compressor	78
Grader	85
Hydraulic Hammer	90*
Dozer	82

Construction Equipment	Noise Level (dBA L_{max}[1] at 50 feet)
Paver	77
Pick Up Truck	75
Torch and Acetylene Tanks	85
Vibratory Compactor	85

Source: Federal Highway Administration (FHWA) Roadway Construction Noise Model User's Guide 2017b.
Notes:
[1] L_{max} is the instantaneous maximum noise level for a specified period of time.
* Actual measured L_{max} at 50 feet not available. Value listed reflects noise levels stated in noise specifications.

For this proposed Project, the two loudest pieces of equipment (e.g., excavator sheer attachment and hydraulic hammer at 96 and 90 dBA respectively) used during construction would reach 97 dBA at 50 feet from the construction activity (FHWA 2006). These noise levels are anticipated to be generated during the use of demolition, excavation, and earth moving equipment during Phase 2, 3, and 4. Thus, during construction, noise levels experienced by noise-sensitive receptors located 40 feet (Ellen Crag Avenue), 55 feet (Fortmann Way), and 65 feet (Clement Avenue) from the Project site would reach approximately 98 dBA, 97 dBA, and 95 dBA, respectively (see Calculation 1).

Calculation 1. Noise Attenuation from Distance

L (dBA) = Lr-20*Log(d2/d1)

L= noise level at sensitive receptor

Lr= noise level at reference distance

d1= reference distance

d2= distance to sensitive receptor

These exterior noise estimates for proposed construction activities are generally conservative in that they assume: 1) the two loudest pieces of equipment (i.e., sheer excavator attachments and hydraulic hammers) would operate simultaneously for the duration of construction; and 2) construction equipment would operate immediately adjacent to the Project site boundary. Rather, construction equipment would only be operated when required for a particular activity. Therefore, the periods during which the two loudest pieces of equipment would operate simultaneously would be limited, both throughout the day and throughout the duration of construction activities. Further, construction activities and equipment would be dispersed throughout the 4.1-acre Project site, meaning only a limited amount of equipment can operate near a given location at a particular time. As previously described doubling of distance from the receptor can reduce noise levels by 6 dBA to 7.5 dBA. Therefore, while demolition and excavation activities occurring at the southeastern end of the Project site may generate a noise level of 98 dBA at the residences along Ellen Crag Avenue, the construction activities at this location would be approximately 650 feet from residences along Fortmann Way, where they would generate a noise level of 75 dBA. Therefore, while there may be peaks in construction noise when construction activities occur immediately adjacent to noise-sensitive receptors, these noise levels would not be sustained throughout the duration of construction.

The use of noise attenuating features, including equipment mufflers (reduces noise by approximately 8 dBA) and/or noise barrier walls (reduces noise by between 10 dBA and 15 dBA) could further reduce construction-related exterior noise levels on all sides of the Project site (FHWA 2017a). As such, with the use of equipment mufflers, a noise barrier wall that breaks the line-of-sight to the Project site, exterior noise levels would be reduced to approximately 80 to 75 dBA. Further, typical building construction would also reduce interior noise levels experienced by noise-sensitive receptors by approximately 10 dBA with windows and doors open, or by approximately 20 dBA to 25 dBA (and up to 30 dBA for more modern buildings) with windows and doors closed (FTA 2006b).

Ground-borne Vibration

Construction activities associated with the proposed Project would involve the use of equipment that would generate ground-borne vibration, including bulldozers, trucks, hydraulic hammers, and vibratory compactors. Because the proposed Project includes complete site demolition and excavation of soil at the northern and southern ends of the Project site, it can be assumed vibratory equipment would be operated at or in close proximity to the Project site's property boundary. As previously described, single-family residences surround the Project site at distances of 40 feet, 55 feet, and 65 feet. Table 9 below summarizes level of ground-borne vibration that would likely be experienced at these residential properties during construction.

Table 9. Ground-borne Vibration Levels and Nearby Sensitive Receptors

Construction Equipment	VdB Level at Distance			
	25 feet (reference distance)	Ellen Crag Avenue (40 feet)	Fortmann Way (55 feet)	Clement Avenue (65 feet)
Bulldozer	87	81	77	75
Water Truck	86	80	76	74
Hydraulic Hammer	87	81	77	75
Vibratory Compactor	94	88	84	82

As shown in Table 9, ground-borne vibration generated by use of heavy construction equipment would exceed the FTA adopted standards associated with human annoyance for ground-borne vibration impacts for residential land use (72 VdB for frequent events, 75 VdB for occasional events, 80 VdB for infrequent events). Frequent ground-borne vibration associated with construction activities of the proposed Project would reach up to 88 VdB along Ellen Crag Avenue, 84 VdB along Fortmann Way, and 82 VdB along Clement Avenue. However, as previously described for exterior noise, it should be noted that the ground-borne vibration described in Table 9 would only be experienced when construction work involving this equipment is occurring along the boundary of the Project site. Therefore, ground-borne vibration would only be experienced for a limited period throughout the entire 5- to 6-month construction period.

Operational Exterior Noise

The proposed Project would remediate portions of the Project site through demolition of existing structures, pavements, other infrastructure, soil and groundwater remediation, and final site closure. No further development or operational activities would be conducted at the Project site as part of the proposed Project. As such, there would be no operational noise or ground-borne vibration associated with the proposed Project.

5.0 Conclusion

Exterior noise levels may reach up to approximately 98 dBA at the single-family residences along Ellen Crag Avenue, 97 dBA at the single-family residences along Fortmann Way, and 95 dBA at single-family residences along Clement Avenue. As previously described, this represents a conservative increase in noise levels given that 1) the two loudest pieces of construction equipment would not be operated simultaneously throughout the duration of construction; and 2) construction activities would not occur along the boundary of the Project site throughout the duration of construction. Nevertheless, compared to the existing Daytime L_{eq} of 56 dBA, construction activities would result in an approximately 10 to 40 dBA increase in exterior noise levels, which would be perceived between two and sixteen times as loud as ordinary conversation. This could result in subjective effects such as annoyance, nuisance, dissatisfaction as well as interference with speech activities.

Construction activities would also create ground-borne vibration from use of vibratory equipment during demolition and excavation phases. Demolition and excavation activities requiring the use of vibratory equipment would occur throughout the Project site, including along the Project site boundary. Vibration levels experienced by nearby sensitive receptors during construction would reach up to approximately 88 VdBd along Ellen Crag Avenue, 84 VdB along Fortmann Way, and 82 VdB along Clement Avenue.

All construction activities would occur within the standard construction hours identified in Subsection 4-10.7(e), *Special Provisions (Exceptions)* of the City's Noise Ordinance, which states that exterior noise and ground-borne vibration standards shall not apply to construction activities that take place between the hours of 7:00 a.m. to 7:00 p.m. Monday through Fridays or 8:00 a.m. to 5:00 p.m. on Saturdays. Therefore, the proposed Project would be consistent with the City's Noise Ordinance. Nevertheless, due to proximity of the Project site to noise-sensitive receptors, noise reduction measures including use of noise barriers, mufflers, and electronically powered equipment should be implemented, where warranted, to the maximum extent practicable. As previously described, use of noise attenuating features (e.g. equipment mufflers) and noise barrier walls, and closing of doors and windows of receiving buildings, could reduce these noise levels to approximately, 75 to 80 dBA. Staging of stationary equipment should be located towards the center of the Project site to reduce noise levels experienced by neighboring single-family residences. Use of heavy construction equipment that would cause neighboring single-family residences to experience ground-borne vibration levels exceeding FTA criteria for human annoyance should also be limited between the hours of 10:00 a.m. and 4:00 p.m. to avoid periods where residents are likely to be home.

Recommended Mitigation Measures

Construction noise levels would vary depending on the construction phase, construction equipment type, duration, distance between noise source and noise-sensitive receptor(s), and the presence/absence of barriers between the noise source and noise-sensitive receptors. To minimize temporary increases in noise, the Applicant shall require the construction contractor to limit standard construction activities as follows:

- Ensure construction equipment and heavy haul trucks use the best available noise control techniques, including improved mufflers, use of intake silencers, ducts, engine enclosures and acoustically attenuating barriers, curtains, and shields.
- Site stationary noise sources, such as air compressors, are as far from noise-sensitive receptors as possible (i.e., toward the center of the Project site) and ensure that they are muffled and enclosed within temporary sheds or incorporate insulation barriers, shields, or other measures to the extent feasible.
- Whenever possible, use impact equipment and machinery that is hydraulically or electrically powered to avoid noise associated with air compressors or pneumatically powered tools. If the use of pneumatically powered tools is necessary, an exhaust muffler shall be installed on the air compressor. Such a muffler can lower noise levels from the exhaust by up to 10 dBA. Similarly, the installation of external jackets on the tools can reduce noise levels by 5 dBA.
- Ensure electrically powered equipment shall be used instead of pneumatic or internal combustion powered equipment, whenever feasible.
- Material stockpiles and mobile equipment, staging, and parking areas shall be located as far as possible from noise-sensitive receptors (i.e., towards the center of the Project site).
- Identify a public relations liaison that can be contacted with concerns regarding construction noise and ground-borne vibration. The liaison's contact information shall be clearly displayed at the Project site on posted signs informing the public of the construction schedule.
- Notify all adjacent landowners and occupants of the properties adjacent to the Project site of the anticipated construction schedule at least 2 weeks prior to ground disturbing activities.

If noise levels, based on noise monitoring, exceed allowable levels, the following mitigation measure is also recommended:

- Construct a temporary solid noise barrier wall around the Project site boundaries along, Clement Avenue, Fortmann Way, and Ellen Crag Avenue during demolition, excavation, and earth moving activities. The noise barrier wall shall be designed to achieve the maximum sound attenuation feasible by breaking the line of site to the Project site and the adjacent noise-sensitive receptor(s). The design and placement of the noise barrier wall shall be reviewed and approved by the City's Community Development Director. Installation of a noise barrier wall would be expected to decrease construction-related noise levels by approximately 10 dBA to 15 dBA.

Construction-related ground-borne vibration would exceed FTA thresholds for human annoyance. To reduce temporary impacts due to construction-related ground-borne vibration, the Applicant shall require the construction contractor to limit standard construction activities as follows:

- Permissible hours of operation of construction equipment that would cause nearby land uses to experience ground-borne vibration levels exceeding FTA criteria thresholds would be limited to 10:00 a.m. to 4:00 p.m. to avoid periods where residents are likely to be home.
- At least 2 weeks prior to the initiation of construction related activities, the Applicant shall prepare and distribute notices to affected residences within distances that would experience ground-borne vibration impacts above FTA criteria thresholds. At a minimum, the notices shall describe the overall construction schedule, advise residents of increased construction-related ground-borne vibration, and provide contract information for a liaison available to receive complaints associated with ground-borne vibration. The Applicant shall keep a log of complaints and shall address complaints, to the maximum extent practicable, in order to minimize disturbance of neighboring residents. The City shall ultimately be responsible for addressing any non-performance issues from the construction contractor.

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