Appendix K
Noise Analysis Report

ESA

LOS CERRITOS WETLANDS RESTORATION PROGRAM

Noise And Vibration Technical Report

Prepared for
Los Cerritos Wetlands Authority

April 2020

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TABLE OF CONTENTS

Page

List of Figures

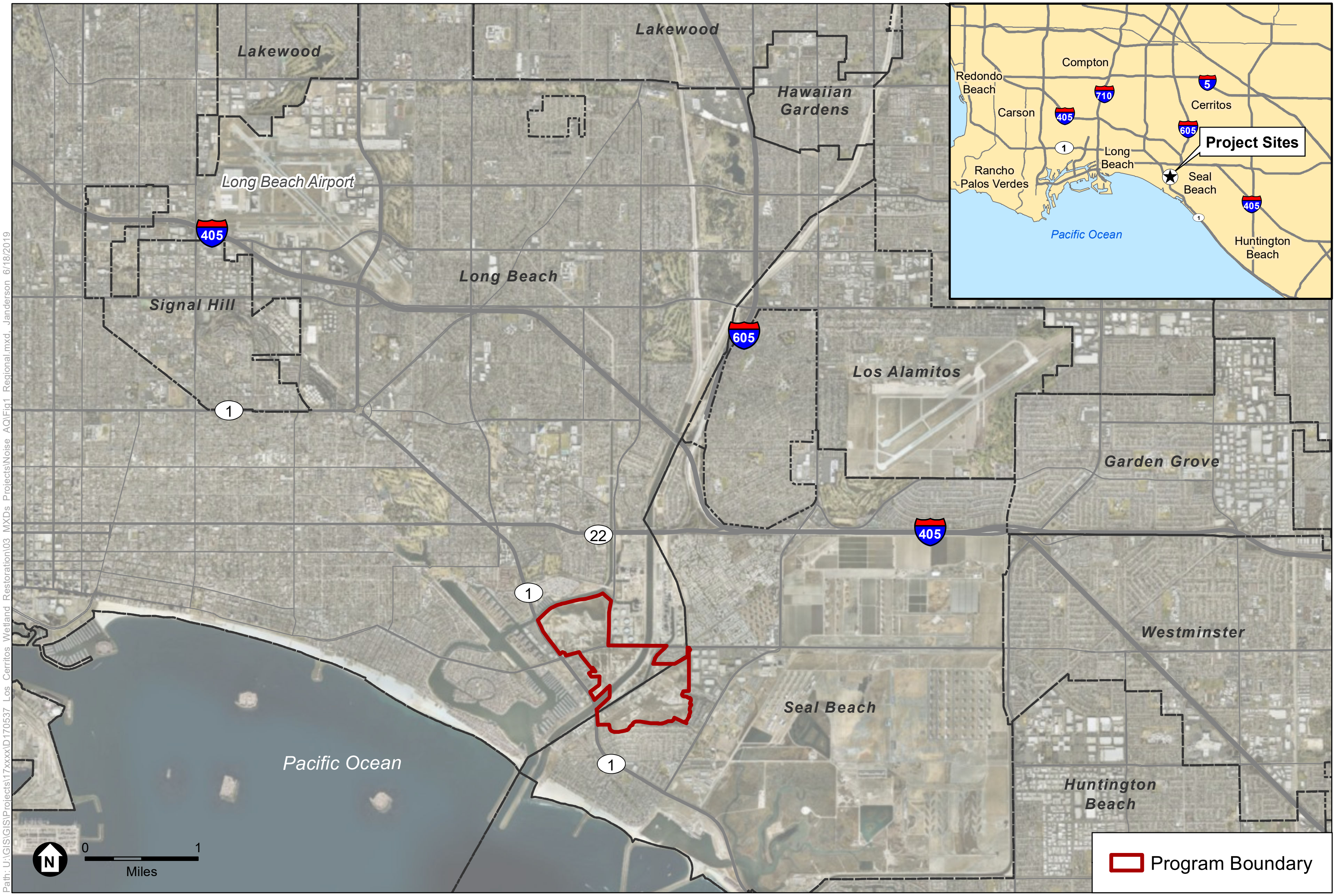
List of Tables

SECTION 1
Introduction

The Los Cerritos Wetlands Authority (the Applicant) proposes to implement the Los Cerritos Wetland Restoration Program (program). The program area is located within the City of Seal Beach, which is within the northwestern portion of Orange County, California, and the City of Long Beach, which is within the southeastern portion of Los Angeles County, California. The program would restore wetland, transition, and upland habitats throughout the plan area.

This report analyzes potential noise and vibration impacts that would result from the program. The analysis characterizes the existing noise environment of the program area and surrounding area, estimates noise and vibration levels from construction and operation on the program area and at surrounding sensitive land uses, evaluates the potential for significant impacts, and provides mitigation measures to address any significant impacts. In addition, this section evaluates the potential cumulative noise and vibration impacts resulting from the program together with related projects and other future growth.

The program area includes approximately 503 acres of land located within an urbanized and industrialized area. The regional location of the program area is shown in **Figure 1**, *Program Area and Local Vicinity*. Regional access to the program area is provided by Interstate 405 (I-405) and Interstate 605 (I-605) as well as State Route 22 (SR-22), which terminates as 7th Street. Pacific Coast Highway (SR-1) traverses the area from the northwest corner to the southeast corner. The program area is located on four individual areas (South, Isthmus, Central, and North). The proposed program would restore wetland, transition, and upland habitats throughout the program area. This would involve remediation of contaminated soil and groundwater, grading, revegetation, construction of new public access opportunities (including trails, visitor center, parking lot, and viewpoints), construction of flood management facilities (including earthen levees and berms, and walls), and modification of existing infrastructure and utilities.



SOURCE: ESRI

Los Cerritos Wetlands Restoration Plan

Figure 1
Program Area and Local Vicinity

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SECTION 2
Environmental Setting

2.1 Noise Fundamentals

Noise Principals and Descriptors

Sound can be described as the mechanical energy of a vibrating object transmitted by pressure waves through a liquid or gaseous medium (e.g., air). Noise is generally defined as unwanted sound (i.e., loud, unexpected, or annoying sound). Acoustics is defined as the physics of sound. In acoustics, the fundamental scientific model consists of a sound (or noise) source, a receiver, and the propagation path between the two. The loudness of the noise source and obstructions or atmospheric factors affecting the propagation path to the receiver determines the sound level and characteristics of the noise perceived by the receiver. Acoustics addresses primarily the propagation and control of sound.

Sound, traveling in the form of waves from a source, exerts a sound pressure level (referred to as sound level) that is measured in decibels (dB), which is the standard unit of sound amplitude measurement. The dB scale is a logarithmic scale that describes the physical intensity of the pressure vibrations that make up any sound, with 0 dB corresponding roughly to the theoretical threshold of human hearing and 120 to 140 dB corresponding to the threshold of pain. Pressure waves traveling through air exert a force registered by the human ear as sound.

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. 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 this frequency range. As a consequence, 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 these extremely low and extremely high frequencies. This method of frequency filtering or weighting is referred to as A-weighting, expressed in units of A-weighted decibels (dBA), which is typically applied to community noise measurements. Some representative common outdoor and indoor noise sources and their corresponding A-weighted noise levels are shown in **Table 1**, *Decibel Scale and Common Noise Sources*.

TABLE 1
TYPICAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
	110	Rock Band
Jet Flyover at 1,000 feet		
	100	
Gas Lawn Mower at 3 feet		
	90	
Diesel Truck at 50 feet, at 50 mph		Food Blender at 3 feet
	80	Garbage Disposal at 3 feet
Noisy Urban Area, Daytime		
	70	Vacuum Cleaner at 10 feet
Commercial Area		Normal speech at 3 feet
Heavy Traffic at 300 feet	60	
		Large Business Office
Quiet Urban Daytime	50	Dishwasher Next Room
Quiet Urban Nighttime	40	Theater, Large Conference Room (background)
Quiet Suburban Nighttime		
	30	Library
Quiet Rural Nighttime		Bedroom at Night, Concert Hall (background)
	20	
		Broadcast/Recording Studio
	10	
Lowest Threshold of Human Hearing	0	Lowest Threshold of Human Hearing

SOURCE: Caltrans, 2013a.

Noise Exposure and Community Noise

An individual's noise exposure is a measure of noise over a period of time; a noise level is a measure of noise at a given instant in time, as presented in Table 1. However, noise levels rarely persist at that level over a long period of time. Rather, community noise varies continuously over a period of time with respect to the sound sources contributing to the community noise environment. Community noise is primarily the product of many distant noise sources, which constitute a relatively stable background noise exposure, with many of the individual contributors unidentifiable. The background noise level changes throughout a typical day, but does so gradually, corresponding with the addition and subtraction of distant noise sources, such as changes in traffic volume. What makes community noise 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), which are readily identifiable to the individual.

These successive additions of sound to the community noise environment change the community noise level from instant to instant, requiring the noise exposure to be measured over periods of time to legitimately characterize a community noise environment and evaluate cumulative noise impacts. The following noise descriptors are used to characterize environmental noise levels over time, which are applicable to the program.

L_{eq}: The equivalent sound level over a specified period of time, typically, 1 hour ($L_{eq(1)}$). The L_{eq} may also be referred to as the average sound level.

L_{max}: The maximum, instantaneous noise level experienced during a given period of time.

L_{min}: The minimum, instantaneous noise level experienced during a given period of time.

L_x: The noise level exceeded a percentage of a specified time period. For instance, L_{50} and L_{90} represent the noise levels that are exceeded 50 percent and 90 percent of the time, respectively.

L_{dn}: The average A-weighted noise level during a 24-hour day, obtained after an addition of 10 dB to measured noise levels between the hours of 10:00 P.M. to 7:00 A.M. to account for nighttime noise sensitivity. The L_{dn} is also termed the day-night average noise level (DNL).

CNEL: The Community Noise Equivalent Level (CNEL) is the average A-weighted noise level during a 24-hour day that includes an addition of 5 dB to measured noise levels between the hours of 7:00 A.M. to 10:00 P.M. and an addition of 10 dB to noise levels between the hours of 10:00 P.M. to 7:00 A.M. to account for noise sensitivity in the evening and nighttime, respectively.

Effects of Noise on People

Noise is generally loud, unpleasant, unexpected, or undesired sound that is typically associated with human activity that is a nuisance or disruptive. The effects of noise on people can be placed into four general categories:

- Subjective effects (e.g., dissatisfaction, annoyance);
- Interference effects (e.g., communication, sleep, and learning interference);
- Physiological effects (e.g., startle response); and
- Physical effects (e.g., hearing loss).

Although exposure to high noise levels has been demonstrated to cause physical and physiological effects, the principal human responses to typical environmental noise exposure are related to subjective effects and interference with activities. Activities most affected by noise include rest, relaxation, recreation, study, and communications.

With regard to the subjective effects, the individuals' responses to similar noise events are diverse and influenced by many factors, including the type of noise, the perceived importance of the noise, the appropriateness of the noise to the setting, the duration of the noise, the time of day and the type of activity during which the noise occurs, and individual noise sensitivity. Overall, there is no completely satisfactory way to measure the subjective effects of noise, or the corresponding reactions of annoyance and dissatisfaction on people. A wide variation in individual thresholds of annoyance exists, 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 environment to which a person has adapted (i.e., comparison to the ambient noise environment). In general, the more a new noise level exceeds the previously existing ambient noise level, the less acceptable the new noise level will be judged by those hearing it. With regard to increases in A-weighted noise level, the following relationships generally occur:

- Except in carefully controlled laboratory experiments, a change of 1 dBA in ambient noise levels cannot be perceived.
- Outside of the laboratory, a 3 dBA change in ambient noise levels is considered to be a barely perceivable difference.
- A change in ambient noise levels of 5 dBA is considered to be a readily perceivable difference.
- A change in ambient noise levels of 10 dBA is subjectively heard as doubling of the perceived loudness.

These relationships occur in part because of the logarithmic nature of sound and the dB scale. The human ear perceives sound in a non-linear fashion; therefore, the dBA scale was developed. Because the dBA scale is based on logarithms, two noise sources do not combine in a simple additive fashion, but rather logarithmically. Under the dBA scale, a doubling of sound energy corresponds to a 3 dBA increase. In other words, when two sources are each producing sound of the same loudness, the resulting sound level at a given distance would be approximately 3 dBA higher than one of the sources under the same conditions. For example, if two identical noise sources produce noise levels of 50 dBA, the combined sound level would be 53 dBA, not 100 dBA. Under the dB scale, three sources of equal loudness together produce a sound level of approximately 5 dBA louder than one source, and ten sources of equal loudness together produce a sound level of approximately 10 dBA louder than the single source.

Noise Attenuation

When noise propagates over a distance, the noise level reduces with distance depending on the type of noise source and the propagation path. Noise from a localized source (i.e., point source) propagates uniformly outward in a spherical pattern, referred to as "spherical spreading." Stationary point sources of noise, including stationary mobile sources such as idling vehicles, attenuate (i.e., reduce) at a rate between 6 dBA for acoustically "hard" sites and 7.5 dBA for "soft" sites for each doubling of distance from the reference measurement, as their energy is continuously spread out over a spherical surface (e.g., for hard surfaces, 80 dBA at 50 feet attenuates to 74 at 100 feet, 68 dBA at 200 feet, etc.). Hard sites, such as asphalt or concrete surfaces or smooth bodies of water, act as a reflective surface between the source and the receiver. No excess ground attenuation is assumed for hard sites and the reduction in noise levels with distance (drop-off rate) is simply the geometric spreading of the noise from the source. Soft sites have an absorptive ground surface, such as soft dirt, grass, or scattered bushes and trees, which in addition to geometric spreading, provides an excess ground attenuation value of 1.5 dBA (per doubling distance).

Roadways and highways consist of several localized noise sources on a defined path, and hence are treated as “line” sources, which approximate the effect of several point sources. Noise from a line source propagates over a cylindrical surface, often referred to as “cylindrical spreading.” Line sources (e.g., traffic noise from vehicles) attenuate at a rate between 3 dBA for hard sites and 4.5 dBA for soft sites for each doubling of distance from the reference measurement. Therefore, noise due to a line source attenuates less with distance than that of a point source with increased distance.

Additionally, receptors located downwind from a noise source can be exposed to increased noise levels relative to calm conditions, whereas locations upwind can have lowered noise levels. Atmospheric temperature inversion (i.e., increasing temperature with elevation) can increase sound levels at long distances (e.g., more than 500 feet). Other factors such as air temperature, humidity, and turbulence can also have significant effects on noise levels (Caltrans 2013a).

2.2 Vibration Fundamentals

Vibration can be interpreted as energy transmitted in waves through the ground or man-made structures, which generally dissipate with distance from the vibration source. Because energy is lost during the transfer of energy from one particle to another, vibration becomes less perceptible with increasing distance from the source.

In contrast to airborne noise, ground-borne vibration is not a common environmental problem, as it is unusual for vibration from sources, such as buses and trucks, to be perceptible to humans, even in proximity to major roads. Some common sources of ground-borne vibration are train movement, heavy trucks traveling on rough roads, and construction activities, such as blasting, pile-driving, and operation of heavy earth-moving equipment.

The effects of ground-borne vibration include movement of the building floors, rattling of windows, shaking of items on shelves or hanging on walls, and rumbling sounds. Typically, ground-borne vibration generated by man-made activities attenuates rapidly with distance from the source of the vibration. Vibration sensitive receptors include buildings where vibration would interfere with operations or equipment within the building or cause structural damage (especially older masonry structures), or annoy people within the building.

Vibration can potentially cause structural damage to buildings, however, vibration is not a factor for most projects, with the exception of rock blasting or pile-driving during construction, or when operating heavy construction equipment adjacent to buildings. Annoyance from vibration often occurs when the vibration levels exceed the threshold of human perception by only a small margin. A vibration level that causes annoyance would be well below the structural damage threshold for modern buildings.

Vibration levels are typically quantified as the peak particle velocity (PPV) defined as the maximum instantaneous peak of the vibration signal in inches per second (in/sec) and used to determine vibration impacts to buildings, as well as, to humans.

2.3 Existing Conditions

Noise-Sensitive Receptors Locations

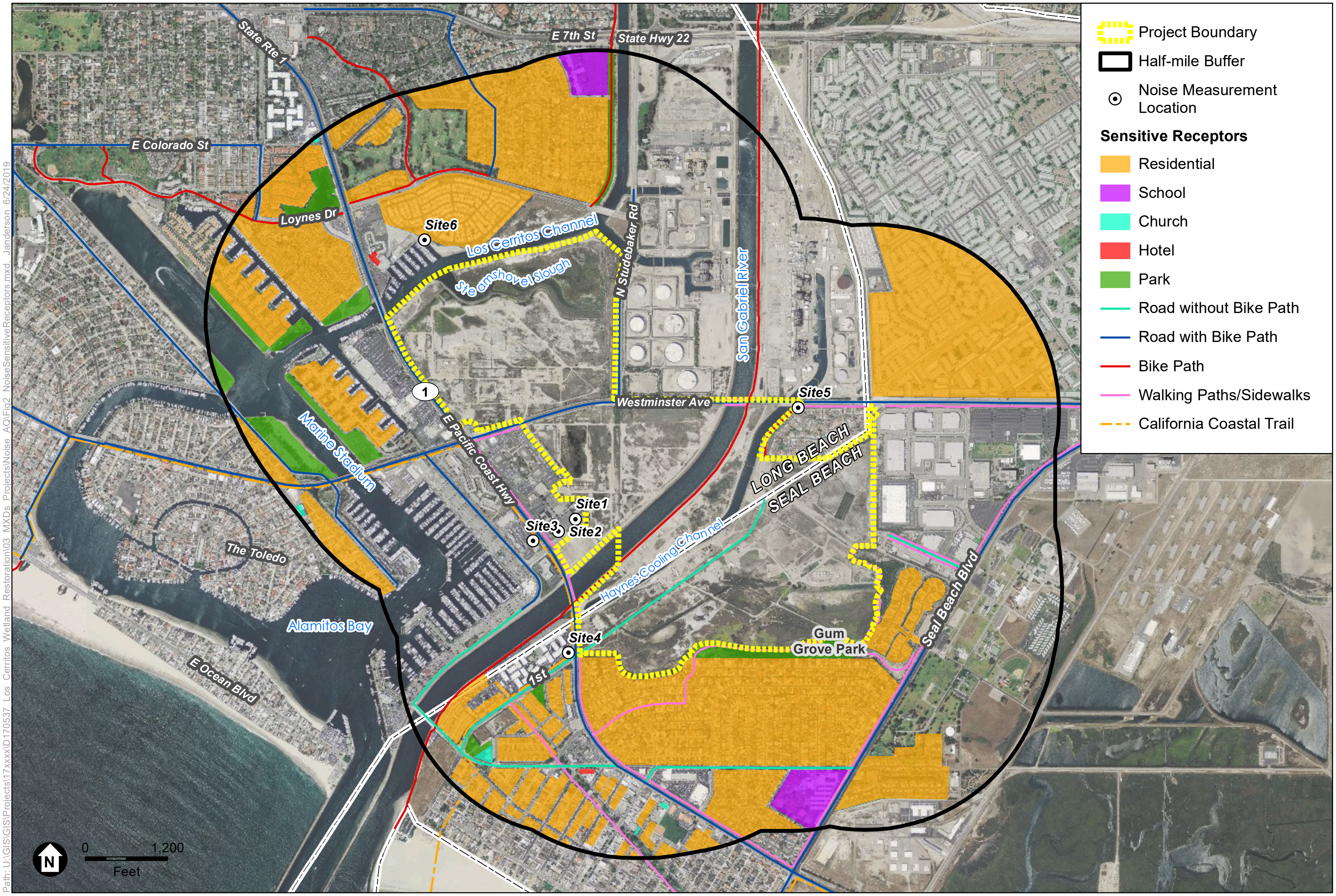
Certain land uses can be more sensitive to noise than other land uses based on the types of activities typically conducted at the land use (i.e., land uses for sleeping, concentration, and convalescence are considered noise-sensitive). Therefore, people at residences, motels and hotels, schools, libraries, religious facilities, hospitals, nursing homes, natural areas, parks, and other passive outdoor recreation areas are generally more sensitive to noise than people at commercial and industrial land uses. Consequently, noise standards for noise-sensitive land uses are more stringent than for those less sensitive uses.

The land uses of the program area are mainly vacant and industrial uses. Noise-sensitive receptors located in the program area are associated with passive recreational areas of the San Gabriel River Trail, which bisects the program area east-west along the southern bank of the San Gabriel River; the outdoor recreation amenities at Zedler Marsh; the fishing area at the Haynes Cooling Channel; and the boating and kayaking opportunities at the Los Cerritos Channel. The areas surrounding the program area are industrial, commercial, parks and open space, and single- and multifamily residential. The existing noise-sensitive land uses within 500 feet of the program area boundary include residences, Gum Grove Park, and bicycle and pedestrian trails, with two elementary schools within a one-half mile. **Figure 2,** *Noise Sensitive Receptors*, illustrates the program area and its immediate surrounding land uses.

Vibration-Sensitive Receptor Locations

Typically, groundborne vibration generated by anthropogenic activities (i.e., rail and roadway traffic, operation of mechanical equipment and typical construction equipment) diminishes rapidly with distance from the vibration source. FTA uses a screening distance of 50 feet for residential uses and schools; when inhabited buildings are within 50 feet from a project site with non-impact construction activities (i.e., no pile driving), detailed vibration impact analysis is required.

There are no existing inhabited structures located within the program area. Outside of the program area boundary, there are no inhabited structures within 50 feet of the proposed operation of heavy equipment (e.g., bulldozer) for restoration activities in the program area. The nearest inhabited structures are located at distances greater than 50 feet from the operation of heavy equipment for restoration activities within the program area.



SOURCE: Mapbox, LCWA

Los Cerritos Wetlands Restoration Plan

Figure 2
Noise Sensitive Receptors

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Ambient Noise Levels

The existing noise sources of the program area include primarily the operating oil wells, and in surrounding areas, vehicle traffic on adjacent roadways. Secondary noise sources of surrounding areas include general residential-related activities, such as landscaping; and commercial-related activities, such as loading dock/delivery truck activities, trash compaction, and refuse service activities.

Ambient noise measurements were previously conducted at commercial and residential uses in proximity to the program area in 2017 for the Los Cerritos Wetland Oil Consolidation and Restoration Project (Greve & Associates 2017). The noise measurements were short-term (15-minute duration), conducted to characterize the existing ambient noise environment at residences and commercial facilities. Overall, the average noise level measurements ranged from 50.1 to 71.1 dBA L_{eq} based on proximity of the measurement locations to various noise sources, primarily vehicle traffic on area roadways. Measurements at residences, as shown on Figure 2, included:

- 71.1 dBA L_{eq} at Site 5 represents the housing development southeast of the LCWA site, the loudest of the sites measured. Noise sources were vehicle traffic on 2nd Street including trucks and motorcycles, and the operating power plant across 2nd Street from the housing development producing a continuous noise level of 55 to 60 dBA.
- 50.1 dBA L_{eq} at Site 6 represents the mobile home park, the quietest of the six sites measured. Noise sources were distant vehicle traffic on Pacific Coast Highway, nearby chirping birds, and occasional aircraft flyovers.

SECTION 3
Regulatory Setting

3.1 Federal

There are no federal noise or vibration standards that directly regulate environmental noise and vibration related to the construction or operation of the proposed program. FTA provides vibration criteria to evaluate potential vibration impacts of structural damage to buildings and human annoyance, similar to the California Department of Transportation (Caltrans) vibration criteria, which is provided below.

3.2 State

There are no State noise or vibration standards that directly regulate environmental noise and vibration related to the construction or operation of the proposed program. However, the Caltrans *Transportation and Construction Vibration Guidance Manual* (Caltrans 2013b) provides vibration criteria to evaluate potential vibration impacts of building structural damage and human annoyance from project construction and operation, depending upon transient or continuous/frequent intermittent sources, as shown in **Table 2** *Caltrans Vibration Damage Potential Threshold Criteria* and **Table 3**, *Caltrans Vibration Annoyance Potential Criteria*, respectively.

TABLE 2
CALTRANS VIBRATION DAMAGE POTENTIAL THRESHOLD CRITERIA

	Maximum PPV (in/sec)	
Structure and Condition	**Transient Sources**	**Continuous/Frequent Intermittent Sources**
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.2	0.1
Historic and some old buildings	0.5	0.25
Older residential structures	0.5	0.3
New residential structures	1.0	0.5
Modern industrial/commercial buildings	2.0	0.5

NOTE: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile-drivers, pogo-stick compactors, crack and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

SOURCE: Caltrans, 2013b.

As shown in Table 2, the vibration damage potential criteria from transient vibration sources (i.e., the operation of heavy equipment for program restoration) to various types of buildings, ranges from 0.12 in/sec PPV for extremely fragile historic buildings, ruins and ancient monuments to 2.0 in/sec PPV or higher for modern industrial/commercial buildings, and for old to new residential structures at 0.50 to 1.0 in/sec PPV, respectively.

TABLE 3
CALTRANS VIBRATION ANNOYANCE POTENTIAL CRITERIA

	Maximum PPV (in/sec)	
Structure and Condition	**Transient Sources**	**Continuous/Frequent Intermittent Sources**
Barely perceptible	0.04	0.01
Distinctly perceptible	0.25	0.04
Strongly perceptible	0.9	0.10
Severe	2.0	0.4

NOTE: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile-drivers, pogo-stick compactors, crack and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.

SOURCE: Caltrans, 2013b.

As shown in Table 3, the vibration annoyance potential criteria from transient sources ranges from 0.04 in/sec PPV for "barely perceptible" at to 2.0 in/sec PPV for "severe".

3.3 Local

Local noise regulation involves implementation of the noise goals and policies of the noise element of the General Plan, and the noise standards of the noise ordinance. The project site is located in the Cities of Long Beach and Seal Beach; therefore, the Cities' General Plan Noise Element and Noise Ordinance are applicable to the project.

City of Long Beach

General Plan, Noise Element

The Noise Element of the City of Long Beach General Plan (City of Long Beach 1975) identifies an interior noise goal of 45 L_{dn} for residential uses, but does not identify standards for other land uses. The City of Long Beach is in the process of updating its General Plan with an updated Noise Element, currently in public review (City of Long Beach 2019) with the goal of providing a tailored approach to noise policy across Long Beach neighborhoods. The updated Noise Element will contain a set of goals, policies, and implementation measures to limit noise exposure, particularly in areas with nearby housing, hospital, school or day care center uses.

Municipal Code, Noise Ordinance

Long Beach Municipal Code (LBMC) Chapter 8.80 represents the City's Noise Ordinance, which governs construction and operational noise. Section 8.80.202, Construction Activity, regulates construction noise and exempts noise generated by construction activities during daytime hours depending on the day of the week. Construction is prohibited between 7:00 p.m. and 7:00 a.m. on weekdays and federal holidays. On Saturdays, construction is prohibited between 7:00 p.m. on Friday and 9:00 a.m. on Saturday, and after 6:00 p.m. on Saturday. On Sundays, construction is prohibited all day.

Chapter 8.80 also governs operational noise generated on one property, potentially impacting an adjacent property. The City of Long Beach Noise Ordinance establishes operational noise criteria of allowable noise levels for percentages of an hour over a given time of day period within a land use district as shown on the Noise District Map provided in the City of Long Beach Noise Ordinance. The program area is located within land use District 1 and 4. The noise levels allowed by the City of Long Beach's Noise Ordinance for Districts 1 and 4 are listed in Error! Reference source not found.**4, *Error! Reference source not found.***.

TABLE 4
ERROR! REFERENCE SOURCE NOT FOUND.

Time Period	L_{max}	L_{eq}
District 1		
Daytime (7:00 a.m. to 10:00 p.m.)	70	50
Nighttime (10:00 p.m. to 7:00 a.m.)	65	45
District 4		
Anytime	90	70

SOURCE: City of Long Beach, 2016.

As shown in **Error! Reference source not found.**4, higher noise level limits are allowed during the daytime (7:00 a.m. to 10:00 p.m.) as compared to the more noise-sensitive nighttime period (10:00 p.m. to 7:00 a.m.). If a location is on a boundary between two different districts, the applicable noise level limit is the arithmetic mean of the two districts. The noise level limits are provided by district for the day- and nighttime periods as L_{max} (the maximum noise level) and L_{eq} (the hourly average noise level). District 1 includes the Northern Synergy Oil Field, Southern Synergy Oil Field, Alamitos Bay Partners, Pumpkin Patch, and Long Beach City Property sites (which is generally defined predominantly residential with other land use types also present), and District 4 includes the Central LCWA and Bryant sites (which is generally defined as predominantly industrial with other land types use also present). City of Long Beach Noise Ordinance Section 8.80.150C allows for adjustments to the noise criteria if the existing ambient noise level is higher than criteria levels, where, the limits should be increased in 5 dB increments as necessary to encompass the ambient noise level.

City of Seal Beach

General Plan, Noise Element

The Noise Element of the City of Seal Beach General Plan (City of Seal Beach 2003), identifies residences as the most noise sensitive land use in Seal Beach. Additionally, The City of Seal

Beach has a number of public and private educational facilities that are considered noise sensitive. The Noise Element includes the Plan for Control and Management of Noise, of which Issue 3- Community Noise Control for Non-Transportation Noise Sources requires construction activity to comply with the limits established in the City of Seal Beach Noise Ordinance.

Municipal Code, Noise Ordinance

City of Seal Beach Municipal Code, Chapter 7.15 represents the City of Seal Beach Noise Ordinance, which establishes noise criteria for noise that impacts adjacent properties. Similar to the City of Long Beach Noise Ordinance, the City of Seal Beach Noise Ordinance provides noise level limits for L_{max} (the maximum noise level) and L_{eq} (the hourly average noise level) for land use zones. The program area is located within land use Zone 2 and 3, with adjacent residential (Zone 1). The noise levels allowed by the City of Seal Beach Noise Ordinance are listed below by land use zone in Error! Reference source not found.**5**, ***Error! Reference source not found.***.

TABLE 5
ERROR! REFERENCE SOURCE NOT FOUND.

Time Period	L_{max}	L_{eq}
Zone 1 (Residential)		
Daytime (7:00 a.m. to 10:00 p.m.)	75	55
Nighttime (10:00 p.m. to 7:00 a.m.)	70	50
Zone 2 (Commercial)		
Anytime	85	65
Zone 3 (Industrial)		
Anytime	90	70
SOURCE: City of Seal Beach, 2016.		

As shown in **Error! Reference source not found.**5, greater noise levels are allowed during the daytime period (7:00 a.m. to 10:00 p.m.) as compared to the nighttime period (10:00 p.m. to 7:00 a.m.). Of note is that the City of Seal Beach's Noise Ordinance criteria, are 5 dB less stringent for residential districts/zones (i.e., District/Zone 1) than the City of Long Beach Noise Ordinance criteria, as previously shown in **Error! Reference source not found.**2. If the ambient noise level is higher than the criteria levels shown in **Error! Reference source not found.**3, then the City of Seal Beach Noise Ordinance Section 7.15.015C allows the noise level limits to be increased to the ambient noise level.

City of Seal Beach's Noise Ordinance Section 7.15.025E exempts noise generated by construction activities during certain hours depending on the day of the week. Construction is exempt between 7:00 a.m. and 8:00 p.m. on weekdays, and on Saturdays between 8:00 a.m. and 8:00 p.m. On Sundays, construction is prohibited all day.

SECTION 4
Significance Thresholds and Methodology

4.1 Significance Thresholds

For the purposes of this Program Environmental Impact Report and consistency with Appendix G of the State *CEQA Guidelines*, the project would have a significant impact related to noise and vibration if it would result in:

a) 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;

b) Generation of excessive groundborne vibration or groundborne noise levels;

c) 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, would the project expose people residing or working in the project area to excessive noise levels.

For the issues related to airports and airstrips, the program area is not located within two miles of a public airport or public use airport. The nearest public airports or airfields to the program area are the Los Alamitos Army Airfield, approximately 2.7 miles northeast, and the Long Beach Airport, approximately 3.2 miles northwest. The Joint Forces Training Base (JFTB) Los Alamitos boundary is located approximately 2.32 miles from the program area boundary, and the program area is located within the Airport Influence Area of the airport land use plan of the Los Alamitos JFTB. However, the program Area is outside of the aircraft noise contours for the JFTB; i.e., the area is not exposed to noise levels greater than 60 dBA CNEL due to operations at JFTB (Orange County ALUC, 2016). Thus, the implementation of the program would not expose people visiting or working in the program area (at the proposed visitor centers or as part of wetland restoration maintenance activities) to excessive aircraft noise levels. Therefore, airport/airstrip-related noise impacts will not be discussed further in this report.

4.2 Methodology

Noise

The evaluation of noise impacts is based on the development assumptions for the proposed project, as described in Section 1. The program would include the remediation of contaminated soil and groundwater, soil grading, revegetation, construction of new public access opportunities (including trails, a visitor center and parking lot, and viewpoints), construction of flood management facilities (including earthen levees and berms, and walls), and modification of existing infrastructure and utilities.

Implementation of the program would generate noise primarily from project construction, and to a lesser degree, the operation of constructed facilities on the program site (i.e., Visitor Center), with minimal construction and operational-related traffic generated on local roadways. The primary sources of construction noise associated with the program would be construction activities within the program site and construction-related traffic volumes generated by daily worker commuting trips, and the truck trip for the transport of construction equipment and materials.

On-site construction noise impacts were evaluated by determining the noise levels generated by the different types of construction activity anticipated, calculating the construction-related noise levels produced by the mix of equipment assumed for all construction activities at the source and at nearby sensitive receptor locations. Estimated noise levels generated by project construction activities and operational sources were compared to the applicable noise standards and thresholds of significance of the applicable city noise ordinances in Section **Error! Reference source not found.**, **Error! Reference source not found.**. For construction noise, the noise ordinances of both cities set allowable hours of construction (i.e., daytime) in which construction activities are exempt from noise regulations; however, the Cities' noise ordinances do not establish construction noise level limits. For operational noise, established criteria noise levels for noise-sensitive uses must not be exceeded by the project traffic noise.

Vibration

In addition to noise levels, groundborne vibration would also be generated on site during construction by various construction-related activities and equipment. The groundborne vibration levels generated by these sources have also been estimated and compared to applicable Caltrans vibration criteria (Caltrans 2013b).

SECTION 5

Program Impacts and Mitigation Measures

Threshold a): Would the program result in the 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?

5.1 Construction and Operational Noise

Construction Noise

Program construction would require the use of heavy equipment during the construction activities on site. The program would include the remediation of contaminated soil and groundwater, soil grading, revegetation, construction of new public access opportunities (including trails, a visitor center and parking lot, and viewpoints), construction of flood management facilities (including earthen levees and berms, and walls), and modification of existing infrastructure and utilities.

Subphases of program construction would include demolition and site preparation, grading/excavation for levees and berms, drainage/utilities/subgrade, building construction for the visitor center, paving for access roads and parking, and architectural coating for the visitor center and traffic markings. The demolition and site preparation includes removal of pipelines, tanks, and other oil infrastructure. Solid waste is assumed to be hauled to the Montebello landfill located approximately 23 miles away. The main wetland restoration activities are covered in the grading/excavation phase, which includes construction, modifying, and removing berms, as well as, establishing tidal channels.

During each construction stage, a different mix of construction equipment would be used. As such, construction activity noise levels at and near the program site would fluctuate depending on the particular type, number, and duration of use of the various pieces of construction equipment. Individual pieces of construction equipment expected to be used during program construction could produce maximum noise levels of 75 to 90 dBA L_{max} and hourly average noise levels of 65 to 83 dBA L_{eq} at a reference distance of 50 feet from the noise source, as shown in **Table 6**, *Construction Equipment Noise Levels*. These maximum noise levels would occur when equipment is operating at full power. The estimated usage factor for the equipment is also shown in Table 6. The usage factors are based on FHWA's Roadway Construction Noise Model (RCNM) User's Guide.

TABLE 6
CONSTRUCTION EQUIPMENT NOISE LEVELS

Construction Equipment	Estimated Usage Factor, %	Maximum Noise Level at 50 Feet (dBA Lmax)	Average Noise Level at 50 Feet (dBA Leq)
Air Compressors	40%	78	74
Bore/Drill Rig	20%	79	72
Cement and Mortar Mixer	40%	79	75
Concrete Saw	20%	90	83
Crane	16%	81	73
Excavator	40%	81	77
Forklift	10%	75	65
Generator Sets	50%	81	78
Grader	40%	85	81
Off-highway Trucks	20%	76	69
Other Equipment	50%	85	82
Paver	50%	77	74
Paving Equipment	20%	90	83
Pump	50%	81	78
Roller	20%	80	73
Rough Terrain Forklift	10%	75	65
Rubber Tired Dozer	40%	82	78
Rubber Tired Loader	50%	79	76
Scraper	40%	84	80
Tractor/Loader/Backhoe	25%	80	74
Welder	40%	74	70

FHWA, 2006

Construction activities could occur at different locations within the 503-acre program area. Actual construction for the program will vary over the three phases of near-, mid-, and long-term (next 10 years, 10-20 years, and 20+ years). Construction noise levels at off-site noise sensitive receptors would be higher when construction activities and equipment are used in proximity to off-site noise sensitive receptors compared to when construction activities and equipment are used in centrally located areas of the program area away from off-site sensitive receptors. For example, assuming that up to four pieces of construction equipment (ranging from 85 – 79 dBA L_{eq} at 50 feet) are operating on the program area, the combined noise level from the equipment would be approximately 88 dBA L_{eq} at 50 feet. However, with distance, for example 500 feet, the combined noise level from up to four pieces of construction equipment would be attenuated (reduced) to approximately 68 dBA L_{eq}, based on a 6 dBA reduction in noise level per doubling of distance.

As discussed in Section 3.3, the Noise Ordinances of the cities of Long Beach and Seal Beach, exempts noise generated by construction activities during daytime hours depending on the day of the week. Per the Noise Ordinances, project construction would be required to occur within these defined daytime hours. The Cities' Noise Ordinances do not establish construction noise level limits. Therefore, program construction noise would not generate a substantial increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance.

Nonetheless, while program construction activities occurring within the allowed times as per the City of Long Beach and City of Seal Beach municipal codes would not exceed the applicable standards and thus result in a less than significant impact, because some of the construction activities within the program area would occur in proximity to noise sensitive receptors (i.e., residences and passive recreation trails and waterways), as shown above in Figure 2, noise reduction measures are recommended to minimize noise levels to off-site noise sensitive receptors. These recommended noise reduction measures are provided in Section 7.

Off-site construction noise associated with the program would be the construction-related traffic volumes generated by daily worker commuting trips and the truck trips required for the transport of construction equipment and materials to and from the site. The program is not likely to generate a substantial number of vehicle trips during construction and operation compared to traffic volumes on existing roadways; therefore, a detailed traffic study has not been prepared for the program. Worst-case program construction traffic volumes, with all construction phases occurring simultaneously, are estimated at approximately 142 average daily trips (ADT) consisting of construction trucks and worker vehicles. Program construction traffic would access the program area via 2nd Street or Pacific Coast Highway, which in the vicinity of the program area, has ADT volumes of approximately 38,000 and 40,000, respectively. Therefore, the addition of the estimated worst-case daily construction trips on these major roadways would be a minimal increase in traffic volumes, which traffic noise is primarily based on. As discussed in Section 2.1, a doubling of traffic volumes results in a 3 dBA increase, which is an increase barely perceptible to the human ear. Program construction traffic would not double existing traffic volumes on area roadways; therefore, program construction traffic noise would be a negligible, non-perceptible increase. Therefore, program off-site construction traffic noise would not generate a substantial increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance.

Operational Noise

Operational noise associated with the program would be the daily traffic volumes anticipated by visitors to the proposed visitor centers on site. Though a detailed traffic study has not been prepared for the program, the visitors centers and recreational trails are assumed to generate the most visitors on Sundays, estimated at approximately 1,102 ADT. The visitors would access the visitor centers via 2nd Street or Pacific Coast Highway, which in the vicinity of the program area has ADT volumes of approximately 38,000 and 40,000, respectively. As discussed in Section 2.1, a doubling of traffic volumes results in a 3 dBA increase, which is an increase barely perceptible to the human ear. Program operational traffic would not double existing traffic volumes on area roadways. Therefore, the addition of the estimated worst-case daily visitor trips on these major roadways would be a minimal increase in traffic volumes. As with program construction traffic, program operational traffic would be a negligible, non-perceptible increase. Therefore, program operational noise would not generate a substantial increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance.

Threshold b): Would the program result in generation of excessive groundborne vibration or groundborne noise levels?

5.2 Groundborne Vibration

Construction Vibration

Construction activities at the program site have the potential to generate relatively low levels of groundborne vibration, as the operation of heavy equipment (e.g., backhoe, dozer, excavators, drill rig, loader, scraper, and haul trucks) generates vibrations that propagate though the ground and diminish in intensity with distance from the source. No rock blasting with explosives or pile driving would be used during program construction.

Program construction would generate varying degrees of ground vibration, depending on the construction procedures and the construction equipment used. The PPV vibration velocities for several types of construction equipment measured at increasing distances are identified in **Table 7,** *Construction Equipment Vibration Levels with Distance*.

TABLE 7
CONSTRUCTION EQUIPMENT VIBRATION LEVELS WITH DISTANCE

	Approximate PPV (in/sec)			
Equipment	**25 Feet**	**50 Feet**	**75 Feet**	**100 Feet**
Large Bulldozer	0.089	0.031	0.017	0.011
Loaded Trucks	0.076	0.027	0.015	0.010
Small Bulldozer	0.003	0.001	0.0006	0.0004

SOURCE: FTA, 2018; ESA, 2018.

As shown in Table 7, at 50 feet, the maximum vibration levels would be up to approximately 0.031 in/sec PPV, respectively, from the operation of a large bulldozer with typical soil conditions.

As previously shown in Table 2, Caltrans vibration criteria for potential structural damage from transient sources for old residential buildings is 0.5 in/sec PPV (Caltrans 2013b). Therefore, the program would generate vibration levels at 50 feet that would not exceed the structural damage potential criteria of 0.5 in/sec PPV. Residences are located as close as approximately 50 feet outside of the program area boundary and the program restoration activities with the operation of heavy equipment (i.e., bulldozer) would not occur at or in proximity to the program area boundary. As such, the potential vibration impacts for structural damage at offsite residences would be less than significant; therefore, no mitigation measures would be required.

In addition to structural damage, the residences adjacent to the program area boundary would be considered as potential vibration sensitive receptors for human annoyance. As shown in Table 3, Caltrans vibration criteria for human annoyance from transient sources for “barely perceptible” is 0.04 in/sec PPV. As shown in Table 7, at 50 feet, the maximum vibration levels would be approximately 0.031 in/sec PPV, respectively, from the operation of a large bulldozer with typical soil conditions, which would be less than the “barely perceptible” criteria of 0.04 in/sec PPV. As such, the potential vibration impacts for human annoyance at offsite inhabited residences would be less than significant; therefore, no mitigation measures would be required. Therefore, the program construction would not result in the generation of excessive groundborne vibration or groundborne noise levels.

Operation Vibration

The program would construct and operate visitor centers, which would potentially include typical commercial-grade stationary mechanical and electrical equipment, such as air handling units, condenser units, and exhaust fans, which would produce low level vibration that would not result in structural damage or human annoyance impacts. According to America Society of Heating, Refrigerating and Air-Conditioning Engineers, pumps or compressor would generate groundborne vibration levels of 0.5 in/sec PPV at a reference distance of 1 foot, which would dissipate rapidly with distance. As such, vibration impacts associated with operation of the program would be below the structural damage and human annoyance criteria of 0.5 in/sec PPV, therefore, the impacts would be less than significant. Therefore, the program operation would not result in the generation of excessive groundborne vibration or groundborne noise levels.

SECTION 6
Cumulative Impacts

The geographic scope for the consideration of cumulative program noise impacts are primarily the areas immediately surrounding the program site, and to a lesser degree, along designated roadways, where program traffic would travel. Generally, noise impacts are limited to the area directly surrounding the noise sources, as noise attenuates logarithmically with distance at a higher rate in proximity to the source, and only has the potential to combine with other noise sources occurring simultaneously in the immediate vicinity. The program's potential noise impacts, when viewed together with the environmental impacts from past, present, and probably future projects, could be cumulatively considerable if program impacts exceed impact thresholds, resulting in significant impacts.

6.1 Construction

Program construction activities would generate noise from the operation of heavy equipment during construction activities, which would increase ambient noise levels at the activity and, to a lesser extent as attenuated by distance, at sensitive receptors. However, the increase in ambient levels due to project construction noise was determined to not expose persons to, or generate, noise levels in excess of standards established in the local General Plan or Noise Ordinance, or applicable standards of other agencies. Therefore, the noise impacts would be less than significant. Therefore, program construction noise would not be of the magnitude to potentially combine with other cumulative projects potentially located in immediate proximity to the project site, where the noise could combine together to cumulatively increase the ambient noise environment in the project area. Therefore, program construction would not be a cumulatively considerable noise impact. Furthermore, implementation of recommended construction noise reduction measures (i.e., construction best management practices) would further reduce the construction noise levels at the sources, thereby, reducing noise levels at the nearest sensitive receptors.

As previously discussed for vibration, program construction would not generate high levels of vibrations at the source and construction activities would not occur in proximity to structures and inhabited buildings to be impacted for structural damage and/or human annoyance. Therefore, vibration impacts would be less than significant. Therefore, program construction would not be a cumulatively considerable vibration impact.

6.2 Operation

Operational noise associated with the program would be the daily traffic volumes anticipated by visitors to the proposed visitor centers on site. As with program construction traffic, program operational traffic would be a negligible, non-perceptible increase. Therefore, program operational noise would not generate a substantial increase in ambient noise levels in the vicinity of the project in excess of standards established in the local general plan or noise ordinance. Therefore, the impact would be less than significant. Therefore, future operational noise levels would not be cumulatively significant.

Program operation would not result in the generation of excessive groundborne vibration or groundborne noise levels. Therefore, program operation would not be a cumulatively considerable vibration impact.

SECTION 7

Mitigation Measures

7.1 Construction

As discussed above, the program would result in less-than-significant impacts associated with construction noise. Therefore, no construction noise mitigation measures would be required.

However, to reduce and minimize the construction noise generated on the program area and attenuated at the nearest off-site residences, the following construction noise reduction measures are recommended:

> **Noise Reduction Measure NOISE-1: Staging Areas and Mufflers.** Staging areas for construction shall be located away from existing off-site residences. All construction equipment shall use properly operating mufflers. These requirements shall be included in construction contracts.
>
> **Noise Reduction Measure NOISE-2: Noise Barriers.** Grading plans and specifications shall include temporary noise barriers for all grading, hauling, and other heavy equipment operations that would occur within 300 feet of sensitive off-site receptors and occur for more than 20 working days. The noise barriers shall be 12-feet high, but may be shorter if the top of the barrier is at least one foot above the line of sight between the equipment and the receptors. The barriers shall be solid from the ground to the top of the barrier, and have a weight of at least 2.5 pounds per square foot, which is equivalent to ¾ inch thick plywood. The barrier design shall optimize the following requirements: (1) the barrier shall be located to maximize the interruption of line-of-sight between the equipment and the receptor, which is normally at the top-of-slope when the grading area and receptor are at different elevations. However, a top-of-slope location may not be feasible if the top-of-slope is not on the Project site; (2) the length, width, and height of the barrier shall be selected to block the line-of-sight between the grading area and the receptors; (3) the barrier shall be located as close as feasible to the receptor or as close as feasible to the grading area; a barrier is least effective when it is at the midpoint between noise source and receptor.

As discussed above, the program would not result in significant impacts associated with construction vibration. Therefore, no construction vibration mitigation measures would be required.

7.2 Operational

As discussed above, the program would result in less-than-significant impacts associated with operational noise Therefore, no operational noise mitigation measure would be required.

As discussed above, the program would not result in significant impacts associated with operational vibration. Therefore, no operational vibration mitigation measures would be required.

SECTION 8
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