4.7.1 ENVIRONMENTAL SETTING

IN THIS SECTION:

- Noise Fundamentals
- Regulatory Setting
- Project Site Noise Setting

The following section is based on the analyses and conclusions in a Noise and Vibration Assessment prepared for the project by Illingworth & Rodkin, Inc in March 2013. The noise assessment is included in Technical Appendix C-6, which is available on the DEIR CD, on the City of Petaluma website at http://cityofpetaluma.net/cdd/riverfront.html, and on file for review at the City of Petaluma Community Development Department, Planning Division, located at 11 English Street in Petaluma, on Monday through Thursday between the hours of Hours: 8 AM to 12 PM and 1 PM to 5 PM. The section also draws from analyses contained in the City of Petaluma *General Plan 2025* Environmental Impact Report (EIR) that was certified on May 19, 2008. The City's General Plan and EIR are also available for review at the Planning Division office and online at: http://cityofpetaluma.net/cdd/plan-general-plan.html.

NOISE FUNDAMENTALS

In general, noise is defined as "unwanted" sound that negatively affects the physiological or psychological well being of individuals or communities. Noise becomes objectionable when it is disturbing or annoying, which is typically either due to pitch or loudness. Pitch is the height or depth of a tone and dependent upon the frequency of vibrations, with higher pitched signals sounding louder to humans. Loudness is the intensity of sound waves as perceived by the human ear.

A typical noise environment consists of background noise that is the combination of many indistinguishable noise sources as well as local noise sources that may be individually identified. The background noise is known as the ambient noise environment. The predominant noise sources in an urban environment include traffic noise from area roadways, trains, and aircrafts, as well as potential industrial uses and construction activities.

Measuring Noise

There are several measurement scales that are used to describe noise. The decibel (dB) is the noise unit of measurement that indicates the amplitude of sound. A zero on the decibel scale is the lowest sound level that an unimpaired human ear can detect. The decibel scale is logarithmic; an

increase of 10 decibels represents a ten-fold increase in acoustic energy, while 20 decibels is 100 times more intense. Each 10-decibel increase in sounds level is perceived as a doubling of loudness. The A-weighted sound level, dBA, gives more weight to high frequency sounds, which are more perceptible to the human ear.

Sound fluctuates depending on the source, distance, and time of day. The equivalent continuous noise level, known as Leq, provides an averaging measure of sound over a given duration of time. The Leq can be measured over any length of time but is typically reported for periods of 15 minutes to 1 hour. Sensitivity to noise increases during the evening hours when the ambient noise environment tends to be quieter. The Community Noise Equivalent Level, CNEL, provides a measure of the cumulative noise exposure by weighting the evening hours from 7:00 pm to 10:00 pm with a 5-decibel increase and the hours from 10:00 pm to 7:00 am with a 10-decibel increase.

Measuring Groundborne Vibration

Certain activities generate groundborne vibration, which consist of rapidly fluctuating motions or waves and is measured in vibration decibels (VdB). Indoor vibration is typically generated by mechanical equipment, movement of people, or slamming doors and results in low-level vibrations. Outdoor sources of vibrational noise include construction, steel wheeled trains, and traffic on rough roads.

The background vibration level in residential areas is around 50 VdB, which is typically below the level of perception for humans. The threshold where minor damage can occur in fragile buildings is around 100 VdB. The threshold of perception for vibration velocity is about 65 VdB for humans and shift to distinctly perceptible at 75 VdB (City of Petaluma, September 2008).

Construction induced vibration has the potential to damage structures and interfere with quality of life. The Peak Particle Velocity (PPV) is used to assess the potential of vibration to induce structural damage and human reaction. The threshold of perception for the average person is in the range of 0.008 to 0.012 in/sec PPV, which would have no effect on buildings (Illingworth & Rodkin, March 2013). Velocity levels that approach 0.3 in/sec PPV can result in risk of damage to older buildings including plastered walls or ceilings. At levels of 0.5 in/sec PPV there is a risk of damage to newer structures. Structural damage to buildings is very rare, but has occurred when elevated vibration from construction has taken place in close proximity to a building that is in a high state of disrepair (Illingworth & Rodkin, March 2013, Table 3).

Rail operations can generate substantial groundborne vibration depending on the distance, type and speed of trains, and the type of railroad tracks. The measure for the velocity of the ground is expressed as 1 $x10^6$ in/sec Root Mean Square (RMS), which equals 0 VdB.

The U.S. Department of Transportation, Federal Transit Administration (FTA) has developed vibration limits for various types of land uses. These criteria can be used to evaluate human

annoyance to groundborne vibration. Table 4.7-1 below shows the FTA Groundborne Vibration Impact Criteria for three land use categories and the frequency of the vibrational event.

TABLE 4.7-1: FTA Groundborne Vibration Impact Criteria

Land Use Category	Impact Level (VdB re 1 micro-inch/sec)		
	Frequent Events[1]	Occasional Events[2]	Infrequent Events[3]
Category 1: Buildings where vibration would interfere with interior operations.[4]	65 VdB	65 VdB	65 VdB
Category 2: Residences, hotels and buildings where people sleep.	72 VdB	75 VdB	80 VdB
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB

SOURCE: Illingworth & Rodkin, Inc., March 2013, Table 4 (U.S. Department of Transportation Federal Transit Administration, Transit Noise and Vibration Impact Assessment, 2006).

1. "Frequent Events" is defined as more than 70 vibration events per day. Most rapid transit project fall into this category.
2. "Occasional Events" is defined as between 30 and 70 vibration events of the same source per day. Most commuter trunk lines have this many operations.
3. "Infrequent Events" is defined as fewer than 30 vibration events per day. This category includes most commuter rail systems.
4. Category 1 applies to operations that have a high degree of sensitivity to vibration such as certain types research and manufacturing. For example computer chip manufacturing, use of lithographic equipment and microscopes fall into Category 1.

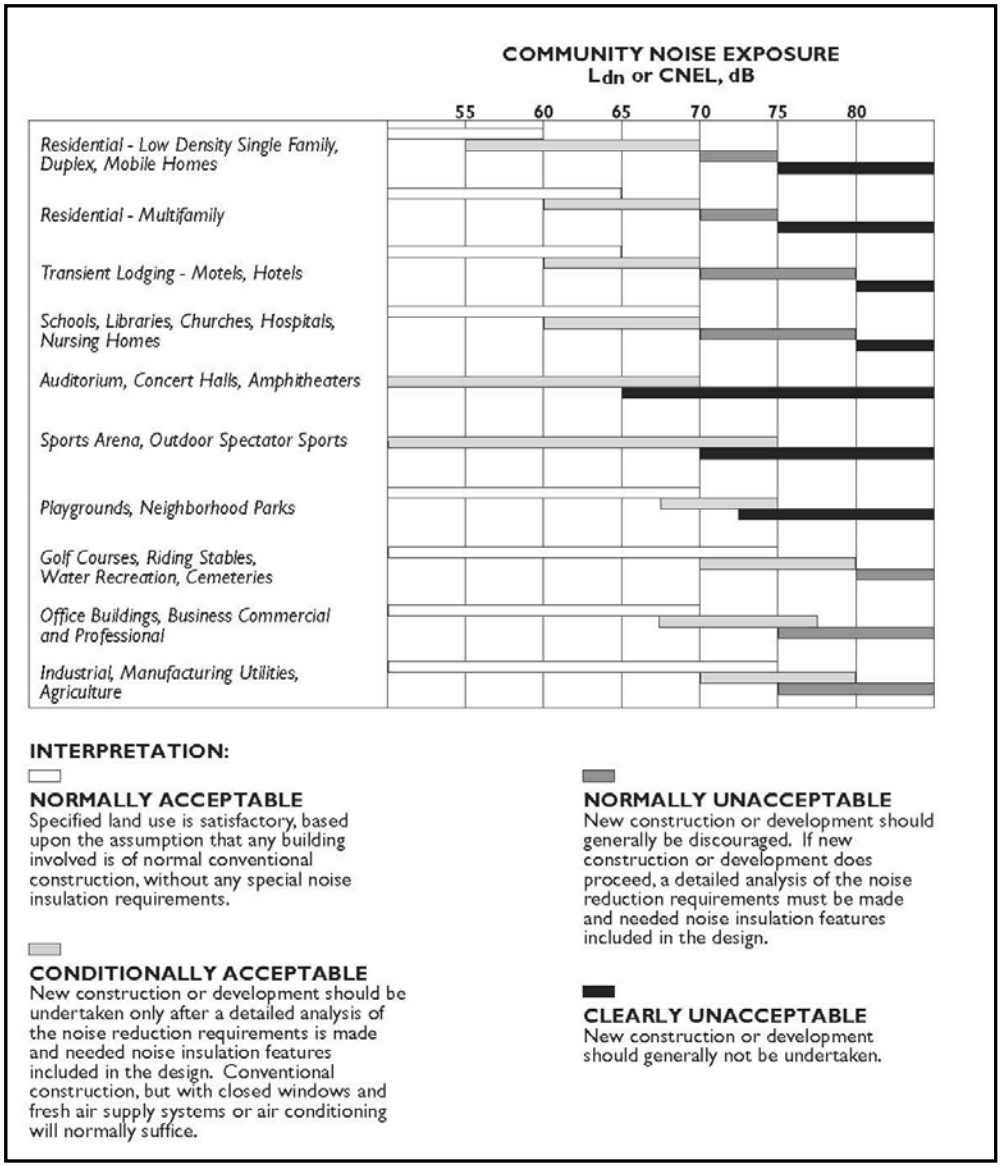
REGULATORY SETTING

Although there are no established federal regulations that govern noise levels, the State of California and the City of Petaluma have adopted guidelines, regulations, and policies designed to limit noise exposure. These regulations are presented in the following section.

State Regulations

The California Department of Health Services, Office of Noise Control has developed guidelines for evaluating the compatibility of land uses based on community noise exposure. These guidelines are included in the City's *General Plan 2025* and are shown on Table 4.7-2. Generally, residential land uses and other noise sensitive uses would be acceptable without special noise attenuation requirements in areas where exterior ambient noise levels do not exceed approximately 60 dBA (CNEL).

TABLE 4.7-2: Land Use – Noise Compatibility Standards



SOURCE: City of Petaluma *General Plan 2025*

As set forth in these standards, multi-family residential and hotel land uses are considered "normally acceptable" up to 65 dBA CNEL and "conditionally acceptable" up to 70 dBA CNEL in common outdoor use areas. Single-family residential land uses are considered "normally acceptable" up to 60 dBA CNEL and "conditionally acceptable" up to 70 dBA

CNEL. Office and commercial uses are considered normally acceptable in noise environments of 70 dBA CNEL or less and conditionally acceptable up to about 77 dBA CNEL.

The State of California establishes exterior sound transmission control standards for new hotels, motels, dormitories, apartments and dwellings other than detached single-family dwellings as set forth in the 2010 California Building Code (Chapter 12, Section 1207.11). Where the exterior noise level exceeds 60 dBA CNEL the interior noise level attributable to exterior environmental noise sources shall not exceed 45 dBA CNEL in any habitable room. When exterior noise levels (the higher of existing or future) where residential structures are to be located exceed 60 dBA CNEL, a report must be submitted with the building plans describing the noise control measures that have been incorporated into the design of the project to meet the noise limit. As further described below, a Noise Study for the Riverfront project was conducted and concludes that with incorporation of noise attenuation measures interior noise levels can be reduced to 45 dBA CNEL or below.

Local Regulations

As set forth in Section 10.2 of the City of Petaluma's *General Plan 2025* (Health and Safety Element), the City's objective is to, "...protect public health and welfare by eliminating or minimizing the effects of existing noise problems, and by minimizing the increase of noise levels in the future." General Plan policy 10-P-3B discourages new noise-sensitive uses, primarily homes, in areas with projected noise levels greater than 65 dB CNEL. Where such uses are permitted, incorporation of mitigation measures are required to ensure that interior noise levels do not exceed 45 dB CNEL.

Noise regulations are established in Section 21.040 of the City of Petaluma's Implementing Zoning Ordinance, Chapter 21 -- Performance Standards. The regulation sets the maximum ambient noise level and defines allowable increases to this level. The maximum ambient noise level for all land uses is 60 dB, and may be increased in 5 dB increments for each time period (cumulative periods of 15, five, and one minutes or more in one hour). For example, daytime ambient noise level may be 70 dB for 15 minutes or less in an hour, 75 dB for five minutes or less in an hour, or 80 dB for one minute or less in an hour. Allowable nighttime levels are slightly lower. Table 4.7-3 summarizes provisions of the City's noise performance standards. The noise regulations in Chapter 21 of the Implementing Zoning Ordinance also regulate time of use of potentially offensive noise sources, such as construction activities, tools, and loudspeakers. The Ordinance prohibits such activity before 7:00 a.m. and after 10:00 p.m. on weekdays and before 9:00 a.m. and after 10:00 p.m. on weekends and State, federal, and local holidays.

TABLE 4.7-3: City of Petaluma Maximum Exterior Noise

	Maximum Exterior Noise Exposure	
	10 p.m. - 7 a.m. Mon-Fri & 10 p.m. - 8 a.m. Sat, Sun & Holidays	7 a.m. - 10 a.m. Mon-Fri & 9 a.m. - 10 p.m. Sat, Sun & Holidays
General Plan Ambient	60	60
Cumulative Period of 15 minutes or more in one hour	65	70
Cumulative Period of 5 minutes or more in one hour	70	75
Cumulative Period of 1 minute or more in one hour	75	80
SOURCE: City of Petaluma Implementing Zoning Ordinance, Table 21.1, 2008		

PROJECT SITE NOISE SETTING

The noise environment of the project site and vicinity is typical of an urban area and is influenced by noise generated by traffic and rail operations. The project site is situated adjacent to linear noise emitters including Highway 101, which borders the eastern edge of the site, and the Northwest Pacific Railroad (NWPR) rail corridor, which passes along the northern edge of the site. This rail corridor currently supports freight rail traffic and is planned to provide commuter rail service as part of the Sonoma-Marin Area Rail Transit system (SMART), which is expected to begin commuter rail service in 2016. Freight service along the NWPR corridor was halted by the Federal Railroad Authority in 2001 (City of Petaluma, September 2008). During preparation of the EIR for the SMART rail, the North Coast Railroad Authority (NCRA), the public entity responsible for freight service on the NWP corridor, announced plans to reinstate freight operations on the SMART rail corridor. Freight service along the NWPR was reinstated in 2010.

Land uses in the vicinity of the project site include a wastewater pump station on the property to the west, as well as undeveloped lands that are designated for industrial and mixed uses. Farther west of the site are the Mary Isaak Center (homeless shelter), an animal shelter, and a City Corporate Yard on City owned property. South of the project site and across the Petaluma River, land use designations include mixed use, medium density residential and industrial.

The project site is located approximately 1.75 miles southwest of the Petaluma Municipal Airport, and is not located within the vicinity of a private airstrip. The subject project is not within the area of influence for noise generated by airports or airstrips.

According to the General Plan EIR, most of the project site is subject to noise levels between 65 and 70+ dB CNEL (Map 3.9-1). General Plan Policy 10-P-3C requires a professional acoustical review for new noise sensitive development in areas subject to noise levels greater than 65 dB CNEL. As such, the "Riverfront Development Noise and Vibration Assessment," Illingworth & Rodkin, Inc., (Illingworth & Rodkin, 2013) was prepared for the proposed Riverfront Project in accordance with City policies and programs, and is summarized in the following section.

Existing Noise Setting At Project Site

EXISTING NOISE SOURCES

The primary noise sources affecting the project site are motor vehicles on adjacent roadways (Highway 101 and Lakeville Boulevard) and existing freight activity along the adjacent NWPR corridor north of the project site. In the future, the addition of commuter rail service will contribute to the ambient noise environment onsite (See Future Noise Environmental below).

The existing wastewater pump station located adjacent to the northwest corner of the project site will periodically contribute to the noise environment due to the backup generator which is used in case of power failure in emergency situation and for testing to ensure proper function. The backup generator produces noise from the operation of mechanical equipment.

During regular operation the pump station is barely audible at the station's north property line and inaudible at its east and south property boundaries that are generally oriented towards the project site. Maintenance activities, assumed to be equipment servicing, repair, and replacement would primarily occur inside the building, and would not make a measurable contribution to the noise environment on the project site.

The former Pomeroy facility located west of the project site is no longer operational and does not currently contribute to the existing noise environment onsite. Should operations resume onsite, noise level will be regulated by the City's zoning ordinance (Chapter 21).

EXISTING NOISE LEVELS

The project site experiences noise levels within the range of 65-70 dBA due to the proximity of Highway 101. It should be noted that Highway 101 is elevated adjacent to the project site as it passes over the Petaluma River, the railroad and Lakeville Boulevard. The difference in elevation substantially reduces the noise level onsite relative to an at-grade condition (Illingworth & Rodkin, March 2013).

Illingworth & Rodkin, Inc. measured noise levels over a 24-hour period adjacent to Highway 101 on a site just south of the Petaluma River Bridge in October 2003. These data were used in conjunction with short-term measurements conducted in 2005 and February 2013 adjacent to U.S. Highway 101 where it adjoins the project site in order to establish existing conditions for

the Riverfront project site. Noise measurements were taken during the midday approximately 365 feet from the edge of Highway 101 and about 400 feet south of the Hopper Street, roughly in the center of the Riverfront site. The average noise levels during the 15-minute measurement ranged from 60 dBA (2005) to 63 dBA L_{eq} (2013). Additional measurements were made in 2013 about 1,000 feet from the highway near the site center and across the Petaluma River where the measured mid-day noise levels were 49 dBA L_{eq} and 57 dBA L_{eq}, respectively. An onsite measurement near the Highway 101 right-of-way that was taken in 2005 indicates that the noise level decreases by up to 2 dBA in proximity to the highway due to the additional shielding provided by the edge of the shoulder along the elevated highway.

As described in the Noise and Vibration Assessment, the CNEL was correlated using the 24-hour and the 15-minute measurements. The existing sound level ranges from a high of 64 dBA CNEL down to 57 dBA CNEL near the highway from north to south along the site's highway frontage at a distance of approximately 250 feet. Three to four hundred feet from the edge of the highway structure the existing level ranges from a high of 66 dBA CNEL down to 59 dBA CNEL from north to south along the site's highway frontage. As noted above, when approaching the highway, the noise level declines by about 2 dBA with a range from 64 dBA CNEL to 57 dBA CNEL from north to south.

Future Noise Environment

AREA ROADWAY NOISE

As described in the Petaluma 2025 General Plan EIR, future noise levels are expected to increase by 1 to 2 dBA over the next 10-15 years. This increase in dBA is attributed to general cumulative growth in the City and the widening of Highway 101. Thus, future noise levels at the project site are estimated as a maximum of 65-68 dBA CNEL within 400 feet of the highway in the northeastern corner of the site and 58-61 dBA CNEL in the southern portion of the site.

The City's General Plan 2025 identifies extension of Caulfield Lane, an arterial roadway, through the project site and over the Petaluma River to connect to Petaluma Boulevard South, which is on the south side of the river. Future noise levels were not predicted along this new road in the General Plan EIR, although sound levels along other vicinity roadways were in the 60 to 67 dBA range. The traffic model developed for the General Plan estimates that approximately 23,000 daily trips will be made on this road. Traffic noise levels were estimated along the Caulfield Lane extension by the project noise consultant for two traffic scenarios: 1) conservatively assuming that the worst-hour traffic volume would be approximately 10% of the ADT (2,300 trips per hour), and 2) using the worst-case link volumes from the Riverfront Traffic Impact Study (1,172 trips per hour). In both cases, traffic noise levels were calculated for a receptor 50 feet from the roadway centerline. The vehicle mix was conservatively assumed to be 99% autos and 1% medium trucks (no heavy trucks were assumed through the residential area), and the travel speed was assumed to be 25 mph. Under the first scenario,

worst-hour traffic noise levels would be about 64 dBA Leq at 50 feet, and under the second scenario, worst-hour traffic noise levels would be about 61 dBA Leq at 50 feet. The worst-hour noise level typically equals the Ldn for these types of collector roadways, and thus, the Ldn under the first scenario would be 64 dBA and the Ldn under the second scenario would be 61 dBA.

AREA RAILWAY NOISE

As previously indicated, the Northwest Pacific Railroad (NWPR) corridor is located north of Hopper Street adjacent to the northern edge of the subject site. Freight traffic along this corridor has been operating since 2010 and commuter rail service is proposed for operation beginning in 2016 as part of the Sonoma-Marin Area Rail Transit system (SMART). According to the SMART project's Supplemental EIR, 13 daily weekday round trips are planned on the line, as well as four weekend round trips (Sonoma-Marin Area Rail Transit, March 2008). Additionally, up to six daily round-trip freight trains were identified (Ibid.). Freight service generally operates at slower speeds and with longer trains than passenger rail service (Ibid.).

Maximum future noise levels along the rail corridor with both passenger and freight service was reported in the SMART Project's Supplemental Draft EIR (March 2008) and were projected to reach approximately 64 dBA Ldn at a distance of 50 feet where freight operates at 50 mph and 60 dBA Ldn where freight operates at 25 mph. At a distance of 100 feet, noise levels were projected at 56 and 59 dBA Ldn with freight service at 25 mph and 50 mph, respectively.

The EIR for the North Coast Railroad Authority (NCRA) Russian River Division Freight Rail Project (NCRA 2009) reported a train horn sound exposure level of 108 dBA at a distance of 50 feet that would decrease at a rate of 4.5 dB per doubling of distance along the track until the "no horn" noise exposure is intersected (NCRA 2009).

As part of the SMART effort, the City is pursuing "Quite Zone Standards," which once approved would change the requirement for the sounding of train horns to be at the operator's discretion within the designated quiet zone. The current practice requires that the train's horn sound for a duration of ¼ mile when approaching an at-grade crossing. To establish a Quiet Zone, all crossings within a designated quiet zone must have physical safety improvements that compensate for the loss of the train horn as a warning device. All quiet zone crossings must at a minimum have advance-warning devices with both flashing lights and crossing gates. Train crews are still permitted to sound the horn within a Quiet Zone for railroad or safety reasons (SMART Quiet Zone, August 2012).

4.7.2 IMPACTS AND MITIGATION MEASURES

CRITERIA FOR DETERMINING SIGNIFICANCE ANALYSIS

In accordance with the California Environmental Quality Act (CEQA), State CEQA Guidelines (including Appendix G), City of Petaluma plans, policies and/or guidelines, and agency and professional standards, a project impact to noise would be considered significant if the project would result in:

- 7a Exposure of persons to or generation of noise levels in excess of standards established in the General Plan or noise ordinance, or applicable standards of other agencies;
- 7b Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels;
- 7c A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project, which is considered in a permanent increase of four dBA or more beyond acceptable standards for noise-sensitive land uses (i.e. residential, hotels, motels, schools, libraries, churches, hospitals, and nursing homes);
- 7d A substantial temporary or periodic increase in ambient noise levels in the project vicinity;
- 7e For a project located within 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; or
- 7f For a project within the vicinity of a private airstrip would the project expose people residing or working in the project area to excessive noise levels.

IMPACT ANALYSIS

Based on the analyses in the Revised Initial Study (Appendix A of this DEIR), the project site would not be exposed to excessive noise levels due to proximity to an airport (7e) or private airstrip (7f), and there is no further discussion of noise impacts associated with airports or airstrips. The following impact analyses addresses the potential exposure to noise in excess of City standards (7a) or groundborne vibration (7b), and the potential for the project to result in a substantial permanent increase in ambient noise (7c) or a substantial temporary increase in ambient noise levels (7d).

Exposure to Noise

Impact 4.7-1 – *Elevated Noise Exposure*: The project could expose people to noise levels that exceed the Petaluma General Plan 2025 Land Use-Noise Compatibility Standards and City regulations. This is a *potentially significant impact*.

The proposed project consists of a mix of uses including single-family homes and townhomes, multi-family apartments, and hotel, commercial, and office uses. The project could expose

sensitive receptors (residential and hotel uses) to noise levels that could conflict with the Petaluma General Plan's Land Use-Noise Compatibility guidelines. Petaluma's General Plan, indicates that low density residential land uses, including single-family homes, are considered normally acceptable in noise environments of 60 dB CNEL/L_{dn} or less and conditionally acceptable up to 70 dB CNEL/L_{dn}. Multi-family residential (apartments) and hotel uses are considered normally acceptable in noise environments of 65 dB CNEL/L_{dn} or less and conditionally acceptable up to 70 dB CNEL/L_{dn}. Office and commercial uses are considered normally acceptable in noise environments of 70 dB CNEL/L_{dn} or less and conditionally acceptable up to about 77 dB CNEL/L_{dn}.

As described above, the project site currently experiences ambient noise levels of 57 to 64 dBA CNEL, primarily due to Highway 101 traffic. With future growth and widening of the highway, the site would be exposed to future traffic noise levels of about 65-68 dBA CNEL in the northeastern portion of the site and 58-61 dBA CNEL in the southern portion of the site. Single-family homes within 50 feet of the center of the Caulfield Road could be exposed to noise levels of 61-64 dBA Ldn due to project and potential future traffic on this roadway.

The project is proposed to have the single-family units concentrated in the southern portion of the site and the multi-family apartments, hotel and townhomes in the northern portion; townhomes, including the live-work townhome units, are considered single-family units pursuant to City code. The proposed hotel site is located approximately 600 feet from the highway and would be expected to be within normally acceptable ranges. The proposed townhomes in the northeastern portion of the site would be exposed to noise levels in excess of the "normally acceptable" range by a maximum of eight dBA. Some single-family homes along Caulfield also would be exposed to noise levels of one to four dBA in excess of the single-family "normally acceptable" standard. Therefore, exposure to noise is a potentially significant impact. However, the existing and projected noise levels fall within the "conditionally acceptable" noise and land use compatibility category for single-family residential land uses. According to the compatibility standards, new construction within the "conditionally acceptable" range should be include noise reduction requirements in the building design, such as insulation features, which is further discussed below.

In addition to highway and road noise, testing and operation of emergency equipment, including the backup generator associated with the adjacent wastewater pump station, is generally exempt from local regulations. Operation of a standby emergency generator would temporarily elevate noise levels in the area during routine testing and emergency operation. Office and parking uses are proposed adjacent to the pump station. The generator was not visible at the station so it is assumed to be located inside the building. Taking into account the effect of the building (recognizing that the primary sound transmission path to the outdoors would be through the louvers that provide minimal attenuation), the generator would cause an estimated level of 80 dBA at the station's east fence line. The noise level at the nearest noise sensitive land use proposed on the project site (the office in the northwest corner) would be 65-70 dBA. Interior noise levels would be attenuated 25-30 dBA by typical office exterior window/wall

treatments, resulting in an estimated interior noise level ranging from 35-45 dBA. Interior office ambient noise levels resulting from mechanical ventilation typically range from 35 to 55 dBA. The noise from intermittent testing and emergency operation of the standby engine generate would have a less than significant impact on the project. The pump station backup generator is not a substantial source of noise relative to the ambient noise levels onsite.

Mixed-use buildings within the project could expose future residents of the development to noise from heating, ventilating, and air conditioning equipment, loading docks, or maintenance activities. These sources are regulated by Chapter 21 of the Petaluma Municipal Code, Noise Ordinance, and as such would be controlled by the businesses so as not to exceed the quantitative noise thresholds in the code or create a nuisance.

Pursuant to the California Building Code and the City's General Plan (Policy 10-P-7), all interior noise levels within residential units must be below 45 dBA CNEL[1], except for the maximum instantaneous noise level during a train passage, which should not exceed 55 dBA Lmax. Typical construction techniques, with windows partially open generally achieve an exterior to interior noise reduction of 15 dBA. With the windows closed, the interior noise reduction can achieve 20 to 25 dBA less than the exterior noise level. As such, in noise environments where noise levels are 65 dBA or less, the State interior noise standard of 45 DBA CNEL can generally be achieved with the incorporation of forced air mechanical or ventilation systems in residential units. These systems allow the occupant the option of controlling noise by maintaining the windows shut. However, where noise conditions exceed 65 dBA CNEL, forced-air mechanical ventilation systems and sound-rated building elements are normally required to ensure that interior noise standards (45 dBA) are achieved.

As previously indicated, a site-specific noise assessment has been conducted and more refined design level acoustical studies will be required at the time of building permit issuance to insure that appropriate building design features are included in the design to attenuate exterior sound levels. The Noise Report concludes that residential building and hotel design can be constructed in a manner that attenuates noise and adequately reduces interior noise levels to 45 dBA or below. Recommendations contained in the noise study to reduce interior noise levels to 45 dBA or below include the use of forced air mechanical ventilation system. The primary sound transmission paths requiring treatments are the windows and doors, ventilation pathways, and finally through the exterior walls. Orientation of bedrooms away from the railroad and Highway 101 would reduce the sound ratings for building elements. Other standard noise attenuation measures consist of building and bedroom orientation, small or no windows facing noise emitters (U.S. 101 and the railroad), double or triple pained windows, and/or greater insulation. Wall thickness and stucco siding can also be used to further reduce interior noise levels. One or more of these noise-reducing elements will be utilized to ensure that the interior sound levels achieve 45 dBA. Based on review and

[1] 2010 California Building Code, Title 24, Part 2 Section 1207.11.

consideration by Illingworth & Rodkin and given the project site existing and potential noise exposure, one or more of the noise attenuation measures above will effectively reduce the exterior to interior noise levels to below the 45 dBA threshold. The specific performance requirements of the building element will be identified in the design-level acoustical analysis. With incorporation of mitigation measures set forth below, exposure to excessive noise levels will be reduced to levels below significance.

It should be noted that as buildings are constructed they will serve as noise buffers to public and private outdoor areas, thereby further reducing the exterior noise levels onsite from the highway noise. As described in the Noise and Vibration Assessment, it is expected that the proposed mixed-use buildings surrounding the Central Green and active park will adequately buffer Highway 101 traffic noise and reduce noise levels to below 60 dBA CNEL. The noise exposure would typically be less than 60 dBA CNEL in the yards of the proposed single-family residences. The exterior noise levels are expected to be within the range of what is conditionally acceptable, up to 65 dBA. Therefore, impacts due to excessive noise exposure for exterior noise levels will be less than significant and no mitigation is required (Illingworth & Rodkin 2013).

FUTURE RAIL OPERATIONS NOISE

As previously indicated, noise levels along the rail corridor with both SMART passenger and freight train service, are estimated to reach 64 dBA CNEL at a distance of 50 feet assuming a freight train speed of 50 mph and 60 dBA CNEL assuming a freight train speed of 25 mph, not including the effects of train warning horns/whistles (SMART Draft Supplemental EIR, 2008). The northeastern portion of the project site is planned for residential townhomes, and the northwestern portion of the site is planned for hotel and office uses. The nearest building to the railway tracks is office land use, which is located 60 feet from the rail corridor, and the estimated noise level with train operations would be within normally acceptable standards for an office use. The proposed townhouse lots are located 150+ feet from the rail corridor, except for three lots in the northern-most portion of the site, which are within 60 to 100 feet of the corridor. It is possible that these lots would be within the 60-65 dBA range, which would potentially expose these units and residents to sound levels that exceed City standards.

As indicated above, all crossings in Petaluma are expected to be improved to "Quiet Zone Standards" as the City is currently pursuing Quiet Zone status. In the event that Quiet Zone designations are not approved, day-night average noise levels have the potential to generate intrusive noise due to the sounding of train horns or if there are nighttime freight trains. Where residential development is located adjacent to at-grade rail crossings (without implementation of a Quiet Zone), these sensitive uses would be subject to maximum instantaneous noise levels (Lmax) from train warning whistles that range from approximately 90 to 100 dBA Lmax outdoors 50 feet from the tracks. Given the number of trains that would use the rail corridor and the expected train speed of 25 mph, the noise study concluded that the effect of rail noise on outdoor areas would be less than significant. Therefore, the noise

from passby trains would not exceed established thresholds for exterior noise standards and impacts would be less than significant. Special sound rated building elements may also be necessary to reduce the intrusiveness of train horns given that typical noise levels could reach 95 dBA Lmax outside the nearest townhomes if Quiet Zone status is not approved.

Mitigation Measures

Implementation of mitigation measure NOISE-1 below will reduce the project impact related to exposure to noise levels to a less-than-significant level.

> NOISE-1: Pursuant to General Plan Policy 10-P-3C, the CPSP EIR Mitigation Measure 10-1, and the State Building Code, a detailed acoustical report shall be prepared by a qualified acoustical specialist as part of design phase to determine the noise control treatments for the residential buildings, offices and the hotel to meet local and state standards. Noise attenuation measures shall include as appropriate thicker walls, stucco siding, window and/or door treatments, building and bedroom orientation, and/or small or no windows facing noise emitters, and other measures pursuant to the detailed acoustical report. To achieve the noise reduction requirements, some form of forced air mechanical ventilation, satisfactory to the local building official, would be required in all residential units and the hotel. Special sound rated building elements such as windows and doors may also be necessary to reduce the intrusiveness of the train noise given that typical noise levels could reach 95 dBA Lmax outside the nearest townhomes if Quiet Zone status is not approved.

Exposure to Groundborne Vibration

Impact 4.7-2 – *Exposure to Groundborne Vibration Due to Rail Operations*: Vibration levels generated by passing trains on the tracks adjacent to the project site may be perceptible, but would be below FTA guidelines and would not be excessive or cause cosmetic or structural damage to buildings. This is considered a *less-than-significant impact.*

The project site is immediately adjacent to the Northwestern Pacific Railroad (NWP) corridor. Rail operations are potential sources of groundborne vibration depending on the distance, type and speed of trains, and the type of railroad tracks. Future residences, hotel guests, and onsite land uses have the potential to be exposed to groundborne vibration generated by the railway located immediately adjacent to the north property line boundary.

Trains on the NWPR tracks through Petaluma are proposed to travel at a maximum speed of 50 mph. The nearest buildings to the tracks would be an office building that could be located about 60 feet from the nearest track. The next nearest building would be townhomes proposed in the northeast corner of the site at a distance of about 100 feet from the near track. There

could be up to an estimated 24 trains per day using the corridor. The FTA criteria from Table 4.7-1 would be 78 VdB for the office and 75 VdB for the housing.

Given the low train speed of 50 mph or less proposed through Petaluma, groundborne vibration levels at distances greater than approximately 100 feet from the tracks would be lower than the level generally perceptible to humans (SMART DEIR 2006). Vibration levels within 20 to 100 feet from the track would be perceptible during a train passing however the vibration velocity would be below the FTA thresholds (0.01 inches per second RMS). Additionally, SMART is committed to using timber crossties and switchties, as well as continuous welded rail, which further reduces vibration from noise operation (SMART Draft Supplemental EIR 2008, pg C.6-15). Thus, potential exposure to groundborne vibration generated by the adjacent railway is expected to be a less-than-significant impact.

Mitigation Measures

None are required, as a significant impact has not been identified.

Impact 4.7-3 – *Exposure to Groundborne Vibration During Construction*: Vibration levels generated during construction activities may be perceptible onsite and at neighboring land uses, but would not be excessive or cause cosmetic or structural damage to buildings. This is considered a *less-than-significant* impact.

Onsite activities that could generate groundborne vibration are limited to the construction phase of project development. As proposed construction will occur in phases with portions of the site being incrementally developed until site build out is realized, which is estimated to occur within six years of project initiation. Once construction is complete there are no ongoing operations proposed onsite that would generate groundborne vibration.

Construction of the project may generate perceptible vibration when heavy equipment or impact tools such as jackhammers, hoe rams, or loaded trucks are in use. The use of pile driving and vibratory compaction equipment (roller) typically generate the highest construction related groundborne vibration levels. Table 4.7-4, below sets forth the vibration levels for various types of construction equipment at a distance of 25 feet.

Construction activities for the Riverfront project include excavation, site preparation work, foundation work, and new building framing and finishing. Vibration levels generated during construction vary depending on soil conditions, construction methods, and equipment used. Project construction activities may include drilling, the use of jackhammers and other high-power or vibratory tools, which would generate groundborne vibration in the immediate vicinity.

TABLE 4.7-4: Construction Equipment Vibration Levels

Equipment		PPV at 25 ft. (in/sec)	Approximate Lv at 25 ft. (VdB)
Pile Driver (Impact)	Upper range Typical	1.158 0.644	112 104
Pile Driver (Sonic)	Upper range Typical	0.734 0.170	105 93
Clam Shovel Drop		0.202	94
Hydromill (slurry wall)	In soil In rock	0.008 0.017	66 75
Vibratory Roller		0.210	94
Hoe Ram		0.089	87
Large Bulldozer		0.089	87
Caisson drilling		0.089	87
Loaded trucks		0.076	86
Jackhammer		0.035	79
Small bulldozer		0.003	58

SOURCE: Illingworth & Rodkin, Inc., March 2013, Table 5 (Transit noise and Vibration Impact Assessment, U.S. Department of Transportation, Office of Planning and Environment, Federal Transit Administration, May 2006)

Site preparation may involve improvement of the soil to protect structures from settlement through use of "Rammed Aggregate Piers" as discussed in the GEOLOGY AND SOILS (Chapter 4.5) section of this EIR. However, the RAP process is not expected to result in significant noise or vibration as might be expected with conventional pile driving, which can generate vibration levels up to 112 Vdb at 25. Overall, measured ground vibrations and noise levels associated with the RAP process are considered moderate and below those typically generated during pile driving.[2]

For structural damage, the California Department of Transportation uses a vibration limit of 0.5 inches/second, peak particle velocity (in/sec, PPV) for buildings that are structurally sound and designed to modern engineering standards. Jackhammers typically generate vibration levels of 0.035 in/sec PPV and drilling typically generates vibration levels of 0.09 in/sec PPV at a distance of 25 feet. Vibration levels would vary depending on soil conditions, construction methods, and equipment used. Vibration levels from typical construction activities expected to occur on the site are estimated to be around 0.2 in/sec PPV, which is below the California

[2] Based on conclusions of study conducted by researchers at Cal-Poly: Gregg L. Fiegel, PhD, PE, GE, California Polytechnic State University San Luis Obispo. "Measurement of Vibration and Noise During the Installation of Rammed Aggregate Piers." Presented at 6th International Conference on Case Histories in Geotechnical Engineering, Arlington, VA, August 11-16, 2008. Peak ground velocities measured during the study ranged between approximately 0.5 and 15 millimeters per second for horizontal distances ranging between 1.5 and 10.5 meters (0.06-0.59 inches per section between 3 and 34 feet.

Department of Transportation's significance threshold of 0.5 in/sec PPV. Thus, potential exposure to vibration during construction would result in a less-than-significant impact.

Vibration generated by construction activities near the property line would at times be perceptible, however, would not be expected to result in "architectural" damage to buildings or structures located in the project vicinity. The nearest vibration sensitive structures are located in the McNear Landing residential development to the southwest and across the Petaluma River from the project site, which is more than 300 feet from where the nearest construction activities would occur and more than 650 feet from any RAP activity. As noted, RAP substantially reduces the noise and vibration generated relative to conventional pile driving. Given the distance to the nearest receptors, groundborne vibration generated by operation of heavy construction equipment onsite would not be excessive. Any groundborne vibration generated by onsite construction activities would be substantially below levels that would cause "architectural" damage (non-uniform displacement, cracking, and windows breaking) to buildings located within the McNear Landing residential development.

Other nearby structures include the elevated bridge and structural support of the adjacent Highway 101 overcrossing, east of the project site and the storage facility located north of the site beyond the railroad. Both of these structures are built to modern engineering standard and due to their distance from the project site would not be exposed to PPV levels that approach the 0.5 in/sec threshold. Therefore, construction of the Riverfront project would have less than significant impacts due to excessive exposure to groundborne vibration.

The proposed phasing of onsite development has the potential to expose onsite sensitive receptors of newly constructed residential units to groundborne vibration during construction of other development phases. Development of the project site could result in occupied dwelling units while subsequent project phases are under construction. This scenario would be similar to the common occurrence during subdivision development where some of the buildings and structures are occupied while development is still underway.

When construction occurs more than 50 feet from sensitive receptors, the impact associated with groundborne vibration generated by the equipment would be below 85 VdB and thus would be less than significant. Future buildings on the Riverfront site could be as close as 25 feet to construction activities. Vibration levels could occasionally be intrusive but would be below the cosmetic damage level. Sensitive receptors (residences and the hotel) located within 25 feet of onsite construction may periodically experience intermittent vibration levels during construction activities that approach the FTA's vibration impact threshold of 85 VdB for human annoyance. This would be limited to times when heavy equipment is being utilized, which would generally be during the initial site preparation stages. Given the short term and intermittent nature of vibrational noise, noise impacts from vibration are expected to be less than significant. In addition, Measure Noise-2 will further limit exposure to construction related vibration.

The Petaluma Zoning Ordinance Section 22-301, Noise Regulations, limits construction to the hours of 7:00 a.m. to 10:00 p.m. on weekdays and between 9:00 a.m. and 10:00 p.m. on Saturdays, Sundays, and holidays. The CPSP EIR is more restrictive and limits construction hours to 7:00 a.m. to 6:00 p.m. on weekdays and between 9:00 a.m. and 5:00 p.m. on Saturdays, Sundays, and holidays. Future construction activities associated with the proposed project would be limited to the more restrictive hours to minimize exposure of persons to construction noise during the sensitive hours of the day. As the hours of construction would be limited, the impact from groundborne vibration would be considered less than significant (General Plan EIR 3.9-23). Thus, exposure to groundborne vibration during construction would be a less-than-significant impact. .

Mitigation Measures

No mitigation measures are required, as a significant impact has not been identified. Implementation of Mitigation Measure NOISE-2 discussed below addresses construction noise.

Permanent Increase in Noise

Impact 4.7-4 – *Permanent Increase in Noise*: The traffic noise level on project area roadways will increase as a result of project traffic. The projected increase is 1 dBA CNEL, which is less than the threshold level of 4 dBA CNEL. This is considered a *less than significant* impact.

The project uses are generally not of the type to result in substantial increases in ambient noise levels, although increases in traffic volumes can affect ambient noise levels. Potential increases in traffic noise levels on local streets due to project generated traffic were calculated by comparing existing traffic volumes to existing volumes with the project traffic added, and by comparing future cumulative traffic volumes to existing volumes. Traffic noise was calculated to increase by about 1 dBA CNEL as a result of the addition of project trips, as well as with the addition of trips from other approved and under construction projects (as identified in the project traffic study). The City's General Plan EIR establishes an increase of 4 dBA CNEL or greater as the significance threshold for determining whether a project would result in a substantial permanent noise increase. Since, project traffic would generate an ambient traffic noise increase of about 1 dBA, the Riverfront project's contribution to traffic noise is determined to be a less-than-significant impact.

The proposed mixed use developed of the Riverfront Project would introduce new onsite noise sources associated with heating, ventilating, air conditioning equipment, loading docks, and maintenance activities. New residences onsite would be exposed to these new noise emitters. These sources are regulated by Chapter 21 of the Petaluma Municipal Code Noise Ordinance, and are required to not exceed the quantitative noise thresholds in the code or create a nuisance (Illingworth and Rodkin, May 2012).

Mitigation Measures

No mitigation measures are required, as a significant impact has not been identified.

Temporary Construction Noise Impacts

Impact 4.7-5 – *Temporary Increase in Noise*: Noise levels generated during construction activities would result in a temporary increase in ambient noise levels for an approximately six-year period during buildout of future development phases. This is considered a *potentially significant* impact.

Construction of the Riverfront project will result in temporary, short-term increases in noise levels increase of the ambient noise levels due to construction activities. Construction-related noise levels would vary throughout the day, depending on the type of equipment in use at any one time and the distance to the receptors. Noise generated during construction would differ depending on the construction phase and the type and amount of equipment used. Construction activities for the proposed Riverfront project would include site grading and excavation, and subsequent foundation work, framing, and exterior & interior finishing as each development phase is constructed. The highest construction-related noise levels would be generated during the initial site preparation, which has the shortest duration of all construction phases and includes activities such as grading, earthmoving and soils compaction. Lower noise levels are generated during building construction and finishing.

Currently, there are no residential or other sensitive uses located in close proximity to the site that would be substantially impacted. The nearest residences are located across the Petaluma River from the project site, approximately 300+ feet from the southernmost portion of the project site. The Mary Isaak Center, a Homeless Shelter on city-owned property, is located approximately 300 feet to the west of the project site.

As development proceeds on the project site, later phases would be constructed after initial phases are in operation, including residential uses, thus, potentially subjecting onsite residents and users to construction noise. All project phases are estimated to be completed within approximately six years. According to the project noise assessment, where noise from construction activities exceeds 60 dBA Leq and the ambient noise environment by 5 dBA Leq or more at nearby residential land uses for a period of more than one year, the impact would be considered significant.

Construction equipment can result in noise levels that range from approximately 76 dBA to 89 dBA when measured at 50 feet and 70 dBA to 83 dBA when measured at 100 feet (City General Plan). The noisiest pieces of equipment that would be used during the project's construction phase would include jackhammers and pavers, which produce noise levels of

approximately 75 and 80 dBA at 50 feet with noise reduction control measures. Noise levels from construction diminish rapidly with distance from the construction activity at a rate of approximately 6 dBA per doubling of distance. For example, a noise level of 86 dBA measured at 50 feet from the noise source to the receptor would reduce to 80 dBA at 100 feet from the source to the receptor, and reduce by another 6 dBA to 74 dBA at 200 feet from the source to the receptor. As proposed, mass grading, which typically represents the loudness construction phase, will occur at the onset of project development. Subsequent phases of construction would not require substantial grading; rather fine site grading is expected to be sufficient. This approach in project development is expected to limit the overall noise exposure of future residences and uses onsite that may be occupied while other phases of project construction are ongoing.

Standard construction noise controls are expected to be sufficient to reduce potential noise impacts onsite and offsite to levels below significance. Mitigation Measure NOISE-2 set forth below specifies the requirement for a noise disturbance coordinator, construction equipment noise mufflers, equipment staging locations, and limits the time of construction activities (pursuant to the City's IZO). These practices will ensure that any potential impacts associated with temporary construction related noise are reduced to levels below significance.

Mitigation Measure

Implementation of the following Mitigation Measure NOISE-2 will reduce the project impact related to temporary construction noise levels to a less-than-significant level.

> NOISE-2: In accordance with Mitigation Measure 10-2 of the Central Petaluma Specific Plan, require implementation of the following measures during all phases of project construction:
>
> - *Construction Scheduling*. Limit noise-generating constructions activities to daytime, weekday hours (7 AM to 6 PM) and 9 AM to 5 PM on weekends and holidays. When construction is occurring within 100 feet of existing residences then construction shall be prohibited on Sundays and Holidays.
> - *Equipment.* Properly muffle and maintain all construction equipment powered by internal combustion engines.
> - *Idling Prohibitions.* Prohibit unnecessary idling of internal combustion engines.
> - *Equipment Locations and Shielding.* Locate all stationary noise-generally equipment, such as air compressors as far as practical from existing nearby noise sensitive receptors.
> - *Quiet Equipment Selection.* Select quiet construction equipment, particularly air compressors, whenever possible.
> - *Noise Disturbance Coordinator.* Designate a project construction supervisor as "Noise Disturbance Coordinator" who would be responsible for responding to any local complaints about construction noise. The Disturbance Coordinator would determine the cause of the noise complaint and institute reasonable measures to correct the problem. Conspicuously post a telephone number for the Disturbance Coordinator

at the construction site and submit to the City of Petaluma Building and Police Departments.

- *Notification.* Notify nearby residents (within 300 feet) in writing of the construction schedule.