4.12 Noise and Vibration

4.12.1 Introduction

This section describes the regulatory setting and environmental setting for noise and vibration in the vicinity of the Altamont Corridor Express (ACE) Extension. It also describes the impacts from noise and vibration on sensitive land use that would result from implementation of the ACE Extension and mitigation measures that would reduce significant impacts, where feasible and appropriate.

Cumulative impacts from noise and vibration, in combination with planned, approved, and reasonably foreseeable projects, are discussed in Chapter 5, *Other CEQA-Required Analysis*.

4.12.1.1 Fundamentals of Environmental Noise and Vibration

Overview of Noise and Sound

Noise from transit systems is expressed in terms of a *source-path-receiver* framework. The *source* generates noise levels that depend on the type of source (e.g., a commuter train) and its operating characteristics (e.g., speed). The *receiver* is the noise-sensitive land use (e.g., residence, hospital, or school) exposed to noise from the source. Between the source and the receiver is the *path*, where the noise is reduced by distance, intervening buildings, and topography. Environmental noise impacts are assessed at the receiver. Noise criteria are established for the various types of receivers because not all receivers have the same noise sensitivity.

Noise is unwanted sound. Sound is measured in terms of sound pressure level and is usually expressed in decibels (dB). The human ear is less sensitive to higher and lower frequencies than it is to mid-range frequencies. All noise ordinances, and this noise analysis, use the *A-weighted decibel* (dBA) system, which measures what humans hear in a more meaningful way because it reduces the sound levels of higher and lower frequency sounds—similar to what humans hear. Figure 4.12-1 shows typical maximum A-weighted sound pressure levels (L_{max}) for transit and non-transit sources.

Analysts use four primary noise measurement descriptors to assess noise impacts from traffic and transit projects. They are the equivalent sound level (L_{eq}), the day-night sound level (L_{dn}), and the sound exposure level (SEL) and the maximum sound level (L_{max}).

- **L_{eq}:** The level of a constant sound for a specified period of time that has the same sound energy as an actual fluctuating noise over the same period of time. The peak-hour L_{eq} is used for all traffic and commuter rail noise analyses at locations with daytime use, such as schools and libraries.
- **L_{dn}**: The L_{eq} over a 24-hour period, with 10 dB added to nighttime sound levels (between 10 p.m. and 7 a.m.) to account for the greater sensitivity and lower background sound levels during this time. The L_{dn} is the primary noise-level descriptor for rail noise at residential land uses. Figure 4.12-2 shows typical L_{dn} noise exposure levels.
- **SEL**: The SEL is the primary descriptor of a single noise event (e.g., noise from a train passing a specific location along the track). The SEL represents a receiver's cumulative noise exposure

from an event and the total A-weighted sound during the event normalized to a 1-second interval.

- **L_{max}**: The loudest 1 second of noise over a measurement period, or L_{max}, is used in many local and state ordinances for noise emitted from private land uses and for construction noise impact evaluations.

Overview of Groundborne Vibration

Vibration from a transit system is also expressed in terms of a *source-path-receiver* framework. The *source* is the train rolling on the tracks, which generates vibration energy transmitted through the supporting structure under the tracks and into the ground. Once the vibration gets into the ground, it propagates through the various soil and rock strata—the *path*—to the foundations of nearby buildings—the *receivers*. Groundborne vibrations are generally reduced with distance depending on the local geological conditions. A receiver is a vibration-sensitive building (e.g., residence, hospital, or school) where the vibrations may cause perceptible shaking of the floors, walls, and ceilings and a rumbling sound inside rooms. Not all receivers have the same vibration sensitivity. Consequently, vibration criteria are established for the various types of receivers. Groundborne noise occurs as a perceptible rumble and is caused by the noise radiated from the vibration of room surfaces.

Vibration above certain levels can damage buildings, disrupt sensitive operations, and cause annoyance to humans within buildings. The response of humans, buildings, and equipment to vibration is most accurately described using velocity or acceleration. In this analysis, vibration velocity (VdB) is the primary measure to evaluate the effects of vibration.

Figure 4.12-3 illustrates typical groundborne vibration velocity levels for common sources and thresholds for human and structural response to groundborne vibration. As shown, the range of interest is from approximately 50 to 100 VdB in terms of vibration velocity level (i.e., from imperceptible background vibration to the threshold of damage). Although the threshold of human perception to vibration is approximately 65 VdB, annoyance does not usually occur unless the vibration exceeds 70 VdB.

4.12.2 Regulatory Setting

This section summarizes federal, state, regional, and local regulations related to noise and vibration and applicable to the ACE Extension.

4.12.2.1 Federal

Noise Control Act of 1972

The Noise Control Act of 1972 (42 United States Code 4910) was the first comprehensive statement of national noise policy. The Noise Control Act declared "it is the policy of the U.S. to promote an environment for all Americans free from noise that jeopardizes their health or welfare." Although the Noise Control Act, as a funded program, was ultimately abandoned at the federal level, it served as the catalyst for comprehensive noise studies and the generation of noise assessment and mitigation policies, regulations, ordinances, standards, and guidance for many states, counties, and municipal governments. For example, the noise elements of community general plan documents and local noise ordinances considered in this analysis were largely created in response to the passage of the Noise Control Act.

U.S. Environmental Protection Agency Railroad Noise Emission Standards

Interstate rail carriers must comply with U.S. Environmental Protection Agency (USEPA) (40 Code of Federal Regulation [C.F.R.] 201) noise emission standards, which are expressed as maximum measured noise levels and applicable to locomotives manufactured after 1979.

- 100 feet from geometric center of stationary locomotive, connected to a load cell and operating at any throttle setting except idle—87 dBA (at idle setting, 70 dBA).
- 100 feet from geometric center of mobile locomotive—90 dBA.
- 100 feet from geometric center of mobile railcars, at speeds of up to 45 miles per hour (mph)—88 dBA—or speeds greater than 45 mph (93 dBA).

Federal Railroad Administration Guidelines and Noise Emission Compliance Regulation

The Federal Railroad Administration (FRA) has developed a guidance manual for assessing noise and vibration impacts from major rail projects. Although not at the level of a rule or a standard, FRA guidance is intended to satisfy environmental review requirements and assist project sponsors in addressing predicted construction and operation noise and vibration during the design process.

FRA also has a regulation governing compliance of noise emissions from interstate railroads. FRA's Railroad Noise Emission Compliance Regulation (49 C.F.R. 210) prescribes compliance requirements for enforcing railroad noise emission standards adopted by USEPA (40 C.F.R. 201).

Federal Transit Administration Guidelines

Similar to FRA, the Federal Transit Administration (FTA) has developed a guidance manual for assessing noise and vibration impacts from major rail projects intended to satisfy environmental review requirements and assist project sponsors in addressing predicted construction and operation noise and vibration during the design process. The FTA guidance manual noise and vibration impact criteria for rail projects and their associated fixed facilities, such as storage and maintenance yards, passenger stations and terminals, parking facilities, and substations are described in Section 4.12.4.2, *Thresholds of Significance*, and are the primary noise criteria used for the ACE Extension. FTA guidance is accepted by FRA.

4.12.2.2 State

California Noise Control Act

At the state level, the California Noise Control Act, enacted in 1973 (Health and Safety Code 46010 et seq.), requires the Office of Noise Control in the Department of Health Services to provide assistance to local communities developing local noise control programs. The Office of Noise Control also works with the Office of Planning and Research to provide guidance for preparing required noise elements in city and county general plans, pursuant to Government Code Section 65302(f). In preparing the noise element, a city or county must identify local noise sources and analyze and quantify, to the extent practicable, current and projected noise levels for various sources, including highways and freeways; passenger and freight railroad operations; ground rapid transit systems; commercial, general, and military aviation and airport operations; and other ground stationary noise sources. These noise sources also would include commuter rail alignments. The California

Noise Control Act stipulates the mapping of noise-level contours for these sources, using community noise metrics appropriate for environmental impact assessment as defined in Section 4.12.4.2. Cities and counties use these as guides to making land use decisions to minimize the community residents' exposure to excessive noise.

4.12.2.3 Regional and Local

The San Joaquin Regional Rail Commission (SJRRC), a state joint powers agency, proposes improvements located within and outside of the Union Pacific Railroad (UPRR) right-of-way (ROW). The Interstate Commerce Commission Termination Act (ICCTA) affords railroads engaged in interstate commerce[1] considerable flexibility in making necessary improvements and modifications to rail infrastructure, subject to the requirements of the Surface Transportation Board. ICCTA broadly preempts state and local regulation of railroads and this preemption extends to the construction and operation of rail lines. As such, activities within the UPRR ROW are clearly exempt from local building and zoning codes and other land use ordinances. ACE Extension improvements outside of the UPRR ROW, however, would be subject to regional and local plans and regulations. Though ICCTA does broadly preempt state and local regulation of railroads, SJRRC intends to obtain local agency permits for construction of facilities that fall outside the UPRR ROW even though SJRRC has not determined that such permits are legally necessary and such permits may not be required.

Appendix G, *Regional Plans and Local General Plans*, provides a list of applicable goals, policies, and objectives from regional and local plans of the jurisdictions in which ACE Extension improvements are proposed. Section 15125(d) of the CEQA Guidelines requires an environmental impact report (EIR) to discuss "any inconsistencies between the proposed project and applicable general plans, specific plans, and regional plans." These plans were considered during the preparation of this analysis and were reviewed to assess whether the ACE Extension would be consistent[2] with the plans of relevant jurisdictions. The ACE Extension would be consistent with most of the applicable goals, policies, and objectives related to noise and vibration identified in Appendix G. There are instances, however, in which the ACE Extension could be inconsistent with the local goals, policies, and objectives related to noise and vibration. The noise and vibration impact and mitigation requirements prescribed for the ACE Extension are based on FRA and FTA standards.

The ACE Extension traverses and is located in the jurisdiction of three counties and nine incorporated cities. Table 4.12-1 provides a list of county and city general plans and a summary of applicable noise and vibration policies that have been reviewed and considered for the preparation of this analysis. Appendix G contains a list of applicable noise and vibration goals, policies, and objectives from these plans.

[1] ACE operates within a ROW and on tracks owned by UPRR, which operates interstate freight rail service in the same ROW and on the same tracks.

[2] An inconsistency with regional or local plans is not necessarily considered a significant impact under CEQA, unless it is related to a physical impact on the environment that is significant in its own right.

Table 4.12-1. List of Local Plans Regarding Noise and Vibration[3]

Document Title	Summary
San Joaquin County	
San Joaquin County General Plan Policy Document (San Joaquin County 2016)	Policy PHS-9.1 sets the maximum allowable noise exposure from transportation noise sources at 65 dB L_{dn} for residential and other noise-sensitive land use.
Stockton General Plan 2035 Goals and Policies Report (City of Stockton 2007)	Policy HS-2.1 prohibits noise-generating land uses adjacent to existing noise-sensitive land uses if noise levels are expected to exceed 70 dB CNEL. Policy HS-2.2 sets the maximum allowable ambient noise exposure at 60 dB L_{dn} for residential and other noise-sensitive land use, and 70 dB L_{dn} for outdoor activity areas.
Comprehensive General Plan for the City of Lathrop, California (City of Lathrop 1991)	Policy Noise 1 sets the noise impact threshold at 60 dB L_{dn} at the exterior of buildings. Policy Noise 2 sets noise limit for new projects at 60 dB L_{dn} in outdoor activity areas.
City of Manteca General Plan 2023 Policy Document (City of Manteca 2003)	Policy N-P-1 sets the maximum allowable noise exposure from mobile sources as 60 dB L_{dn} for noise-sensitive land use, 65 dB L_{dn} or office buildings, and 70 dB L_{dn} for playgrounds for mobile noise sources. Policy N-P-5 requires noise mitigation for construction.
City of Ripon General Plan 2040 (City of Ripon 2006)	Policy J6 sets noise standards for residential uses at 60 dB L_{dn}, other noise-sensitive land uses at 65 dB L_{dn}, and 70 or 75 dB L_{dn} for outdoor activity areas.
Stanislaus County	
Stanislaus County General Plan (Stanislaus County 2015)	Noise Policy 2 requires mitigation in unincorporated areas when noise exceeds standards. For transportation noise sources, limits are set at 60 dB L_{dn} for outdoor activity areas of single family homes and 65 dB L_{dn} for outdoor activity areas of multifamily dwellings. Noise Policy 3 protects noise-sensitive land uses and requires mitigation when L_{dn} is increased by 3 dB and exceeds “normally acceptable” levels or increased by 5 dB and remains with in “normally acceptable” levels.
City of Modesto Final Urban Area General Plan (City of Modesto 2008)	Noise Policy A requires construction activities to comply with the City’s noise ordinance. Noise Policy B requires new projects to have additional studies and/or mitigation if noise exposure at single family residential uses exceeds 65 dBA or if noise levels exceed standards set.
City of Ceres General Plan Policy Document (City of Ceres 1997)	Policy 7.H.7 states that noise created by new transportation noise sources shall be mitigated as to not exceed 60 dB L_{dn} for residential and other noise-sensitive land uses and 70 dB L_{dn} for playgrounds and neighborhood parks.
Ceres General Plan 2035 Public Review Draft[4] (City of Ceres 2017)	Policy 5.L.2 sets the maximum allowable noise exposure for transportation noise sources which identifies 60 dB L_{dn} as the maximum for residential and other noise-sensitive land uses and 65 dB L_{dn} for office buildings and playgrounds/neighborhood parks. Policy Noise 5.L.12 requires noise mitigation to achieve these noise standards.

[3] All general plans follow the noise standards set by the State of California.

[4] The City of Ceres is in the process of updating their 20-year general plan. The proposed level of service goals are from the public review draft of the General Plan, which has yet to be formally adopted by the City. The City is currently collecting comments on the public review draft general plan and starting work on the general plan EIR.

Document Title	Summary
Turlock General Plan (City of Turlock 2012)	Policy 9.4-b requires preventative measures for the degradation of the noise environment. Policy 9.4-c protects residential and noise-sensitive land use areas by minimizing excessive noise exposure. Policy 9.4-e requires noise-attenuating features for projects with noise exposures exceeding "normally acceptable" standards identified as 60 dB L_{dn} residential and other noise-sensitive land uses, 65 dB L_{dn} for playgrounds, recreational, and commercial and office uses, and 70 dB L_{dn} for industrial uses.
Merced County	
2030 Merced County General Plan (Merced County 2013)	Policy HS-7.2 requires noise mitigation measures to reduce traffic and/or rail noise levels to comply with standards if pre-project noise levels already exceed the standards for new uses affected by transportation (65 dB L_{dn} for residential, office buildings, and other noise-sensitive land uses; and 70 dB L_{dn} for playgrounds and parks) and the increase is significant. Policy HS-7.11 support improvements to at-grade crossings in urban areas to eliminate the need for train horn sounding near communities. Policy HS-7.12 requires new projects to include appropriate noise mitigation measures to comply with standards.
City of Livingston 2025 General Plan (City of Livingston 2008)	Policy Noise 3 requires noise created by new transportation sources be mitigated as not to exceed 65 dB L_{dn} for residential and other noise-sensitive land uses.
City of Atwater General Plan (City of Atwater 2000)	Policy NO-2.4 requires mitigation for noise created by new transportation sources for standards in excess of 60 dB L_{dn} for residential and other noise-sensitive land uses, and 70 dB L_{dn} for playgrounds and parks.
Merced Vision 2030 General Plan (City of Merced 2012)	Policy N-1.6 requires mitigation for all significant noise impacts as a condition of project approval for sensitive land uses. The maximum allowable noise exposure from transportation (railroad) noise sources is set at 65 dB L_{dn} for residential and other noise-sensitive land uses and 70 dB L_{dn} for playgrounds and parks.

Notes:
dBA = A-weighted decibel
FTA = Federal Transit Administration
dB = decibels
L_{dn} = day-night sound level
CNEL = community noise equivalent level

4.12.3 Environmental Setting

This section describes the environmental setting related to noise and vibration by geographic segment for ACE Extension improvements. For the purposes of this analysis, the study area for noise and vibration is defined as follows.

- The study area for noise is the area within approximately 500 feet of the track centerline.
- The study area for vibration is the area within approximately 200 feet of the track centerline.

Figures 4.12-4 through 4.12-28 depict the noise and vibration study areas for the ACE Extension.

Information presented in this section regarding noise and vibration was obtained from the following sources.

- Available reports and data (federal and state statutes, regional agency policies, and ordinances).
- Field reconnaissance throughout the study area to assess potential locations for noise measurements.
- Noise measurements at locations throughout the study area to document existing conditions at sensitive receptors.
- ACE data on existing locomotive fleet and operations.
- Available data on UPRR freight train volumes.
- General plan noise elements for jurisdictions along the ACE Extension.

Based on this information, existing noise sources in the study area include commuter rail operations (in some areas), freight rail operations, roadway traffic, and general community activity. Significant sources of vibration in the study area are commuter (in some areas) and freight rail operations.

Because the thresholds for noise impacts in FTA noise criteria are based on the existing noise levels, measuring and characterizing the existing noise levels at noise-sensitive receptor locations in the study area is an important step in the impact assessment. The noise measurements included both long-term (24-hour) and short-term (1-hour) monitoring of the A-weighted sound level at noise-sensitive receptor locations in the study area.

The noise measurements were performed with NTi Audio model XL2 noise monitors that conform to American National Standard Institute standards for Type 1 (precision) sound level meters. Calibrations, based on the U.S. National Institute of Standards and Technology standards, were conducted before and after each measurement. The noise monitors were set to continuously monitor and record multiple noise level metrics, as well as to obtain audio recordings during the measurement periods.

Table 4.12-2 summarizes results of the existing noise measurements for the study area for Phase I improvements. Figures 4.12-4 through 4.12-28 show the locations of the 10 long-term noise sites (LT) and 9 short-term noise sites (ST). The long-term noise measurements were used to characterize the existing noise levels at residential locations, and the short-term sites were used to characterize the existing noise levels at sensitive nonresidential locations. A general noise assessment was performed for the Phase II improvements, and thus existing noise levels were not measured. Existing noise measurements would be conducted for the subsequent project-level analysis for Phase II improvements.

The sensitive land use for vibration is essentially the same as for noise, except that parkland is not considered a vibration-sensitive receptor. Because a general vibration assessment (rather than a detailed vibration analysis) was performed, existing vibration levels were not measured for this analysis.

Table 4.12-2. Phase I Improvements—Existing Noise Level Measurements in the Study Area

Site No.	City	Measurement Location	Measurement Start		Meas. Dur. (Hrs.)	Noise Level (dBA)[a] L_{eq}	L_{dn}
Lathrop to Stockton							
LT-10	Lathrop	River Islands Welcome Center	2015-12-14	14:00:00	24	55	60
LT-12	Lathrop	13521 Quartz Way	2015-12-16	12:00:00	24	56	52
LT-13	Stockton	1817 S Aurora Street	2015-12-14	17:00:00	24	57	68
ST-5	French Camp	Adas Yeshuran Cemetery	2015-12-17	10:36:30	1	70	68
ST-6	Stockton	Stockton Station	2015-12-16	10:07:00	1	62	60
Lathrop to Ceres							
LT-14	Manteca	1548 Malvick Court	2016-04-25	14:00:00	24	64	71
LT-15	Manteca	144 Goodale Court	2016-04-26	15:00:00	24	69	77
LT-16	Ripon	238 North Locust Avenue	2016-04-26	10:00:00	24	66	71
LT-17	Modesto	2508 Strivens Avenue	2016-04-25	10:00:00	24	65	70
LT-18	Modesto	1814 Lauralee Court	2016-04-25	9:00:00	24	57	63
ST-7	Manteca	East Atherton Drive	2016-04-25	14:35:59	1	62	60
ST-8	Ripon	99 North Frontage Road	2016-04-26	14:59:00	1	72	70
ST-9	Ripon	Garrison Way	2016-04-25	16:26:30	1	61	59
ST-10	Salida	5213 Whitestone Drive	2016-04-25	11:37:10	1	62	60
ST-11	Modesto	Brink Avenue	2016-04-26	11:06:00	1	71	69
ST-12	Modesto	8th Street	2016-04-26	7:59:23	1	75	73
LT-19	Modesto	1019 Boulder Avenue	2017-08-28	13:00:00	24	63	68
LT-20	Ceres	2079 Poplar Street	2017-08-28	14:00:00	24	59	63
ST-13	Ceres	4319 Lucas Road	2017-08-28	14:24:00	1	69	67

[a] L_{dn} is used for Category 2 (residential) land use and L_{eq} is used for Category 3 (institutional) land use.

LT-# = longer-term noise sites
ST-# = short-term noise sites
No. = number
hrs. = hours
dBA = A-weighted decibels
L_{eq} = equivalent sound level
L_{dn} = day-night sound level
Meas. Dur. = measurement duration

4.12.3.1 Lathrop to Stockton

The Lathrop to Stockton segment is located in the southern central portion of San Joaquin County. The segment extends from northeastern Lathrop, through French Camp, to central Stockton along the existing UPRR Fresno Subdivision.

Noise-sensitive land uses in Lathrop for this segment include single-family and multifamily housing. Noise-sensitive land uses in French Camp include single-family and multifamily housing. Noise-sensitive land uses and receptors in Stockton include the Trinity Chapel Church of God in Christ, Gurdwara Wahib Sikh Temple, and single-family and multifamily housing.

The noise measurement sites for Lathrop are LT-10 and LT-12. The noise measurement site for French Camp is ST-5, and the noise measurement sites for Stockton are LT-13 and ST-6.

- **Site LT-10, River Islands Welcome Center (Lathrop):** The Ldn measured at this location was 60 dBA. The dominant noise source was traffic on Interstate 5. Other noise sources include traffic on local streets and freight traffic. Noise levels were measured for 24 hours in the backyard of the Welcome Center.
- **Site LT-12, 13521 Quartz Way (Lathrop):** The L_{dn} measured at this location was 52 dBA. The dominant noise source was traffic on local streets. Noise levels were measured for 24 hours in the front yard of the residence. This noise measurement site is representative of all noise-sensitive land uses from McKinley Avenue to Brookfield Avenue.
- **Site LT-13, 1817 South Aurora Street (Stockton):** The L_{dn} measured at this location was 68 dBA. The dominant noise source was traffic on Aurora Street and freight rail traffic. Noise levels were measured for 24 hours in the front yard of the residence. This noise measurement site is representative of all noise-sensitive land uses from California Street to State Route (SR) 4.
- **Site ST-5, Adas Yeshuran Cemetery (French Camp):** The L_{eq} measured at this location was 70 dBA. The dominant noise sources were traffic on South McKinley Avenue and train traffic. Noise levels were measured for 1 hour on the shoulder of South McKinley Avenue in front of Adas Yeshuran Cemetery. This noise measurement site is representative of all noise-sensitive land uses from Roth Road to French Camp Road.
- **Site ST-6, Stockton Station (Stockton):** The L_{eq} measured at this location was 62 dBA. The dominant noise sources were traffic on East Weber Avenue and SR 4 and urban community noise. Noise levels were measured for 1 hour on the sidewalk at the northwest corner of Channel Street and East Weber Avenue. This noise site is representative of all noise-sensitive land uses from SR 4 to the Stockton Station.

4.12.3.2 Lathrop to Ceres

The Lathrop to Ceres segment is located in the southern portion of San Joaquin County and the central portion of Stanislaus County. The segment extends from southeastern Lathrop to central Ceres and traverses Manteca, Ripon, Salida, Modesto, Bystrom, and rural areas, along the existing UPRR Oakland and Fresno Subdivisions.

Noise-sensitive land uses and receptors in Lathrop for this segment include the Lathrop Church of Christ, Living Word Ministries, Abundant Life Center, and single-family and multifamily housing. Noise-sensitive land uses and receptors in Manteca include the Jehovah's Witnesses Church, Life in Christ Fellowship Church, Crossroads Grace Community Church, Freewill Baptist Church, and single-family and multifamily housing. Noise-sensitive land uses and receptors in Ripon include Ripon Christian Schools, Ripon High School, and single-family and multifamily housing. Noise-sensitive land uses in Salida include single-family housing. Noise-sensitive land uses and receptors in Modesto include the Modesto Junior College, Libreria Catilica Unidos Por Cristo y Maria, St. Stanislaus Catholic Church, Redeemer Modesto, The Universal Church, Gallo Center for the Arts, Bendan Theater, The House Downtown, La Luz Del Mundo, St. Paul Missionary Baptist Church, Revival Center, Victory in Praise Church of Modesto, Los Verdaderos Pentecostales, Bible Way Tabernacle, and single-family and multifamily housing. The noise-sensitive land uses in Bystrom include single-family and multifamily housing. Noise-sensitive land uses and receptors in Ceres for this segment includes the Ceres Memorial Park, Valley Christian Center, First Missionary Baptist Church, Iglesia Santuario De Jesucristo, Mar Gewargis Assyrian Church of the East, and single-family and multifamily housing. Noise-sensitive land use in rural areas of San Joaquin and Stanislaus Counties, between the incorporated cities, include scattered single-family housing.

The noise measurement sites used to characterize Manteca are LT-14, LT-15, and ST-7. The noise measurement site used to characterize the rural unincorporated areas between Manteca and Ripon is ST-8. The noise measurement sites used to characterize Ripon are LT-16 and ST-9. The noise measurement site used to characterize Salida is ST-10. The noise measurement sites used to characterize Modesto are LT-17, LT-18, LT-19, ST-11, and ST-12 and the noise measurement sites used to characterize Ceres are LT-20 and ST-13.

- **Site LT-14, 1548 Malvick Court (Manteca):** The L_{dn} measured at this location was 71 dBA. The dominant noise sources were the freight trains and traffic on Phillips Drive. Noise levels were measured for 24 hours on the side of the residence closest to Phillips Drive. This noise measurement site is representative of all noise-sensitive land uses from South Airport Way to North Union Road.
- **Site LT-15, 144 Goodale Court (Manteca):** The L_{dn} measured at this location was 77 dBA. The dominant noise sources were local road traffic and freight trains. Noise levels were measured for 24 hours in the backyard of the residence. This noise measurement site is representative of all noise-sensitive land uses from North Union Road to SR 120.
- **Site LT-16, 238 No Locust Avenue (Ripon):** The L_{dn} measured at this location was 71 dBA. The dominant noise sources were SR 99 and freight trains. Noise levels were measured for 24 hours in the backyard of the residence. This noise measurement site is representative of all noise-sensitive land uses from Fulton Avenue to the Stanislaus River.
- **Site LT-17, 2508 Strivens Avenue (Modesto):** The L_{dn} measured at this location was 70 dBA. The dominant noise sources were SR 99 and freight trains. Noise levels were measured for 24 hours in the backyard of the residence. This noise measurement site is representative of all noise-sensitive land uses from Bangs Avenue to West Briggsmore Avenue on the northbound side of the tracks.
- **Site LT-18, 1814 Lauralee Court (Modesto):** The L_{dn} measured at this location was 63 dBA. The dominant noise sources were traffic on SR 99 and freight trains. Noise levels were measured for 24 hours in the backyard of the property along the back fence. This noise measurement site is representative of all noise-sensitive land uses from West Briggsmore Avenue to Kansas Avenue.
- **Site ST-7, East Atherton Drive (Manteca):** The L_{eq} measured at this location was 62 dBA. The dominant noise sources were traffic on SR 99, SR 120, and freight trains. Noise levels were measured for 1 hour on the sidewalk at the corner of East Atherton Drive and Tesora Drive This noise site is representative of all noise-sensitive land use from SR 120 to East Woodward Avenue.
- **Site ST-8, 99 North Frontage Road (Ripon):** The L_{eq} measured at this location was 72 dBA. The dominant noise sources were traffic on SR 99 and freight trains. Noise levels were measured for 1 hour on the shoulder of 99 North Frontage Road approximately 0.5 mile north of South

Olive Avenue. This noise measurement site is representative of all noise-sensitive land uses from Austin Road to Jack Tone Road.

- **Site ST-9, Garrison Way (Ripon):** The L_{eq} measured at this location was 61 dBA. The dominant noise sources were traffic on SR 99 and freight trains. Noise levels were measured for 1 hour on the shoulder of Garrison Way next to the parking lot for the Canal Street Grille. This noise measurement site is representative of all noise-sensitive land uses from South Olive Avenue to Fulton Avenue.
- **Site ST-10, 5213 Whitestone Drive (Salida):** The L_{eq} measured at this location was 62 dBA. The dominant noise source was traffic on SR 99. Noise levels were measured for 1 hour on the shoulder of Whitestone Drive on the sidewalk across the street from the residence. This noise measurement site is representative of all noise-sensitive land uses from Hammet Road to Murphy Road.
- **Site ST-11, Brink Avenue (Modesto):** The L_{eq} measured at this location was 71 dBA. The dominant noise sources were traffic on SR 99 and freight trains. Noise levels were measured for 1 hour on the shoulder of Brink Avenue close to its intersection with Shoemaker Avenue. This noise site is representative of all noise-sensitive land uses from Murphy Road to West Briggsmore Avenue on the southbound side of the tracks.
- **Site ST-12, Eighth Street (Modesto):** The L_{eq} measured at this location was 75 dBA. The dominant noise sources were typical urban activities and activities at the train station. Noise levels were measured for 1 hour on the sidewalk of Eighth Street across the tracks from the Modesto Transportation Center. This noise measurement site is representative of all noise-sensitive land uses from Kansas Avenue to the Modesto Station.
- **Site LT-19, 1019 Boulder Avenue (Modesto):** The L_{dn} measured at this location was 68 dBA. The dominant noise sources were traffic on SR 99 and freight trains. Noise levels were measured for 24 hours in the front yard of the property. This noise measurement site is representative of all noise-sensitive land uses from K Street to Park Street where there are grade crossings nearby.
- **Site LT-20, 2079 Poplar Street (Ceres):** The L_{dn} measured at this location was 63 dBA. The dominant noise source was traffic on SR 99. Noise levels were measured for 24 hours in the backyard of the property. This noise measurement site is representative of all noise-sensitive land uses from K Street to Park Street where there are no grade crossings nearby.
- **Site ST-13, 4319 Lucas Road (Ceres):** The L_{eq} measured at this location was 69 dBA. The dominant noise source was traffic on SR 99. Noise levels were measured for 1 hour on the shoulder of Lucas Road. This noise measurement site is representative of all noise-sensitive land uses from Service Road to Faith Home Road in Ceres and Keyes.

4.12.3.3 Ceres to Merced

The Ceres to Merced segment is located in the central portion of Stanislaus County and the eastern portion of Merced County. The segment extends from central Ceres to central Merced, and traverses Keyes, Turlock, Delhi, Livingston, and Atwater, along the existing UPRR Fresno Subdivision.

Noise-sensitive land uses in Ceres for this segment include single-family and multifamily housing. Noise-sensitive land use in Keyes include single-family housing. Noise-sensitive land uses and receptors in Turlock include New Hope Church, Good News Tabernacle, and single-family and multifamily housing. Noise-sensitive land uses in Delhi include single-family and multifamily housing. Noise-sensitive land uses and receptors in Livingston include the Apostolic Assembly and single-family and multifamily housing. Noise-sensitive land uses in Atwater include single-family and multifamily housing. Noise-sensitive land uses and receptors in Merced include the Merced Baptist Church and single-family and multifamily housing.

The existing noise levels along the rail corridor in this segment are similar to those in the Lathrop to Ceres segment. Additionally, the interim Ceres to Merced bus bridge with Phase I operations would not cause any change in noise levels on roadways in this segment. Thus, quantitative noise measurements at specific sites in this segment were not conducted.

4.12.4 Impact Analysis

This section describes the environmental impacts of the ACE Extension on noise and vibration. It describes the methods used to evaluate the impacts and the thresholds used to determine whether an impact would be significant. Measures to mitigate significant impacts are provided, where appropriate.

4.12.4.1 Methods for Analysis

The method for analyzing noise and vibration impacts is different for Phase I and Phase II improvements. Phase I improvements are analyzed at a project level and a quantitative assessment of potential noise and vibration impacts associated with construction and operation is provided. Potential noise and vibration impacts associated with Phase II operations are analyzed quantitatively; however, construction noise and vibration impacts for Phase II improvements are qualitatively presented because specific construction plans for Phase II improvements have not been determined. The approach can be summarized as follows.

- Analyze direct noise and vibration impacts through quantitative analysis.
- To assess station noise and vibration: consider train type; train schedules (number of stopping trains and number of through trains during daytime and nighttime hours); number of cars in each train; speed profiles for stopping and through trains; plans and profiles of station structures; landform topography; and noise level changes associated with alterations to train service volumes.
- To assess railroad noise and vibration: consider train type; train schedules (number of through trains during daytime and nighttime hours); number of cars in each train; speed profiles; landform topography; and noise level changes associated with alterations to train service volumes.
- To assess construction noise emissions: consider equipment expected to be used by contractors during construction, usage scenarios for how equipment would be operated, estimated site layouts of equipment along the ROW, and the location of construction operations with respect to nearby noise-sensitive receptors.
- To assess construction vibration: account for vibration from construction equipment, estimated site layout of equipment along the ROW, and the location of construction operations with respect to nearby vibration-sensitive receptors.

- Include the following scenarios: existing conditions plus construction; Phase I operations; and Phase II operations.
- Refer to FTA's guidance manual, *Transit Noise and Vibration Impact Assessment* (Federal Transit Administration 2006).

Construction Noise and Vibration Impact Assessment Methodology

The construction noise impact assessment used the methodology described in the FTA guidance manual (Federal Transit Administration 2006). SJRRC, UPRR, and their contractors will make decisions regarding procedures and equipment. For this analysis, construction scenarios for typical railroad construction projects are used to predict noise impacts. The construction noise methodology includes the following information.

- Noise emissions from typical equipment used by contractors
- Construction methods
- Scenarios for equipment usage
- Estimated site layouts of equipment along the ROW
- Proximity of construction activities to nearby noise-sensitive receptors
- FTA construction noise assessment criteria

The FTA guidance manual (Federal Transit Administration 2006) also provides the methodology for the assessment of construction vibration impacts. Estimated construction scenarios have been developed for typical railroad construction projects allowing a quantitative construction vibration assessment to be conducted. Construction vibration is assessed quantitatively where the potential for blasting, pile driving, vibratory compaction, demolition, or excavation close to vibration-sensitive structures exists. The methodology included the following information.

- Vibration source levels from equipment used by contractors
- Estimated site layouts of equipment along the ROW
- Relationship of construction activities to nearby vibration-sensitive receptors
- FTA vibration impact criteria for annoyance and building damage

Train Operation Noise and Vibration Impact Assessment Methodology

Train operational noise and vibration levels were projected using ACE Extension operational plans and the prediction models provided in the FTA guidance manual (Federal Transit Administration 2006). Potential impacts were evaluated in accordance with the Detailed Noise Analysis and General Vibration Assessment procedures outlined in the FTA guidance manual. The methodology and assumptions for train operation are as follows.

- ACE currently operates four westbound trains in the morning from Stockton to San Jose and four eastbound trains in the afternoon from San Jose to Stockton during weekdays only. There are currently no ACE operations between Lathrop and Ceres.
- There are two operational scenarios for Phase I, which are dependent on whether or not SJRRC chooses to implement direct ACE service from Ceres to San Jose.
    - Phase I operational scenario A

        - In the morning, four westbound trains from Ceres to Lathrop, where passengers would transfer onto the four westbound trains from Stockton to San Jose at the selected Lathrop-area station (timed transfers). Four buses from Merced would meet the four trains at Ceres in the morning.
        - Trains supporting the roundtrips between Ceres and Lathrop in the morning would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, and return to Lathrop for evening service.
        - In the evening, four eastbound trains from San Jose to Stockton, where passengers would transfer onto the four eastbound trains from Lathrop to Ceres at the selected Lathrop-area station (timed transfers). Four buses would meet the four trains at Ceres in the evening and provide a connection to Merced.
    - Phase I operational scenario B
        - In the morning, three westbound trains from Ceres to Lathrop, where passengers would transfer onto the three westbound trains from Stockton to San Jose at the selected Lathrop-area station (timed transfers); and one westbound train from Ceres to San Jose. Four buses from Merced would meet the four trains at Ceres in the morning.
        - Trains supporting the roundtrips between Ceres and Lathrop in the morning would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, and return to Lathrop for evening service.
        - In the evening, three eastbound trains from San Jose to Stockton, where passengers would transfer onto the three eastbound trains from Lathrop to Ceres at the selected Lathrop-area station (timed transfers); and one eastbound train from San Jose to Ceres. Four buses would meet the four trains at Ceres in the evening and provide a connection to Merced.
- There are two operational scenarios for Phase II, which are dependent on whether SJRRC chooses to implement direct ACE service from Merced to San Jose or not.
    - Phase II operational scenario A
        - In the morning, four westbound trains from Merced to Lathrop, where passengers would transfer onto the four westbound trains from Stockton to San Jose at the selected Lathrop-area station (timed transfers).
        - Trains supporting the roundtrips between Merced and Lathrop in the morning would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, and return to Lathrop for evening service.
        - In the evening, four eastbound trains from San Jose to Stockton, where passengers would transfer onto the four eastbound trains from Lathrop to Merced at the selected Lathrop-area station (timed transfers).
    - Phase II operational scenario B
        - In the morning, three westbound trains from Merced to Lathrop, where passengers would transfer onto the three westbound trains from Stockton to San Jose at the selected Lathrop-area station (timed transfers); and one westbound train from Merced to San Jose.

- Trains supporting the roundtrips between Merced and Lathrop in the morning would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, and return to Lathrop for evening service.
- In the evening, three eastbound trains from San Jose to Stockton, where passengers would transfer onto the three eastbound trains from Lathrop to Merced at the selected Lathrop-area station (timed transfers); and one eastbound train from San Jose to Merced.

Projected and existing ambient noise exposures were tabulated at the identified noise-sensitive receptors or clusters of receptors, and the levels of noise impact (no impact, moderate impact, or severe impact) were identified by comparing the existing and train noise exposure based on the applicable FTA noise impact criteria. Similarly, projected and existing maximum train vibration levels were tabulated at vibration-sensitive receptor locations and potential impacts were identified based on the applicable FTA vibration impact criteria along with FTA guidance on how to account for existing vibration.

4.12.4.2 Thresholds of Significance

The State CEQA Guidelines Appendix G (14 California Code of Regulations 15000 et seq.) has identified significance criteria for determining whether a project could have significant impacts on noise- and vibration-sensitive land use from noise and vibration.

An impact would be considered significant if construction or operation of the project would have any of the following consequences.

- Expose persons to (or generate noise levels in excess of) severe impact standards for a severe impact established by FTA for transit projects and other changes related to the project. These standards cover both permanent and temporary/periodic increases in ambient noise levels in the project vicinity above levels existing without the proposed project.
- Expose persons to or generate excessive groundborne vibration or groundborne noise levels.
- Permanently substantially increase ambient noise levels in the project vicinity above levels existing without the project.
- Temporarily or periodically substantially increase ambient noise levels in the project vicinity above levels existing without the project.

The noise and vibration impact criteria for the ACE Extension are based on FTA and FRA guidelines, which are described in the following subsections.

FTA Noise Criteria

Construction Noise and Vibration Impact Assessment Criteria

Construction activities for a large transportation project often generate noise and vibration complaints even though they take place only for a limited time. For the ACE Extension, construction noise and vibration impacts are assessed where the exposure of noise- and vibration-sensitive receptors in relation to construction-related noise or vibration is expected to occur at levels exceeding standards established by FTA and established thresholds for architectural and structural building damage (Federal Transit Administration 2006).

Construction Noise Impact Criteria

Table 4.12-3 presents the FTA noise assessment criteria for construction activity. The last column applies to construction activities that extend over 30 days near any given receptor. L_{dn} is used to assess impacts in residential areas and 24-hour L_{eq} is used in commercial and industrial areas. The 8-hour L_{eq} and the 30-day average L_{dn} noise exposure from construction noise calculations use the noise emission levels of the construction equipment, its location, and operating hours. The construction noise limits are normally assessed at the noise-sensitive receptor property line.

Table 4.12-3. Federal Transit Administration Construction Noise Assessment Criteria

	8-hour L_{eq}, dBa		**Noise Exposure, L_{dn}, dBA**
Land Use	**Day**	**Night**	**30-day Average**
Residential	80	70	75[a]
Commercial	85	85	80[b]
Industrial	90	90	85[b]

Source: Federal Transit Administration 2006

Notes:

[a] In urban areas with very high ambient noise levels (L_{dn} greater than 65 dB), L_{dn} from construction operations should not exceed existing ambient noise levels + 10 dB.

[b] 24-hour L_{eq}, not L_{dn}.

L_{eq} = equivalent sound level
dBA = A-weighted decibel
L_{dn} = day-night sound level
dB = decibels

Construction Vibration Impact Criteria

Guidelines in the FTA guidance manual (Federal Transit Administration 2006) provide the basis for the construction vibration assessment. FTA provides construction vibration criteria designed primarily to prevent building damage, and to assess whether vibration might interfere with vibration-sensitive building activities or temporarily annoy building occupants during the construction period. The FTA criteria include two ways to express vibration levels.

- Root-mean-square (RMS) vibration velocity level ($L_{v,}$ in VdB) for annoyance and activity interference.
- Peak particle velocity (PPV), which is the maximum instantaneous peak of a vibration signal used for assessments of damage potential.

To avoid temporary annoyance to building occupants during construction or construction interference with vibration-sensitive equipment inside special-use buildings, such as a magnetic resonance imaging (MRI) machine, FTA recommends using the long-term operational vibration criteria (discussed in the *Operational Noise and Vibration Impact Assessment Criteria* subsection).

Table 4.12-4 presents the FTA building damage criteria for construction activity and lists PPV and approximate L_v limits for four building categories. These limits are used to estimate potential problems that should be addressed during final design.

Table 4.12-4. Federal Transit Administration Construction Vibration Damage Criteria

Building Category	PPV (inch/sec)	Approximate L_v[a]
I. Reinforced concrete, steel, or timber (no plaster)	0.5	102
II. Engineered concrete and masonry (no plaster)	0.3	98
III. Non-engineered timber and masonry buildings	0.2	94
IV. Buildings extremely susceptible to vibration damage	0.12	90

Source: Federal Transit Administration 2006

Notes:

[a] RMS vibration velocity level in VdB relative to 1 micro-inch/second.

PPV = peak particle velocity

RMS = root-mean-square

VdB = vibration decibel

Operational Noise and Vibration Impact Assessment Criteria

Train Noise Impact Criteria

The descriptors and criteria for assessing noise impacts vary according to land use categories adjacent to the track. For land uses where people live and sleep (e.g., residential neighborhoods, hospitals, and hotels), L_{dn} is the assessment parameter. For other land use types where there are noise-sensitive uses (e.g., outdoor concert areas, schools, and libraries), $L_{eq}(h)$ for an hour of noise sensitivity that coincides with train activity is the assessment parameter. Table 4.12-5 summarizes the three land use categories and noise metrics applied to each category.

Table 4.12-5. Federal Transit Administration Noise-Sensitive Land Use Categories

Land Use Category	Noise Metric (dBA)	Land Use Category
1	Outdoor $L_{eq}(h)$*	Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet, such as outdoor amphitheaters, concert pavilions, and National Historic Landmarks with significant outdoor use.
2	Outdoor L_{dn}	Residences and buildings where people normally sleep. This category includes homes and hospitals, where nighttime sensitivity to noise is of utmost importance.
3	Outdoor $L_{eq}(h)$*	Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, and churches, where it is important to avoid interference with such activities as speech, meditation, and concentration. Buildings with interior spaces where quiet is important, such as medical offices, conference rooms, recording studios, and concert halls fall into this category, as well as places for meditation or study associated with cemeteries, monuments, and museums. Certain historical sites, parks, and recreational facilities are also included.

Source: Federal Transit Administration 2006

Notes:

* L_{eq} for the noisiest hour of transit-related activity during hours of noise sensitivity.

dBA = A-weighted decibel

L_{eq} = equivalent sound level

L_{dn} = day-night sound level

The noise impact criteria used by FTA and FRA are ambient-based; the increase in future noise (future noise levels with the ACE Extension compared to existing noise levels) is assessed rather than the noise caused by each passing train. It is important to note that the criteria do not specify a comparison of future ACE Extension noise with projections of future No Project noise. This is because comparison of a noise projection with an existing noise condition is more accurate than comparison of a projection with another noise projection. Because background noise is expected to increase by the time ACE Extension improvements generate noise, this approach of using existing noise conditions is conservative.

Figure 4.12-29 depicts the FTA noise impact criteria for human annoyance. Depending on the magnitude of the cumulative noise increases, FTA and FRA categorize impacts as follows.

- No impact
- Moderate impact—The change in cumulative noise level would be noticeable to most people, but may not be sufficient to generate strong, negative reactions
- Severe impact—A significant percentage of people would be highly annoyed by the project's noise

Although the curves in Figure 4.12-29 are defined in terms of the project noise exposure and the existing noise exposure, the increase in the cumulative noise—when project-generated noise is added to existing noise levels—is the basis for the criteria. To illustrate this point, Figure 4.12-30 shows the noise impact criteria for Category 1 and Category 2 land uses in terms of the allowable increase in the cumulative noise exposure. Because L_{dn} and L_{eq} are measures of total acoustic energy, any new noise source in a community will cause an increase, even if the new source level is lower than the existing level. As shown in Figure 4.12-30, the criterion for a moderate impact allows a noise exposure increase of 10 dB if the existing noise exposure is 42 dBA or less, but only a 1 dB increase when the existing noise exposure is 70 dBA.

As the existing level of ambient noise increases, the allowable level of transit noise increases, but the total amount that community noise exposure is allowed to increase is reduced. This approach accounts that the potential for a project noise exposure that is lower than the existing noise exposure to still cause an effect.

Train Vibration Impact Criteria

Table 4.12-6 summarizes FTA criteria for acceptable groundborne vibrations and presents vibration sensitivity in terms of the land use categories. These levels represent the maximum vibration level of an individual train passby. A vibration event occurs each time a train passes the building or property and causes discernible vibration. *Frequent events* are more than 70 vibration events per day, *occasional events* are 30 to 70 vibration events per day, and *infrequent events* are fewer than 30 vibration events per day. Groundborne vibration impacts from train operations inside vibration-sensitive buildings are defined by the vibration velocity level, expressed in terms of VdB, and the number of vibration events per day from the same kind of source. As shown in Table 4.12-7, these guidelines also provide impact criteria for special buildings that are very sensitive to groundborne vibrations, such as concert halls, recording studios, and theaters.

Tables 4.12-6 and 4.12-7 include separate FTA criteria for groundborne noise. Although the criteria are expressed in dBA, which emphasizes the more audible middle and high frequencies, the criteria are significantly lower than airborne noise criteria to account for the annoying low-frequency character of groundborne noise. Groundborne noise is a low-frequency rumbling sound inside buildings, caused by vibrations of floors, walls, and ceilings. Groundborne noise is generally not a problem for buildings near railroad tracks at or above grade, because the airborne noise from trains typically overshadows effects of groundborne noise. Groundborne noise becomes an issue in cases where airborne noise cannot be heard, such as for buildings near tunnels.

Table 4.12-6. Federal Transit Administration Groundborne Vibration and Groundborne Noise Impact Criteria

	Groundborne Vibration Impact Levels (VdB re 1 micro-inch /sec)			Groundborne Noise Impact Levels (dBA re 20 micro Pascals)		
Land Use Category	**Frequent Events**	**Occasional Events**	**Infrequent Events**	**Frequent Events**	**Occasional Events**	**Infrequent Events**
Category 1: Buildings where vibration would interfere with interior operations.	65 VdB[a]	65 VdB[a]	65 VdB[a]	N/A[b]	N/A[b]	N/A[b]
Category 2: Residences and buildings where people normally sleep.	72 VdB	75 VdB	80 VdB	35 dBA	38 dBA	43 dBA
Category 3: Institutional land uses with primarily daytime use.	75 VdB	78 VdB	83 VdB	40 dBA	43 dBA	48 dBA

Source: Federal Transit Administration 2006

[a] This criterion limit is based on levels that are acceptable for most moderately sensitive equipment such as optical microscopes. For equipment that is more sensitive, a detailed vibration analysis must be performed.

[b] Vibration-sensitive equipment is generally not sensitive to groundborne noise.

VdB = vibration decibel

dBA = A-weighted decibel

N/A = not applicable

Table 4.12-7. Federal Transit Administration Groundborne Vibration and Groundborne Noise Impact Criteria for Special Buildings

Type of Building or Room	Groundborne Vibration Impact Levels (VdB re 1 micro-inch/sec)		Groundborne Noise Impact Levels (dBA re 20 micro-Pascals)	
	Frequent Events	Occasional or Infrequent Events	Frequent Events	Occasional or Infrequent Events
Concert Halls	65 VdB	65 VdB	25 dBA	25 dBA
TV Studios	65 VdB	65 VdB	25 dBA	25 dBA
Recording Studios	65 VdB	65 VdB	25 dBA	25 dBA
Auditoriums	72 VdB	80 VdB	30 dBA	38 dBA
Theaters	72 VdB	80 VdB	35 dBA	43 dBA

Source: Federal Transit Administration 2006
VdB = vibration decibel
dBA = A-weighted decibel

One factor not incorporated in the criteria is existing vibration. In most cases, except near railroad tracks, the existing environment does not include a substantial number of perceptible groundborne vibration or noise events. However, rail projects sometimes use existing railroad tracks. The criteria presented in Tables 4.12-6 and 4.12-7 do not indicate how to account for existing vibration, a common situation for rail projects using existing rail ROWs. Representative scenarios for existing vibrations can be assessed using the following methods.

- **Infrequently used rail route:** Use the vibration criteria from Tables 4.12-6 and 4.12-7 when the existing rail traffic consists of four trains or fewer per day.
- **Moderately used rail route:** If the existing rail traffic consists of 5 to 12 trains per day with vibration that substantially exceeds the impact criteria, there would be no effect as long as the project vibration levels are at least 5 VdB less than the existing vibration. Vibration from existing trains can be estimated using the General Assessment procedures in Chapter 10 of the FTA guidelines.
- **Heavily used rail route:** If the existing traffic exceeds 12 trains per day and if the project would not substantially increase the number of vibration events (less than doubling the number of trains is usually considered not substantial), there would be no additional effect unless the project vibration, estimated using the procedures of Chapter 10 of the FTA guidelines, would be higher than the existing vibration. In locations where the new trains would be operating at higher speeds than the existing rail traffic, the trains would likely generate substantially higher levels of groundborne vibration. When the project would cause vibration more than 5 VdB greater than the existing source, the existing source can be ignored and the vibration criteria in Tables 4.12-6 and 4.12-7 can be applied to the project.
- **Moving existing tracks:** Another scenario where existing vibration can be substantial is a new rail line within an existing rail ROW that requires shifting the location of existing tracks. Where the track relocation would cause higher vibration levels at sensitive receptors, the projected vibration levels from both rail systems must be compared to the appropriate impact criterion to determine if there would be a new effect. If an effect is judged to have existed prior to moving the tracks, new effects would be assessed only if the relocation would result in an increase of more than 3 VdB in vibration level. Although the impact thresholds given in Tables 4.12-6 and

4.12-7 are based on experience with vibration from rail transit systems, the thresholds can be applied to freight train vibrations as well. However, locomotive and rail car vibration should be considered separately. Because locomotive vibration only lasts for a few seconds, the infrequent-event limit is appropriate, but for a typical line haul freight train where the rail car vibration lasts for several minutes, the frequent-event limits should be applied to the rail car vibration. Some judgment must be exercised to make sure that the approach is reasonable. For example, some spur rail lines carry very little rail traffic (sometimes only one train per week) or have short trains, in which case the infrequent-event limits are appropriate.

4.12.4.3 Phase I Improvements Impacts and Mitigation Measures

Impact NOI-1	Construction of Phase I improvements could expose sensitive receptors to substantial increases in noise levels.
Level of Impact	Potentially significant
Mitigation Measures	NOI-1.1: Implement a construction noise control plan
Level of Impact after Mitigation	Significant and unavoidable

Impact Characterization

Construction of Phase I improvements would include three basic activities: (1) site work, (2) rail work, and (3) structures work. Depending on the Phase I improvement selected, site work is expected to occur over periods of 4 to 19 months, rail work is expected to occur over periods of 4 to 36 months, and structures work is expected to occur over periods of 4 to 18 months. Generally, construction of a Phase I improvement could last anywhere from 8 to 42 months, depending on the improvement (refer to Table 2-6 in Chapter 2, *Description of Phase I Improvements*). Because most Phase I improvements are located on an active rail line, construction work could occur during the nighttime. The local noise ordinances for the cities and counties along the extension alignment generally limit construction noise to particular time periods during weekday, weekend, and holiday daytime hours. Nighttime construction work is generally prohibited, but some jurisdictions allow for a variance.

Table 4.12-8 summarizes the estimated construction noise levels and residential noise impact screening distances for each of the planned construction activities. The noise estimates are based on scenarios for the construction activities, using FTA methodology described in Section 4.12.4.1, *Methods for Analysis*, and FTA criteria described in Section 4.12.4.2. However, to be conservative, the screening distance estimates did not assume any topography or ground effects. The results of the analysis indicate that noise impacts would be limited to residences within 135 to 270 feet from a Phase I improvement construction site, depending on the activity. The potential for noise impacts would be greatest during structures work at locations where pile driving is required for bridge construction. Construction activities would be considered to have a potentially significant impact if they would generate noise exposure in excess of the FTA thresholds.

Table 4.12-8. Residential Noise Impact Assessment for Construction Activities

Construction Activity and Equipment	Noise Level at 50 feet (dBA)	Equipment Usage Factor (%)	8-Hour L_{eq} at 50 feet (dBA)		Approx. Noise Impact Distance (feet)
			Predicted Exposure	Daytime Criterion	
Site Work			**89**	**80**	**135**
Grader	85	53	82	--	--
Water Truck	84	44	80	--	--
D6 Dozer	85	61	83	--	--
D8 Dozer	85	45	82	--	--
Compactor	82	45	79	--	--
Dump Truck	84	23	78	--	--
Rail Work			**90**	**80**	**150**
Locomotive	88	25	82	--	--
D6 Dozer	85	38	81	--	--
Grader	85	38	81	--	--
Water Truck	84	38	80	--	--
Tamper	83	20	76	--	--
Aligner	85	20	78	--	--
Swinger	85	19	78	--	--
Welder	74	38	70	--	--
Flat Bed Truck	84	31	79	--	--
Pickup Truck	75	25	69	--	--
Sports Utility Vehicle	75	31	70	--	--
35 Ton Rough Terrain Crane	83	38	79	--	--
Flat Bed Tractor	84	13	75	--	--
Wheel Loader	80	28	74	--	--
Structures Work			**95**	**80**	**270**
Impact Pile Driver	101	20	94	--	--
Generator	82	90	82	--	--
75 Ton Mobile Crane	83	38	79	--	--
Water Truck	84	20	77	--	--
Flat Bed Truck	84	25	78	--	--
Pickup Truck	75	53	72	--	--
Concrete Mixer	85	13	76	--	--
Concrete Pump	82	18	75	--	--
Wheel Loader	80	20	73	--	--
Welder	74	31	69	--	--

L_{eq} = equivalent sound level
dBA = A-weighted decibel

Significance Conclusion and Mitigation Measures

Significance Prior to Mitigation

As shown in Table 4.12-8, the operation of certain construction equipment and construction activities could generate noise exposure in excess of FTA thresholds for residences within 135 to 270 feet from a Phase I improvement construction site, depending on the activity. The potential for noise impacts would be greatest during structures work at locations where pile driving is required for bridge construction. Nighttime construction near residential uses would have larger impacts than daytime construction and would result in a potentially significant impact.

Significance with Application of Mitigation

Mitigation Measure NOI-1.1 would require the preparation and implementation of a construction noise control plan to reduce the impacts of construction noise on nearby noise-sensitive receptors that could be exposed to noise in excess of FTA thresholds. Although the measures specified in Mitigation Measure NOI-1.1 would generally reduce the construction noise levels, the measures would not necessarily guarantee that noise-sensitive residential receptors would not be exposed to noise levels exceeding the 80-dBA limit during the day or the 70-dBA limit at night. Specifically, because Phase I improvements are located within or near an active railroad, it is probable that construction near some residential areas would have to be conducted at night to avoid disruption of freight and passenger rail operations and to complete construction on schedule. Furthermore, a temporary soundwall may be effective in certain locations, but in many cases the nature of the construction work makes use of such soundwalls infeasible.

Construction-related noise would be short term and would cease after the construction is completed. However, even with mitigation, the impact of temporary construction-related noise on nearby noise-sensitive receptors would remain a significant and unavoidable impact, in particular where heavy construction would occur immediately adjacent to residences and where construction would occur at night near residences.

Mitigation Measures

Mitigation Measure NOI-1.1 would apply to the construction of Phase I improvements for construction-period noise impacts.

Mitigation Measure NOI-1.1: Implement a construction noise control plan

A noise control plan that incorporates, at a minimum, the following best practices into the construction scope of work and specifications to reduce the impact of temporary construction-related noise on nearby noise-sensitive receptors will be prepared and implemented.

- Install temporary construction site sound barriers near noise sources.
- Use moveable sound barriers at the source of the construction activity.
- Avoid the use of impact pile drivers where possible near noise-sensitive areas or use quieter alternatives (e.g., drilled piles) where geological conditions permit.
- Locate stationary construction equipment as far as possible from noise-sensitive sites.
- Re-route construction-related truck traffic along roadways that will cause the least disturbance to residents.

- Use low-noise emission equipment.
- Implement noise-deadening measures for truck loading and operations.
- Line or cover storage bins, conveyors, and chutes with sound-deadening material.
- Use acoustic enclosures, shields, or shrouds for equipment and facilities.
- Use high-grade engine exhaust silencers and engine-casing sound insulation.
- Minimize the use of generators to power equipment.
- Limit use of public address systems.
- Grade surface irregularities on construction sites.
- Monitor and maintain equipment to meet noise limits.
- Establish an active community liaison program to keep residents informed about construction and to provide a procedure for addressing complaints.

Impact NOI-2	Increased passenger rail on the existing ACE route and new passenger rail on new routes with Phase I operations could result in severe noise impacts.
Level of Impact	Potentially significant
Mitigation Measures	NOI-2.1: Implement a phased program to reduce train noise along the ACE Extension as necessary to address noise increases over Federal Transit Administration's severe impact thresholds
Level of Impact after Mitigation	Significant and unavoidable

Impact Characterization

The noise impact assessment for Phase I operations evaluates two components.

1. Phase I improvements: Individual Phase I improvements (such as stations and tracks) were assessed for their potential to create noise impacts. In most cases, individual Phase I improvements by themselves do not result in noise impacts.
2. Phase I improvements plus new passenger service: With Phase I operations, new rail passenger service would be introduced between Lathrop and Ceres and an interim bus bridge service would be introduced between Ceres and Merced. Phase I operations would increase or introduce new passenger rail and bus service in the following segments.
    - Lathrop to Stockton: Because two trains would support Phase I operations between Ceres and Lathrop and would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, there would be up to four additional one-way service runs in this segment to account for the mid-day layovers.
    - Lathrop to Ceres: Phase I operations would consist of four westbound trains operating during the AM commute peak period towards Lathrop or San Jose, and four returning service trains operating during the PM peak commute period. Because two trains would support Phase I operations between Ceres and Lathrop, there would be up to four additional

one-way service runs to account for the trains returning to the origin station. Accordingly there would be up to 12 one-way trips in this segment.

- Ceres to Merced: Phase I operations with the interim bus bridge service would consists of four westbound buses operating during the AM commute peak period towards Ceres, and four returning service buses operating during the PM peak commute period. Because three buses would support Phase I operations between Ceres and Merced, there would be up to two additional one-way service runs to account for the buses returning the origin station. Accordingly, there would be 10 one-way trips in this segment.

For locations with only increased passenger rail service, the FTA increase in noise level criteria is used to assess the potential for noise impacts. At locations where new passenger rail service is introduced, the FTA project noise level criteria were used to assess the potential for noise impacts.

Table 4.12-9 provides an overview of operational noise impacts associated with Phase I improvements and increased or new passenger rail service. Tables 4.12-12 and 4.12-13 in Section 4.12.5.1, *Phase I Impact Assessment Tables,* provide detailed information regarding impacts in each segment, including locations, existing noise levels, noise levels with Phase I operations or noise level increases with Phase I operations, impact thresholds, and numbers of severe and moderate impacts. Figures 4.12-31 through 4.12-33 depict the locations of noise impacts.

Table 4.12-9. Overview of Operational Noise Impacts for Phase I Improvements

	Noise Impacts	
Phase I Improvement	**Moderate**	**Severe**
Lathrop to Stockton[a]	**0**	**0**
Lathrop to Ceres[a]	**101**	**3**
North Lathrop Station	0[b]	0[b]
Existing Lathrop/Manteca Station	0[b]	0[b]
Relocated Lathrop/Manteca Station alternative	0[b]	0[b]
Ceres Extension Alignment	101	3
Downtown Manteca Station	0[b]	0[b]
Ripon Station	0[b]	0[b]
Modesto Station	0[b]	0[b]
Ceres Station	0[b]	0[b]
Ceres Layover Facility, variant 1 or 2	16	0
Ceres to Merced[a]	**16**	**0**
Turlock Bus Stop	0	0
Livingston Bus Stop	0	0
Atwater Bus Stop	0[b]	0[b]
Merced Bus Stop	0	0

Notes:
[a] Impacts in these segments are related to the increase in passenger train or bus traffic.
[b] There are no sensitive receptors within the screening distance; therefore, no impacts are anticipated.

All severe impacts and the majority of the moderate impacts for Phase I operations are at locations within 0.25 mile of grade crossings where train horns would be sounded. Most of these impacts are at the areas where there are Phase I improvements that introduce new passenger service along the extension alignment.

Lathrop to Stockton

As shown in Table 4.12-12, there would be no moderate or severe noise impacts on residential or institutional receptors along this segment related to Phase I operations.

Lathrop to Ceres

There would be no noise impacts associated with the **Relocated Lathrop/Manteca Station** alternative, **Existing Lathrop/Manteca Station**, **North Lathrop Station, Downtown Manteca Station, Ripon Station, Modesto Station,** and **Ceres Station** because there are no sensitive receptors within the 250-foot screening distance for stations in the FTA guidance manual.

As shown in Table 4.12-13, there would be moderate and severe noise impacts on residential receptors. There would be no noise impacts on institutional receptors. These noise impacts are due to the **Ceres Extension Alignment**, **Ceres Layover Facility, variants 1** (alternative) **and 2,** and the new passenger rail service in this segment. Noise impacts would occur at the following locations.

- **SR 120 to West Yosemite Avenue (Lathrop):** Moderate noise impact is projected at three residences along the southbound side of the alignment between SR 120 and West Yosemite Avenue. These impacts are related to horn noise from trains approaching the grade crossings.
- **South Airport Way to West Louise Avenue (Manteca):** Moderate noise impact is projected at 25 residences, and severe noise impacts are projected at 2 residences along the northbound side of the alignment between South Airport Way and West Louise Avenue. These impacts are related to horn noise from trains approaching the grade crossings.
- **West Louise Avenue to North Union Road (Manteca):** Moderate noise impacts are projected at 20 single-family residences, and a severe noise impact is projected at one residence along the northbound side of the alignment between West Louise Avenue and North Union Road. These impacts are related to horn noise from trains approaching the nearby grade crossing.
- **West Louise Avenue to North Union Road (Manteca):** Moderate noise impacts are projected at 40 single-family residences along the southbound side of the alignment between West Louise Avenue and North Union Road. These impacts are related to horn noise from trains approaching the nearby grade crossing.
- **North Union Road to West Yosemite Avenue (Manteca):** Moderate noise impacts are projected at 11 single-family and multifamily residences along the northbound side of the alignment between North Union Road and West Yosemite Avenue. These impacts are related to the proximity of the alignment and horn noise from trains approaching the nearby grade crossing.
- **North Union Road to West Yosemite Avenue (Manteca):** Moderate noise impacts are projected at two single-family residences along the southbound side of the alignment between North Union Road and West Yosemite Avenue. These impacts are related to the proximity of the alignment and horn noise from trains approaching the nearby grade crossing.

- **Pine Street to Michel Road SB (Ceres):** There would be 16 moderate noise impacts due to the **Ceres Layover Facility,** variant 1 or 2, between Industrial Way and Don Pedro Road on the southbound side of the tracks. The impacts would be due to the proximity of the facility to the residences and the time of day of the activities at the facility.

Ceres to Merced

There would be no noise impacts due to the interim Ceres to Merced bus bridge with Phase I operations because these bus operations are not at a level that would cause any change in noise level on the roadways in this segment. There would be no impacts at the **Turlock**, **Livingston, Atwater,** and **Merced Bus Stations** because there are no sensitive receptors within the 250-foot screening distance for stations in the FTA guidance manual.

Significance Conclusion and Mitigation Measures

Significance Prior to Mitigation

Phase I operations would result in a total of 117 moderate and 3 severe noise impacts because of the combination of implementing Phase I improvements and new passenger rail service. All the severe impacts would be at locations where train horns are sounded at grade crossings. Per the significance criteria, the moderate impacts are considered adverse but less than significant. Phase I operations would cause an increase in ambient noise levels that exceed the FTA severe impact criteria at 3 locations, which is considered a significant impact.

Significance with Application of Mitigation

There are a number of different methods to reduce the noise impacts of cumulative trains.

- **Wayside horns**: Train horn noise can be reduced through use of a wayside horn, which is an automatically triggered horn located at the at-grade crossing itself that sounds upon approach of a train. Because the horns are located at the crossing itself, the area of effect is smaller than the area of effect of actual train horns; but sensitive receptors in the immediate vicinity of the at-grade crossing could still be affected by horn noise. Wayside horns are included as one option in Mitigation Measure NOI-2.1.
- **Building sound insulation**: Another method of reducing the impact of train horn noise is building sound insulation. Sound insulation of residences and institutional buildings improve the outdoor-to-indoor noise reduction. Although this approach has no effect on noise in exterior areas, it is a feasible method for sites where noise barriers are not feasible or desirable, for buildings where indoor sensitivity is of most concern, or where the horn noise dominates the noise environment. Improvements in building sound insulation often can be achieved by adding an extra layer of glazing to the windows and by sealing any holes in exterior surfaces that act as sound leaks. Building sound insulation is included as one option in Mitigation Measure NOI-2.1.
- **Quiet zones**: FRA has established a process by which a local jurisdiction can designate a specific area containing at-grade crossings as a “quiet zone,” provided that certain supplemental safety measures (SSMs) are used in place of the locomotive horn to provide an equivalent level of safety at the at-grade crossing (Federal Transit Administration 2006).
  - The SSMs commonly used for quiet zones include four-quadrant gates, gates with medians or channelization devices, one-way street with gates, and street closure. By adopting an

approved SSM at each of the affected at-grade crossings, a quiet zone at least 0.5 mile long can be established.

  - Only with local implementation of the quiet zone can ACE, freight operators, and other tenant railroad operations be relieved of the requirement to sound their horns when crossing at-grade crossings. However, following implementation of a quiet zone, if any unsafe conditions were present at the time of train passage (such as a vehicle going around the gates or pedestrians in the crossing), train operators would still have the discretion to sound train horns. Although the quiet zone regulations are silent on the issue of liability, local jurisdictions may perceive that the implementation of a quiet zone includes acceptance of potential liability in the event of related accidents. It is possible that jurisdictions may not wish to risk the potential liability associated with implementing a quiet zone and decline to do so. In such a case, ACE, freight operators, and other rail operators would continue to use train horns as a safety device in compliance with FRA requirements.
  - Where quiet zones are implemented and accepted by local jurisdictions, noise levels related to Phase I operations may be reduced to a less-than-significant level at some but not necessarily all affected locations.
  - Quiet zones are included as one option in Mitigation Measure NOI-2.1.

- **Noise Barriers**: Noise barriers are not considered a feasible mitigation to address horn noise because train horns are elevated; thus, noise barriers would have to be as high as or higher than the locomotives themselves to be effective at shielding train horn noise. Along the extension corridor, such high walls likely would not be acceptable to local communities. Noise barriers cannot be placed at the at-grade crossing, which also reduces their effectiveness for horn noise reduction. While lower noise barriers would help to reduce engine and wheel noise for adjacent receptors, lower noise barriers are not considered cost effective because they would be only partially effective at addressing train noise and would not address train horn noise, which is the dominant concern.
- **Grade Separation**: While grade separations are a technically feasible way to avoid the need for train horn use, it is a highly expensive mitigation strategy. SJRRC has supported prior grade separation efforts. SJRRC supports future efforts at grade separation where acceptable to local communities and where local, state, and federal funding can be obtained to fund these improvements. Grade separations can cost approximately $50 million to $100 million per crossing (and sometime more), grade separating all existing at-grade crossings in areas of significant noise impacts would be cost-prohibitive. The funding available to this project now and in the future is not sufficient to fund grade separations as mitigation. Thus, SJRRC cannot commit to a comprehensive program of grade separations at this time. However, as described in Mitigation Measure NOI-2.1, SJRRC will work with local jurisdictions, transportation funding agencies, and state and federal agencies to support grade separations over time as funding becomes available.

While the recommended mitigation (Mitigation Measure NOI-2.1) would help to reduce noise, where feasible to implement, it will take time to implement it and it may not be feasible to reduce all noise impacts to a less-than-significant level; thus, this impact is considered significant and unavoidable.

The secondary environmental impacts of Mitigation Measure NOI-2.1 would vary according to which mitigation options were chosen. Wayside horns and building sound insulation would have limited to no secondary environmental impacts. Quiet zone improvements would require additional construction, but the likely environmental impacts of such construction are limited given the limited footprint of four-quadrant gates, active warning systems, medians, and street work. In general, construction impacts for quiet zone improvements would be similar to the impacts disclosed for improvements construction, would occur in previously developed and disturbed areas, and would be temporary in nature. The applicable mitigation described for construction impacts in this EIR, where relevant, would also be applied to quiet zone improvements.

The design and feasibility of a select number of future grade separations are unknown and unstudied at this time; thus, the specific environmental impacts cannot be identified. While grade separations are statutorily exempt from CEQA review, a grade separation may nevertheless have substantial environmental impacts depending on its design and location, and construction can be highly disruptive. Therefore, as a conservative assumption, the secondary environmental impacts of grade separations are assumed to be significant and unavoidable.

SJRRC will work with other parties when implementing this measure to apply the relevant construction mitigation measures identified in this EIR to the implementation of future noise mitigation improvements. SJRRC is only responsible for that portion of the cumulative increases caused by the improvements. Other sources of cumulative increases, including freight services and non-rail sources near the ACE Extension, would also bear responsibility for cumulative noise increases.

Mitigation Measures

Mitigation Measure NOI-2.1 would apply to the Phase I improvements for operational-period noise impacts.

Mitigation Measure NOI-2.1: Implement a phased program to reduce train noise along the ACE Extension as necessary to address noise increases over Federal Transit Administration's severe impact thresholds

SJRRC will coordinate with other rail operators, local jurisdictions, transportation funding agencies, and state and federal agencies to implement incremental noise reduction measures at the locations of severe cumulative noise impacts as funding becomes available, where measures are acceptable to the local community, and where measures are determined feasible. This mitigation applies to the locations where the ACE Extension would substantially contribute to cumulative noise impacts. Where the ACE Extension does not contribute to cumulative noise impacts, SJRRC is not responsible to participate in mitigation, even if the cumulative noise impacts are severe.

SJRRC will work with local, state, and federal partners to establish priorities for noise reduction measures to be implemented as funding becomes available. SJRRC will also work with other willing rail operators to seek additional funding from other parties that contribute to cumulative train noise levels.

This program is expected to be implemented over a period of decades. Improvements will be phased as needed to address changes in rail service over time and the associated rail noise over thresholds. If funding participation by other parties is limited, SJRRC may not be able to fund all potential noise mitigation on its own, particularly in cases in which the mitigation to address cumulative noise impacts far exceeds SJRRC's share of the impact.

Wayside Horns and Residential Building Sound Insulation

SJRRC, in cooperation with local jurisdictions and UPRR, will evaluate the potential to reduce noise impacts through the installation of wayside horns and building sound insulation improvements at residences projected to have a sound increase greater than the FTA moderate impact criteria. Building sound insulation methods may include extra wall insulation, window glazing, and sealing of exterior surfaces.

During final design, a technical study will be completed to evaluate the effectiveness of reducing impacts to below the FTA moderate impact threshold through these methods. If the study determines it is feasible to reduce the impact to below the threshold at an affected sensitive noise receptor, then no additional mitigation at that location will be required. Building sound insulation measures will only be installed to the extent necessary to meet the impact threshold at the receptor location and will only be installed if building owners are willing to accept such measures.

Quiet Zones

The lead agency for a quiet zone designation is the local jurisdiction (typically the city or county) responsible for traffic control and law enforcement on the roads at the at-grade crossings.

SJRRC, in cooperation with affected local jurisdictions, will implement a phased program considering the potential establishment of quiet zones along the ACE Extension at all locations where train noise is predicted to exceed FTA severe impact thresholds. SJRRC will work closely with local jurisdictions to prepare the engineering studies and coordination agreements to design, construct, and enforce potential quiet zones.

Options for establishing quiet zones could include implementation of the following FRA pre-approved SSMs.

- **Four-quadrant gate system**. This measure involves the installation of at least one gate for each direction of traffic to fully block vehicles from entering the crossing.
- **Gates with medians or channelization devices**. This measure keeps traffic in the proper travel lanes as it approaches the crossing, thus denying the driver the option of circumventing the gates by travelling in the opposite lane.
- **One-way street with gates**. This measure consists of one-way streets with gates installed so that all approaching travel lanes are completely blocked. This option may not be feasible or acceptable to local jurisdictions at all locations.
- **Road closure**. This measure consists of closing the road to through travel at the at-grade crossing. This option may not be feasible or acceptable to local jurisdictions at all locations.

In addition to these pre-approved SSMs, FRA also identifies a range of other measures that may be used to establish a quiet zone. These measures could be modified SSMs or non-engineering measures that might involve law enforcement or public awareness programs. Such alternative safety measures must be approved by FRA based on the prerequisite that they provide a level of safety equivalent to the sounding of train horns.

Wayside horns can also be utilized as part of a quiet zone. While not avoiding the sounding of a horn, wayside horns affect a smaller area than train-mounted horns. Wayside horns can be used when quad gates, medians, channelization, one-way streets, and/or road closures are not adequate to avoid the use of a horn or not acceptable to the local jurisdiction.

The lead agency for a quiet zone designation is the local public authority, which is the only authority that can implement a quiet zone. SJRRC or the other rail operators cannot, on their own, designate the quiet zone. However, only with the implementation of the quiet zone can SJRRC, other tenant railroads, and freight operators be relieved of the requirement to sound their horns when crossing at-grade crossings. Thus, if a local city does not accept the quiet zone, then even if the required SSMs are present, SJRRC, freight and other rail operators would continue to use train horns as a safety device in compliance with FRA requirements.

Grade Separations

Grade separations are not being considered for the mitigation of severe noise impacts due to the relatively higher cost and the existence of other feasible mitigation measures.

Noise Barriers

For noise barriers to be effective, these barriers are constructed to intercept the line of sight between a noise source and receptors. Noise barriers can be constructed from concrete, brick or masonry blocks, metals, wood, rubber, or transparent panels. The height of each noise barrier would depend on engineering design on the conditions at each specific location, but typical noise barriers are 8 to 10 feet in height.

Recommended Noise Reduction Methods for the ACE Extension (Phase I Operations)

The following is the recommendation for methods to reduce severe noise impacts along the ACE Extension for Phase I operations.

- Manteca—Create a quiet zone between South Airport Way and North Union Road, which would mitigate all severe impacts in this section.

Impact NOI-3	Construction of Phase I improvements could expose sensitive receptors to substantial increases in groundborne vibration levels.
Level of Impact	Potentially significant
Mitigation Measures	NOI-3.1: Implement a construction vibration control plan
Level of Impact after Mitigation	Less than significant

Impact Characterization

Construction of Phase I improvements can be expected to generate vibration levels from 25 feet away as high as 94 VdB due to compactors during site work, 87 VdB due to bulldozers during rail work, and 104 VdB due to impact pile drivers during structures work. Except for pile drivers, it is unlikely that such equipment would be used close enough to sensitive structures to have any damage effects. For pile driving, it is anticipated that the potential for damage effects will be limited to structures located at distances in the range of 30 to 75 feet from the operations, depending on the building category.

In terms of vibration annoyance effects or interference with the use of sensitive equipment, the potential extent of vibration impact from pile driving is expected to be even greater than for damage effects. Table 4.12-10 provides the approximate distances within which receptors could experience construction-related vibration annoyance effects based on FTA methodology. The results of the analysis indicate that vibration impacts would extend to distances of 230 to 630 feet from pile driving operations, 100 to 240 feet for compacting, and less than 130 feet for bulldozers, depending on the vibration sensitivity of the land use category. Construction activities would be considered to have a potentially significant impact if they would generate vibration levels in excess of the FTA thresholds.

Table 4.12-10. Approximate Screening Distances for Vibration Annoyance Effects from Pile Driving

Land Use Category[a]	Vibration Criterion Level (VdB)	Approximate Vibration Impact Distance (feet)
Category 1 (Sensitive Buildings)	65	630
Category 2 (Residential Buildings)	72	290
Category 3 (Institutional Buildings)	75	230

Notes:
[a] See Table 4.12-6 for a description of land use categories.
VdB = vibration velocity

Significance Conclusion and Mitigation Measures

Significance Prior to Mitigation

As shown in Table 4.12-10, construction activities would be considered to have a significant impact if they would generate vibration in excess of FTA thresholds. It is expected that groundborne vibration from construction activities would cause only intermittent localized disturbance along the rail corridor. Although processes such as earthmoving with bulldozers or the use of vibratory compaction rollers can create annoying vibration, there should be only isolated cases where it is necessary to use this type of equipment in close proximity to residential buildings. It is possible that construction activities involving pile drivers occurring at the edge of or slightly outside of the current ROW could result in vibration damage, and damage from construction vibration would be a potentially significant impact.

Significance with Application of Mitigation

Mitigation Measure NOI-3.1 would require the preparation and implementation of a construction vibration control plan to reduce the impacts of construction vibration on nearby vibration-sensitive land uses that could be exposed to vibration levels in excess of FTA thresholds. In the event building damage occurs due to construction, repairs would be made or compensation would be provided for. With implementation of Mitigation Measure NOI-3.1, impacts resulting from construction vibration structural damage would be less than significant.

Mitigation Measures

Mitigation Measure NOI-3.1 would apply to the construction of Phase I improvements for construction-period vibration impacts.

Mitigation Measure NOI-3.1: Implement construction vibration control plan

A vibration control plan that incorporates, at a minimum, the following best practices into the construction scope of work and specifications to reduce the impact of temporary construction-related vibration on nearby vibration-sensitive land uses will be prepared and implemented.

- Avoid the use of impact pile drivers where possible near vibration-sensitive areas or use alternative construction methods (e.g., drilled piles) where geological conditions permit.
- Avoid vibratory compacting/rolling in close proximity to structures.
- Require vibration monitoring during vibration-intensive activities.

In the event building damage occurs due to construction, repairs would be made or compensation would be provided for

Impact NOI-4	Increased passenger rail on the existing ACE route and new passenger rail on new routes with Phase I operations could result in vibration impacts.
Level of Impact	Less than significant

Impact Characterization and Significance Conclusion

The vibration impact assessment for Phase I operations evaluates two components.

1. Phase I improvements: Individual Phase I improvements (such as stations and tracks) were assessed for their potential to create vibration impacts. There are no vibration impacts associated with individual Phase I improvements.
2. Phase I improvements plus new passenger service: With Phase I operations, new rail passenger service would be introduced between Lathrop and Ceres and an interim bus bridge service would be introduced between Ceres and Merced. Phase I operations would increase or introduce new passenger rail and bus service in the following segment:
   - Lathrop to Stockton: Because two trains would support Phase I operations between Ceres and Lathrop and would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, there would be up to four additional one-way service runs in this segment to account for the mid-day layovers.
   - Lathrop to Ceres: Phase I operations would consist of four westbound trains operating during the AM commute peak period towards Lathrop or San Jose, and four returning service trains operating during the PM peak commute period. Because two trains would support Phase I operations between Ceres and Lathrop, there would be up to four additional one-way service runs to account for the trains returning to the origin station. Accordingly, there would be up to 12 one-way trips in this segment.
   - Ceres to Merced: Phase I operations with the interim bus bridge service would consists of four westbound buses operating during the AM commute peak period towards Ceres, and

four returning service buses operating during the PM peak commute period. Because three buses would support Phase I operations between Ceres and Merced, there would be up to two additional one-way service runs to account for the buses returning the origin station. Accordingly, there would be 10 one-way trips in this segment.

For locations with existing freight train traffic, FTA vibration criteria for locations with existing vibration was used. There is existing freight train traffic on both the Oakland and Fresno Subdivisions, approximately 18 and 4 daily freight trains, respectively, where Phase I operations would occur.[5]

Because of the high volume of existing freight train traffic in the area where Phase I operations would occur, the very small increase in passenger trains with Phase I operations, and because the new passenger rail service would not result in vibration levels greater than existing levels, no vibration impacts are projected at locations with existing train operations. Additionally, there would be no vibration impacts from bus service between Ceres and Merced. Rubber-tired vehicles operating on roadways do not generate vibration levels that would exceed the impact criterion. Thus, Phase I operations would not result in vibration impacts and impacts would be less than significant.

4.12.4.4 Phase II Improvements Impacts and Mitigation Measures

Impact NOI-5	Construction of Phase II improvements could expose sensitive receptors to substantial increases in noise levels.
Level of Impact	Potentially significant
Mitigation Measures	NOI-1.1: Implement a construction noise control plan
Level of Impact after Mitigation	Significant and unavoidable

Impact Characterization

Construction of Phase II improvements would include three basic activities: (1) site work, (2) rail work, and (3) structures work. Based on construction timeframes for similar Phase I improvements, Phase II improvement site work is expected to occur over periods of 4 to 19 months, rail work is expected to occur over periods of 4 to 36 months, and structures work is expected to occur over periods of 4 to 18 months. Generally, construction for similar Phase I improvements could last anywhere from 8 to 42 months, and this timeframe is applicable to Phase II improvements. Because most Phase II improvements are located on an active rail line, construction work could occur during the nighttime. The local noise ordinances for the cities and counties along the extension alignment generally limit construction noise to particular time periods during weekday, weekend, and holiday daytime hours. Nighttime construction work is generally prohibited, but some jurisdictions allow for a variance.

Table 4.12-8 as presented in Impact NOI-1 summarizes the estimated construction noise levels and residential noise impact screening distances for each of the planned construction activities. The noise estimates are based on scenarios for the construction activities, using FTA methodology

[5] The *2013 California State Rail Plan* (Caltrans 2013) presents estimates of freight train volumes.

described in Section 4.12.4.1, and FTA criteria described in Section 4.12.4.2. However, to be conservative, the screening distance estimates did not assume any topography or ground effects. The results of the analysis indicate that noise impacts would be limited to residences within 135 to 270 feet from a Phase II improvement construction site, depending on the activity. The potential for noise impacts would be greatest during structures work at locations where pile driving is required for bridge construction. Construction activities would be considered to have a potentially significant impact if they would generate noise exposure in excess of the FTA thresholds.

Significance Conclusion and Mitigation Measures

Significance Prior to Mitigation

As shown in Table 4.12-8 in Impact NOI-1, the operation of certain construction equipment and construction activities could generate noise exposure in excess of FTA thresholds for residences within 135 to 270 feet from a Phase II improvement construction site, depending on the activity. The potential for noise impacts would be greatest during structures work at locations where pile driving is required for bridge construction. Nighttime construction near residential uses would have larger impacts than daytime construction would have and would result in a potentially significant impact.

Significance with Application of Mitigation

Mitigation Measure NOI-1.1 would require the preparation and implementation of a construction noise control plan to reduce the impacts of construction noise on nearby noise-sensitive receptors that could be exposed to noise in excess of FTA thresholds. Although the measures specified in Mitigation Measure NOI-1.1 would generally reduce the construction noise levels, the measures would not necessarily guarantee that noise-sensitive residential receptors would not be exposed to noise levels exceeding the 80 dBA limit during the day or the 70 dBA limit at night. Specifically, because Phase II improvements are located within or near an active railroad, it is probable that construction near some residential areas would have to be conducted at night to avoid disruption of freight and passenger rail operations and to complete construction on schedule. Furthermore, a temporary soundwall may be effective in certain locations, but in many cases the nature of the construction work makes use of such soundwalls infeasible.

Construction-related noise would be short term and would cease after the construction is completed. However, even with mitigation, the impact of temporary construction-related noise on nearby noise-sensitive receptors would remain a significant and unavoidable impact, in particular where heavy construction would occur immediately adjacent to residences and where construction would occur at night near residences.

Mitigation Measures

Mitigation Measure NOI-1.1 would apply to the construction of Phase II improvements for construction-period noise impacts. The description of Mitigation Measure NOI-1.1 is presented in Impact NOI-1.

Mitigation Measure NOI-1.1: Implement a construction noise control plan

Impact NOI-6	Increased passenger rail on the existing ACE route and new passenger rail on new routes with Phase II operations could result in severe noise impacts.
Level of Impact	Potentially less than significant
Mitigation Measures	If significant impacts identified in subsequent project-level detailed analysis, then the following mitigation measure may be necessary: NOI-2.1: Implement a phased program to reduce train noise along the ACE Extension as necessary to address noise increases over Federal Transit Administration's severe impact thresholds
Level of Impact after Mitigation	Less than significant

A general noise assessment was performed for the Phase II improvements, and thus existing noise levels were not measured. Existing noise measurements would be conducted for the subsequent project-level analysis for Phase II improvements. As such, the conclusions in this impact analysis should be considered preliminary.

Impact Characterization

The noise impact assessment for Phase II operations evaluates two components.

1. Phase II improvements: Individual Phase II improvements (such as stations and tracks) were assessed for their potential to create noise impacts. In most cases, individual Phase II improvements by themselves do not result in noise impacts.
2. Phase II improvements plus new passenger service: With Phase II operations, new rail passenger service would be introduced between Ceres and Merced (building from the extension of rail passenger service introduced between Lathrop and Ceres in Phase I). Phase II operations would increase or introduce new passenger rail service in the following segments.
    - Lathrop to Stockton: Because three trains would support Phase II operations between Merced and Lathrop and would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, there would be up to six additional one-way service runs in this segment to account for the mid-day layovers.
    - Lathrop to Merced (Lathrop to Ceres and Ceres to Merced): Phase II operations would consist of four westbound trains operating during the AM commute peak period towards Lathrop or San Jose, and four returning service trains operating during the PM peak commute period. Because three trains would support Phase II operations between Merced and Lathrop, there would be up to two additional one-way service runs to account for the trains returning to the origin station. Accordingly, there would be up to 10 one-way trips in this segment.

For locations with only increased passenger rail service, the FTA increase in noise level criteria is used to assess the potential for noise impacts. At locations where new passenger rail service is introduced, the FTA project noise level criteria were used to assess the potential for noise impacts.

Table 4.12-11 provides an overview of noise impacts associated with Phase I improvements and increased or new passenger rail service. Tables 4.12-14 and 4.12-15 in Section 4.12.5.2, *Phase II Impact Assessment Tables,* provide detailed information regarding impacts in each segment, including locations, existing noise levels, noise levels with Phase II operations or noise level increases with Phase II operations, impact thresholds, and numbers of severe and moderate impacts. Figures 4.12-34 and 4.12-35 depicts the locations of noise impacts.

All severe impacts and the majority of the moderate impacts for Phase II operations are at locations within 0.25 mile of grade crossings where train horns would be sounded. Most of these impacts are in the areas where there are Phase II improvements that introduce new passenger service along the extension alignment.

Table 4.12-11. Overview of Operational Noise Impacts for Phase II Improvements

	Noise Impacts	
Phase II Improvements	**Moderate**	**Severe**
Lathrop to Stockton[a]	**0**	**0**
Lathrop to Ceres[a]	**44**	**0**
Ceres to Merced[a]	**80[c]**	**0[c]**
Merced Extension Alignment	80	0
Turlock Station	0[b]	0[b]
Livingston Station	0[b]	0[b]
Atwater Station	0[b]	0[b]
Merced Layover Facility	0	0
Merced Station	0[b]	0[b]

Notes:
[a] Impacts in these segments are related to the increase in passenger train traffic.
[b] There are no sensitive receptors within the screening distance; therefore, no impacts are anticipated.
[c] Because the Union Pacific Railroad train volume is the same from Lathrop through Merced, the same existing noise levels were used to estimate the number of impacts in this segment.

Lathrop to Stockton

As shown in Table 4.12-14, there would be no noise impacts on residential or institutional receptors along this segment related to Phase II operations.

Lathrop to Ceres

As shown in Table 4.12-15, there would be 44 moderate noise impacts and no severe noise impacts on residential receptors and no noise impacts on institutional receptors along this segment related to Phase II operations.

Ceres to Merced

There would be no noise impacts associated with the **Turlock, Livingston, Atwater,** and **Merced Stations** because there are no sensitive receptors within the 250-foot screening distance for stations in the FTA guidance manual.

There would be 80 moderate noise impacts and no severe noise impacts on residential receptors and no noise impacts on institutional receptors along this segment related to Phase II operations.

Significance Conclusion and Mitigation Measures

Phase II operations would result in 124 moderate noise impacts because of the new passenger rail service. There would be no severe noise impacts. All moderate impacts would be at locations where train horns are sounded at grade crossings. Phase II operations would not cause an increase in ambient noise levels that exceed the FTA severe impact criteria, which is considered a less than significant impact. As noted above, a general noise assessment was performed for the Phase II improvements, and thus existing noise levels were not measured. Existing noise measurements would be conducted for the subsequent project-level analysis for Phase II improvements. It is possible that the conclusion in this document may change and that the project-level analysis could indicate noise impacts exceeding the FTA severe impact criteria. If that is identified, then as shown in Impact NOI-2 for Phase I operations, a significant impact may be identified, in which case Mitigation Measure NOI-2.1 would also apply to locations with a significant impact due to Phase II operations.

No significant impacts are identified for Phase II operations and thus no mitigation is required.

Impact NOI-7	Construction of Phase II improvements could expose sensitive receptors to substantial increases in groundborne vibration levels.
Level of Impact	Potentially significant
Mitigation Measures	NOI-3.1: Implement a construction vibration control plan
Level of Impact after Mitigation	Less than significant

Impact Characterization

Based on similar Phase I improvements, construction of Phase II improvements can be expected to generate vibration levels from 25 feet away as high as 94 VdB due to compactors during site work, 87 VdB due to bulldozers during rail work, and 104 VdB due to impact pile drivers during structures work. Except for pile drivers, it is unlikely that such equipment would be used close enough to sensitive structures to have any damage effects. For pile driving, it is anticipated that the potential for damage effects will be limited to structures located at distances in the range of 30 to 75 feet from the operations, depending on the building category.

In terms of vibration annoyance effects or interference with the use of sensitive equipment, the potential extent of vibration impact from pile driving is expected to be even greater than for damage effects. Table 4.12-10 as presented in Impact NOI-3 provides the approximate distances within which receptors could experience construction-related vibration annoyance effects based on FTA methodology. The results of the analysis indicate that vibration impacts would extend to distances of 230 to 630 feet from pile driving operations, 100 to 240 feet for compacting, and less than 130 feet for bulldozers, depending on the vibration sensitivity of the land use category. Construction activities would be considered to have a potentially significant impact if they would generate vibration levels in excess of the FTA thresholds.

Significance Conclusion and Mitigation Measures

Significance Prior to Mitigation

As shown in Table 4.12-10 in Impact NOI-3, construction activities would be considered to have a significant impact if they would generate vibration in excess of FTA thresholds. It is expected that groundborne vibration from construction activities would cause only intermittent localized disturbance along the rail corridor. Although processes such as earthmoving with bulldozers or the use of vibratory compaction rollers can create annoying vibration, there should be only isolated cases where it is necessary to use this type of equipment in close proximity to residential buildings. It is possible that construction activities involving pile drivers occurring at the edge of or slightly outside of the current ROW could result in vibration damage, and damage from construction vibration would be a potentially significant impact.

Significance with Application of Mitigation

Mitigation Measure NOI-3.1 would require the preparation and implementation of a construction vibration control plan to reduce the impacts of construction vibration on nearby vibration-sensitive land uses that could be exposed to vibration levels in excess of FTA thresholds. In the event building damage occurs due to construction, repairs would be made or compensation would be provided for. With implementation of Mitigation Measure NOI-3.1, impacts resulting from construction vibration structural damage would be less than significant.

Mitigation Measures

Mitigation Measure NOI-3.1 would apply to the construction of Phase II improvements for construction-period vibration impacts. The description of Mitigation Measure NOI-3.1 is presented in Impact NOI-3.

Mitigation Measure NOI-3.1: Implement construction vibration control plan

Impact NOI-8	Increased passenger rail on the existing ACE route and new passenger rail on new routes with Phase II operations could result in vibration impacts.
Level of Impact	Less than significant

Impact Characterization

The vibration impact assessment for Phase II operations evaluates two components.

1. Phase II improvements: Individual Phase II improvements (such as stations and tracks) were assessed for their potential to create vibration impacts. There are no vibration impacts associated with individual Phase II improvements.
2. Phase II improvements plus new passenger service: With Phase II operations, new rail passenger service would be introduced between Ceres and Merced (building from the extension of rail passenger service introduced between Lathrop and Ceres in Phase I). Phase II operations would increase or introduce new passenger rail service in the following segments.

- Lathrop to Stockton: Because three trains would support Phase II operations between Merced and Lathrop and two of the trains would travel from Lathrop to Stockton to layover at the ACE Maintenance Facility mid-day, there would be up to four additional one-way service runs in this segment to account for the mid-day layovers.
- Lathrop to Merced (Lathrop to Ceres and Ceres to Merced): Phase II operations would consist of four westbound trains operating during the AM commute peak period towards Lathrop or San Jose, and four returning service trains operating during the PM peak commute period. Because three trains would support Phase I operations between Merced and Lathrop, there would be up to two additional one-way service runs to account for the trains returning to the origin station. Accordingly, there would be up to 10 one-way trips in this segment.

For locations with existing freight train traffic, FTA vibration criteria for locations with existing vibration was used. There is existing freight train traffic on both the Oakland and Fresno Subdivisions, approximately 18 and 4 daily freight trains, respectively, where Phase II operations would occur.[6]

Because of the high volume of existing freight train traffic in the area where Phase II operations would occur, the very small increase in passenger trains with Phase II operations, and because the new passenger rail service would not result in vibration levels greater than existing levels, no vibration impacts are projected at locations with existing train operations. Thus, Phase II operations would not result in vibration impacts and impacts would be less than significant.

4.12.5 Noise Impact Assessment Tables

4.12.5.1 Phase I Impact Assessment Tables

Table 4.12-12. Lathrop to Stockton—Residential and Institutional Noise Impact Assessment for Phase I Operations

Location	Side of Track	Dist to Near Track (ft.)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Phase I Noise Level Increase (dBA)				
					Phase I Incr.	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Residential									
McKinley Avenue to Brookfield Avenue	NB	No noise-sensitive receptors							
McKinley Avenue to Brookfield Avenue	SB	237	50	59	1	2	4	0	0
Roth Road to East Wyman Road	NB	152	70	70	0	0	2	0	0
Roth Road to East Wyman Road	SB	No noise-sensitive receptors							

[6] The *2013 California State Rail Plan* (California Department of Transportation 2013) presents estimates of freight train volumes.

Location	Side of Track	Dist to Near Track (ft.)	Max. Train Speed (mph)	Existing Noise Level (dBA)	Phase I Noise Level Increase (dBA)				
					Phase I Incr.	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
East Wyman Road to French Camp Road	NB	159	50	75	0	0	2	0	0
East Wyman Road to French Camp Road	SB	146	50	73	0	0	2	0	0
California Street to East Charter Way	NB	No noise-sensitive receptors							
California Street to East Charter Way	SB	87	50	59	2	2	5	0	0
East Charter Way to SR 4	NB	431	50	64	0	2	4	0	0
East Charter Way to SR 4	SB	449	50	59	0	2	5	0	0
SR 4 to Stockton Station	NB	437	50	66	0	1	3	0	0
SR 4 to Stockton Station	SB	166	50	66	1	1	3	0	0
Institutional									
Haven Peace Inc.	SB	185	50	73	0	2	5	0	0
Gurdwara Sahib Sikh Temple	SB	184	50	66	0	3	7	0	0

NB = northbound
SB = southbound
ft. = feet
mph = miles per hour
dBA = A-weighted decibels
Incr. = increase
Mod. = moderate
Sev. = severe
FTA = Federal Transit Administration
SR = State Route

Table 4.12-13. Lathrop to Ceres—Residential and Institutional Noise Impact Assessment for Phase I Operations

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase I Noise Level (dBA)				
						FTA Criteria		Type and # of Impacts	
					Phase I	Mod.	Sev.	Mod.	Sev.
Residential									
SR 120 to W Yosemite Ave	NB	176	60	64	59	60	66	0	0
SR 120 to W Yosemite Ave	SB	97	60	64	63	60	66	3	0
South Airport Way to West Louise Avenue	NB	57	50	64	66	60	66	25	2
South Airport Way to West Louise Avenue	SB	190	50	64	58	60	66	0	0
West Louise Avenue to North Union Road	NB	56	50	59	66	57	63	20	1
West Louise Avenue to North Union Road	SB	126	50	59	61	57	63	40	0
North Union Road to West Yosemite Avenue	NB	44	50	73	67	65	72	11	0
North Union Road to West Yosemite Avenue	SB	95	50	73	65	65	72	2	0
West Yosemite Avenue to South Main Street	NB	No noise-sensitive receptors							
West Yosemite Avenue to South Main Street	SB	246	50	73	55	65	72	0	0
South Main Street to South Powers Avenue	NB	243	50	69	57	63	69	0	0
South Main Street to South Powers Avenue	SB	No noise-sensitive receptors							
South Powers Avenue to SR 120	NB	206	50	69	58	63	69	0	0
South Powers Avenue to SR 120	SB	No noise-sensitive receptors							
SR 120 to East Woodward Avenue	NB	No noise-sensitive receptors							
SR 120 to East Woodward Avenue	SB	188	50	62	52	59	64	0	0

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase I Noise Level (dBA)				
					Phase I	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Austin Road to South Olive Avenue	NB	239	70	72	51	65	71	0	0
Austin Road to South Olive Avenue	SB	351	70	76	54	65	74	0	0
South Olive Avenue to Jack Tone Road	NB	273	70	61	50	58	64	0	0
South Olive Avenue to Jack Tone Road	SB	302	70	61	50	58	64	0	0
Jack Tone Road to Fulton Avenue	NB	No noise-sensitive receptors							
Jack Tone Road to Fulton Avenue	SB	481	50	59	39	62	68	0	0
Fulton Avenue to Main Street	NB	214	50	66	51	62	67	0	0
Fulton Avenue to Main Street	SB	181	50	66	52	62	67	0	0
Main Street to Stanislaus River	NB	294	50	66	49	62	67	0	0
Main Street to Stanislaus River	SB	No noise-sensitive receptors							
Hammet Road to Toomes Road	NB	343	50	66	48	61	67	0	0
Hammet Road to Toomes Road	SB	No noise-sensitive receptors							
Toomes Road to Kiernan Avenue	NB	361	50	64	41	65	70	0	0
Toomes Road to Kiernan Avenue	SB	199	50	66	53	61	67	0	0
Kiernan Avenue to Bangs Avenue	NB	341	50	70	50	65	70	0	0
Kiernan Avenue to Bangs Avenue	SB	98	50	70	64	65	70	0	0
Bangs Avenue to Murphy Road	NB	139	50	66	60	61	67	0	0
Bangs Avenue to Murphy Road	SB	259	50	66	50	61	67	0	0
Murphy Road to Beckwith Road	NB	380	50	70	40	69	74	0	0
Murphy Road to Beckwith Road	SB	416	50	70	52	65	70	0	0
Beckwith Road to Conant Avenue	NB	340	50	65	48	60	66	0	0

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase I Noise Level (dBA)				
					Phase I	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Beckwith Road to Conant Avenue	SB	212	50	66	51	61	67	0	0
Conant Avenue to West Briggsmore Avenue	NB	413	50	65	47	60	66	0	0
Conant Avenue to West Briggsmore Avenue	SB	228	50	64	44	65	70	0	0
West Briggsmore Avenue to Princeton Avenue	NB	459	50	57	46	56	62	0	0
West Briggsmore Avenue to Princeton Avenue	SB	No noise-sensitive receptors							
Princeton Avenue to Kansas Avenue	NB	139	50	62	58	59	64	0	0
Princeton Avenue to Kansas Avenue	SB	No noise-sensitive receptors							
Kansas Avenue to K Street	NB	312	50	70	53	65	70	0	0
Kansas Avenue to K Street	SB	No noise-sensitive receptors							
K Street to River Road	NB	305	50	68	55	63	68	0	0
K Street to River Road	SB	292	50	68	53	63	68	0	0
River Road to East Hatch Road	NB	172	50	68	62	63	68	0	0
River Road to East Hatch Road	SB	154	50	66	60	62	67	0	0
East Hatch Road to East Whitmore Avenue	NB	247	50	63	56	60	65	0	0
East Hatch Road to East Whitmore Avenue	SB	137	50	66	60	62	67	0	0
East Whitmore Avenue to Pine Street	NB	324	50	63	54	60	65	0	0
East Whitmore Avenue to Pine Street	SB	150	50	66	60	62	67	0	0
Pine Street to Mitchell Road	NB	251	50	63	58	60	65	0	0

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase I Noise Level (dBA)				
					Phase I	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Pine Street to Mitchell Road	SB	76	50	66	66	62	67	16	0
Mitchel Road to Faith Home Road	NB	405	50	66	54	62	67	0	0
Mitchel Road to Faith Home Road	SB	167	50	66	61	62	67	0	0
Institutional									
Valley Charter High School	NB	139	50	63	47	64	70	0	0
Modesto Junior College	SB	228	50	64	44	65	70	0	0
Humphreys College	NB	380	50	70	40	69	74	0	0
San Joaquin Valley College	NB	361	50	64	41	65	70	0	0
Ripon Cemetery	NB	283	50	71	42	70	75	0	0
Ripon Christian Schools	SB	412	50	71	40	70	75	0	0
Zion United Reformed Church	SB	481	50	59	39	62	68	0	0
Freewill Baptist Church	NB	163	50	82	55	70	80	0	0
Manteca Gospel Assembly	NB	198	50	82	51	70	80	0	0
Freedom Christian Center	NB	358	50	82	43	70	75	0	0
Libreria Catolica Unidos Por Cristo y Maria	SB	145	50	63	57	65	70	0	0
St Stanislaus Catholic Church	SB	319	50	63	47	65	70	0	0
Redeemer Modesto	NB	32	50	63	63	65	70	0	0
The Universal Church	SB	492	50	63	47	65	70	0	0
Ceres Memorial Park	SB	117	50	71	54	70	75	0	0
Valley Christian Center	NB	317	50	58	47	62	67	0	0
First Missionary Baptist Church	SB	303	50	71	43	70	75	0	0
Iglesia Santuario De Jesucristo	NB	385	50	58	46	62	67	0	0

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase I Noise Level (dBA)				
					Phase I	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Mar Gewargis Assyrian Church of the East	NB	312	50	69	42	68	73	0	0
Gallo Center for the Arts	NB	699	50	63	37	65	70	0	0
Bendan Theater	NB	353	50	63	46	65	70	0	0
The House Downtown	NB	1094	50	63	35	65	70	0	0
La Luz Del Mundo	SB	757	50	63	38	65	70	0	0
St Paul Missionary Baptist Church	SB	708	50	63	37	65	70	0	0
Revival Center	SB	523	50	63	40	65	70	0	0
Victory In Praise Church of Modesto	SB	159	50	63	55	65	70	0	0
Los Verdaderos Pentecostales	SB	562	50	63	38	65	70	0	0
Bible Way Tabernacle	SB	1267	50	63	31	65	70	0	0

NB = northbound
SB = southbound
ft. = feet
mph = miles per hour
dBA = A-weighted decibels
Mod. = moderate
Sev. = severe
FTA = Federal Transit Administration

4.12.5.2 Phase II Impact Assessment Tables

Table 4.12-14. Lathrop to Stockton—Residential and Institutional Noise Impact Assessment for Phase II Operations

Location	Side of Track	Near Track Dist (ft.)	Train Speed (mph)	Existing Noise (dBA)	Phase II Noise Level Increase (dBA)				
					Phase II Incr.	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Residential									
McKinley Avenue to Brookfield Avenue	NB	No noise-sensitive receptors							
McKinley Avenue to Brookfield Avenue	SB	237	50	59	1	2	4	0	0
Roth Road to East Wyman Road	NB	152	70	70	0	0	2	0	0
Roth Road to East Wyman Road	SB	No noise-sensitive receptors							
East Wyman Road to French Camp Road	NB	159	50	75	0	0	2	0	0
East Wyman Road to French Camp Road	SB	146	50	73	0	0	2	0	0
California Street to East Charter Way	NB	No noise-sensitive receptors							
California Street to East Charter Way	SB	87	50	59	1	2	5	0	0
East Charter Way to SR 4	NB	431	50	64	0	2	4	0	0
East Charter Way to SR 4	SB	449	50	59	0	2	5	0	0
SR 4 to Stockton Station	NB	437	50	66	0	1	3	0	0
SR 4 to Stockton Station	SB	166	50	66	1	1	3	0	0
Institutional									
Haven Peace Inc.	SB	185	50	73	0	2	5	0	0
Gurdwara Sahib Sikh Temple	SB	184	50	66	0	3	7	0	0

NB = northbound
SB = southbound
ft. = feet
mph = miles per hour
dBA = A-weighted decibels
Mod. = moderate
Sev. = severe
FTA = Federal Transit Administration

Table 4.12-15. Lathrop to Ceres—Residential and Institutional Noise Impact Assessment for Phase II Operations

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase II Noise Levels (dBA)				
					Phase II	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Residential									
SR 120 to W Yosemite Ave	NB	176	60	64	58	60	66	0	0
SR 120 to W Yosemite Ave	SB	97	60	64	62	60	66	2	0
South Airport Way to West Louise Avenue	NB	57	50	64	65	60	66	18	0
South Airport Way to West Louise Avenue	SB	190	50	64	57	60	71	0	0
West Louise Avenue to North Union Road	NB	56	50	59	65	57	63	14	0
West Louise Avenue to North Union Road	SB	126	50	59	60	57	63	0	0
North Union Road to West Yosemite Avenue	NB	44	50	73	66	65	72	10	0
North Union Road to West Yosemite Avenue	SB	95	50	73	65	65	72	0	0
West Yosemite Avenue to South Main Street	NB	No noise-sensitive receptors							
West Yosemite Avenue to South Main Street	SB	246	50	73	54	65	72	0	0
South Main Street to South Powers Avenue	NB	243	50	69	56	63	69	0	0
South Main Street to South Powers Avenue	SB	No noise-sensitive receptors							
South Powers Avenue to SR 120	NB	206	50	69	57	63	69	0	0
South Powers Avenue to SR 120	SB	No noise-sensitive receptors							
SR 120 to East Woodward Avenue	NB	No noise-sensitive receptors							
SR 120 to East Woodward Avenue	SB	188	50	62	46	59	64	0	0

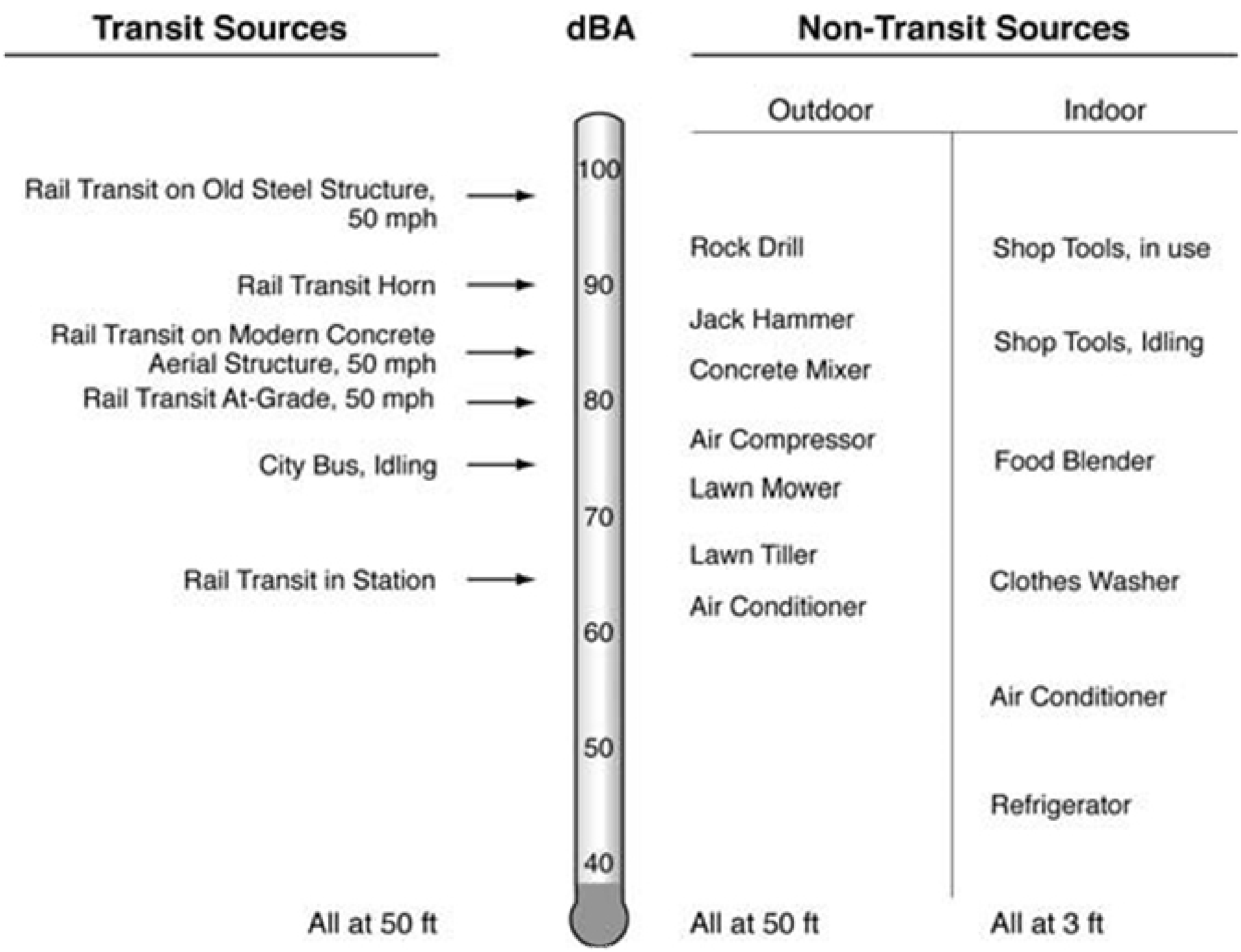
Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase II Noise Levels (dBA)				
					Phase II	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Austin Road to South Olive Avenue	NB	239	70	72	46	65	76	0	0
Austin Road to South Olive Avenue	SB	351	70	76	53	65	79	0	0
South Olive Avenue to Jack Tone Road	NB	273	70	61	45	58	69	0	0
South Olive Avenue to Jack Tone Road	SB	302	70	61	44	58	69	0	0
Jack Tone Road to Fulton Avenue	NB	No noise-sensitive receptors							
Jack Tone Road to Fulton Avenue	SB	481	50	59	38	62	68	0	0
Fulton Avenue to Main Street	NB	214	50	66	45	62	67	0	0
Fulton Avenue to Main Street	SB	181	50	66	46	62	67	0	0
Main Street to Stanislaus River	NB	294	50	66	43	62	72	0	0
Main Street to Stanislaus River	SB	No noise-sensitive receptors							
Hammet Road to Toomes Road	NB	343	50	66	42	61	67	0	0
Hammet Road to Toomes Road	SB	No noise-sensitive receptors							
Toomes Road to Kiernan Avenue	NB	361	50	64	40	65	70	0	0
Toomes Road to Kiernan Avenue	SB	199	50	66	52	61	67	0	0
Kiernan Avenue to Bangs Avenue	NB	341	50	70	49	65	70	0	0
Kiernan Avenue to Bangs Avenue	SB	98	50	70	64	65	70	0	0
Bangs Avenue to Murphy Road	NB	139	50	66	59	61	72	0	0
Bangs Avenue to Murphy Road	SB	259	50	66	44	61	67	0	0
Murphy Road to Beckwith Road	NB	380	50	70	40	69	74	0	0
Murphy Road to Beckwith Road	SB	416	50	70	52	65	70	0	0
Beckwith Road to Conant Avenue	NB	340	50	65	42	60	66	0	0

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase II Noise Levels (dBA)				
					Phase II	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Beckwith Road to Conant Avenue	SB	212	50	66	45	61	72	0	0
Conant Avenue to West Briggsmore Avenue	NB	413	50	65	41	60	71	0	0
Conant Avenue to West Briggsmore Avenue	SB	228	50	64	43	65	70	0	0
West Briggsmore Avenue to Princeton Avenue	NB	459	50	57	40	56	67	0	0
West Briggsmore Avenue to Princeton Avenue	SB	No noise-sensitive receptors							
Princeton Avenue to Kansas Avenue	NB	139	50	62	57	59	69	0	0
Princeton Avenue to Kansas Avenue	SB	No noise-sensitive receptors							
Kansas Avenue to K Street	NB	312	50	70	52	65	70	0	0
Kansas Avenue to K Street	SB	No noise-sensitive receptors							
K Street to River Road	NB	305	50	68	53	63	68	0	0
K Street to River Road	SB	292	50	68	51	63	68	0	0
River Road to East Hatch Road	NB	172	50	68	59	63	68	0	0
River Road to East Hatch Road	SB	154	50	66	56	62	67	0	0
East Hatch Road to East Whitmore Avenue	NB	247	50	63	50	60	65	0	0
East Hatch Road to East Whitmore Avenue	SB	137	50	66	55	62	67	0	0
East Whitmore Avenue to Pine Street	NB	324	50	63	48	60	65	0	0
East Whitmore Avenue to Pine Street	SB	150	50	66	54	62	67	0	0

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase II Noise Levels (dBA)				
					Phase II	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
Institutional									
Valley Charter High School	NB	139	50	63	47	64	70	0	0
Modesto Junior College	SB	228	50	64	43	65	70	0	0
Humphreys College	NB	380	50	70	40	69	74	0	0
San Joaquin Valley College	NB	361	50	64	40	65	70	0	0
Ripon Cemetery	NB	283	50	71	42	70	75	0	0
Ripon Christian Schools	SB	412	50	71	39	70	75	0	0
Zion United Reformed Church	SB	481	50	59	38	62	68	0	0
Freewill Baptist Church	NB	163	50	82	54	70	80	0	0
Manteca Gospel Assembly	NB	198	50	82	50	70	80	0	0
Freedom Christian Center	NB	358	50	82	43	70	75	0	0
Libreria Catolica Unidos Por Cristo y Maria	SB	145	50	63	57	65	70	0	0
St Stanislaus Catholic Church	SB	319	50	63	47	65	70	0	0
Redeemer Modesto	NB	32	50	63	63	65	70	0	0
The Universal Church	SB	492	50	63	47	65	70	0	0
Ceres Memorial Park	SB	117	50	71	54	70	75	0	0
Valley Christian Center	NB	317	50	58	47	62	67	0	0
First Missionary Baptist Church	SB	303	50	71	43	70	75	0	0
Iglesia Santuario De Jesucristo	NB	385	50	58	46	62	67	0	0
Mar Gewargis Assyrian Church of the East	NB	312	50	69	42	68	73	0	0
Gallo Center for the Arts	NB	699	50	63	37	65	70	0	0
Bendan Theater	NB	353	50	63	46	65	70	0	0
The House Downtown	NB	1094	50	63	35	65	70	0	0

Location	Side of Track	Dist. to Track (ft.)	Max. Train Speed (mph)	Exist. Noise Level (dBA)	Phase II Noise Levels (dBA)				
					Phase II	FTA Criteria		Type and # of Impacts	
						Mod.	Sev.	Mod.	Sev.
La Luz Del Mundo	SB	757	50	63	38	65	70	0	0
St Paul Missionary Baptist Church	SB	708	50	63	37	65	70	0	0
Revival Center	SB	523	50	63	40	65	70	0	0
Victory In Praise Church of Modesto	SB	159	50	63	55	65	70	0	0
Los Verdaderos Pentecostales	SB	562	50	63	38	65	70	0	0
Bible Way Tabernacle	SB	1267	50	63	31	65	70	0	0

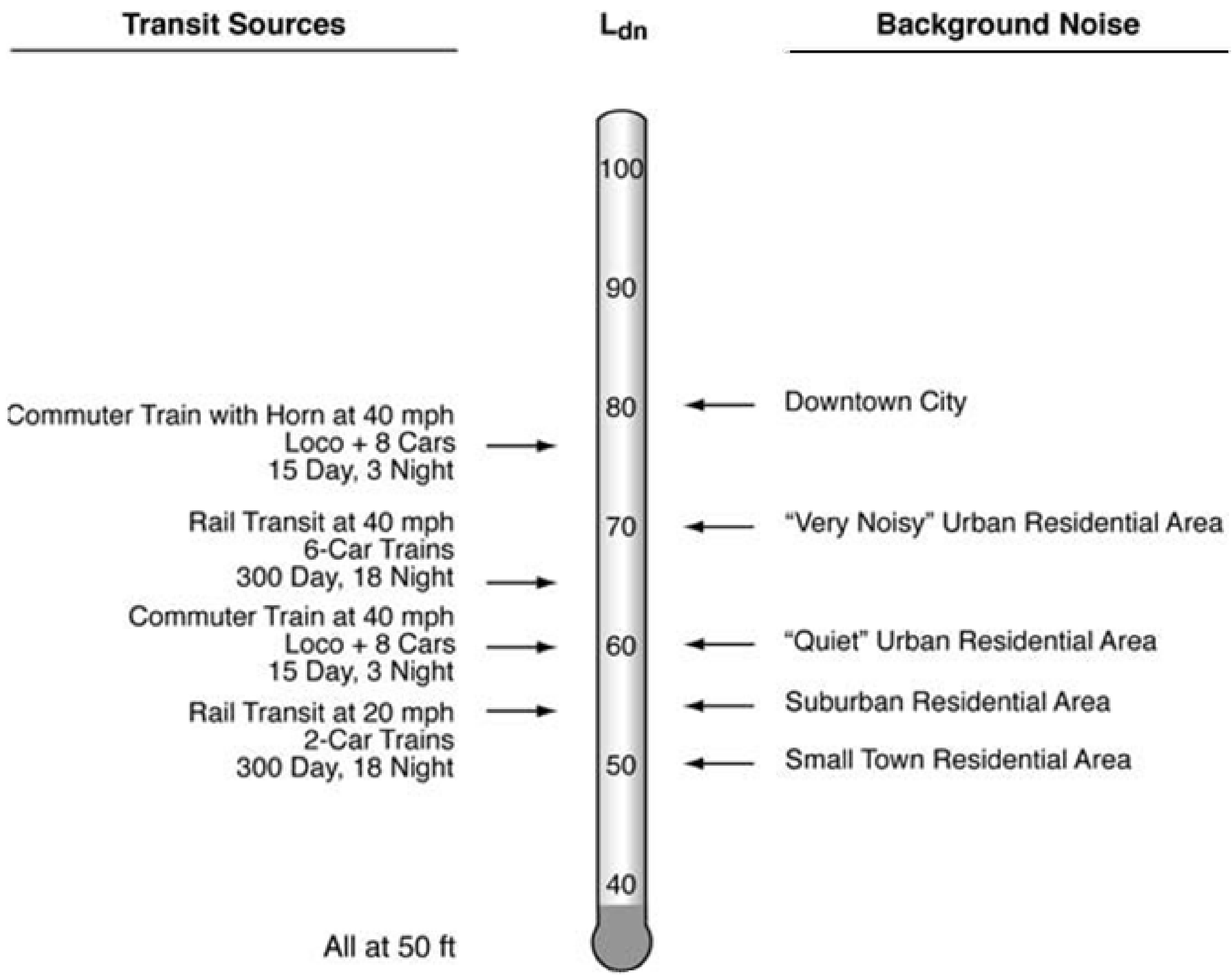
NB = northbound
SB = southbound
ft. = feet
mph = miles per hour
dBA = A-weighted decibels
Mod. = moderate
Sev. = severe
FTA = Federal Transit Administration



(Source: Federal Transit Administration 2006)

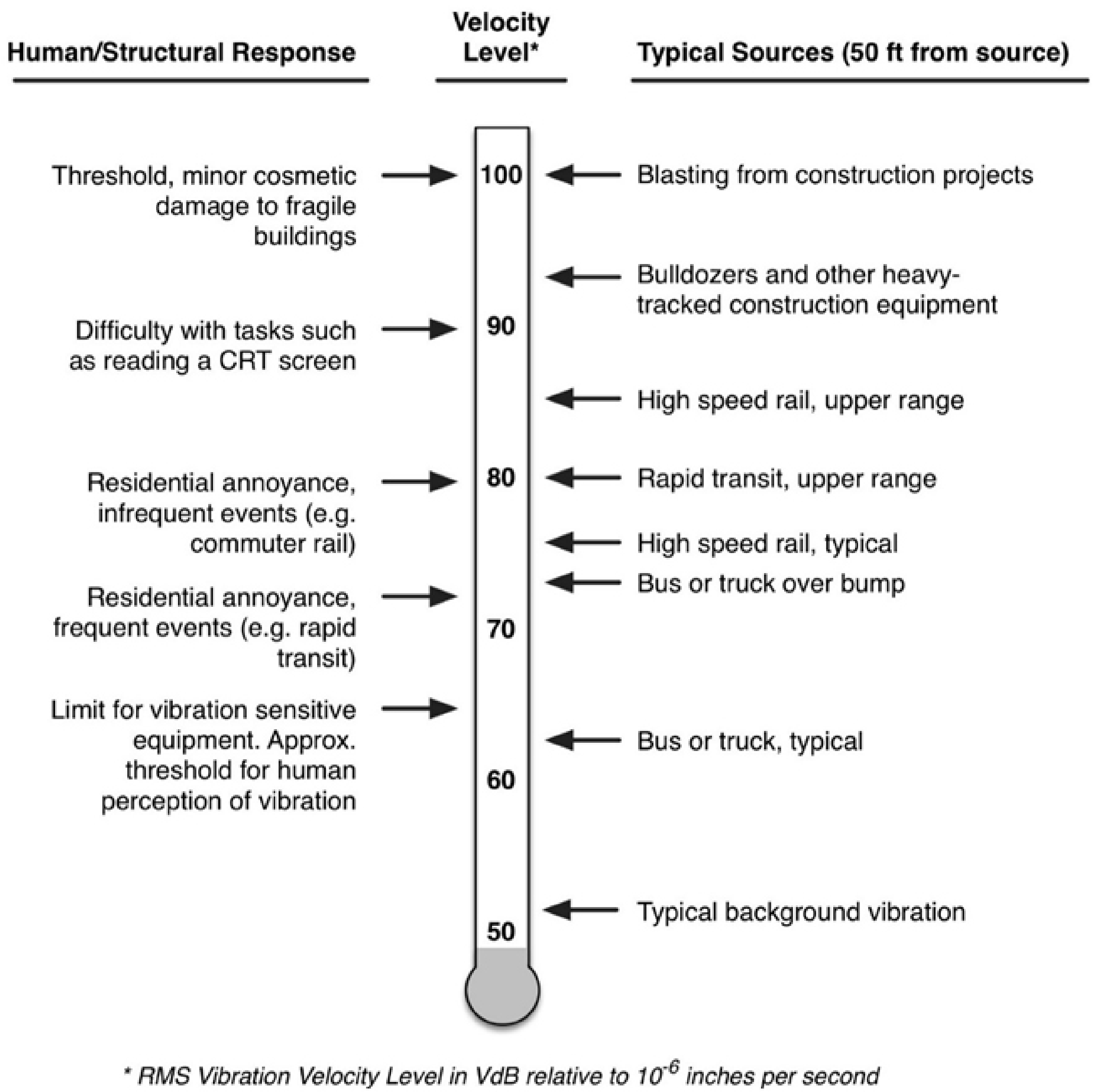
ALTAMONT CORRIDOR EXPRESS

Figure 4.12-1
Typical A-Weighted Sound Levels
ACE*forward*



(Source: Federal Transit Administration 2006)

Figure 4.12-2
Typical Ldn Noise Exposure Levels
ACE*forward*



(Source: Federal Transit Administration 2006)

Figure 4.12-3
Typical Levels of Ground-borne Vibration
ACE*forward*

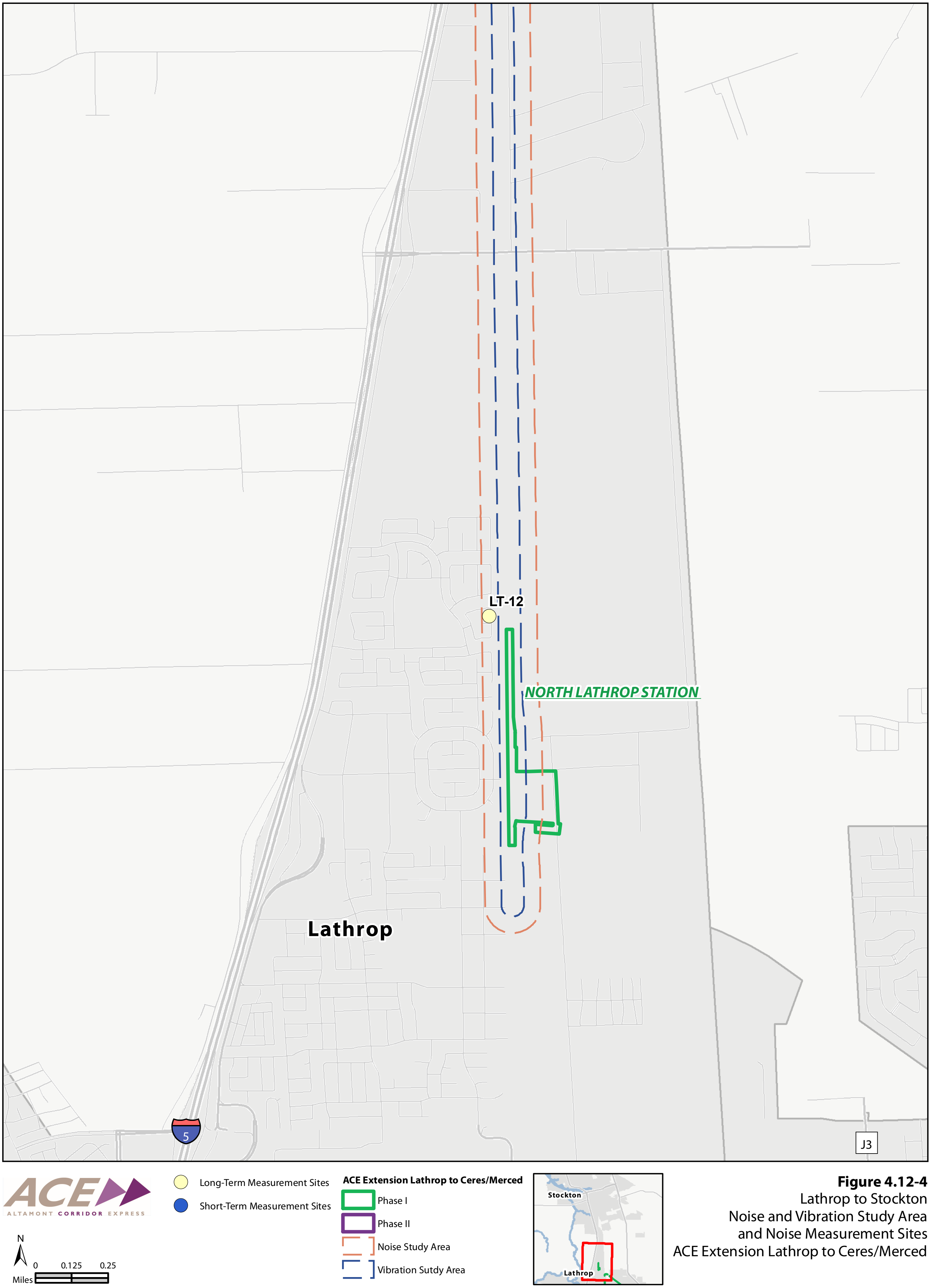


Figure 4.12-4
Lathrop to Stockton
Noise and Vibration Study Area
and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

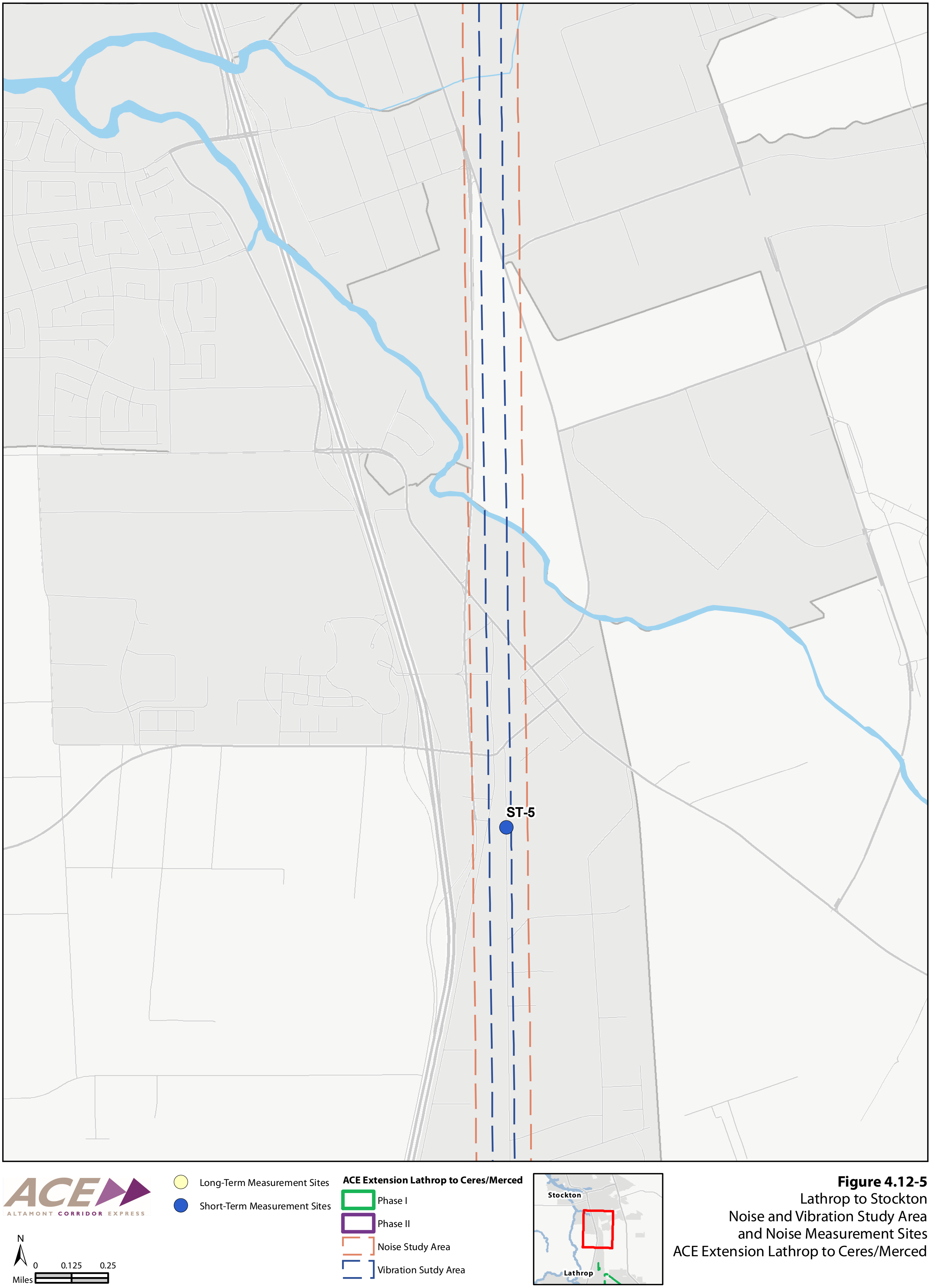
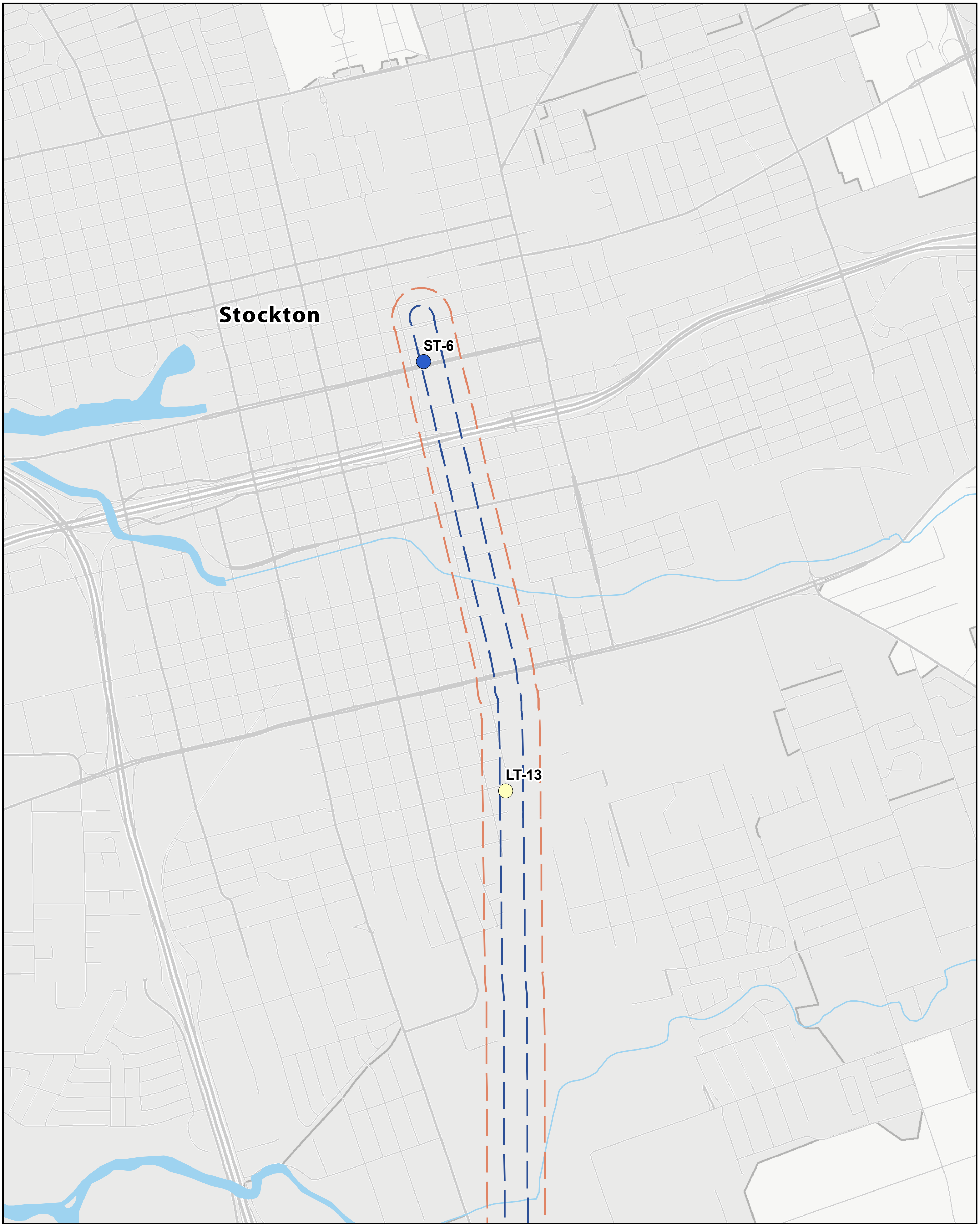
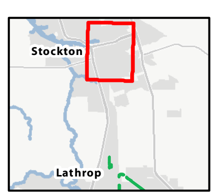


Figure 4.12-5
Lathrop to Stockton
Noise and Vibration Study Area
and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



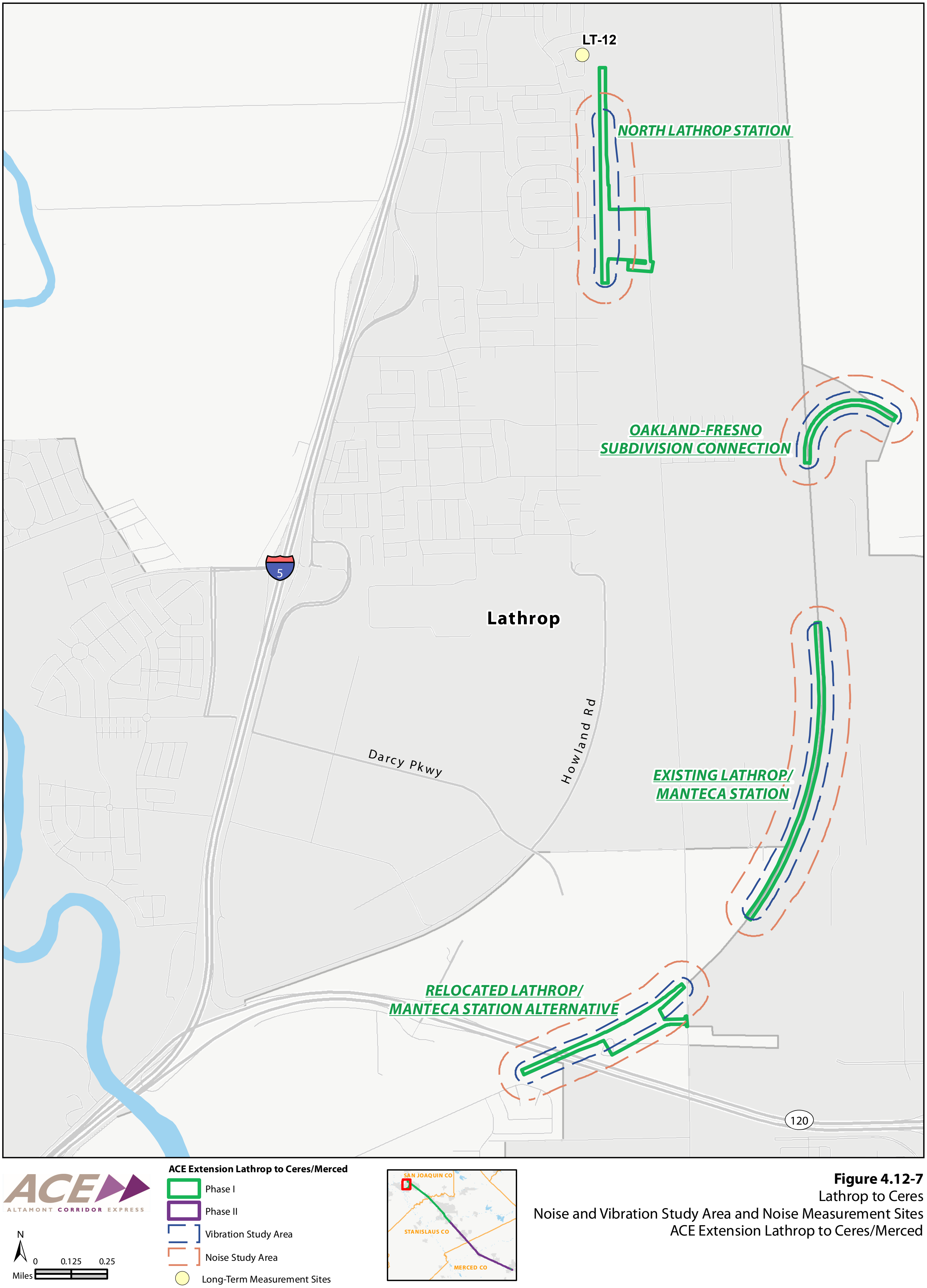
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced
Phase I
Phase II
Noise Study Area
Vibration Sutdy Area



N
0 0.125 0.25
Miles

Figure 4.12-6
Lathrop to Stockton
Noise and Vibration Study Area
and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



ACE ALTAMONT CORRIDOR EXPRESS

Figure 4.12-7
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

Figure 4.12-8
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

ACE ALTAMONT CORRIDOR EXPRESS

N

0 0.25 0.5
Miles

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced
Phase I
Phase II
Vibration Study Area
Noise Study Area

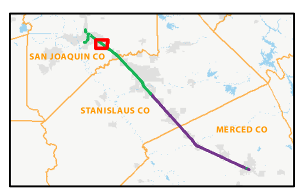
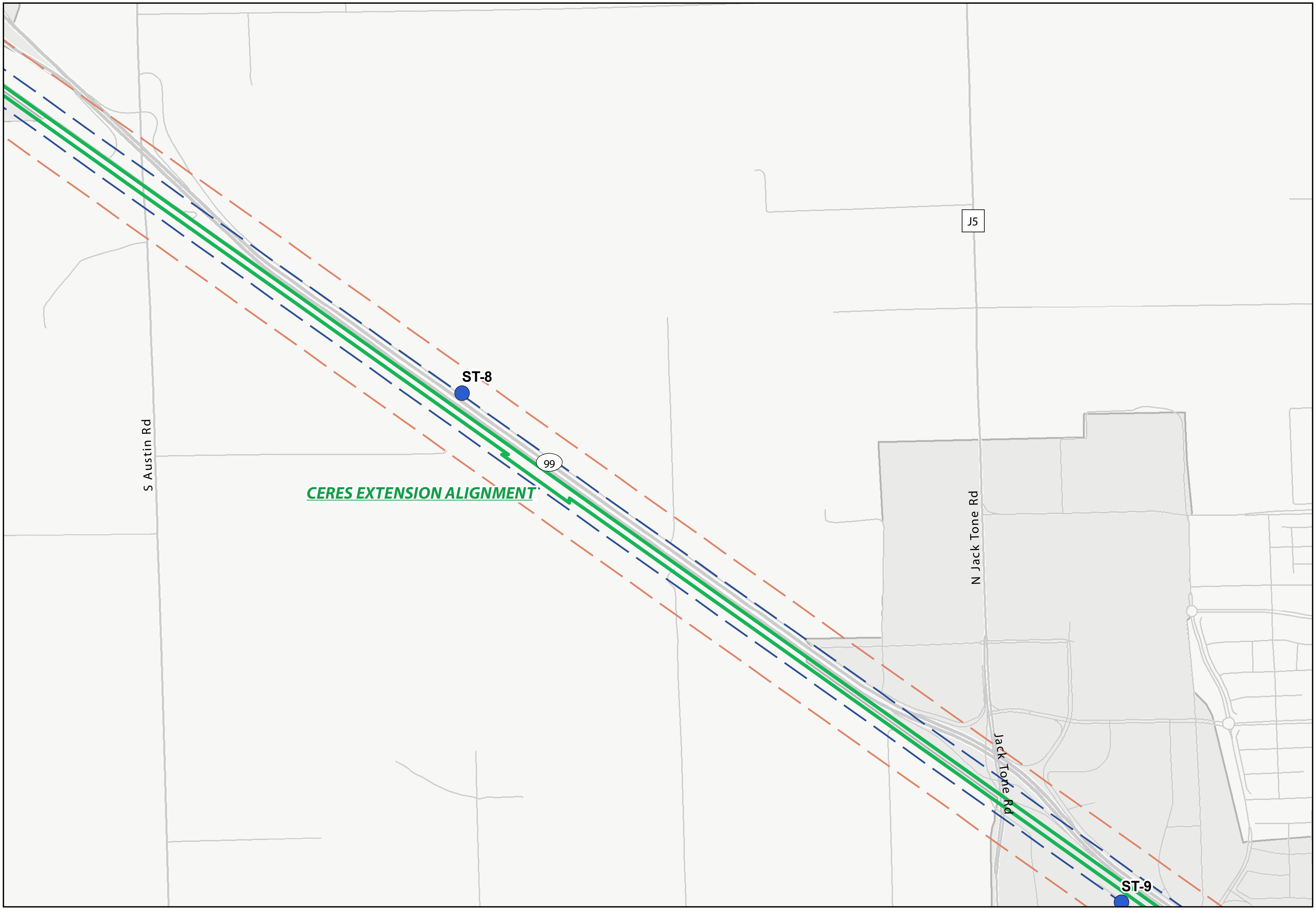


Figure 4.12-9
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



ACE ALTAMONT CORRIDOR EXPRESS

N

0 0.25 0.5
Miles

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

Phase I
Phase II
Vibration Study Area
Noise Study Area

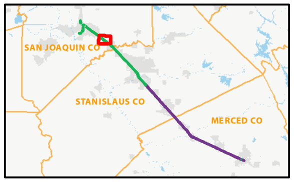


Figure 4.12-10
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

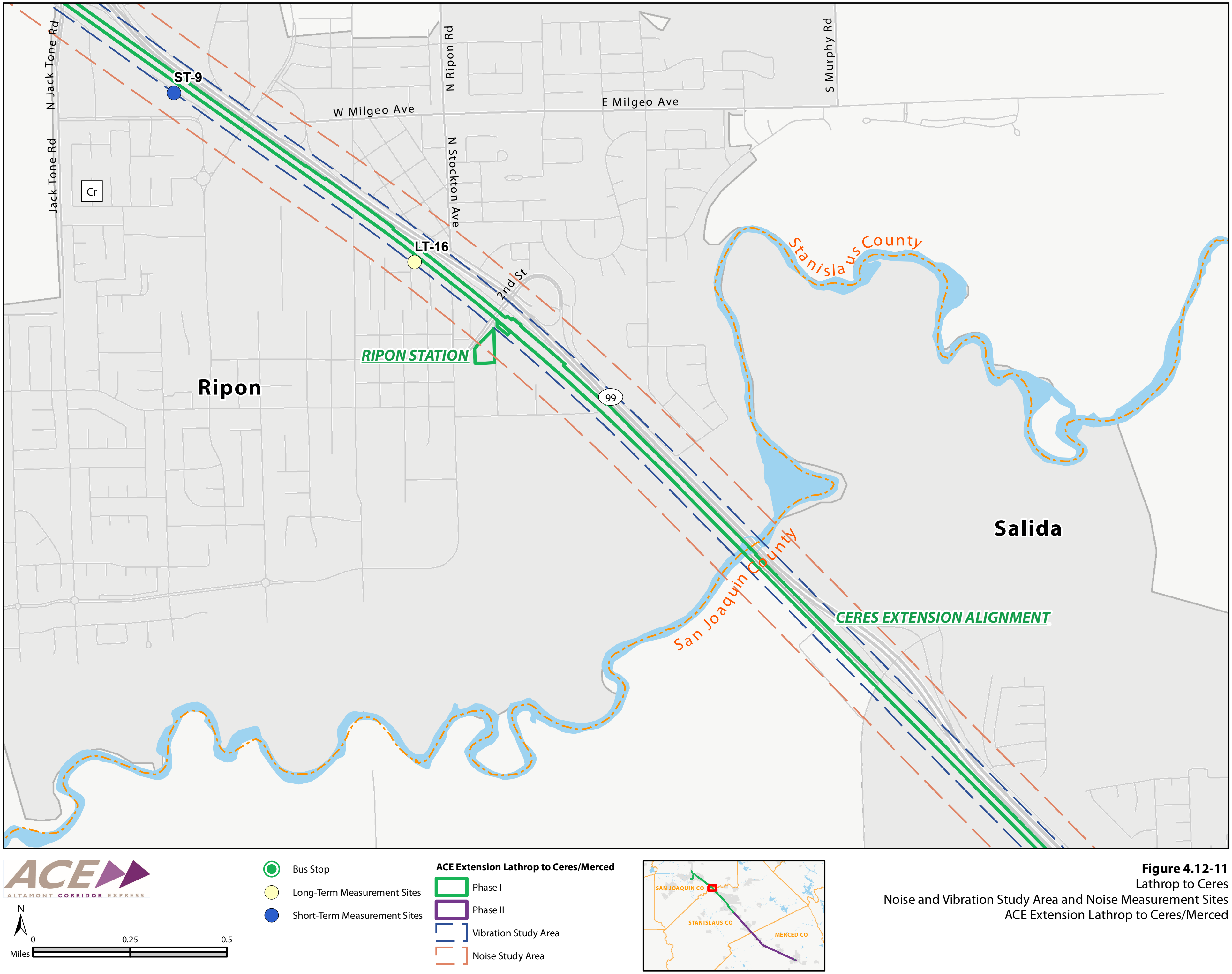


Figure 4.12-11
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

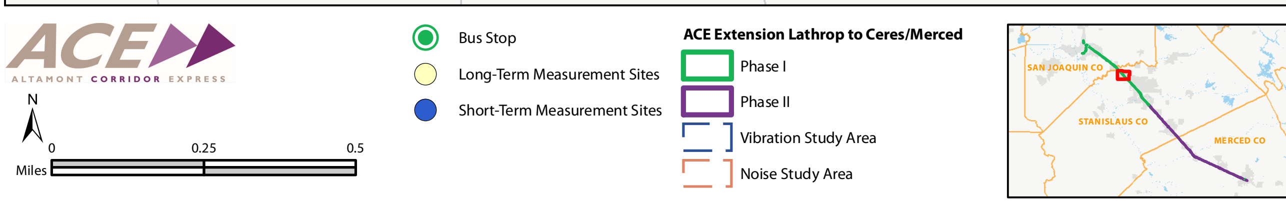
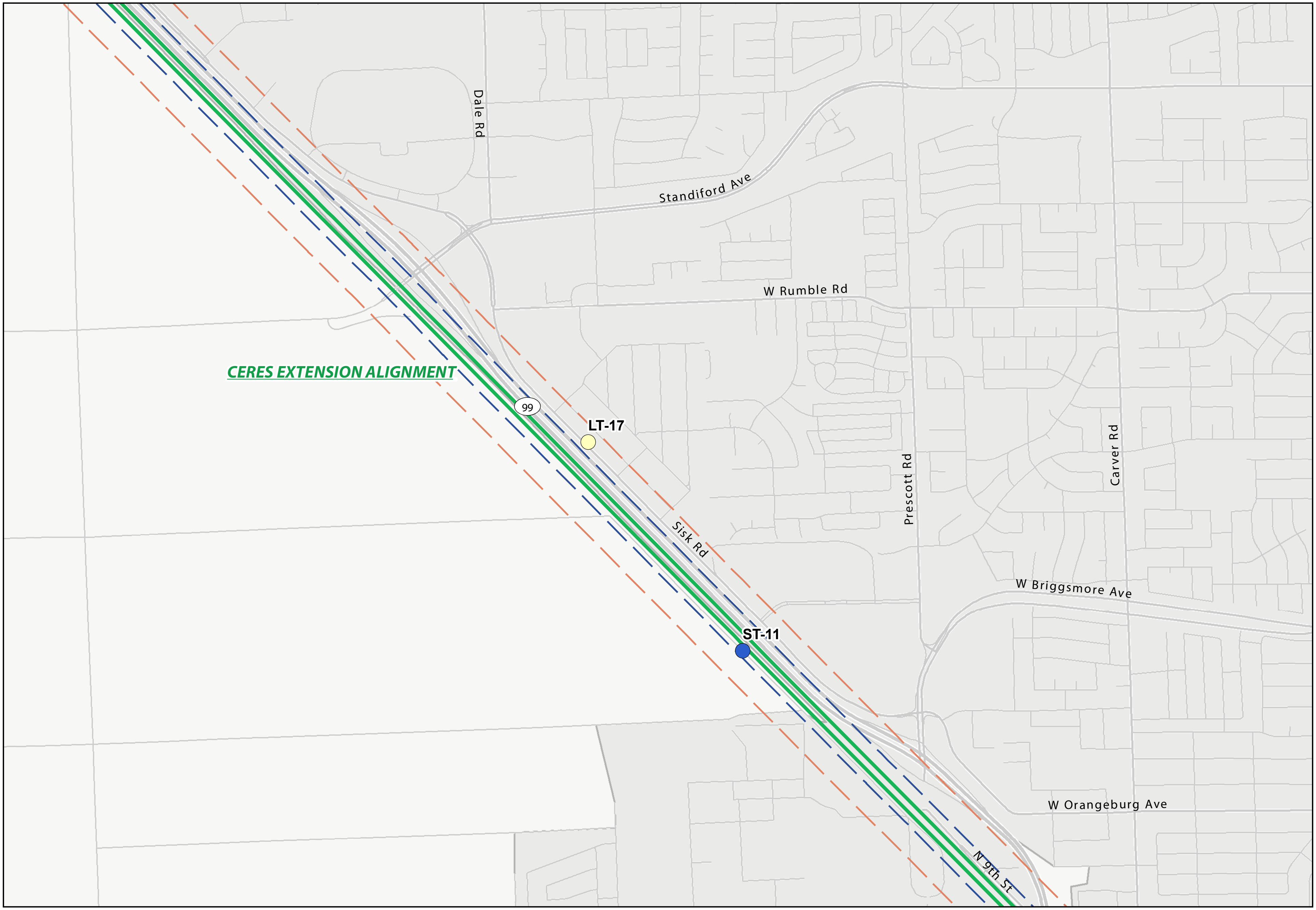
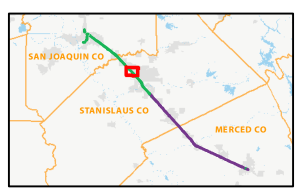


Figure 4.12-12
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



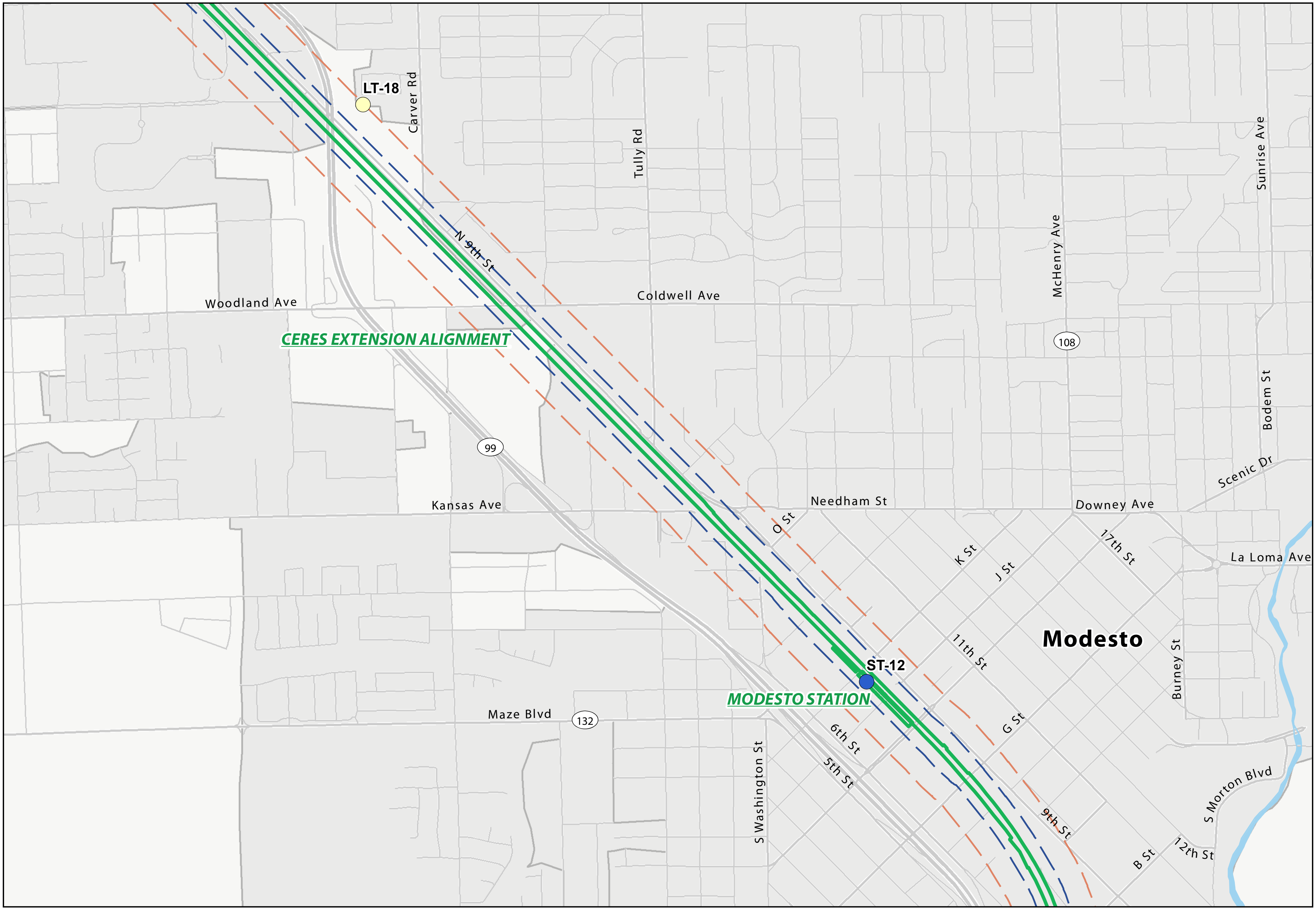


N
0 0.25 0.5
Miles

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced
Phase I
Phase II
Vibration Study Area
Noise Study Area

Figure 4.12-13
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

Phase I
Phase II
Vibration Study Area
Noise Study Area

N

0 0.25 0.5
Miles

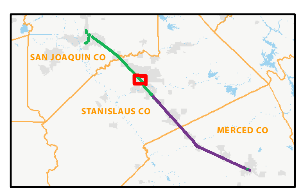


Figure 4.12-14
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

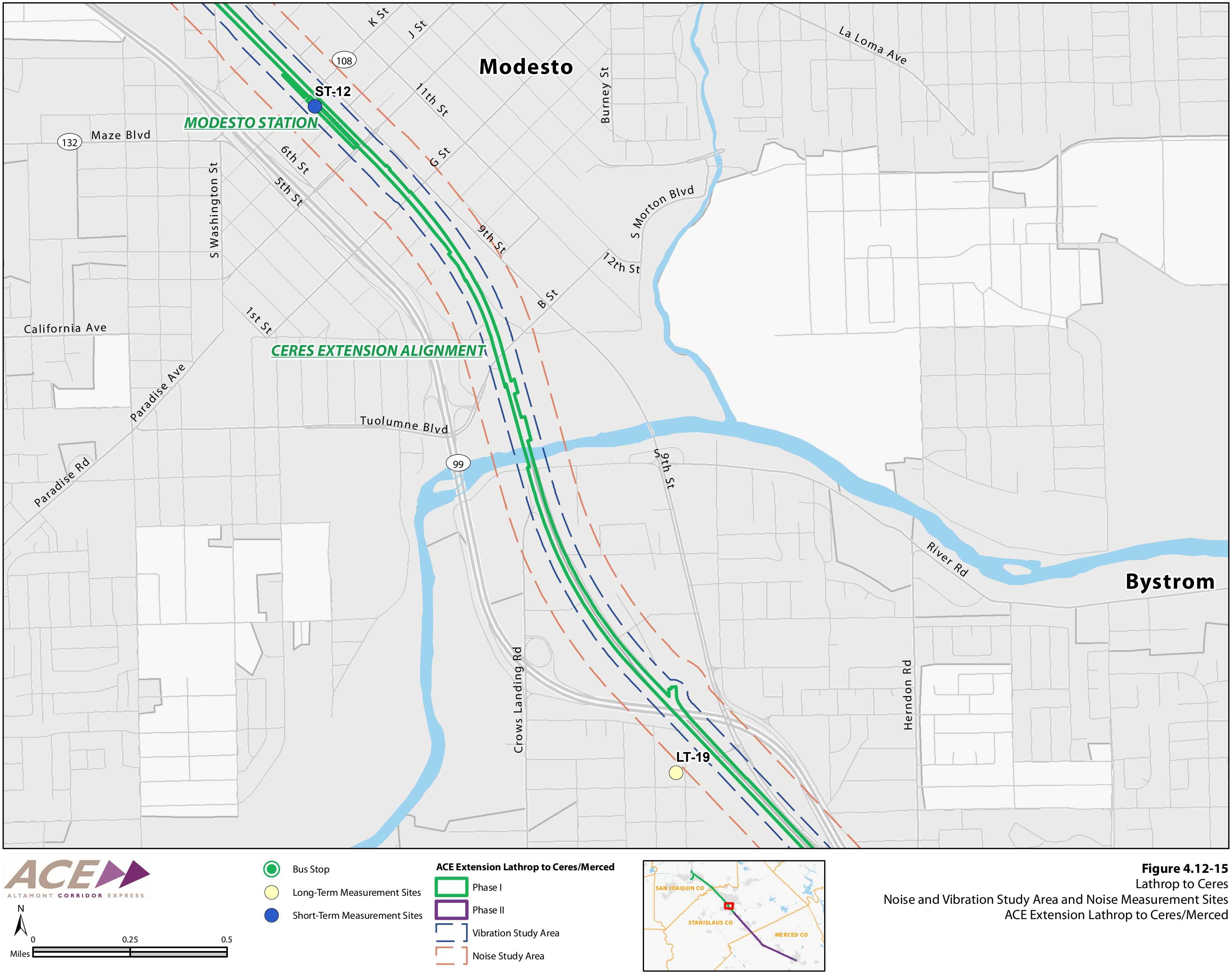
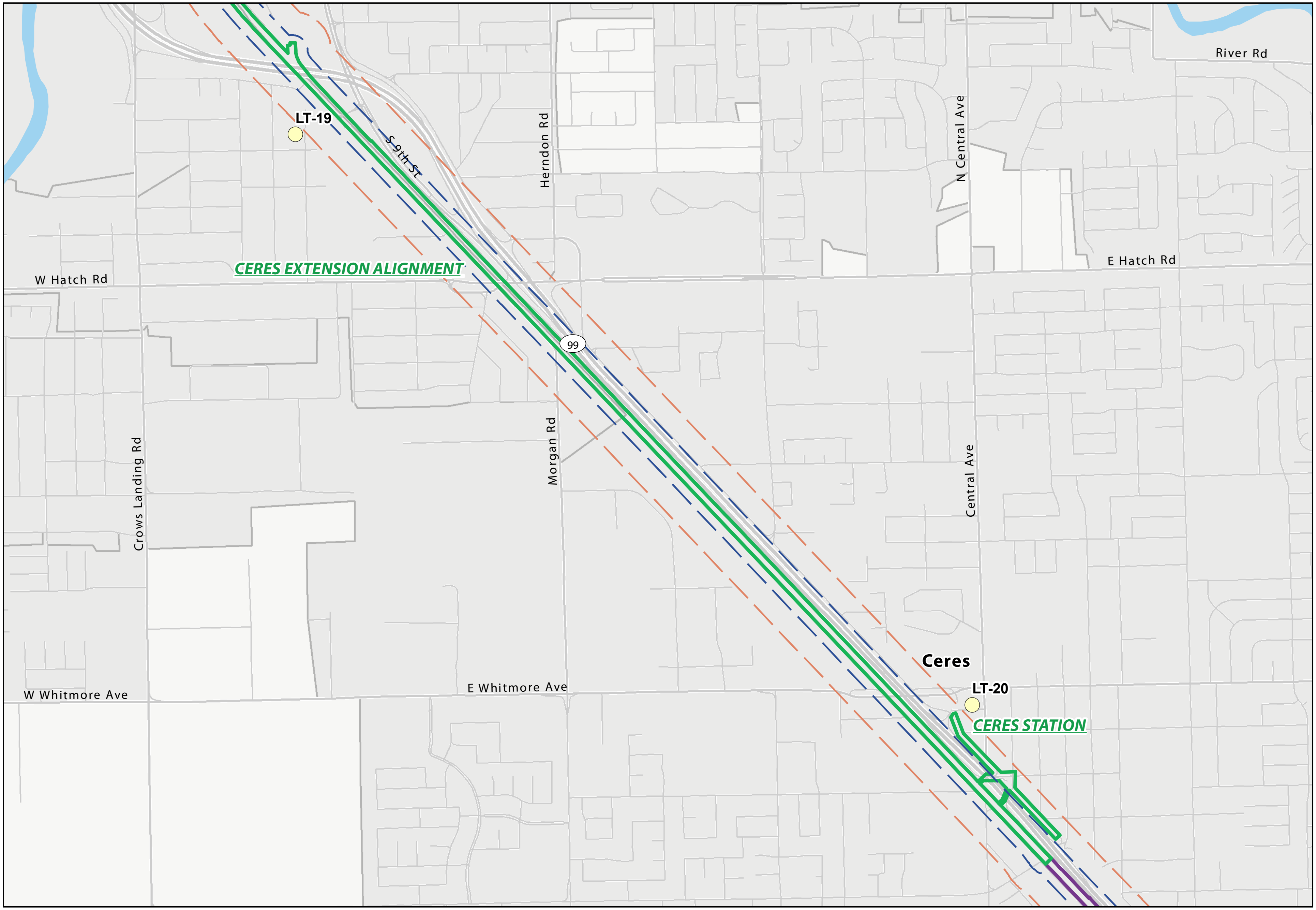


Figure 4.12-15
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



ALTAMONT CORRIDOR EXPRESS

N

0 0.25 0.5
Miles

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

Phase I
Phase II
Vibration Study Area
Noise Study Area

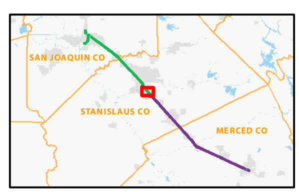
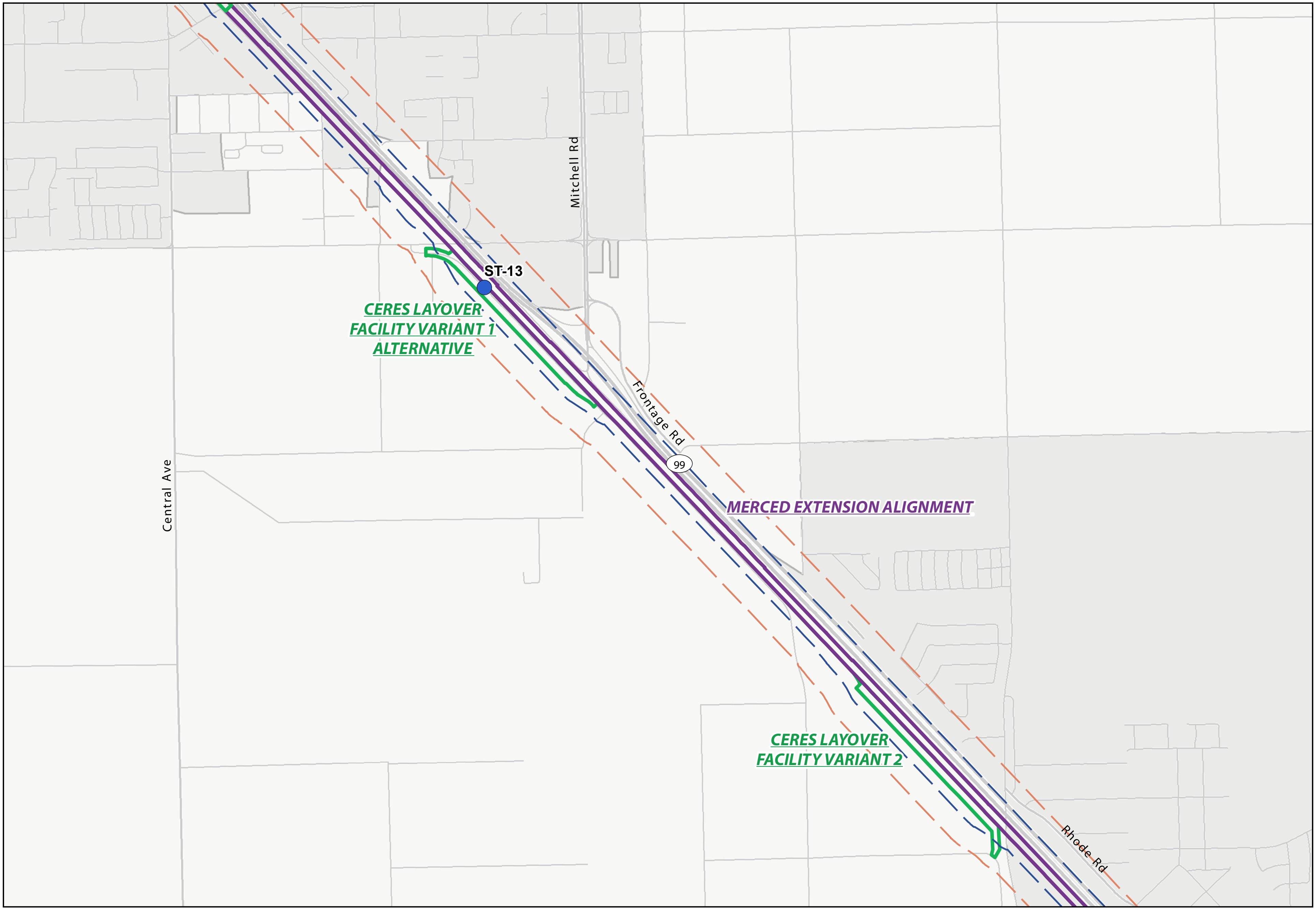
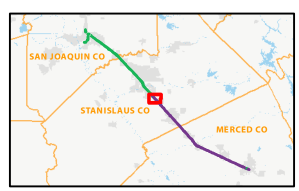


Figure 4.12-16
Lathrop to Ceres
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced





ALTAMONT CORRIDOR EXPRESS

N

0 0.25 0.5 Miles

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced
Phase I
Phase II
Vibration Study Area
Noise Study Area

Figure 4.12-17
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

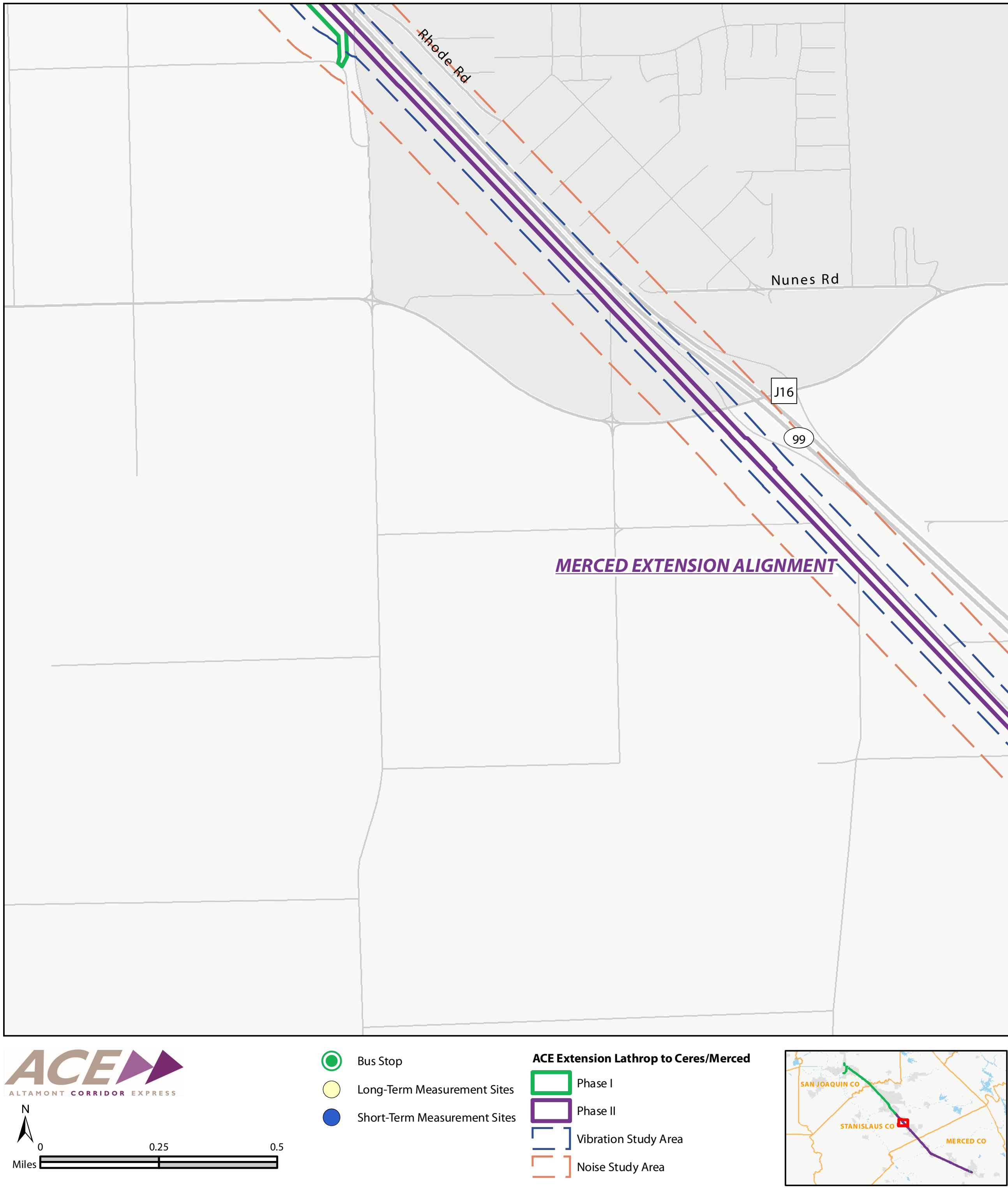
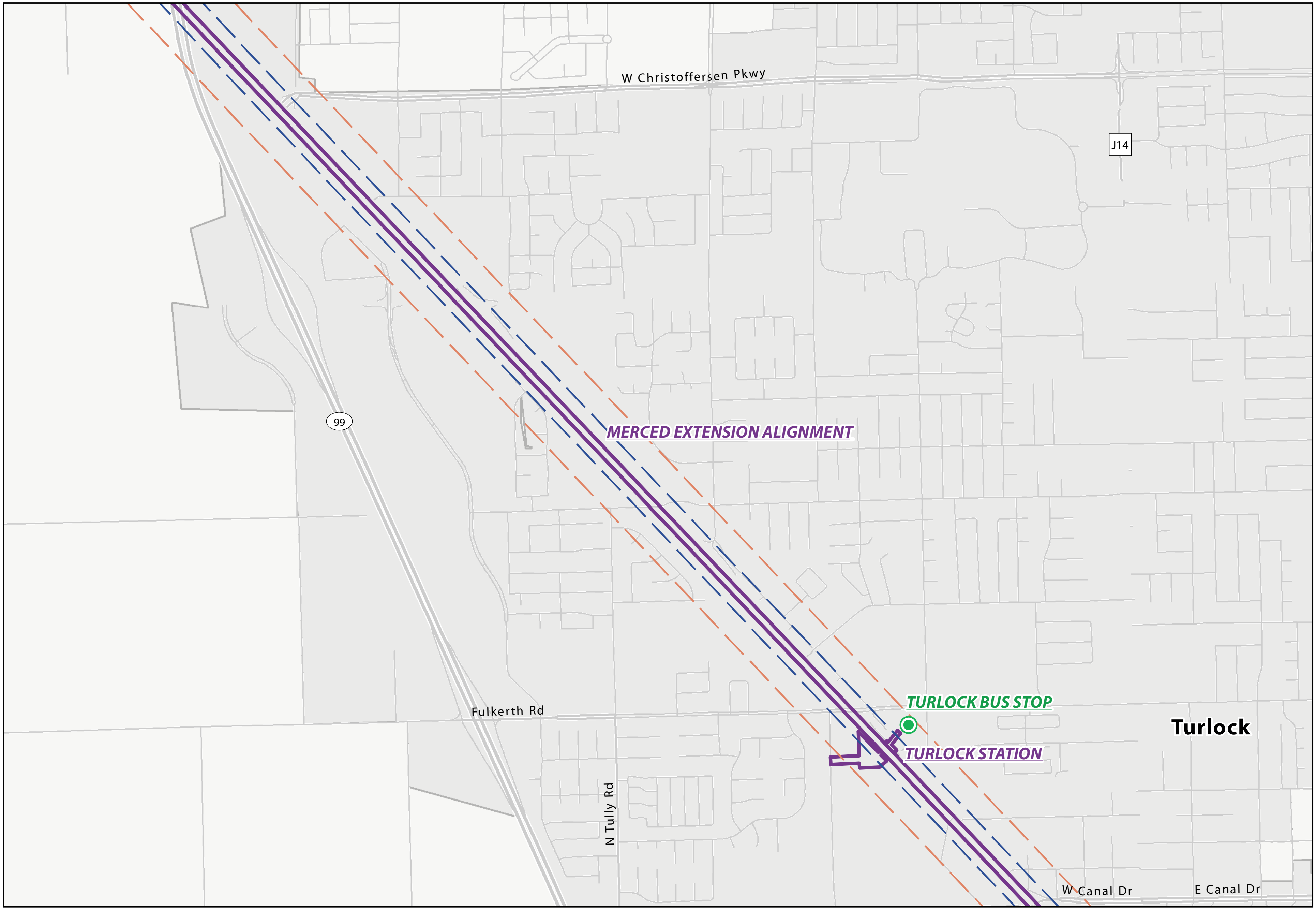


Figure 4.12-18
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



ACE ALTAMONT CORRIDOR EXPRESS

N

0 0.25 0.5 Miles

- Bus Stop
- Long-Term Measurement Sites
- Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

- Phase I
- Phase II
- Vibration Study Area
- Noise Study Area

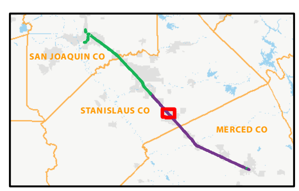
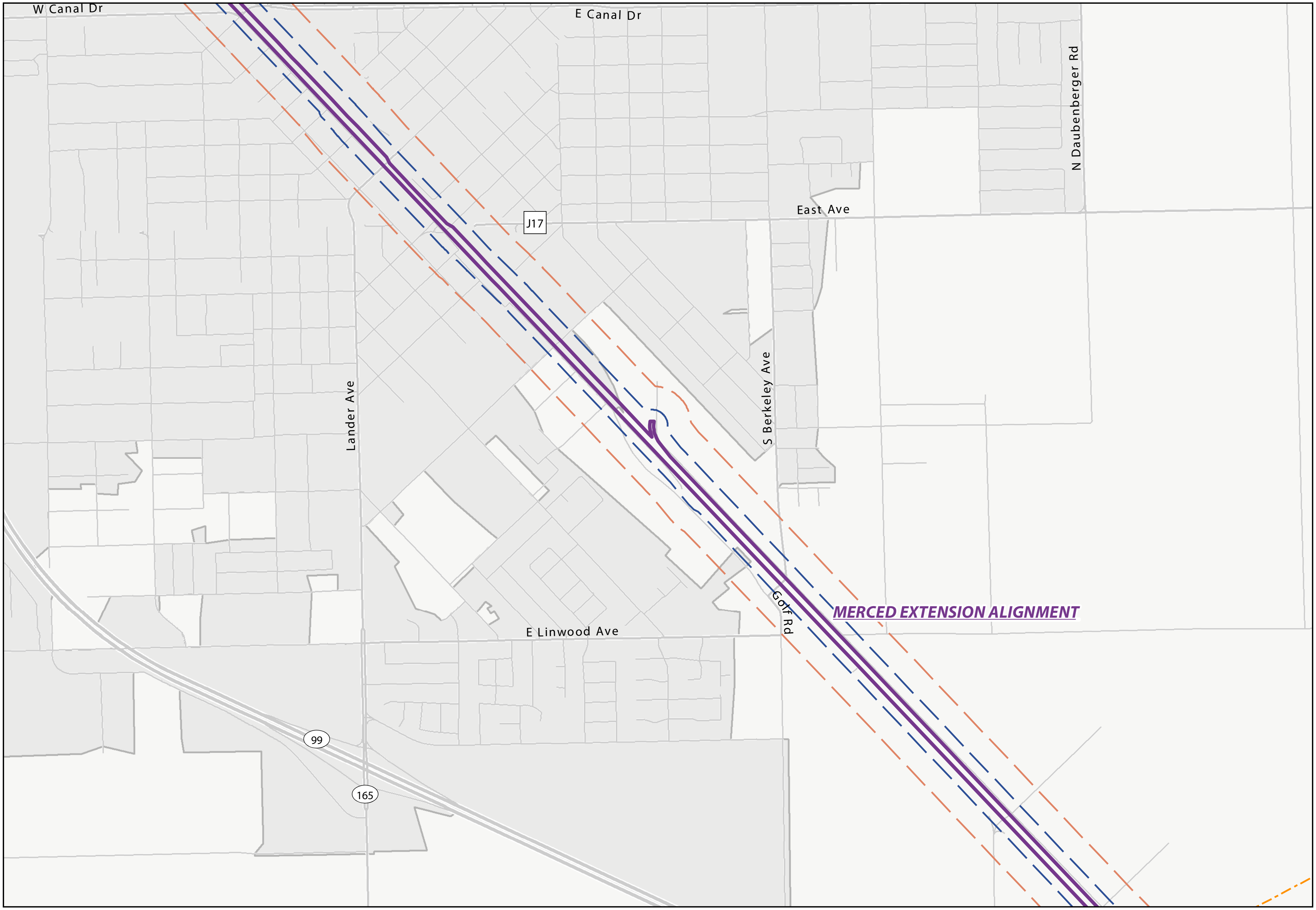


Figure 4.12-19
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



ACE ALTAMONT CORRIDOR EXPRESS

N

0 0.25 0.5
Miles

- Bus Stop
- Long-Term Measurement Sites
- Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

- Phase I
- Phase II
- Vibration Study Area
- Noise Study Area

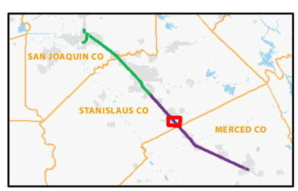


Figure 4.12-20
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

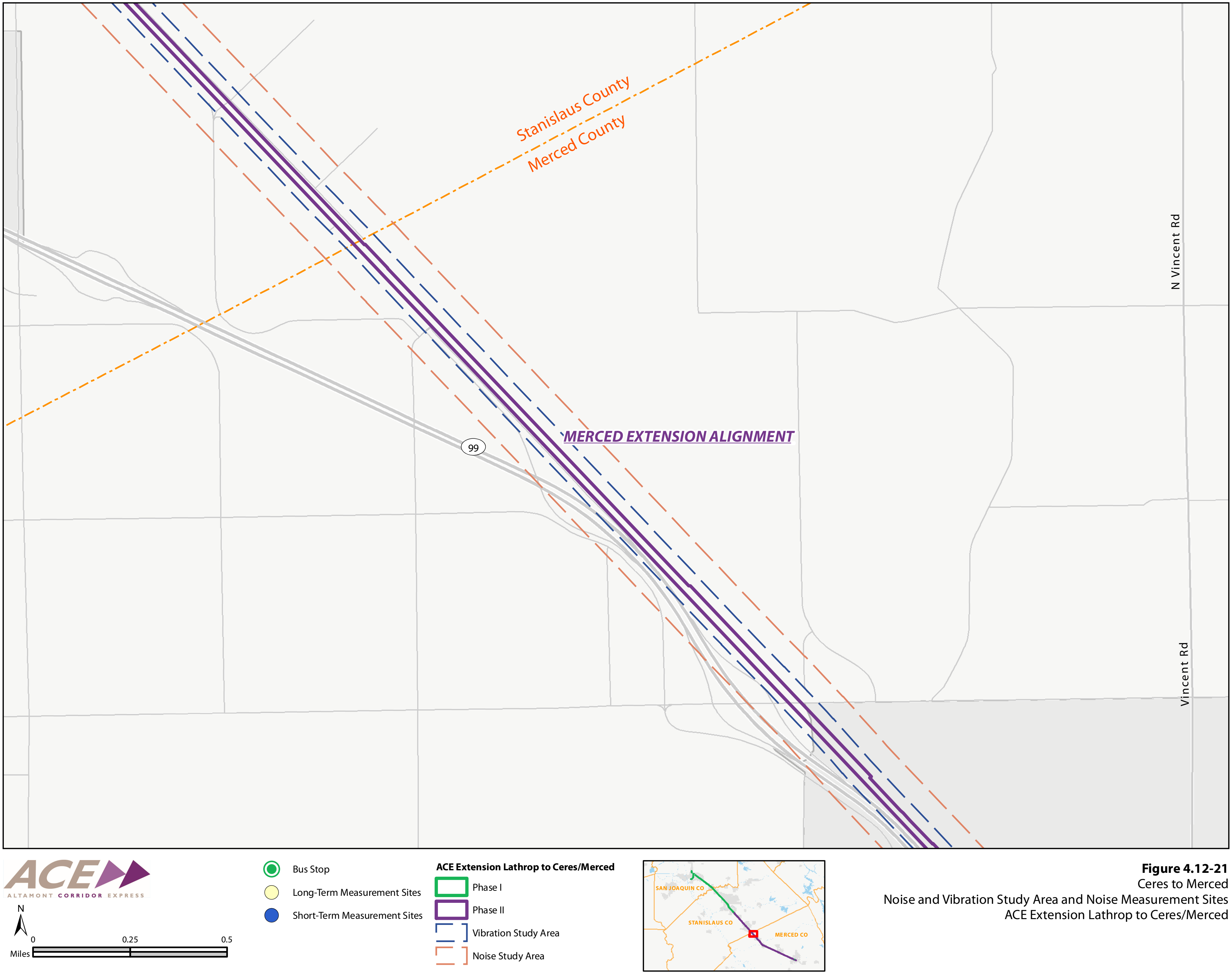


Figure 4.12-21
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

ALTAMONT CORRIDOR EXPRESS

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

Phase I
Phase II
Vibration Study Area
Noise Study Area

N
Miles 0 0.25 0.5

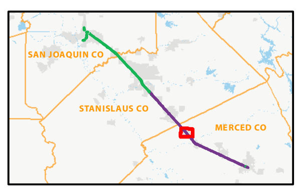
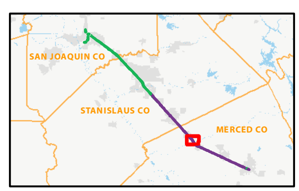


Figure 4.12-22
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

Phase I
Phase II
Vibration Study Area
Noise Study Area



N
0 0.25 0.5
Miles

Figure 4.12-23
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

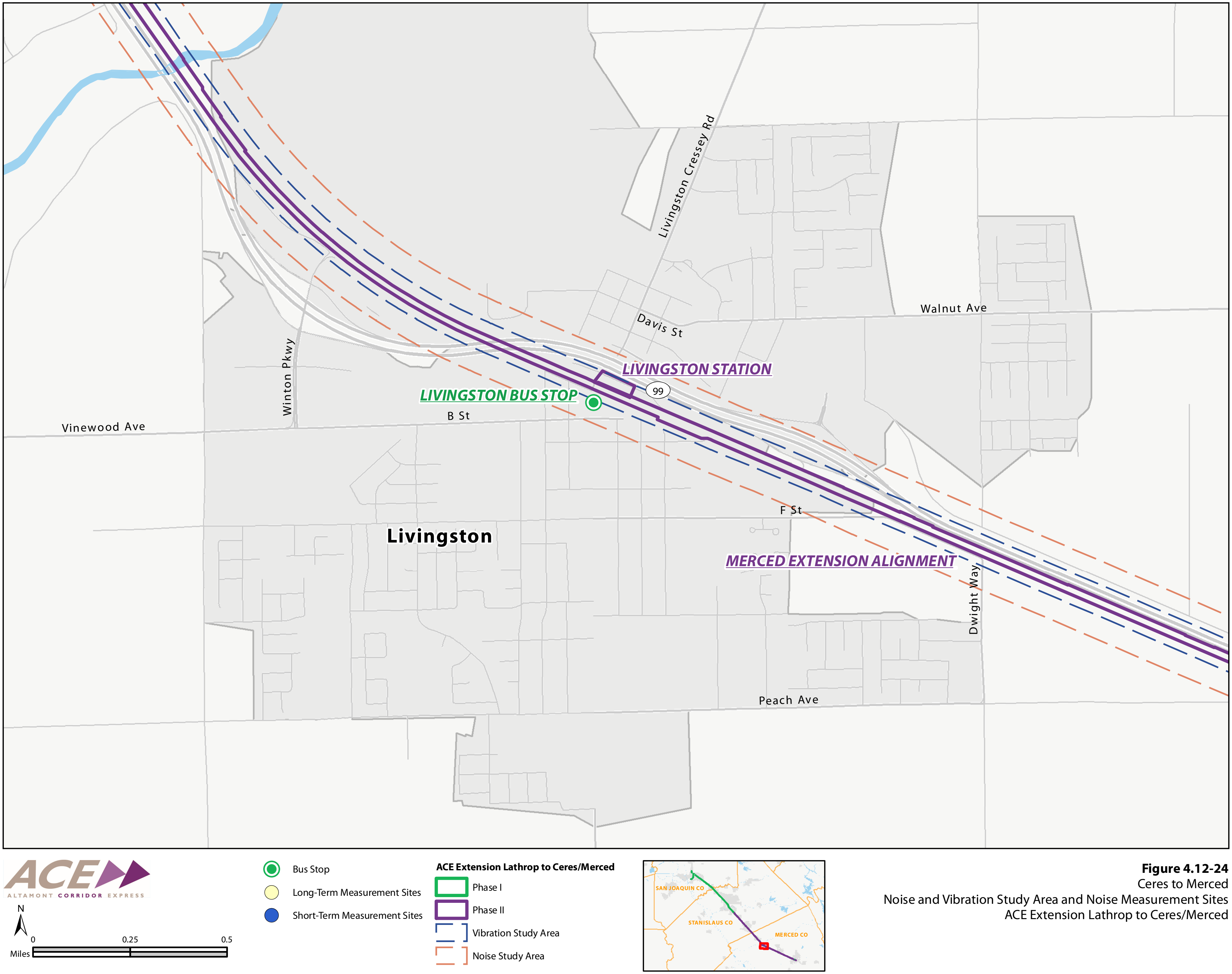
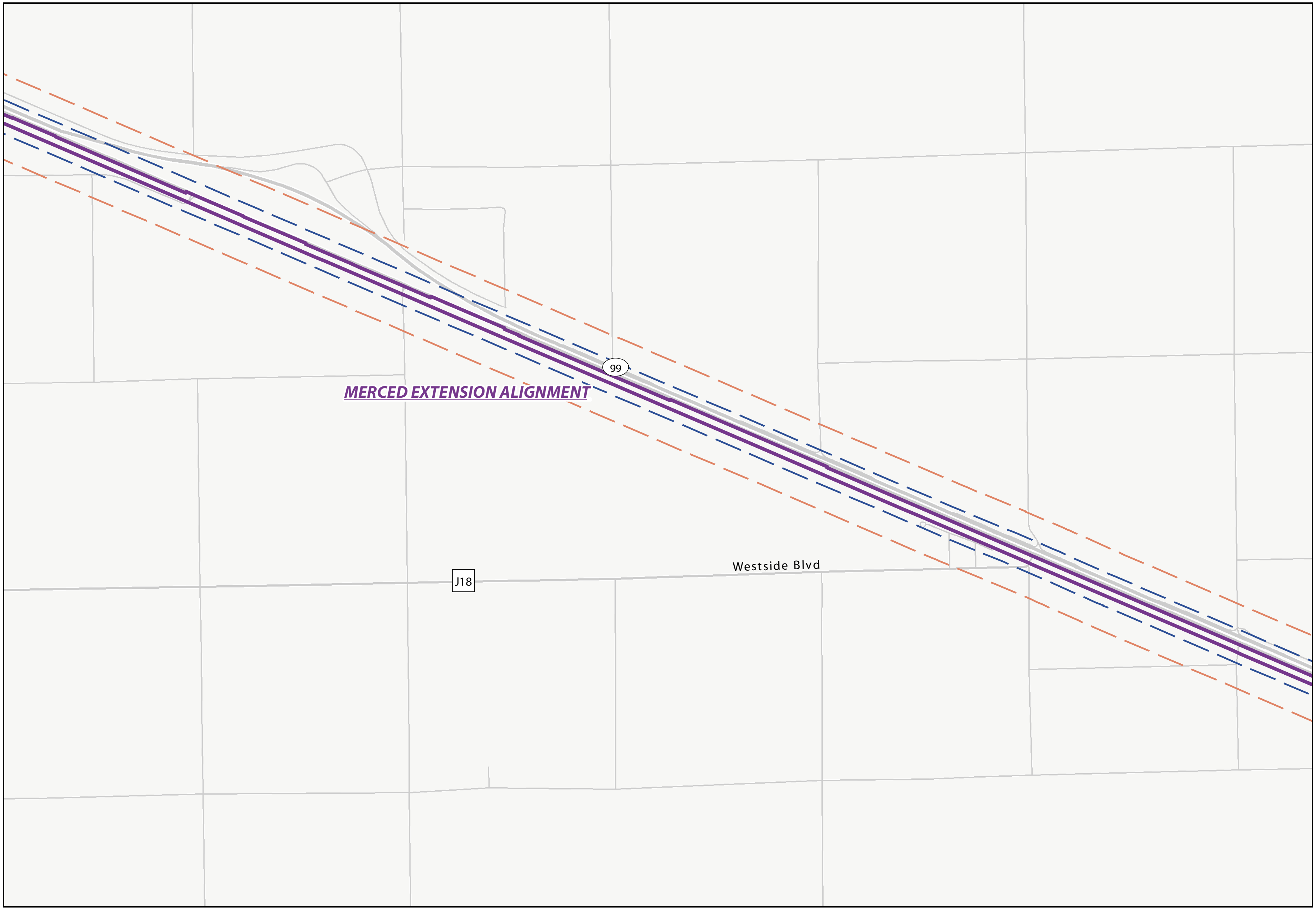
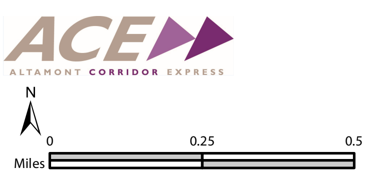


Figure 4.12-24
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced





Bus Stop

Long-Term Measurement Sites

Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced

Phase I

Phase II

Vibration Study Area

Noise Study Area

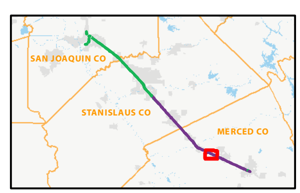


Figure 4.12-25
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

Bus Stop
Long-Term Measurement Sites
Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced
Phase I
Phase II
Vibration Study Area
Noise Study Area

N
0 0.25 0.5
Miles

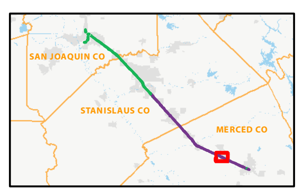
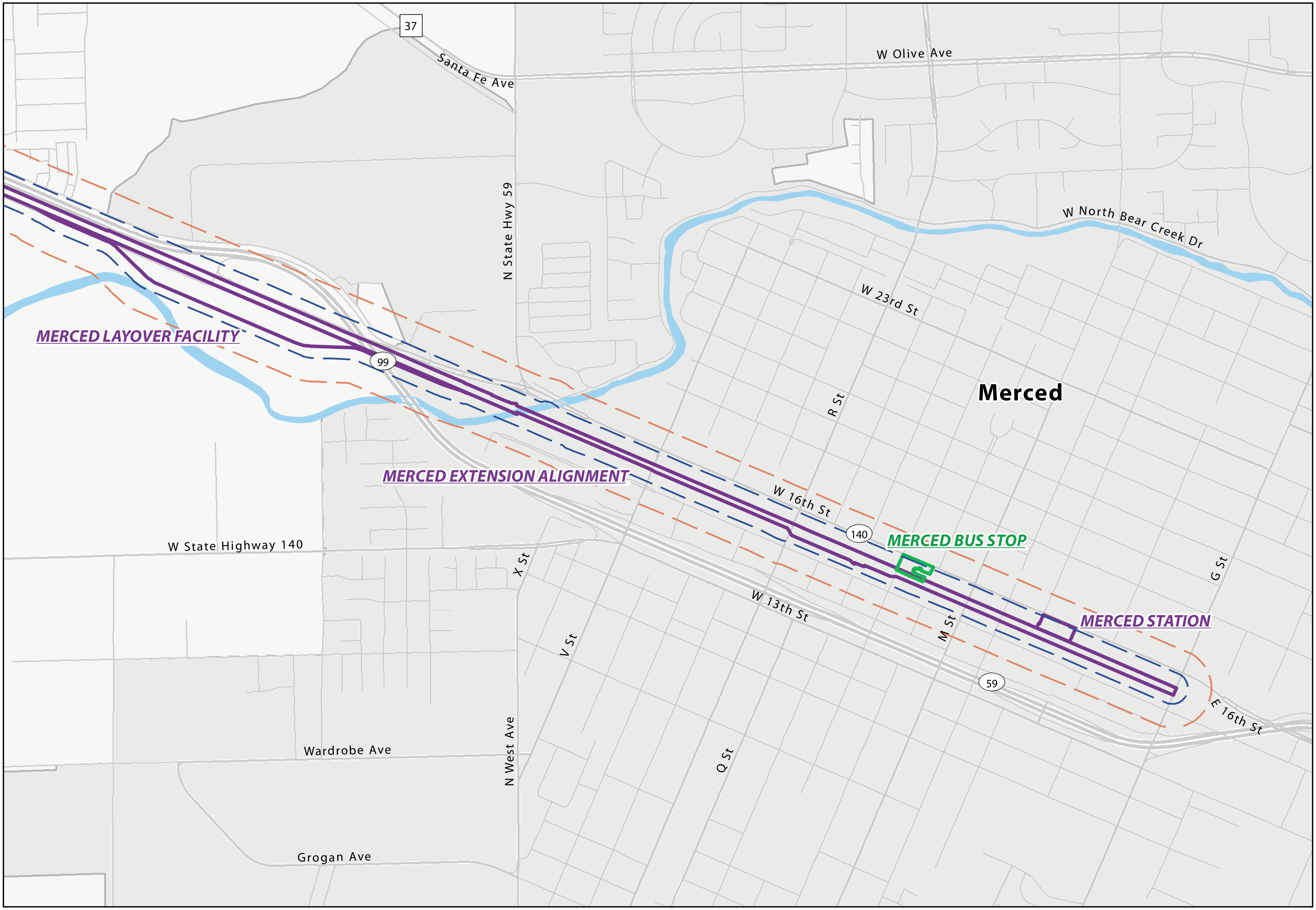


Figure 4.12-26
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced

Figure 4.12-27
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



ACE ALTAMONT CORRIDOR EXPRESS

N

0 0.25 0.5
Miles

- Bus Stop
- Long-Term Measurement Sites
- Short-Term Measurement Sites

ACE Extension Lathrop to Ceres/Merced
- Phase I
- Phase II
- Vibration Study Area
- Noise Study Area

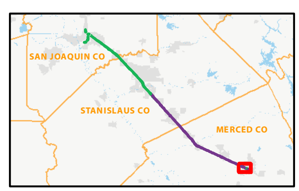
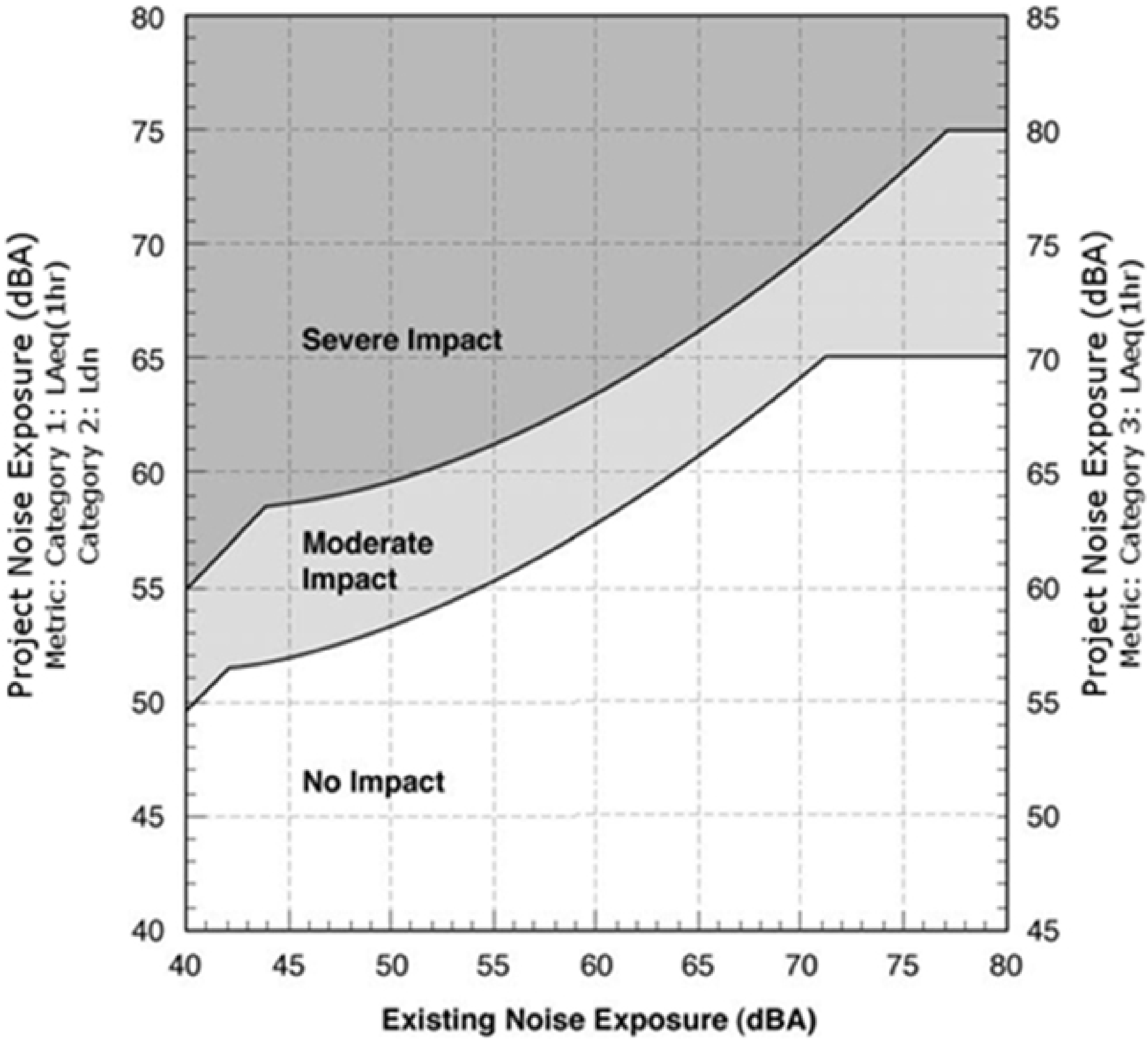


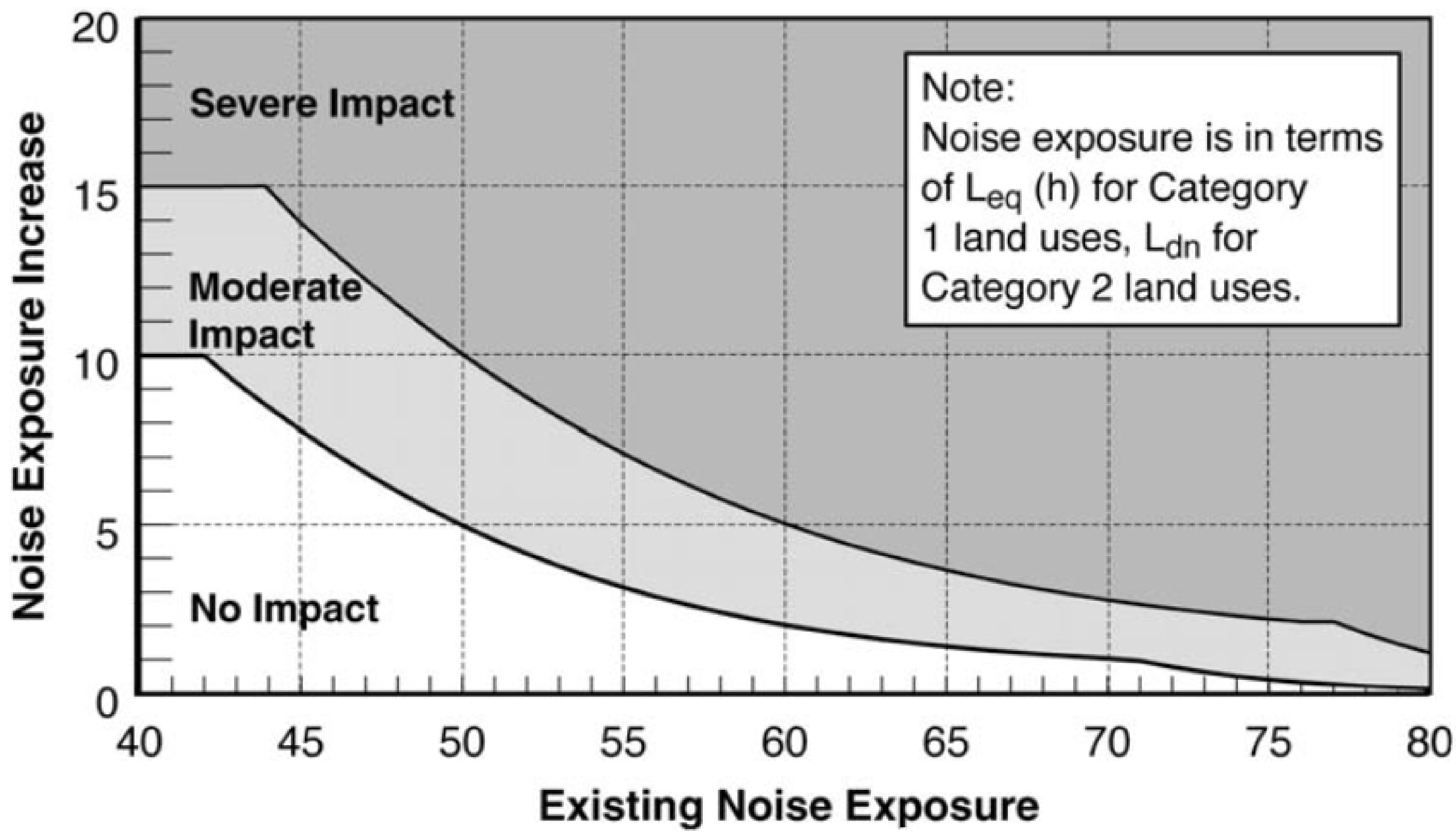
Figure 4.12-28
Ceres to Merced
Noise and Vibration Study Area and Noise Measurement Sites
ACE Extension Lathrop to Ceres/Merced



(Source: Federal Transit Administration 2006)

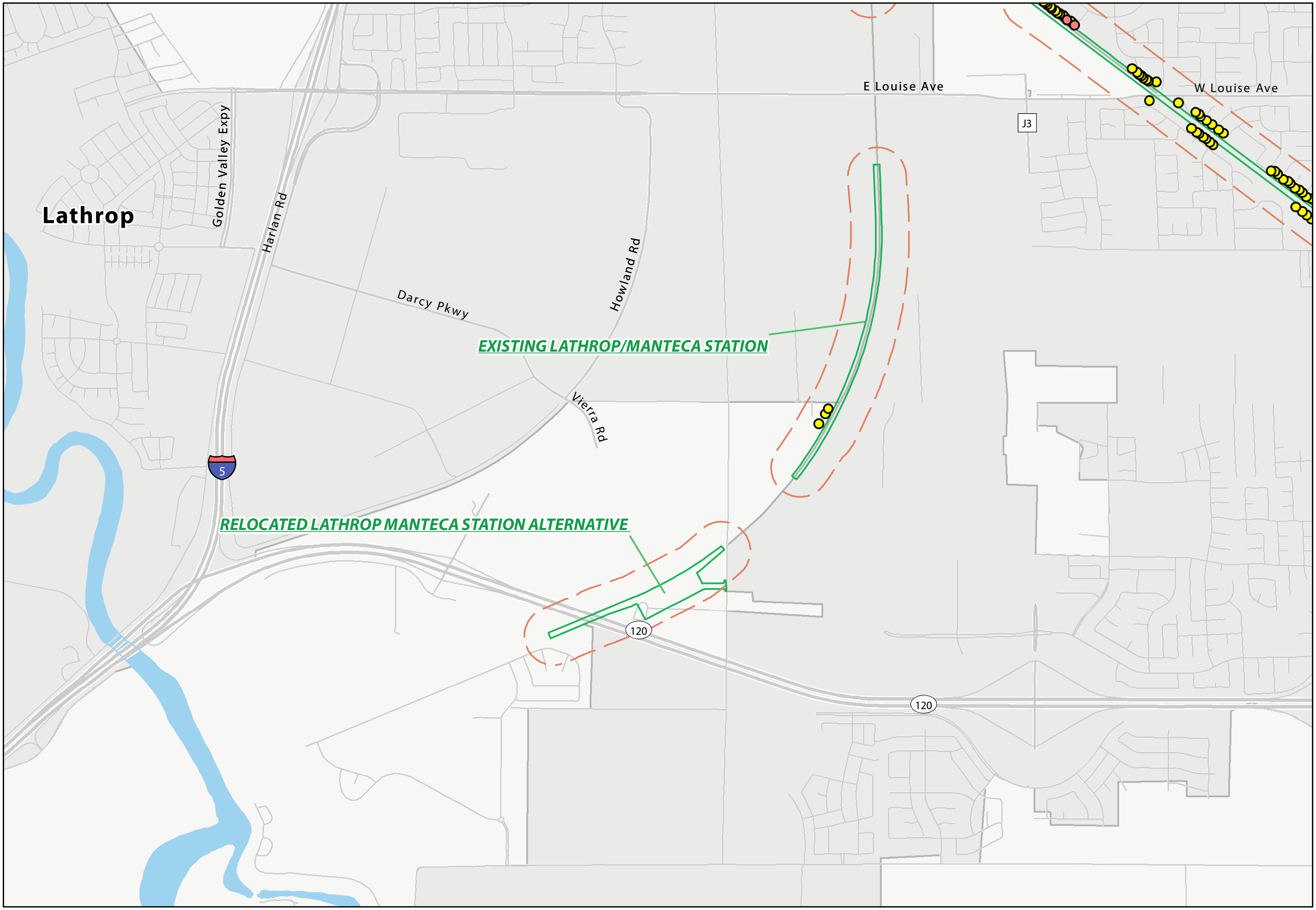
ACE ALTAMONT CORRIDOR EXPRESS

Figure 4.12-29
FTA Noise Impact Criteria
ACE Extension Lathrop to Ceres/Merced



(Source: Federal Transit Administration 2006)

Figure 4.12-30
FTA Cumulative Noise Impact Criteria
ACE Extension Lathrop to Ceres/Merced



ACE ALTAMONT CORRIDOR EXPRESS

N
0 0.25 0.5
Miles

ACE Extension Lathrop to Ceres/Merced
- Phase I
- Phase II

Phase I Noise Impacts
- Moderate
- Severe
- Noise Study Area

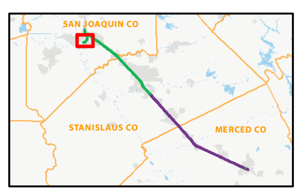
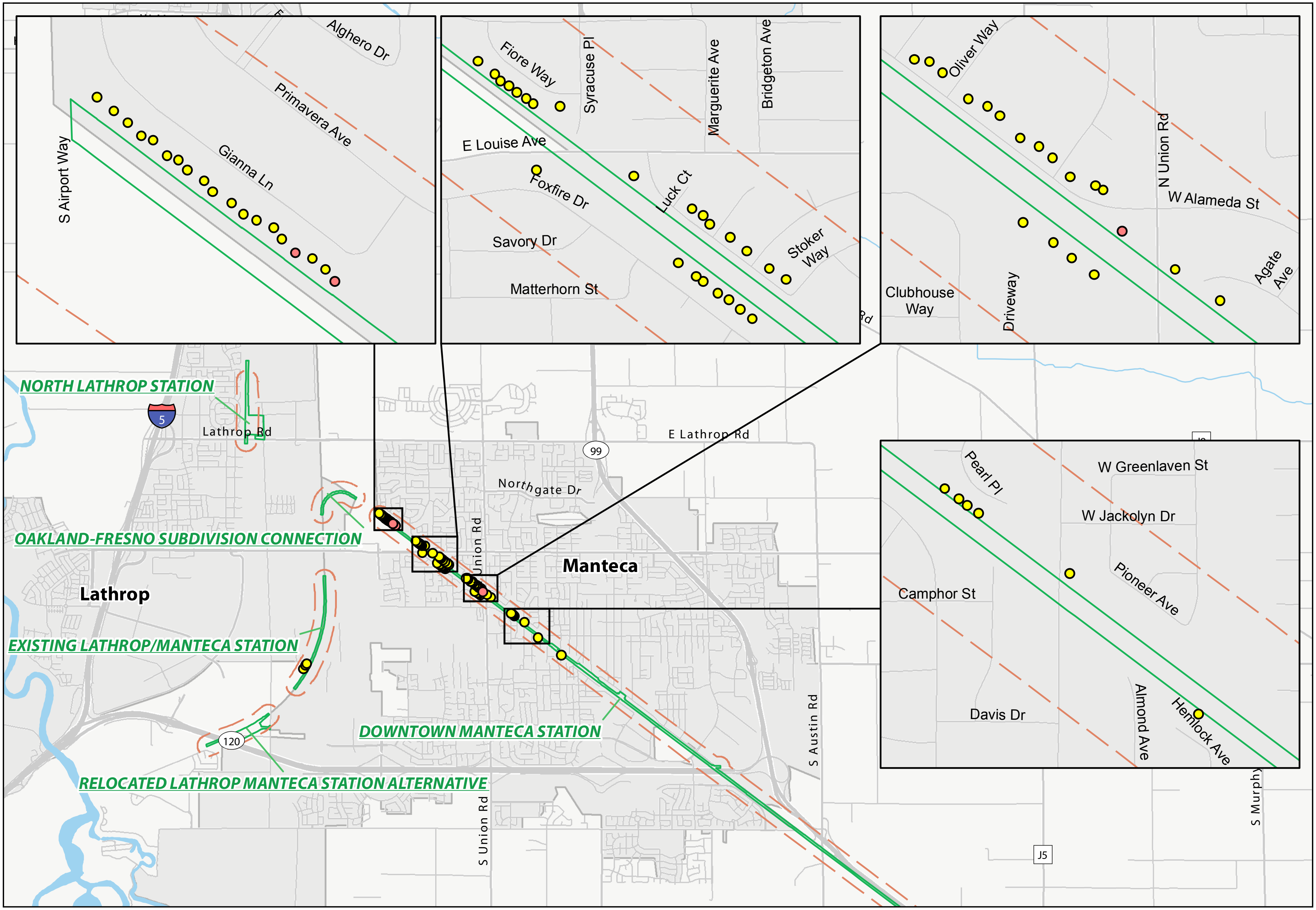


Figure 4.12-31
Lathrop to Ceres – Phase I Noise Impacts in Manteca
ACE Extension Lathrop to Ceres/Merced



ACE ALTAMONT CORRIDOR EXPRESS

N
0 0.25 0.5
Miles

ACE Extension Lathrop to Ceres/Merced
Phase I
Phase II

Phase I Noise Impacts
Moderate
Severe
Noise Study Area

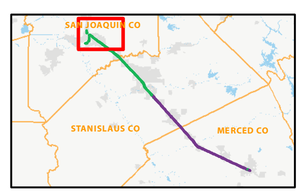
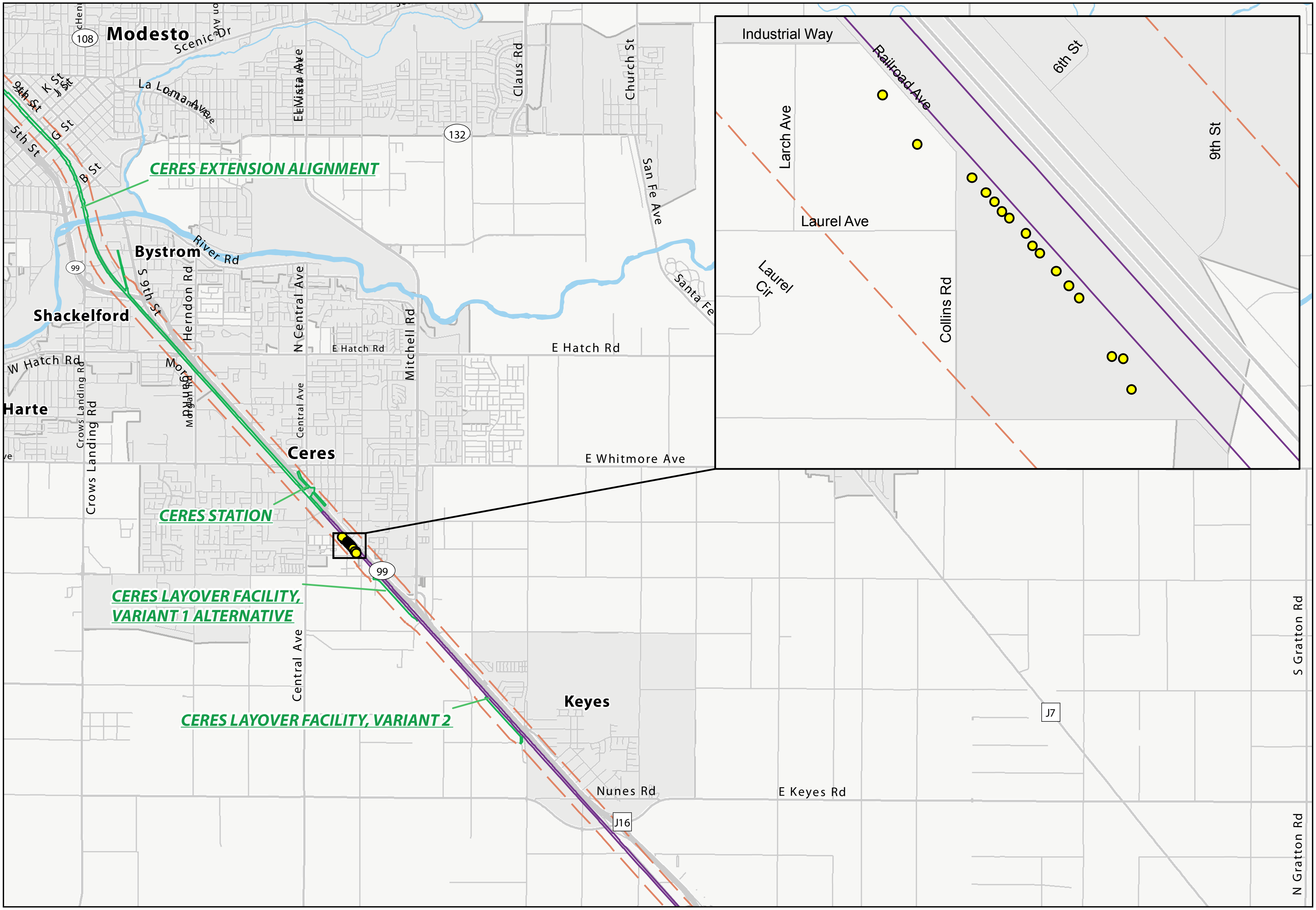
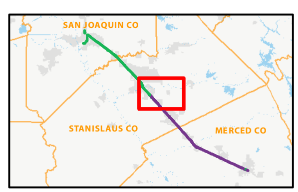


Figure 4.12-32
Lathrop to Ceres – Phase I Noise Impacts in Manteca
ACE Extension Lathrop to Ceres/Merced





ACE Extension Lathrop to Ceres/Merced

Phase I

Phase II

Phase I Noise Impacts

Moderate

Noise Study Area

Figure 4.12-33

Lathrop to Ceres – Phase I Noise Impacts in Ceres

ACE Extension Lathrop to Ceres/Merced

Figure 4.12-34
Lathrop to Ceres – Phase II Noise Impacts in Manteca
ACE Extension Lathrop to Ceres/Merced

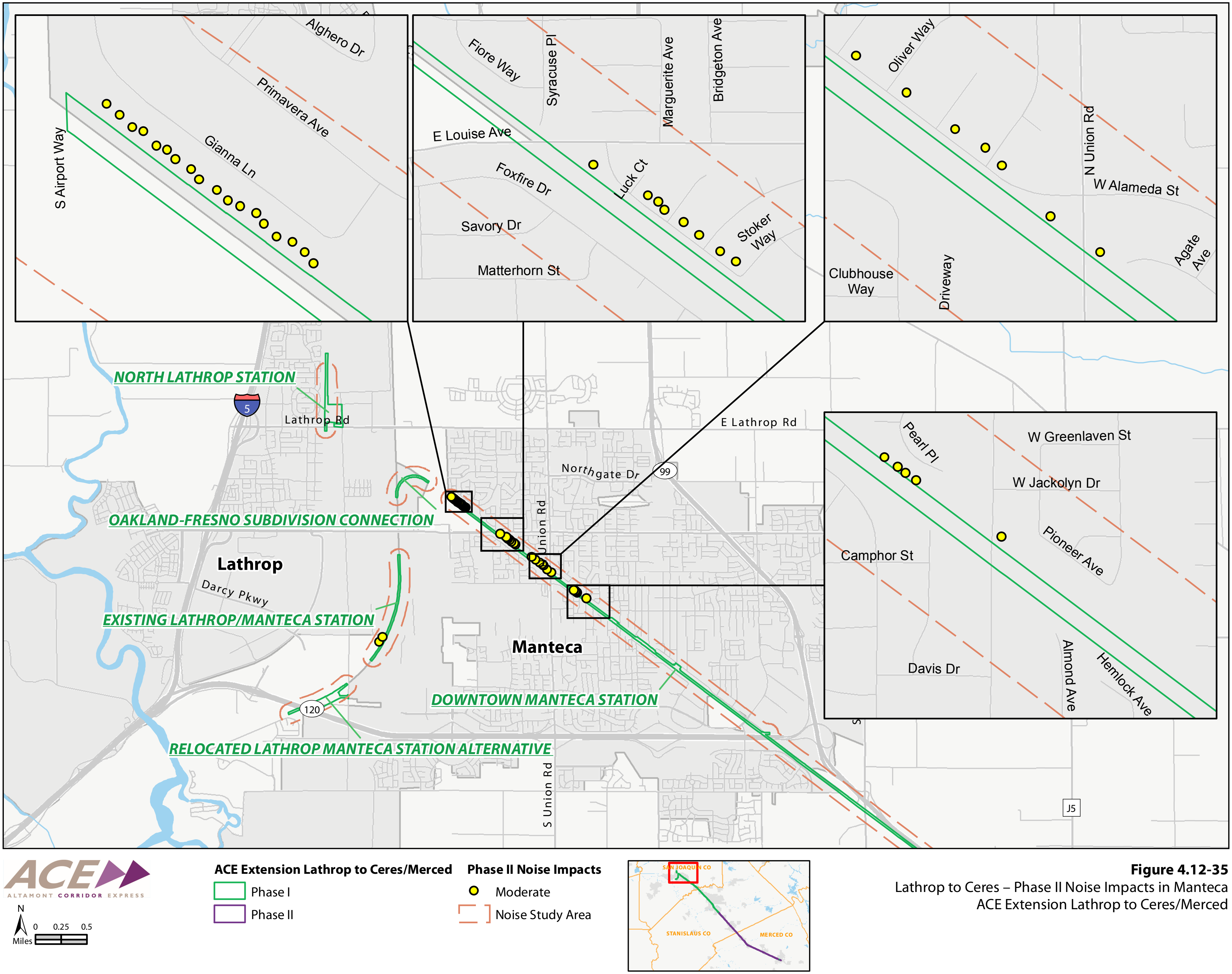


Figure 4.12-35
Lathrop to Ceres – Phase II Noise Impacts in Manteca
ACE Extension Lathrop to Ceres/Merced