Appendix B

Air Quality, Health Risk Assessment, Greenhouse Gas, and Energy

Valley Rail Sacramento Extension Project

Final Health Risk Assessment

AECOM has prepared this technical report to describe the results of the Health Risk Assessment for the proposed Valley Rail Sacramento Extension Project. The Health Risk Assessment has been requested by the Sacramento Metropolitan Air Quality Management District (SMAQMD), for compliance with the California Environmental Quality Act (CEQA) and is consistent with the San Joaquin Valley Air Pollution Control District Guidance for Air Dispersion Modeling (SJVAPCD, 2006), APR – 1906 Framework for Performing Health Risk Assessments (SJVAPCD, 2018), 2017 Bay Area Air Quality Management District CEQA Guidelines (BAAQMD, 2017), the California Air Pollution Control Officers Association (CAPCOA, 2009), the California Air Resources Board (ARB, 2017), the Office of Environmental Health Hazard Assessment (OEHHA, 2015), SMAQMD Mobile Sources Air Toxics (MSAT) Protocol (SMAQMD, 2019), and the U.S. Environmental Protection Agency (EPA, 2017). This air quality technical report describes the project, the approach to the Health Risk Assessment, and the modeling methodologies used to perform the analysis.

This report addresses the following topics, as listed below by section:

1.0 – Introduction describes the project understanding and the objectives and methodology for the Health Risk Assessment.

2.0 – Emissions Estimates describes the methods used to estimate the emissions of toxic air contaminants generated from project construction and operations.

3.0 – Air Dispersion Modeling describes the methods for modeling pollutant dispersion and estimating pollutant concentration contributions from project sources.

4.0 – Health Risk Analysis Methodology provides an overview of the methodology for estimating potential health risks to new and existing sensitive receptors.

5.0 – Health Risk Analysis Results provides the results of the excess cancer risk at the project's maximally exposed individual (MEI) and cumulative assessment based on SMAQMD MSAT Protocol Guidance Document.

6.0 – Uncertainties provides a discussion of uncertainties and limitations associated with the Health Risk Analysis.

7.0 – References lists the sources cited in the air quality Health Risk Assessment.

1. Introduction

1.1. Project Understanding

The San Joaquin Joint Powers Authority (SJJPA) and the San Joaquin Regional Rail Commission (SJRRC), which manage the Amtrak San Joaquins and the Altamont Corridor Express (ACE), respectively, are jointly undertaking the planning, design, and environmental review of the Valley Rail Sacramento Extension Project (proposed project), a proposed passenger rail service line between Stockton and Sacramento, California.

As outlined in the Environmental Impact Report (EIR), the proposed project is designed to expand passenger rail service to new markets in the San Joaquin and Sacramento counties; increase frequency of service; increase passenger rail ridership; reduce travel time between the San Joaquin Valley and the Sacramento area; augment existing transit capacity and provide transit connections; provide an alternative to single-use vehicle commuting and reduce automobile traffic congestion; improve regional air quality; reduce greenhouse gas (GHG) emissions; and support local and regional land use development plans and policies. In addition, the proposed project would contribute to geographic equality by providing increased connectivity within the Central Valley.

1.2. Proposed Project

The proposed project would expand Amtrak San Joaquins and ACE passenger rail services to the greater Sacramento area through the construction of five new rail stations and track improvements along the Union Pacific Railroad (UPRR) Sacramento Subdivision (**Figures 1-1** and **1-2**).[1]

Each proposed station and track improvement would be located along the existing UPRR alignment Sacramento Subdivision. For stations that include alternatives or variants (Lodi Station), only one alternative would be selected for implementation. The proposed stations include:

- **Lodi Station** – a 13-acre site located along the south side of SR 12 just east of the existing UPRR alignment.
- **Lodi Station South Alternative** – this alternative design and location for Lodi Station would be constructed on a 15-acre site along the north side of West Harney Lane just east of the UPRR alignment.
- **City College Station** – would be constructed adjacent to the existing SacRT City College light rail station north of Sutterville Road in Sacramento. The station would also include the construction of tracks for ACE trains within the existing station area.
- **Midtown Sacramento Station** – would be constructed near Q Street between 19th Street and 20th Street in Sacramento. This site was selected to minimize potential impacts to east-west roadways in Midtown during times when ACE and San Joaquins trains are at the station.
- **Old North Sacramento Station** – an 8-acre site has been selected for the construction of this station along the west side of Acoma Street just north of El Monte Avenue in Sacramento.

[1] A subdivision is a portion of railroad or railway that operates under a single timetable (authority for train movement in the area).

- **Natomas/Sacramento Airport Station** – would be constructed on an 8.4-acre site along the east side of Blacktop Road just south of West Elkhorn Boulevard. Shuttle services to and from Sacramento International Airport would be provided and timed to meet all incoming and departing trains. This station would also include layover tracks south of the platform to accommodate ACE and Amtrak train layovers between service runs.

In addition to the proposed six new stations, track improvements to the existing UPRR tack at various locations along the Sacramento Subdivision are included as part of the proposed project. These improvements are necessary to increase allowable train speeds and meeting operational requirements. Track improvement fall into one of the following four categories: (1) track curve reconstruction; (2) upgrades to existing passing siding track; (3) new passing siding tracks; and (4) new crossover tracks. Note that there is overlap at 3 of the 4 curve reconstruction sites with siding improvements.

Track curve reconstruction would take place at four locations (see **Table 1-1**) at existing track curves, which involves increasing the curve radii and shifting the centerline of the mainline track. These improvements would increase the allowable speeds of the curves.

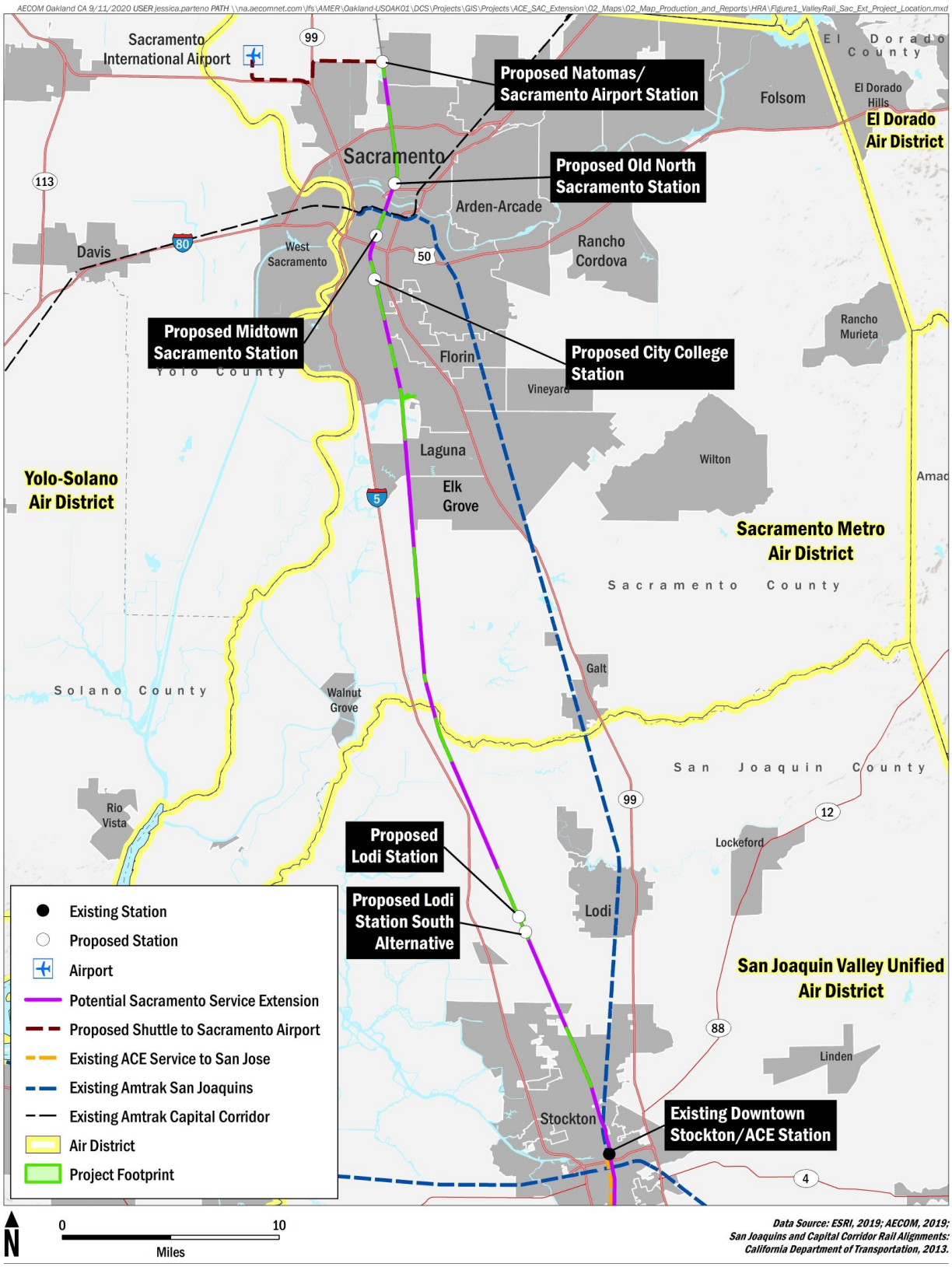
Upgrades to existing passing siding tracks and construction of new siding would accommodate the operational requirements UPRR needs to allow passenger service to run along the rail line. Upgrades at existing sites would occur at six sites, while new UPRR sidings are needed at two sites. **Table 1-1** provides the sites affected by these track improvements.

A new crossover track and signaling would be installed just south of the proposed City College Station to allow northbound and southbound passenger trains to pass, using the existing track siding south of the proposed station.

Table 1-1: Proposed Track Improvement Locations

Track Curve Reconstruction	Upgrades to Existing Passing Siding Track	New Passing Siding Tracks	New Crossover Track
• North of Elk Grove • Thornton • Hammer Lane • Existing Railroad Realignment	• Hammer Lane Siding Upgrade • Thornton Siding Upgrade/Extension • Phillips Siding Upgrade/Extension • Pollock Siding Upgrade • South Sacramento Siding Upgrade • Del Paso Siding Upgrade/Extension	• Lodi Siding Variants	• City College Station

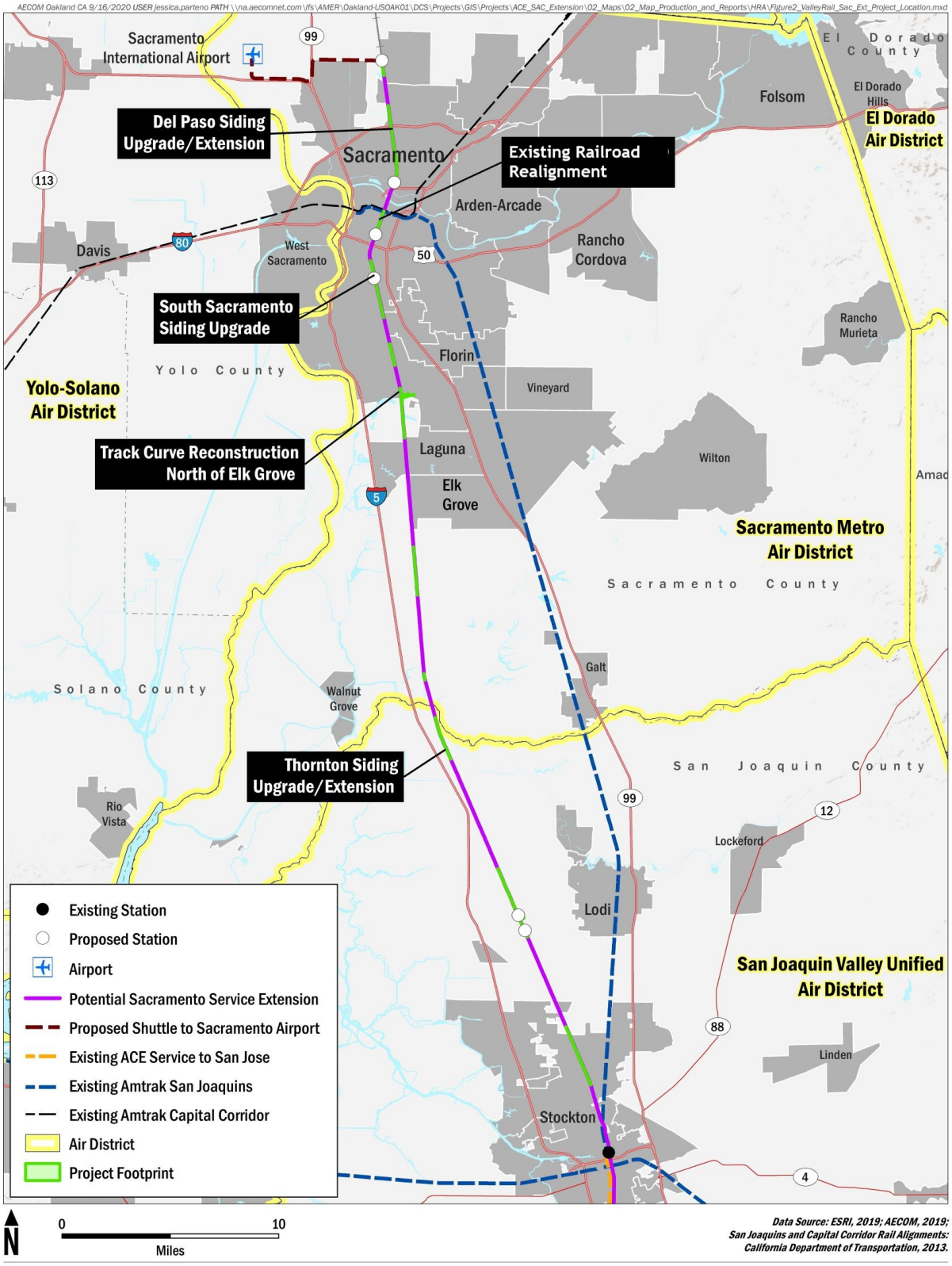
Figure 1-1: Project Stations



AECOM
San Joaquin Regional Rail Commission

Project Stations

Figure 1-2: Project Track Improvements



1.3. Health Risk Background

The United States Environmental Protection Agency (U.S. EPA) regulates hazardous air pollutants, also known as toxic air contaminants or TACs. Toxic air contaminants may be emitted by stationary, area, or mobile sources. Common stationary sources of toxic air contaminant emissions include gasoline stations, dry cleaners, and diesel backup generators, which are subject to the requirements of local air districts' permits. The other, often more substantial, sources of toxic air contaminant emissions are motor vehicles on freeways, on high-volume roadways, or in other areas with high numbers of diesel vehicles, such as distribution centers. Off-road mobile sources are also major contributors of toxic air contaminant emissions and include construction equipment, ships, and trains.

Toxic air contaminants collectively refer to a diverse group of air pollutants that are capable of causing chronic (i.e., long-duration) and acute (i.e., severe but short-term) adverse effects on human health, including carcinogenic effects. Human health effects of toxic air contaminants include birth defects, neurological damage, cancer, and mortality. There are hundreds of different types of toxic air contaminants with varying degrees of toxicity. The health risks of individual toxic air contaminants vary greatly; at a given level of exposure, one toxic air contaminant may pose a hazard that is many times greater than another.

Toxic air contaminants can be separated into carcinogens and noncarcinogens based on the nature of the effects associated with exposure to the pollutant. For regulatory purposes, carcinogens are assumed to have no safe threshold below which health impacts would not occur. Any exposure to a carcinogen poses some risk of contracting cancer. Noncarcinogens differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis.

Air pollution does not affect every individual in the population in the same way, and some groups are more sensitive than others to adverse health effects. Land uses such as residences, schools, daycare centers, hospitals, and nursing and convalescent homes are considered most sensitive to poor air quality, because the population groups associated with these uses are more susceptible to respiratory distress or, for residential receptors, their exposure time is greater than that for other land uses. Therefore, these groups are referred to as sensitive receptors.

1.4. Objective and Approach

The purpose of this Health Risk Assessment is to assess potential toxic air contaminant emission impacts associated with the proposed project. The analysis was conducted consistent with guidance and methodologies from local, regional, state and federal agencies, including the BAAQMD, CAPCOA, California ARB, OEHHA, SMAQMD MSAT Protocol, SJVAPCD, and the EPA.

This analysis evaluates health risk and hazard impacts of short-term construction and long-term operational emissions from the proposed project on existing offsite sensitive receptors within 500 feet of the proposed project emissions sources to determine the probability of contracting cancer over 70 years based on SJVAPCD guidance or 30 years based on SMAQMD guidance from two years of exposure. For construction, the project sources would exist within the proposed footprint of the rail station and along the track improvement sections (where applicable). There are discrete sites where construction would occur and, in many cases, there are existing residential areas or other sensitive land uses for which sensitive receptors were evaluated for potential health risk impacts from the proposed project. Construction and operations of the proposed project would occur throughout the length of the railway alignment between the existing Stockton ACE Station and the proposed Natomas/Sacramento Airport Station, which is

approximately 52-miles. Given the large number of construction sites and the various track alignments at each one, modeling all of them for operations would generally account for the majority of track alignments throughout the 52-mile line. As a result, every receptor used in the operational modeling runs were treated as sensitive. For operations, a 2-kilometer (km) (approximately 1.24-mile) segment along the track alignment (1 km to the north and south) was used to characterize the emissions over the rail line. The selected areas modeled serve as representative of other areas along the rail line that are in similar in their track orientation and meteorological conditions. Additional details on the source characterization and receptor placement are provided in Section 3.0.

For proposed rail stations that have alternatives (Lodi Station), only one of the options were modeled. The driving factors for only modeling one scenario of each of these stations included: (1) construction emissions and duration were the same; and (2) the track alignment did not change between the alternatives. For the proposed Lodi Station, the proposed alterative option was modeled. Modeling scenarios also included combining emissions from station and track improvements that would occur adjacent to or nearby each other and that are scheduled to occur in the same construction year, into a single model run, thereby presenting the maximum potential construction-related emissions that would be generated by the proposed project in those given locations. **Tables 1-2** and **1-3** list the station and track improvement construction and operational model scenarios.

Table 1-2: Construction Modeling Scenarios

Modeling Scenario	Stations/Track Improvements	Air District	Construction Year
Thornton	Thornton Siding Upgrade & Extension	SJVAPCD	2023
Lodi	Lodi Station; Lodi Siding		2021
North Elk Grove	Track Curve Reconstruction North of Elk Grove	SMAQMD	2021
City College	City College Station; South Sacramento Siding Upgrades		2023
Midtown Sacramento	Midtown Sacramento Station		2021
Old North Sacramento	Old North Sacramento Station		2023
Del Paso	Del Paso Siding Upgrade and Extension		2021
Natomas	Natomas/Sacramento Airport Station		2021

Notes: SJVAPCD = San Joaquin Valley Air Pollution Control District; SMAQMD = Sacramento Metropolitan Air Quality Management District.

Table 1-3: Operational Modeling Scenarios

Modeling Scenario	Station/Track Segment	Air District
Stockton	Stockton ACE Station	SJVAPCD
Thornton	Thornton Siding Upgrade & Extension	
Lodi	Lodi Station	
North Elk Grove	North Elk Grove Track Curve Reconstruction	SMAQMD
City College	City College Station	
Freeport Curve	Existing Railroad Realignment	
Midtown Sacramento	Midtown Sacramento Station	
Old North Sacramento	Old North Sacramento Station	
Natomas	Natomas/Sacramento Airport Station	

Notes: SJVAPCD = San Joaquin Valley Air Pollution Control District; SMAQMD = Sacramento Metropolitan Air Quality Management District.

1.5. Project Emissions Sources

This Health Risk Assessment evaluates the following sources of air pollutant emissions and exposures:

1. **Construction Emissions**: The proposed project's on-site construction-related emissions affecting local sensitive receptors within 500 feet of the respective construction area footprints. On-site emissions sources include off-road equipment and vehicles and diesel-powered locomotives idling on-site during the transport and delivery of rail materials.

2. **Operational Emissions**: The proposed project's operational emissions associated with the additional trains operating along the existing railway and at the proposed stations, affecting local sensitive receptors located with 500 feet of the project alignment. Operational emissions associated with the proposed Natomas/Sacramento Airport Station

2. Emissions Estimates

This Health Risk Assessment evaluates fine particulate matter (PM_{10}) emissions and emissions of diesel PM (assumed to be equivalent to PM_{10} exhaust). These emissions estimates are then used to evaluate the excess cancer and chronic non-cancer risk a receptor is exposed to as a result of the proposed project. This section identifies the methodologies used to estimate these $PM_{2.5}$ and PM_{10} exhaust emissions.

The proposed project construction and operational air pollutant emissions were quantified according to guidance and methods from SMAQMD, SJVAPCD, California Air Resources Board (ARB), and U.S. EPA as previously referenced above. The process for determining the parameters and assumptions used to model emissions, along with the modeling methods, are described below. While there would be other emissions of criteria air pollutants and greenhouse gases generated as a result of the proposed project, the following focuses on the modeling parameters and methodology used to estimate project-related emissions of $PM_{2.5}$ and PM_{10} exhaust.[2] A summary of the emissions used in this analysis is provided in Attachment A of this document.

2.1. Construction Emissions

On-site construction-related PM exhaust emissions would be generated by off-road construction equipment, including on-site operations of diesel-powered locomotives to transport and deliver rail materials. Construction would occur throughout the project alignment but would be phased over approximately three years. The construction of each project element would include site work, rail work, and structural work. It is assumed that certain elements of each of these activities could overlap in time. Thus, maximum daily emissions were estimated assuming the maximum potential overlap of supporting construction activities (i.e., assuming that the maximum use of equipment and related construction activities would occur in a single day). To conservatively estimate maximum daily emissions, calculations accounted for the potential overlap of maximum daily emissions from concurrent construction phases for individual project elements, as well as the potential for concurrent construction of project elements throughout the project alignment that are anticipated to be constructed within the same year. Total annual emissions were based on actual annual use of equipment related construction activities that could occur in a given year and was not always a multiplication of maximum daily emissions by total days of work per year.

In cases for which a project improvement includes both a proposed and alternative improvement, emissions were estimated for all alternatives. To demonstrate the maximum daily and maximum annual emissions scenarios, the greater of the emissions estimates from a proposed versus alternative improvement were used. The HRA modeling scenarios presented in this report applied mitigated emissions estimates, as mitigation would be required to reduce construction-related mass emissions to levels that would not exceed the respective air district recommended thresholds of significance, irrespective of the HRA findings. Applied mitigation would require that off-road equipment greater than 25 horsepower used during construction and diesel-powered locomotives be powered by engines that meet or exceed Tier 4 emissions standards. Unmitigated and mitigated emissions estimates and detailed estimating methodology and calculations are provided in Appendix B-1.

[2] Emissions estimating methodology for non-DPM sources of criteria air pollutant and greenhouse gas emissions is available in Sections 3.3, "Air Quality," and 3.8, "Greenhouse Gas Emissions," of the Valley Rail Sacramento Extension Project EIR, respectively. Detailed modeling inputs, assumptions, and emissions estimate calculations are available in Appendix B of the Valley Rail Sacramento Extension Project EIR.

The following details the methodology for estimating exhaust PM emissions that would be generated by construction of the proposed project.

- **Off-road equipment:** Emission factors from off-road construction equipment were obtained from the California Air Pollution Control Officers Association's (CAPCOA) California Emissions Estimator Model (CalEEMod) (version 2016.3.2) User Guide, which provides values per unit of activity by calendar year for each pollutant for each equipment type. Construction emissions from the operation of diesel-fueled off-road equipment were estimated by multiplying construction equipment usage information by the equipment-specific emissions factors, based on aggregate model years and horsepower used in CalEEMod, which are derived from the California Air Resources Board's OFFROAD[3] emissions inventory model. To conservatively estimate potential emissions, emission factors were based on an aggregate equipment fleet mix for the year 2021 (the earliest potential year of construction). The equipment inventory was developed with consideration for project-specific elements; where project-specific details were not available, CalEEMod default data was used.

- **Locomotives:** Emissions from diesel-powered locomotives used to transport rail materials during construction were quantified using EPA's 2009 locomotive engine emission standards and project-specific activity data (EPA, 2009). These locomotives were assumed to utilize a 1,500 horsepower, Tier 1 engine.

- **On-site vehicles: C**onstruction would include the use of on-site work trucks. Exhaust emission factors from on-site vehicles were obtained from the CARB Emission FACtor (EMFAC) model, EMFAC2017. Emission factors for on-site on-road vehicle use were based on 5 miles per hour (mph) emission rates for the aggregate model year of the fleet in the year 2021 (the earliest potential year of construction). The estimated maximum daily number and activity (hours on-site) of on-road vehicles to be used during each construction activity phase was a project-specific data input. Maximum daily on-site exhaust emissions from on-road motor vehicles were estimated by multiplying the appropriate emission factors by the project-specific on-road vehicle inventory. Emission factors for gasoline-powered light duty vehicles within the on-site vehicle fleet mix were adjusted using CARB's Off-model Adjustment Factors to account for the Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Par One: One National Program, adopted by the USEPA and the National Highway Traffic Safety Administration in 2019.

Total construction-related emissions for each project element used for the purposes of this Health Risk Assessment are summarized in **Table 2-1**.

[3] OFFROAD is ARB's emissions inventory database for off-road diesel engines, used to quantify the amount of pollutants from thousands of engines in equipment used in industrial applications, agriculture, construction, mining, oil drilling, power generation, and many other industries. The OFFROAD emission factors provided within the California Emissions Estimator Model (CalEEMod, Version 2016.3.2) were used to generate emission factors for the different types of equipment anticipated to be used by the proposed project. CalEEMod (Version 2016.3.2) is the statewide model recommended for use to quantify criteria air pollutant emissions.

Table 2-1: On-site Construction-Related Emissions for Each Station and Track Improvement Site

Project Element	Construction Start Year	Construction Duration (months)	Total PM_{10} Exhaust (pounds)
LODI STATION	2021	14	
Off-Road Equipment & Locomotive			26.88
On-site Vehicles			2.71
Total			*29.59*
THORNTON SIDING UPGRADE & EXTENSION	2023	4	
Off-Road Equipment & Locomotive			9.15
On-site Vehicles			0.48
Total			9.63
LODI SIDING	2021	8	
Off-Road Equipment & Locomotive			18.29
On-site Vehicles			0.97
Total			19.25
CITY COLLEGE STATION	2023	8	
Off-Road Equipment & Locomotive			22.07
On-site Vehicles			1.32
Total			23.38
MIDTOWN SACRAMENTO STATION	2021	12	
Off-Road Equipment & Locomotive			28.20
On-site Vehicles			2.07
Total			30.28
OLD NORTH SACRAMENTO STATION	2023	14	
Off-Road Equipment & Locomotive			37.32
On-site Vehicles			2.82
Total			40.14
NATOMAS / SACRAMENTO AIRPORT STATION	2021	12	
Off-Road Equipment & Locomotive			27.57
On-site Vehicles			1.82
Total			29.39
TRACK CURVE RECONSTRUCTION NORTH OF NORTH ELK GROVE	2022	1	
Off-Road Equipment & Locomotive			2.30
On-site Vehicles			0.12
Total			2.42

Project Element	Construction Start Year	Construction Duration (months)	Total PM_{10} Exhaust (pounds)
SOUTH SACRAMENTO SIDING UPGRADE	2023	4	
Off-Road Equipment & Locomotive			10.97
On-site Vehicles			0.48
Total			11.44
DEL PASO SIDING UPGRADE & EXTENSION	2021	12	
Off-Road Equipment & Locomotive			34.98
On-site Vehicles			2.15
Total			37.13

Source: Modeled by AECOM in August 2020.
Note: For detailed emissions modeling inputs and calculations, see Appendix B-1.

2.2. Operational Emissions

Operational emissions sources from the proposed project that were evaluated as a part of this Health Risk Assessment include locomotive emissions from passenger rail service from the existing Stockton Downtown/ACE Station to the proposed Natomas/Sacramento Airport Station, inclusive of stops at the proposed new stations along the route, and on-road vehicle emissions from the proposed shuttle bus between the proposed Natomas/Sacramento Airport Station and the Sacramento International Airport. The following details the methodology for estimating operational exhaust PM emissions that would be generated by activities associated with the proposed project.

- **Passenger Train Operations:** The proposed new passenger rail service would result in diesel fuel combustion and associated criteria pollutant emissions from train activity. Daily one-way trips are anticipated to include the extension of existing train lines that currently go to Stockton, as well as the initiation of new trips between Stockton and Natomas, for a total of 14 one-way trips between the existing Stockton Downtown/ACE Station and the proposed Natomas/Sacramento Airport station.

  Diesel locomotive engine power is controlled by "notched" throttles. Idling, braking, and moving the locomotive is conducted by placing the throttle in one of several available "notch" settings. A locomotive's duty cycle is a description of how much, on average, the locomotive spends in each notch setting while operating. PM emission factors for calculations were based on EPA's 2009 Emission Factors for Locomotives Technical Highlights (EPA-240-F-09-025). Emission standards are defined per unit of activity (in grams per horsepower-hour) for Tier 4 engines. Emissions were estimated using operational hours estimates for the new passenger train operations that would result from the proposed project, inclusive of idling time at each station. Daily criteria pollutant emissions were annualized conservatively assuming 365 operating days per year. Emissions were apportioned to SJVAPCD and SMAQMD based on the number of track miles within each air district.

  As noted previously, this Health Risk Assessment uses a 2-km (approximately 1.24-mile) segment at identified representative station and other railway locations along the track alignment was used to characterize the emissions over the rail line. Accordingly, operational emissions were estimated

for the representative 2-km alignment segments. These emissions were further broken down into those emissions associated with the longer duration of time spent travelling at slower speeds, and the time spent travelling at higher speeds within the 2-km segment as a train approaches and departs a station; this was used to weight the distribution of emissions throughout the 2-km segment and present the maximum potential impact in areas where the higher proportion of operational emissions would occur.

- **Shuttle Bus Operations:** The proposed shuttle bus from the Natomas/Sacramento Airport Station to the Sacramento International Airport would generate emissions from on-road travel. The shuttle bus was assumed to operate 7 round-trips per day. Exhaust emission factors were obtained from EMFAC2017. Emission factors were based on emission rates for aggregate speed and model year for the Urban Bus vehicle category, assuming a diesel-powered bus. Maximum daily exhaust emissions were estimated by multiplying the emission factors by the anticipated daily VMT (daily trips x trip distance).

Operational emissions that would be generated by the proposed project within the representative modeling domains described above and used for the purposes of this Health Risk Assessment are summarized in **Table 2-2**.

Table 2-2: Operational Emissions within the Modeling Domain of Representative Locations along the Proposed Project Alignment

Operational Source	Exhaust PM_{10} (pounds per year)
Passenger Train Operations (2-km segment)	9.9593
Shuttle Bus Operations	0.3573

Source: Modeled by AECOM in August 2020.
Note: for detailed emissions modeling inputs and calculations, see Appendix B-1.

3. Air Dispersion Modeling

The American Meteorological Society/U.S. EPA Regulatory Model (AERMOD) dispersion model (Version 19191) was used to estimate pollutant concentrations at specific distances from project emission sources, in conjunction with representative meteorological data. The meteorological dataset varied based on the location of the proposed station and track improvement. Three meteorological sites were selected based on their proximity to the proposed project. These included; Stockton Metropolitan Airport, Sacramento Executive Airport, and Sacramento International Airport. **Figure 3-1** shows the three meteorological airport sites relative to the proposed project sites. **Table 3-1** summarizes the meteorological datasets selected for each station and track improvement.

Table 3-1: Selection of Meteorological Data for Each Station and Track Improvement Site

Stockton Metropolitan Airport	Sacramento Executive Airport	Sacramento International Airport
• Stockton ACE Station • Thornton Track Improvements • Lodi Station & Track Improvements	• Track Curve Reconstruction North of Elk Grove • City College Station • South Sacramento Track Improvements • Existing Railroad Realignment • Midtown Sacramento Station	• Old North Sacramento Station • Del Paso Track Improvements • Natomas/Sacramento Airport Station

The Stockton Metropolitan Airport meteorological data was obtained from the SJVAPCD FTP[4] server for a five-year period from 2013 through 2017. Both the Sacramento Executive and Sacramento International airport meteorological data were obtained from SMAQMD's CEQA Guidance & Tools website (SMAQMD 2020) for a five-year period from 2014 through 2018. All three of these datasets were processed by the respective air districts in model-ready format. The selection of the three meteorological stations for the project sites are consistent with guidelines issued by ARB (ARB, 2017) and U.S. EPA Appendix W (U.S. EPA, 2017) and is described in more detail below.

3.1. Selection of Representative Meteorological Data

As depicted in **Figure 3-1**, construction and operation of the proposed project would occur in two counties: San Joaquin County and Sacramento County. The proposed project sites in San Joaquin County include: the Stockton ACE Station (note that there are no proposed improvements at this station, but operations would include an increase in passenger train activity), Thornton track improvements, and Lodi Station. The existing Stockton ACE Station is located approximately 4 miles to the north of the Stockton Metropolitan Airport with only flat terrain separating the two. The proposed Lodi Station and Thornton track improvements would be approximately 13 miles and 20 miles to the north-northwest of the Stockton Metropolitan Airport, respectively. This meteorological station is still the closest in proximity for these two sites with little to no elevated terrain obstructions between them and the airport. **Figure 3-2** shows the 5-year (2013-2017) near-surface wind pattern for Stockton Metropolitan Airport. For these reasons along with these three proposed project sites being in San Joaquin County, the Stockton Metropolitan Airport is representative for dispersion modeling.

[4] File Transfer Protocol (FTP) is a standard network protocol used to transfer electronic files between a client and a server.

The remaining sites in Sacramento County are located either north or south of the American River. This water feature served as a natural divider in selecting either the Sacramento International or Sacramento Executive airports in this county. To the north of the American River, the proposed Natomas/Sacramento Airport Station is approximately 5 miles due east of the Sacramento International Airport. Only a few miles to the south of Natomas, are the proposed track improvement site of Del Paso and the Old North Sacramento Station. **Figure 3-3** shows the 5-year (2014-2018) near-surface wind pattern for the Sacramento International Airport. Given the proximity and generally flat surroundings, the Sacramento International Airport is the most representative meteorological dataset for proposed project elements north of the American River.

The proposed Track Curve Reconstruction North of Elk Grove, City College Station, Midtown Sacramento Station, and South Sacramento and Existing Railroad Realignment track improvements are all located south of the American River and east of the Sacramento River. The Sacramento Executive Airport is situated within about 4 miles from all these proposed sites and is also located south and east of the American and Sacramento Rivers, respectively. The 5-year (2014-2018) near surface wind pattern, shown in **Figure 3-4**, appears to capture the localized influence of the two rivers with the predominant flows being nearly parallel to the two water features. Therefore, the most representative meteorological station to use for modeling for the group of proposed project elements in Sacramento County to the south of the American River is the Sacramento Executive Airport.

3.2. Receptor Locations

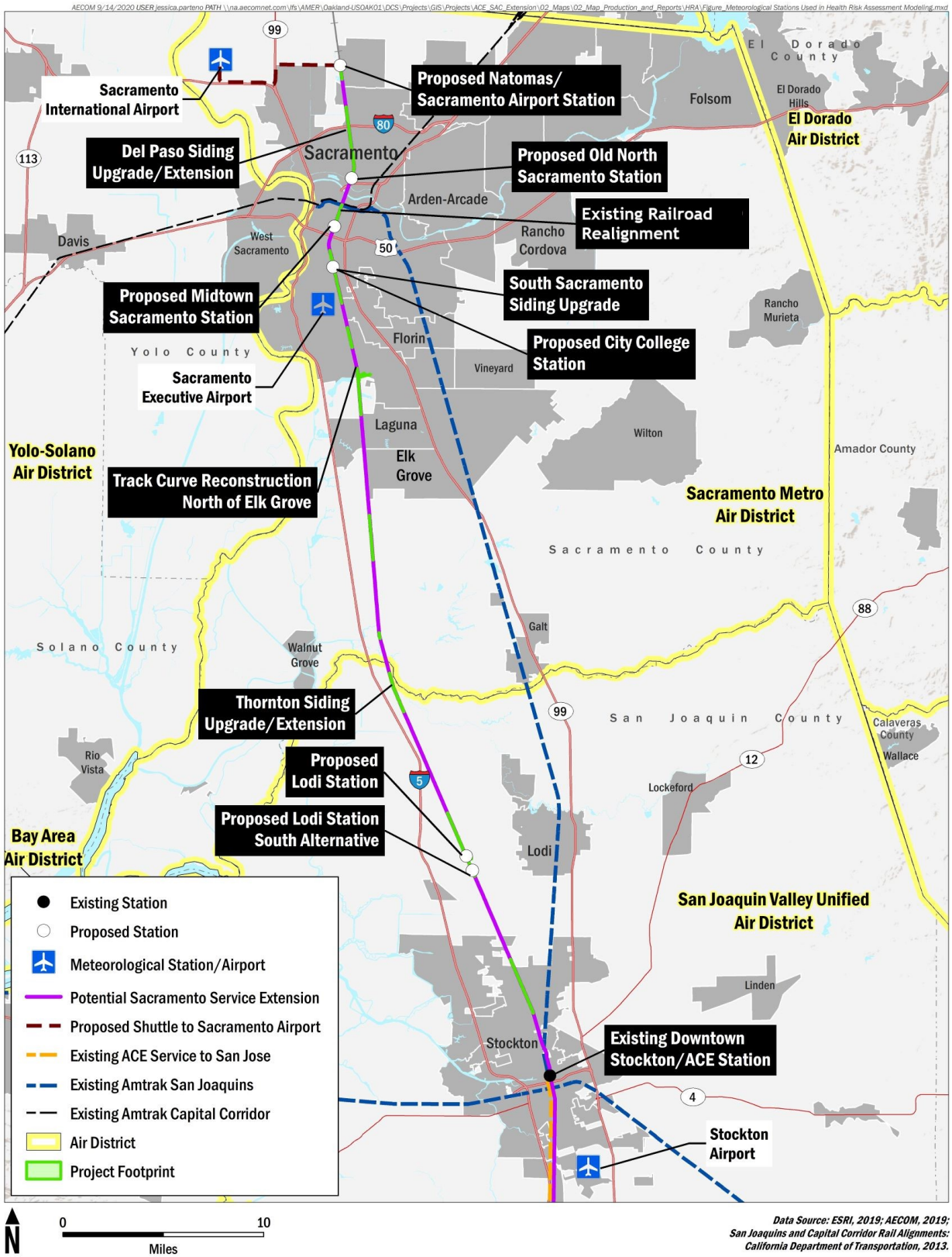
Receptors were placed within 500 feet of the rail alignment along sections undergoing track improvement construction and within 500 feet of station construction. The closest receptors were placed 30 feet from the center of the track alignment then extended outward at 70[5], 100, 150, 200, 250, 300, 350, 400, 450 and 500 feet, consistent with SJVAPCD guidance. In the event a residential dwelling, school or childcare center was identified to fall just outside the 500-foot distance, a discrete receptor was added to the modeling grid for that site to ensure it was captured in the modeling analysis. The receptors were assigned a flagpole height of 5.9 feet (1.8 meters) for the ground-level residences.

Figure 3-5 provides an example of the receptor grid used for the construction of the proposed City College Station and track improvements. Receptor figures for all the sites modeled are provided in **Attachment A** to this document.

Terrain elevations were obtained from commercially available digital terrain elevations developed by the U.S. Geological Survey by using its National Elevation Dataset. The National Elevation Dataset data provide terrain elevations with 3.28-feet (1-meter) vertical resolution and 32.81-feet (10-meter) (1/3 arc-second) horizontal resolution based on a Universal Transverse Mercator (UTM) coordinate system. The U.S. Geological Survey specifies coordinates in North American Datum 83, UTM Zone 10. Lakes Environmental software was used to process the National Elevation Dataset data and assign elevations to the receptor locations and sources.

[5] SJVAPCD guidance recommends distance of 75 feet, but for ease of generating the receptor grid, multiples of 10 were used and a slightly closer distance at 70 feet was selected.

Figure 3-1: Locations of Meteorological Stations Relative to Project Sites



AECOM
San Joaquin Regional Rail Commission

Meteorological Stations Used in Health Risk Assessment Modeling

Figure 3-2: 5-Year (2013-2017) Wind Rose for Stockton Metropolitan Airport

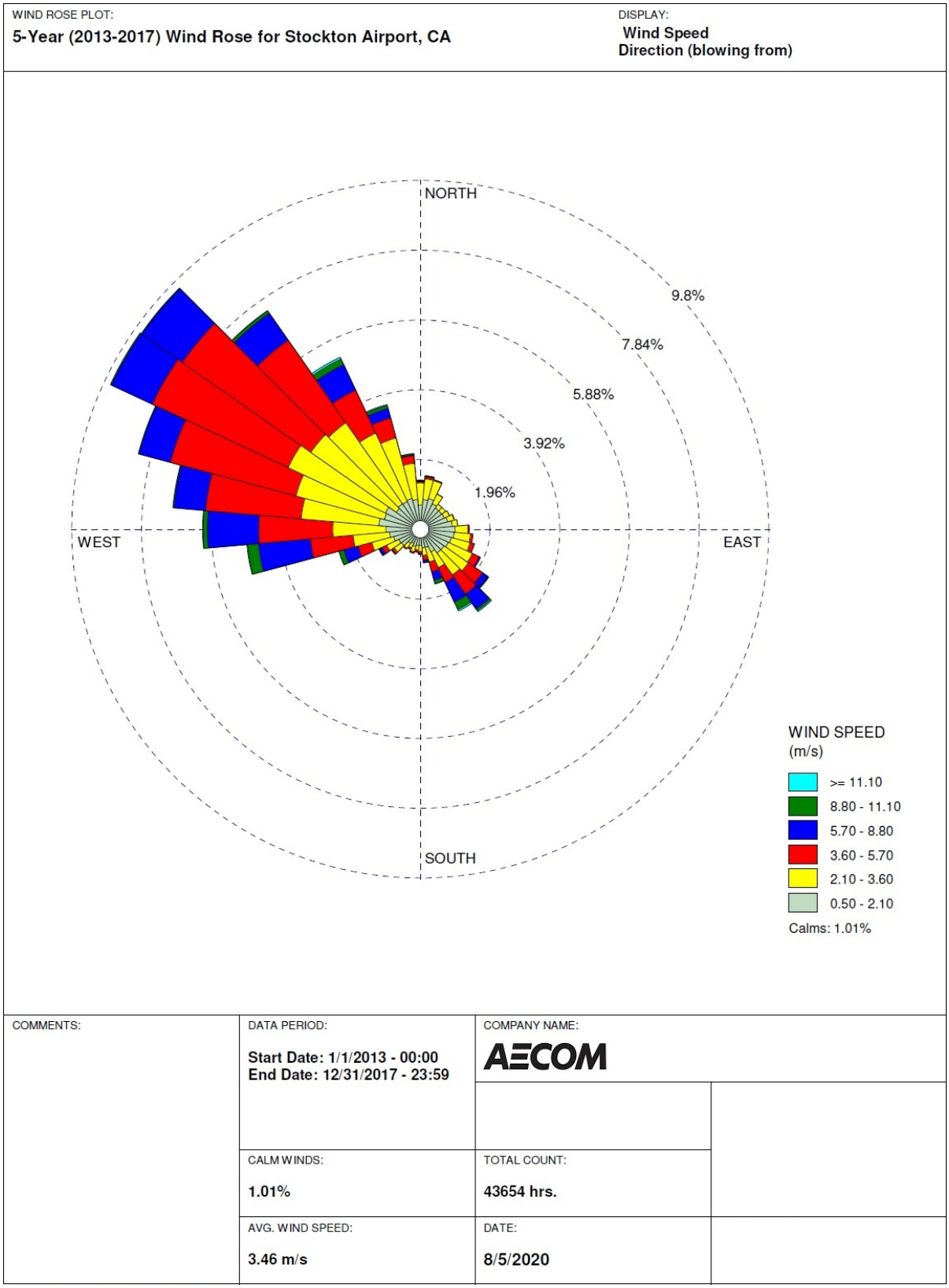


Figure 3-3: 5-Year (2013-2017) Wind Rose for Sacramento International Airport

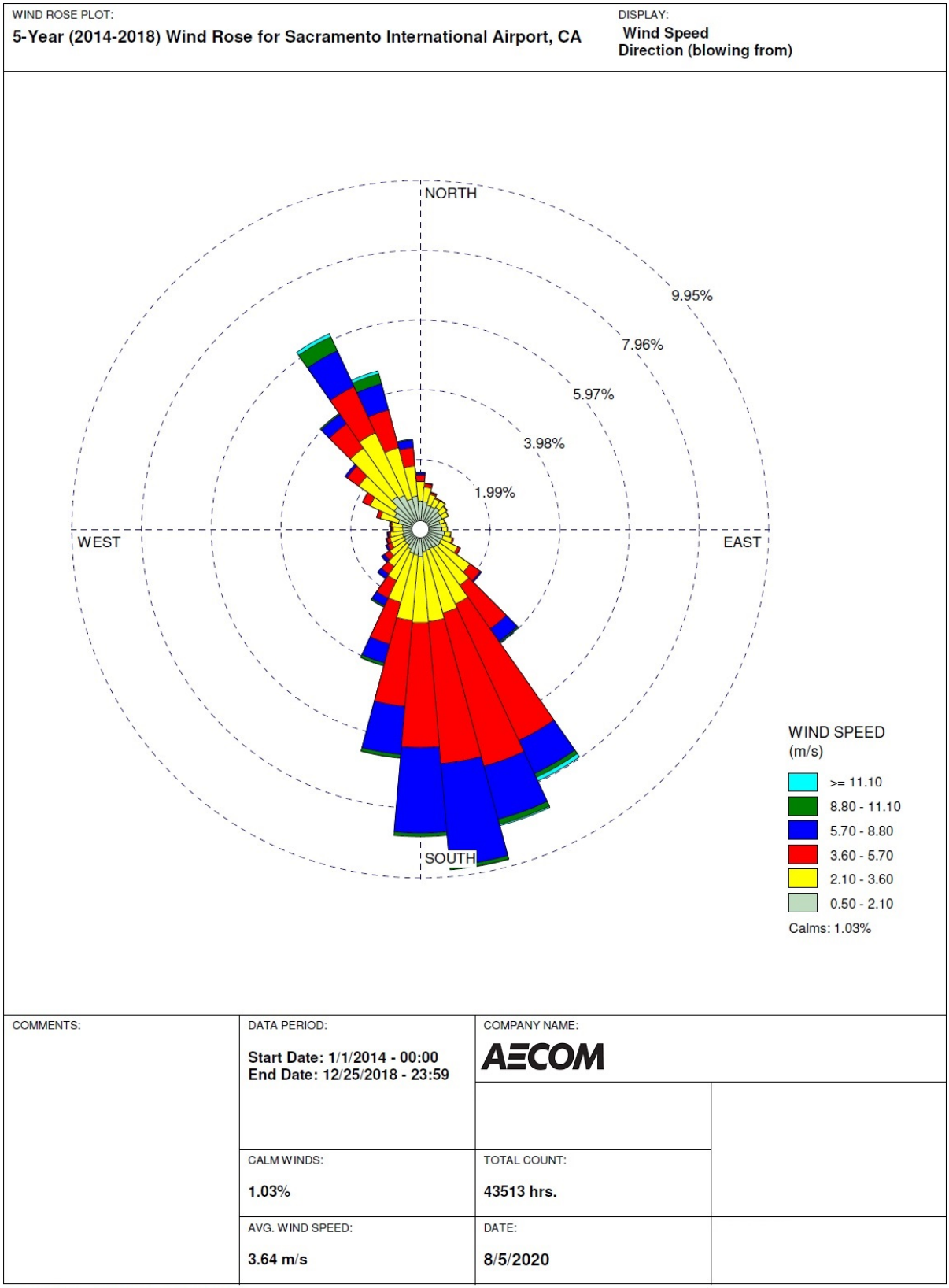


Figure 3-4: 5-Year (2013-2017) Wind Rose for Sacramento Executive Airport

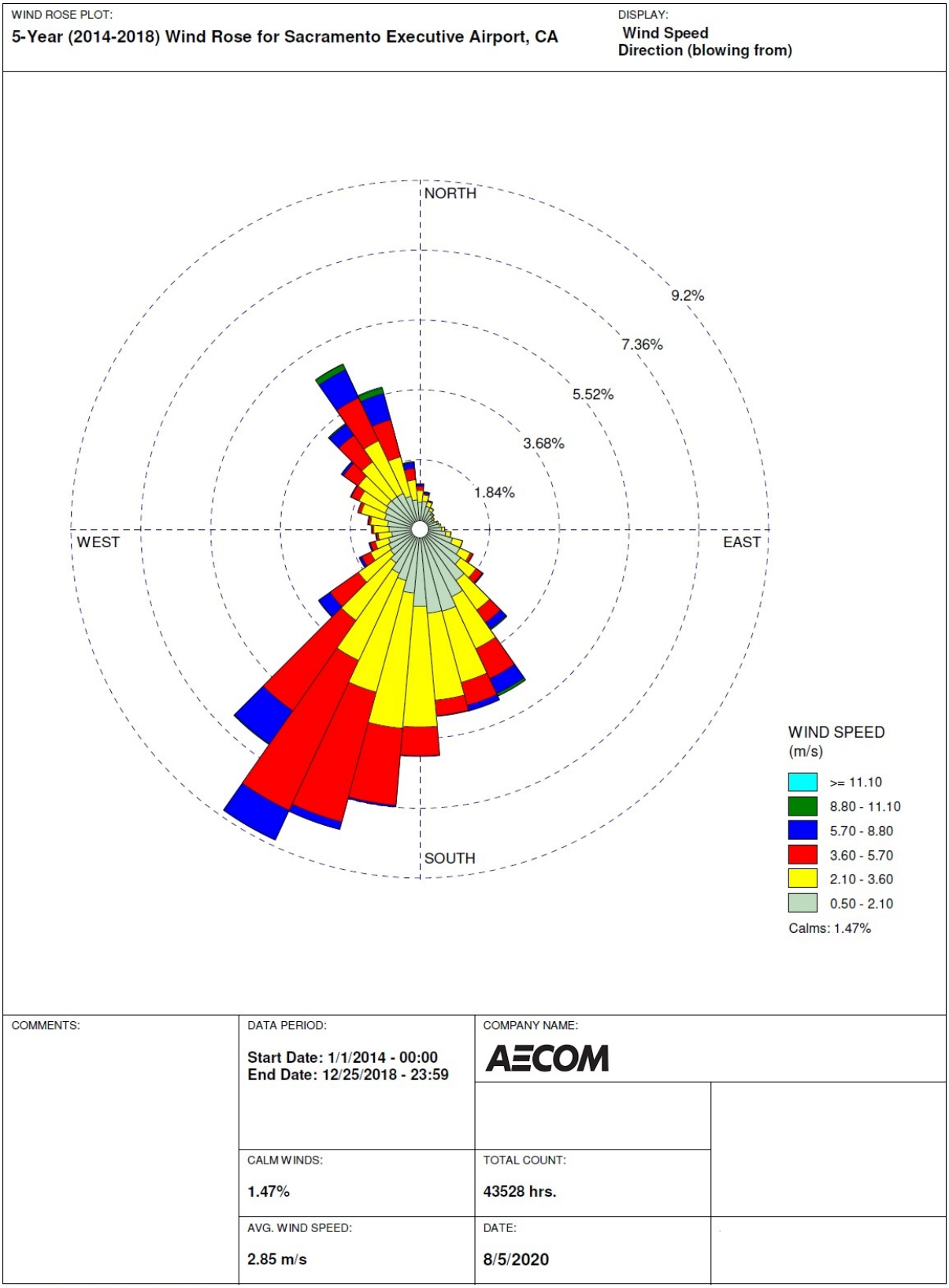
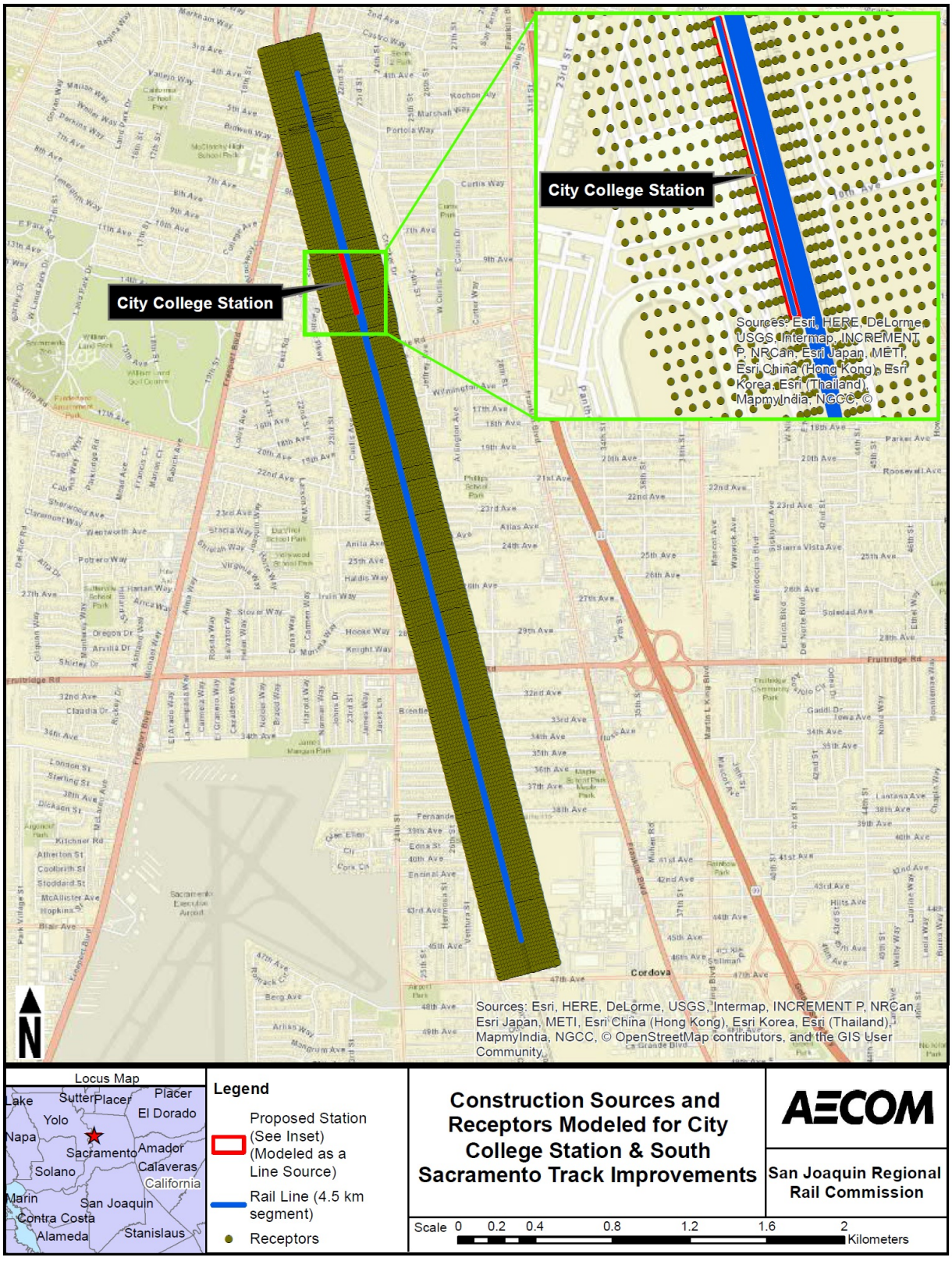


Figure 3-5: Receptor Grid and Sources Modeled for the Construction of City College Station and Track Improvements



3.3. Construction Sources

Construction of the rail stations were represented by adjacent volume sources in the model. These adjacent volume sources were placed over the proposed project site footprint where structures or parking areas would be developed. The South Coast Air Quality Management District (SCAQMD, 2008) provides detailed guidance on lateral dimensions and release height for adjacent volume sources used for construction activities. Consistent with this guidance, the release height of these sources was set to 16.4 feet (5 meters) and an initial vertical dimension of 4.59 feet (1.4 meters). The lateral dimension of each volume source depended on the size of the construction area. For areas greater than 5 acres, the lateral dimension was set to 65.62 feet (20 meters). For areas less than 5 acres, the lateral dimension was set to 32.81 feet (10 meters). Figures showing the location of the proposed stations with the adjacent volume sources are provided for each modeled site in **Attachment A (Figures A-1** through **A-8)**.

For the source characterization along-track improvements (i.e. siding upgrades and extensions), the guidance is slightly different between SJVAPCD and SMAQMD. As a result, sources representing track improvements were tailored to the respective air district guidance for each specific location. Lodi and Thornton are located within SJVAPCD. Sites within SMAQMD receiving track improvements include North Elk Grove, South Sacramento, and Del Paso. Site-specific details are provided in the following sub-sections.

Construction for both stations and track improvement activities are anticipated to occur Monday through Friday from 7 a.m. to 5 p.m. Occasional night-time (5 p.m. to 7 a.m.) and weekend construction activities are possible. To account for this night-time and weekend work, 10% of normal weekday, daytime activity was assumed. The AERMOD EMISFACT (emission factor) hour-day-of-week (HRDOW) keyword was used to mimic this construction hour schedule.

3.3.1. LODI SIDING

The track siding improvement activity in the vicinity to the proposed Lodi Station was represented by adjacent line volume sources. This activity is along a single track for a total length of approximately 3.7 miles (6 km). The lateral dimension of each volume source was 29.9 feet (9.1 meters), which considers 10.2 feet (3.1 meters) for the track width and 9.84 feet (3 meters) on either side of the track to account for turbulent wake affects, consistent with SJVAPCD guidance. Since the construction equipment would be similar is nature to that used for the stations, an initial vertical dimension of 4.59 feet (1.4 meters) was used. The length of the adjacent volume line source equaled the length of the proposed section of track improvements, which is approximately 3.7 miles (6 km). **Figure A-1** (**Attachment A of this Health Risk Assessment**) shows the placement of these adjacent volume sources. Total siding emissions were divided among the total number of volumes, which adequately accounts for the increased emissions in those areas with multiple tracks (refer to **Table A-1**).

3.3.2. THORNTON SIDING

The track siding improvement activity at Thornton was represented by adjacent line volume sources. This activity is along a single track for a total length of approximately 2.1 miles (3.3 km). The lateral dimension of each volume source was 29.9 feet (9.1 meters), which considers 10.2 feet (3.1 meters) for the track width and 9.84 feet (3 meters) on either side of the track to account for turbulent wake affects, consistent with SJVAPCD guidance. Since the construction equipment would be similar is nature to that used for the stations, an initial vertical dimension of 4.59 feet (1.4 meters) was used. The length of the adjacent volume line source equaled the length of the proposed section of track improvements, which is approximately 2.1 miles (3.3 km). **Figure A-2** shows the placement of these adjacent volume sources. Total siding emissions

were divided among the total number of volumes, which adequately accounts for the increased emissions in those areas with multiple tracks (refer to **Table A-2**).

3.3.3. SOUTH SACRAMENTO SIDING

The siding activity at South Sacramento is along a single track extending for a total length of 2.86 miles (4.6 km). Siding along a second track will cover 2.5 miles (4 km) of the 2.86-mile length. Siding activity along an additional 2 tracks will take place in the vicinity of the proposed College City station and platform for a total of 4 tracks in that area. The lateral dimension of each volume source at these locations was 9.84 feet (3 meters). A 6.56-foot (2 meter) gap was added for Del Paso since two tracks exist and SMAQMD guidance recommends adding a 6.56-foot distance to the track widths for modeling. An initial vertical dimension of 4.59 feet (1.4 meters) was used, consistent with the sources modeled in SJVAPCD. The length of the adjacent volume line source equaled the length of the proposed section of track improvements, which varied from location. **Figure A-4** shows the placement of these adjacent volume sources. Total siding emissions were divided among the total number of volumes, which adequately accounts for the increased emissions in those areas with multiple tracks (refer to **Table A-4**).

3.3.4. DEL PASO SIDING

The track improvements at the Del Paso site is along a single track extending for a total length of approximately 4.2 miles (6.7 km). The siding activity is almost exclusively adjacent or north of the proposed Old North Station, with the exception of approximately 426 feet (130 m) of track to the south. A 6.56-foot (2 meter) gap was added for Del Paso since two tracks exist and SMAQMD guidance recommends adding a 6.56-foot distance to the track widths for modeling. An initial vertical dimension of 4.59 feet (1.4 meters) was used, consistent with the sources modeled in SJVAPCD. The length of the adjacent volume line source equaled the length of the proposed section of track improvements, which was 4.2 miles for Del Paso. **Figure A-7** shows the placement of these adjacent volume sources. Total siding emissions were divided among the total number of volumes, which adequately accounts for the increased emissions in those areas with multiple tracks (refer to **Table A-6**).

3.4. Operational Sources

Operational emission sources evaluated in this dispersion modeling included passenger train activities, such as locomotive movement and idling and connecting shuttle service. Operational emissions were modeled as adjacent line volume sources along a 1.24-mile (2 km) segment along the rail line. For sites that involved the construction of a new rail station, the center of the 1.24-mile segment was centered at the station (meaning 0.62 miles (1 km) extended to the north and south of the station). This approach is consistent with the ACE Extension Lathrop to Ceres/Merced EIR health risk analysis (SJRRC 2018, Section 4.3). For sites that did not include a new station (Thornton and Existing Railroad Realignment), a 1.24-mile (2 km) segment was modeled.

As previously discussed in Section 3.3, guidance on source parameterization of rail line sources differs slightly between SJVAPCD and SMAQMD. These have been applied in a similar manner for the operations emissions associated with the locomotives. Figures of the operational 1.24-mile (2-km) track segments are provided in **Attachment A (Figures A-9** through **A-16)** along with **Tables A-8** through **A-15** summarizing the adjacent line volume sources used to represent these emissions.

Operational emissions are almost entirely comprised of exhaust from the locomotives traveling along the proposed project rail line. Throughout a trip, the speed of the train would vary (i.e. travel faster between stations and travel slow or idle at or in the vicinity of stations). As part of a supplemental analysis of TAC

impacts from Caltrain sources prepared by Illingworth and Rodkin, Inc. (Illingworth & Rodkin, 2017) for a Health Risk Assessment in Redwood City, CA, train speed was factored into the emission calculation. Similarly, the consideration of train speed was applied for this proposed project. Within approximately 0.75 miles (1,200 meters) of any station, train speed was assumed to be slower and would be assigned the low-speed train emission rate (as discussed in Section 2). For the 0.25-mile (400 meter) track segments beyond the 0.75-mile segment, train speed was assumed to be higher and assigned the high-speed train emission rate (as discussed in Section 2).

The only non-locomotive exhaust emission source for operations are the shuttle buses that would connect travelers between the Natomas/Sacramento Airport Station and the airport. This source was represented as an adjacent line volume source in the model with a total length of approximately 3.2 miles (5.1 km). The route modeled from the rail station access road, located off West Elkhorn Boulevard, then west along West Elkhorn Boulevard to State Route 99. The lateral dimension of each volume source was 12 feet (3.65 meters), which is equal to the width of the roadway. An initial vertical dimension of 10.5 feet (3.2 meters) was used. **Table A-15** summarizes the volume source parameters for the shuttle bus source.

4. Health Risk Analysis Methodology

4.1. Pollutant Concentrations

Emissions from the sources described in Sections 3.3 and 3.4 were run in AERMOD to determine air pollutant concentrations at sensitive receptor locations. AERMOD was run using unit emissions. Each source was modeled assuming emissions of 1 gram per second (g/s) divided by the number of volume sources in a rail line segment, or 1 g/s divided by the number of adjacent sources within a station construction area. The unitized AERMOD results for each source are output in $\mu g/m^3$ per g/s [$(\mu g/m^3)(g/s)^{-1}$]. Maximum hourly and period-average plot files generated by AERMOD as described above were input to HARP2[6] with corresponding toxic air contaminant emission rates for construction as well as the project operational emissions to calculate project pollutant concentration contributions. These concentrations were then used to estimate the long-term effects of toxic air contaminants on nearby existing sensitive receptor locations.

4.2. Receptor Exposure and Health Risk Calculations

Exposure factors were used to calculate the dose associated with exposure to the estimated unit concentration results obtained using AERMOD. California Air Resources Board created the HARP2 software to assist in the development of emissions inventories, dispersion modeling, and risk assessment. For this project, HARP2 was used solely to estimate cancer risk via HARP2's Air Dispersion Modeling and Risk Tool (ADMRT), Version 19121; ADMRT was developed to encapsulate the exposure factors and guidance of the 2015 OEHHA Health Risk Assessment (OEHHA, 2015). AECOM evaluated the probability of contracting cancer over 30 years for resident receptors through the inhalation, soil ingestion, mother's milk, and homegrown produce pathways, using the OEHHA-Derived Method. The 1-year or less construction period of each project site was also evaluated for cancer risk for the existing nearby sensitive receptors.

Factors that affect the dose that a receptor would receive include but are not limited to age-specific daily breathing rates as well as exposure time, frequencies, and duration. The general formula for calculating residential inhalation risk is as follows:

$RISK_{inh\text{-}res} = DOSE_{air} \times CPF \times ASF \times ED/AT \times FAH$

Where:

$RISK_{inh\text{-}res}$ = Residential inhalation cancer risk

$DOSE_{air}$ = Daily inhalation dose (milligrams/kilogram [mg/kg]-day)

CPF = Inhalation cancer potency factor ($mg/kg\text{-}day^{-1}$)

ASF = Age sensitivity factor for a specified age group (unitless)

ED = Exposure duration (in years) for a specified age group

[6] The Hotspots Analysis and Reporting Program (HARP) is a software suite that addresses the programmatic requirement of the Air Toxics "Hot Spots" Program (Assembly Bill 2588). HARP incorporates the information presented in the 2015 Air Toxics Hotspots Program Guidance Manual.

AT = Averaging time for lifetime cancer risk (years)

FAH = Fraction of time spent at home (unitless)

The inhalation risk was calculated in HARP2 using the OEHHA 2015 recommended default values for these parameters:

CPF = Substance-specific

ASF = 10 for 3rd trimester of pregnancy to age 2, 3 for age 2 to 16, 1 for age 16 to 30

ED = 0.25 years for 3rd trimester, 2 years for age 0 to 2,

AT = 70 years (for sites within SJVAPCD) and 30 years (for sites within SMAQMD)

FAH = 1.0 (no adjustment)

The daily inhalation dose is defined as:

$DOSE_{air} = C_{air} \times \{BR/BW\} \times A \times EF \times 10^{-6}$

Where:

$DOSE_{air}$ = Dose through inhalation (mg/kg-day)

C_{air} = Concentration in air ($\mu g/m^3$)

{BR/BW} = Daily Breathing rate normalized to body weight (Liters/kilogram body weight - day)

A = Inhalation absorption factor (unitless)

EF = Exposure frequency (unitless), days/365 days

10^{-6} = Micrograms to milligrams conversion, liters to cubic meters conversion

The daily inhalation dose is calculated in HARP2 using OEHHA 2015 recommended default values for these parameters:

C_{air} = Concentration as calculated from AERMOD

{BR/BW} = RMP derived method (i.e., 95th percentile) estimates (361 for 3rd trimester of pregnancy, 1090 for age 0 to 2, 745 for age 2 to 16, 335 for age 16 to 30)

A = 1

EF = 0.96 (350 days/365 days in a year for a resident)

4.3. Health Risk Thresholds for SMAQMD

The SMAQMD does not recommend any particular health risk or concentration-based thresholds and instead defers to the local jurisdiction to determine appropriate risk levels. However, the neighboring air district, the Bay Area Air Quality Management District (BAAQMD, 2012), does recommend project-specific and cumulative cancer risk thresholds of 10 and 100 in a million, respectively. A chronic non-cancer Hazard Index of less than 1.0 is also recommended. Therefore, the health risks for excess cancer and chronic non-cancer associated with construction and operations of the proposed project that would take place within the SMAQMD jurisdictional boundary were compared against the BAAQMD thresholds for construction and operation phases separately.

SMAQMD has developed the MSAT Protocol as guidance to local land use jurisdictions for assessing and disclosing potential cancer risk and $PM_{2.5}$ concentrations from major roadways and railways. The MSAT Protocol includes a risk mapping tool, guidance document, and detailed methodology document. The mapping tool does not reflect existing features on or adjacent to the location of interest that may reduce reported risk such as barriers, vegetative plantings, or enhanced indoor air filtration. **Table 4-1** presents a range of the modeled potential increase in cancer risk due to major roadways and railways at the modeling locations along the proposed project alignment using the MSAT risk mapping tool. Existing potential cancer risk values at the maximum project-only location would then be added to the project-only results and compared against the 100 in a million cumulative cancer risk threshold.

Table 4-1: Existing Potential Cancer Risk at Proposed Project Modeling Sites within SMAQMD

Modeling Site	Range of Existing Potential Cancer Risk Along Track Segment (in a million)[1,2]
Track Curve Reconstruction North of Elk Grove	2 – 3
City College and South Sacramento Track Improvements	30 – 55
Existing Railroad Realignment	50 – 165
Midtown Station	35 – 165
Old North Sacramento Station[3]	4 – 30
Natomas/Sacramento Airport Station	2 - 36

[1] Cancer risk obtained using the SMAQMD MSAT Protocol risk mapping tool. Data retrieved September 2020.

[2] A range of values obtained from the SMAQMD MSAT Protocol risk mapping tool are provided. These include values from select receptors at points along the 2 km track segments at each modeling site.

4.4. Health Risk Thresholds for SJVAPCD

The SJVAPCD have outlined their health risk assessment thresholds in APR-1906 Framework for Performing Health Risk Assessments (SJVAPCD, 2018). For projects that fall under CEQA, such as the proposed Project, the cancer risk threshold for the project is less than or equal to 20 in a million and the chronic non-cancer Hazard Index threshold is less than 1.0. The Framework guidance document includes a tiered approach for conducting a Health Risk Assessment, which include the following:

- Tier 1 – Screening estimate;
- Tier 2 – Refined Project Specific Modeling Inputs; and
- Tier 3 – Refined Project Specific Exposure Parameters.

For this Health Risk Assessment, the Tier 2 level has been selected, as refined AERMOD inputs that are specific to the project are used.

5. Health Risk Analysis Results

Excess cancer and chronic non-cancer health risks were evaluated for each modeled site for the duration of construction and then a 30-year (sites within SMAQMD) or 70-year (sites within SJVAPCD) exposure period for operations. Given the differences in risk thresholds between the two air districts, results that are presented below are grouped by district.

5.1. Health Risk Results for Sites Located within SJVAPCD – Construction Emissions

The excess cancer risk attributed to construction sources from the Lodi Station and track improvements and Thornton track improvements are listed in **Table 5-1**. The excess cancer risk associated with construction of these project elements would result in maximum excess cancer risk of 2.63 and 0.15 in a million, respectively. Both are below the threshold of 20 in a million. **Table 5-2** provides the chronic non-cancer risk results for the Lodi Station and track improvements and the Thornton track improvements during construction. The maximum chronic non-cancer Hazard Index values would be 0.003 and 0.0003, respectively, both of which fall well below the threshold of 1.0.

Table 5-1: Maximum Excess Cancer Risk at Off-Site Sensitive Receptors for Construction Sites within SJVAPCD

Site	Year	Years of Age	Maximum Excess Cancer Risk (in a million)[1]	Significance Threshold (in a million)[2]	Exceeds Threshold?
Lodi Station/Track Improvements	2021	Third Trimester to 1	2.63	20	No
Thornton Track Improvements	2021	Third Trimester to 1	0.15	20	No

1. Values rounded to the nearest hundredth.
2. APR-1906 Framework for Performing Health Risk Assessments (SJVAPCD, 2018).

Table 5-2: Maximum Chronic Non-Cancer Hazard Index at Off-Site Sensitive Receptors for Construction Sites within SJVAPCD

Site	Maximum Chronic Non-Cancer Hazard Index[1]	Significance Threshold[2]	Exceeds Threshold?
Lodi Station/Track Improvements	0.0030	1.0	No
Thornton Track Improvements	0.0003	1.0	No

1. Values rounded to the nearest thousandth.
2. APR-1906 Framework for Performing Health Risk Assessments (SJVAPCD, 2018).

5.2. Health Risk Results for Sites Located within SJVAPCD – Operational Emissions

The excess cancer risk attributed to railway operational sources (i.e. locomotives) within 1 km north and south of Lodi Station, Thornton and Stockton ACE Station are provided in **Table 5-3**. The excess cancer risk

associated with operations for a 70-year period at each of these sites would result in maximum excess cancer risk of 3.63 (Lodi), 3.30 (Thornton), and 3.37 (Stockton). All three sites are below the threshold of 20 in a million. **Table 5-4** provides the chronic non-cancer risk results for these three sites during operations. The maximum chronic non-cancer Hazard Index values at Lodi Station, Thornton and Stockton would be all be 0.001 and well below the threshold of 1.0.

Table 5-3: Maximum Excess Cancer Risk at Off-Site Sensitive Receptors for Operations within SJVAPCD

Site	Years of Age	Maximum Excess Cancer Risk (in a million)[1]	Significance Threshold (in a million)[2]	Exceeds Threshold?
Lodi Station	Third Trimester to 70 (70 years)	3.62	20	No
Thornton	Third Trimester to 70 (70 years)	3.37	20	No
Stockton ACE Station	Third Trimester to 70 (70 years)	3.27	20	No

1. Values rounded to the nearest hundredth.
2. APR-1906 Framework for Performing Health Risk Assessments (SJVAPCD, 2018).

Table 5-4: Maximum Chronic Non-Cancer Hazard Index at Off-Site Sensitive Receptors for Operations within SJVAPCD

Site	Maximum Chronic Non-Cancer Hazard Index[1]	Significance Threshold[2]	Exceeds Threshold?
Lodi Station	0.001	1.0	No
Thornton	0.001	1.0	No
Stockton ACE Station	0.001	1.0	No

1. Values rounded to the nearest thousandth.
2. APR-1906 Framework for Performing Health Risk Assessments (SJVAPCD, 2018).

5.3. Health Risk Results for Sites Located within SMAQMD – Construction Emissions

The excess cancer risk attributed to construction sources from the North Elk Grove, City College, Midtown, Old North, Del Paso, and Natomas modeling locations are listed in **Table 5-5**. All sites were found to have excess cancer risk well below the project-specific threshold of 10 in a million, with the highest cancer risk from any of the sites at 3.21 in a million from City College. **Table 5-6** provides the chronic non-cancer risk results for the above listed sites during construction. The maximum chronic non-cancer Hazard Index values across all sites was 0.004 at City College and Natomas. Therefore, all sites fall well below the chronic non-cancer threshold of 1.0.

Table 5-5: Maximum Excess Cancer Risk at Off-Site Sensitive Receptors for Construction Sites within SMAQMD

Site	Year	Years of Age	Maximum Excess Cancer Risk (in a million)[1]	Significance Threshold[2]	Exceeds Threshold?
Track Curve Reconstruction North of Elk Grove	2021	Third Trimester to 1	0.95	10	No
City College and South Sacramento Track Improvements	2023	Third Trimester to 1	3.21	10	No
Midtown Station	2021	Third Trimester to 1	2.50	10	No
Old North Sacramento Station	2021	Third Trimester to 1	2.46	10	No
Del Paso Track Improvements	2023	Third Trimester to 1	0.37	10	No
Natomas/Sacramento Airport Station	2021	Third Trimester to 1	3.13	10	No

1. Values rounded to the nearest hundredth.
2. BAAQMD, 2017.

Table 5-6: Maximum Chronic Non-Cancer Risk at Off-Site Sensitive Receptors for Construction Sites within SJVAPCD

Site	Maximum Chronic Non-Cancer Hazard Index[1]	Significance Threshold[2]	Exceeds Threshold?
Track Curve Reconstruction North of Elk Grove	0.001	1.0	No
City College and South Sacramento Track Improvements	0.004	1.0	No
Midtown Station	0.003	1.0	No
Old North Sacramento Station	0.003	1.0	No
Del Paso Track Improvements	< 0.001	1.0	No
Natomas/Sacramento Airport Station	0.004	1.0	No

1. Values rounded to the nearest hundredth.
2. BAAQMD, 2017.

5.4. Health Risk Results for Sites Located within SMAQMD – Operational Emissions

The excess cancer risk attributed to railway operational sources (i.e. locomotives) within 2 km of the sites of the proposed project within SMAQMD are provided in **Table 5-7**. The excess cancer risk associated with

operations for a 30-year period at each of these sites would result in highest maximum excess cancer risk for any of the sites to be 6.94 in a million (at the Existing Railroad Realignment). All sites are below the project-specific threshold of 10 in a million. **Table 5-8** provides the chronic non-cancer risk results for these same sites during operations. The maximum chronic non-cancer risk value would all be 0.002 or less, and well below the threshold of 1.0.

Table 5-7: Maximum Excess Cancer Risk at Off-Site Sensitive Receptors for Operations within SMAQMD

Site	Years of Age	Maximum Excess Cancer Risk (in a million)[1]	Significance Threshold[2]	Exceeds Threshold?
North Elk Grove Track Curve	Third Trimester to 30 (30 years)	5.77	10	No
City College and South Sacramento Track Improvements	Third Trimester to 30 (30 years)	4.63	10	No
Existing Railroad Realignment	Third Trimester to 30 (30 years)	6.94	10	No
Midtown Station	Third Trimester to 30 (30 years)	4.48	10	No
Old North Sacramento Station[3]	Third Trimester to 30 (30 years)	5.18	10	No
Natomas/Sacramento Airport Station	Third Trimester to 30 (30 years)	4.76	10	No

1. Values rounded to the nearest hundredth.
2. BAAQMD, 2017.
3. Includes track segments associated with Del Paso track improvements.

Table 5-8: Maximum Chronic Non-Cancer Hazard Index at Off-Site Sensitive Receptors for Operations within SMAQMD

Site	Maximum Chronic Non-Cancer Hazard Index[1]	Significance Threshold[2]	Exceeds Threshold?
North Elk Grove Track Curve	0.001	1.0	No
City College and South Sacramento Track Improvements	0.001	1.0	No
Existing Railroad Realignment	0.002	1.0	No
Midtown Station	0.001	1.0	No
Old North Sacramento Station[3]	0.001	1.0	No
Natomas/Sacramento Airport Station	0.001	1.0	No

1. Values rounded to the nearest thousandth.
2. BAAQMD, 2017.
3. Includes track segments associated with Del Paso track improvements.

In conjunction with the MSAT Protocol, SMAQMD developed an internet-based mapping tool that discloses localized cancer risk and $PM_{2.5}$ levels in proximity to high-volume roadways and rail within Sacramento County. This mapping data has been used to inform this analysis of the potential existing health risks in the vicinity of the proposed project and consider the proposed project's relative contribution to excess health risks at sensitive receptors. The sum of the project-specific (**Table 5-7**) and existing potential cancer risk values at the maximum project-specific receptor, at each modeling site within Sacramento County are summarized in **Table 5-9**.

As shown in **Table 5-9**, the existing health risk at all maximum project-only locations is less than 100 in a million; however, as noted in Table 4-1, areas of the project alignment near the Existing Railroad Realignment and Midtown Sacramento stations already exceed the 100 in a million risk level recommended threshold of the neighboring BAAQMD prior to the addition of the project. Contributing sources of DPM and Total Organic Gasses (TOG) at these locations include the existing rail activity, as well as vehicles along the nearby roadways. Operations of the proposed Project would use engines that meet or exceed Tier 4 emissions standards, the most stringent standards under current regulations. In addition, it is expected to result in a transportation mode shift (i.e., attract passengers who otherwise would have driven cars) that would reduce travel by highway vehicles, reducing mobile source emissions and congestion. Reduced congestion would also serve to reduce the emissions associated with on-road trucks that emit DPM and contribute to the existing health risks.

Table 5-9: Maximum Excess Cancer Risk at Off-Site Sensitive Receptors for Operations within SMAQMD

Modeling Scenario	Years of Age	Existing Potential Cancer Risk (in a million)[1,2]	Maximum Project Excess Cancer Risk (in a million)[1,3]	Maximum Cumulative Excess Cancer Risk (in a million)[1]	Significance Threshold[4]	Exceeds Threshold?
North Elk Grove Curve	Third Trimester to 30 (30 years)	2.1	5.77	7.87	100	No
City College and South Sacramento Track Improvements	Third Trimester to 30 (30 years)	31	4.63	35.63	100	No
Existing Railroad Realignment	Third Trimester to 30 (30 years)	64	6.94	71.94	100	No
Midtown Station	Third Trimester to 30 (30 years)	47	4.48	51.48	100	No
Old North Sacramento Station[5]	Third Trimester to 30 (30 years)	8.6	5.18	13.78	100	No
Natomas/Sacramento Airport Station	Third Trimester to 30 (30 years)	7.3	4.76	12.06	100	No

1. Values rounded to the nearest hundredth.
2. Values equal to the existing potential cancer risk at the maximum receptor location of the project-only maximum excess cancer risk obtained by using the SMAQMD MSAT Air Toxics Protocol tool.
3. Values equal to the sum of cancer risk from Table 5-7.
4. BAAQMD, 2017.
5. Includes track segments associated with Del Paso track improvements.

6. Uncertainties

In accordance with risk assessment guidance, the following discussion summarizes the main uncertainties associated with the emissions estimation, air dispersion modeling, and risk estimation components of the Health Risk Assessment methodology.

6.1. Emissions Estimates

Uncertainties exist in estimating emissions from construction equipment. Where project-specific data were not available, CalEEMod default values or conservative input assumptions were used. It is anticipated that the intensity and duration of equipment used during construction would more likely be less than estimated. In addition, emission factors used were for a 2021 fleet mix; any construction in future years would more realistically result in fewer emissions for the same level of activity due to fleet turnover over time, in which older equipment and vehicles are replaced by those with new engines meeting more recent and more stringent emission standards.

6.2. Air Dispersion Modeling

In addition to the uncertainty associated with emission estimates, uncertainty exists regarding the pollutant concentrations estimated by the air dispersion model. The limitations of the air dispersion model provide a source of uncertainty in the estimation of exposure concentrations. According to the U.S. EPA Appendix W, errors attributable to the limitation of the algorithms implemented in the air dispersion model in the highest estimated concentrations of +/- 10 percent to 40 percent are typical. The health risk methodologies use conservative assumptions and techniques to produce conservative results; thus, predicted exposure concentrations are likely to be at or above actual exposure concentrations.

The source parameters used to model emission sources add uncertainty. For all emission sources, source parameters were used that are either recommended as defaults or expected to produce more conservative (worst-case) results. Discrepancies might exist between the actual emissions characteristics of a source and its representation in the model; exposure concentrations used in this assessment represent approximate exposure concentrations.

6.3. Health Risk Analysis

Numerous assumptions must be made to estimate human exposure to pollutants. These assumptions include parameters such as breathing rates, exposure time and frequency, exposure duration, and human activity patterns. While a mean value derived from scientifically defensible studies is the best estimate of central tendency, most exposure variables used in this Health Risk Assessment are high-end estimates. For example, it is assumed that residential receptors would be exposed to project emissions during the entire construction duration. This assumption is conservative because most residents do not remain in their homes for this period of time. The combination of several high-end estimates used as exposure parameters may substantially overestimate chemical intake. The excess lifetime cancer risks calculated in this assessment are therefore likely to be higher than may be required to be protective of public health. Generally, the concentrations and health risk decrease substantially as the distance between the source and receptor increases.

The OEHHA Cancer Potency Factor (CPF) for diesel PM is used to estimate cancer risks associated with exposure to diesel PM from project emissions. However, the CPF derived by OEHHA for diesel PM is highly uncertain in the estimation of both response and dose. In the past, because of inadequate animal test

data and epidemiology data on diesel exhaust, the International Agency for Research on Cancer, a branch of the World Health Organization, had classified diesel PM as Probably Carcinogenic to Humans (Group 2); U.S. EPA had also concluded that the existing data did not provide an adequate basis for quantitative risk assessment.[7] However, based on two recent scientific studies,[8,9] International Agency for Research on Cancer recently reclassified diesel PM as Carcinogenic to Humans (Group 1),[10] which means that the agency has determined that there is "sufficient evidence of carcinogenicity" of a substance in humans and represents the strongest weight-of-evidence rating in International Agency for Research on Cancer's carcinogen classification scheme. This determination by International Agency for Research on Cancer may provide additional impetus for the U.S. EPA to identify a quantitative dose/response relationship between exposure to diesel PM and cancer.

Project-specific PM_{10} emissions and PM_{10} emissions from the MSAT mapping tool both assume total PM_{10} equals total DPM from diesel-fueled equipment (including locomotives). While almost all DPM from diesel exhaust is within the range of $PM_{2.5}$ (fine particle diameter of 2.5 microns or less), this is considered a conservative estimate to provide health-protective risk. In addition, the MSAT mapping tool does not reflect existing features on or adjacent to the location of interest that may reduce reported risk such as barriers, tree plantings, or enhanced indoor air filtration. The Sacramento Air District funded a study (CAPCOA, 2009) that indicates that trees and other vegetation have been shown to alter pollutant transport and dispersion, reducing pollutant concentrations by 65-85 percent on the leeward side of a tree line. As such, there may be a benefit of reduced pollutant concentrations at sensitive receptor locations due to the proposed landscaping. However, this reduction is not quantifiable and therefore has not been taken into consideration for the modeling results presented in this HRA.

OEHHA 2015 notes that the conservative assumptions used in a risk assessment are intended to avoid underestimation of actual risks posed by a site, and are designed to err on the side of health protection. The estimated risks in this Health Risk Assessment are based primarily on a series of conservative assumptions related to predicted environmental concentrations, exposure, and chemical toxicity. The use of conservative assumptions tends to produce upper-bound estimates of risk. Although it is difficult to quantify the uncertainties associated with all the assumptions made in this risk assessment, the use of conservative assumptions is likely to result in substantial overestimates of exposure and, hence, risk.

[7] U.S. EPA. 2002 (May). Health Assessment Document for Diesel Engine Exhaust. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. EPA/600/8-90/057F.

[8] Benbrahim-Tallaa, L. et al. 2012. Carcinogenicity of Diesel-engine and Gasoline-engine Exhausts and Some Nitroarenes, Lancet Oncology. July 2012.

[9] Attfield MD, Schleiff PL, Lubin JH, Blair A, Stewart PA, Vermeulen R, Coble JOB, Silverman DT. 2012. The Diesel Exhaust in Miners Study: A Nested Case-Control Study of Lung Cancer and Diesel Exhaust. J Natl Cancer Inst.

[10] International Agency for Research on Cancer (IARC). 2012. Press Release No. 213. IARC: Diesel Engine Exhaust Carcinogenic. June.

7. References

Attfield, M.D., P. L. Schleiff, J. H. Lubin, A. Blair, P. A. Stewart, R. Vermeulen, J. B. Coble, and D. T. Silverman. 2012. The Diesel Exhaust in Miners Study: A Nested Case-Control Study of Lung Cancer and Diesel Exhaust. *Journal of the National Cancer Institute* 104(11):855–868.

Bay Area Air Quality Management District (BAAQMD). 2012 (May). Recommended Methods for Screening and Modeling Local Risks and Hazards. Available: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en. Accessed August 2020.

———. 2017 (May). *CEQA Air Quality Guidelines*. Available: https://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en. Accessed July 2020.

Benbrahim-Tallaa, L., R. A. Baan, Y. Grosse, B. Lauby-Secretan, F. El Ghissassi, V. Bouvard, N. Guha, D. Loomis, and K. Straif. 2012. Carcinogenicity of Diesel-engine and Gasoline-engine Exhausts and Some Nitroarenes, *Lancet Oncology* 13(7):663–664.

California Air Pollution Control Officers Association (CAPCOA). 2009 (July). *Health Risk Assessments for Proposed Land Use Projects.*

California Air Resources Board (ARB). 2017.California Air Resources Board (ARB). 2018 (July). *EMFAC2017 Volume III – Technical Documentation v1.0.2. https://www.arb.ca.gov/msei/downloads/emfac2017-volume-iii-technical-documentation.pdf*

International Agency for Research on Cancer (IARC). 2012 (June). *IARC: Diesel Engine Exhaust Carcinogenic*. Press Release No. 213.

Office of Environmental Health Hazard Assessment (OEHHA). 2015 (February). *Air Toxics Hot Spots Program Guidance Manual.*

Sacramento Metropolitan Air Quality Management District (SMAQMD). 2019 (April). *Guidance Document for the Mobile Sources Air Toxics Protocol.*

———. 2020. CEQA Guidance & Tools. Available at: http://www.airquality.org/Residents/CEQA-Land-Use-Planning/CEQA-Guidance-Tools

San Joaquin Regional Rail Commission (SJRRC). 2018 (April). ACE Extension Lathrop to Ceres/Merced Draft EIR Section 4.3. ICF 00509.17. Available: https://acerail.com/projects-initiatives/.

South Coast Air Quality Management District (SCAQMD). 2008 (July). Localized Significance Threshold Methodology (Final). Available: http://www.aqmd.gov/docs/default-source/ceqa/handbook/localized-significance-thresholds/final-lst-methodology-document.pdf.

U.S. Environmental Protection Agency (EPA). 2002 (May). *Health Assessment Document for Diesel Engine Exhaust.* EPA/600/8-90/057F. Washington, DC: National Center for Environmental Assessment, Office of Research and Development.

———. 2009 (April). Emission Factor for Locomotives. EPA-420-F-09-025.

———. 2017. Guideline on Air Quality Models (Revised). 40 Code of Federal Regulations, Part 51, Appendix W. Office of Air Quality Planning and Standards. January.

ATTACHMENT A

Figures showing construction and operational emission sources at each site modeled along with placement of receptors for the Valley Rail Sacramento Extension Project. Tables summarizing the emissions to be allocated at each volume source are also provided in this attachment to the HRA.

Figure A-1: Lodi Station

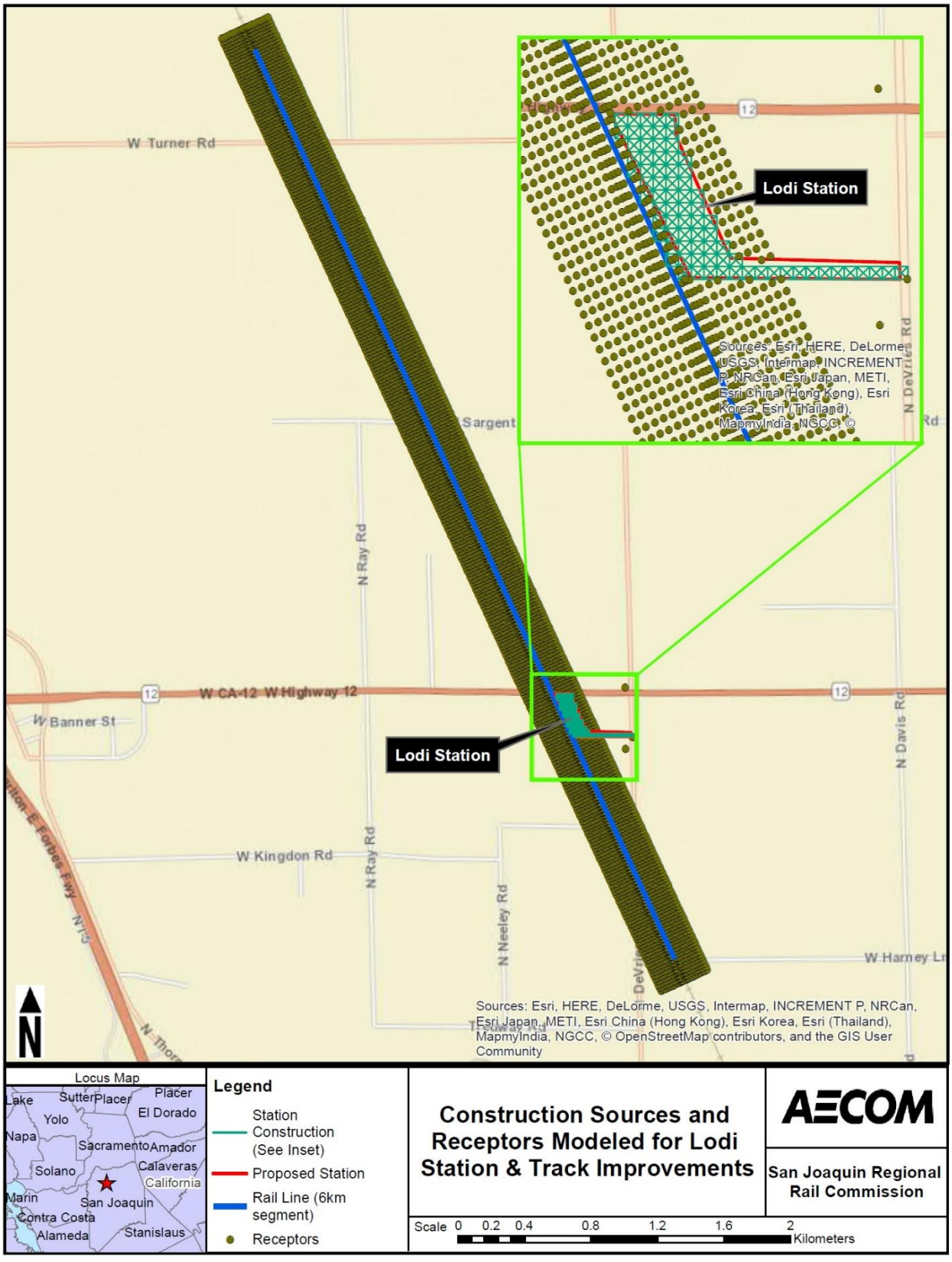


Figure A-2: Thornton Siding Upgrade and Extension

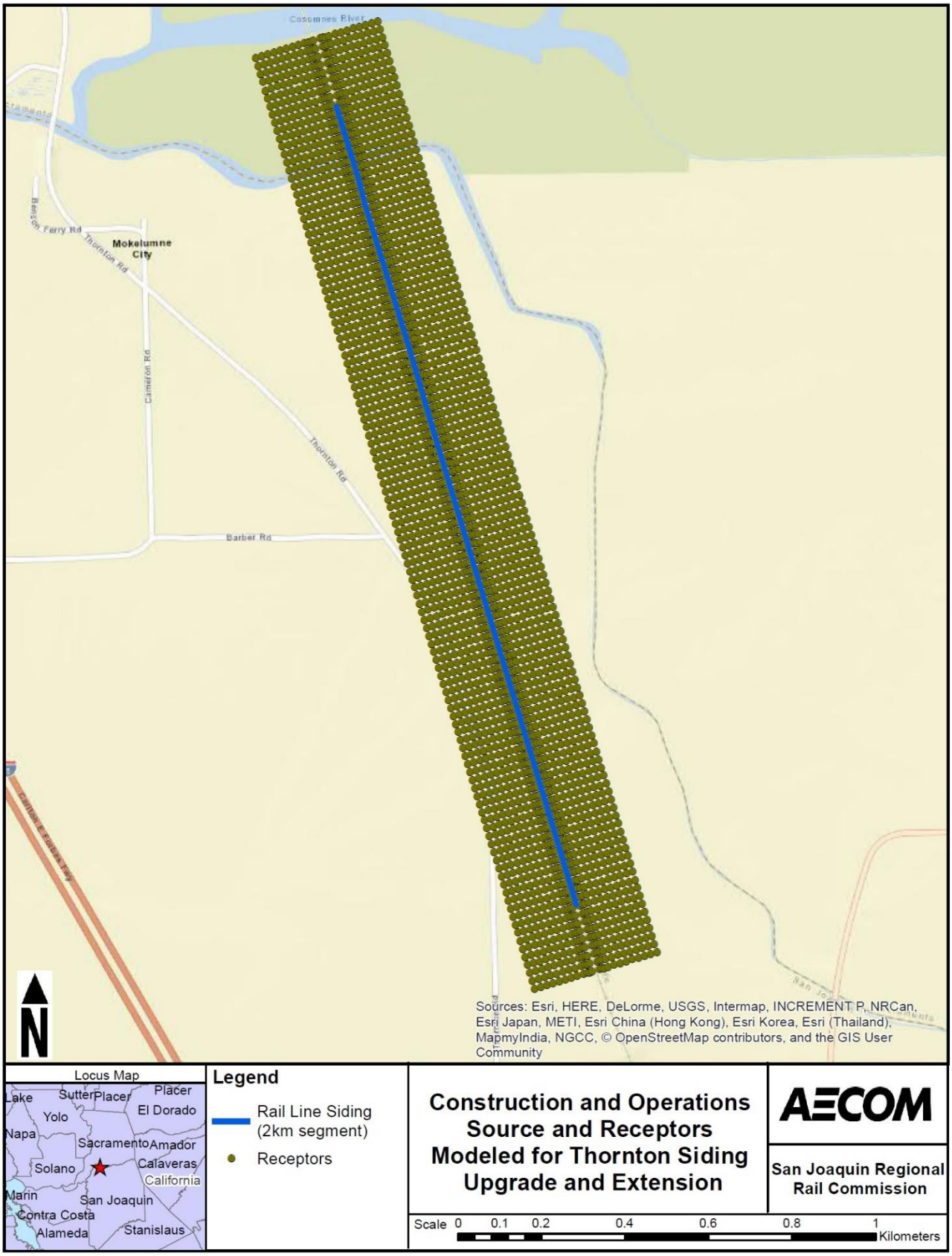


Figure A-3: Track Curve Reconstruction North of Elk Grove

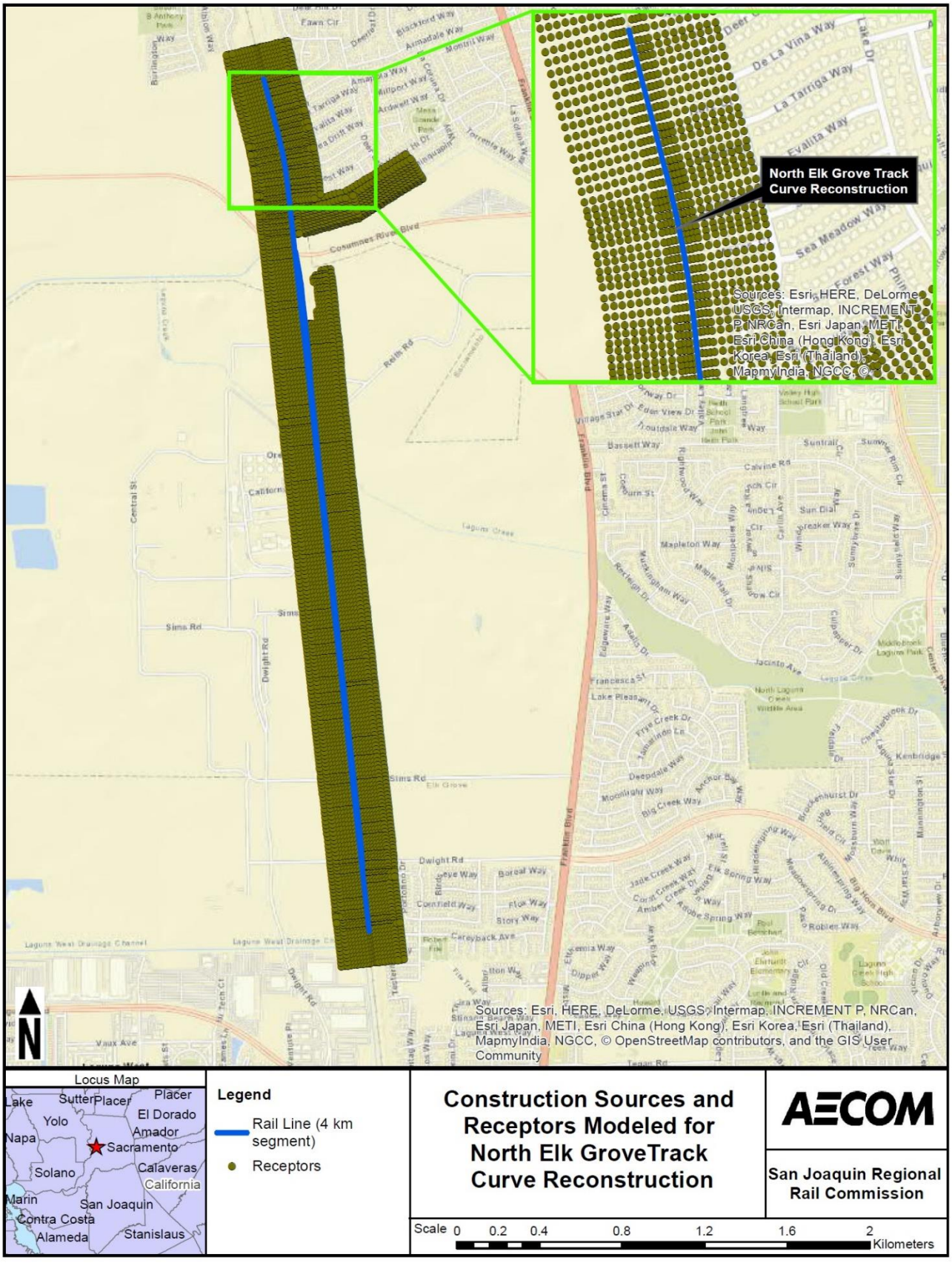


Figure A-4: City College and South Sacramento Siding Upgrade

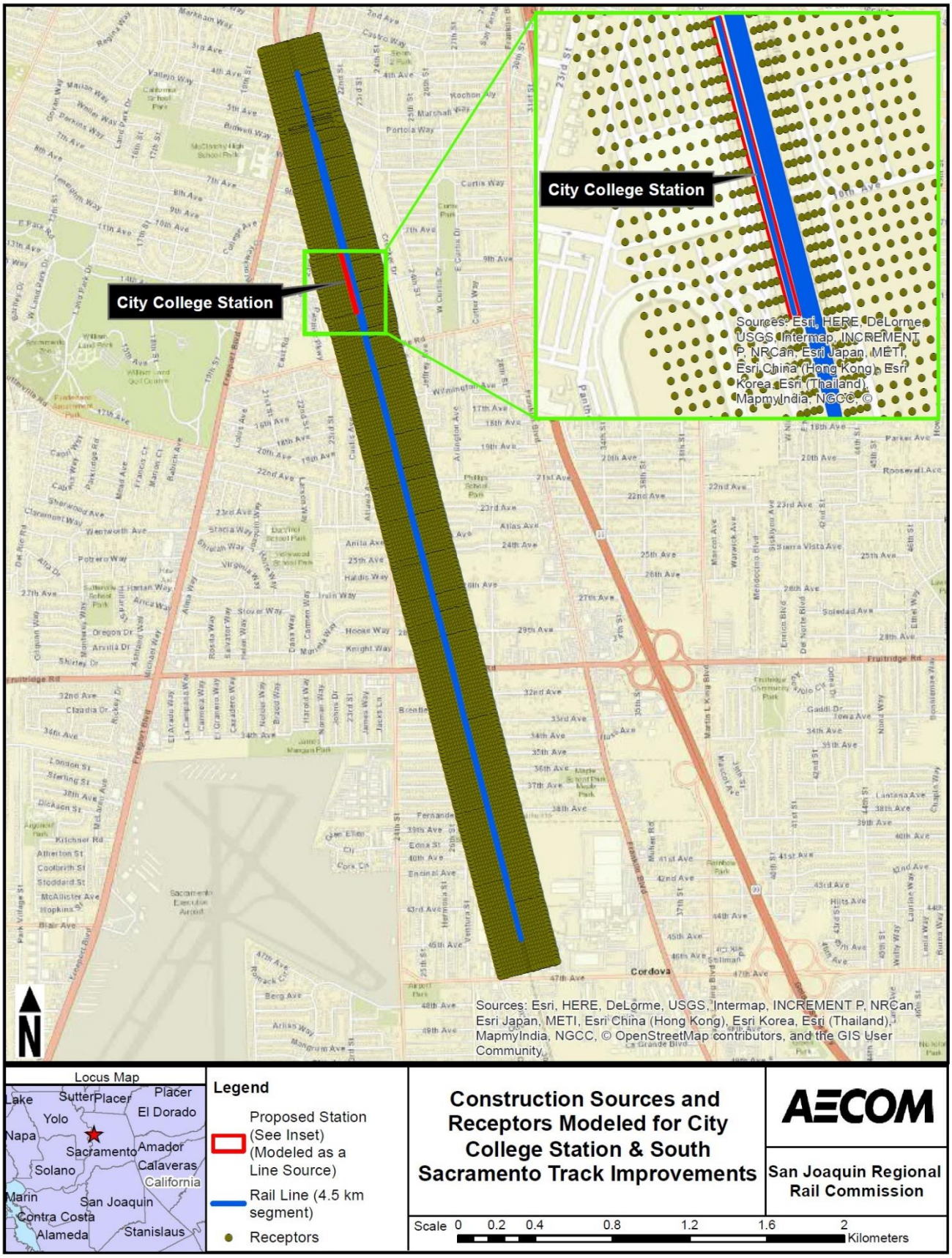


Figure A-5: Midtown Sacramento Station

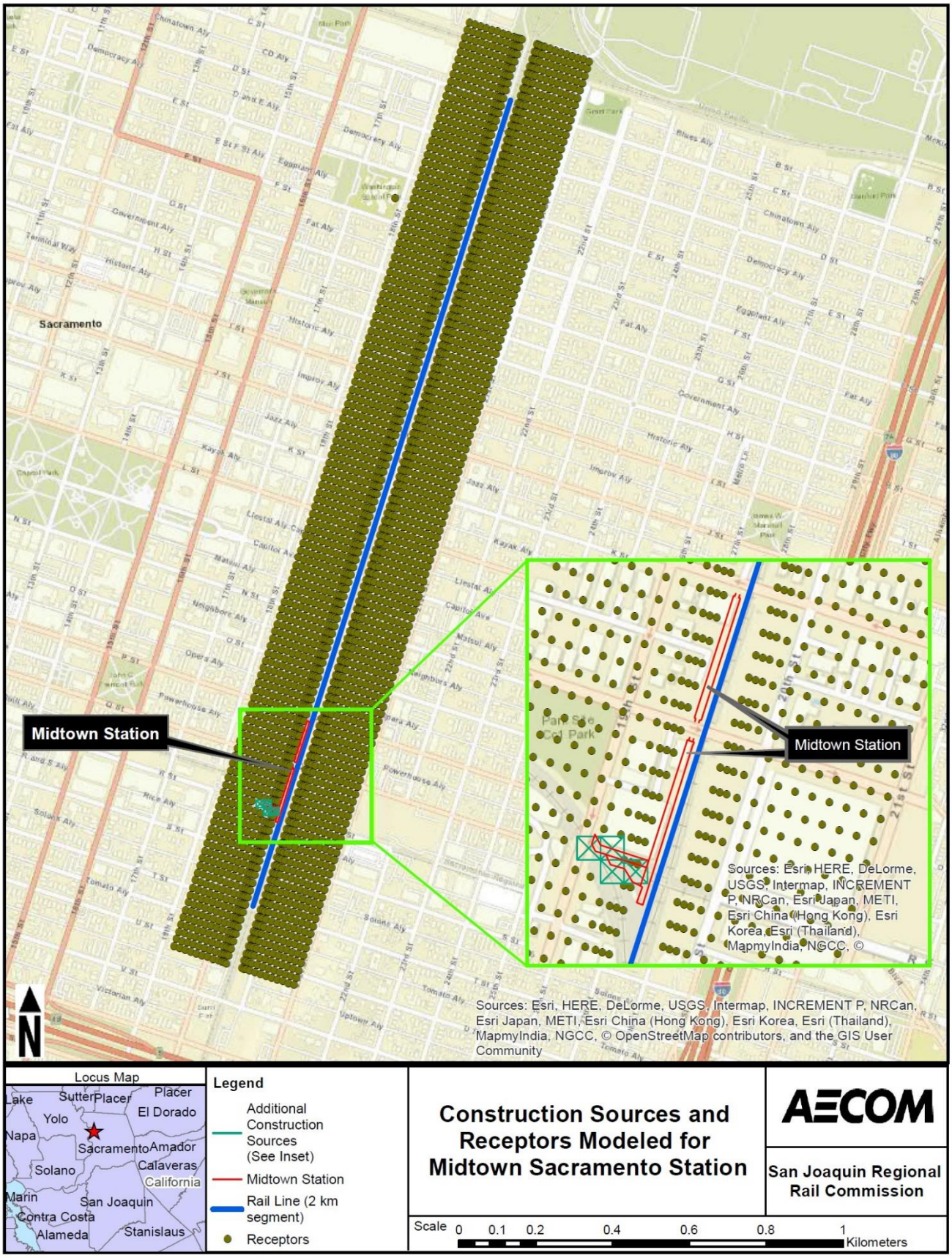


Figure A-6: Old North Sacramento Station

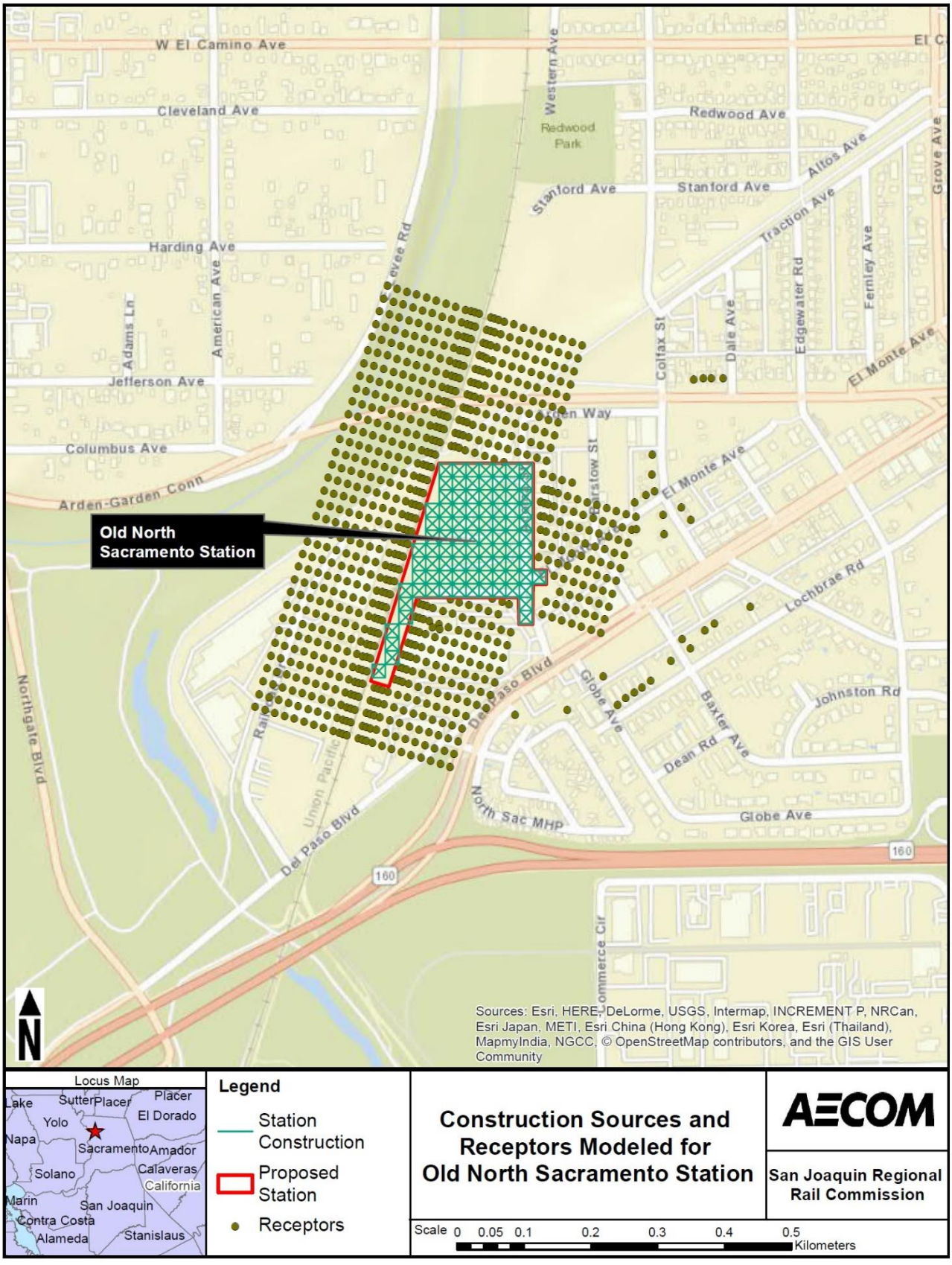


Figure A-7: Del Paso Siding Upgrade and Extension

Figure A-8: Natomas / Sacramento Airport Station

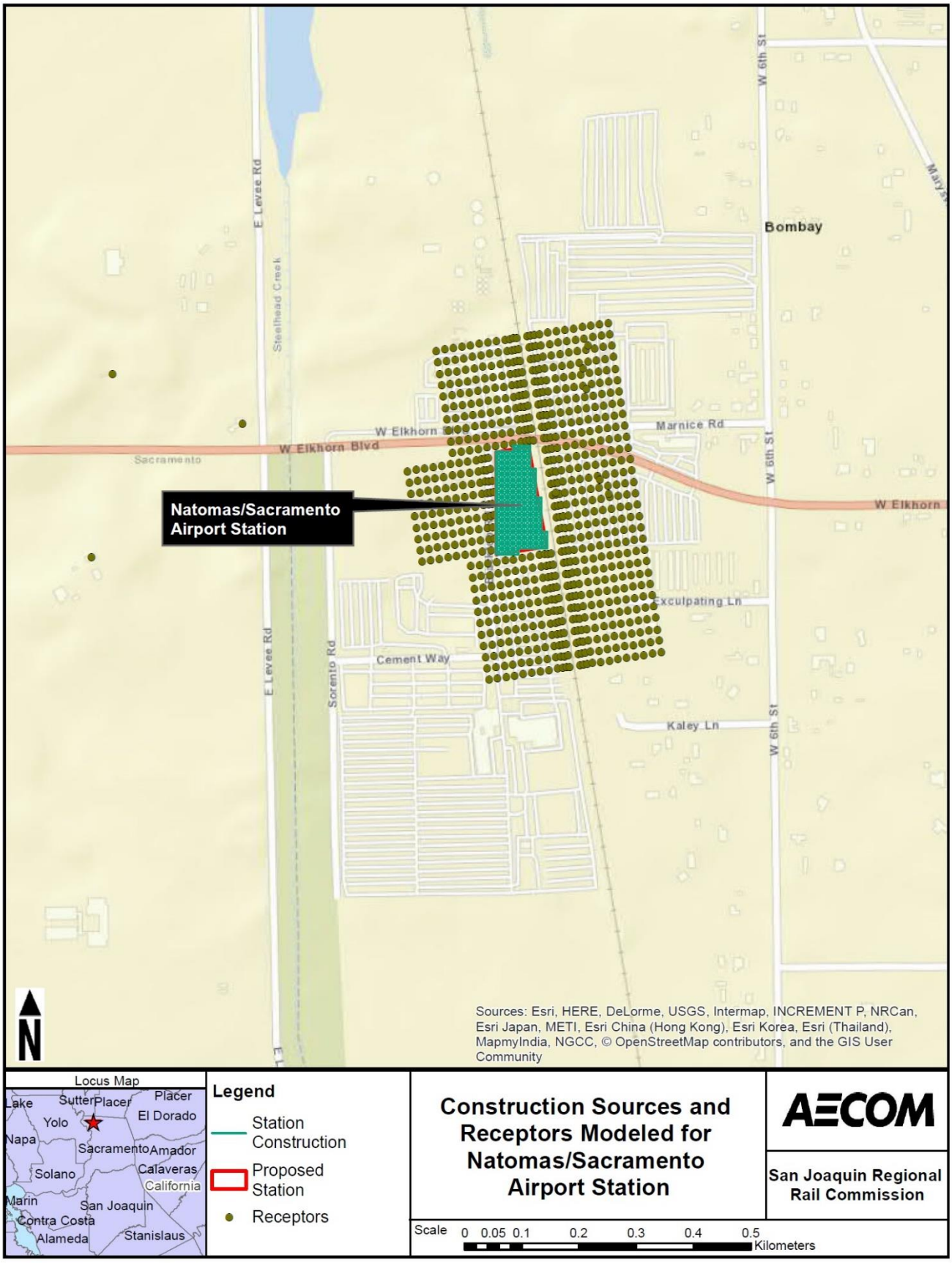


Table A-1: Lodi Station & Track Construction Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Construction at Station[1]	76	1.31579E-02	20	5	4.651	1.40
Siding Track[2]	661	1.51286E-03	9.1	5	4.23	1.40

Notes: g/s/vol = grams per second per number of volume sources. Follows SJVAPCD guidance.
1. Construction site greater than 5 acres; therefore, source width equal to 20 m.
2. Source width accounts for 3 m on each side of track for wake affects and 3.1 m for track width.

Table A-2: Thornton Siding Upgrade & Extension Construction Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	Width[1] [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Siding Track Line 1[2]	336	1.77620E-03	9.1	5	4.23	1.40
Siding Track Line 2[2]	132		9.1	5	4.23	1.40
Siding Track Line 3[2]	65		9.1	5	4.23	1.40

Notes: g/s/vol = grams per second per number of volume sources. Follows SJVAPCD guidance.
1. Source width accounts for 3 m on each side of track for wake affects and 3.1 m for track width.

Table A-3: Track Curve Reconstruction North of Elk Grove Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track Reconstruction	110	9.09091E-03	3	5	1.40	1.40

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
2. Construction site greater than 5 acres; therefore, source width equal to 20 m.
3. Construction emissions account for both areas of activity, so these are merged in the modeling.

Table A-4: City College Station & South Sacramento Siding Construction Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Construction at Station[1]	32	3.125E-02	10	5	2.33	1.40
Track Line 1[2]	1541	2.8169E-04	3	5	1.40	1.40
Track Line 2[2]	1306		3	5	1.40	1.40
Track Line 3[2]	362		3	5	1.40	1.40
Track Line 4[2]	341		3	5	1.40	1.40

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Construction site less than 5 acres; therefore, source width equal to 10 m.
2. Construction emissions account for both areas of activity, so these are merged in the modeling.

Table A-5: Midtown Sacramento Station Construction Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume[1] [g/s/vol]	Line Source Plume Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Construction Along Track	4	8.877193E-03	20	5	4.651	1.40
Construction at Station[2]	110		20	5	4.651	1.40

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Construction emissions account for both areas of activity, so these are merged in the modeling.
2. Construction site greater than 5 acres; therefore, source width equal to 20 m.

Table A-6: Old North Sacramento Station & Del Paso Siding Construction Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume[1] [g/s/vol]	Line Source Plume Width [m]	Track Gap [m]	Total Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Construction at Station[2]	90	1.11111E-02	20	-	20	5	4.651	1.40
Del Paso Siding	839	1.19190E-03	6	2	8	5	3.72	1.40

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Construction emissions account for both areas of activity, so these are merged in the modeling.
2. Construction site greater than 5 acres; therefore, source width equal to 20 m.

Table A-7: Natomas/Sacramento International Airport Station Construction Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	Line Source Plume Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Construction at Station[1]	135	7.40741E-03	10	5	2.33	1.40

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Construction site less than 5 acres; therefore, source width equal to 10 m.

Figure A-9: Lodi Station

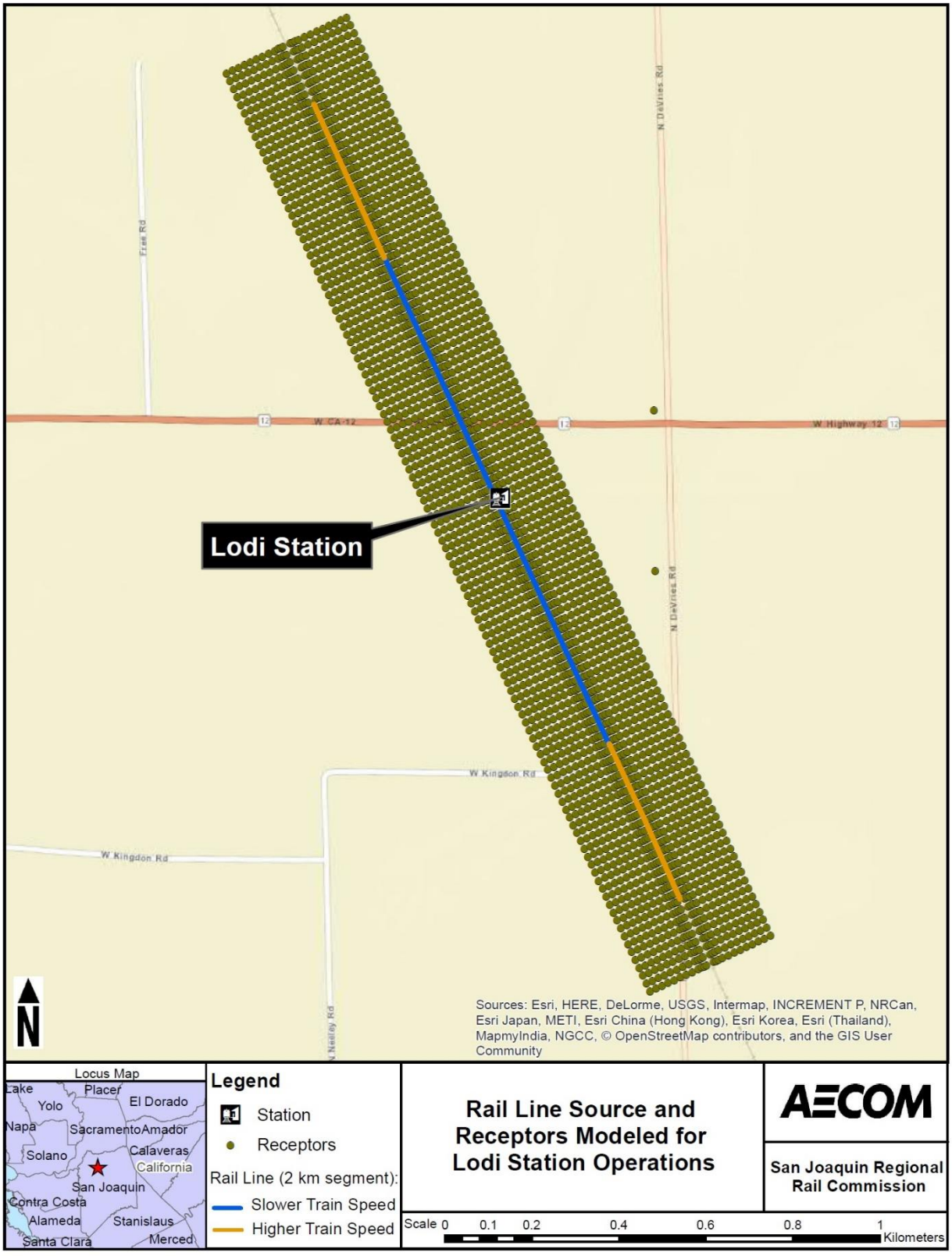


Figure A-10: Stockton Station

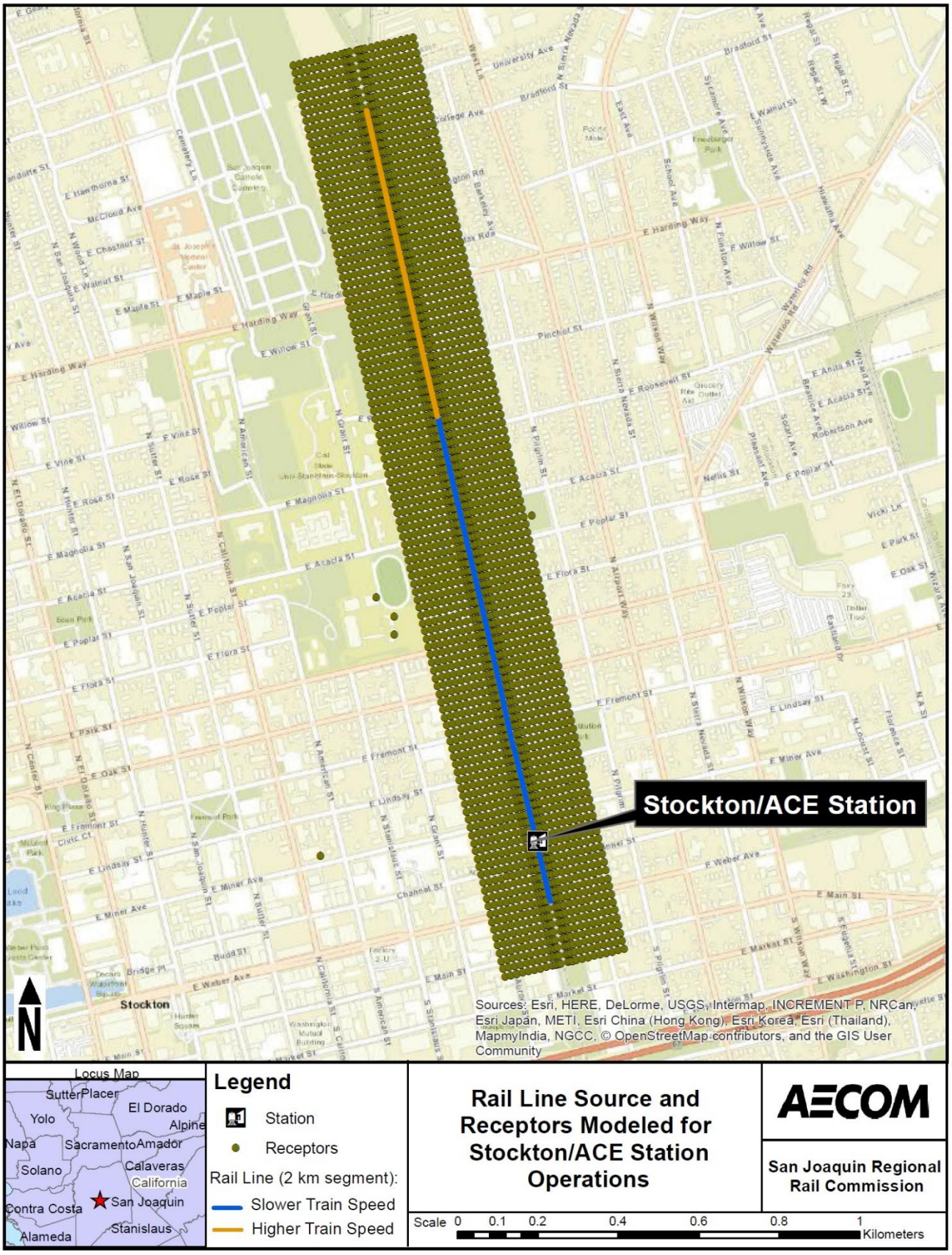


Figure A-11: Thornton

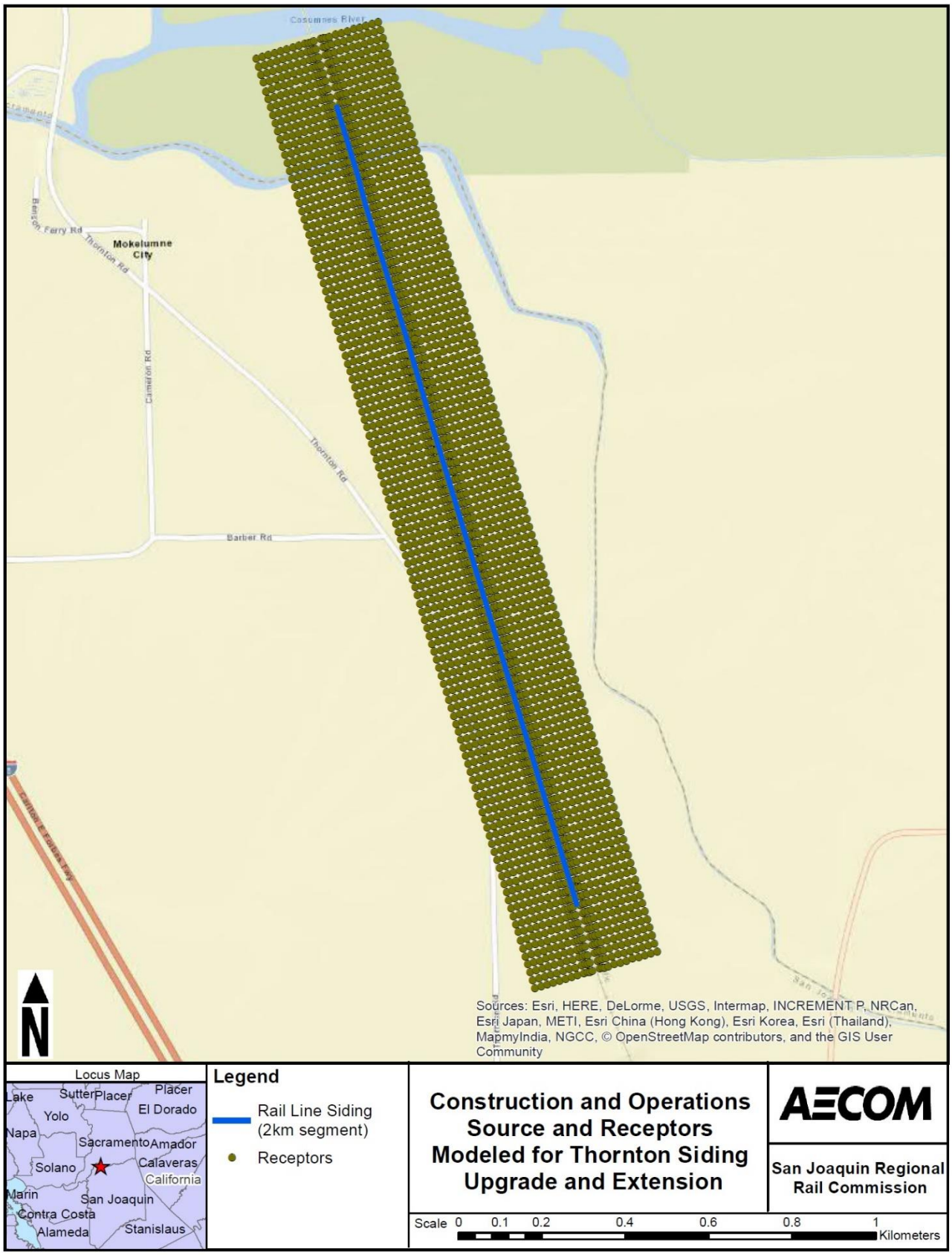


Figure A-12: North of Elk Grove

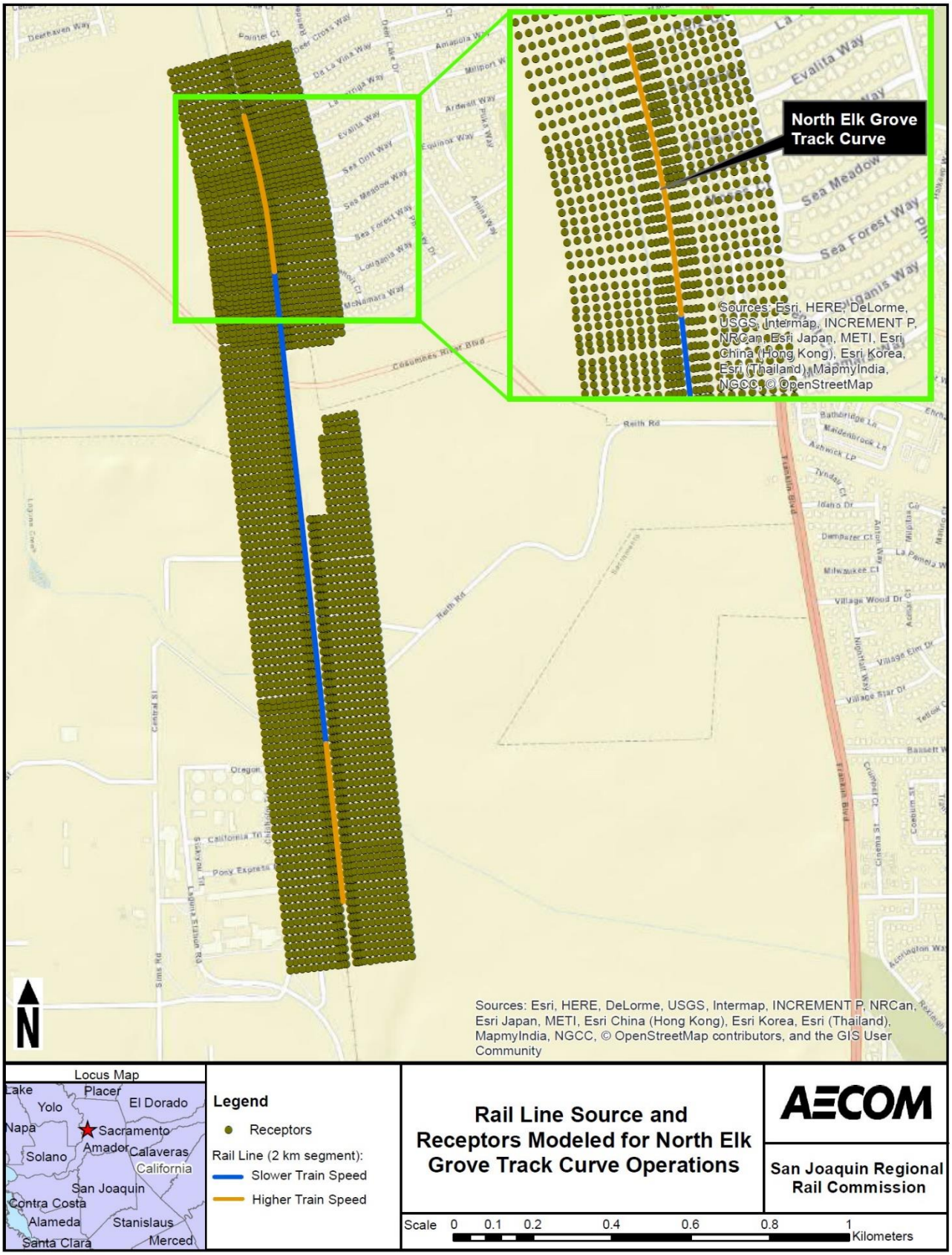


Figure A-13: City College Station

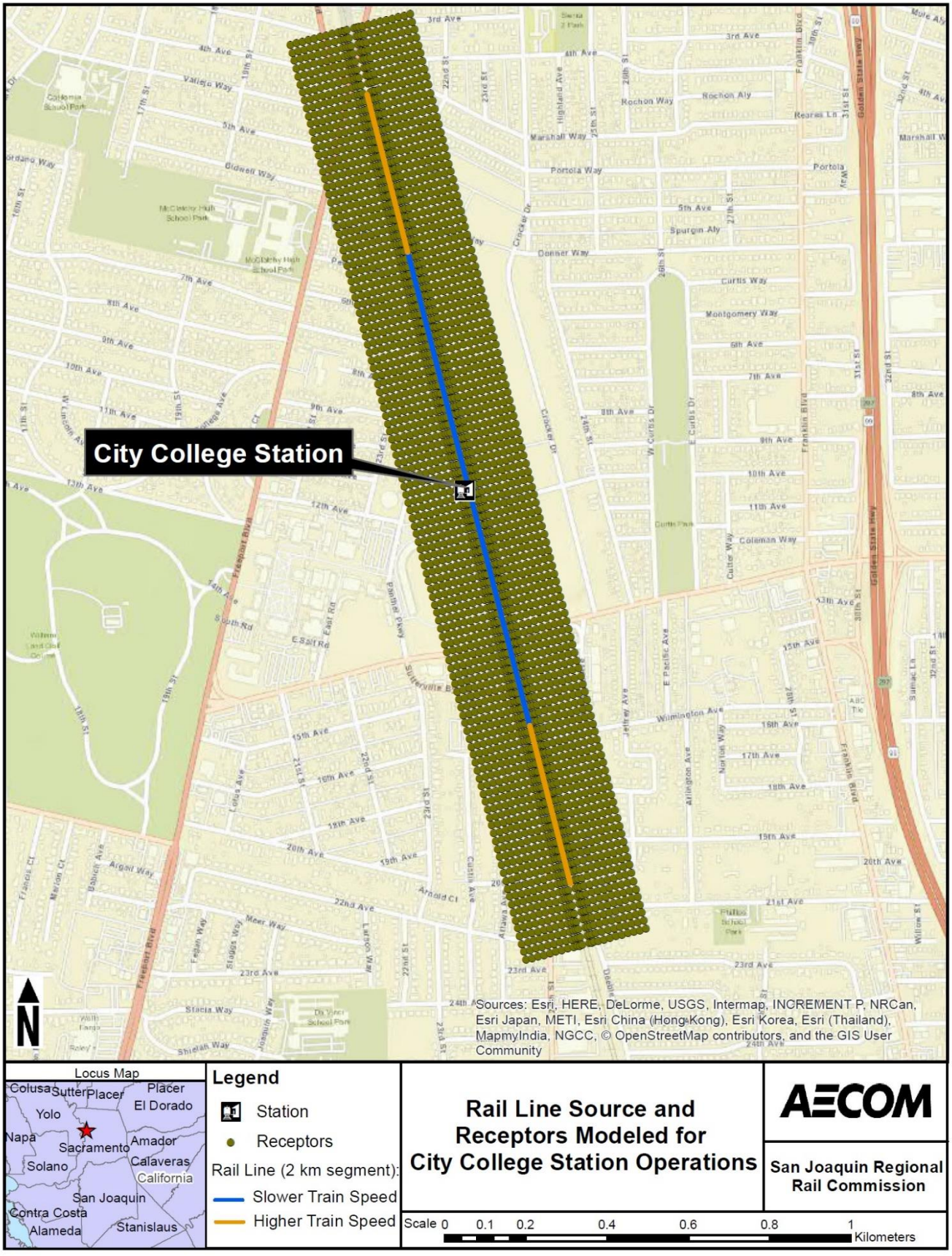


Figure A-14: Freeport Boulevard Curve

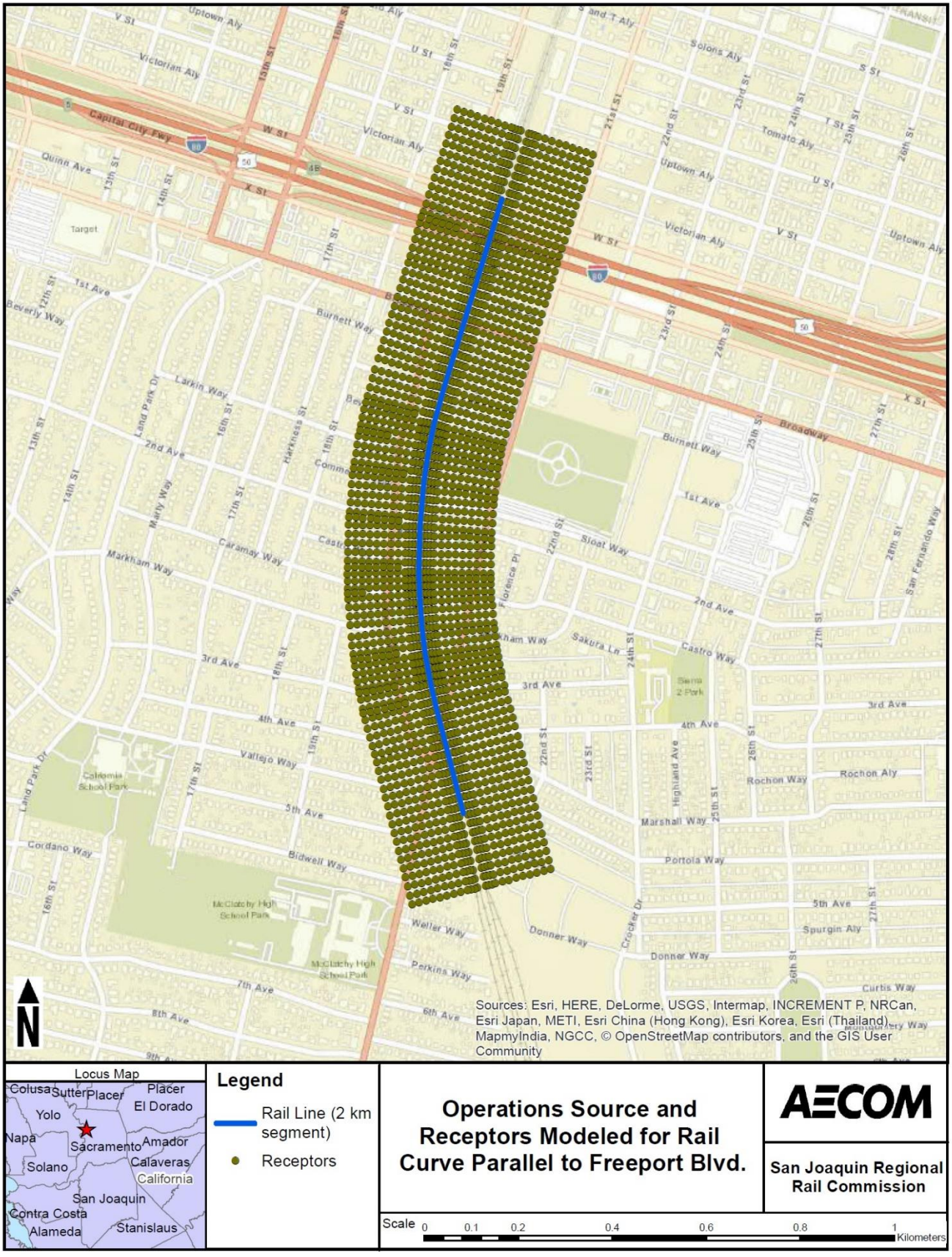


Figure A-15: Midtown Sacramento Station

Figure A-15: Old North Sacramento Station

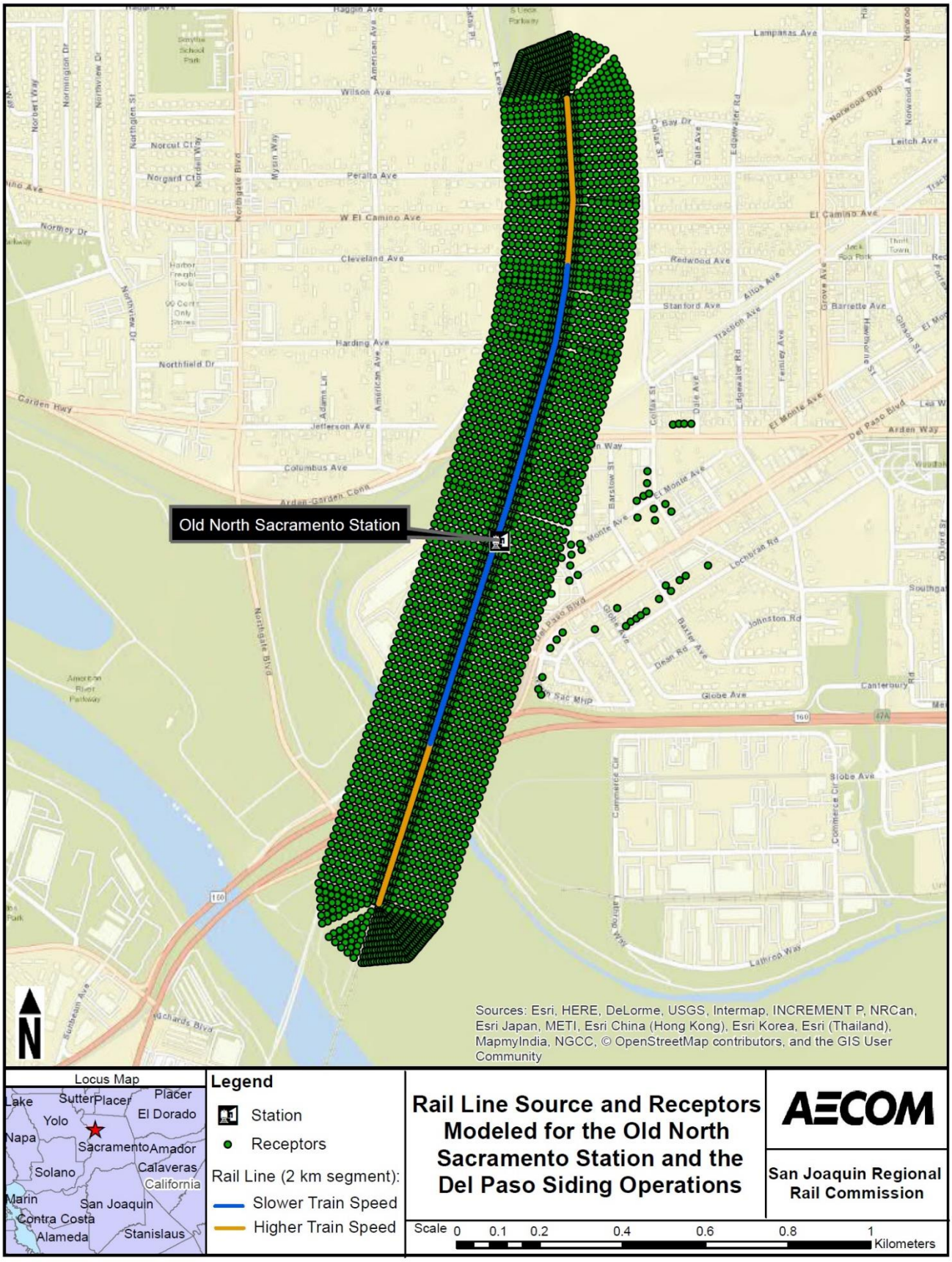


Figure A-16: Natomas / Sacramento Airport Station

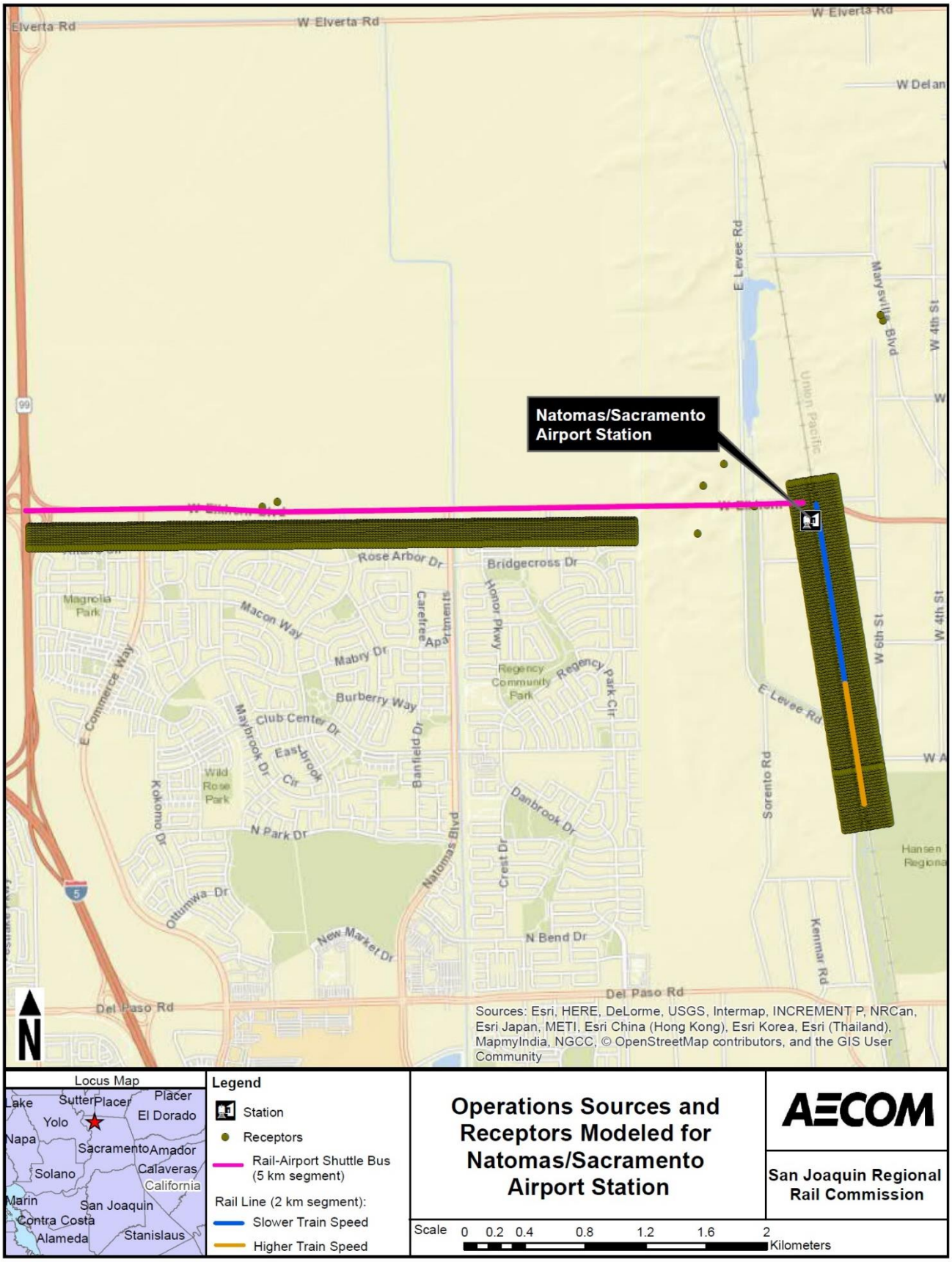


Table A-8: Lodi Station Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width[3] [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track (North Segment) – High Speeds[1]	43	1.16279E-02	2	12.2	5	5.67	1.163
Track (South Segment) – High Speeds[2]	43		2	12.2	5	5.67	1.163
Track – Slow Speeds/Near Station	135	7.40741E-03	2	12.2	5	5.67	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SJVAPCD guidance.
1. Segment of track that is 400 m north of the station.
2. Segment of track that is 400 m south of the station.
3. Source width accounts for 3 m on each side of track for wake affects and 3.1 m for track width.

Table A-9: Stockton ACE Station Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width[3] [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track (North Segment) – High Speeds[1]	32	1.56250E-02	2	12.2	5	5.67	1.163
Track (South Segment) – High Speeds[2]	32		2	12.2	5	5.67	1.163
Track – Slow Speeds/Near Station	101	9.90099E-03	2	12.2	5	5.67	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SJVAPCD guidance.
1. Segment of track that is 400 m north of the station.
2. Segment of track that is 400 m south of the station.
3. Source width accounts for 3 m on each side of track for wake affects and 3.1 m for track width.

Table A-10: Thornton Track Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width[2] [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track – High Speed[1]	164	6.09756E-03	2	12.2	5	5.67	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SJVAPCD guidance.
1. Higher train speed used since no station at this site.
2. Source width accounts for 3 m on each side of track for wake affects and 3.1 m for track width.

Table A-11: North of Elk Grove Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Units	-	[g/s/vol]	-	[m]	[m]	[m]	[m]
Track (North Segment) – High Speeds[1]	134	3.74532E-03	1	3	5	1.40	1.163
Track (South Segment) – High Speeds[2]	133		1	3	5	1.40	1.163
Track – Slow Speeds/Near Curve	400	2.50000E-03	1	3	5	1.40	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Segment of track that is north of the curve.
2. Segment of track that is south of the curve approach.

Table A-12: City College Station Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width[3] [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track (North Segment) – High Speeds[1]	50	1.00000E-02	2	8	5	3.72	1.163
Track (South Segment) – High Speeds[2]	50		2	8	5	3.72	1.163
Track – Slow Speeds/Near Station	150	6.66667E-03	2	8	5	3.72	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Segment of track that is 400 m north of the station.
2. Segment of track that is 400 m south of the station.
3. Width accounts for 2 m gap between tracks. Each track width is 6 m.

Table A-13: Freeport Boulevard Curve Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track – High Speed	446	2.24215E-03	1	3	5	1.40	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Higher train speed used since no station at this site.

Table A-14: Midtown Sacramento Station Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track (North Segment) – High Speeds[1]	133	3.74532E-03	1	3	5	1.40	1.163
Track (South Segment) – High Speeds[2]	134		1	3	5	1.40	1.163
Track – Slow Speeds/Near Station	401	2.49377E-03	1	3	5	1.40	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Segment of track that is 400 m north of the station.
2. Segment of track that is 400 m south of the station.

Table A-15: Old North Station & Del Paso Track Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width[3] [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track (North Segment) – High Speeds[1]	51	9.80392E-03	2	8	5	3.72	1.163
Track (South Segment) – High Speeds[2]	51		2	8	5	3.72	1.163
Track – Slow Speeds/Near Station	150	6.66667E-03	2	8	5	3.72	1.163

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.
1. Segment of track that is 400 m north of the station.
2. Segment of track that is 400 m south of the station.
3. Width accounts for 2 m gap between tracks. Each track width is 6 m.

Table A-16: Natomas/Sacramento International Airport Station Operational Volume Source Parameters

Source Details	# of Volume Sources	Emissions per Volume [g/s/vol]	No. of Tracks	Width [m]	Release Height [m]	Sigma-y [m]	Sigma-z [m]
Track (North Segment) – High Speeds[1]	134	3.73134E-03	1	3	5	1.40	1.163
Track (South Segment) – High Speeds[2]	134		1	3	5	1.40	1.163
Track – Slow Speeds/Near Station	400	2.50000E-03	1	3	5	1.40	1.163
Shuttle Bus[3]	1406	7.11238E-04	-	3.65	6.8	1.70	3.200

Notes: g/s/vol = grams per second per number of volume sources. Follows SMAQMD guidance.

1. Segment of track that is 400 m north of the station.
2. Segment of track that is 400 m south of the station.
3. Shuttle bus between rail station and Sacramento International Airport.

AECOM

Valley Rail Sacramento Extension Project

Health Risk Screening Modeling Archive

September 2020

This document provides descriptions of the files within the Health Risk modeling archive for the proposed Valley Rail Sacramento Extension Project.

Model_Archive_Readme.docx: This file which describes the modeling archive organization and files.

Executables: EPA executable files for AERMAP (version 18081) and AERMOD (version 19191).

Results_Summary: Contains Excel spreadsheets for each air district that include the cancer risk and chronic non-cancer risk output from HARP. The results are summarized in tables provided in the Summary tabs.

SJVAPCD: Contains the modeling files for San Joaquin Valley Air Pollution Control District (SJVAPCD). Each of the modeling sites are listed in separate folders. The meteorological data for all SJVAPCD sites are contained in the Met_Data folder. In each modeling site folders (except for Stockton ACE which does not involve construction) are the directories as follows:

- **Construction** – contains the input and output files modeling files for the construction phase of the station/track improvements.
  - **AERMAP** – contains the input and output files used to create the modeling receptor files (*.rou) that are used for input to AERMOD. National Elevation Dataset (NED) files are included, which are obtained from the U.S. Geological Survey (USGS).
  - **AERMOD** – contains the input and output files from AERMOD.
  - **HARP2** – contains the input and output files (including emissions) from the HARP software.
- **Operations** – contains the input and output files modeling files for the operational phase of the tracks for the 2 km segments discussed in the HRA.
  - **AERMAP** – contains the input and output files used to create the modeling receptor files (*.rou) that are used for input to AERMOD. National Elevation Dataset (NED) files are included, which are obtained from the U.S. Geological Survey (USGS).
  - **AERMOD** – contains the input and output files from AERMOD.
  - **HARP2** – contains the input and output files (including emissions) from the HARP software.

SMAQMD: Contains the modeling files for Sacramento Metropolitan Air Quality Management District (SMAQMD). The meteorological data for the SMAQMD sites are contained in the Met_Data folder. In each modeling site folders (except for Freeport Curve which does not involve construction) are the directories as follows:

- **Construction** – contains the input and output files modeling files for the construction phase of the station/track improvements.
  - **AERMAP** – contains the input and output files used to create the modeling receptor files (*.rou) that are used for input to AERMOD. National Elevation Dataset (NED) files are included, which are obtained from the U.S. Geological Survey (USGS).
  - **AERMOD** – contains the input and output files from AERMOD.
  - **HARP2** – contains the input and output files (including emissions) from the HARP software.
- **Operations** – contains the input and output files modeling files for the operational phase of the tracks for the 2 km segments discussed in the HRA.
  - **AERMAP** – contains the input and output files used to create the modeling receptor files (*.rou) that are used for input to AERMOD. National Elevation Dataset (NED) files are included, which are obtained from the U.S. Geological Survey (USGS).
  - **AERMOD** – contains the input and output files from AERMOD.
  - **HARP2** – contains the input and output files (including emissions) from the HARP software.

AECOM
2020 L Street, Suite 400
Sacramento, CA 95811
916-414-5800 Tel

June 23, 2020

Proposed Health Risk Assessment for the Valley Rail Sacramento Extension Project

With consideration for comments on the Valley Rail Sacramento Extension Project (proposed project) Draft Environmental Impact Report (EIR), the San Joaquin Joint Powers Authority (SJJPA) and the San Joaquin Regional Rail Commission (SJRRC) have decided to conduct a health risk assessment (HRA) for the proposed project in support of the air quality impact analysis in the EIR. The following provides an overview of the proposed approach.

I. Introduction

The Air Quality Analysis in support of the proposed project will be expanded to include preparation of a HRA and supporting Technical Report in response to comments by the Sacramento Metropolitan Air Quality Management District (SMAQMD) on the proposed project's Draft EIR. The HRA will be conducted on Phase I improvements under the proposed project only and will not consider Phase II improvements.[1]

II. Objectives

The purpose of the HRA is to assess potential toxic air contaminant (TAC) emission impacts associated with short-term construction and long-term daily operation of the proposed project. SMAQMD has requested that the HRA be prepared as part of the response to comments on the Draft EIR to determine the potential risk on the exposure of sensitive receptors to TAC emissions from the proposed project.

The HRA and Technical Report will be developed consistent with guidance and methodologies from local, regional, state, and federal agencies, including the California Air Pollution Control Officers Association (CAPCOA) (2009), the California Air Resources Board (ARB) (2017), the Office of Environmental Health Hazard Assessment (OEHHA) (2015), SMAQMD Mobile Sources Air Toxics Protocol (2019), and the U.S. Environmental Protection Agency (EPA) (2017) to support the proposed project's California Environmental Quality Act (CEQA) documentation.

Consistent with CEQA requirements and guidance provided by CAPCOA, the analysis will evaluate:

1. *Health risk and hazard impacts of construction emissions* from the proposed project to the existing off-site sensitive receptors located within 500 feet of the project alignment.

2. *Health risk and hazard impacts of operational emissions* from the project-related to existing off-

[1] All proposed Phase II improvements have been dropped from further consideration by the SJRRC.

site sensitive receptors (residents and schools) located within 500 feet of the project alignment.

III. HRA Methodology Overview

Mass Emissions Estimates

Project-related construction and operational emissions were estimated for each component of the proposed project in support of the Draft EIR. These emissions will be refined slightly to include application of the ARB off-model adjustment factors for EMFAC2017 to account for changes in vehicle emissions due to the *Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule Part One: One National Program*, recently adopted at the Federal government level. The refined emissions will be broken out by location and serve as the input to the HRA modeling. Only the mitigated construction emissions will be used, not separate unmitigated and mitigated scenarios, as these are required to reduce construction-related emissions to a less than significant level irrespective of the HRA.

Receptor Exposure and Health Risk Calculations

The HRA will evaluate TAC emissions (e.g., diesel particulate matter) and the potential exposure of existing nearby sensitive receptors within 500 feet of the proposed project alignment to substantial pollutant concentrations. The HRA will quantify health risks (cancer and non-cancer chronic risk) resulting from the proposed project on the surrounding community per year of construction and under full operational conditions.

The incremental increase in cancer risk and non-cancer chronic risk will be assessed using an acceptable air dispersion model. The American Meteorological Society/EPA Regulatory Model (AERMOD) dispersion model (Version 19191) will be used to estimate pollutant concentrations at specific distances from emission sources. Hourly meteorological data will be obtained from the most representative meteorological station to each location to be analyzed along the alignment. Terrain elevations will be obtained from commercially available digital terrain elevations developed by the United States Geological Survey's (USGS') National Elevation Dataset (NED). The NED data provide terrain elevations with 1 meter vertical resolution and 10 meter (1/3 arc-second) horizontal resolution based on a Universal Transverse Mercator (UTM) coordinate system. The USGS specifies coordinates in North American Datum 83, UTM Zone 10. Lakes Environmental software will be used to process the NED data and assign elevations to the receptor locations and sources.

The ARB created the Hot Spots Analysis and Reporting Program Version 2 (HARP2) software (Version 19121) to assist in the development of emissions inventories, dispersion modeling, and risk assessment. Maximum hourly and period-average files generated by AERMOD will be input to HARP2 with corresponding TAC emission rates for each phase of construction as well as the project operational emissions to calculate project concentration contributions. HARP2 will be used solely to estimate cancer and non-cancer chronic risk consistent with the exposure factors and guidance from OEHHA. Health risks will be calculated for all receptors and for the maximally exposed individual at a sensitive receptor. Risks to receptors will be calculated assuming exposure during the entire construction period through operations. A total 30-year cancer and non-cancer chronic risk from 30 years of exposure to project emissions will be presented by adding the construction risks to the operational risk at each receptor location.

Due to the linear nature of the proposed project over approximately 52 miles of existing railroad alignment, modeling in support of the HRA will be conducted at select locations to represent the maximum potential impacts. These locations have been identified based upon the following criteria: magnitude of potential project-related emissions, alignment orientation, unique meteorological conditions, and proximity of sensitive receptors. See Tables 1 and 2 for a detailed list of proposed modeling locations selected to analyze the maximum potential impact of the proposed project, considering both construction and operational emissions.

IV. Revisions to the Draft EIR

The results of the HRA will be summarized in a Technical Report. The modeling outputs and assumptions will also be provided as a part of the Technical Report, which will be provided as an appendix to the EIR. The air quality analysis and impact findings in the EIR will be updated according to the conclusions of the HRA.

V. Modeling Scenarios

Table 1. Modeling Scenarios within SJVAPCD

Project Element (Refer to Draft EIR Chapter 2, Project Description)	Alignment (degrees from North)	Meteorological Station	Phase (Construction and/or Operations)	Construction Duration (months)	Construction Year	Model (Y/N)	Notes
Stockton Downtown/ACE Station	347.7	Stockton	Operations	N/A	N/A	Y	No construction proposed, but will incur increased train operations.
Track Curve Reconstruction East March Lane to East Swain Road	337.5-343.5	Stockton	Construction	1	2022	N	Same emissions and alignment as Thornton
Track Curve Reconstruction North of North New Hope Road	340.4	Stockton	Construction	1	2022	N	Same emissions and alignment as Thornton
Hammer Lane Siding Upgrade	336.7	Stockton	Construction	1	2023	N	Same emissions and alignment as Thornton
Thornton Siding Upgrade & Extension	336.9-343.4	Stockton	Construction /Operations	4	2023	Y	
Lodi Station	336.7	Stockton	Construction/Operations	14	2021	Y	Model Lodi Station construction with Lodi siding
Lodi Station South Alternative	336.7	Stockton	Construction/Operations	14	2021	N	Same as other alternative
Lodi Siding	336.7	Stockton	Construction	8	2021	N	Model w/ station construction

Table 2. Modeling Scenarios within SMAQMD

Project Element (Refer to Draft EIR Chapter 2, Project Description)	Alignment (degrees from North)	Meteorological Station	Phase (Construction and/or Operations)	Construction Duration (months)	Construction Year	Model (Y/N)	Notes
Track Curve Reconstruction South of Desmond Road	349.85	Sac. Exec.	Construction	1	2022	N	No residences within 500 ft
Philips Siding Upgrade and Extension	355.3	Sac. Exec.	Construction	2	2021	N	Same alignment as N. Elk Grove
North Elk Grove Station	355.29	Sac. Exec.	Construction/Operations	14	2021	Y	All Variants Result in the Same Emissions and Duration
North Elk Grove Siding	355.29	Sac. Exec.	Construction	8	2021		
Track Curve Reconstruction North of North Elk Grove Station	355	Sac. Exec.	Construction	1	2022		
Pollock Siding Upgrade	346.9	Sac. Exec.	Construction	2	2023	N	Same alignment and emissions as South Sacramento Siding
New Crossover	346.9	Sac. Exec.	Construction	2	2023	N	Same alignment and emissions as South Sacramento Siding
City College Station	347	Sac. Exec.	Construction/Operations	8	2023	Y	Model construction w/ South Sacramento Siding
South Sacramento Siding Upgrade	347	Sac. Exec.	Construction	4	2023	N	Model construction w/ City College Station
Freeport Blvd Parallel - Curve	347-19	Sac. Exec.	Operations	N/A	N/A	Y	Included to assess increased train operations on a unique segment of alignment that doesn't also include construction activity.
Midtown Sacramento Station	19.24	Sac. Exec.	Construction/Operations	12	2021	Y	
Old North Sacramento Station	19.54	Sac. McCl.	Construction/Operations	14	2023	Y	SETA Childcare, Residences up by Del Paso Curve
Del Paso Siding Upgrade and Extension	352.1-19.54	Sac. McCl.	Construction/Operations	12	2021		
Natomas / Sacramento Airport Station	352.14	Sac. McCl.	Construction/Operations	12	2021	Y	

Construction Emissions by Location

Project Element	Construction	Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e	Max Annual Emissions (tons/year) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Total Emissions (metric tons) CO2e
LODI STATION																					
Equipment		8.03	39.75	99.90	0.10	3.17	3.06	9735.88	1.40	0.63	4.52	0.52	2.92	5.46	0.01	0.23	0.22	585.38	0.14	0.06	550.93
Onsite Vehicles		0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10	0.01	0.02	0.05	0.00	0.37	0.04	13.51	0.00	0.00	12.25
Earthmoving		-	-	-	-	19.72	10.80	-	-	-	-	-	-	-	-	0.38	0.21	-	-	-	-
Paving		1.48	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68	0.02	0.25	0.30	0.00	0.19	0.06	141.98	0.00	0.01	128.81
Total	2021	*9.94*	*44.58*	*103.76*	*0.12*	*32.16*	*14.62*	9963.95	*2.01*	*0.72*	5.30	*0.60*	*3.19*	*5.82*	*0.01*	*1.18*	*0.52*	*740.87*	*0.14*	*0.08*	*691.99*
LODI STATION - SOUTH ALTERNATIVE																					
Equipment		8.03	39.75	99.90	0.10	3.17	3.06	9735.88	1.40	0.63	4.52	0.52	2.92	5.46	0.01	0.23	0.22	585.38	0.14	0.06	550.93
Onsite Vehicles		0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10	0.01	0.02	0.05	0.00	0.37	0.04	13.51	0.00	0.00	12.25
Earthmoving		-	-	-	-	19.82	10.81	-	-	-	-	-	-	-	-	0.38	0.21	-	-	-	-
Paving		1.70	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68	0.02	0.25	0.30	0.00	0.19	0.06	141.98	0.00	0.01	128.81
Total	2021	10.16	44.58	103.76	0.12	32.25	14.63	9963.95	2.01	0.72	5.30	0.60	3.19	5.82	0.01	1.18	0.52	740.87	0.14	0.08	691.99
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD																					
Equipment		5.56	21.51	77.11	0.06	2.16	2.08	5936.26	0.94	0.42	2.75	0.05	0.23	0.68	0.00	0.02	0.02	55.92	0.01	0.01	52.42
Onsite Vehicles		0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.02	0.00	0.81	0.00	0.00	0.74
Earthmoving		-	-	-	-	19.58	10.79	-	-	-	-	-	-	-	-	0.02	0.01	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.02	0.01	0.00	0.01	0.00	7.56	0.00	0.00	6.86
Total	2022	5.86	24.49	80.30	0.07	28.03	13.38	6088.44	1.40	0.50	3.33	0.06	0.25	0.70	0.00	0.07	0.04	64.29	0.01	0.01	60.01
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD																					
Equipment		5.56	21.51	77.11	0.06	2.16	2.08	5936.26	0.94	0.42	2.75	0.05	0.23	0.68	0.00	0.02	0.02	55.92	0.01	0.01	52.42
Onsite Vehicles		0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.02	0.00	0.81	0.00	0.00	0.74
Earthmoving		-	-	-	-	19.58	10.79	-	-	-	-	-	-	-	-	0.02	0.01	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.02	0.01	0.00	0.01	0.00	7.56	0.00	0.00	6.86
Total	2022	5.86	24.49	80.30	0.07	28.03	13.38	6088.44	1.40	0.50	3.33	0.06	0.25	0.70	0.00	0.07	0.04	64.29	0.01	0.01	60.01
HAMMER LANE SIDING UPGRADE																					
Equipment		5.56	21.51	77.11	0.06	2.16	2.08	5936.26	0.94	0.42	2.75	0.11	0.47	1.37	0.00	0.05	0.04	111.83	0.02	0.01	104.84
Onsite Vehicles		0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07	0.00	0.00	0.01	0.00	0.05	0.00	1.63	0.00	0.00	1.48
Earthmoving		-	-	-	-	19.58	10.79	-	-	-	-	-	-	-	-	0.03	0.02	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.03	0.03	0.00	0.02	0.01	15.12	0.00	0.00	13.72
Total	2023	5.86	24.49	80.30	0.07	28.03	13.38	6088.44	1.40	0.50	3.33	0.11	0.50	1.40	0.00	0.15	0.07	128.58	0.02	0.01	120.03
THORNTON SIDING UPGRADE & EXTENSION																					
Equipment		5.56	21.51	77.11	0.06	2.16	2.08	5936.26	0.94	0.42	2.75	0.22	0.93	2.73	0.00	0.09	0.09	223.66	0.05	0.02	209.67
Onsite Vehicles		0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07	0.00	0.00	0.01	0.00	0.10	0.01	3.26	0.00	0.00	2.96
Earthmoving		-	-	-	-	20.42	10.89	-	-	-	-	-	-	-	-	0.07	0.04	-	-	-	-
Paving		0.03	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.06	0.06	0.00	0.04	0.01	30.24	0.00	0.00	27.43
Total	2023	5.89	24.49	80.30	0.07	28.87	13.48	6088.44	1.40	0.50	3.33	0.22	1.00	2.80	0.00	0.30	0.14	257.16	0.05	0.02	240.06
LODI SIDING																					
Equipment		5.56	21.51	77.11	0.06	2.16	2.08	5936.26	0.94	0.42	2.75	0.44	1.87	5.46	0.00	0.19	0.18	447.32	0.09	0.04	419.35
Onsite Vehicles		0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07	0.00	0.01	0.02	0.00	0.20	0.02	6.52	0.00	0.00	5.91
Earthmoving		-	-	-	-	20.65	10.92	-	-	-	-	-	-	-	-	0.13	0.07	-	-	-	-
Paving		0.11	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.01	0.12	0.12	0.00	0.08	0.02	60.48	0.00	0.01	54.86
Total	2021	5.98	24.49	80.30	0.07	29.10	13.51	6088.44	1.40	0.50	3.33	0.45	1.99	5.60	0.01	0.60	0.29	514.31	0.10	0.05	480.12
Max Daily / Annual	**2021**	**16.14**	**69.07**	**184.06**	**0.19**	**61.35**	**28.14**	**16,052.39**	**3.41**	**1.23**	**8.63**	**1.05**	**5.18**	**11.42**	**0.01**	**1.77**	**0.81**	**1,255.18**	**0.24**	**0.13**	**1,172.11**
	2022	**11.73**	**48.98**	**160.60**	**0.15**	**56.05**	**26.76**	**12,176.89**	**2.80**	**1.01**	**6.67**	**0.11**	**0.50**	**1.40**	**0.00**	**0.15**	**0.07**	**128.58**	**0.02**	**0.01**	**120.03**
	2023	**11.76**	**48.98**	**160.60**	**0.15**	**56.90**	**26.86**	**12,176.89**	**2.80**	**1.01**	**6.67**	**0.34**	**1.50**	**4.20**	**0.00**	**0.44**	**0.22**	**385.74**	**0.07**	**0.04**	**360.09**
SJVAPCD Thresholds		100.00	100.00	100.00	100.00	100.00	100.00	-	-	-		10.00	100.00	10.00	27.00	15.00	15.00	-	-	-	
Emissions Exceed Thresholds?		No	No	Yes	No	No	No					No	No	Yes	No	No	No				

Construction Emissions by Location		Daily Emissions (lb/day)									Daily Emissions (metric tons/day)	Max Annual Emissions (tons/year)									Total Emissions (metric tons)
Project Element	Construction	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	CO2e	ROG	CO	NOX	SO2	PM10 (Total)	PM2.5 (Total)	CO2	CH4	N20	CO2e
~~ELK GROVE STATION ACCESS (New Intersection West of Existing)~~																					
~~Equipment~~		~~3.15~~	~~18.56~~	~~33.90~~	~~0.04~~	~~1.53~~	~~1.41~~	~~3,851.34~~	~~0.94~~	~~0.42~~	~~3.79~~	~~0.44~~	~~2.63~~	~~4.47~~	~~0.01~~	~~0.20~~	~~0.19~~	~~595.60~~	~~0.12~~	~~0.06~~	~~476.64~~
~~Onsite Vehicles~~		~~0.08~~	~~0.17~~	~~0.51~~	~~0.00~~	~~2.70~~	~~0.38~~	~~133.91~~	~~0.00~~	~~0.02~~	~~0.06~~	~~0.01~~	~~0.02~~	~~0.05~~	~~0.00~~	~~0.34~~	~~0.02~~	~~12.51~~	~~0.00~~	~~0.00~~	~~41.26~~
Equipment		5.56	21.51	77.11	0.06	2.16	2.08	5,936.26	0.94	0.42	2.75	0.11	0.47	1.37	0.00	0.05	0.04	111.83	0.02	0.01	104.84
Onsite Vehicles		0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07	0.00	0.00	0.01	0.00	0.05	0.00	1.63	0.00	0.00	1.48
Earthmoving		-	-	-	-	19.58	10.79	-	-	-	-	-	-	-	-	0.03	0.02	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.03	0.03	0.00	0.02	0.01	15.12	0.00	0.00	13.72
Total	2023	5.86	24.49	80.30	0.07	28.03	13.38	6,088.44	1.40	0.50	3.33	0.11	0.50	1.40	0.00	0.15	0.07	128.58	0.02	0.01	120.03
Max Daily / Annual	**2021**	**37.11**	**158.22**	**391.57**	**0.43**	**126.50**	**57.52**	**35,980.29**	**7.43**	**2.68**	**19.23**	**2.41**	**11.59**	**27.28**	**0.03**	**3.45**	**1.61**	**2,837.48**	**0.53**	**0.27**	**2,648.97**
	2022	**11.73**	**48.98**	**168.60**	**0.15**	**56.06**	**26.76**	**12,176.89**	**2.80**	**1.01**	**6.67**	**0.11**	**0.58**	**1.40**	**0.00**	**0.15**	**0.07**	**128.58**	**0.02**	**0.01**	**120.03**
	2023	**36.06**	**162.62**	**448.41**	**0.46**	**141.79**	**68.69**	**38,193.23**	**8.22**	**2.96**	**20.60**	**1.84**	**8.85**	**21.35**	**0.02**	**2.58**	**1.19**	**2,204.53**	**0.40**	**0.20**	**2,056.86**
SMAQMD Thresholds		-	-	85.00	-	80.00	82.00	-	-	-	-	-	-	-	-	14.60	15.00	-	-	-	1,100.00
Emissions Exceed Thresholds?		-	-	Yes	-	Yes	No	-	-	-	-	-	-	-	-	No	No	-	-	-	Yes
								CO2	CH4	N20	CO2e							CO2	CH4	N20	CO2e
Maximum Annual GHG Emissions Acorss Entire Project Alignment:	**2021**							52,032.68	10.84	3.90	27.87							4093	0.76	0.40	3821
	2022							24,353.78	5.60	2.01	13.34							257	0.05	0.02	240
	2023							50,370.12	11.03	3.96	27.27							2590	0.47	0.24	2416
	Total																	6940	1.28	0.67	6477

Construction Emissions by Location

		Mitigated Daily Emissions (lb/day)									Daily Emissions (metric tons/day)	Mitigated Maximum Annual Emissions (tons/year)													Total Emissions (metric tons)
Project Element	Construction Start Year	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	CO2e	ROG	CO	NOX	SO2	PM10 (Fugitive Dust)	PM10 (Exhaust)	PM10 (Total)	PM2.5 (Fugitive Dust)	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	CH4	N20	CO2e
LODI STATION																									
Equipment		1.31	44.27	13.05	0.10	0.20	0.19	9735.88	1.40	0.63	4.52	0.08	2.95	0.50	0.01	-	0.01	0.01	-	0.01	0.01	585.40	0.14	0.06	550.93
Onsite Vehicles		0.12	0.30	0.79	0.00	3.00	0.31	225.68	0.01	0.03	0.10	0.01	0.02	0.05	0.00	0.1591	0.0012	0.16	0.0155	0.0011	0.02	13.51	0.00	0.00	12.25
Earthmoving		-	-	-	-	7.79	4.22	-	-	-	-	-	-	-	-	0.15	-	0.15	0.08	-	0.08	-	-	-	-
Paving		1.48	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68	0.02	0.25	0.30	0.00	0.1852	0.0074	0.19	0.0485	0.0071	0.06	141.98	0.00	0.01	128.81
Total	2021	*3.21*	*49.09*	*16.90*	*0.12*	*13.29*	*4.79*	9963.95	*2.01*	*0.72*	*5.30*	*0.16*	*3.22*	*0.85*	*0.01*	*0.49*	*0.02*	*0.52*	*0.15*	*0.02*	*0.17*	*740.90*	*0.14*	*0.08*	*691.99*
LODI STATION - SOUTH ALTERNATIVE																									
Equipment		1.31	44.27	13.05	0.10	0.20	0.19	9735.88	1.40	0.63	4.52	0.08	2.95	0.50	0.01	-	0.01	0.01	-	0.01	0.01	585.40	0.14	0.06	550.93
Onsite Vehicles		0.12	0.30	0.79	0.00	3.00	0.31	225.68	0.01	0.03	0.10	0.01	0.02	0.05	0.00	0.1591	0.0012	0.16	0.0155	0.0011	0.02	13.51	0.00	0.00	12.25
Earthmoving		-	-	-	-	7.88	4.23	-	-	-	-	-	-	-	-	0.15	-	0.15	0.08	-	0.08	-	-	-	-
Paving		1.70	-	-	-	-	-	-	-	-	-	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68	0.02	0.25	0.30	0.00	0.1852	0.0074	0.19	0.0485	0.0071	0.06	141.98	0.00	0.01	128.81
Total	2021	3.43	49.09	16.90	0.12	13.38	4.80	9963.95	2.01	0.72	5.30	0.17	3.22	0.85	0.01	*0.50*	*0.02*	0.52	*0.15*	*0.02*	0.17	740.90	0.14	0.08	691.99
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD																									
Equipment		0.85	22.27	10.02	0.06	0.14	0.13	5936.26	0.94	0.42	2.75	0.01	0.23	0.07	0.00	-	0.00	0.00	-	0.00	0.00	55.94	0.01	0.01	52.42
Onsite Vehicles		0.08	0.20	0.53	0.00	1.96	0.20	150.38	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.0106	0.0001	0.01	0.0010	0.0001	0.00	0.81	0.00	0.00	0.74
Earthmoving		-	-	-	-	7.64	4.21	-	-	-	-	-	-	-	-	0.01	-	0.01	0.00	-	0.00	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.02	0.01	0.00	0.0094	0.0003	0.01	0.0025	0.0003	0.00	7.56	0.00	0.00	6.86
Total	2022	1.15	25.25	13.21	0.07	11.48	4.61	6088.44	1.40	0.50	3.33	0.01	0.25	0.08	0.00	*0.03*	*0.00*	0.03	*0.01*	*0.00*	0.01	64.32	0.01	0.01	60.01
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD																									
Equipment		0.85	22.27	10.02	0.06	0.14	0.13	5936.26	0.94	0.42	2.75	0.01	0.23	0.07	0.00	-	0.00	0.00	-	0.00	0.00	55.94	0.01	0.01	52.42
Onsite Vehicles		0.08	0.20	0.53	0.00	1.96	0.20	150.38	0.00	0.02	0.07	0.00	0.00	0.00	0.00	0.0106	0.0001	0.01	0.0010	0.0001	0.00	0.81	0.00	0.00	0.74
Earthmoving		-	-	-	-	7.64	4.21	-	-	-	-	-	-	-	-	0.01	-	0.01	0.00	-	0.00	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.02	0.01	0.00	0.0094	0.0003	0.01	0.0025	0.0003	0.00	7.56	0.00	0.00	6.86
Total	2022	1.15	25.25	13.21	0.07	11.48	4.60	6088.44	1.40	0.50	3.33	0.01	0.25	0.08	0.00	*0.03*	*0.00*	0.03	*0.01*	*0.00*	0.01	64.32	0.01	0.01	60.01
HAMMER LANE SIDING UPGRADE																									
Equipment		0.85	22.27	10.02	0.06	0.14	0.13	5936.26	0.94	0.42	2.75	0.02	0.46	0.13	0.00	-	0.00	0.00	-	0.00	0.00	111.86	0.02	0.01	104.84
Onsite Vehicles		0.08	0.20	0.53	0.00	1.96	0.20	150.38	0.00	0.02	0.07	0.00	0.00	0.01	0.00	0.0211	0.0001	0.02	0.0021	0.0001	0.00	1.63	0.00	0.00	1.48
Earthmoving		-	-	-	-	7.64	4.21	-	-	-	-	-	-	-	-	0.01	-	0.01	0.01	-	0.01	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.03	0.03	0.00	0.0188	0.0007	0.02	0.0049	0.0007	0.01	15.12	0.00	0.00	13.72
Total	2023	1.15	25.25	13.21	0.07	11.48	4.61	6088.44	1.40	0.50	3.33	0.02	0.49	0.17	0.00	*0.05*	*0.00*	0.06	*0.01*	*0.00*	0.02	128.60	0.02	0.01	120.03
THORNTON SIDING UPGRADE & EXTENSION																									
Equipment		0.85	22.27	10.02	0.06	0.14	0.13	5936.26	0.94	0.42	2.75	0.03	0.92	0.27	0.00	-	0.00	0.00	-	0.00	0.00	223.69	0.05	0.02	209.67
Onsite Vehicles		0.08	0.20	0.53	0.00	1.96	0.20	150.38	0.00	0.02	0.07	0.00	0.00	0.01	0.00	0.0423	0.0002	0.04	0.0041	0.0002	0.00	3.26	0.00	0.00	2.96
Earthmoving		-	-	-	-	8.48	4.31	-	-	-	-	-	-	-	-	0.03	-	0.03	0.01	-	0.01	-	-	-	-
Paving		0.03	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.06	0.06	0.00	0.0377	0.0014	0.04	0.0099	0.0013	0.01	30.24	0.00	0.00	27.43
Total	2023	1.18	25.25	13.21	0.07	12.32	4.71	6088.44	1.40	0.50	3.33	0.04	0.99	0.34	0.00	*0.1073*	*0.0062*	0.1136	*0.028*	*0.006*	0.034	257.18	0.05	0.02	240.06
LODI SIDING																									
Equipment		0.85	22.27	10.02	0.06	0.14	0.13	5936.26	0.94	0.42	2.75	0.06	1.85	0.54	0.00	-	0.01	0.01	-	0.01	0.01	447.35	0.09	0.04	419.35
Onsite Vehicles		0.08	0.20	0.53	0.00	1.96	0.20	150.38	0.00	0.02	0.07	0.00	0.01	0.02	0.00	0.0845	0.0005	0.09	0.0082	0.0005	0.01	6.52	0.00	0.00	5.91
Earthmoving		-	-	-	-	8.71	4.34	-	-	-	-	-	-	-	-	0.06	-	0.06	0.03	-	0.03	-	-	-	-
Paving		0.11	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.01	0.12	0.12	0.00	0.0753	0.0027	0.08	0.0197	0.0026	0.02	60.48	0.00	0.01	54.86
Total	2021	1.26	25.25	13.21	0.07	12.55	4.74	6088.44	1.40	0.50	3.33	0.08	1.97	0.68	0.01	*0.22*	*0.01*	0.23	*0.056*	*0.012*	0.07	514.34	0.095	0.05	480.12
Max Daily / Annual	**2021**	**4.70**	**74.34**	**30.11**	**0.19**	**25.93**	**9.54**	**16,052.39**	**3.41**	**1.23**	**8.63**	**0.24**	**5.19**	**1.53**	**0.01**	**0.71**	**0.03**	**0.75**	**0.20**	**0.03**	**0.23**	**1,255.24**	**0.24**	**0.13**	**1,172.11**
	2022	**2.31**	**50.49**	**26.42**	**0.15**	**22.96**	**9.21**	**12,176.89**	**2.80**	**1.01**	**6.67**	**0.02**	**0.49**	**0.17**	**0.00**	**0.05**	**0.00**	**0.06**	**0.01**	**0.00**	**0.02**	**128.63**	**0.02**	**0.01**	**120.03**
	2023	**2.34**	**50.49**	**26.42**	**0.15**	**23.80**	**9.31**	**12,176.89**	**2.80**	**1.01**	**6.67**	**0.06**	**1.48**	**0.51**	**0.00**	**0.16**	**0.01**	**0.17**	**0.04**	**0.01**	**0.05**	**385.79**	**0.07**	**0.04**	**360.09**
	SJVAPCD Thresholds	100.00	100.00	100.00	100.00	100.00	100.00	-	-	-		10.00	100.00	10.00	27.00	-	-	15.00	-	-	15.00	-	-	-	
	Emissions Exceed Thresholds?	No	No	No	No	No	No					No	No	No	No	NA	NA	No	NA	NA	No				

Construction Emissions by Location

Project Element	Construction Start Year	Mitigated Daily Emissions (lb/day)									Daily Emissions (metric tons/day)	Mitigated Maximum Annual Emissions (tons/year)												Total Emissions (metric tons)
		ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	CO2e	ROG	CO	NOX	SO2	PM10 (Fugitive Dust)	PM10 (Exhaust)	PM10 (Total)	PM2.5 (Fugitive Dust)	PM2.5 (Exhaust)	PM2.5 (Total)	CO2	CH4	N20	CO2e
~~ELK GROVE STATION ACCESS (New Intersection West of Existing)~~																									
~~Equipment~~		~~0.52~~	~~22.32~~	~~3.40~~	~~0.04~~	~~0.87~~	~~0.87~~	~~3851.34~~	~~0.94~~	~~0.42~~	~~1.79~~	~~0.07~~	~~2.64~~	~~0.38~~	~~0.01~~	-	~~0.01~~	~~0.01~~	-	~~0.01~~	~~0.01~~	~~595.42~~	~~0.12~~	~~0.06~~	~~476.64~~
~~Onsite Vehicles~~		~~0.08~~	~~0.17~~	~~0.53~~	~~0.00~~	~~1.64~~	~~0.17~~	~~153.91~~	~~0.00~~	~~0.02~~	~~0.06~~	~~0.01~~	~~0.02~~	~~0.05~~	~~0.00~~	~~0.1444~~	~~0.0011~~	~~0.15~~	~~0.0141~~	~~0.0011~~	~~0.02~~	~~12.51~~	~~0.00~~	~~0.00~~	~~11.35~~
Equipment		0.85	22.27	10.02	0.06	0.14	0.13	5936.26	0.94	0.42	2.75	0.02	0.46	0.13	0.00	-	0.00	0.00	-	0.00	0.00	111.86	0.02	0.01	104.84
Onsite Vehicles		0.08	0.20	0.53	0.00	1.96	0.20	150.38	0.00	0.02	0.07	0.00	0.00	0.01	0.00	0.0211	0.0001	0.02	0.0021	0.0001	0.00	1.63	0.00	0.00	1.48
Earthmoving		-	-	-	-	7.64	4.21	-	-	-	-	-	-	-	-	0.01	-	0.01	0.01	-	0.01	-	-	-	-
Paving		0.00	-	-	-	-	-	-	-	-	-	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-
Offsite Vehicles		0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52	0.00	0.03	0.03	0.00	0.0188	0.0007	0.02	0.0049	0.0007	0.01	15.12	0.00	0.00	13.72
Total	2023	1.15	25.25	13.21	0.07	11.48	4.61	6,088.44	1.40	0.50	3.33	0.02	0.49	0.17	0.00	*0.05*	*0.00*	0.06	*0.014*	*0.003*	0.02	128.60	0.02	0.01	120.03
Max Daily / Annual	**2021**	**12.22**	**172.53**	**63.91**	**0.43**	**53.34**	**19.25**	**35,980.29**	**7.43**	**2.68**	**19.23**	**0.50**	**11.77**	**3.44**	**0.03**	**1.30**	**0.07**	**1.37**	**0.34**	**0.07**	**0.41**	**2,837.59**	**0.53**	**0.27**	**2,648.97**
	2022	**2.31**	**50.49**	**26.42**	**0.15**	**22.96**	**9.21**	**12,176.89**	**2.80**	**1.01**	**6.67**	**0.02**	**0.49**	**0.17**	**0.00**	**0.05**	**0.00**	**0.06**	**0.01**	**0.00**	**0.02**	**128.63**	**0.02**	**0.01**	**120.03**
	2023	**8.48**	**173.93**	**73.43**	**0.46**	**60.96**	**23.40**	**38,193.23**	**8.22**	**2.96**	**20.60**	**0.37**	**9.09**	**2.71**	**0.02**	**0.96**	**0.05**	**1.01**	**0.25**	**0.05**	**0.30**	**2,204.66**	**0.40**	**0.20**	**2,056.06**
	SMAQMD Thresholds	-	-	85.00	-	80.00	82.00	-	-	-	-	-	-	-	-	-	-	14.60	-	-	15.00	-	-	-	1,100.00
	Emissions Exceed Thresholds?	-	-	No	-	No	No	-	-	-	-	-	-	-	-	-	-	No	-	-	No	-	-	-	Yes

Maximum Annual GHG Emissions Acoross Entire Project Alignment:		CO2	CH4	N20	CO2e	CO2	CH4	N20	CO2e
	2021	52,032.68	10.84	3.90	27.87	4,092.82	0.762	0.401	3,821.08
	2022	24,353.78	5.60	2.01	13.34	257.26	0.048	0.024	240.06
	2023	50,370.12	11.03	3.96	27.27	2,590.45	0.467	0.241	2,416.15
	Total	126757	27	10	68	6941	1	1	6477

Project Construction Data Input		

								Project Element																					
								STATIONS									TRACK IMPROVEMENTS												
DESCRIPTION OF EQUIPMENT	Construction Timing	EMPLOYEES PER DAY	HRS/DAY (onsite)	EQUIPMENT LOAD FACTOR (engine operation)	Onsite Miles/Day (vehicles only)	Offsite Miles/Day (vehicles only)	UNITS	LODI STATION	LODI STATION - SOUTH ALTERNATIVE	~~ELK GROVE STATION ACCESS (New Intersection West of Baseline)~~	~~ELK GROVE STATION ACCESS (Fourth leg of Existing Intersection)~~	CITY COLLEGE STATION	MIDTOWN SACRAMENTO STATION	OLD NORTH SACRAMENTO STATION	NATOMAS / SACRAMENTO AIRPORT STATION	TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	HAMMER LANE SIDING UPGRADE	THORNTON SIDING UPGRADE & EXTENSION	PHILLIPS SIDING UPGRADE & EXTENSION	POLLOCK SIDING UPGRADE	SOUTH SACRAMENTO SIDING UPGRADE	DEL PASO SIDING UPGRADE & EXTENSION	LODI SIDING	~~ELK GROVE SIDING~~	NEW CROSSOVER
REFERENCE CODING																													
CORRIDOR WORK SITE LENGTH							LF					2200	7200	0	4210	1120	970	1411	1080	12020	10580	6770	5220	14110	20035	18000	~~10250~~	325
TRACK WORK LENGTH							TF	525	525			2200	1900	0	6730	1120	970	1411	1080	12020	10580	6770	5220	20940	20035	18000	~~10250~~	325
PARKING SPACES								278	236	~~203~~	~~203~~	0	0	252	149													
PROJECT CONSTRUCTION DURATION FOR EACH PROJECT ELEMENT							Months	14	14	~~14~~	~~14~~	8	12	14	12	1	1	1	1	2	4	2	2	4	12	8	~~8~~	2
START CONSTRUCTION							YEAR	2021	2021	~~2023~~	~~2023~~	2023	2021	2023	2021	2022	2022	2022	2022	2023	2023	2021	2023	2023	2021	2021	~~2023~~	2023
SITE WORK PHASE							MONTHS	12	12	~~12~~	~~12~~	4	10	10	8	0.5	0.5	0.5	0.5	1	2	1	1	1	6	4	~~4~~	1
GRADER	Initial Site Work - Prior to other const. activity	1	7	0.6																								
WATER TRUCK (100% onsite)	Initial Site Work - Prior to other const. activity	1	7	0.5	3	0																						
D6 DOZER	Initial Site Work - Prior to other const. activity	2	7	0.7																								
D 8 DOZER	Initial Site Work - Prior to other const. activity	1	6	0.6																								
COMPACTOR	Latter Portion of Site Work Phase	2	6	0.6																								
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	Entire Site Work Phase	4	6	0.6	2	63																						
		11																										
RAIL WORK PHASE							MONTHS	1	1	~~0~~	~~0~~	4	4	4	4	0.5	0.5	0.5	0.5	1	2	1	1	3	6	4	~~8~~	1
LOCOMOTIVE (switch, 1200-1500 HP)	Latter Portion of Rail Work Phase	2	5	0.4																								
D6 DOZER	First Portion of Rail Work Phase	1	6	0.5																								
GRADER	First Portion of Rail Work Phase	1	6	0.5																								
WATER TRUCK (100% onsite)	First Portion of Rail Work Phase	2	6	0.5	3	0																						
TAMPER (max 100 HP)	Latter Portion of Rail Work Phase	1	4	0.4																								
ALLIGNER (max 100 HP)	Latter Portion of Rail Work Phase	1	4	0.4																								
SWINGER (max 50 HP)	Latter Portion of Rail Work Phase	1	5	0.3																								
WELDERS	Latter Portion of Rail Work Phase	3	5	0.6																								
FLAT BED TRUCK (75% onsite/25% offsite)	Entire Rail Work Phase	1	5	0.5	2	22																						
PICKUPS (50% onsite/50% offsite)	Entire Rail Work Phase	3	4	0.5	3	35																						
SUV (100% onsite)	Entire Rail Work Phase	2	5	0.5	3	0																						
35 TON RT CRANE	Latter Portion of Rail Work Phase	1	5	0.6																								
FLAT BED TRACTOR (75% onsite/25% offsite)	Entire Rail Work Phase	1	4	0.25	2	9																						
WHEEL LOADER	First Portion of Rail Work Phase	1	5	0.45																								
		24																										
STRUCTURAL WORK PHASE							MONTHS	6	6	~~6~~	~~6~~	3	3	6	3	0	0	0	0	0	0	0	0	0	6	0	~~4~~	0
GENERATOR	Entire Structural Work Phase	2	9	0.8																								
25 T MOBILE CRANE	Entire Structural Work Phase	1	5	0.6																								
WATER TRUCK (100% onsite)	Entire Structural Work Phase	1	4	0.4	3	0																						
FLAT BED TRUCK (75% onsite/25% offsite)	Entire Structural Work Phase	1	4	0.5	2	18																						
PICKUPS (50% onsite/50% offsite)	Entire Structural Work Phase	3	7	0.6	3	74																						
CONCRETE MIXERS DELIVERY (100% onsite)	Entire Structural Work Phase	5	5	0.2	2	0																						
CONCRETE PUMP	Entire Structural Work Phase	1	7	0.2																								
WHEEL LOADER	Entire Structural Work Phase	4	4	0.4																								
WELDERS	Entire Structural Work Phase	2	5	0.5																								
		24																										
CLEAR & GRUBBING							ACRES	9	13	~~35~~	~~34~~	1	2	1	1	0	0	0	0	0	5	3	0	0	9	12	~~2~~	0
EARTHWORK							C.Y.	16310	35990	~~51480~~	~~45185~~	2200	3890	7850	18500	200	150	250	200	0	18800	27900	0	0	149200	100000	~~56040~~	0
PAVED AREAS							S.F.	200000	230000	~~330000~~	~~170000~~	0	150000	210000	23800	0	0	0	0	0	1400	1400	0	0	9200	10070	~~2400~~	0
DEMOLITION							S.F.	0	0	~~0~~	~~0~~	0	85000	155000	180000	0	0	0	0	1000	1400	1400	1000	0	9200	10070	~~2400~~	1000
Average onsite speed (mph)		5																										
Average offsite speed (mph)		35																										

Off-road Equipment Exhaust Emissions

Project-Specific Equipment (CalEEMod equivalent) [1]	Construction Timing	# / Day	Operational hours / day	Horsepower [2]	Load Factor	Emission Factors (g/hp-hr) [3] ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O
SITE WORK PHASE														
GRADER (grader)	Initial Site Work - Prior to other const. activity	1	7	187	0.41	0.335	1.30687	4.38134	0.005	0.139	0.128	475	0.15	0.07
D6 DOZER (rubber tired dozer)	Initial Site Work - Prior to other const. activity	2	7	247	0.4	0.6	2.31719	6.29617	0.005	0.306	0.281	475	0.15	0.07
D8 DOZER (rubber tired dozer)*	Initial Site Work - Prior to other const. activity	1	6	354	0.4	0.492	4.04107	5.081	0.005	0.232	0.214	479	0.16	0.07
Phase Total														
COMPACTOR (place compactor)	Latter Portion of Site Work Phase	2	6	8	0.43	0.661	3.469	4.142	0.008	0.161	0.161	568	0.06	0.03
Phase Total														
RAIL WORK PHASE														
D6 DOZER (rubber tired dozer)	First Portion of Rail Work Phase	1	6	247	0.4	0.6	2.31719	6.29617	0.005	0.306	0.281	475	0.15	0.07
GRADER (grader)	First Portion of Rail Work Phase	1	6	187	0.41	0.335	1.30687	4.38134	0.005	0.139	0.128	475	0.15	0.07
WHEEL LOADER (rubber tired loader)	First Portion of Rail Work Phase	1	5	203	0.36	0.266	1.24034	2.9977	0.005	0.1	0.092	470	0.15	0.07
LOCOMOTIVE (switch, 1200-1500 HP) [5]	Latter Portion of Rail Work Phase	1	5	1500	0.4	0.60021	1.83	9.9	0.0063	0.23	0.223	671	0.05	0.02
TAMPER (max 100 HP) (other construction equipment)*	Latter Portion of Rail Work Phase	1	4	100	0.42	0.482	3.70304	4.4558	0.005	0.323	0.298	472	0.15	0.07
ALLIGNER (max 100 HP) (other construction equipment)*	Latter Portion of Rail Work Phase	1	4	100	0.42	0.482	3.70304	4.4558	0.005	0.323	0.298	472	0.15	0.07
SWINGER (max 50 HP) (other construction equipment)*	Latter Portion of Rail Work Phase	1	5	50	0.42	1.01	5.30749	4.90234	0.005	0.382	0.351	528	0.17	0.08
WELDERS (welder)	Latter Portion of Rail Work Phase	3	5	46	0.45	0.829	4.708	4.133	0.007	0.203	0.203	568	0.07	0.03
35 TON RT CRANE (crane)	Latter Portion of Rail Work Phase	1	5	231	0.29	0.349	1.67824	4.10439	0.005	0.167	0.153	473	0.15	0.07
Phase Total														
FLAT BED TRACTOR (75% onsite/25% offsite) (off-highway truck)	Entire Rail Work Phase	1	4	402	0.37	0.225	1.33781	1.95357	0.005	0.072	0.066	475	0.15	0.07
STRUCTURAL WORK PHASE														
GENERATOR (generator sets)	Entire Structural Work Phase	2	9	84	0.74	0.326	3.361	2.888	0.006	0.153	0.153	568	0.03	0.01
75 T MOBILE CRANE (crane)	Entire Structural Work Phase	1	5	231	0.29	0.349	1.67824	4.10439	0.005	0.167	0.153	473	0.15	0.07
CONCRETE PUMP (pumps)	Entire Structural Work Phase	1	7	84	0.74	0.347	3.412	2.928	0.006	0.162	0.162	568	0.03	0.01
WHEEL LOADER (rubber tired loader)	Entire Structural Work Phase	4	4	203	0.37	0.266	1.24034	2.9977	0.005	0.1	0.092	470	0.15	0.07
WELDERS (welder)	Entire Structural Work Phase	2	5	46	0.45	0.829	4.708	4.133	0.007	0.203	0.203	568	0.07	0.03
Phase Total														

Project-Specific Equipment (CalEEMod equivalent) [1]	Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e
SITE WORK PHASE										
GRADER (grader)	0.40	1.55	5.18	0.01	0.16	0.15	561	0.18	0.08	0.27
D6 DOZER (rubber tired dozer)	1.83	7.07	19.20	0.02	0.93	0.86	1448	0.47	0.21	0.69
D8 DOZER (rubber tired dozer)*	0.92	7.57	9.52	0.01	0.43	0.40	897	0.29	0.13	0.43
Phase Total	*3.15*	*16.18*	*33.90*	*0.03*	*1.53*	*1.41*	*2907*	*0.94*	*0.42*	*1.39*
COMPACTOR (place compactor)	0.06	0.32	0.38	0.00	0.01	0.01	52	0.01	0.00	0.02
Phase Total	*0.06*	*0.32*	*0.38*	*0.00*	*0.01*	*0.01*	*52*	*0.01*	*0.00*	*0.02*
RAIL WORK PHASE										
D6 DOZER (rubber tired dozer)	0.78	3.03	8.23	0.01	0.40	0.37	621	0.20	0.09	0.30
GRADER (grader)	0.34	1.33	4.44	0.01	0.14	0.13	481	0.16	0.07	0.23
WHEEL LOADER (rubber tired loader)	0.21	1.00	2.41	0.00	0.08	0.07	378	0.12	0.06	0.18
	1.34	*5.35*	*15.09*	*0.02*	*0.62*	*0.57*	*1480*	*0.48*	*0.22*	*0.71*
LOCOMOTIVE (switch, 1200-1500 HP) [5]	3.97	12.10	65.48	0.04	1.52	1.48	4441	0.35	0.16	2.04
TAMPER (max 100 HP) (other construction equipment)*	0.18	1.37	1.65	0.00	0.12	0.11	175	0.06	0.03	0.08
ALLIGNER (max 100 HP) (other construction equipment)*	0.18	1.37	1.65	0.00	0.12	0.11	175	0.06	0.03	0.08
SWINGER (max 50 HP) (other construction equipment)*	0.23	1.23	1.13	0.00	0.09	0.08	122	0.04	0.02	0.06
WELDERS (welder)	0.57	3.22	2.83	0.00	0.14	0.14	389	0.05	0.02	0.18
35 TON RT CRANE (crane)	0.26	1.24	3.03	0.00	0.12	0.11	349	0.11	0.05	0.17
Phase Total	*5.39*	*20.54*	*75.77*	*0.06*	*2.11*	*2.03*	*5651*	*0.66*	*0.30*	*2.61*
FLAT BED TRACTOR (75% onsite/25% offsite) (off-highway truck)	0.11	0.66	0.96	0.00	0.04	0.03	233	0.08	0.03	0.11
STRUCTURAL WORK PHASE										
GENERATOR (generator sets)	0.80	8.29	7.12	0.01	0.38	0.38	1402	0.07	0.03	0.64
75 T MOBILE CRANE (crane)	0.26	1.24	3.03	0.00	0.12	0.11	349	0.11	0.05	0.17
CONCRETE PUMP (pumps)	0.33	3.27	2.81	0.01	0.16	0.16	545	0.03	0.01	0.25
WHEEL LOADER (rubber tired loader)	0.70	3.29	7.94	0.01	0.26	0.24	1244	0.40	0.18	0.59
WELDERS (welder)	0.38	2.15	1.89	0.00	0.09	0.09	259	0.03	0.02	0.12
Phase Total	*2.48*	*18.24*	*22.79*	*0.04*	*1.01*	*0.98*	*3800*	*0.65*	*0.29*	*1.77*

Project-Specific Equipment (CalEEMod equivalent) [1]	Mitigated Emission Factors (g/hp-hr) [4] ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O
SITE WORK PHASE									
GRADER (grader)	0.06	2.2	0.26	0.005	0.008	0.008	474.539	0.153	0.069
D6 DOZER (rubber tired dozer)	0.06	2.2	0.26	0.005	0.008	0.008	474.798	0.154	0.069
D8 DOZER (rubber tired dozer)*	0.06	2.2	0.26	0.005	0.008	0.008	478.987	0.155	0.070
Phase Total									
COMPACTOR (place compactor)	0.661	3.469	4.142	0.008	0.161	0.161	568.299	0.059	0.027
Phase Total									
RAIL WORK PHASE									
D6 DOZER (rubber tired dozer)	0.06	2.2	0.26	0.005	0.008	0.008	474.798	0.154	0.069
GRADER (grader)	0.06	2.2	0.26	0.005	0.008	0.008	474.539	0.153	0.069
WHEEL LOADER (rubber tired loader)	0.06	2.2	0.26	0.005	0.008	0.008	469.564	0.152	0.068
LOCOMOTIVE (switch, 1200-1500 HP) [5]	0.08424	1.83	1	0.0063	0.015	0.01455	671.450	0.053	0.017
TAMPER (max 100 HP) (other construction equipment)*	0.06	3.7	0.26	0.005	0.008	0.008	472.275	0.153	0.069
ALLIGNER (max 100 HP) (other construction equipment)*	0.06	3.7	0.26	0.005	0.008	0.008	472.275	0.153	0.069
SWINGER (max 50 HP) (other construction equipment)*	0.12	3.7	2.74	0.005	0.008	0.008	527.783	0.171	0.077
WELDERS (welder)	0.12	4.1	2.75	0.007	0.008	0.008	568.299	0.074	0.033
35 TON RT CRANE (crane)	0.06	2.2	0.26	0.005	0.008	0.008	472.906	0.153	0.069
Phase Total									
FLAT BED TRACTOR (75% onsite/25% offsite) (off-highway truck)	0.06	3.7	0.26	0.005	0.008	0.008	474.542	0.153	0.069
STRUCTURAL WORK PHASE									
GENERATOR (generator sets)	0.06	3.7	0.26	0.006	0.008	0.008	568.299	0.029	0.013
75 T MOBILE CRANE (crane)	0.06	2.2	0.26	0.005	0.008	0.008	472.906	0.153	0.069
CONCRETE PUMP (pumps)	0.06	3.7	0.26	0.006	0.008	0.008	568.300	0.031	0.014
WHEEL LOADER (rubber tired loader)	0.06	2.2	0.26	0.005	0.008	0.008	469.564	0.152	0.068
WELDERS (welder)	0.12	4.1	2.75	0.007	0.008	0.008	568.299	0.074	0.033
Phase Total									

Project-Specific Equipment (CalEEMod equivalent) [1]	Mitigated Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e
SITE WORK PHASE										
GRADER (grader)	0.071	2.603	0.308	0.006	0.009	0.009	561.474	0.181	0.081	0.268
D6 DOZER (rubber tired dozer)	0.183	6.709	0.793	0.015	0.024	0.024	1447.866	0.470	0.211	0.691
D8 DOZER (rubber tired dozer)*	0.112	4.121	0.487	0.009	0.015	0.015	897.165	0.290	0.131	0.428
Phase Total	*0.366*	*13.432*	*1.587*	*0.031*	*0.049*	*0.049*	*2906.505*	*0.941*	*0.423*	*1.386*
COMPACTOR (place compactor)	0.060	0.316	0.377	0.001	0.015	0.015	51.719	0.005	0.002	0.024
Phase Total	*0.060*	*0.316*	*0.377*	*0.001*	*0.015*	*0.015*	*51.719*	*0.005*	*0.002*	*0.024*
RAIL WORK PHASE										
D6 DOZER (rubber tired dozer)	0.078	2.875	0.340	0.007	0.010	0.010	620.514	0.201	0.091	0.296
GRADER (grader)	0.061	2.231	0.264	0.005	0.008	0.008	481.263	0.155	0.070	0.229
WHEEL LOADER (rubber tired loader)	0.048	1.772	0.209	0.004	0.006	0.006	378.266	0.122	0.055	0.180
	0.188	*6.879*	*0.813*	*0.016*	*0.025*	*0.025*	*1480.044*	*0.479*	*0.215*	*0.706*
LOCOMOTIVE (switch, 1200-1500 HP) [5]	0.557	12.103	6.614	0.042	0.099	0.096	4440.882	0.348	0.157	2.039
TAMPER (max 100 HP) (other construction equipment)*	0.022	1.370	0.096	0.002	0.003	0.003	174.920	0.057	0.026	0.083
ALLIGNER (max 100 HP) (other construction equipment)*	0.022	1.370	0.096	0.002	0.003	0.003	174.920	0.057	0.026	0.083
SWINGER (max 50 HP) (other construction equipment)*	0.028	0.856	0.634	0.001	0.002	0.002	122.174	0.040	0.018	0.058
WELDERS (welder)	0.082	2.807	1.882	0.005	0.005	0.005	389.021	0.051	0.023	0.180
35 TON RT CRANE (crane)	0.044	1.625	0.192	0.004	0.006	0.006	349.212	0.113	0.051	0.167
Phase Total	*0.756*	*20.132*	*9.515*	*0.055*	*0.118*	*0.115*	*5651.127*	*0.665*	*0.299*	*2.611*
FLAT BED TRACTOR (75% onsite/25% offsite) (off-highway truck)	0.030	1.820	0.128	0.002	0.004	0.004	233.415	0.075	0.034	0.111
STRUCTURAL WORK PHASE										
GENERATOR (generator sets)	0.148	9.127	0.641	0.015	0.020	0.020	1401.828	0.072	0.032	0.641
75 T MOBILE CRANE (crane)	0.044	1.625	0.192	0.004	0.006	0.006	349.212	0.113	0.051	0.167
CONCRETE PUMP (pumps)	0.058	3.549	0.249	0.006	0.008	0.008	545.156	0.030	0.013	0.249
WHEEL LOADER (rubber tired loader)	0.159	5.829	0.689	0.013	0.021	0.021	1244.076	0.403	0.181	0.593
WELDERS (welder)	0.055	1.871	1.255	0.003	0.004	0.004	259.347	0.034	0.015	0.120
Phase Total	*0.464*	*22.001*	*3.027*	*0.041*	*0.058*	*0.058*	*3799.619*	*0.651*	*0.293*	*1.770*

1. Equipment list is based on project-specific list of anticipated equipment requirements provided by project engineers. Equipment type, number of each equipment, operational hours per day, and load factor are all project-specific. The CalEEMod equivalent equipment type is listed in parentheses.
2. Used CalEEMod default horsepower unless otherwise indicated by *.
3. Emission factors based on CalEEMod for year 2021 (earliest year of construction) for equipment equivalent and specific horsepower noted.
4. Mitigated emission factors for equipment >25 hp, based on Carl Moyer provided in CalEEMod User Guide Table D.3.5 (OFFROAD Emission Factor Based on Engine Tier) for ROG, CO, NOx, PM10 and PM2.5. Other EFs based on CalEEMod for year 2021.
5. Locomotive emission factors based upon the following for switch:
 > PM10, HC, NOx, CO: Table 2 of EPA 2009 Emission Factors for Locomotives Technical Highlights
 > PM2.5 assumed to be 97% of PM10.
 > VOC (presented as ROG) = 1.053 * HC emissions
 > SO2 Emission Factor (g/gal) = (fuel density) * (64 g SO2 / 32 g S) * (S content of fuel);
 Sulfur Content of Fuel (ppm) (per CARB regulations in CA) = 15
 SO2 EF = 0.096 g/gal * conversion factor of 1/15.2 = 0.0063 g/hp-hr
 > CO2 is defined by U.S. EPA as 10,206 g CO2/gal fuel * conversion factor of 1/15.2 = 671.45 g/hp-hr
 > CH4 and N20 Emission Factors per EPA: Table 5 in https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf
 *CH4 EF = 0.8 g/gal * 1/15.2 conversion factor = 0.05263158 g/bhp-hr
 *N2O EF = 0.26 g/gal * 1/15.2 conversion factor = 0.01710526 g/bhp-hr

Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

Average Workdays per Year:	260
Months per Year	12

Project Element	Construction Duration (years) Site Work Prior to Rail Work/Structures Work	Total Site Work Phase	Rail Work	Structures	Maximum Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e
LODI STATION	0.67	1.00	0.08	0.50	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
LODI STATION - SOUTH ALTERNATIVE	0.67	1.00	0.08	0.50	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
~~ELK GROVE STATION ACCESS (New Intersection West of Existing)~~	~~0.67~~	~~1.00~~	~~0.00~~	~~0.50~~	~~3.15~~	~~18.55~~	~~33.90~~	~~0.04~~	~~1.53~~	~~1.41~~	~~3851~~	~~0.94~~	~~0.42~~	~~1.79~~
~~ELK GROVE STATION ACCESS (Fourth Leg of Existing Intersection)~~	~~0.67~~	~~1.00~~	~~0.00~~	~~0.50~~	~~3.15~~	~~18.55~~	~~33.90~~	~~0.04~~	~~1.53~~	~~1.41~~	~~3851~~	~~0.94~~	~~0.42~~	~~1.79~~
CITY COLLEGE STATION	0.33	0.33	0.33	0.25	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
MIDTOWN SACRAMENTO STATION	0.67	0.83	0.33	0.25	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
OLD NORTH SACRAMENTO STATION	0.67	0.83	0.33	0.50	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
NATOMAS / SACRAMENTO AIRPORT STATION	0.67	0.67	0.33	0.25	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.50	1.17	0.67	2.00	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.04	0.04	0.04	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.04	0.04	0.04	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.04	0.04	0.04	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.04	0.04	0.04	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
HAMMER LANE SIDING UPGRADE	0.08	0.08	0.08	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
THORNTON SIDING UPGRADE & EXTENSION	0.17	0.17	0.17	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
PHILLIPS SIDING UPGRADE & EXTENSION	0.08	0.08	0.08	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
POLLOCK SIDING UPGRADE	0.08	0.08	0.08	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
SOUTH SACRAMENTO SIDING UPGRADE	0.08	0.08	0.25	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
DEL PASO SIDING UPGRADE & EXTENSION	0.50	0.50	0.50	0.50	8.03	39.75	99.90	0.10	3.17	3.06	9736	1.40	0.63	4.52
LODI SIDING	0.33	0.33	0.33	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75
~~ELK GROVE SIDING~~	~~0.25~~	~~0.25~~	~~0.25~~	~~0.33~~	~~8.03~~	~~39.75~~	~~99.90~~	~~0.10~~	~~3.17~~	~~3.06~~	~~9736~~	~~1.40~~	~~0.63~~	~~4.52~~
NEW CROSSOVER	0.08	0.08	0.08	0.00	5.56	21.51	77.11	0.06	2.16	2.08	5936	0.94	0.42	2.75

Project Element	Maximum Annual Emissions (tons/year) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N20	Total Emissions (metric tons) CO2e
LODI STATION	0.516	2.916	5.463	0.006	-	0.231	0.231	-	0.216	0.216	585	0.138	0.062	551
LODI STATION - SOUTH ALTERNATIVE	0.516	2.916	5.463	0.006	-	0.231	0.231	-	0.216	0.216	585	0.138	0.062	551
~~ELK GROVE STATION ACCESS (New Intersection West of Existing)~~	~~0.442~~	~~2.629~~	~~4.469~~	~~0.005~~	-	~~0.201~~	~~0.201~~	-	~~0.188~~	~~0.188~~	~~506~~	~~0.125~~	~~0.056~~	~~477~~
~~ELK GROVE STATION ACCESS (Fourth Leg of Existing Intersection)~~	~~0.442~~	~~2.629~~	~~4.469~~	~~0.005~~	-	~~0.201~~	~~0.201~~	-	~~0.188~~	~~0.188~~	~~506~~	~~0.125~~	~~0.056~~	~~477~~
CITY COLLEGE STATION	0.516	2.458	6.205	0.006	-	0.220	0.220	-	0.208	0.208	571	0.115	0.052	534
MIDTOWN SACRAMENTO STATION	0.656	3.180	7.699	0.007	-	0.287	0.287	-	0.270	0.270	700	0.156	0.070	658
OLD NORTH SACRAMENTO STATION	0.737	3.772	8.439	0.009	-	0.320	0.320	-	0.302	0.302	824	0.177	0.080	773
NATOMAS / SACRAMENTO AIRPORT STATION	0.655	3.173	7.690	0.007	-	0.287	0.287	-	0.269	0.269	699	0.156	0.070	657
NATOMAS MAINTENANCE & LAYOVER FACILITY	1.450	8.142	16.144	0.019	-	0.605	0.605	-	0.577	0.577	1823	0.337	0.152	1702
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.054	0.233	0.683	0.001	-	0.023	0.023	-	0.022	0.022	56	0.012	0.005	52
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.054	0.233	0.683	0.001	-	0.023	0.023	-	0.022	0.022	56	0.012	0.005	52
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.054	0.233	0.683	0.001	-	0.023	0.023	-	0.022	0.022	56	0.012	0.005	52
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.054	0.233	0.683	0.001	-	0.023	0.023	-	0.022	0.022	56	0.012	0.005	52
HAMMER LANE SIDING UPGRADE	0.109	0.466	1.366	0.001	-	0.047	0.047	-	0.044	0.044	112	0.023	0.011	105
THORNTON SIDING UPGRADE & EXTENSION	0.218	0.933	2.732	0.002	-	0.093	0.093	-	0.088	0.088	224	0.047	0.021	210
PHILLIPS SIDING UPGRADE & EXTENSION	0.109	0.466	1.366	0.001	-	0.047	0.047	-	0.044	0.044	112	0.023	0.011	105
POLLOCK SIDING UPGRADE	0.109	0.466	1.366	0.001	-	0.047	0.047	-	0.044	0.044	112	0.023	0.011	105
SOUTH SACRAMENTO SIDING UPGRADE	0.257	1.042	3.356	0.003	-	0.107	0.107	-	0.101	0.101	271	0.050	0.022	253
DEL PASO SIDING UPGRADE & EXTENSION	0.814	3.983	9.678	0.009	-	0.346	0.346	-	0.328	0.328	918	0.183	0.082	859
LODI SIDING	0.435	1.865	5.464	0.005	-	0.187	0.187	-	0.176	0.176	447	0.094	0.042	419
~~ELK GROVE SIDING~~	~~0.434~~	~~2.189~~	~~5.086~~	~~0.005~~	-	~~0.184~~	~~0.184~~	-	~~0.174~~	~~0.174~~	~~500~~	~~0.099~~	~~0.044~~	~~468~~
NEW CROSSOVER	0.109	0.466	1.366	0.001	-	0.047	0.047	-	0.044	0.044	112	0.023	0.011	105

Project Element	Mitigated Maximum Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e
LODI STATION	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
LODI STATION - SOUTH ALTERNATIVE	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
~~ELK GROVE STATION ACCESS (New Intersection West of Existing)~~	~~0.52~~	~~22.32~~	~~3.40~~	~~0.04~~	~~0.07~~	~~0.07~~	~~3851~~	~~0.94~~	~~0.42~~	~~1.79~~
~~ELK GROVE STATION ACCESS (Fourth Leg of Existing Intersection)~~	~~0.52~~	~~22.32~~	~~3.40~~	~~0.04~~	~~0.07~~	~~0.07~~	~~3851~~	~~0.94~~	~~0.42~~	~~1.79~~
CITY COLLEGE STATION	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
MIDTOWN SACRAMENTO STATION	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
OLD NORTH SACRAMENTO STATION	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
NATOMAS / SACRAMENTO AIRPORT STATION	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
NATOMAS MAINTENANCE & LAYOVER FACILITY	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
HAMMER LANE SIDING UPGRADE	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
THORNTON SIDING UPGRADE & EXTENSION	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
PHILLIPS SIDING UPGRADE & EXTENSION	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
POLLOCK SIDING UPGRADE	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
SOUTH SACRAMENTO SIDING UPGRADE	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
DEL PASO SIDING UPGRADE & EXTENSION	1.31	44.27	13.05	0.10	0.20	0.19	9736	1.40	0.63	4.52
LODI SIDING	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75
~~ELK GROVE SIDING~~	~~1.31~~	~~44.27~~	~~13.05~~	~~0.10~~	~~0.20~~	~~0.19~~	~~9736~~	~~1.40~~	~~0.63~~	~~4.52~~
NEW CROSSOVER	0.85	22.27	10.02	0.06	0.14	0.13	5936	0.94	0.42	2.75

Project Element	Mitigated Maximum Annual Emissions (tons/year) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N20	Total Emissions (metric tons) CO2e
LODI STATION	0.080	2.948	0.497	0.006	-	0.012	0.012	-	0.011	0.011	585	0.138	0.062	551
LODI STATION - SOUTH ALTERNATIVE	0.080	2.948	0.497	0.006	-	0.012	0.012	-	0.011	0.011	585	0.138	0.062	551
~~ELK GROVE STATION ACCESS (New Intersection West of Existing)~~	~~0.070~~	~~2.635~~	~~0.384~~	~~0.005~~	-	~~0.010~~	~~0.010~~	-	~~0.010~~	~~0.010~~	~~506~~	~~0.125~~	~~0.056~~	~~477~~
~~ELK GROVE STATION ACCESS (Fourth Leg of Existing Intersection)~~	~~0.070~~	~~2.635~~	~~0.384~~	~~0.005~~	-	~~0.010~~	~~0.010~~	-	~~0.010~~	~~0.010~~	~~506~~	~~0.125~~	~~0.056~~	~~477~~
CITY COLLEGE STATION	0.076	2.560	0.637	0.006	-	0.011	0.011	-	0.011	0.011	571	0.115	0.052	534
MIDTOWN SACRAMENTO STATION	0.096	3.163	0.730	0.007	-	0.014	0.014	-	0.014	0.014	700	0.156	0.070	658
OLD NORTH SACRAMENTO STATION	0.111	3.878	0.828	0.009	-	0.016	0.016	-	0.016	0.016	824	0.177	0.080	773
NATOMAS / SACRAMENTO AIRPORT STATION	0.094	3.156	0.722	0.007	-	0.014	0.014	-	0.014	0.014	699	0.156	0.070	657
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.238	9.140	1.854	0.019	-	0.033	0.033	-	0.033	0.033	1823	0.337	0.152	1702
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.008	0.231	0.067	0.001	-	0.001	0.001	-	0.001	0.001	56	0.012	0.005	52
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.008	0.231	0.067	0.001	-	0.001	0.001	-	0.001	0.001	56	0.012	0.005	52
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.008	0.231	0.067	0.001	-	0.001	0.001	-	0.001	0.001	56	0.012	0.005	52
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.008	0.231	0.067	0.001	-	0.001	0.001	-	0.001	0.001	56	0.012	0.005	52
HAMMER LANE SIDING UPGRADE	0.015	0.461	0.135	0.001	-	0.002	0.002	-	0.002	0.002	112	0.023	0.011	105
THORNTON SIDING UPGRADE & EXTENSION	0.030	0.923	0.269	0.002	-	0.005	0.005	-	0.005	0.005	224	0.047	0.021	210
PHILLIPS SIDING UPGRADE & EXTENSION	0.015	0.461	0.135	0.001	-	0.002	0.002	-	0.002	0.002	112	0.023	0.011	105
POLLOCK SIDING UPGRADE	0.015	0.461	0.135	0.001	-	0.002	0.002	-	0.002	0.002	112	0.023	0.011	105
SOUTH SACRAMENTO SIDING UPGRADE	0.036	1.086	0.361	0.003	-	0.005	0.005	-	0.005	0.005	271	0.050	0.022	253
DEL PASO SIDING UPGRADE & EXTENSION	0.121	4.198	1.004	0.009	-	0.017	0.017	-	0.017	0.017	918	0.183	0.082	859
LODI SIDING	0.061	1.845	0.538	0.005	-	0.009	0.009	-	0.009	0.009	447	0.094	0.042	419
~~ELK GROVE SIDING~~	~~0.066~~	~~2.337~~	~~0.535~~	~~0.005~~	-	~~0.009~~	~~0.009~~	-	~~0.009~~	~~0.009~~	~~500~~	~~0.099~~	~~0.044~~	~~468~~
NEW CROSSOVER	0.015	0.461	0.135	0.001	-	0.002	0.002	-	0.002	0.002	112	0.023	0.011	105

*Note that some locations do not include all phases, so formulas for maximum daily emissions in above chart vary to not include emissions for phases with no activity at a specific location.
* To estimate maximum daily emissions, it is assumed that all construction phases could overlap at some point within the overal construction duration for each location.

Onsite On-Raod ConstructionVehicle Emissions (Exhaust)

Vehilcle Type	# Vehicles On-Site	Miles / Day [2]	Emission Factors (g/mile) [3] ROG_RUNEX	CO_ RUNEX	NOX_ RUNEX	SO2_ RUNEX	PM10 Fugitive Dust [4]	PM10_ RUNEX	PM10 Total	PM2.5 Fugitive Dust [4]	PM2.5_ RUNEX	PM2.5 Total	CO2_ RUNEX	CH4_ RUNEX	N2O_ RUNEX
SITE WORK PHASE															
Water Truck (100% on-site)	1	3	1.57	2.70	10.39	0.02	57.16	0.24	57.40	5.57	0.23	5.80	2417	0.07	0.38
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	4	8	1.57	2.70	10.39	0.02	57.16	0.24	57.40	5.57	0.23	5.80	2417	0.07	0.38
Phase Total															
RAIL WORK PHASE															
Water Truck (100% on-site)	2	6	1.57	2.70	10.39	0.02	57.16	0.24	57.40	5.57	0.23	5.80	2417	0.07	0.38
FLAT BED TRUCK (75% onsite/25% offsite)	1	2	1.70	3.72	15.65	0.03	57.16	0.21	57.37	5.57	0.20	5.78	3632	0.08	0.57
PICKUPS (50% onsite/50% offsite)	3	9	0.13	2.01	0.19	0.01	57.16	0.01	57.17	5.57	0.01	5.58	840	0.03	0.02
SUV (100% onsite)	2	6	0.13	2.01	0.19	0.01	57.16	0.01	57.17	5.57	0.01	5.58	840	0.03	0.02
FLAT BED TRUCK (75% onsite/25% offsite)	1	2	1.70	3.72	15.65	0.03	57.16	0.21	57.37	5.57	0.20	5.78	3632	0.08	0.57
Phase Total															
STRUCTURAL WORK PHASE															
Water Truck (100% on-site)	1	3	1.57	2.70	10.39	0.02	57.16	0.24	57.40	5.57	0.23	5.80	2417	0.07	0.38
FLAT BED TRUCK (75% onsite/25% offsite)	1	2	1.70	3.72	15.65	0.03	57.16	0.21	57.37	5.57	0.20	5.78	3632	0.08	0.57
PICKUPS (50% onsite/50% offsite)	3	9	0.13	2.01	0.19	0.01	57.16	0.01	57.17	5.57	0.01	5.58	840	0.03	0.02
Concrete Mixer Delivery (100% onsite)	5	5	1.57	2.70	10.39	0.02	57.16	0.24	57.40	5.57	0.23	5.80	2417	0.07	0.38
Phase Total															

Vehilcle Type	Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O	Daily Emissions (metric tons/day) CO2e
SITE WORK PHASE														
Water Truck (100% on-site)	0.01	0.02	0.07	0.00	0.38	0.00	0.38	0.04	0.00	0.04	16	0.00	0.00	0.01
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	0.03	0.05	0.18	0.00	1.01	0.00	1.01	0.10	0.00	0.10	43	0.00	0.01	0.02
Phase Total	*0.04*	*0.07*	*0.25*	*0.00*	*1.39*	*0.01*	*1.39*	*0.14*	*0.01*	*0.14*	*59*	*0.00*	*0.01*	*0.03*
RAIL WORK PHASE														
Water Truck (100% on-site)	0.02	0.04	0.14	0.00	0.76	0.00	0.76	0.07	0.00	0.08	32	0.00	0.01	0.01
FLAT BED TRUCK (75% onsite/25% offsite)	0.01	0.02	0.07	0.00	0.25	0.00	0.25	0.02	0.00	0.03	16	0.00	0.00	0.01
PICKUPS (50% onsite/50% offsite)	0.00	0.04	0.00	0.00	1.13	0.00	1.13	0.11	0.00	0.11	17	0.00	0.00	0.01
SUV (100% onsite)	0.00	0.03	0.00	0.00	0.76	0.00	0.76	0.07	0.00	0.07	11	0.00	0.00	0.01
FLAT BED TRUCK (75% onsite/25% offsite)	0.01	0.02	0.07	0.00	0.25	0.00	0.25	0.02	0.00	0.03	16	0.00	0.00	0.01
Phase Total	*0.04*	*0.13*	*0.28*	*0.00*	*3.15*	*0.01*	*3.16*	*0.31*	*0.01*	*0.31*	*92*	*0.00*	*0.01*	*0.04*
STRUCTURAL WORK PHASE														
Water Truck (100% on-site)	0.01	0.02	0.07	0.00	0.38	0.00	0.38	0.04	0.00	0.04	16	0.00	0.00	0.01
FLAT BED TRUCK (75% onsite/25% offsite)	0.01	0.02	0.07	0.00	0.25	0.00	0.25	0.02	0.00	0.03	16	0.00	0.00	0.01
PICKUPS (50% onsite/50% offsite)	0.00	0.04	0.00	0.00	1.13	0.00	1.13	0.11	0.00	0.11	17	0.00	0.00	0.01
Concrete Mixer Delivery (100% onsite)	0.02	0.03	0.11	0.00	0.63	0.00	0.63	0.06	0.00	0.06	27	0.00	0.00	0.01
Phase Total	*0.04*	*0.10*	*0.26*	*0.00*	*2.39*	*0.01*	*2.40*	*0.23*	*0.01*	*0.24*	*75*	*0.00*	*0.01*	*0.03*
Total	**0.12**	**0.30**	**0.79**	**0.00**	**6.93**	**0.02**	**6.95**	**0.68**	**0.02**	**0.69**	**226**	**0.01**	**0.03**	**0.10**

Vehilcle Type	Mitigated Emission Factors (g/mile) [3] ROG	CO	NOX	SO2	PM10 Fugitive Dust [4]	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust [4]	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O
SITE WORK PHASE													
Water Truck (100% on-site)	1.57	2.70	10.39	0.02	24.58	0.24	57.40	2.40	0.23	5.80	2417	0.07	0.38
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	1.57	2.70	10.39	0.02	24.58	0.24	57.40	2.40	0.23	5.80	2417	0.07	0.38
Phase Total													
RAIL WORK PHASE													
Water Truck (100% on-site)	1.57	2.70	10.39	0.02	24.58	0.24	57.40	2.40	0.23	5.80	2417	0.07	0.38
FLAT BED TRUCK (75% onsite/25% offsite)	1.70	3.72	15.65	0.03	24.58	0.21	57.37	2.40	0.20	5.78	3632	0.08	0.57
PICKUPS (50% onsite/50% offsite)	0.13	2.01	0.19	0.01	24.58	0.01	57.17	2.40	0.01	5.58	840	0.03	0.02
SUV (100% onsite)	0.13	2.01	0.19	0.01	24.58	0.01	57.17	2.40	0.01	5.58	840	0.03	0.02
FLAT BED TRUCK (75% onsite/25% offsite)	1.70	3.72	15.65	0.03	24.58	0.21	57.37	2.40	0.20	5.78	3632	0.08	0.57
Phase Total													
STRUCTURAL WORK PHASE													
Water Truck (100% on-site)	1.57	2.70	10.39	0.02	24.58	0.24	57.40	2.40	0.23	5.80	2417	0.07	0.38
FLAT BED TRUCK (75% onsite/25% offsite)	1.70	3.72	15.65	0.03	24.58	0.21	57.37	2.40	0.20	5.78	3632	0.08	0.57
PICKUPS (50% onsite/50% offsite)	0.13	2.01	0.19	0.01	24.58	0.01	57.17	2.40	0.01	5.58	840	0.03	0.02
Concrete Mixer Delivery (100% onsite)	1.57	2.70	10.39	0.02	24.58	0.24	57.40	2.40	0.23	5.80	2417	0.07	0.38
Phase Total													

Vehilcle Type	Mitigated Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O	Daily Emissions (metric tons/day) CO2e
SITE WORK PHASE														
Water Truck (100% on-site)	0.01	0.02	0.07	0.00	0.16	0.00	0.16	0.02	0.00	0.02	16	0.00	0.00	0.01
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	0.03	0.05	0.18	0.00	0.43	0.00	0.44	0.04	0.00	0.05	43	0.00	0.01	0.02
Phase Total	*0.04*	*0.07*	*0.25*	*0.00*	*0.60*	*0.01*	*0.60*	*0.06*	*0.01*	*0.06*	*59*	*0.00*	*0.01*	*0.03*
RAIL WORK PHASE														
Water Truck (100% on-site)	0.02	0.04	0.14	0.00	0.33	0.00	0.33	0.03	0.00	0.03	32	0.00	0.01	0.01
FLAT BED TRUCK (75% onsite/25% offsite)	0.01	0.02	0.07	0.00	0.11	0.00	0.11	0.01	0.00	0.01	16	0.00	0.00	0.01
PICKUPS (50% onsite/50% offsite)	0.00	0.04	0.00	0.00	0.49	0.00	0.49	0.05	0.00	0.05	17	0.00	0.00	0.01
SUV (100% onsite)	0.00	0.03	0.00	0.00	0.33	0.00	0.33	0.03	0.00	0.03	11	0.00	0.00	0.01
FLAT BED TRUCK (75% onsite/25% offsite)	0.01	0.02	0.07	0.00	0.11	0.00	0.11	0.01	0.00	0.01	16	0.00	0.00	0.01
Phase Total	*0.04*	*0.13*	*0.28*	*0.00*	*1.35*	*0.01*	*1.36*	*0.13*	*0.01*	*0.14*	*92*	*0.00*	*0.01*	*0.04*
STRUCTURAL WORK PHASE														
Water Truck (100% on-site)	0.01	0.02	0.07	0.00	0.16	0.00	0.16	0.02	0.00	0.02	16	0.00	0.00	0.01
FLAT BED TRUCK (75% onsite/25% offsite)	0.01	0.02	0.07	0.00	0.11	0.00	0.11	0.01	0.00	0.01	16	0.00	0.00	0.01
PICKUPS (50% onsite/50% offsite)	0.00	0.04	0.00	0.00	0.49	0.00	0.49	0.05	0.00	0.05	17	0.00	0.00	0.01
Concrete Mixer Delivery (100% onsite)	0.02	0.03	0.11	0.00	0.27	0.00	0.27	0.03	0.00	0.03	27	0.00	0.00	0.01
Phase Total	*0.04*	*0.10*	*0.26*	*0.00*	*1.03*	*0.01*	*1.03*	*0.10*	*0.01*	*0.11*	*75*	*0.00*	*0.01*	*0.03*
Total	**0.12**	**0.30**	**0.79**	**0.00**	**2.98**	**0.02**	**3.00**	**0.29**	**0.02**	**0.31**	**226**	**0.01**	**0.03**	**0.10**

1. Miles per day for on-road construction equipment is based on on-road on-site activity estimate in Data Tab (off-site activity emissions estimated in Const Off-Site EMFAC On-Road EFs tab).
2. Emission factors based on EMFAC2017 aggregate fleet for year 2021 (earliest year of construction).
3. Includes emissions factors for tire wear and break wear (EMFAC), and fugitive re-entrained road dust emissions for paved roads (fugitive re=entrained road dust per AP-42,Section 13.2.2)

Assumptions	
Worker Trip length	16.8
Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298
Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.	

Average Workdays/yr:	260
Months/Year	12
Fugitive Dust Control Efficiency	57%

Project Element	Construction Duration (years) Total	Site Work	Rail Work	Structures	Maximum Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e
LODI STATION	1.2	1.00	0.08	0.50	0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10
LODI STATION - SOUTH ALTERNATIVE	1.2	1.00	0.08	0.50	0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10
CITY COLLEGE STATION	0.7	0.33	0.33	0.25	0.12	0.30	0.79	0.00	0.39	0.00	225.68	0.01	0.03	0.10
MIDTOWN SACRAMENTO STATION	1.0	0.83	0.33	0.25	0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10
OLD NORTH SACRAMENTO STATION	1.2	0.83	0.33	0.50	0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10
NATOMAS / SACRAMENTO AIRPORT STATION	1.0	0.67	0.33	0.25	0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10
NATOMAS MAINTENANCE & LAYOVER FACILITY	2.5	1.17	0.67	2.00	0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.1	0.04	0.04	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.1	0.04	0.04	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.1	0.04	0.04	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.1	0.04	0.04	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
HAMMER LANE SIDING UPGRADE	0.2	0.08	0.08	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
THORNTON SIDING UPGRADE & EXTENSION	0.3	0.17	0.17	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
PHILLIPS SIDING UPGRADE & EXTENSION	0.2	0.08	0.08	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
POLLOCK SIDING UPGRADE	0.2	0.08	0.08	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
SOUTH SACRAMENTO SIDING UPGRADE	0.3	0.08	0.25	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
DEL PASO SIDING UPGRADE & EXTENSION	1.0	0.50	0.50	0.50	0.12	0.30	0.79	0.00	6.95	0.69	225.68	0.01	0.03	0.10
LODI SIDING	0.7	0.33	0.33	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07
NEW CROSSOVER	0.2	0.08	0.08	0.00	0.08	0.20	0.53	0.00	4.55	0.45	150.38	0.00	0.02	0.07

Project Element	Maximum Annual Emissions (tons/year) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N20	Total Emissions (metric tons) CO2e
LODI STATION	0.01	0.02	0.05	0.00	0.37	0.0012	0.37	0.04	0.0011	0.04	13.51	0.00	0.00	12.25
LODI STATION - SOUTH ALTERNATIVE	0.01	0.02	0.05	0.00	0.37	0.0012	0.37	0.04	0.0011	0.04	13.51	0.00	0.00	12.25
CITY COLLEGE STATION	0.00	0.01	0.03	0.00	0.27	0.0007	0.28	0.03	0.0006	0.03	8.96	0.00	0.00	8.13
MIDTOWN SACRAMENTO STATION	0.01	0.02	0.05	0.00	0.36	0.0010	0.37	0.04	0.0010	0.04	12.77	0.00	0.00	11.59
OLD NORTH SACRAMENTO STATION	0.01	0.02	0.06	0.00	0.44	0.0012	0.44	0.04	0.0012	0.04	15.22	0.00	0.00	13.81
NATOMAS / SACRAMENTO AIRPORT STATION	0.01	0.01	0.04	0.00	0.33	0.0009	0.34	0.03	0.0009	0.03	11.50	0.00	0.00	10.44
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.02	0.05	0.13	0.00	1.11	0.0027	1.11	0.11	0.0026	0.11	36.42	0.00	0.00	33.04
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.00	0.00	0.00	0.00	0.02	0.0001	0.02	0.00	0.0001	0.00	0.81	0.00	0.00	0.74
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.00	0.00	0.00	0.00	0.02	0.0001	0.02	0.00	0.0001	0.00	0.81	0.00	0.00	0.74
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.00	0.00	0.00	0.00	0.02	0.0001	0.02	0.00	0.0001	0.00	0.81	0.00	0.00	0.74
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.00	0.00	0.00	0.00	0.02	0.0001	0.02	0.00	0.0001	0.00	0.81	0.00	0.00	0.74
HAMMER LANE SIDING UPGRADE	0.00	0.00	0.01	0.00	0.05	0.0001	0.05	0.00	0.0001	0.00	1.63	0.00	0.00	1.48
THORNTON SIDING UPGRADE & EXTENSION	0.00	0.00	0.01	0.00	0.10	0.0002	0.10	0.01	0.0002	0.01	3.26	0.00	0.00	2.96
PHILLIPS SIDING UPGRADE & EXTENSION	0.00	0.00	0.01	0.00	0.05	0.0001	0.05	0.00	0.0001	0.00	1.63	0.00	0.00	1.48
POLLOCK SIDING UPGRADE	0.00	0.00	0.01	0.00	0.05	0.0001	0.05	0.00	0.0001	0.00	1.63	0.00	0.00	1.48
SOUTH SACRAMENTO SIDING UPGRADE	0.00	0.01	0.01	0.00	0.12	0.0002	0.12	0.01	0.0002	0.01	3.62	0.00	0.00	3.28
DEL PASO SIDING UPGRADE & EXTENSION	0.01	0.02	0.05	0.00	0.45	0.0011	0.45	0.04	0.0010	0.04	14.67	0.00	0.00	13.31
LODI SIDING	0.00	0.01	0.02	0.00	0.20	0.0005	0.20	0.02	0.0005	0.02	6.52	0.00	0.00	5.91
NEW CROSSOVER	0.00	0.00	0.01	0.00	0.05	0.0001	0.05	0.00	0.0001	0.00	1.63	0.00	0.00	1.48

Project Element	Mitigated Maximum Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e
LODI STATION	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
LODI STATION - SOUTH ALTERNATIVE	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
CITY COLLEGE STATION	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
MIDTOWN SACRAMENTO STATION	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
OLD NORTH SACRAMENTO STATION	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
NATOMAS / SACRAMENTO AIRPORT STATION	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
HAMMER LANE SIDING UPGRADE	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
THORNTON SIDING UPGRADE & EXTENSION	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
PHILLIPS SIDING UPGRADE & EXTENSION	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
POLLOCK SIDING UPGRADE	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
SOUTH SACRAMENTO SIDING UPGRADE	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
DEL PASO SIDING UPGRADE & EXTENSION	0.12	0.30	0.79	0.002	3.00	0.31	225.68	0.01	0.03	0.10
LODI SIDING	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07
NEW CROSSOVER	0.08	0.20	0.53	0.001	1.96	0.20	150.38	0.00	0.02	0.07

Project Element	Mitigated Maximum Annual Emissions (tons/year) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N20	Total Emissions (metric tons) CO2e
LODI STATION	0.008	0.017	0.052	0.000	0.159	0.0012	0.160	0.016	0.0011	0.017	13.508	0.0004	0.002	12.25
LODI STATION - SOUTH ALTERNATIVE	0.008	0.017	0.052	0.000	0.159	0.0012	0.160	0.016	0.0011	0.017	13.508	0.0004	0.002	12.25
CITY COLLEGE STATION	0.005	0.012	0.031	0.000	0.118	0.0007	0.119	0.012	0.0006	0.012	8.964	0.0003	0.001	8.13
MIDTOWN SACRAMENTO STATION	0.007	0.016	0.048	0.000	0.157	0.0010	0.158	0.015	0.0010	0.016	12.773	0.0004	0.002	11.59
OLD NORTH SACRAMENTO STATION	0.008	0.020	0.056	0.000	0.190	0.0012	0.191	0.019	0.0012	0.020	15.221	0.0005	0.002	13.81
NATOMAS / SACRAMENTO AIRPORT STATION	0.006	0.015	0.042	0.000	0.144	0.0009	0.145	0.014	0.0009	0.015	11.503	0.0003	0.002	10.44
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.019	0.049	0.129	0.000	0.475	0.0027	0.478	0.046	0.0026	0.049	36.421	0.0011	0.005	33.04
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.000	0.001	0.003	0.000	0.011	0.0001	0.011	0.001	0.0001	0.001	0.815	0.0000	0.000	0.74
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.000	0.001	0.003	0.000	0.011	0.0001	0.011	0.001	0.0001	0.001	0.815	0.0000	0.000	0.74
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.000	0.001	0.003	0.000	0.011	0.0001	0.011	0.001	0.0001	0.001	0.815	0.0000	0.000	0.74
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.000	0.001	0.003	0.000	0.011	0.0001	0.011	0.001	0.0001	0.001	0.815	0.0000	0.000	0.74
HAMMER LANE SIDING UPGRADE	0.001	0.002	0.006	0.000	0.021	0.0001	0.021	0.002	0.0001	0.002	1.629	0.0000	0.000	1.48
THORNTON SIDING UPGRADE & EXTENSION	0.002	0.004	0.012	0.000	0.042	0.0002	0.043	0.004	0.0002	0.004	3.258	0.0001	0.000	2.96
PHILLIPS SIDING UPGRADE & EXTENSION	0.001	0.002	0.006	0.000	0.021	0.0001	0.021	0.002	0.0001	0.002	1.629	0.0000	0.000	1.48
POLLOCK SIDING UPGRADE	0.001	0.002	0.006	0.000	0.021	0.0001	0.021	0.002	0.0001	0.002	1.629	0.0000	0.000	1.48
SOUTH SACRAMENTO SIDING UPGRADE	0.002	0.005	0.012	0.000	0.050	0.0002	0.051	0.005	0.0002	0.005	3.617	0.0001	0.000	3.28
DEL PASO SIDING UPGRADE & EXTENSION	0.008	0.020	0.051	0.000	0.194	0.0011	0.195	0.019	0.0010	0.020	14.669	0.0004	0.002	13.31
LODI SIDING	0.003	0.009	0.023	0.000	0.085	0.0005	0.085	0.008	0.0005	0.009	6.516	0.0002	0.001	5.91
NEW CROSSOVER	0.001	0.002	0.006	0.000	0.021	0.0001	0.021	0.002	0.0001	0.002	1.629	0.0000	0.000	1.48

*Note that some locations do not include all phases, so formulas for maxikum daily emissions in above chart vary to not include emissions for phases with no activity at a specific location.
* To estimate maximum daily emissions, it is assumed that all construction phases could overlap at some point within the overal construction duration for each location.

Earth Moving & Demolition Emissions

Emission Factors							
Earth Moving		Grading		Cut & Fill		Demolition	
PM10 (lb/hr)	PM2.5 (lb/hr)	PM10 (lb/acre)	PM2.5 (lb/acre)	PM10 (lb/cy)	PM2.5 (lb/cy)	PM10 (lb/sf)	PM2.5 (lb/sf)
0.75276	0.41482	0.52594	0.04766	0.00007	0.00001	0.00004	0.00001

*See "Fugitive Dust Emission Factors" Worksheet for emission factor details.

Project Element	Maximum Phase Duration (Months)	% Time for Earthwork	Earthwork Days of Activity	% Time for Demolition	Demolition Days of Activity	# of Bulldozers	Use per Day (hrs)	Graded Area (acres)	Cut/Fill (cy)	Demolition (sf)
LODI STATION	12	15%	38.7	5%	12.9	4	6.5	9	16310	0
LODI STATION - SOUTH ALTERNATIVE	12	15%	38.7	5%	12.9	4	6.5	13	35990	0
CITY COLLEGE STATION	4	15%	12.9	5%	4.3	4	6.5	1	2200	0
MIDTOWN SACRAMENTO STATION	10	15%	32.25	5%	10.75	4	6.5	2	3890	85000
OLD NORTH SACRAMENTO STATION	10	15%	32.25	5%	10.75	4	6.5	1	7850	155000
NATOMAS / SACRAMENTO AIRPORT STATION	8	15%	25.8	5%	8.6	4	6.5	4	18500	180000
NATOMAS MAINTENANCE & LAYOVER FACILITY	14	15%	45.15	5%	15.05	4	6.5	5	135190	155000
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.5	15%	1.6125	5%	0.5375	4	6.5	0	200	0
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.5	15%	1.6125	5%	0.5375	4	6.5	0	150	0
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.5	15%	1.6125	5%	0.5375	4	6.5	0	250	0
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.5	15%	1.6125	5%	0.5375	4	6.5	0	200	0
HAMMER LANE SIDING UPGRADE	1	15%	3.225	5%	1.075	4	6.5	0	0	1000
THORNTON SIDING UPGRADE & EXTENSION	2	15%	6.45	5%	2.15	4	6.5	5	38800	1400
PHILLIPS SIDING UPGRADE & EXTENSION	1	15%	3.225	5%	1.075	4	6.5	3	27900	1400
POLLOCK SIDING UPGRADE	1	15%	3.225	5%	1.075	4	6.5	0	0	1000
SOUTH SACRAMENTO SIDING UPGRADE	1	15%	3.225	5%	1.075	4	6.5	0	0	0
DEL PASO SIDING UPGRADE & EXTENSION	6	15%	19.35	5%	6.45	4	6.5	9	149200	9200
LODI SIDING	4	15%	12.9	5%	4.3	4	6.5	12	100000	10070
NEW CROSSOVER	1	15%	3.225	5%	1.075	4	6.5	0	0	1000

	Emission (total tons)									
	Earth Moving		Grading		Cut & Fill		Demolition		*Total*	
Project Element	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	*PM10*	*PM2.5*
LODI STATION	0.3787	0.2087	0.0024	0.0002	0.0006	0.0001	0.0000	0.0000	*0.3817*	*0.2090*
LODI STATION - SOUTH ALTERNATIVE	0.3787	0.2087	0.0034	0.0003	0.0013	0.0002	0.0000	0.0000	*0.3834*	*0.2092*
CITY COLLEGE STATION	0.1262	0.0696	0.0003	0.0000	0.0001	0.0000	0.0000	0.0000	*0.1266*	*0.0696*
MIDTOWN SACRAMENTO STATION	0.3156	0.1739	0.0005	0.0000	0.0001	0.0000	0.0015	0.0002	*0.3178*	*0.1742*
OLD NORTH SACRAMENTO STATION	0.3156	0.1739	0.0003	0.0000	0.0003	0.0000	0.0027	0.0004	*0.3189*	*0.1744*
NATOMAS / SACRAMENTO AIRPORT STATION	0.2525	0.1391	0.0011	0.0001	0.0007	0.0001	0.0032	0.0005	*0.2573*	*0.1398*
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.4418	0.2435	0.0013	0.0001	0.0049	0.0007	0.0027	0.0004	*0.4507*	*0.2447*
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.0158	0.0087	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0158*	*0.0087*
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.0158	0.0087	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0158*	*0.0087*
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.0158	0.0087	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0158*	*0.0087*
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.0158	0.0087	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0158*	*0.0087*
HAMMER LANE SIDING UPGRADE	0.0316	0.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0316*	*0.0174*
THORNTON SIDING UPGRADE & EXTENSION	0.0631	0.0348	0.0013	0.0001	0.0014	0.0002	0.0000	0.0000	*0.0659*	*0.0351*
PHILLIPS SIDING UPGRADE & EXTENSION	0.0316	0.0174	0.0008	0.0001	0.0010	0.0002	0.0000	0.0000	*0.0334*	*0.0176*
POLLOCK SIDING UPGRADE	0.0316	0.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0316*	*0.0174*
SOUTH SACRAMENTO SIDING UPGRADE	0.0316	0.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0316*	*0.0174*
DEL PASO SIDING UPGRADE & EXTENSION	0.1894	0.1043	0.0024	0.0002	0.0054	0.0008	0.0002	0.0000	*0.1973*	*0.1054*
LODI SIDING	0.1262	0.0696	0.0032	0.0003	0.0036	0.0005	0.0002	0.0000	*0.1332*	*0.0704*
NEW CROSSOVER	0.0316	0.0174	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0316*	*0.0174*

	Emission (lbs/day)									
	Earth Moving		Grading		Cut & Fill		Demolition		*Total*	
Project Element	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	*PM10*	*PM2.5*
LODI STATION	19.57	10.79	0.12	0.01	0.03	0.00	0.00	0.00	*19.72*	*10.80*
LODI STATION - SOUTH ALTERNATIVE	19.57	10.79	0.18	0.02	0.07	0.01	0.00	0.00	*19.82*	*10.81*
CITY COLLEGE STATION	19.57	10.79	0.04	0.00	0.01	0.00	0.00	0.00	*19.62*	*10.79*
MIDTOWN SACRAMENTO STATION	19.57	10.79	0.03	0.00	0.01	0.00	0.09	0.01	*19.71*	*10.80*
OLD NORTH SACRAMENTO STATION	19.57	10.79	0.02	0.00	0.02	0.00	0.17	0.03	*19.77*	*10.81*
NATOMAS / SACRAMENTO AIRPORT STATION	19.57	10.79	0.08	0.01	0.05	0.01	0.24	0.04	*19.95*	*10.84*
NATOMAS MAINTENANCE & LAYOVER FACILITY	19.57	10.79	0.06	0.01	0.22	0.03	0.12	0.02	*19.97*	*10.84*
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	19.57	10.79	0.00	0.00	0.01	0.00	0.00	0.00	*19.58*	*10.79*
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	19.57	10.79	0.00	0.00	0.01	0.00	0.00	0.00	*19.58*	*10.79*
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	19.57	10.79	0.00	0.00	0.01	0.00	0.00	0.00	*19.58*	*10.79*
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	19.57	10.79	0.00	0.00	0.01	0.00	0.00	0.00	*19.58*	*10.79*
HAMMER LANE SIDING UPGRADE	19.57	10.79	0.00	0.00	0.00	0.00	0.01	0.00	*19.58*	*10.79*
THORNTON SIDING UPGRADE & EXTENSION	19.57	10.79	0.41	0.04	0.43	0.07	0.01	0.00	*20.42*	*10.89*
PHILLIPS SIDING UPGRADE & EXTENSION	19.57	10.79	0.49	0.04	0.62	0.09	0.02	0.00	*20.70*	*10.93*
POLLOCK SIDING UPGRADE	19.57	10.79	0.00	0.00	0.00	0.00	0.01	0.00	*19.58*	*10.79*
SOUTH SACRAMENTO SIDING UPGRADE	19.57	10.79	0.00	0.00	0.00	0.00	0.00	0.00	*19.57*	*10.79*
DEL PASO SIDING UPGRADE & EXTENSION	19.57	10.79	0.24	0.02	0.56	0.08	0.02	0.00	*20.39*	*10.89*
LODI SIDING	19.57	10.79	0.49	0.04	0.56	0.08	0.03	0.00	*20.65*	*10.92*
NEW CROSSOVER	19.57	10.79	0.00	0.00	0.00	0.00	0.01	0.00	*19.58*	*10.79*

	Mitigated Emission (total tons)									
	Earth Moving		Grading		Cut & Fill		Demolition		*Total*	
Project Element	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	*PM10*	*PM2.5*
LODI STATION	0.1477	0.0814	0.0024	0.0002	0.0006	0.0001	0.0000	0.0000	*0.1507*	*0.0817*
LODI STATION - SOUTH ALTERNATIVE	0.1477	0.0814	0.0034	0.0003	0.0013	0.0002	0.0000	0.0000	*0.1524*	*0.0819*
CITY COLLEGE STATION	0.0492	0.0271	0.0003	0.0000	0.0001	0.0000	0.0000	0.0000	*0.0496*	*0.0272*
MIDTOWN SACRAMENTO STATION	0.1231	0.0678	0.0005	0.0000	0.0001	0.0000	0.0015	0.0002	*0.1252*	*0.0681*
OLD NORTH SACRAMENTO STATION	0.1231	0.0678	0.0003	0.0000	0.0003	0.0000	0.0027	0.0004	*0.1263*	*0.0683*
NATOMAS / SACRAMENTO AIRPORT STATION	0.0985	0.0543	0.0011	0.0001	0.0007	0.0001	0.0032	0.0005	*0.1033*	*0.0549*
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.1723	0.0950	0.0013	0.0001	0.0049	0.0007	0.0027	0.0004	*0.1812*	*0.0962*
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.0062	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0062*	*0.0034*
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.0062	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0062*	*0.0034*
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.0062	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0062*	*0.0034*
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.0062	0.0034	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0062*	*0.0034*
HAMMER LANE SIDING UPGRADE	0.0123	0.0068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0123*	*0.0068*
THORNTON SIDING UPGRADE & EXTENSION	0.0246	0.0136	0.0013	0.0001	0.0014	0.0002	0.0000	0.0000	*0.0274*	*0.0139*
PHILLIPS SIDING UPGRADE & EXTENSION	0.0123	0.0068	0.0008	0.0001	0.0010	0.0002	0.0000	0.0000	*0.0141*	*0.0070*
POLLOCK SIDING UPGRADE	0.0123	0.0068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0123*	*0.0068*
SOUTH SACRAMENTO SIDING UPGRADE	0.0123	0.0068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0123*	*0.0068*
DEL PASO SIDING UPGRADE & EXTENSION	0.0738	0.0407	0.0024	0.0002	0.0054	0.0008	0.0002	0.0000	*0.0818*	*0.0418*
LODI SIDING	0.0492	0.0271	0.0032	0.0003	0.0036	0.0005	0.0002	0.0000	*0.0562*	*0.0280*
NEW CROSSOVER	0.0123	0.0068	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	*0.0123*	*0.0068*

	Mitigated Emission (lbs/day)									
	Earth Moving		Grading		Cut & Fill		Demolition		*Total*	
Project Element	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	PM10	PM2.5	*PM10*	*PM2.5*
LODI STATION	7.6330	4.2062	0.12	0.01	0.03	0.00	0.00	0.00	*7.79*	*4.22*
LODI STATION - SOUTH ALTERNATIVE	7.6330	4.2062	0.18	0.02	0.07	0.01	0.00	0.00	*7.88*	*4.23*
CITY COLLEGE STATION	7.6330	4.2062	0.04	0.00	0.01	0.00	0.00	0.00	*7.69*	*4.21*
MIDTOWN SACRAMENTO STATION	7.6330	4.2062	0.03	0.00	0.01	0.00	0.09	0.01	*7.77*	*4.22*
OLD NORTH SACRAMENTO STATION	7.6330	4.2062	0.02	0.00	0.02	0.00	0.17	0.03	*7.84*	*4.24*
NATOMAS / SACRAMENTO AIRPORT STATION	7.6330	4.2062	0.08	0.01	0.05	0.01	0.24	0.04	*8.01*	*4.26*
NATOMAS MAINTENANCE & LAYOVER FACILITY	7.6330	4.2062	0.06	0.01	0.22	0.03	0.12	0.02	*8.03*	*4.26*
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	7.6330	4.2062	0.00	0.00	0.01	0.00	0.00	0.00	*7.64*	*4.21*
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	7.6330	4.2062	0.00	0.00	0.01	0.00	0.00	0.00	*7.64*	*4.21*
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	7.6330	4.2062	0.00	0.00	0.01	0.00	0.00	0.00	*7.64*	*4.21*
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	7.6330	4.2062	0.00	0.00	0.01	0.00	0.00	0.00	*7.64*	*4.21*
HAMMER LANE SIDING UPGRADE	7.6330	4.2062	0.00	0.00	0.00	0.00	0.01	0.00	*7.64*	*4.21*
THORNTON SIDING UPGRADE & EXTENSION	7.6330	4.2062	0.41	0.04	0.43	0.07	0.01	0.00	*8.48*	*4.31*
PHILLIPS SIDING UPGRADE & EXTENSION	7.6330	4.2062	0.49	0.04	0.62	0.09	0.02	0.00	*8.76*	*4.35*
POLLOCK SIDING UPGRADE	7.6330	4.2062	0.00	0.00	0.00	0.00	0.01	0.00	*7.64*	*4.21*
SOUTH SACRAMENTO SIDING UPGRADE	7.6330	4.2062	0.00	0.00	0.00	0.00	0.00	0.00	*7.63*	*4.21*
DEL PASO SIDING UPGRADE & EXTENSION	7.6330	4.2062	0.24	0.02	0.56	0.08	0.02	0.00	*8.45*	*4.32*
LODI SIDING	7.6330	4.2062	0.49	0.04	0.56	0.08	0.03	0.00	*8.71*	*4.34*
NEW CROSSOVER	7.6330	4.2062	0.00	0.00	0.00	0.00	0.01	0.00	*7.64*	*4.21*

Days of work per week:	5
Average Workdays per Month:	21.5
Control Efficiency of Watering every 3 hours during Earth Moving activities*	61%

*Per SCAQMD Table X1-A

Conversion Factors	
pounds per ton	2000

Paving and Architectural Coating Emissions

				Arch Coating Emission		Paving Emissions		Total Emissions	
Project Element	Maximum Phase Duration (Months)	% Time for work	Area (ft^2)	Total (tons)	Daily (lb/day)	Total (tons)	Daily (lb/day)	Total (tons)	Daily (lb/day)
LODI STATION	6	50%	200000	0.04	1.2939	0.01	0.1865	0.05	1.48
LODI STATION - SOUTH ALTERNATIVE	6	50%	230000	0.05	1.4879	0.01	0.2145	0.05	1.70
CITY COLLEGE STATION	3	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
MIDTOWN SACRAMENTO STATION	3	50%	150000	0.03	1.9408	0.00	0.2798	0.04	2.22
OLD NORTH SACRAMENTO STATION	6	50%	210000	0.04	1.3586	0.01	0.1958	0.05	1.55
NATOMAS / SACRAMENTO AIRPORT STATION	3	50%	238000	0.05	3.0794	0.01	0.4439	0.06	3.52
NATOMAS MAINTENANCE & LAYOVER FACILITY	24	50%	315000	0.07	0.5095	0.01	0.0734	0.08	0.58
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
HAMMER LANE SIDING UPGRADE	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
THORNTON SIDING UPGRADE & EXTENSION	2	50%	1400	0.00	0.0272	0.00	0.0039	0.00	0.03
PHILLIPS SIDING UPGRADE & EXTENSION	1	50%	1400	0.00	0.0543	0.00	0.0078	0.00	0.06
POLLOCK SIDING UPGRADE	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
SOUTH SACRAMENTO SIDING UPGRADE	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00
DEL PASO SIDING UPGRADE & EXTENSION	6	50%	9200	0.00	0.0595	0.00	0.0086	0.00	0.07
LODI SIDING	4	50%	10070	0.00	0.0977	0.00	0.0141	0.00	0.11
NEW CROSSOVER	0	50%	0	0.00	0.0000	0.00	0.0000	0.00	0.00

*Assumed paving to occur during structures phase except where noted by *, in which it occurs during rail work phase.

Days of work per week:	5
Average Workdays per Month:	21.5

Offsite On-Raod ConstructionVehicle Emissions (Exhaust)

Vehilcle Type	Trips / Day[1]	Miles / Day[2]	Emission Factors (g/mile)[3] ROG_ RUNEX	ROG_ STREX	CO_ RUNEX	CO_ STREX	NOX_ RUNEX	NOX_ STREX	SO2_ RUNEX	SO2_ STREX	PM10 Fugitive Dust[4]	PM10_ RUNEX	PM10_ STREX	PM10 Total
SITE WORK														
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	8	252	0.221	0.000	0.627	0.000	3.639	1.418	0.010	0.000	1.637	0.093	0.000	1.730
Worker Trips	14	235.2	0.016	0.354	0.921	2.715	0.073	0.287	0.003	0.001	0.334	0.002	0.002	0.338
Phase Total														
RAIL WORK														
FLAT BED TRUCK (75% onsite/25% offsite)	2	21.875	0.426	0.000	1.137	0.000	6.503	3.517	0.004	0.037	1.592	0.115	0.000	1.707
PICKUPS (50% onsite/50% offsite)	6	105	0.018	0.405	1.028	3.060	0.099	0.362	0.003	0.001	0.334	0.002	0.002	0.338
FLAT BED TRACTOR (75% onsite/25% offsite)	2	8.75	0.221	0.000	0.627	0.000	3.639	1.418	0.010	0.000	1.637	0.093	0.000	1.730
Worker Trips	38	638.4	0.016	0.354	0.921	2.715	0.073	0.287	0.003	0.001	0.334	0.002	0.002	0.338
Phase Total														
STRUCTURES														
FLAT BED TRUCK (75% onsite/25% offsite)	2	17.5	0.426	0.000	1.137	0.000	6.503	3.517	0.018	0.037	1.592	0.115	0.000	1.707
PICKUPS (50% onsite/50% offsite)	6	24.5	0.018	0.405	1.028	3.060	0.099	0.362	0.003	0.001	0.334	0.002	0.002	0.338
Worker Trips	40	672	0.016	0.354	0.921	2.715	0.073	0.287	0.003	0.001	0.334	0.002	0.002	0.338
Phase Total														

Vehilcle Type	PM2.5 Fugitive Dust[4]	PM2.5_ RUNEX	PM2.5_ STREX	PM2.5 Total	CO2_ RUNEX	CO2_ STREX	CH4_ RUNEX	CH4_ STREX	N2O_ RUNEX	N2O_ STREX
SITE WORK										
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	0.426	0.089	0.000	0.515	1072	0	0.010	0.000	0.169	0.000
Worker Trips	0.089	0.002	0.002	0.092	311.947	65.892	0.004	0.073	0.007	0.032
Phase Total										
RAIL WORK										
FLAT BED TRUCK (75% onsite/25% offsite)	0.402	0.110	0.000	0.512	1859.783	0.000	0.020	0.000	0.292	0.000
PICKUPS (50% onsite/50% offsite)	0.089	0.001	0.002	0.092	346.517	74.577	0.004	0.084	0.008	0.037
FLAT BED TRACTOR (75% onsite/25% offsite)	0.426	0.089	0.000	0.515	1072.198	0.000	0.010	0.000	0.169	0.000
Worker Trips	0.089	0.002	0.002	0.092	311.947	65.892	0.004	0.073	0.007	0.032
Phase Total										
STRUCTURES										
FLAT BED TRUCK (75% onsite/25% offsite)	0.402	0.110	0.000	0.512	1859.783	0.000	0.020	0.000	0.292	0.000
PICKUPS (50% onsite/50% offsite)	0.089	0.001	0.002	0.092	346.517	74.577	0.004	0.084	0.008	0.037
Worker Trips	0.089	0.002	0.002	0.092	311.947	65.892	0.004	0.073	0.007	0.032
Phase Total										

Vehilcle Type	Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O	Daily Emissions (metric tons/day) CO2e
SITE WORK														
RENTAL DUMP TRUCKS (50% onsite/50% offsite)	0.123	0.348	2.047	0.006	0.909	0.052	0.961	0.236	0.049	0.286	595.676	0.006	0.094	0.270
Worker Trips	0.019	0.561	0.047	0.002	0.173	0.001	0.175	0.046	0.001	0.048	163.787	0.004	0.005	0.074
Phase Total	*0.142*	*0.910*	*2.093*	*0.007*	*1.082*	*0.053*	*1.136*	*0.282*	*0.050*	*0.334*	*759*	*0.010*	*0.098*	*0.344*
RAIL WORK														
FLAT BED TRUCK (75% onsite/25% offsite)	0.021	0.055	0.329	0.000	0.077	0.006	0.082	0.019	0.005	0.025	89.690	0.001	0.014	0.041
PICKUPS (50% onsite/50% offsite)	0.010	0.279	0.028	0.001	0.077	0.000	0.078	0.021	0.000	0.021	81.200	0.002	0.002	0.037
FLAT BED TRACTOR (75% onsite/25% offsite)	0.004	0.012	0.076	0.000	0.032	0.002	0.033	0.008	0.002	0.010	20.683	0.000	0.003	0.009
Worker Trips	0.053	1.524	0.127	0.004	0.470	0.002	0.476	0.125	0.002	0.130	444.565	0.012	0.012	0.202
Phase Total	*0.087*	*1.869*	*0.561*	*0.006*	*0.656*	*0.010*	*0.669*	*0.173*	*0.010*	*0.186*	*636*	*0.015*	*0.032*	*0.289*
STRUCTURES														
FLAT BED TRUCK (75% onsite/25% offsite)	0.016	0.044	0.266	0.001	0.061	0.004	0.066	0.016	0.004	0.020	71.752	0.001	0.011	0.033
PICKUPS (50% onsite/50% offsite)	0.006	0.096	0.010	0.000	0.018	0.000	0.018	0.005	0.000	0.005	19.703	0.001	0.001	0.009
Worker Trips	0.056	1.604	0.134	0.005	0.495	0.0	0.501	0.132	0.002	0.137	467.963	0.012	0.013	0.212
Phase Total	*0.078*	*1.744*	*0.411*	*0.006*	*0.574*	*0.007*	*0.585*	*0.152*	*0.007*	*0.161*	*559*	*0.014*	*0.025*	*0.254*
Total	0.308	4.523	3.065	0.019	2.313	0.070	2.390	0.607	0.067	0.681	1955	0.039	0.155	0.887

1. The number of worker trips is based upon the number of workers listed in the Data Tab for each phase subtract the workers accounted for in driving the other on-road equipment to/from the site.
2. Miles per day for on-road construction equipment is based on on-road off-site activity estimate in Data Tab (on-site activity emissions estimated in Const On-Site EMFAC On-Road EFs tab). Default worker trip length (based on CalEEMod default for San Joaquin County, which is longer than default for Sacramento County) (miles)
3. Emission factors based on EMFAC2017 aggregate fleet for year 2021 (earliest year of construction), and gasoline light duty vehicle (LDA, LDT1, LDT2 and MDV) emission factors were adjusted using the CARB Off-Model Adjustment Factors for the same year (shown below).
4. Includes emission factor for fugitive re-entrained road dust emissions for unpaved roads (AP-42,Section 13.2.1)

Assumptions	
Worker Trip length	16.8
Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298
Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.	

Average Workdays per Year:	260
Months per Year	12

Project Element	Construction Activity Duration (years) Total	Site Work	Rail Work	Structures
LODI STATION	1.2	1.00	0.08	0.50
LODI STATION - SOUTH ALTERNATIVE	1.2	1.00	0.08	0.50
CITY COLLEGE STATION	0.7	0.33	0.33	0.25
MIDTOWN SACRAMENTO STATION	1.0	0.83	0.33	0.25
OLD NORTH SACRAMENTO STATION	1.2	0.83	0.33	0.50
NATOMAS / SACRAMENTO AIRPORT STATION	0.8	0.67	0.17	0.25
NATOMAS MAINTENANCE & LAYOVER FACILITY	2.5	1.17	0.67	2.00
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.1	0.04	0.04	0.00
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.1	0.04	0.04	0.00
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.1	0.04	0.04	0.00
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.1	0.04	0.04	0.00
HAMMER LANE SIDING UPGRADE	0.2	0.08	0.08	0.00
THORNTON SIDING UPGRADE & EXTENSION	0.3	0.17	0.17	0.00
PHILLIPS SIDING UPGRADE & EXTENSION	0.2	0.08	0.08	0.00
POLLOCK SIDING UPGRADE	0.2	0.08	0.08	0.00
SOUTH SACRAMENTO SIDING UPGRADE	0.3	0.08	0.25	0.00
DEL PASO SIDING UPGRADE & EXTENSION	1.0	0.50	0.50	0.50
LODI SIDING	0.7	0.33	0.33	0.00
NEW CROSSOVER	0.2	0.08	0.08	0.00

Project Element	Daily Emissions (lb/day) ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	Daily Emissions (metric tons/day) CO2e
LODI STATION	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
LODI STATION - SOUTH ALTERNATIVE	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
CITY COLLEGE STATION	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
MIDTOWN SACRAMENTO STATION	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
OLD NORTH SACRAMENTO STATION	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
NATOMAS / SACRAMENTO AIRPORT STATION	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
HAMMER LANE SIDING UPGRADE	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
THORNTON SIDING UPGRADE & EXTENSION	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
PHILLIPS SIDING UPGRADE & EXTENSION	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
POLLOCK SIDING UPGRADE	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
SOUTH SACRAMENTO SIDING UPGRADE	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
DEL PASO SIDING UPGRADE & EXTENSION	0.31	4.52	3.06	0.02	2.31	0.07	2.39	0.61	0.07	0.68
LODI SIDING	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52
NEW CROSSOVER	0.23	2.78	2.65	0.01	1.74	0.06	1.81	0.46	0.06	0.52

Project Element	Max Annual Emissions (tons/year) ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N20	Total Emissions (metric tons) CO2e
LODI STATION	0.02	0.25	0.30	0.00	0.19	0.007	0.19	0.05	0.007	0.06	141.98	0.00	0.01	128.81
LODI STATION - SOUTH ALTERNATIVE	0.02	0.25	0.30	0.00	0.19	0.007	0.19	0.05	0.007	0.06	141.98	0.00	0.01	128.81
CITY COLLEGE STATION	0.01	0.18	0.13	0.00	0.09	0.003	0.10	0.02	0.003	0.03	78.66	0.00	0.01	71.36
MIDTOWN SACRAMENTO STATION	0.02	0.24	0.26	0.00	0.16	0.006	0.17	0.04	0.006	0.05	128.02	0.00	0.01	116.14
OLD NORTH SACRAMENTO STATION	0.02	0.29	0.28	0.00	0.18	0.007	0.19	0.05	0.006	0.05	146.20	0.00	0.01	132.63
NATOMAS / SACRAMENTO AIRPORT STATION	0.02	0.18	0.21	0.00	0.13	0.005	0.13	0.03	0.005	0.04	97.78	0.00	0.01	88.71
NATOMAS MAINTENANCE & LAYOVER FACILITY	0.05	0.75	0.47	0.00	0.37	0.011	0.38	0.10	0.010	0.11	315.77	0.01	0.02	286.46
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0.00	0.02	0.01	0.00	0.01	0.000	0.01	0.00	0.000	0.00	7.56	0.00	0.00	6.86
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0.00	0.02	0.01	0.00	0.01	0.000	0.01	0.00	0.000	0.00	7.56	0.00	0.00	6.86
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0.00	0.02	0.01	0.00	0.01	0.000	0.01	0.00	0.000	0.00	7.56	0.00	0.00	6.86
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0.00	0.02	0.01	0.00	0.01	0.000	0.01	0.00	0.000	0.00	7.56	0.00	0.00	6.86
HAMMER LANE SIDING UPGRADE	0.00	0.03	0.03	0.00	0.02	0.001	0.02	0.00	0.001	0.01	15.12	0.00	0.00	13.72
THORNTON SIDING UPGRADE & EXTENSION	0.00	0.06	0.06	0.00	0.04	0.001	0.04	0.01	0.001	0.01	30.24	0.00	0.00	27.43
PHILLIPS SIDING UPGRADE & EXTENSION	0.00	0.03	0.03	0.00	0.02	0.001	0.02	0.00	0.001	0.01	15.12	0.00	0.00	13.72
POLLOCK SIDING UPGRADE	0.00	0.03	0.03	0.00	0.02	0.001	0.02	0.00	0.001	0.01	15.12	0.00	0.00	13.72
SOUTH SACRAMENTO SIDING UPGRADE	0.00	0.07	0.04	0.00	0.03	0.001	0.03	0.01	0.001	0.01	28.90	0.00	0.00	26.22
DEL PASO SIDING UPGRADE & EXTENSION	0.02	0.29	0.20	0.00	0.15	0.005	0.16	0.04	0.004	0.04	127.08	0.00	0.01	115.28
LODI SIDING	0.01	0.12	0.12	0.00	0.08	0.003	0.08	0.02	0.003	0.02	60.48	0.00	0.01	54.86
NEW CROSSOVER	0.00	0.03	0.03	0.00	0.02	0.001	0.02	0.00	0.001	0.01	15.12	0.00	0.00	13.72

*Note that some locations do not include all phases, so formulas for maximum daily emissions in above chart vary to not include emissions for phases with no activity at a specific location.
* To estimate maximum daily emissions, it is assumed that all construction phases could overlap at some point within the overal construction duration for each location.

Total	Construction Phase Duration (months) Site Work	Rail Work	Structures
14	12	1	6
14	12	1	6
14	12	0	6
14	12	0	6
8	4	4	3
12	10	4	3
14	10	4	6
14	12	3	6
10	8	2	3
10	6	1	3
30	14	8	18
30	14	8	24
1	0.5	0.5	0
1	0.5	0.5	0
1	0.5	0.5	0
1	0.5	0.5	0
2	1	1	0
4	2	2	0
2	1	1	0
2	1	1	0
4	1	3	0
12	6	6	6
8	4	4	0
8	3	3	4
2	1	1	0

Offsite EMFAC On-Road Emission Factors

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: SAN JOAQUIN
Calendar Year: 2021
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN

Region	Calendar Y	Vehicle Ca	Model Year	Speed	Fuel	Population	VMT	Trips	% VMT (weight factor)	ROG_RUN	ROG_IDLEX	ROG_STRE	ROG_HOTS	ROG_RUNL	ROG_RESTI	ROG_DIU	TOG_RUN	TOG_IDLE	TOG_STR	TOG_HOT	TOG_RUN	TOG_RES	TOG_DIU	CO_RUNE	CO_IDLEX	CO_STRE	NOx_RUN	NOx_IDLE	NOx_STR	CO2_RUN	CO2_IDLE	CO2_STR	CH4_RUN	CH4_IDLE	CH4_STR	PM10_RU	PM10_IDI	PM10_STI	PM10_PM	PM10_PM	PM2_5_RI	PM2_5_ID	PM2_5_S	PM2_5_PI	PM2_5_PI	SOx_RUN	SOx_IDLE	SOx_STRE	N2O_RUN	N2O_IDLE	N2O_STREX
		Worker Vehicles																																																	
SAN JOAQUIN	2021	LDA	Aggregated	Aggregated	GAS	286267.8223	11331154	1340711	0.5934364	0.010534	0	0.2808523	0.1217589	0.2444938	0.2316212	0.30741	0.015365	0	0.307496	0.121759	0.244494	0.231621	0.30741	0.664425	0	2.387597	0.045336	0	0.218013	273.761	0	57.38895	0.002702	0	0.061001	0.001424	0	0.002035	0.008	0.03675	0.00131	0	0.001871	0.002	0.01575	0.002709	0	0.000568	0.004981	0	0.028313
SAN JOAQUIN	2021	LDA	Aggregated	Aggregated	DSL	2226.814274	94152.13	10574.47	0.0049309	0.013295	0	0	0	0	0	0	0.015136	0	0	0	0	0	0	0.185938	0	0	0.100275	0	0	207.1587	0	0	0.000618	0	0	0.007448	0	0	0.008	0.03675	0.007126	0	0	0.002	0.01575	0.001958	0	0	0.032562	0	0
SAN JOAQUIN	2021	LDA	Aggregated	Aggregated	ELEC	3716.128485	145672.7	18655.36	0.0076292	0	0	0	0.004888	0	0.0072524	0.024367	0	0	0	0.004888	0	0.007252	0.024367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
SAN JOAQUIN	2021	LDT1	Aggregated	Aggregated	GAS	29154.07954	1025943	131402.3	0.0537308	0.03032	0	0.5033395	0.2807376	0.9639554	0.5499699	0.822291	0.044215	0	0.55109	0.280738	0.963955	0.54997	0.822291	1.360352	0	2.680191	0.131307	0	0.334788	318.707	0	68.3831	0.006829	0	0.096004	0.002101	0	0.003047	0.008	0.03675	0.001932	0	0.002802	0.002	0.01575	0.003154	0	0.000677	0.009675	0	0.033113
SAN JOAQUIN	2021	LDT1	Aggregated	Aggregated	DSL	24.7964189	441.5487	85.78495	2.312E-05	0.16055	0	0	0	0	0	0	0.182775	0	0	0	0	0	0	1.11269	0	0	1.092935	0	0	434.6655	0	0	0.007457	0	0	0.127048	0	0	0.008	0.03675	0.121552	0	0	0.002	0.01575	0.004109	0	0	0.068323	0	0
SAN JOAQUIN	2021	LDT1	Aggregated	Aggregated	ELEC	96.9868293	3961.982	492.4094	0.0002075	0	0	0	0.004888	0	0.0072524	0.024367	0	0	0	0.004888	0	0.007252	0.024367	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
SAN JOAQUIN	2021	LDT2	Aggregated	Aggregated	GAS	93274.26907	3447688	430889.5	0.1805627	0.017962	0	0.4068583	0.1631987	0.534949	0.3627797	0.459698	0.026195	0	0.445457	0.163199	0.534949	0.36278	0.459698	0.953064	0	3.0772	0.099048	0	0.364189	346.8632	0	75.00631	0.004341	0	0.084203	0.001482	0	0.00205	0.008	0.03675	0.001363	0	0.001885	0.002	0.01575	0.003432	0	0.000742	0.007781	0	0.037199
SAN JOAQUIN	2021	LDT2	Aggregated	Aggregated	DSL	436.8525286	19843.58	2148.405	0.0010392	0.0131	0	0	0	0	0	0	0.014913	0	0	0	0	0	0	0.103127	0	0	0.043992	0	0	280.0091	0	0	0.000608	0	0	0.005749	0	0	0.008	0.03675	0.005501	0	0	0.002	0.01575	0.002647	0	0	0.044014	0	0
SAN JOAQUIN	2021	MDV	Aggregated	Aggregated	GAS	91099.84328	2958779	411208.1	0.1549575	0.026199	0	0.5566639	0.1963976	0.5985694	0.4449654	0.532859	0.037339	0	0.609426	0.196398	0.598569	0.444965	0.532859	1.172616	0	3.839472	0.134148	0	0.476683	432.8402	0	94.33352	0.005886	0	0.10764	0.001489	0	0.002186	0.008	0.03675	0.00137	0	0.002012	0.002	0.01575	0.004283	0	0.000934	0.009952	0	0.04219
SAN JOAQUIN	2021	MDV	Aggregated	Aggregated	DSL	1618.986421	66498.03	7829.274	0.0034826	0.010714	0	0	0	0	0	0	0.012197	0	0	0	0	0	0	0.173466	0	0	0.060427	0	0	384.2818	0	0	0.000498	0	0	0.005569	0	0	0.008	0.03675	0.005328	0	0	0.002	0.01575	0.003633	0	0	0.060404	0	0
		Pickup Trucks & SUVs							1																																										
SAN JOAQUIN	2021	LDT2	Aggregated	Aggregated	GAS	93274.26907	3447688	430889.5	0.9942773	0.017962	0	0.4068583	0.1631987	0.534949	0.3627797	0.459698	0.026195	0	0.445457	0.163199	0.534949	0.36278	0.459698	0.953064	0	3.0772	0.099048	0	0.364189	346.8632	0	75.00631	0.004341	0	0.084203	0.001482	0	0.00205	0.008	0.03675	0.001363	0	0.001885	0.002	0.01575	0.003432	0	0.000742	0.007781	0	0.037199
SAN JOAQUIN	2021	LDT2	Aggregated	Aggregated	DSL	436.8525286	19843.58	2148.405	0.0057227	0.0131	0	0	0	0	0	0	0.014913	0	0	0	0	0	0	0.103127	0	0	0.043992	0	0	280.0091	0	0	0.000608	0	0	0.005749	0	0	0.008	0.03675	0.005501	0	0	0.002	0.01575	0.002647	0	0	0.044014	0	0
		Flatbed Trucks							1																																										
SAN JOAQUIN	2021	T7 Single (	Aggregated	Aggregated	DSL	498.9874784	35085.4	2255.903	1	0.426037	1.578025	0	0	0	0	0	0.48501	1.796461	0	0	0	0	0	1.137284	20.04249	0	6.503024	22.67283	3.516605	1859.783	3917.792	0	0.019788	0.073295	0	0.115259	0.032354	0	0.036	0.06174	0.110273	0.030955	0	0.009	0.02646	0.003633	0.01757	0.037013	0	0.615822	0
		Dump Truck							1																																										
SAN JOAQUIN	2021	T6 instate	Aggregated	Aggregated	DSL	1391.016683	164000.3	16052.14	1	0.221034	0.1018353	0	0	0	0	0	0.251631	0.115932	0	0	0	0	0	0.626915	1.956622	0	3.63873	6.400711	1.220403	1072.198	677.5531	0	0.010266	0.00473	0	0.093109	0.023887	0	0.012	0.13034	0.089081	0.022854	0	0.003	0.05586	0.01013	0.006401	0	0.168535	0.106502	0
		Haul Trucks																																																	
SAN JOAQUIN	2021	T7 Single	Aggregated	Aggregated	DSL	849.4934503	58857.51	9803.037	1	0.211773	2.1378325	0	0	0	0	0	0.241087	2.43376	0	0	0	0	0	0.714266	27.87722	0	4.555231	29.88259	2.89115	1595.501	5449.109	0	0.009836	0.099297	0	0.084852	0.031568	0	0.036	0.06174	0.081182	0.030203	0	0.009	0.02646	0.015074	0.05148	0	0.250791	0.856524	0

Vehicle Category	Emission Factors (g/mile)[3]																					
	ROG_ RUNEX	ROG_ STREX	CO_ RUNEX	CO_ STREX	NOX_ RUNEX	NOX_ STREX	SO2_ RUNEX	SO2_ STREX	PM10 Fugitive Dust [4]	PM10_ RUNEX	PM10_ STREX	PM10 Total	PM2.5 Fugitive Dust [4]	PM2.5_ RUNEX	PM2.5_ STREX	PM2.5 Total	CO2_ RUNEX	CO2_ STREX	CH4_ RUNEX	CH4_ STREX	N2O_ RUNEX	N2O_ STREX
Worker Vehicle	0.015307	0.353754	0.8232452	2.711478	0.0734216	0.28699	0.0030858	0.0006521	0.04475	0.001523	0.00208	0.048353	0.01775	0.001403	0.001913	0.021066	311.9473	65.89199	0.003672	0.073242	0.006841	0.031836
Pickup Truck	0.017938	0.404894	0.9486739	3.05959	0.0987531	0.3621052	0.003428	0.000738	0.04475	0.001508	0.002038	0.048296	0.01775	0.001388	0.001874	0.021012	346.4806	74.57707	0.00432	0.083721	0.007988	0.036986
SUV	0.017938	0.404894	0.9486739	3.05959	0.0987531	0.3621052	0.003428	0.000738	0.04475	0.001508	0.002038	0.048296	0.01775	0.001388	0.001874	0.021012	346.4806	74.57707	0.00432	0.083721	0.007988	0.036986
Flatbed Truck	0.426037	0	1.1372845	0	6.5030242	3.5166048	0.0036328	0.0370134	0.09774	0.115259	0	0.212999	0.03546	0.110273	0	0.145733	1859.783	0	0.019788	0	0.00000	0.00000
Dump Truck, Water Truck, Cement Truck	0.221034	0	0.6269153	0	3.63873	1.2204027	0.0101296	0	0.14234	0.093109	0	0.235449	0.05886	0.089081	0	0.147941	1072.198	0	0.010266	0	0.168535	0
Haul Truck	0.211773	0	0.7142658	0	4.5552313	2.8911502	0.0150735	0	0.09774	0.084852	0	0.182592	0.03546	0.081182	0	0.116642	1595.501	0	0.009836	0	0.250791	0

Green cells indicate calculations using EMFAC 2017 data.

Region	Calendar Y	Vehicle Ca	Model Year	Speed	Fuel	Population	VMT	Trips	% VMT (weight factor)	ROG_RUN	ROG_IDLEX	ROG_STRE	ROG_HOTS	ROG_RUNL	ROG_RESTI	ROG_DIU	TOG_RUN	TOG_IDLE	TOG_STR	TOG_HOT	TOG_RUN	TOG_RES	TOG_DIU	CO_RUNE	CO_IDLEX	CO_STRE	NOx_RUN	NOx_IDLE	NOx_STR	CO2_RUN	CO2_IDLE	CO2_STR	CH4_RUN	CH4_IDLE	CH4_STR	PM10_RU	PM10_IDI	PM10_STI	PM10_PM	PM10_PM	PM2_5_RI	PM2_5_ID	PM2_5_S	PM2_5_PI	PM2_5_PI	SOx_RUN	SOx_IDLE	SOx_STRE	N2O_RUN	N2O_IDLE	N2O_STREX
		Worker Vehicles																																																	
Sacramento (SV)	2021	LDA	Aggregated	Aggregated	GAS	576916.8631	20787700	2693629	0.5847869	0.012159	0	0.2904273	0.1299485	0.2629767	0.242705	0.35763	0.017737	0	0.317977	0.129949	0.262977	0.242705	0.35763	0.779755	0	2.446513	0.048316	0	0.220833	273.8216	0	57.73396	0.003047	0	0.061696	0.001544	0	0.002117	0.008	0.03675	0.00142	0	0.001947	0.002	0.01575	0.00271	0	0.000571	0.00514	0	0.028041
Sacramento (SV)	2021	LDA	Aggregated	Aggregated	DSL	5127.443098	187775.7	23866.73	0.0052824	0.017949	0	0	0	0	0	0	0.020434	0	0	0	0	0	0	0.244451	0	0	0.110268	0	0	205.6384	0	0	0.000834	0	0	0.009074	0	0	0.008	0.03675	0.008682	0	0	0.002	0.01575	0.001944	0	0	0.032323	0	0
Sacramento (SV)	2021	LDA	Aggregated	Aggregated	ELEC	8079.660016	321842.1	40368.83	0.0090539	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
Sacramento (SV)	2021	LDT1	Aggregated	Aggregated	GAS	63439.28027	2114018	287695.6	0.0594703	0.02836	0	0.459525	0.2522123	0.8703402	0.4759252	0.769637	0.041363	0	0.503119	0.252212	0.87034	0.475925	0.769637	1.357251	0	2.616616	0.111468	0	0.311807	318.7127	0	68.06871	0.006397	0	0.088178	0.002084	0	0.002806	0.008	0.03675	0.001916	0	0.00258	0.002	0.01575	0.003154	0	0.000674	0.008612	0	0.031907
Sacramento (SV)	2021	LDT1	Aggregated	Aggregated	DSL	209.6176798	3849.404	780.139	0.0001083	0.128142	0	0	0	0	0	0	0.145881	0	0	0	0	0	0	1.027164	0	0	1.216965	0	0	468.5736	0	0	0.005952	0	0	0.084085	0	0	0.008	0.03675	0.080448	0	0	0.002	0.01575	0.00443	0	0	0.073653	0	0
Sacramento (SV)	2021	LDT1	Aggregated	Aggregated	ELEC	295.4763678	11205.52	1446.841	0.0003152	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
Sacramento (SV)	2021	LDT2	Aggregated	Aggregated	GAS	203602.0528	7045516	940182.8	0.1982002	0.018177	0	0.3962692	0.1578115	0.5124988	0.3373072	0.455775	0.026515	0	0.433863	0.157811	0.512499	0.337307	0.455775	1.038514	0	3.086747	0.092806	0	0.358714	348.7579	0	75.263	0.004419	0	0.08204	0.001535	0	0.001973	0.008	0.03675	0.001411	0	0.001814	0.002	0.01575	0.003451	0	0.000745	0.007532	0	0.036765
Sacramento (SV)	2021	LDT2	Aggregated	Aggregated	DSL	998.7214779	41538.7	4905.297	0.0011685	0.01592	0	0	0	0	0	0	0.018123	0	0	0	0	0	0	0.134723	0	0	0.046021	0	0	279.9734	0	0	0.000739	0	0	0.005314	0	0	0.008	0.03675	0.005084	0	0	0.002	0.01575	0.002647	0	0	0.044008	0	0
Sacramento (SV)	2021	LDT2	Aggregated	Aggregated	ELEC	1133.378667	37589.13	5738.72	0.0010574	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
Sacramento (SV)	2021	MDV	Aggregated	Aggregated	GAS	150774.0204	4871688	684465.9	0.1370474	0.028096	0	0.5326644	0.1879381	0.581165	0.4174096	0.553206	0.039698	0	0.583127	0.187938	0.581165	0.41741	0.553206	1.282501	0	3.772704	0.127104	0	0.448516	426.786	0	93.18898	0.006168	0	0.10293	0.001616	0	0.002228	0.008	0.03675	0.001487	0	0.002051	0.002	0.01575	0.004223	0	0.000922	0.009514	0	0.040468
Sacramento (SV)	2021	MDV	Aggregated	Aggregated	DSL	2723.066508	108044.4	13192.59	0.0030394	0.013528	0	0	0	0	0	0	0.0154	0	0	0	0	0	0	0.222922	0	0	0.066146	0	0	372.4955	0	0	0.000628	0	0	0.005838	0	0	0.008	0.03675	0.005585	0	0	0.002	0.01575	0.003521	0	0	0.058551	0	0
Sacramento (SV)	2021	MDV	Aggregated	Aggregated	ELEC	494.1842773	16712.94	2514.484	0.0004702	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
		Pickup Trucks & SUVs							1																																										
Sacramento (SV)	2021	LDT2	Aggregated	Aggregated	GAS	203602.0528	7045516	940182.8	0.9888938	0.018177	0	0.3962692	0.1578115	0.5124988	0.3373072	0.455775	0.026515	0	0.433863	0.157811	0.512499	0.337307	0.455775	1.038514	0	3.086747	0.092806	0	0.358714	348.7579	0	75.263	0.004419	0	0.08204	0.001535	0	0.001973	0.008	0.03675	0.001411	0	0.001814	0.002	0.01575	0.003451	0	0.000745	0.007532	0	0.036765
Sacramento (SV)	2021	LDT2	Aggregated	Aggregated	DSL	998.7214779	41538.7	4905.297	0.0058303	0.01592	0	0	0	0	0	0	0.018123	0	0	0	0	0	0	0.134723	0	0	0.046021	0	0	279.9734	0	0	0.000739	0	0	0.005314	0	0	0.008	0.03675	0.005084	0	0	0.002	0.01575	0.002647	0	0	0.044008	0	0
Sacramento (SV)	2021	LDT2	Aggregated	Aggregated	ELEC	1133.378667	37589.13	5738.72	0.0052759	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
		Flatbed Trucks							1																																										
Sacramento (SV)	2021	T7 single (	Aggregated	Aggregated	DSL	309.8995926	21790.03	1401.044	1	0.426037	1.578025	0	0	0	0	0	0.48501	1.796461	0	0	0	0	0	1.137284	20.04249	0	6.492248	22.67283	3.516605	1859.783	3917.792	0	0.019788	0.073295	0	0.115259	0.032354	0	0.036	0.06174	0.110273	0.030955	0	0.009	0.02646	0.01757	0.037013	0	0.292332	0.615822	0
		Dump Truck							1																																										
Sacramento (SV)	2021	T6 instate	Aggregated	Aggregated	DSL	1369.930654	181458.7	15808.81	1.1064535	0.158921	0.0888674	0	0	0	0	0	0.180919	0.101169	0	0	0	0	0	0.468843	1.969413	0	2.915255	5.529468	1.417976	1032.78	659.6794	0	0.007381	0.004128	0	0.066679	0.018063	0	0.012	0.13034	0.063795	0.017282	0	0.003	0.05586	0.009757	0.006232	0	0.162339	0.103692	0
		Haul Trucks																																																	
Sacramento (SV)	2021	T7 Single	Aggregated	Aggregated	DSL	1308.104506	97550.47	15095.34	1.6574006	0.205588	2.1263261	0	0	0	0	0	0.234047	2.42066	0	0	0	0	0	0.704095	28.05369	0	4.220222	28.89895	2.935797	1533.394	5224.232	0	0.009549	0.098762	0	0.087875	0.034121	0	0.036	0.06174	0.084074	0.032645	0	0.009	0.02646	0.014487	0.049356	0	0.241028	0.821177	0

Vehicle Category	Emission Factors (g/mile)[3]																					
	ROG_ RUNEX	ROG_ STREX	CO_ RUNEX	CO_ STREX	NOX_ RUNEX	NOX_ STREX	SO2_ RUNEX	SO2_ STREX	PM10 Fugitive Dust [4]	PM10_ RUNEX	PM10_ STREX	PM10 Total	PM2.5 Fugitive Dust [4]	PM2.5_ RUNEX	PM2.5_ STREX	PM2.5 Total	CO2_ RUNEX	CO2_ STREX	CH4_ RUNEX	CH4_ STREX	N2O_ RUNEX	N2O_ STREX
Worker Vehicle	0.016422	0.348707	0.9210016	2.7151	0.0716806	0.2802486	0.0030595	0.0006482	0.04475	0.001635	0.002101	0.048486	0.01775	0.001506	0.001932	0.021189	309.2913	65.49857	0.003891	0.07169	0.006723	0.031128
Pickup Truck	0.018072	0.391868	1.0282799	3.0525	0.0920621	0.35473	0.0034283	0.0007365	0.04475	0.00155	0.001951	0.048252	0.01775	0.001427	0.001794	0.020971	346.5169	74.42712	0.004374	0.081128	0.007705	0.036357
SUV	0.018072	0.391868	1.0282799	3.0525	0.0920621	0.35473	0.0034283	0.0007365	0.04475	0.00155	0.001951	0.048252	0.01775	0.001427	0.001794	0.020971	346.5169	74.42712	0.004374	0.081128	0.007705	0.036357
Flatbed Truck	0.426037	0	1.1372845	0.0000	6.4922476	3.5166048	0.0175703	0	0.09774	0.115259	0	0.212999	0.03546	0.110273	0	0.145733	1859.783	0	0.019788	0	0.292332	0
Dump Truck, Water Truck, Cement Truck	0.158921	0	0.468843	0.0000	2.9152549	1.4179758	0.0097572	0	0.14234	0.066679	0	0.209019	0.05886	0.063795	0	0.122655	1032.78	0	0.007381	0	0.162339	0
Haul Truck	0.205588	0	0.7040945	0.0000	4.2202224	2.9357971	0.0144867	0	0.09774	0.087875	0	0.185615	0.03546	0.084074	0	0.119534	1533.394	0	0.009549	0	0.241028	0

Green cells indicate calculations using EMFAC 2017 data.

CARB Off-Model Adjustment Factors for Gasoline Light Duty Vehicle Emissions in EMFAC2017.

Year	Nox Exhau	TOG Evapo	TOG Exhaus	PM Exhau	CO Exhaust
2021	1.0002	1.0001	1.0002	1.0009	1.0005

*Use of adjustment factors accounts for implmentation of the SAFE Vehicle Rule Part One
Source: https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf

Offsite EMFAC On-Road Emission Factors

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: SAN JOAQUIN
Calendar Year: 2021
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, g/mile for RUNEX, PMBW and PMTW

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	VMT	% VMT (Weight Factor)	ROG_RUN	TOG_RUN	CO_RUNE	NOx_RUN	SOx_RUNI	CO2_RUN	CH4_RUN	PM10_RU	PM2_5_RU	N2O_RUNEX
		Pickup Trucks & SUVs															
SAN JOAQUIN	2021	LDT2	Aggregated	5	GAS	126.4129292	0.994277319	0.1243005	0.1813156	2.0069118	0.1860717	0.0082422	832.89565	0.0303866	0.0107255	0.0098619	0.0145421
SAN JOAQUIN	2021	LDT2	Aggregated	5	DSL	0.727584641	0.005722681	0.2605718	0.2966436	2.1832402	0.1579255	0.0066052	698.69671	0.0121031	0.018326	0.0175333	0.1098254
		Flatbed Trucks					1										
SAN JOAQUIN	2021	T7 Single Unit Cons	Aggregated	5	DSL	35085.4027	1	1.696794	1.93167	3.719777	15.64866	0.01757	3631.987	0.078812	0.211127	0.201994	0.570898
		Dump, Water, Cement Truck					1										
SAN JOAQUIN	2021	T6 instate heavy	Aggregated	5	DSL	2522.346665	1	1.5700147	1.7873422	2.7000179	10.394601	0.0228337	2416.9054	0.0729231	0.2390995	0.2287562	0.3799039
		Haul Truck															
SAN JOAQUIN	2021	T7 Single	Aggregated	5	DSL	794.1150023	1	1.5757755	1.7939005	3.6353612	14.150194	0.0345829	3660.5312	0.0731907	0.1914129	0.1831324	0.5753845

Vehicle Category	Emission Factors (g/mile)								
	ROG	CO	NOX	SO2	PM10 Exhaust	PM2.5 Exhaust	CO2	CH4	N2O
Pickup Truck	0.125105344	2.008924795	0.18594784	0.00823281	0.010778712	0.009914754	832.1276694	0.0302819	0.0150874
SUV	0.125105344	2.008924795	0.18594784	0.00823281	0.010778712	0.009914754	832.1276694	0.0302819	0.0150874
Flatbed Truck	1.696793683	3.719776898	15.648661	0.017570304	0.21112743	0.20199415	3631.98701	0.0788117	0.5708978
Dump, Water, Cement Truck	1.570014675	2.70001787	10.3946006	0.022833724	0.239099527	0.228756187	2416.905398	0.0729231	0.3799039
Haul Truck	1.575775535	3.635361192	14.1501937	0.034582884	0.191412851	0.183132415	3660.531237	0.0731907	0.5753845

Green cells indicate calculations using EMFAC 2017 data.

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	VMT	% VMT (Weight Factor)	ROG_RUN	TOG_RUN	CO_RUNE	NOx_RUN	SOx_RUNI	CO2_RUN	CH4_RUN	PM10_RU	PM2_5_RU	N2O_RUNEX
		Pickup Trucks & SUVs															
SACRAMENTO (SV)	2021	LDT2	Aggregated	5	GAS	296.45416	0.994138792	0.116326	0.169703	1.926574	0.175844	0.008316	840.3959	0.028605	0.010313	0.009482	0.014098
SACRAMENTO (SV)	2021	LDT2	Aggregated	5	DSL	1.74782383	0.005861208	0.258797	0.294623	2.271538	0.158383	0.006733	712.2217	0.012021	0.014773	0.014134	0.111951
		Flatbed Trucks					1										
SACRAMENTO (SV)	2021	T7 Single Unit Cons	Aggregated	5	DSL	2645.28861	1	1.696794	1.93167	3.719777	15.61872	0.034313	3631.987	0.078812	0.211127	0.201994	0.570898
		Dump, Water, Cement Truck					1										
SACRAMENTO (SV)	2021	T6 instate heavy	Aggregated	5	DSL	2790.8593	1	1.123056	1.278514	2.116495	8.934198	0.022284	2358.675	0.052163	0.16914	0.161823	0.370751
		Haul Truck															
SACRAMENTO (SV)	2021	T7 Single	Aggregated	5	DSL	1316.16672	1	1.536111	1.748746	3.510968	13.72855	0.033405	3535.901	0.071348	0.179354	0.171595	0.555794

Vehicle Category	Emission Factors (g/mile)								
	ROG	CO	NOX	SO2	PM10 Exhaust	PM2.5 Exhaust	CO2	CH4	N2O
Pickup Truck	0.117184448	1.929559993	0.17577642	0.008307118	0.010348031	0.009517997	839.6446386	0.0285081	0.0146717
SUV	0.117184448	1.929559993	0.17577642	0.008307118	0.010348031	0.009517997	839.6446386	0.0285081	0.0146717
Flatbed Truck	1.696793683	3.719776898	15.618722	0.034313212	0.21112743	0.20199415	3631.98701	0.0788117	0.5708978
Dump, Water, Cement Truck	1.123055962	2.116495189	8.93419815	0.022283592	0.169139663	0.161822756	2358.674979	0.052163	0.3707509
Haul Truck	1.536111408	3.510967695	13.7285549	0.03340544	0.179354103	0.171595324	3535.901112	0.0713484	0.5557944

Green cells indicate calculations using EMFAC 2017 data.

CARB Off-Model Adjustment Factors for Gasoline Light Duty Vehicle Emissions in EMFAC2017.

Year	Nox Exhaust	TOG Evaporative	TOG Exhau	PM Exhaust	CO Exhaust
2021	1.0002	1.0001	1.0002	1.0009	1.0005

*Use of adjustment factors accounts for implmentation of the SAFE Vehicle Rule Part One
Source: https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf

Fugitive Dust Emission Factors

Truck Loading Fugitive Dust Emission Factors
$EF_E = k \times (0.0032) \times ((U/5)^{1.3})/((M/2)^{1.4})$

Variable	Amount	Units	
EF (PM_{10})	0.0001	lb/ton	
EF ($PM_{2.5}$)	0.00001	lb/ton	
k (PM_{10})	0.35	factor	
k ($PM_{2.5}$)	0.053	factor	
U (mean wind speed)	3.5	miles/hr	CalEEMod default value for Sacramento County (is greater than San Jaquin County of 2.7 mph)
M (moisture content)	12	percent	USEPA, AP-42, July 1998, Table 11.9-3 Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations
Soil density	1.26	tons/cy	CalEEMod default
Rip rap density	0.05	tons/sf	

E (lbs) = EF (lb/ton) x TP (tons)

Cut/Fill Truck Loading Emissions:	**7.22444E-05**	**EF (PM10) as lb/cy**
	1.09399E-05	**EF (PM2.5) as lb/cy**
Demolition Truck Loading Emission:	**2.63749E-06**	**EF (PM10) as lb/sf**
	3.99392E-07	**EF (PM2.5) as lb/sf**

Bulldozing, Scraping

PM10 Emission Factor [lb/hr] = 0.75 x (silt content (%))$^{1.5}$ / (moisture)$^{1.4}$
PM2.5 Emission Factor [lb/hr] = 0.60 x (silt content (%))$^{1.2}$ / (moisture)$^{1.3}$
Reference: AP-42, Table 11.9-1, July 1998

Parameter	Value	Basis
Silt Content	6.9	USEPA, AP-42, July 1998, Table 11.9-3 Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations
Moisture	7.9	USEPA, AP-42, July 1998, Table 11.9-3 Typical Values for Correction Factors Applicable to the Predictive Emission Factor Equations

PM10 Emission Factor	0.75	lb/hr
PM2.5 Emission Factor	0.41	lb/hr

Emissions (pounds per day) = Controlled emission factor (pounds per hour) x Bulldozing, scraping or grading time (hours/day)

Grading
AP-42, Section 11.9
$EF_{PM10} = 0.051 * (S)^2$
$EF_{TSP} = 0.04 * (S)^2.5)$
$EF_{PM10} = EF_{PM25} * F_{PM10}$
$EF_{PM25} = EF_{TSP} * F_{PM2.5}$

	5	S: mean vehicle speed (mph)	Per Data Sheet
	1.275	EF_{PM25}	
VMT = (Site Acres/12 ft) * (43,560 sq.ft./acre) / (5280 ft / mile)	2.236067977	EF_{TSP}	
	0.6	F_{PM10}	default AP-42 value
	0.031	$F_{PM2.5}$	default AP-42 value
	0.765	**EF_{PM10} (lb/VMT)**	
	0.069318107	**$EF_{PM2.5}$ (lb/VMT)**	
	0.08	VMT Calculation Factor (site acres / 12 ft)	
	43560	sq. ft. per acre	
	5280	ft. parr mile	
	0.5259375	**EF_{PM10} (lb/acre)**	calculated
	0.047656199	**$EF_{PM2.5}$ (lb/acre)**	calculated

Demolition Fugitive Dust
$EF_E = k \times (0.0032) \times ((U/5)^{1.3})/((M/2)^{1.4})$

Variable	Amount	Units	
EF (PM_{10})	0.0007	lb/ton of debris	
EF ($PM_{2.5}$)	0.00011	lb/ton of debris	
k (PM_{10})	0.35	factor	
k ($PM_{2.5}$)	0.053	factor	
U (mean wind speed)	3.5	miles/hr	CalEEMod default value for Sacramento County (is greater than San Jaquin County of 2.7 mph)
M (moisture content)	2	percent	CalEEMod default
Building weight	0.046	tons/sq.ft.	CalEEMod default

E (lbs) = EF (lb/ton) x TP (tons)

	3.24043E-05	**EF (PM10) as lb/sq.ft.**
	4.90694E-06	**EF (PM2.5) as lb/sq.ft.**

Paved Road Dust $EF_{Dust} = [(k(sL)^{0.91} \times (W)^{1.02})(1 - P/4N))$
Source: AP-42 Section 13.2.1 (Paved Roads) - http://www.epa.gov/ttnchie1/ap42/ch13/final/c13s0201.pdf

Variable	Value	Description	
k (PM10)	0.0022	particle size multiplier for particle size rangeand units of interest (lb/VMT)	
k (PM2.5)	0.00054	particle size multiplier for particle size rangeand units of interest (lb/VMT)	
sL	0.1	road surface silt loading (g/m^2)	
W	2.4	average weight (tons) of vehicles (2.4 tons)	
W	12	haul truck tons	
P	51	number of "wet" days with at least 0.254 mm (0.1 inches) of precipitation during the averaging period	CalEEMod data for San Joaquin County (less than that for Sacramento County (58days), which leads to higher EF (more conservative))
N	365	number of days in averaging period	

Pickup and Worker		
EF (PM10)	0.000637964	lb/VMT
EF (PM2.5)	0.000156591	lb/VMT
Haul Truck		
EF (PM10)	0.003294168	lb/VMT
EF (PM2.5)	0.000808568	lb/VMT

Unpaved Road Dust

Equations: EF (unpaved) = (k * (s/12)a * (S/30)d)/(M/0.5)c) - C			
Ref: AP-42, Section 13.2.2, "Unpaved Roads," November 2006			
Constants:			
k_{PM} =	1.8	(Particle size multiplier for PM10)	
	0.18	(Particle size multiplier for PM2.5)	
s	2.9	Unpaved surface material silt content (%)	Source: spreadsheet link: at 4th bullet: https://www3.epa.gov/ttnchie1/ap42/ch13/related/c13s02-2.html; used by EPA for National Emissions Inventory.
S	5	mean vehicle speed	
a =	1	for PM10 and PM2.5	
c =	0.2	for PM10 and PM2.5	
d =	0.5	for PM10 and PM2.5	
C	0.00047	for PM10	
C	0.00035	for PM2.5	
M	12	Moisture Content	

EF (PM10)	0.126014699	lb/VMT
EF (PM2.5)	0.01228847	lb/VMT

[a] Uncontrolled emissions [lb/day] = Emission factor [lb/mi] x Number x Daily miles traveled [mi/vehicle-day]

[b] Control efficiency from watering unpaved road twice a day (55%) and limiting maximum speed to 15 mph (57%), from Table XI-A, Mitigation Measure Examples, Fugitive Dust from Construction & Demolition, http://www.aqmd.gov/ceqa/handbook/mitigation/fugitive/MM_fugitive.html

[c] Controlled emissions [lb/day] = Uncontrolled emissions [lb/day] x (1 - Control efficiency [%])

	Low HP	High HP	ROG (g/bhp-hr)	NOX (g/bhp-hr)	CO (g/bhp-hr)	PM10 (g/bhp-hr)	PM2.5 (g/bhp-hr)
Tier 4	25	49	0.12	2.75	4.1	0.008	0.008
Tier 4	50	74	0.12	2.74	3.7	0.008	0.008
Tier 4	75	119	0.06	0.26	3.7	0.008	0.008
Tier 4	120	174	0.06	0.26	3.7	0.008	0.008
Tier 4	175	299	0.06	0.26	2.2	0.008	0.008
Tier 4	300	599	0.06	0.26	2.2	0.008	0.008
Tier 4	600	750	0.06	0.26	2.2	0.008	0.008
Tier 4 (except generator sets for NOx)	751	2000	0.06	2.24	2.6	0.016	0.016
Tier 4 (generator sets for NOx)	751	1200	0.06	0.5	2.6	0.016	0.016

Source: Tier 4 emissions factors from CalEEMod User Guide Table D 3.5, which provides tiered engine emission factors based on Carl Moyer Standards.
http://www.aqmd.gov/caleemod/user's-guide/users-tips

Operational Emissions Summary

Project Operational Emissions:

		Daily Emissions (lb/day)						Max Annual Emissions (tons/year)									Total Emissions (metric tons)
Air District	Operational Activity	ROG	CO	NOX	SO2	PM10	PM2.5	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	CO2e
SJVAPCD																	
	Locomotive Operations	1.40	42.60	33.28	0.15	0.50	0.48	0.25	7.67	5.99	0.03	0.09	0.09	2939.52	0.23	0.07	2692.16
	Station Electricity Emissions	-	-	-	-	-	-	-	-	-	-	-	-	9.16	0.00	0.00	9.22
	Station Waste Emissions	-	-	-	-	-	-	-	-	-	-	-	-	1.74	0.09	0.00	3.90
	Sub-total	*1.40*	*42.60*	*33.28*	*0.15*	*0.50*	*0.48*	*0.25*	*7.67*	*5.99*	*0.03*	*0.09*	*0.09*	*2950.42*	*0.32*	*0.08*	*2705.28*
	Air District Threshold	100.00	100.00	100.00	100.00	100.00	100.00	10.00	100.00	10.00	27.00	15.00	15.00	-	-	-	
	Exceed Threshold?	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**				
SMAQMD																	
	Locomotive Operations	1.84	55.95	43.71	0.20	0.66	0.64	0.33	10.07	7.87	0.04	0.12	0.11	3860.56	0.30	0.10	3535.69
	Station Electricity Emissions	-	-	-	-	-	-	-	-	-	-	-	-	27.35	0.00	0.00	27.44
	Station Waste Emissions	-	-	-	-	-	-	-	-	-	-	-	-	3.83	0.19	0.00	8.57
	Airport Shuttle Service	0.00	0.01	0.12	0.00	0.11	0.03	0.00	0.00	0.02	0.00	0.02	0.01	51.78	0.00	0.01	49.21
	Sub-total	*1.84*	*55.96*	*43.83*	*0.20*	*0.76*	*0.67*	*0.33*	*10.07*	*7.89*	*0.04*	*0.14*	*0.12*	*3943.52*	*0.50*	*0.11*	*3620.92*
	Air District Threshold	65.00	-	65.00	-	80.00	82.00	-	-	-	-	14.60	15.00	-	-	-	1100.00
	Exceed Threshold?	**No**		**No**		**No**	**No**					**No**	**No**				**Yes**

Net Operational Emissions Accounting for Displaced VMT

		Daily Emissions (lb/day)						Max Annual Emissions (tons/year)									Total Emissions (metric tons)
On-Road Emissions Avoided Due to VMT Displaced by Rail Ridership Increase		ROG	CO	NOX	SO2	PM10	PM2.5	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N20	CO2e
	SJVAPCD	(1.50)	(111.01)	(6.97)	(0.45)	(57.12)	(15.33)	(0.27)	(19.98)	(1.25)	(0.08)	(10.28)	(2.76)	(8,257.83)	(0.07)	(0.15)	(7,532.40)
	SMAQMD	(1.97)	(145.79)	(9.15)	(0.60)	(75.01)	(20.13)	(0.36)	(26.24)	(1.65)	(0.11)	(13.50)	(3.62)	(10,845.27)	(0.09)	(0.19)	(9,892.53)
Net Regional Emissions (Project Direct Emissions - VMT Displaced Emissions Reductions)																	
	SJVAPCD	(0.10)	(68.41)	26.31	(0.30)	(56.62)	(14.84)	(0.02)	(12.31)	4.74	(0.05)	(10.19)	(2.67)	(5,307.41)	0.25	(0.07)	(4,827.12)
	SMAQMD	(0.13)	(89.83)	34.68	(0.39)	(74.25)	(19.46)	(0.02)	(16.17)	6.24	(0.07)	(13.36)	(3.50)	(6,901.75)	0.40	(0.08)	(6,271.61)

Conversion Factors	
pounds per ton	2000
pounds per metric ton	2204.62262

Project GHG Emission Summary:

Operational Activity	**Maximum Annual Emissions (tons per year)**			**Total Annual GHG Emissions (metric tons per year)**
	CO2	CH4	N20	CO2e
Locomotive Operations	6,800	0.53	0.17	6,228
Station Electricity Emissions	37	0.00	0.00	37
Station Waste Emissions	6	0.28	-	12
Shuttle	52	0.00	0.01	49
Sub-total	6,894	0.81	0.18	6,326
On-road Mobile Emission Reductions	(19,103)	(0.16)	(0.34)	(17,425)
Net Project Regional Emissions	**(12,209)**	**0.65**	**(0.16)**	**(11,099)**

Locomotive Operational Emissions

Daily Locomotive Operational Emissions by Air District

Air District	Daily In-Transit Emissions (lbs/day)									
	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O	CO2e
SJVAPCD	1.401844084	42.60114974	33.28214824	0.153609915	0.499232224	0.484255257	16330.65408	1.280082625	0.416026853	16486.63215
SMAQMD	1.841086004	55.94943222	43.71049393	0.201740741	0.655657409	0.635987687	21447.56255	1.681172843	0.546381174	21652.41346

In-Transit Train Operations Emissions				Daily In-Transit Emissions (lbs/day)										
	Daily Operational Hours	*HP*	*Load Factor*	ROG	CO	NOX	SO2	PM10	PM2.5	CO2	CH4	N2O	CO2e
Total Daily Operations*	19	4000	0.47	3.2429	98.5506	76.9926	0.3554	1.1549	1.1202	37778.2166	2.9613	0.9624	38139

**Calculations account for average idling time and time in each notch power level.*

Emission Factors

Locomotive Application	Emission Factors (g/bhp-hr)*				Emission Factors (g/bhp-hr)									
	PM10	HC	Nox	CO	HC	ROG	CO	NO_x	SO2	PM10	PM2.5	CO2	CH4	N2O
Line Haul (Tier 4)	0.015	0.04	1	1.28	0.04	0.04212	1.28	1	0.004615385	0.015	0.01455	490.673077	0.038461538	0.0125

*Source: EPA Emission Factors for Locomotives - Technical Highlights (EPA-420-F-09-025)

Notes:

Assumes Line-Haul Locomotives with Tier 4 Engines

Emission Factors Calculations:	Conversion Factor
ROG is estimated as 1.053 times the EF for HC	1.053
PM10 = PM	
PM2.5 as a 97% of PM10	97%
SO2 Emission Factor (g/gal) = (fuel density) * (64 g SO2 / 32 g S) * (S content of fuel)	
Fuel density	3200
Sulfur Content of Fuel (15 ppm) (per CARB regulations, CCR Title 13, Div 3, Chapter 5, Article 2, Section 2281)	15
SO2 EF (g/gal)	0.096
CO2 is defined by U.S. EPA as 10,206 g CO2/gal fuel	10206
CH4 and N2O Emission Factors per EPA: Table 5 in https://www.epa.gov/sites/production/files/2018-03/documents/emission-factors_mar_2018_0.pdf	
CH4 g/gal	0.8
N2O g/gal	0.26

CO2 (g/gal) = (fuel density) * (44 g CO2/12 g C) * (C content of fuel)

Carbon content of renewable diesel =
density of fuel 3200 g/gal
39.33 gCO2e/MJ

Conversion for g/gal to g/hp-hr (divide by) per EPA 2009 Technical Highlights

Line Haul and Passenger	20.8
Switch	15.2

Operational Variables	
Total New Locomotive Daily Operating Hours	18.67
Engine Tier	4
Engine HP	4000
% Travel Distance per Air District	
SJVAPCD	43%
SMAQMD	57%

**One leg of train route is approximately 1 hour and15 to 20 minutes . Total of 14 one-way trips per day = 18 2/3 operating hours. Inclusive of idling time at stations.*

Horsepower and Load Factor Calculations

Notch	*Percent Operating Time at Each Notch Power Level*[1]	Reweighted time (split idle and moving time)	Notch Power Level as a Percent of Rated Power[2]
Normal Idle	*47.40%*	100.00%	0.40%
Dynamic Break	*6.20%*	11.79%	2.10%
Notch 1	*7.00%*	13.31%	4.50%
Notch 2	*5.10%*	9.70%	11.50%
Notch 3	*5.70%*	10.84%	23.50%
Notch 4	*4.70%*	8.94%	35.00%
Notch 5	*4.00%*	7.60%	48.50%
Notch 6	*2.90%*	5.51%	64.00%
Notch 7	*1.40%*	2.66%	85.00%
Notch 8	*15.60%*	29.66%	100.00%

1. Per EPA 1998 Locomotive Emission Standards Regulatory Support Document , Table 4-5 https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F9QT.PDF?Dockey=P100F9QT.PDF
2. Per EPA 1998 Locomotive Emission Standards Regulatory Support Document , Table 5-2 https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F9QT.PDF?Dockey=P100F9QT.PDF

Time-weighted engine Load Factor

Idle	0.40%
In-transit	46.8%
Idling and In-Transit	24.8%

Conversion Factors (per EPA 2009 Emission Factors for Locomotives Technical Highlights - Table 3)

Locomotive Application	Conversion Factor (bhp-hr/gal)
Large Line-Haul and Passenger	20.8
Small Line-Haul	18.2
Switching	15.2

Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

On-Road Emissions Avoided

		Emissions (lb/day)													Emissions (tons/year) (CO2e measured in MT/year)												
Air District	**Displaced Daily VMT**	**ROG**	**CO**	**NOX**	**SO2**	**PM10 Fugitive Dust**	**PM10 Exhaust**	**PM10 Total**	**PM2.5 Fugitive Dust**	**PM2.5 Exhaust**	**PM2.5 Total**	**CO2**	**CH4**	**N2O**	**CO2e**	**ROG**	**CO**	**NOX**	**SO2**	**PM10 Fugitive Dust**	**PM10 Exhaust**	**PM10 Total**	**PM2.5 Fugitive Dust**	**PM2.5 Exhaust**	**PM2.5 Total**	**CO2**	**CH4**	**N2O**	**CO2e**
SJVAPCD	77,222.44	1.50	111.01	6.97	0.45	56.88	0.23	57.12	15.11	0.21	15.33	45,876.83	0.38	0.81	46,128	0.2743718	20.259157	1.2721632	0.0828145	10.38127029	0.042502533	10.42377282	2.758346534	0.039141876	2.7974884	8372.5207	0.0701381	0.1479588	7,637
SMAQMD	101,418.66	1.97	145.79	9.15	0.60	74.71	0.31	75.01	19.85	0.28	20.13	60,251.48	0.50	1.06	60,581	0.3603412	26.60699	1.670772	0.1087629	13.63404936	0.055819916	13.68986928	3.622623413	0.051406626	3.6740297	10995.895	0.0921146	0.194319	10,030
Total	178,641.10	3.48	256.80	16.13	1.05	131.59	0.54	132.13	34.96	0.50	35.46	106,128.31	0.89	1.88	106,709	0.634713	46.866147	2.9429353	0.1915774	24.01531965	0.098322449	24.1136421	6.380969947	0.090548136	6.4715181	19368.416	0.1622526	0.3422778	17,667

Percent Rail Operations Per Air District	
Air District	**%**
SJVAPCD	43%
SMAQMD	57%

**Percent based upon relative percent of proposed rail operational distance within each air district.*

Displaced VMT:	**Annual**	**Daily**
Due to ACE Ridership	35,804,100	98,093
Due to San Joaquins Ridership	29,399,900	80,548
Total	65,204,000	178,641

*Calculations based upon TRCIP Application and traffic analysis.

TIRCP Application Ridership Data

See Appendix A of the TIRCP Application.

San Joaquins ridership and related VMT reduction:

VMT reduction due to increased San Joaquins operations under the proposed project are presented in Table 10 of the TIRCP Application Appendix A.5. The estimated VMT reduction is representative of the delta in total VMT without the project versus total VMT with the project.

ACE ridership and related VMT reduction:

VMT reduction due to increased ACE operations under the proposed project is a sub-set of the total reported in Table 13 of the TIRCP Application Appendix A.4. The estimated VMT reduction is representative of the delta in VMT reduction for the total build system without the Sacramento extension versus with, and is comprised of the VMT associated with any trip having at least one end at one of the stations included in the proposed project (which assumes they would be auto trips otherwise without the extension).

Operational days per year: 365

Vehicle Category	**Emission Factors (g/mile)** [3]											
	ROG	**CO**	**NOX**	**SO2**	**PM10 Fugitive Dust**	**PM10 Exhaust**	**PM10 Total**	**PM2.5 Fugitive Dust**	**PM2.5 Exhaust**	**PM2.5 Total**	**CO2**	**CH4**	**N2O**
LDA, LDT1, LDT2, MDV Fleet Average	0.008830777	0.652049769	0.040945125	0.0026654	0.3341257	0.00136796	0.335493653	0.0887786	0.0012598	0.09003838	269.47321	0.002257425	0.0047621

*EMFAC 2017. CARB off-model adjustment factors applied to gasoline powered vehicles.

Because activity would be reduced throughout the alignment region, used the maximum potential emissions factor for each pollutant reported by EMFAC for San Joaquin and Sacramento Counties.

Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

Station Electricity Emissions (Indirect)

			Emissions (lb/day)				Emissions (metric tons per year)			
Station	**kWh/month**	**Electricity Provider**	**CO2**	**CH4**	**N2O**	**CO2e**	**CO2**	**CH4**	**N2O**	**CO2e**
Lodi	4,019	PG&E	38.74	0.00	0.00	39.01	6.41	0.00	0.00	6.46
Lodi Variant	5,741	PG&E	55.34	0.01	0.00	55.72	9.16	0.00	0.00	9.22
Elk Grove	-	SMUD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Elk Grove Variant	-	SMUD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
City College	287	SMUD	5.55	0.00	0.00	5.57	0.92	0.00	0.00	0.92
Midtown	718	SMUD	13.89	0.00	0.00	13.94	2.30	0.00	0.00	2.31
Old North Sacramento	3,229	SMUD	62.46	0.00	0.00	62.68	10.34	0.00	0.00	10.38
Natomas	4,306	SMUD	83.30	0.00	0.00	83.58	13.79	0.00	0.00	13.84

*Anticipated station electricity use provided by project engineering team.

Station Electricity Emissions by Air District

	Emissions (pounds per day)				Emissions (metric tons per year)			
	CO2	**CH4**	**N2O**	**CO2e**	**CO2**	**CH4**	**N2O**	**CO2e**
SJVAPCD	55.34	0.01	0.00	55.72	9.16	0.00	0.00	9.22
SMAQMD	165.20	0.01	0.00	165.76	27.35	0.00	0.00	27.44

Emission Factors

	CO2 (lb/MWh)	CH4 (lb/MWh)	N2O (lb/MWh)
PG&E[1]	294.00	0.033	0.004
SMUD[2]	590	0.033	0.004

Notes:
1. PG&E CO2 emission factor based upon PG&E 2018 Corporate Responsibility and Sustainability Report (http://www.pgecorp.com/corp_responsibility/reports/2018/assets/PGE_CRSR_2018.pdf). Emission factors for CH4 and N2O based upon U.S. EPA eGrid (https://www.epa.gov/sites/production/files/2018-02/documents/egrid2016_summarytables.pdf)
2. SMUD emission factors based upon U.S. EPA eGrid 2016

Conversion Factors	
kWh to MWh	0.001
pounds per ton	2000
pounds per metric ton	2204.62262
average days per month	30.5
days per year	365
Global Warming Potential	
CO2	1
Ch4	25
N20	298
Note: GWP are the 100-year GWPs from the IPCC fourth	

Station Waste Emissions (Indirect)

		Emissions (lb/day)				Emissions (metric tons per year)			
Station	**Average Monthly Tonnage**	**CO2**	**CH4**	**N2O**	**CO2e**	**CO2**	**CH4**	**N2O**	**CO2e**
Lodi	0.58	8.7061	0.4317	0.0000	19.4987	1.44	0.07	0.00	3.23
Lodi Variant	0.70	10.5073	0.5210	0.0000	23.5329	1.74	0.09	0.00	3.90
City College	0.05	0.7505	0.0372	0.0000	1.6809	0.12	0.01	0.00	0.28
Midtown	0.14	2.1015	0.1042	0.0000	4.7066	0.35	0.02	0.00	0.78
Old North Sacramento	0.54	8.1057	0.4019	0.0000	18.1540	1.34	0.07	0.00	3.01
Natomas	0.81	12.1585	0.6029	0.0000	27.2310	2.01	0.10	0.00	4.51

*Anticipated station electricity use provided by project engineering team.

Station Waste Emissions by Air District

	Emissions (pounds per day)				Emissions (metric tons per year)			
	CO2	**CH4**	**N2O**	**CO2e**	**CO2**	**CH4**	**N2O**	**CO2e**
SJVAPCD	10.51	0.52	0.00	23.53	1.74	0.09	0.00	3.90
SMAQMD	23.12	1.15	0.00	51.77	3.83	0.19	0.00	8.57

Emission Factors

CO2 (tons/ton waste)	CH4 (tons/ton waste)	N2O (tons/ton waste)
0.23	0.011350894	0

Source: CalEEMod

Conversion Factors	
pounds per ton	2000
pounds per metric ton	2204.62262
average days per month	30.5
days per year	365
Global Warming Potential	
CO2	1
Ch4	25
N20	298

Note: GWP are the 100-year GWPs from the IPCC fourth assessment report (AR4), consistent with the California Air Resources Board 2019 GHG emissions inventory.

Shuttle Bus Emissions

					Emissions (lb/day)													Emissions (tons/year) (CO2e measured in MT/year)												
Air District	Number of Busses per Trip	One-Way Trips per Day	Distance per Trip (miles)	Vehicle Category	ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O	CO2e	ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O	CO2e
SJVAPCD	0	0	0	Urban Bus (Diesel)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
SMAQMD	1	14	8	Urban Bus (Diesel)	0.00013	0.01449	0.12106	0.00272	0.1066	0.00098	0.10758	0.03207	0.00094	0.03301	287.658	0.00945	0.04522	301.3681225	2.46355E-05	0.00265	0.02209	0.0005	0.01945	0.00018	0.01963	0.00585	0.00017	0.00602	52.4975	0.00172	0.00825	49.8949

Operational days per year: 365

Vehicle Category	Emission Factors (g/mile) [3]												
	ROG	CO	NOX	SO2	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM2.5 Fugitive Dust	PM2.5 Exhaust	PM2.5 Total	CO2	CH4	N2O
UBUS (Diesel)	0.000546697	0.058703	0.490305	0.011013381	0.431716	0.003964	0.43568	0.129889	0.003793	0.133682	1164.994	0.038263	0.183121

*Source: EMFAC 2017 v1.0.2 Emission Rates for Sacramento County Calendar Year 2025 (operational year)
Note: Fugitive dust accounts for tire wear and brake wear.

Conversion Factors	
grams per pound	453.59237
pounds per ton	2000
pounds per metric ton	2204.62262
Global Warming Potential	
CO2	1
Ch4	25
N20	298
Note: GWP are the 100-year GWPs from the IPCC fourth	

EMFAC2017 (v1.0.2) Emission Rates

EMFAC2017 (v1.0.2) Emission Rates - adjusted gasoline powered light-duty vehicles using CARB off-model adjustment factors.
Region Type: County
Region: SAN JOAQUIN
Calendar Year: 2025
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN

Region	Calendar Year	Vehicle Cate	Model Year	Speed	Fuel	Populatior	VMT	% VMT*	Trips	ROG_RUN	ROG_IDLE	ROG_STR	ROG_HOT	ROG_RUN	ROG_RES	ROG_DIU	TOG_RUN
SAN JOAQUIN	2025	LDA	Aggregated	Aggregated	GAS	323207.2	12208642	60.00%	1516080	0.005537	0	0.191291	0.093348	0.211287	0.175931	0.223371	0.008067
SAN JOAQUIN	2025	LDA	Aggregated	Aggregated	DSL	3082.905	124351.83	0.61%	14715.85	0.007564	0	0	0	0	0	0	0.008611
SAN JOAQUIN	2025	LDA	Aggregated	Aggregated	ELEC	8438.32	351259.6	1.73%	41938.31	0	0	0	0.004888	0	0.007252	0.024367	0
SAN JOAQUIN	2025	LDT1	Aggregated	Aggregated	GAS	32110.01	1109935.7	5.45%	146519.9	0.015005	0	0.314305	0.193621	0.678908	0.39658	0.56035	0.021861
SAN JOAQUIN	2025	LDT1	Aggregated	Aggregated	DSL	17.32784	311.91823	0.00%	60.08799	0.107011	0	0	0	0	0	0	0.121825
SAN JOAQUIN	2025	LDT1	Aggregated	Aggregated	ELEC	374.4938	16296.478	0.08%	1887.304	0	0	0	0.004888	0	0.007252	0.024367	0
SAN JOAQUIN	2025	LDT2	Aggregated	Aggregated	GAS	102634.1	3642479.8	17.90%	475411.5	0.010291	0	0.285276	0.130087	0.454031	0.315947	0.381608	0.014992
SAN JOAQUIN	2025	LDT2	Aggregated	Aggregated	DSL	690.2516	28424.934	0.14%	3363.628	0.010853	0	0	0	0	0	0	0.012356
SAN JOAQUIN	2025	LDT2	Aggregated	Aggregated	ELEC	1599.975	47132.864	0.23%	8011.251	0	0	0	0.004888	0	0.007252	0.024367	0
SAN JOAQUIN	2025	MDV	Aggregated	Aggregated	GAS	87466.71	2711830.1	13.33%	394247	0.014063	0	0.388398	0.172688	0.548767	0.42576	0.489661	0.020486
SAN JOAQUIN	2025	MDV	Aggregated	Aggregated	DSL	2099.722	77150.033	0.38%	9990.645	0.008236	0	0	0	0	0	0	0.009377
SAN JOAQUIN	2025	MDV	Aggregated	Aggregated	ELEC	1004.632	30344.94	0.15%	5072.219	0	0	0	0.004888	0	0.007252	0.024367	0
						Total:	20348160.1	100.00%									
									Weighted Average EF*:	0.00795117	0	0.23474549	0.1129771	0.31821215	0.24064586	0.29868683	0.01155349
								*Calculated									

Vehicle Cate	Fuel	TOG_IDLE	TOG_STR	TOG_HOT	TOG_RUN	TOG_RES	TOG_DIU	CO_RUNE	CO_IDLE	CO_STRE	NOx_RUN	NOx_IDLE	NOx_STRI	CO2_RUN	CO2_IDLE	CO2_STR	CH4_RUN	CH4_IDLE	CH4_STR
LDA	GAS	0	0.209439	0.093348	0.211287	0.175931	0.223371	0.4963	0	2.105307	0.027391	0	0.167991	244.5224	0	51.35207	0.001564	0	0.044291
LDA	DSL	0	0	0	0	0	0	0.141241	0	0	0.040088	0	0	185.7807	0	0	0.000351	0	0
LDA	ELEC	0	0	0.004888	0	0.007252	0.024367	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	GAS	0	0.344124	0.193621	0.678908	0.39658	0.56035	0.833249	0	2.27749	0.068747	0	0.23561	284.4213	0	60.90152	0.003535	0	0.063763
LDT1	DSL	0	0	0	0	0	0	0.799336	0	0	0.772481	0	0	406.2988	0	0	0.00497	0	0
LDT1	ELEC	0	0	0.004888	0	0.007252	0.024367	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	GAS	0	0.312341	0.130087	0.454031	0.315947	0.381608	0.681644	0	2.678626	0.055327	0	0.252827	300.1593	0	65.38155	0.002636	0	0.062078
LDT2	DSL	0	0	0	0	0	0	0.100069	0	0	0.030135	0	0	249.3388	0	0	0.000504	0	0
LDT2	ELEC	0	0	0.004888	0	0.007252	0.024367	0	0	0	0	0	0	0	0	0	0	0	0
MDV	GAS	0	0.425247	0.172688	0.548767	0.42576	0.489661	0.784261	0	3.129422	0.075214	0	0.334217	380.6035	0	83.88005	0.003455	0	0.078459
MDV	DSL	0	0	0	0	0	0	0.156932	0	0	0.036128	0	0	343.958	0	0	0.000383	0	0
MDV	ELEC	0	0	0.004888	0	0.007252	0.024367	0	0	0	0	0	0	0	0	0	0	0	0
		0	0.25701672	0.1129771	0.31821215	0.24064586	0.29868683	0.57137442	0	2.28394636	0.04054772	0	0.2034442	269.473211	0	57.01524	0.00206821	0	0.05162069

Vehicle Cate	Fuel	PM10_RU	PM10_IDI	PM10_STI	PM10_PM	PM10_PM	PM2_5_RI	PM2_5_IC	PM2_5_S'	PM2_5_PI	PM2_5_PI	SOx_RUNI	SOx_IDLE	SOx_STRI	N2O_RUN	N2O_IDLE	N2O_STREX
LDA	GAS	0.00122	0	0.001741	0.008	0.03675	0.001121	0	0.001601	0.002	0.01575	0.00242	0	0.000508	0.003681	0	0.024225
LDA	DSL	0.003647	0	0	0.008	0.03675	0.003489	0	0	0.002	0.01575	0.001756	0	0	0.029202	0	0
LDA	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
LDT1	GAS	0.001535	0	0.002268	0.008	0.03675	0.001411	0	0.002085	0.002	0.01575	0.002815	0	0.000603	0.005968	0	0.027212
LDT1	DSL	0.084185	0	0	0.008	0.03675	0.080543	0	0	0.002	0.01575	0.003841	0	0	0.063865	0	0
LDT1	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
LDT2	GAS	0.001264	0	0.001776	0.008	0.03675	0.001162	0	0.001633	0.002	0.01575	0.00297	0	0.000647	0.005143	0	0.029678
LDT2	DSL	0.004047	0	0	0.008	0.03675	0.003872	0	0	0.002	0.01575	0.002357	0	0	0.039193	0	0
LDT2	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
MDV	GAS	0.00127	0	0.001831	0.008	0.03675	0.001168	0	0.001684	0.002	0.01575	0.003766	0	0.00083	0.006444	0	0.033653
MDV	DSL	0.004001	0	0	0.008	0.03675	0.003828	0	0	0.002	0.01575	0.003252	0	0	0.054065	0	0
MDV	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
		0.00125542	0	0.00173017	0.008	0.03675001	0.00115597	0	0.00159083	0.002	0.01575	0.00266542	0	0.00056421	0.00475289	0	0.02581649

EMFAC2017 (v1.0.2) Emission Rates - adjusted gasoline powered light-duty vehicles using CARB off-model adjustment factors.
Region Type: County
Region: SACRAMENTO
Calendar Year: 2025
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN

Region	Calendar Year	Vehicle Categor	Model Year	Speed	Fuel	Population	VMT	% VMT*	Trips	ROG_RUNEX	ROG_IDLEX	ROG_STREX	ROG_HOTSC	ROG_RUNLC	ROG_RESTLC	ROG_DIURN	TOG_RUNEX
SACRAMENTO	2025	LDA	Aggregated	Aggregated	GAS	635993.9	22083309	58.95%	2975297	0.006645	0	0.202456	0.103837	0.22443	0.19153	0.275053	0.009681
SACRAMENTO	2025	LDA	Aggregated	Aggregated	DSL	6649.442	234801.75	0.63%	31098.57	0.010803	0	0	0	0	0	0	0.012299
SACRAMENTO	2025	LDA	Aggregated	Aggregated	ELEC	17095.32	733142.04	1.96%	84696.48	0	0	0	0.004888	0	0.007011	0.025397	0
SACRAMENTO	2025	LDT1	Aggregated	Aggregated	GAS	67470.71	2184625.2	5.83%	307534.3	0.01509	0	0.304501	0.187818	0.661114	0.36856	0.563376	0.021984
SACRAMENTO	2025	LDT1	Aggregated	Aggregated	DSL	140.8336	2204.9013	0.01%	499.9571	0.116669	0	0	0	0	0	0	0.13282
SACRAMENTO	2025	LDT1	Aggregated	Aggregated	ELEC	814.5665	35517.961	0.09%	4050.034	0	0	0	0.004888	0	0.007011	0.025397	0
SACRAMENTO	2025	LDT2	Aggregated	Aggregated	GAS	216827.9	7183351.7	19.17%	1000201	0.010896	0	0.28764	0.133445	0.45907	0.310112	0.399817	0.015874
SACRAMENTO	2025	LDT2	Aggregated	Aggregated	DSL	1470.049	56082.319	0.15%	7131.619	0.014648	0	0	0	0	0	0	0.016676
SACRAMENTO	2025	LDT2	Aggregated	Aggregated	ELEC	3158.493	96675.284	0.26%	15809.3	0	0	0	0.004888	0	0.007011	0.025397	0
SACRAMENTO	2025	MDV	Aggregated	Aggregated	GAS	149939.7	4660429.5	12.44%	680430.6	0.014565	0	0.373429	0.164469	0.530364	0.392101	0.499195	0.021216
SACRAMENTO	2025	MDV	Aggregated	Aggregated	DSL	3616.435	131507.62	0.35%	17290.98	0.010309	0	0	0	0	0	0	0.011736
SACRAMENTO	2025	MDV	Aggregated	Aggregated	ELEC	1949.648	61082.473	0.16%	9831.259	0	0	0	0.004888	0	0.007011	0.025397	0
						Total:	37462729.84	100.00%									
									Weighted Average EF*:	0.00883078	0	0.23870888	0.1183306	0.32485176	0.24280899	0.33438207	0.01282262
								*Calculated									
SACRAMENTO	2025	UBUS	Aggregated	Aggregated	DSL	0.92807055	76.34290744		3.71228222	0.0005467	0	0	0	0	0	0	0.03904982

Vehicle Categor	Fuel	TOG_IDLEX	TOG_STREX	TOG_HOTSO	TOG_RUNLO	TOG_RESTLC	TOG_DIURN	CO_RUNEX	CO_IDLEX	CO_STREX	NOx_RUNEX	NOx_IDLEX	NOx_STREX	CO2_RUNEX	CO2_IDLEX	CO2_STREX	CH4_RUNEX	CH4_IDLEX	CH4_STREX
LDA	GAS	0	0.221664	0.103837	0.22443	0.19153	0.275053	0.583684	0	2.127581	0.029773	0	0.171738	244.5861	0	51.5375	0.001805	0	0.045426
LDA	DSL	0	0	0	0	0	0	0.196158	0	0	0.04701	0	0	184.8761	0	0	0.000502	0	0
LDA	ELEC	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0
LDT1	GAS	0	0.33339	0.187818	0.661114	0.36856	0.563376	0.889569	0	2.272133	0.062839	0	0.230807	286.8941	0	61.28041	0.003553	0	0.061697
LDT1	DSL	0	0	0	0	0	0	0.941294	0	0	1.092511	0	0	458.3198	0	0	0.005419	0	0
LDT1	ELEC	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0
LDT2	GAS	0	0.314929	0.133445	0.45907	0.310112	0.399817	0.7666	0	2.72431	0.054185	0	0.258131	304.3033	0	66.23294	0.002797	0	0.062213
LDT2	DSL	0	0	0	0	0	0	0.139075	0	0	0.035103	0	0	250.6164	0	0	0.00068	0	0
LDT2	ELEC	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0
MDV	GAS	0	0.408857	0.164469	0.530364	0.392101	0.499195	0.859392	0	3.064605	0.070691	0	0.317506	374.1527	0	82.36203	0.003565	0	0.075413
MDV	DSL	0	0	0	0	0	0	0.202991	0	0	0.038379	0	0	332.8258	0	0	0.000479	0	0
MDV	ELEC	0	0	0.004888	0	0.007011	0.025397	0	0	0	0	0	0	0	0	0	0	0	0
		0	0.26135612	0.1183306	0.32485176	0.24280899	0.33438207	0.65204977	0	2.2902718	0.04094513	0	0.20368834	268.530912	0	56.8994914	0.00225742	0	0.0516858
UBUS	DSL	0	0	0	0	0	0	0.05870345	0	0	0.49030457	0	0	1164.9938	0	0	0.03826263	0	0

Vehicle Categor	Fuel	PM10_RUNE	PM10_IDLEX	PM10_STREX	PM10_PMTV	PM10_PMBV	PM2_5_RUN	PM2_5_IDLE	PM2_5_STRE	PM2_5_PMT	PM2_5_PMB	SOx_RUNEX	SOx_IDLEX	SOx_STREX	N2O_RUNEX	N2O_IDLEX	N2O_STREX
LDA	GAS	0.001339	0	0.001805	0.008	0.03675	0.001231	0	0.001659	0.002	0.01575	0.00242	0	0.00051	0.003811	0	0.024039
LDA	DSL	0.004542	0	0	0.008	0.03675	0.004346	0	0	0.002	0.01575	0.001748	0	0	0.02906	0	0
LDA	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
LDT1	GAS	0.001613	0	0.002192	0.008	0.03675	0.001483	0	0.002015	0.002	0.01575	0.002839	0	0.000606	0.005672	0	0.026931
LDT1	DSL	0.076154	0	0	0.008	0.03675	0.07286	0	0	0.002	0.01575	0.004333	0	0	0.072041	0	0
LDT1	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
LDT2	GAS	0.001355	0	0.001755	0.008	0.03675	0.001246	0	0.001614	0.002	0.01575	0.003011	0	0.000655	0.005147	0	0.029871
LDT2	DSL	0.00437	0	0	0.008	0.03675	0.004181	0	0	0.002	0.01575	0.002369	0	0	0.039393	0	0
LDT2	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
MDV	GAS	0.001374	0	0.001846	0.008	0.03675	0.001263	0	0.001697	0.002	0.01575	0.003703	0	0.000815	0.00618	0	0.032457
MDV	DSL	0.004084	0	0	0.008	0.03675	0.003907	0	0	0.002	0.01575	0.003146	0	0	0.052316	0	0
MDV	ELEC	0	0	0	0.008	0.03675	0	0	0	0.002	0.01575	0	0	0	0	0	0
		0.00136796	0	0.00175778	0.008	0.03675001	0.0012598	0	0.00161621	0.002	0.01575	0.00265612	0	0.00056307	0.00476212	0	0.02550636
UBUS	DSL	0.0039644	0	0	0.01200001	0.13034008	0.0037929	0	0	0.003	0.05586003	0.01101338	0	0	0.1831208	0	0

CARB Off-Model Adjustment Factors for Gasoline Light Duty Vehicle Emissions in EMFAC2017.

Year	Nox Exhaus	TOG Evapo	TOG Exha	PM Exhau	CO Exhaust
2025	1.0018	1.0016	1.0016	1.0074	1.0065

*Use of adjustment factors accounts for implmentation of the SAFE Vehicle Rule Part One
Source: https://ww3.arb.ca.gov/msei/emfac_off_model_adjustment_factors_final_draft.pdf

Constrution Energy

Table 4.6-3 Estimated Fuel Consumption During Project Construction

Segment and Facility	Total Emissions (metric tons CO_2e) per Year			Emission Factor (MT CO_2/gallon) a	Fuel Usage b (gallons/Year)			Total Energy (MMBtu)
	2021	2022	2023		2021	2022	2023	
San Joaquin County								
LODI STATION	692	0	0	1.02E-02	68,109	0	0	9,406
LODI STATION - SOUTH ALTERNATIVE	692	0	0	1.02E-02	68,109	0	0	9,406
TRACK CURVE RECONSTRUCTION EAST MARCH LN TO EAST SWAIN RD	0	60	0	1.02E-02	0	5,907	0	816
TRACK CURVE RECONSTRUCTION NORTH OF NORTH NEW HOPE RD	0	60	0	1.02E-02	0	5,907	0	816
HAMMER LANE SIDING UPGRADE	0	0	120	1.02E-02	0	0	11,814	1,631
THORNTON SIDING UPGRADE & EXTENSION	0	0	240	1.02E-02	0	0	23,628	3,263
LODI SIDING	480	0	0	1.02E-02	47,256	0	0	6,526
Sacramento County								
~~ELK GROVE STATION ACCESS (Fourth Leg of Existing Intersection)~~	~~611~~	~~0~~	~~0~~	~~1.02E-02~~	~~60,094~~	~~0~~	~~0~~	~~8,299~~
~~ELK GROVE STATION ACCESS (Fourth Leg of Existing Intersection)~~	~~611~~	~~0~~	~~0~~	~~1.02E-02~~	~~60,094~~	~~0~~	~~0~~	~~8,299~~
CITY COLLEGE STATION	0	0	614	1.02E-02	0	0	60,424	8,344
MIDTOWN SACRAMENTO STATION	785.40	0	0	1.02E-02	77,303	0	0	10,675
OLD NORTH SACRAMENTO STATION	0	0	919	1.02E-02	0	0	90,471	12,494
NATOMAS / SACRAMENTO AIRPORT STATION	755.78	0	0	1.02E-02	74,388	0	0	10,273
TRACK CURVE RECONSTRUCTION SOUTH OF DESMOND RD	0	60	0	1.02E-02	0	5,907	0	816
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	0	60	0	1.02E-02	0	5,907	0	816
PHILLIPS SIDING UPGRADE & EXTENSION	120.03	0	0	1.02E-02	11,814	0	0	1,631
POLLOCK SIDING UPGRADE	0	0	120	1.02E-02	0	0	11,814	1,631
SOUTH SACRAMENTO SIDING UPGRADE	0	0	283	1.02E-02	0	0	27,845	3,845
DEL PASO SIDING UPGRADE & EXTENSION	2021	0	0	1.02E-02	198,917	0	0	27,470
~~ELK GROVE SIDING~~	~~538~~	~~0~~	~~0~~	~~1.02E-02~~	~~53,000~~	~~0~~	~~0~~	~~7,319~~
NEW CROSSOVER	0	0	120	1.02E-02	0	0	11,814	1,631
Total Construction								
Total Construction San Joaquin County	1,172	120	360	1.02E-02	115,365	11,814	35,442	15,931
Total Construction Sacramento County	2,649	120	2,056	1.02E-02	260,725	11,814	202,369	36,005
Amortized Demands (over 30 years)								
Total Construction San Joaquin County					3,845.50	393.80	1,181.40	531
Total Construction Sacramento County					8,690.84	393.80	6,745.62	1,200

a U.S. Energy Information Administration 2016 (https://www.eia.gov/environment/emissions/co2_vol_mass.php)

b Conservatively assumed diesel

Conversion Factors			
Category	Amount	Units	
Diesel (heat content)	5.8	MMBtu/barrel	http://www.theclimateregistry.org/wp-content/uploads/2017/05/2017-Climate-Registry-Default-Emission-Factors.pdf
Motor Gasoline	5.25	MMBtu/barrel	http://www.theclimateregistry.org/wp-content/uploads/2017/05/2017-Climate-Registry-Default-Emission-Factors.pdf
Natural Gas	0.1	MMBtu/therm	https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
Propane	0.0913	MMBtu/gallon	https://www.eia.gov/environment/emissions/co2_vol_mass.php
Kerosene	0.135	MMBtu/gallon	https://www.eia.gov/environment/emissions/co2_vol_mass.php
Wood	20	MMBtu/cord	https://www.eia.gov/energyexplained/index.cfm?page=about_btu
Gallons per Barrel	42	gallons/barrel	http://www.theclimateregistry.org/wp-content/uploads/2017/05/2017-Climate-Registry-Default-Emission-Factors.pdf

Operational Energy

Table 4.6-4 Estimated Energy Usage During Project Operation

County	Operational Activity	Energy Requirement	Energy Unit	Annual Energy Consumption (MMBtu)
San Joaquin				
	Locomotive Operations	264,976	Gallson Diesel/year	36,592
	Electricity Use	*117,120*	KWh/yr	400
	Subtotal			*36,992*
Sacramento				
	Locomotive Operations	348,001	Gallson Diesel/year	48,057
	Shuttle Service	4,844	Gallson Diesel/year	669
	Electricity Use	119,700	KWh/yr	409
	Subtotal			*49,135*

County	On-Road Fuel Demand Avoided Due to VMT Displaced by Rail Ridership Increase	Energy Requirement	Energy Unit	Annual Energy Consumption (MMBtu)
San Joaquin				
	DSL	(8,576)	Gallons Diesel/year	(1,184)
	GAS	(837,770)	Gallons Gasoline/year	(104,721)
	Subtotal			*(105,906)*
Sacramento				
	DSL	(11,263)	Gallons Diesel/year	(1,555)
	GAS	(1,100,270)	Gallons Gasoline/year	(137,534)
	Subtotal			*(139,089)*

County	Net Energy Reductions	Annual Energy Consumption (MMBtu)
San Joaquin		
	Operational Demand	36,992
	Operational Offsets	(105,906)
	Subtotal	*(68,914)*
Sacramento		
	Operational Demand	49,135
	Operational Offsets	(139,089)
	Subtotal	*(89,954)*

Conversion Factors			
Category	**Amount**	**Units**	
Diesel (heat content)	5.8	MMBtu/barrel	http://www.theclimateregistry.org/wp-content/uploads/2017/05/2017-Climate-Registry-Default-Emission-Factors.pdf
Motor Gasoline	5.25	MMBtu/barrel	http://www.theclimateregistry.org/wp-content/uploads/2017/05/2017-Climate-Registry-Default-Emission-Factors.pdf
Natural Gas	0.1	MMBtu/therm	https://www.epa.gov/energy/greenhouse-gases-equivalencies-calculator-calculations-and-references
Propane	0.0913	MMBtu/gallon	https://www.eia.gov/environment/emissions/co2_vol_mass.php
Kerosene	0.135	MMBtu/gallon	https://www.eia.gov/environment/emissions/co2 vol mass.php
Wood	20	MMBtu/cord	https://www.eia.gov/energyexplained/index.cfm?page=about_btu
Gallons per Barrel	42	gallons/barrel	http://www.theclimateregistry.org/wp-content/uploads/2017/05/2017-Climate-Registry-Default-Emission-Factors.pdf

Project Mobile Fuel Estimates:

County	Operational Activity	GHG Emissions from Fuel Use (metric tons CO2e/year)	Emission Factor (MT CO2/gallon) a	2025 Gallons of Fuel
San Joaquin				
	Locomotive Operations	2692.16	1.02E-02	264,975.96
	Sub-total	2692.16		264,975.96
Sacramento				
	Locomotive Operations	3535.69	1.02E-02	348,001.28
	Airport Shuttle Service	49.21	1.02E-02	4,843.64
	Sub-total	3584.90		352,844.92
	On-Road Fuel Demand Avoided Due to VMT Displaced by Rail Ridership Increase			
San Joaquin		(7,532.4)		
	DSL	1%	1.02E-02	(8,576.23)
	GAS	99%	8.89E-03	(837,769.99)
Sacramento		(9,892.5)		
	DSL	1%	1.02E-02	(11,263.44)
	GAS	99%	8.89E-03	(1,100,269.72)

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: SAN JOAQUIN
Calendar Year: 2025
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	Population	VMT	% VMT*
SAN JOAQUIN	2025	LDA	Aggregated	Aggregated	GAS	323207.155	1.2E+07	61.34%
SAN JOAQUIN	2025	LDA	Aggregated	Aggregated	DSL	3082.90456	124352	0.62%
SAN JOAQUIN	2025	LDT1	Aggregated	Aggregated	GAS	32110.0094	1109936	5.58%
SAN JOAQUIN	2025	LDT1	Aggregated	Aggregated	DSL	17.3278395	311.918	0.00%
SAN JOAQUIN	2025	LDT2	Aggregated	Aggregated	GAS	102634.084	3642480	18.30%
SAN JOAQUIN	2025	LDT2	Aggregated	Aggregated	DSL	690.251608	28424.9	0.14%
SAN JOAQUIN	2025	MDV	Aggregated	Aggregated	GAS	87466.714	2711830	13.63%
SAN JOAQUIN	2025	MDV	Aggregated	Aggregated	DSL	2099.72241	77150	0.39%
					Total:		19903126	100.00%

EMFAC2017 (v1.0.2) Emission Rates
Region Type: County
Region: SACRAMENTO
Calendar Year: 2025
Season: Annual
Vehicle Classification: EMFAC2011 Categories
Units: miles/day for VMT, trips/day for Trips, g/mile for RUNEX, PMBW and PMTW, g/trip for STREX, HTSK and RUNLS, g/vehicle/day for IDLEX, RESTL and DIURN

Region	Calendar Year	Vehicle Category	Model Year	Speed	Fuel	Population	VMT	% VMT*
SACRAMENTO	2025	LDA	Aggregated	Aggregated	GAS	635993.874	2.2E+07	60.44%
SACRAMENTO	2025	LDA	Aggregated	Aggregated	DSL	6649.4425	234802	0.64%
SACRAMENTO	2025	LDT1	Aggregated	Aggregated	GAS	67470.7121	2184625	5.98%
SACRAMENTO	2025	LDT1	Aggregated	Aggregated	DSL	140.833561	2204.9	0.01%
SACRAMENTO	2025	LDT2	Aggregated	Aggregated	GAS	216827.922	7183352	19.66%
SACRAMENTO	2025	LDT2	Aggregated	Aggregated	DSL	1470.04907	56082.3	0.15%
SACRAMENTO	2025	MDV	Aggregated	Aggregated	GAS	149939.678	4660429	12.76%
SACRAMENTO	2025	MDV	Aggregated	Aggregated	DSL	3616.43487	131508	0.36%
					Total:		36536312	100.00%

Construction Emissions for HRA by Location

	Total Construction-Related Emissions		
Project Element	**Construction Start Year**	**Construction Duration (months)**	**PM_{10} Exhaust (pounds)**
LODI STATION	*2021*	*14*	
Equipment			26.88
Onsite Vehicles			2.71
Total			*29.59*
THORNTON SIDING UPGRADE & EXTENSION	2023	4	
Equipment			9.15
Onsite Vehicles			0.48
Total			9.63
LODI SIDING	2021	8	
Equipment			18.29
Onsite Vehicles			0.97
Total			19.25
CITY COLLEGE STATION	2023	8	
Equipment			22.07
Onsite Vehicles			1.32
Total			23.38
MIDTOWN SACRAMENTO STATION	2021	12	
Equipment			28.20
Onsite Vehicles			2.07
Total			30.28
OLD NORTH SACRAMENTO STATION	2023	14	
Equipment			37.32
Onsite Vehicles			2.82
Total			40.14
NATOMAS / SACRAMENTO AIRPORT STATION	2021	12	
Equipment			27.57
Onsite Vehicles			1.82
Total			29.39
TRACK CURVE RECONSTRUCTION NORTH OF ELK GROVE ~~STATION~~	2022	1	
Equipment			2.30
Onsite Vehicles			0.12
Total			2.42
SOUTH SACRAMENTO SIDING UPGRADE	2023	4	
Equipment			10.97
Onsite Vehicles			0.48
Total			11.44
DEL PASO SIDING UPGRADE & EXTENSION	2021	12	
Equipment			34.98
Onsite Vehicles			2.15
Total			37.13

Operational HRA Summary

Rail Operations - Using Emissions Calculations From "Rail Operations" tab

	Total Trip Length miles	Total Track Length (km)	HRA Analysis Segment Length (km)	Total Daily Train Operational PM10 Emissions (lb/day)	Average emissions per 2KM segment (lb/day)	Average PM10 emissions per 2KM segment (lb/year)	% Time at Sub-Section Speed Over 2-km Segment[1]	Average Emissions per Sub-Segement (lb/day)	Average PM10 Emissions per Sub-Segement (lb/year)	
Emissions per 2km Segment	52.60	84.65	2.00	1.1549	0.0273	9.9593	-			Non-Station Segments
Emissions at tails of each segment (assume higher speed/shorter duration of time)	-	-	-	-	-		39.40%	0.0108	3.9240	40 MPH
Emissions approaching, idling at, and departing the station	-	-	-	-	-		60.60%	0.0165	6.0353	10 MPH

1. Estimated time at each idling, dynamic break, and at each notch level is representative of EPA 'Percent Operating Time at Each Notch Level' per EPA 1998 Locomotive Emission Standards Regulatory Support Document, Table 4-5 *https://nepis.epa.gov/Exe/ZyPDF.cgi/P100F9QT.PDF?Dockey=P100F9QT.PDF*

Shuttle Bus Operations - Unique to Sacramento/Natomas Station Area

					Emissions (tons/year)			Emissions (pounds/year)		
Air District	Number of Busses per Trip	One-Way Trips per Day	Distance per Trip (miles)	Vehicle Category	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total	PM10 Fugitive Dust	PM10 Exhaust	PM10 Total
SMAQMD	1	14	8	Urban Bus (Diesel)	0.019454186	0.000178646	0.019632832	38.91	0.3573	39.27
									1.43E-01	

Conversion Factors:	
tons	pounds
1	2000

Model Length (1-way)	
5141.30	m
3.19	mi