To	Steven Smith	Pages	60 (without appendices)
CC	Lindy Chan, Redwood City Planning		
Subject	South Main Mixed-Use Project Draft Air Quality Technical Report		
From	Mary Kaplan; Stephanie Carcieri; Christopher Warren; Paola Pena Steven Smith; Florentina Craciun		
Date	March 16, 2020		

AECOM has prepared this air quality technical report (AQTR) for the proposed Greystar GP II, LLC South Main Mixed-Use project, referred to hereafter as the "proposed project" at the periphery of Redwood City's Downtown core. The proposed project consists of five contiguous blocks totaling 8.3 acres (Parcels A through E) and one separate block of approximately 0.15 acre (Parcel F) (**Figure 1**). The proposed project would be mixed-used with both residential and commercial office and retail.

This AQTR is required by the City of Redwood for compliance with the California Environmental Quality Act (CEQA) and is consistent with the 2017 Bay Area Air Quality Management District (BAAQMD) CEQA Guidelines (BAAQMD, 2017). This AQTR describes the proposed project, the modeling methodologies used to perform the air quality analyses for this AQTR, and the results of the analyses. Analyses performed were based on the most up-to-date information available regarding specific details of the proposed project.

This AQTR addresses the following topics:

- **Section 1.0, "Introduction,"** describes the project understanding, existing air quality setting, and the purpose and approach of this AQTR.
- **Section 2.0, "Emissions Estimates,"** describes the methods used to estimate the emissions of criteria air pollutants, precursors, and toxic air contaminants (TACs) generated by the proposed project construction and operation. Results before and after incorporation of control measures are also provided.
- **Section 3.0, "Air Dispersion Modeling,"** describes the methods used to model pollutant dispersion and estimate contributions of project sources to pollutant concentrations. Results before and after incorporation of control measures are also provided.
- **Section 4.0, "Health Risk Analysis,"** provides an overview of the methodology for estimating potential health risks to new and existing sensitive receptors. Results before and after incorporation of control measures are also provided.
- **Section 5.0, "Uncertainties,"** discusses the uncertainties and limitations associated with the health risk analysis.
- **Section 6.0, "References,"** lists the sources cited in this AQTR.

1.0 Introduction

Project Understanding

Greystar GP II, LLC proposes to redevelop five contiguous parcels (A through E) and a single block parcel (F) (herein referred to collectively as the "proposed project". Parcels A through E are bounded by El Camino Real, Maple Street, Elm Street, Main Street, Caltrain right-of-way, Chestnut Street, Shasta Street, and Cedar Street (**Figure 2**). Parcel F is approximately 1,000 feet northwest of Parcels A through E at the southwest corner of El Camino Real and Jackson Avenue.). The proposed project would encompass privately owned parcels totaling approximately 8.45 acres (8.30 acres Parcels A through E and 0.15 acre Parcel F).

Lathrop Street and Main Street run through Parcels A through E in a north-south direction, and Beech Street in an east-west direction. These parcels are regionally accessible via State Route (SR) 84, west of US 101 and 300 feet to the southeast of the project site; and the SR 84/US 101 interchange, about 1 mile to the northeast. Local access to the project site is via El Camino Real, which fronts the project site. The project site is in a transit-rich area: Parcels A through E are approximately 0.5 mile from the Redwood City Transit Center, and one block from the nearest SamTrans bus stop; Parcel F is in the City's Downtown core, approximately 0.3 mile southeast of the Redwood City Transit Center.

Existing use of the project site is primarily auto sales, repair, and warehouse space, including one multi-tenant residential building owned by the City; a restaurant; and a former indoor roller rink. Uses surrounding the site include auto repair shops, small commercial buildings, large multi-tenant residential developments, some retail, and a proposed 109,000-square-foot office building.

The proposed project site's six blocks are currently developed, and configured as follows (**Figure 2**):

- **Parcel A** is made up of two existing parcels, totaling about 1.68 acres, and occupying the entire block. Parcel A is bounded by El Camino Real to the west, a concrete-lined drainage channel (Redwood Creek) and Maple Street to the north, Lathrop Street to the east, and Beech Street to the south. The site is currently occupied by a car dealership with existing buildings in the western 25%, and asphalt-paved parking lots covering the remainder of the site.
- **Parcel B** is made up of four existing parcels, totaling about 1.39 acres, and is bounded by El Camino Real to the west, Beech Street to the north, Lathrop Street to the east, and Cedar Street to the south. The site is currently occupied by a car dealership and service buildings that cover about 65% of the site, with asphalt-paved parking lots in the southwestern and northwestern portions of the site.
- **Parcel C** is made up of five existing parcels, totaling about 1.50 acres. The site is bounded by Lathrop Street to the west, Beech Street to the north, Main Street to the east, and Cedar Street to the south. The site is currently occupied by an existing auto body shop building in the southwestern corner, covering about 25% of the site, with asphalt-paved parking lots covering the remainder of the site. A portion of the parcel is occupied by a City-owned multi-family development, with 22 below-market-rate units and a manager's unit.
- **Parcel D** is a rectangular-shaped parcel totaling about 1.27 acres. Parcel D encompasses approximately 80% of the block bounded by Lathrop Street to the west, Elm Street to the north, commercial properties to the east, and Beech Street to the south. The site is occupied by an asphalt-paved parking lot with a detailing shop on the northern end, as well as a restaurant, car storage, and office space that is not occupied. Parcel D does not include the one-story buildings at the northeastern portion of this block.

- **Parcel E** is made up three existing parcels, totaling about 2.46 acres and occupying the entire block. The site is bounded by Main Street to the west, Beech Street to the north, Cedar Street to the northwest, the Caltrain railroad tracks to the northeast, Chestnut Street to the southeast, and Shasta Street to the south. The site is predominantly occupied by an asphalt-paved parking lot, and a commercial/industrial building along the southeastern edge of the property that covers less than 20% of the site. A former roller rink, car wash, and historic-era metal shed are also on this parcel.
- **Parcel F** is made up of one existing parcel, totaling 0.15 acre and occupying the northeastern corner parcel of the block at 1304 El Camino Real. The site is bounded by El Camino Real to the east, Jackson Avenue to the north, and existing development to the west and south. The development to the south is a historic resource (labeled as "R" in the Downtown Precise Plan [DTPP]). The site is occupied by a former auto repair building that covers a majority of the site.

The proposed project would include one building each on Parcel A, D and F, developed with primarily residential uses; and four additional buildings on Parcels B, C and E, where the primary use would be commercial office space. The proposed project would develop 540 multi-family residential units, including 252 units on Parcel A, 249 units of Parcel D, and 39 units on Parcel F. The project would also include approximately 530,000 square feet of office uses, an 8,563-square-foot childcare facility (not including 5,800 square feet of dedicated outdoor space), and 28,901 square feet of retail uses, including 19,000 square feet of ground-floor space on Parcel B designed to accommodate retail/entertainment uses. The approximately 40,000 square feet of public open space proposed throughout the site would include a public creek walk and park at Shasta Street and Chestnut Street

The following general land uses would be constructed at each parcel:

- **Parcel A** – multi-family residential use and retail, public and private open space.
- **Parcel B** – retail and office space, childcare facility, family-oriented entertainment/retail and parking.
- **Parcel C** – office space, parking and private open space.
- **Parcel D** – multi-family residential use and retail, public and private open space.
- **Parcel E** – retail and office space, parking, retail, and public and private open space.
- **Parcel F** – multi-family residential use.

The existing street network would be largely maintained. Shasta Street between Main Street and Chestnut Street would be closed to create additional green space, as described below. Additionally, Beech Street would be reconfigured to align with Lincoln Street to the west, while a portion of Cedar Street east of Main Street would become a private street. The buildings would include architectural elements that would take cues from the existing eclectic mix of low-scale buildings, uses, and designs with an industrial feel, such as brick, curved glass curtainwalls, ribbon windows, corrugated metal (Perry's Feed Shed), and other architectural elements as approved by the City's Architectural Permit. In addition, the noncontiguous Parcel F would be developed with a six-story building fronting El Camino Real and Jackson Avenue.

FIGURE 1
PROJECT LOCATION

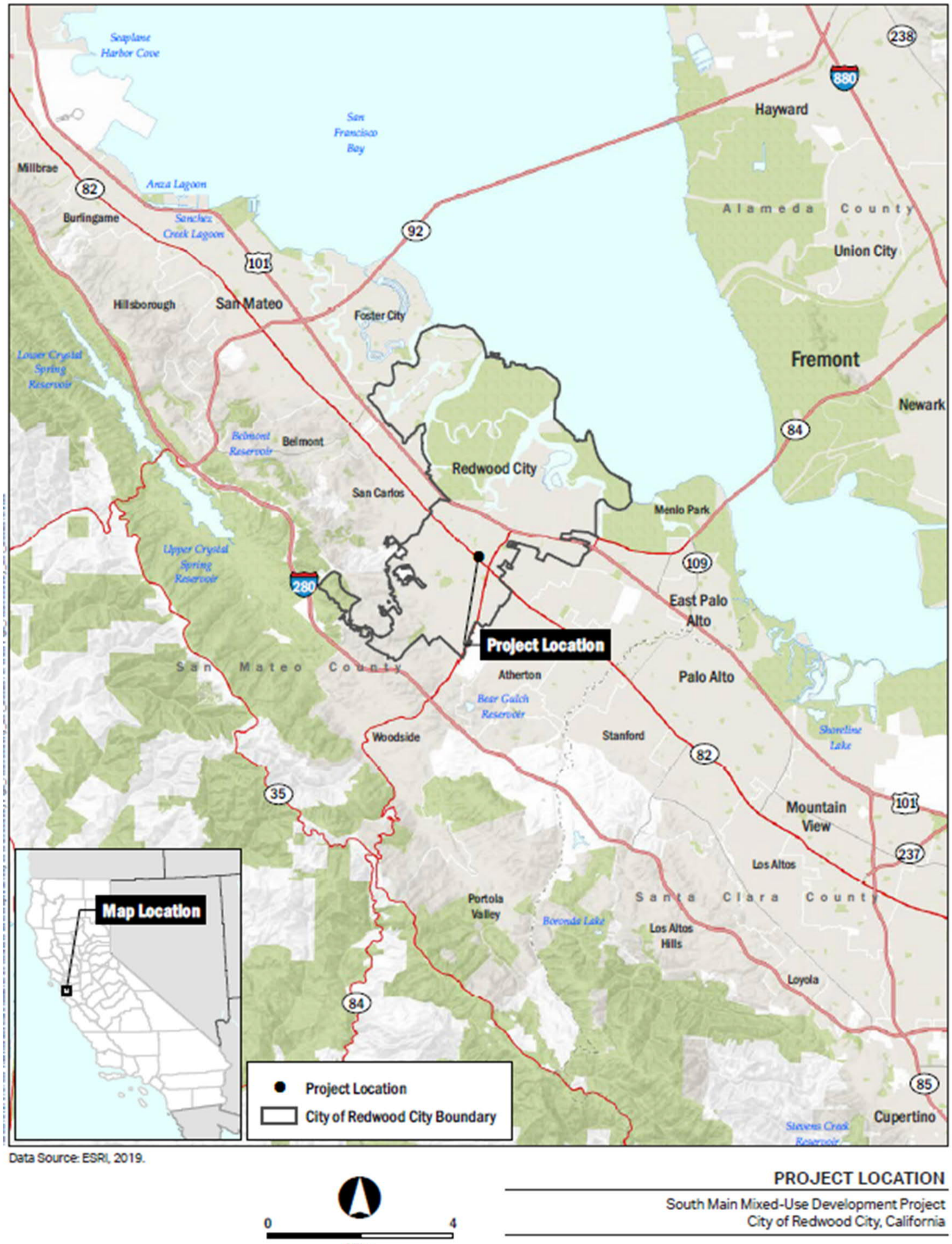
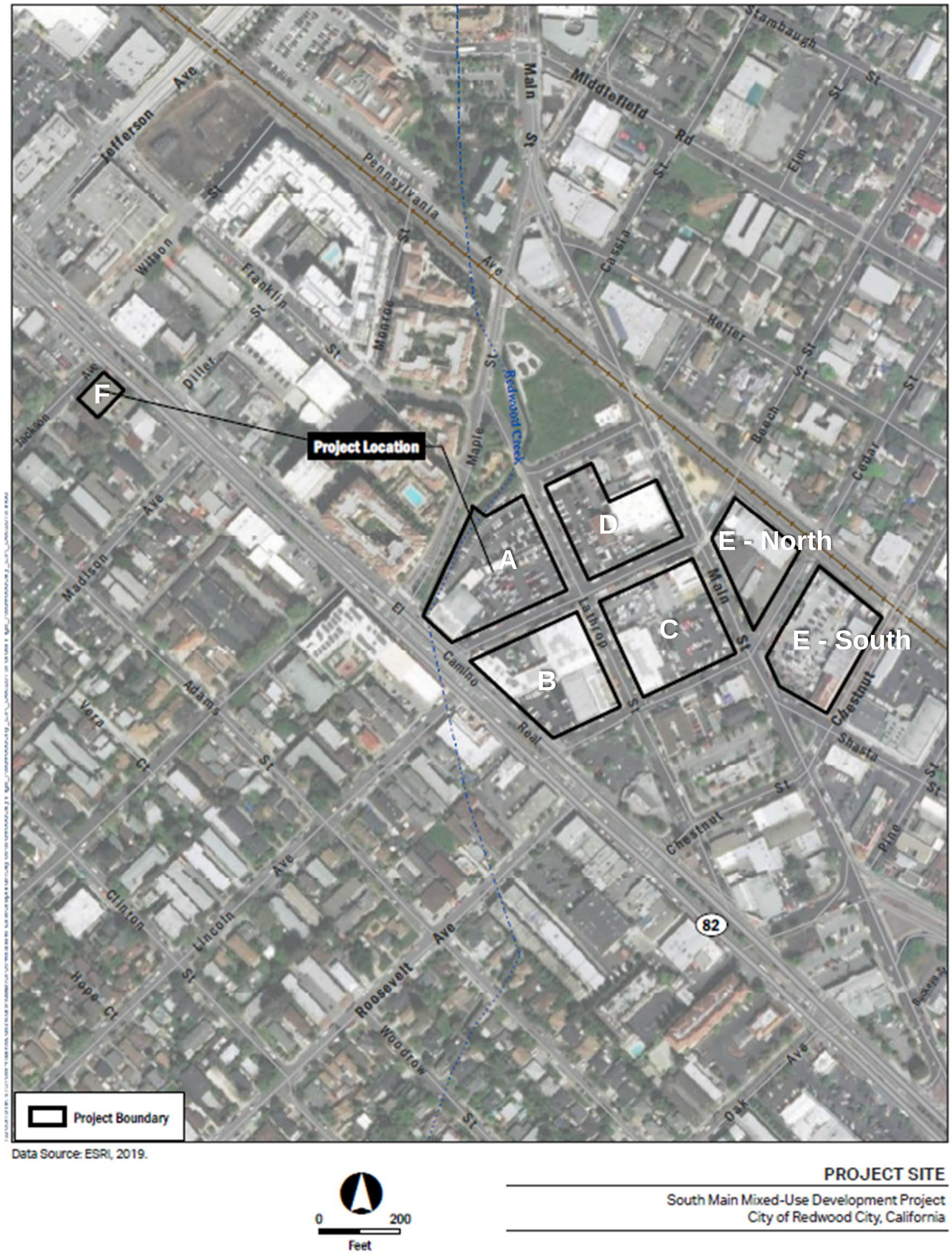


FIGURE 2
PROJECT SITE MAP



Parcel A

The project would construct 252 residential units in a seven-story, 84-foot-tall building. The residential units would be comprised of a mix of Studios and one- to three-bedroom units ranging in size from approximately 525 square feet to approximately 1,283 square feet as shown in **Table 1**. The proposed building would include a corner plaza at Maple Street and El Camino Real. The interior courtyard would include private green space, as well as a pool and other amenities. Retail space would front El Camino Real at Beech Street. The main residential lobby would be on Lathrop Street, close to Elm Street. The parking lot entrance would be available from Beech Street.

Parcel B

The project would construct a four-story, 85.5-foot-high building. The building would have two entrances: one at the corner of El Camino Real and Beech Street, and an entry court at Lathrop Street. The main entertainment space would be located along El Camino Real. The proposed childcare facility and commercial entry would be along Lathrop Street, along with the associated child care outdoor space that would be protected by a brick wall from the street. The parking lot entrance would be available from Beech Street via the proposed loading dock. The office space and childcare sizes are provided in **Tables 2** and **3**, respectively.

Parcel C

The project would construct a three-story, 66.5-foot-high building. The primary building entrance would be along Main Street, with a private tenant entrance along Lathrop Street. Parking lot access would be via Cedar Street. Private open space would be available on the ground-floor inner courtyard of the proposed building, while public open space would be available along Lathrop Street. The office space size is provided in **Table 2**.

Parcel D

The project would construct 249 residential units in a seven-story, 83 feet high building. The residential units would be comprised of a mix of Studios and one- to three-bedroom units ranging in size from approximately 525 square feet to approximately 1,283 square feet as shown in **Table 1**. The main entry to the building would be along Lathrop Street. The one-story structures at the corner of Elm and Main Streets are outside the project scope would be maintained in their current configuration. A secondary entry plaza would be located along Beech Street. Parking garage entry would be available via Elm Street. The office space size is provided in **Table 2**.

Parcel E

The project would construct two three-story buildings on both sides of Parcel E. The northern building would be 74.5 feet in height, while the southern building would be 79 feet in height. The existing Perry's Feed Shed would be replaced with a similar shed structure that would support the proposed public open space with retail uses. The main entrances for both buildings would be along Main Street, with entry plazas and pedestrian facilities. Parking access would be available at the terminus of Cedar Street. The office space size is provided in **Table 2**.

Parcel F

The project would construct a six-story, 66–foot-high building fronting El Camino Real. The main entrance to the building would be along El Camino Real Boulevard. A main lobby and a community room would be on the first floor. The parking lot would be accessible via Jackson Avenue, and the bike storage area would be accessible via the podium parking lot. The proposed building would occupy the entirety of the project lot.

Open Space

The project would include a mix of public and private open space on all parcels, as shown in **Table 4**, below. The private open space would be available to building occupants only, while the public open space would be open to the public at large. The public open space would include green space and sitting areas, as well as sitting areas associated with the commercial space.

The approximately 8.45-acre project site is generally flat. The site's elevation varies slightly between 18 and 19 feet above mean sea level (msl) at both Parcels A through E and Parcel F locations.

Concurrent Pipeline Construction

To accommodate the higher density usages at these parcels, upgrades to underground recycled water and sewer pipelines are proposed to be installed. These pipelines would connect to the project at parcels A through E (at the intersection of El Camino Real and Maple Street) and run north along Maple Street, Main Street, Bradford Street, Walnut Street, and ending at Veteran's Avenue.

TABLE 1
PROPOSED RESIDENTIAL UNITS ON PARCELS A, D, AND F

Unit Type	Quantity
Studio	64 Parcel A
	67 Parcel D
	30 Parcel F
Junior 1 bedroom	67 Parcel A
	77 Parcel D
1 bedroom	69 Parcel A
	56 Parcel D
	8 Parcel F
1-bedroom townhouse	7 Parcel A
2 bedrooms	40 Parcel A
	34 Parcel D
	1 Parcel F
3 bedrooms	5 Parcel A
3-bedroom townhouse	15 Parcel D
Total Residential	**540**

Source: Greystar 2018

TABLE 2
PROPOSED OFFICE SPACE

Parcel	Office Square Feet
Parcel B	109,379
Parcel C	164,302
Parcel E	256,319
Total Office	**530,000**

Source: Greystar 2018

TABLE 3
PROPOSED RETAIL AND CHILDCARE SPACE

Parcel	Proposed Uses	Square Feet
Parcel A	Retail	5,295
Parcel B	Childcare	8,563
	Entertainment	18,878
Parcel E	Retail	4,571

Source: Greystar 2018

TABLE 4
PROPOSED OPEN SPACE

Parcel	Open Space Type	Square Feet
Parcel A	Public	10,933
	Private/Residential	31,510
Parcel B	Public	2,421
	Childcare	5,762
	Private	6,583
Parcel C	Public	1,859
	Private	3,579
Parcel D	Public	3,658
	Private	4,055
Parcel E	Public	21,273
	Private	7,773

Source: Greystar 2018

Air Quality Setting

The project site is located in the City of Redwood, which is part of the San Francisco Bay Area Air Basin (SFBAAB). Air quality in the SFBAAB is regulated at the regional level by BAAQMD and at the State and federal levels by the California Air Resources Board (ARB) and U.S. Environmental Protection Agency (EPA), respectively. BAAQMD attains and maintains air quality conditions in the SFBAAB through a comprehensive program of planning, regulation, enforcement, technical innovation, and promotion of the understanding of air quality issues. Per Mitigation Measure 12-1 in Redwood City's Downtown Precise Plan (DPP), any new development located within 500 feet of El Camino Real, Veterans Boulevard and the Caltrain railway (until Caltrain electrification is completed) needs to conduct a health risk assessment (unless BAAQMD-approved modeling deems it unnecessary). The proposed project runs adjacent to El Camino Real and resides approximately 100 feet from the Caltrain railway. Therefore, exposure to toxic air contaminants (TACs) and $PM_{2.5}$ emissions is assessed as part of this HRA to future on-site project sensitive receptors.

The project has the potential to generate emissions during both the construction and operational phases. In addition to emissions generated by construction equipment and vehicles, and increased vehicular traffic once the project is complete, the proposed project would add new stationary emissions sources. Up to eight emergency generators and two fire-water pumps would be added as emergency power sources and two small boilers for the seven and eight-story multi-family residential complex on Parcel A and D, respectively.

Criteria Air Pollutants

In accordance with the California and federal Clean Air Acts, air pollutant standards are identified for six criteria air pollutants: ozone, carbon monoxide (CO), particulate matter (PM), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead. These air pollutants are called “criteria air pollutants” because they are regulated by developing specific public health and welfare–based criteria as the basis for setting permissible levels.

Ozone is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving reactive organic gases (ROG) and oxides of nitrogen (NO_X). Construction activities for land use development projects typically generate PM emissions. Studies have shown that applying best management practices at construction sites substantially controls fugitive PM dust (WRAP, 2006), and individual control measures have been shown to reduce fugitive dust by anywhere from 30 to 90 percent (BAAQMD, 2009). Regional concentrations of CO in the SFBAAB have not exceeded State standards in the past 11 years and SO_2 concentrations have never exceeded the standards.

In general, the SFBAAB experiences low concentrations of most pollutants when compared to federal or State standards. The SFBAAB is designated as either in attainment[1] or unclassified for most criteria pollutants, with the exceptions of ozone and particulate matter with an aerodynamic resistance diameter of 2.5 microns or less or 10 microns or less ($PM_{2.5}$ and PM_{10}), which are designated as nonattainment for either the State or federal standards. By its very nature, regional air pollution is largely a cumulative impact in that no single project is large enough to result in nonattainment of air quality standards by itself. Instead, a project’s individual emissions contribute to existing cumulative air quality impacts.

Toxic Air Contaminants

In addition to criteria air pollutants, EPA regulates hazardous air pollutants, also known as TACs. TACs may be emitted by stationary, area, or mobile sources. Common stationary sources of TAC 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 TAC 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 TAC emissions and include construction equipment, ships, and trains.

TACs 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 TACs include birth defects, neurological damage, cancer, and mortality. There are hundreds of different types of TACs with varying degrees of toxicity. The health risks of individual TACs vary greatly; at a given level of exposure, one TAC may pose a hazard that is many times greater than another.

TACs 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.

[1] “Attainment” status means that a region is meeting federal and/or State standards for a specified criteria pollutant. “Nonattainment” status means that the region does not meet federal and/or State standards for a specified criteria pollutant. “Unclassified” status means that there are not enough data to determine the region’s attainment status for a specified criteria air pollutant.

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. BAAQMD defines sensitive receptors as children, adults, and seniors occupying or residing in residential dwellings, schools, daycare centers, hospitals, and senior-care facilities.

The project site is adjacent to an existing residential area whose sensitive receptors were evaluated for potential air quality impacts from the proposed project. The project will be added new residential receptors on-site along with a childcare facility. Section 3.0, “Air Dispersion Modeling,” and Section 4.0, “Health Risk Analysis,” provide a full description of the air quality modeling and the health risk analyses and results.

Purpose and Approach

The purpose of this air quality analysis is to assess potential impacts caused by emissions of criteria air pollutants, ozone precursors, and TACs during construction and operation of the proposed project. The analysis was conducted consistent with guidance and methodologies from local, regional, State, and federal agencies, including BAAQMD (2017), the California Air Resources Board (ARB) (2017), the Office of Environmental Health Hazard Assessment (OEHHA) (2015), and the U.S. Environmental Protection Agency (EPA) (2017). Additionally, the purpose of this AQTR is to assess the results and determine whether modeling refinements are necessary. Feasible measures to reduce project impacts (i.e., control measures) were also identified for consideration by the reviewing agencies.

Analysis Evaluation

Consistent with CEQA requirements, the analysis evaluated all of the following:

1. *Short-term construction and long-term operational emissions* of criteria air pollutants and precursors associated with the proposed project.

2. *Health risk and hazard impacts of construction emissions* from the proposed project on the existing off-site receptors located within 1,000 feet of the project site. **Figure 3** shows the receptors to be evaluated during construction phase of the proposed project.

3. *Health risk and hazard impacts of operational emissions* from the proposed project on the off-site and future on-site sensitive receptors. **Figure 4** shows the future on-site receptors to be evaluated during the operational phase of the proposed project. The off-site receptors would be the same as those shown in **Figure 3**.

Project Sources

This AQTR evaluated the following sources of air quality emissions or exposures:

1. **Construction Emissions:** Construction-related emissions associated with the proposed project that have the potential to affect regional air quality and local sensitive receptors; and

2. **Operational Emissions**: The proposed project operational emissions affecting regional air quality and local sensitive receptors. This includes the addition of vehicle traffic, emergency generators, boilers and fire water pumps.

Figure 3: Sensitive Receptors Associated with the Proposed Project – Construction Phase

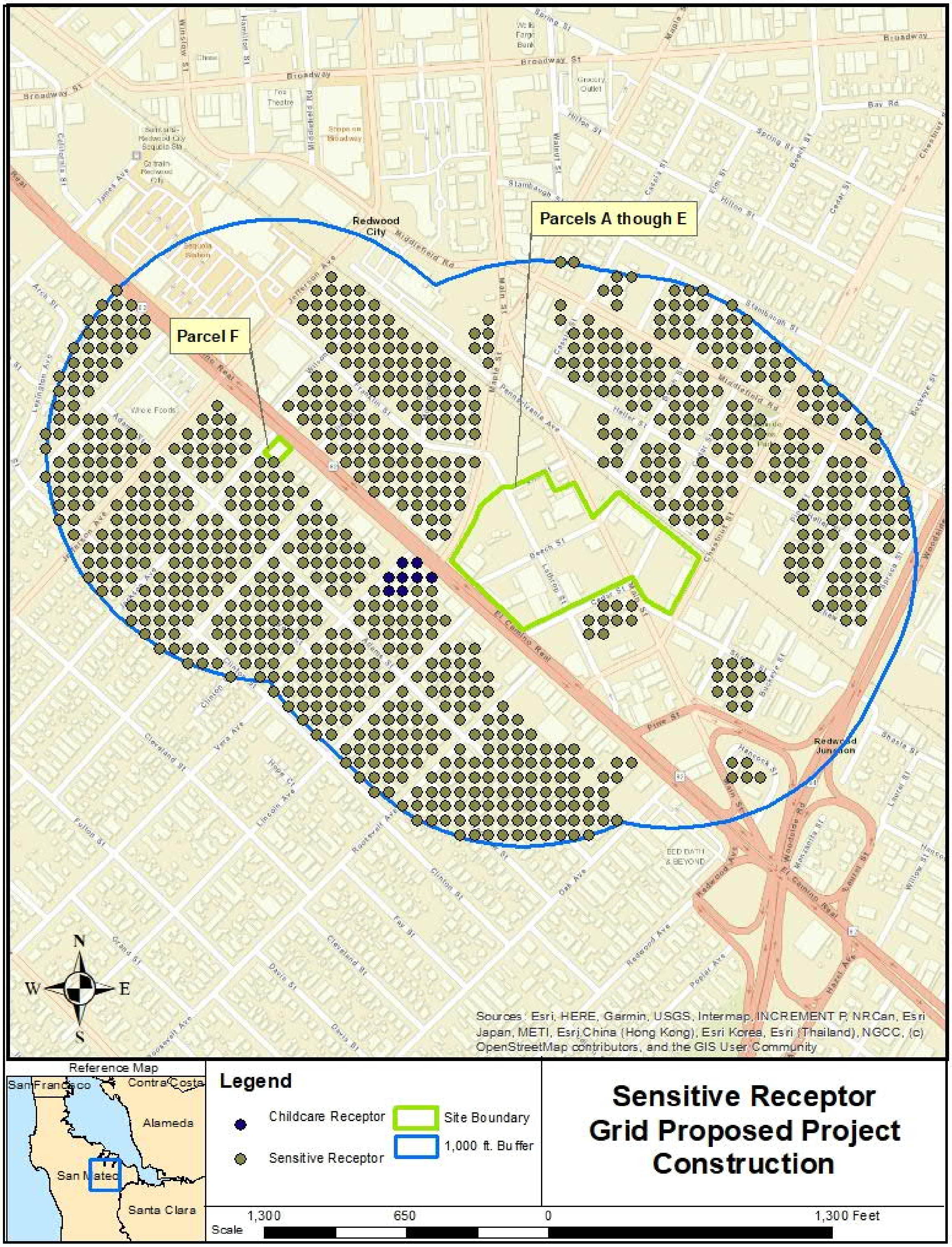
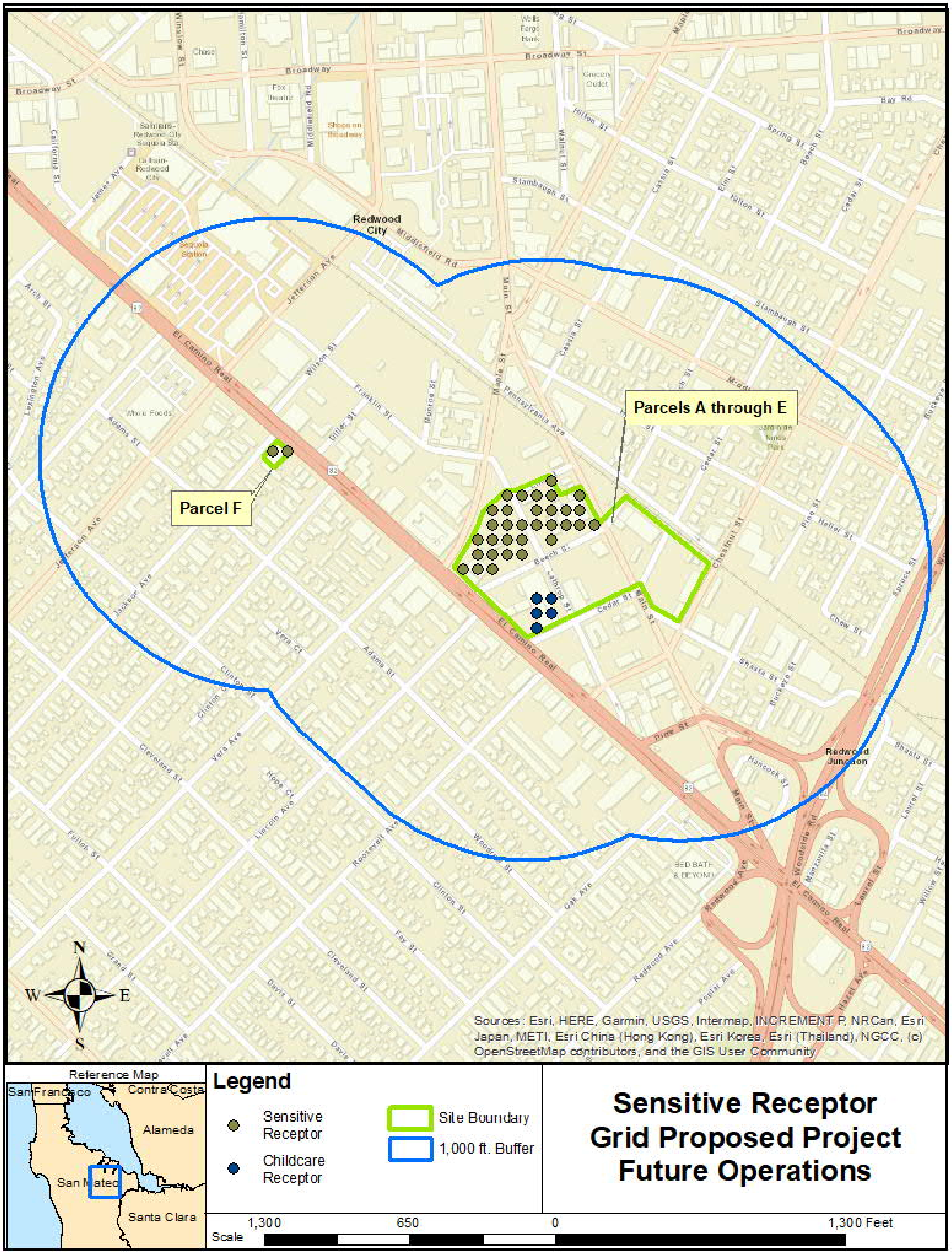


Figure 4: Sensitive Receptors Associated with the Proposed Project – Future Operations Phase



2.0 Assessment of Existing Health Risks

This section describes existing health risks at the project site and within the project vicinity (1,000 feet from the project site). BAAQMD conducted modeling (BAAQMD, 2014) of $PM_{2.5}$ concentrations and excess cancer risk in 2014 for all highways/freeways and roadways with annual average daily traffic greater than 30,000 within the air district. The modeling consisted of a grid cells at 20 meter by 20 meter spacing and used EMFAC 2014 data for fleet mix and includes the OEHHA factor.

Based on the BAAQMD modeling, the project site has an estimated existing excess cancer risk between 9 per one million and 21 per one million due to nearby mobile sources for Parcels A through E. For Parcel F, the estimated excess existing cancer risk between 14 per one million and 17 per one million due to nearby mobile sources. The annual $PM_{2.5}$ concentration at the project site is between 0.2 µg/m^3 and 0.5 µg/m^3 for Parcels A through E and between 0.2 µg/m^3 and 0.4 µg/m^3 for Parcel F.

For stationary sources within 1,000 feet of the proposed project (relative to Parcels A through E and Parcel F), an emissions inventory of nearby existing stationary sources was provided by BAAQMD as summarized in **Table 5**. Health risk values were then calculated for each project parcel group (i.e. Parcels A-E and Parcel F) using BAAQMD-provided Health Risk Calculator (Beta 3.0). The results from these calculations are provided in **Tables 6** and **7** for Parcels A through E and Parcel F, respectively.

TABLE 5
NEARBY EXISTING STATIONARY SOURCES

Facility Name	BAAQMD Facility ID	Address	Source Type
Pacific Bell	13509	1121 Jefferson Avenue	Generator
Roy's Cleaners[1]	345	1100 El Camino Real	Dry cleaner
Premier Auto Collision Center	20979	1612 El Camino Real	Auto spray booth
Broadway Cleaners[1]	289	1681 Main Street	Dry cleaner
City of Redwood City #5546	17462	1017 Middlefield Road	Generator
Cooks AutoBody	4796	1104 Main Street	Auto spray booth
ARCO Facility #00306	110651	1700 Middlefield Road	Auto spray booth

[1] Emissions inventories do not include TACs that are part of BAAQMD Risk Calculator spreadsheet and are therefore not modeled.

TABLE 6
NEARBY EXISTING STATIONARY SOURCES CANCER RISK AND $PM_{2.5}$ – PARCELS A THROUGH E

Facility Name	Facility No.	Distance (m)	Diesel Generator (Y/N)	Total Cancer Risk	Total PM2.5
Cook's Autobody	4796	130	N	0	0
City of Redwood City #5546	17462	260	N	0.541	0.001
Premier Auto Collision Center	20979	35	Y	0	0
ARCO Facility #00306	110651	300	N	0.01	0
Pacific Bell	13509	300	Y	0.545	0.001
TOTAL				**1.096**	**0.002**

TABLE 7
NEARBY EXISTING STATIONARY SOURCES CANCER RISK AND $PM_{2.5}$ – PARCEL F

Facility Name	Facility No.	Distance (m)	Diesel Generator (Y/N)	Total Cancer Risk	Total PM2.5
City of Redwood City #5546	17462	260	N	0.541	0.001
ARCO Facility #00306	110651	300	N	0.01	0
Pacific Bell	13509	100	Y	2.999	0.004
TOTAL				**3.55**	**0.005**

Another source of diesel particulate are the locomotives that carry passenger and freight cars along the Caltrain rail line. The rail passes through downtown Redwood City and is located approximately 100 feet from the proposed project (Parcels A-E). Emissions from these sources were included as part of this analysis. A Caltrain Modernization (CalMod) Program (CalMod, 2019) is currently underway to electrify the Caltrain's commuter rail service and phase out the diesel locomotives. As of November 2019, the first passenger service with electric trains would begin in 2022. The existing funding for CalMod is to replace 75% of the Caltrain passenger fleet with electrified cars by 2023. Additional funding would be needed to reach 100% electrification. Therefore, with the occupancy of the proposed project beginning in 2023, it is assumed that 75% of the Caltrain locomotives will be electrified. Details on emissions and modeling are presented in Section 3.0 and 4.0.

3.0 Emissions Estimates

This HRA evaluates fine particulate matter ($PM_{2.5}$) emissions and emissions of diesel PM (assumed to be equivalent to $PM_{2.5}$ exhaust) and total organic gases or TOGs. These emissions estimates are then used to determine concentrations of each pollutant at sensitive receptor locations in order to report $PM_{2.5}$ concentrations and to then evaluate the excess cancer risk a receptor is exposed to as a result of the proposed project. This section identifies the methodologies used to estimate pollutant emissions.

The proposed project construction and operational air quality emissions were quantified according to guidance and methods from BAAQMD, ARB, and EPA as previously referenced above. The process for determining the parameters and assumptions used to model these emissions, along with the modeling methods, are described below. Attachment A of this HRA contains the detailed emissions output and a summary of the emissions used in this analysis is provided in Attachment A of this document.

Calculation Methodologies for Construction Emission Sources

Construction would generate emissions of criteria air pollutants, precursors, and TACs (e.g., diesel PM) from a variety of sources, including off-road construction equipment, on-road vehicles, earthmoving activities, and off-gassing from paving activities. Construction emissions are dependent on the following project information:

- schedule and duration of construction phases and subphases (e.g., site clearing, grading, excavation, building construction),
- types and sizes (site acreages and building square footages) of land uses to be developed,
- off-road construction equipment lists and activity schedules,
- volume of construction-related haul-truck traffic,
- volume of construction worker traffic,

- demolition of existing buildings/structures,
- earthmoving activities (e.g., cut/fill, grading), and
- acres of asphalt paving.

Construction of the project is estimated to start in 2020 and take approximately 2.5 years to complete parcels A through E and 14 months for parcel F, with various activities occurring in a sequential manner. The underground recycled water and sewer pipeline upgrades will be installed during the final 6-months (March through August) of construction.

Total construction emissions were calculated and converted from total tons to average pounds per day (lb/day) using the total days of construction to estimate the average daily emissions for the proposed project.

Off-Road Construction Equipment

Off-road construction equipment would generate exhaust-related emissions of criteria air pollutants, precursors, and TACs. To calculate emissions, the number and types of construction equipment required for each construction phase and subphase must be identified. Other parameters needed to quantify construction equipment emissions include hours of operation per day, horsepower, and the load factor for each respective piece of equipment.

The analysis performed used CalEEMod Version 2016.3.2, which was the most current version of the CalEEMod at the time of the analysis. ARB's OFFROAD 2011 emissions inventory was used by CalEEMod to calculate off-road emissions. Both EPA and the State of California have set emissions standards for new off-road equipment engines, ranging from Tier 1 to Tier 4. Tier 1 emission standards were phased in between 1996 and 2000, and Tier 4 interim and final emission standards for all new engines were phased in between 2008 and 2015. Default assumptions for the parameters noted above contained in CalEEMod were used to quantify emissions. Default assumptions typically are conservative, providing a reasonable upper boundary for potential construction emissions.

For uncontrolled emissions before mitigation techniques, the emission factors for the engines were based on the fleet average, which includes all tier engines, for the calendar year of the analysis. Mitigation to control emissions included using Tier 4 final emission standards for all off-road engines greater than 50 horsepower. Engines less than or equal to 50 horsepower used Tier 3 emission standards with Tier 3 particulate filters.

On-Road Vehicles

Mobile-source emissions for construction vehicles, worker, customer and residential trips were calculated using vehicle miles traveled (VMT) from the Transportation Impact Analysis (TIS) (Fehr & Peers, 2019) and CalEEMod. CalEEMod was used to estimate emissions resulting from these on-road emissions. PM2.5 exhaust emissions from DPM as well as reactive organic gas (ROG) emissions from gasoline exhaust are also estimated by CalEEMod. As noted above, PM2.5 exhaust was assumed to be DPM. Default assumptions for parameters such as construction-worker vehicles and on-site work trucks, trip distance, hauling trip numbers and vehicle type were estimated using CalEEMod. Daily material delivery trips and construction worker trips were estimated based on project staffing levels and number of vendor trucks per day for this project.

The CalEEMod emissions were scaled by trip length within the modeling domain divided by CalEEMod trip distance to determine the amount of emissions within the modeling domain the project. Air pollution emissions from CalEEMod were estimated using emission factors from EMFAC2014 and OFFROAD2011.

Off-Gas Emissions of Reactive Organic Gases

Asphalt paving and architectural coating activities during construction would generate off-gas ROG emissions. CalEEMod was used to estimate these off-gas ROG emissions. The data collection process determined the acres of asphalt paving required, which CalEEMod uses to determine associated ROG emissions. For architectural coatings, CalEEMod contains coating application assumptions based on the land use type and square footage of buildings to be constructed. CalEEMod assumes the total surface for painting equals 2.7 times the floor square footage for residential land uses and 2 times the square footage for nonresidential land uses.

SUMMARY OF CONSTRUCTION-RELATED CRITERIA POLLUTANT EMISSIONS

Uncontrolled Scenario

Tables 8 shows average daily construction emissions per construction year for both the proposed project parcels A through E and parcel F. **Appendix A** contains more detailed information on the emissions estimates and results.

As shown in **Table 8**, the proposed project for Parcels A-E plus Parcel F would generate maximum average daily emissions of approximately 32.2 pounds (lbs) of ROG, 95.1 lbs of oxides of nitrogen (NO_X), 3.0 lbs of PM_{10}, and 2.8 lbs of $PM_{2.5}$.

TABLE 8
SUMMARY OF MODELED DAILY AND ANNUAL (UNCONTROLLED) CONSTRUCTION-RELATED EMISSIONS OF CRITERIA POLLUTANTS AND PRECURSORS FOR PARCELS A-F

Portion of Construction Phase	Annual Emissions (tons/year)					
	ROG	NO_X	CO	SO_2	PM_{10}	$PM_{2.5}$
2020 Emissions	0.9	12.8	9.1	0.03	0.32	0.30
2021 Emissions	1.4	12.1	15.9	0.04	0.44	0.42
2022 Emissions[1]	7.3	3.4	5.2	0.01	0.13	0.12
Total Emissions (tons)	**9.6**	**28.3**	**30.2**	**0.08**	**0.89**	**0.84**
Average Daily Emissions	**lb/day**					
	32.2	**95.1**	**101.3**	**0.3**	**3.0**	**2.8**
BAAQMD significance threshold	54	54	N/A	N/A	82	54
Exceeds Threshold?	No	**Yes**	No	No	No	No

Notes: lb/day = pounds per day; tons/year = tons per year; ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter. Thresholds for particulate matter are for exhaust emissions only. Fugitive emissions must follow best management practices.

[1] Includes 6-month (March – August) water and sewer pipeline construction work.

Source: AECOM 2020; See Appendix A for detailed modeling assumptions, outputs, and results.

Controlled Scenario

A controlled scenario was analyzed to reduce construction-related emissions. EPA estimates that implementing the federal Tier 4 final engine standards for off-road construction equipment would reduce NO_X and PM emissions more than 90 percent compared to Tier 1, 2, and 3 engines (SCAQMD, 2014). In addition, twice daily watering of exposed areas to control fugitive particulate dust was included as mitigation during construction, which EPA estimates reduces PM emissions by 55%.

Table 9 summarizes the controlled lb/day emissions for parcels A through F. As shown in **Table 9**, the proposed project under the controlled scenario for Parcels A-F would generate maximum average daily emissions of approximately 27.8 pounds (lbs) of ROG, 44.1 lbs of oxides of nitrogen (NO_X), 0.4 lbs of PM_{10} and $PM_{2.5}$.

TABLE 9
SUMMARY OF MODELED DAILY AND ANNUAL (CONTROLLED) CONSTRUCTION-RELATED EMISSIONS OF CRITERIA POLLUTANTS AND PRECURSORS FOR PARCELS A-F

Portion of Construction Phase	Annual Emissions (tons/year)					
	ROG	**NO_X**	**CO**	**SO_2**	**PM_{10}**	**$PM_{2.5}$**
2020 Emissions	0.4	7.3	10.0	0.03	0.04	0.04
2021 Emissions	0.8	4.7	18.7	0.04	0.07	0.07
2022 Emissions[1]	7.1	1.3	6.1	0.01	0.02	0.02
Total Emissions (tons)	**8.3**	**13.3**	**34.8**	**0.08**	**0.13**	**0.13**
Average Daily Emissions	**lb/day**					
	27.8	**45.0**	**116.7**	**0.3**	**0.4**	**0.4**
BAAQMD significance threshold	54	54	N/A	N/A	82	54
Exceeds Threshold?	No	No	No	No	No	No

Notes: lb/day = pounds per day; tons/year = tons per year; ROG = reactive organic gases; NO_X = oxides of nitrogen; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter. Thresholds for particulate matter are for exhaust emissions only. Fugitive emissions must follow best management practices.

[1] Includes 6-month (March – August) water and sewer pipeline construction work.

Source: AECOM 2020; See Appendix A for detailed modeling assumptions, outputs, and results.

Calculation Methodologies for Operational Emission Sources

After construction of the proposed project, long-term operations would generate emissions of criteria air pollutants, precursors, and TACs (i.e., diesel PM) from a variety of stationary, area, and mobile sources.

Stationary Sources

AECOM assumes emergency generators and fire water pumps would be installed and used in both the residential and commercial buildings. These emergency generators would generate emissions of criteria pollutants and TACs. Based on information provided by Greystar, AECOM assumes that the proposed project would utilize up to eight emergency generators (stacks), two for each commercial building to be developed (building B, C, and E (north and south)). **Figure 5** shows the approximate proposed locations of the emergency generators.

Table 10 details the proposed size and manufacturer of each emergency generator and fire water pump, provided by Greystar. AECOM used emission factors and methods prescribed by ARB and EPA (e.g., AP-42, Compilation of Air Pollutant Emission Factors) to estimate emissions from these sources. Each emergency generator is assumed to meet a minimum of Tier 2 emission standards (before control measures) when they are installed in 2022, and to comply with BAAQMD Regulation

2, Rule 5, New Source Review for Toxic Air Contaminants. Each emergency generator is assumed to comply with BAAQMD testing limits of no more than 50 hours per year.

TABLE 10
PROPOSED EMERGENCY GENERATORS

Unit	Parcel Location	Size (hp)
Emergency Generator 1	Parcel B	335
Emergency Generator 2	Parcel B	335
Emergency Generator 3	Parcel C	335
Emergency Generator 4	Parcel C	335
Emergency Generator 5	Parcel E	335
Emergency Generator 6	Parcel E	335
Emergency Generator 7	Parcel E	335
Emergency Generator 8	Parcel E	335
Fire Water Pump 1	Parcel A	335
Fire Water Pump 2	Parcel D	335

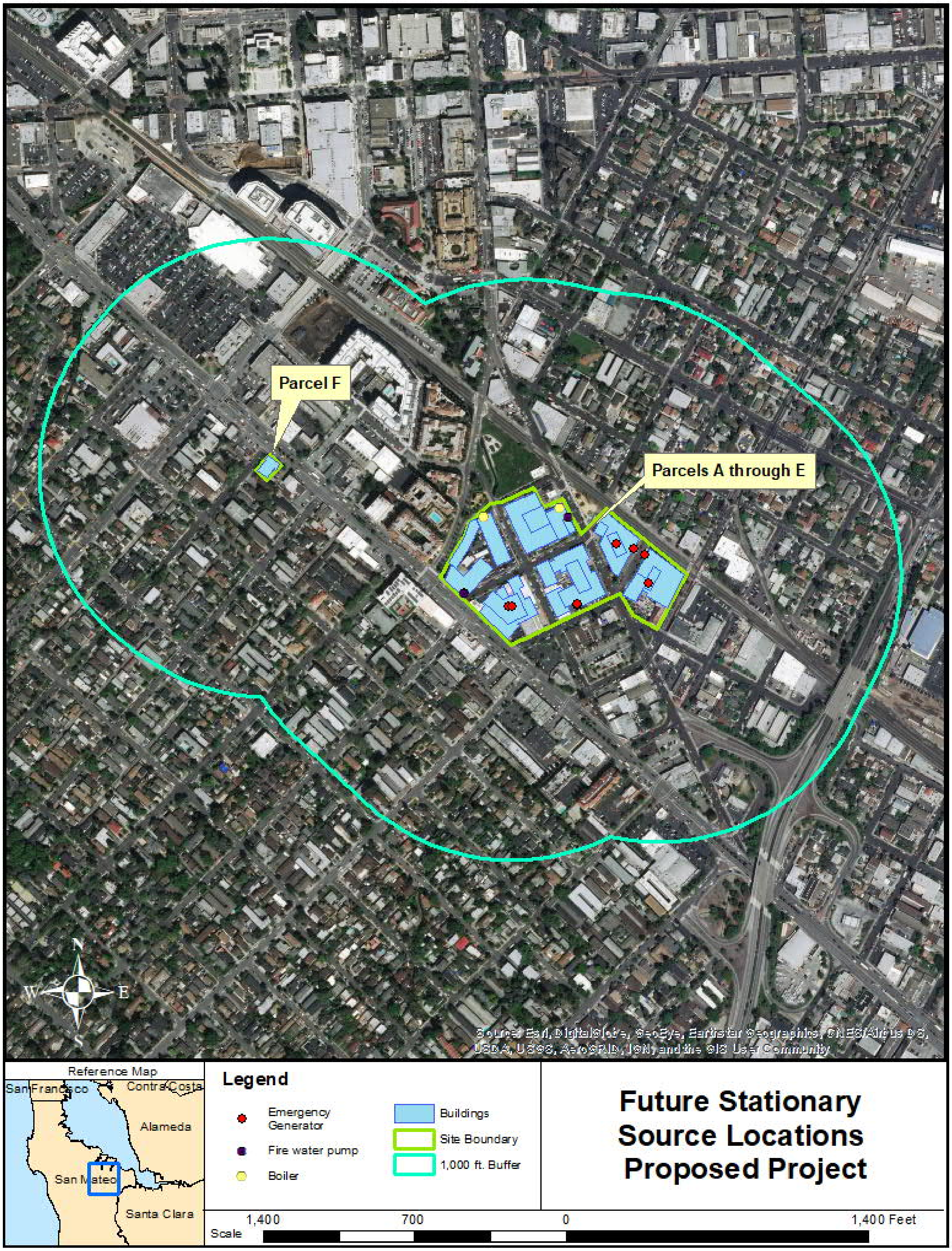
Note: hp = horsepower
Source: Greystar 2019

In addition to the emergency generator point sources, the proposed project will also add two small boilers within parcel A and parcel D (one boiler in each) for the residential complexes to be built on those sites (**Figure 3**). The proposed size and manufacturer of each boiler is assumed to be 0.5 MMBtu/hr. AECOM used emission factors and methods prescribed by ARB and EPA (e.g., AP-42, Compilation of Air Pollutant Emission Factors) to estimate emissions from this source. Both boilers are assumed to operate 8760 hours per year (i.e. continuously).

Mobile Sources

Mobile-source emissions under each project scenario were calculated using default VMT results from CalEEMod and then compared with the daily trip estimates from the TIS prepared for the project (Fehr & Peers, 2019). The CalEEMod emissions estimates account for variation in the number of trips for weekend travel, where the TIS output estimate is an average weekday daily trip estimate. In addition, CalEEMod appropriately assigns trips and VMT to the correct proposed land uses (including the recreational and school uses) and property, whereas the TIS trip estimates are based on an overall summary of residential, office, and retail land uses only. CalEEMod's variation for weekday and weekend travel and default trip lengths were combined with the number of trips per day provided by Fehr & Peers to estimate VMT and associated vehicle emissions. As described for construction on-road vehicles, CalEEMod Version 2016.3.2 incorporates EMFAC2014 mobile-source emission factors.

Figure 5: Locations of Emergency Generators Associated with the Proposed Project



SUMMARY OF EXISTING AND PROJECT-RELATED OPERATIONAL CRITERIA POLLUTANT EMISSIONS

Existing Project Area Operations – Parcels A-F

Table 11 and **Table 12** present existing land use daily and annual emissions, respectively, associated with the project area for Parcels A through F. **Appendix A** contains more detailed information on the emissions estimates and results.

TABLE 11
TOTAL AVERAGE DAILY OPERATIONAL EMISSIONS (LB/DAY)

Type	ROG	NOx	PM_{10}	$PM_{2.5}$
Area	2.37	0.02	0.01	0.01
Energy	0.08	0.69	0.05	0.05
Mobile	2.55	6.84	4.97	1.39
Waste	0.00	0.00	< 0.01	< 0.01
Water	0.00	0.00	< 0.01	< 0.01
Total Average Daily Emissions (lb/day)	**5.0**	**7.50**	**5.03**	**1.45**

Notes: lb/day = pounds per day; NOx = oxides of nitrogen; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; ROG = reactive organic gases
Source: Compiled by AECOM in 2020.

TABLE 12
TOTAL ANNUAL OPERATIONAL EMISSIONS (TPY)

Type	ROG	NOx	PM_{10}	$PM_{2.5}$
Area	0.43	0.00	0.00	0.00
Energy	0.01	0.13	0.01	0.01
Mobile	0.47	1.25	0.91	0.25
Waste	0.00	0.00	0.00	0.00
Water	0.00	0.00	0.00	0.00
Total Annual Emissions (tpy)	**0.91**	**1.38**	**0.92**	**0.26**

Notes: tpy = tons per year; NOx = oxides of nitrogen; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; ROG = reactive organic gases
Source: Compiled by AECOM in 2020.

Total Future Project Operations – Parcels A-F

Table 13 and **Table 14** present daily and annual operational emissions, respectively, associated with the proposed project for Parcels A through F. **Table 15** summarizes the $PM_{2.5}$ emissions and **Table 16** and **Table 17** summarize the TAC emissions used in the dispersion modeling analyses. The CalEEMod emissions were scaled by trip length within the modeling domain divided by CalEEMod trip distance to determine the amount of emissions within modeling domain of the proposed project. **Appendix A** contains more detailed information on the emissions estimates and results.

TABLE 13
TOTAL AVERAGE DAILY OPERATIONAL EMISSIONS (LB/DAY)

Type	ROG	NOx	PM_{10}	$PM_{2.5}$
Stationary	0.51	8.06	0.34	0.34
Area	29.04	0.36	0.13	0.13
Energy	0.46	4.12	0.32	0.32
Mobile	8.85	27.14	33.19	9.11
Waste	0.00	0.00	0.00	0.00
Water	0.00	0.00	0.00	0.00
Total Average Daily Emissions (lb/day)	**38.9**	**39.7**	**34.0**	**9.9**
BAAQMD significance threshold	**54**	**54**	**82**	**54**
Exceeds Threshold?	No	No	No	No

Notes: lb/day = pounds per day; NOx = oxides of nitrogen; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; ROG = reactive organic gases
Source: Compiled by AECOM in 2020.

TABLE 14
TOTAL ANNUAL OPERATIONAL EMISSIONS (TPY)

Type	ROG	NOx	PM_{10}	$PM_{2.5}$
Stationary	0.09	1.47	0.06	0.06
Area	5.30	0.07	0.02	0.02
Energy	0.08	0.75	0.06	0.06
Mobile	1.62	4.95	6.06	1.66
Waste	0.00	0.00	< 0.01	< 0.01
Water	0.00	0.00	< 0.01	< 0.01
Total Annual Emissions (tpy)	**7.09**	**7.24**	**6.20**	**1.81**
BAAQMD significance threshold	**10**	**10**	**15**	**10**
Exceeds Threshold?	No	No	No	No

Notes: tpy = tons per year; NOx = oxides of nitrogen; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; ROG = reactive organic gases
Source: Compiled by AECOM in 2020.

TABLE 15
TOTAL ANNUAL $PM_{2.5}$ OPERATIONAL EMISSIONS (TPY)

Sources	Parcel Location	Vehicle $PM_{2.5}$ Brake Wear and Tire Wear (tpy)	Vehicle $PM_{2.5}$ Exhaust (tpy)	Vehicle $PM_{2.5}$ Total (tpy)	Stationary Boiler $PM_{2.5}$ Total (tpy)	Stationary Engine Tier 2 $PM_{2.5}$ Total (tpy)	Stationary Engine Tier 4 $PM_{2.5}$ Total (tpy)
Emergency Generator 1	Parcel B	–	–	–	–	2.77E-03	2.77E-04
Emergency Generator 2	Parcel B	–	–	–	–	2.77E-03	2.77E-04
Emergency Generator 3	Parcel C	–	–	–	–	2.77E-03	2.77E-04
Emergency Generator 4	Parcel C	–	–	–	–	2.77E-03	2.77E-04
Emergency Generator 5	Parcel E	–	–	–	–	2.77E-03	2.77E-04
Emergency Generator 6	Parcel E	–	–	–	–	2.77E-03	2.77E-04
Emergency Generator 7	Parcel E	–	–	–	–	2.77E-03	2.77E-04
Emergency Generator 8	Parcel E	–	–	–	–	2.77E-03	2.77E-04
Fire Water Pump 1	Parcel A	–	–	–	–	2.77E-03	–
Fire Water Pump 2	Parcel D	–	–	–	–	2.77E-03	–
Boiler 1	Parcel A	–	–	–	1.69E-02	–	–
Boiler 2	Parcel D	–	–	–	1.69E-02	–	–
Mobile	–	1.6134	0.0500	1.6634	–	–	–

Notes: $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; tpy = tons per year
Source: Compiled by AECOM in 2020.

TABLE 16
TOTAL ANNUAL OPERATIONAL EMISSIONS OF TOXIC AIR CONTAMINANTS, ENGINES AND MOBILE SOURCES (LB/YR)

Sources	Parcel Location	ROG (lb/yr)	Tier 2 Engine Diesel PM (lb/yr)	Tier 4 Engine Diesel PM (lb/yr)
Emergency Generator 1	Parcel B	–	17.6	1.76
Emergency Generator 2	Parcel B	–	17.6	1.76
Emergency Generator 3	Parcel C	–	17.6	1.76
Emergency Generator 4	Parcel C	–	17.6	1.76
Emergency Generator 5	Parcel E	–	17.6	1.76
Emergency Generator 6	Parcel E	–	17.6	1.76
Emergency Generator 7	Parcel E	–	17.6	1.76
Emergency Generator 8	Parcel E	–	17.6	1.76
Fire Water Pump 1	Parcel A	–	5.54	–
Fire Water Pump 2	Parcel D	–	5.54	–
Mobile[1,2]	–	252.26	8.09	–

Notes: lb/yr = pounds per year; PM = particulate matter; ROG = reactive organic gases
1. CalEEMod emissions were scaled by trip length within the modeling domain divided by CalEEMod trip distance, which was calculated to be 11%.
2. Mobile emissions include traffic for Parcels A through F.

Source: Compiled by AECOM in 2020.

TABLE 17
TOTAL ANNUAL AND SHORT-TERM OPERATIONAL EMISSIONS OF TOXIC AIR CONTAMINANTS, BOILERS (PER BOILER)

Pollutant	Annual Emissions (lb/yr)	Short Term Emissions (lb/hr)
Benzene	1.94	2.21E-04
Formaldehyde	3.87	4.42E-04
Hexane	0.97	1.10E-04
Toluene	0.97	1.10E-04

Notes: lb/yr = pounds per year; lb/hr = pounds per hour
Source: Compiled by AECOM in 2020.

Net Project Area Operations – Parcels A-F

Table 18 and **Table 19** present the net daily and annual emissions, respectively, associated with the project area for Parcels A through F (future project minus existing conditions). These net project emissions plus the project related stationary source emissions shown in **Tables 15, 16** and **17** were used in the dispersion modeling analyses. **Appendix A** contains more detailed information on the emissions estimates and results.

TABLE 18
NET AVERAGE DAILY OPERATIONAL EMISSIONS (LB/DAY)

Type	ROG	NOx	PM_{10}	$PM_{2.5}$
Stationary Sources	0.51	8.06	0.34	0.34
Area	26.67	0.34	0.12	0.12
Energy	0.39	3.43	0.27	0.27
Mobile	6.30	20.30	28.22	7.73
Waste	0.00	0.00	0.00	0.00
Water	0.00	0.00	0.00	0.00
Total Average Daily Emissions (lb/day)	**33.9**	**32.1**	**28.9**	**8.5**
BAAQMD significance threshold	**54**	**54**	**82**	**54**
Exceeds Threshold?	No	No	No	No

Notes: lb/day = pounds per day; NOx = oxides of nitrogen; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; ROG = reactive organic gases
Source: Compiled by AECOM in 2020.

TABLE 19
NET ANNUAL OPERATIONAL EMISSIONS (TPY)

Type	ROG	NOx	PM_{10}	$PM_{2.5}$
Stationary	0.09	1.47	0.06	0.06
Area	4.87	0.06	0.02	0.02
Energy	0.07	0.63	0.05	0.05
Mobile	1.15	3.70	5.15	1.41
Waste	0.00	0.00	0.00	0.00
Water	0.00	0.00	0.00	0.00
Total Annual Emissions (tpy)	**6.18**	**5.86**	**5.28**	**1.54**
BAAQMD significance threshold	**10**	**10**	**15**	**10**
Exceeds Threshold?	No	No	No	No

Notes: tpy = tons per year; NOx = oxides of nitrogen; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; PM_{10} = particulate matter with aerodynamic diameter less than 10 microns; ROG = reactive organic gases
Source: Compiled by AECOM in 2020.

Caltrain Rail Line Sources

Diesel locomotives are currently utilized along the Caltrain railway, which is located approximately 100 feet from the proposed project (Parcels A-E). Emissions from these sources were included as part of the analysis. A Caltrain Modernization (CalMod) Program (CalMod, 2019) is currently underway to electrify the Caltrain's commuter rail service and phase out the diesel locomotives. As of November 2019, the first passenger service with electric trains would begin in 2022. The existing funding for CalMod is to replace 75% of the Caltrain passenger fleet with electrified cars by 2023. Additional funding would be needed to reach 100% electrification. With occupancy of the proposed project occurring as 75% of the Caltrain passenger fleet is electrified, this HRA assumes that 75% of the passenger trains will be electric and the remaining 25% still operating on diesel.

The current (as of September 2019) Caltrain schedule (Caltrain, 2019) indicates there are 92 weekday trains and 52 weekend trains that would pass the proposed project site. Of the 92 weekday trains, 76 make stops at Redwood City Station and 16 pass-through without stopping at the station. On the weekends all trains make a stop at Redwood City Station. Of the 52 weekend trains, 48 trains occur both Saturday and Sunday, with an additional 4 stops on Saturday only. Freight trains also operate along the Caltrain railway, with 4 freight trains passing the proposed project site on a daily basis (Bay Area Regional Rail Plan, 2006).

Emissions from trains operating along the Caltrain railway were calculated using EPA emission factors for locomotive (EPA 2009) and CARB adjustment factors to account for fuels used in California (CARB, 2006). **Table 20** summarizes the locomotive DPM emission factors used in the modeling.

As part of a supplemental analysis of TAC impacts from Caltrain sources prepared by Illingworth and Rodkin, Inc. (Illingworth & Rodkin, 2017) for Greystar at 1409 El Camino Real, train speed was factored into the emission calculation. Given the very close proximity between this proposed project and the 1409 El Camino Real project, the same methodology was incorporated into the emission calculations. This methodology includes the following assumptions:

- Trains stopping at Redwood City station are assumed to be traveling at an average speed of 10 mph. For the proposed project, this would be the track segment north of Maple Street.
- Trains passing through and not stopping at Redwood City and those traveling south of Maple Street are assumed to be traveling at an average speed of 40 mph.

Average DPM emissions from the Caltrain passenger and freight trains for the 30-year cancer risk period were calculated based on average EPA emission factors for periods 2023-2025, 2026-2033, 2034-2041 and 2042-2052. Health risk impacts are assessed on both Parcels A through E and Parcel F, separately, from Caltrain rail sources within 1,000 feet of each parcel grouping. **Tables 21** and **22** summarizes the locomotive DPM emission factors used for impacts on Parcels A through E and on Parcel F, respectively.

TABLE 20
LOCOMOTIVE DPM EMISSION FACTORS (G/HP-HR)

Train Type	2023-2025	2026-2033	2034-2041	2042-2052
Passenger	0.074	0.042	0.020	0.014
Freight	0.083	0.054	0.026	0.019

[1] grams per horsepower – hour (g/hp-hr)
[2] Average factor for period.

TABLE 21
CALTRAIN PASSENGER AND FREIGHT TRAIN MODELED SOURCE PARAMETERS – PARCELS A-E CASE[4]

Year	Description	Model ID	DPM Emission Rates				$PM_{2.5}$ Emission Rates[3]			
			Average Daily Emission Rate (g/mi/day)[1,2]	Average Daily Emission Rate (g/day)	Link Emission Rate (g/s)	Link Emission Rate (lb/hr)	Average Daily Emission Rate (g/mi/day)	Average Daily Emission Rate (g/day)	Link Emission Rate (g/s)	Link Emission Rate (lb/hr)
2023-2025	Caltrain North - Near Station	CLTRN10	184.8	22.4	2.60E-04	2.06E-03	170.0	20.6	2.39E-04	1.90E-03
	Caltrain North - Skip Station	CLTRS40	8.2	3.5	4.02E-05	3.19E-04	7.5	3.2	3.70E-05	2.94E-04
	Passenger - Caltrain South	CLTRSK40	54.4	29.7	3.43E-04	2.73E-03	50.0	27.3	3.16E-04	2.51E-03
	Freight Trains	FRIEGHT	19.3	10.5	1.22E-04	9.69E-04	17.8	9.7	1.12E-04	8.91E-04
	Total	**-**	**266.7**	**66.1**	**7.65E-04**	**6.07E-03**	**245.3**	**60.8**	**7.04E-04**	**5.59E-03**
2026-2033	Caltrain North - Near Station	CLTRN10	105.5	12.8	1.48E-04	1.18E-03	97.0	11.8	1.36E-04	1.08E-03
	Caltrain North - Skip Station	CLTRS40	4.7	2.0	2.29E-05	1.82E-04	4.3	1.8	2.11E-05	1.68E-04
	Passenger - Caltrain South	CLTRSK40	31.0	16.9	1.96E-04	1.56E-03	28.5	15.6	1.80E-04	1.43E-03
	Freight Trains	FRIEGHT	8.2	4.5	5.20E-05	4.13E-04	7.6	4.1	4.78E-05	3.80E-04
	Total	**-**	**149.4**	**36.2**	**4.19E-04**	**3.33E-03**	**137.4**	**33.3**	**3.86E-04**	**3.06E-03**
2034-2041	Caltrain North - Near Station	CLTRN10	51.2	6.2	7.20E-05	5.71E-04	47.1	5.7	6.62E-05	5.26E-04
	Caltrain North - Skip Station	CLTRS40	2.3	1.0	1.11E-05	8.84E-05	2.1	0.9	1.03E-05	8.14E-05
	Passenger - Caltrain South	CLTRSK40	15.1	8.2	9.52E-05	7.55E-04	13.9	7.6	8.76E-05	6.95E-04
	Freight Trains	FRIEGHT	4.0	2.2	2.53E-05	2.00E-04	3.7	2.0	2.32E-05	1.84E-04
	Total	**-**	**72.6**	**17.6**	**2.04E-04**	**1.62E-03**	**66.8**	**16.2**	**1.87E-04**	**1.49E-03**
2042-2052	Caltrain North - Near Station	CLTRN10	36.2	4.4	5.08E-05	4.03E-04	33.3	4.0	4.67E-05	3.71E-04
	Caltrain North - Skip Station	CLTRS40	1.6	0.7	7.87E-06	6.24E-05	1.5	0.6	7.24E-06	5.74E-05
	Passenger - Caltrain South	CLTRSK40	10.6	5.8	6.72E-05	5.33E-04	9.8	5.3	6.18E-05	4.91E-04
	Freight Trains	FRIEGHT	2.8	1.5	1.78E-05	1.42E-04	2.6	1.4	1.64E-05	1.30E-04
	Total	**-**	**51.2**	**12.4**	**1.44E-04**	**1.14E-03**	**47.1**	**11.4**	**1.32E-04**	**1.05E-03**

Notes: Assumes 1 locomotive per train and engine load at 60%.

[1] CARB fuel factors = 0.709 (passenger); 0.84 (freight)
[2] Locomotive horsepower = 3,467 (passenger); 2,300 (freight)
[3] $PM_{2.5}$ to DPM Ratio = 0.92 (CARB CEIDERS)
[4] Assumes 75% of Caltrain passenger fleet is electrified and 25% are diesel by 2023.

TABLE 22
CALTRAIN PASSENGER AND FREIGHT TRAIN MODELED SOURCE PARAMETERS – PARCEL F CASE[4]

Year	Description	Model ID	DPM Emission Rates				$PM_{2.5}$ Emission Rates[3]			
			Average Daily Emission Rate (g/mi/day)[1,2]	Average Daily Emission Rate (g/day)	Link Emission Rate (g/s)	Link Emission Rate (lb/hr)	Average Daily Emission Rate (g/mi/day)	Average Daily Emission Rate (g/day)	Link Emission Rate (g/s)	Link Emission Rate (lb/hr)
2023-2025	Caltrain North - Near Station	CLTRN10	184.8	44.5	5.15E-04	4.09E-03	170.0	41.0	4.74E-04	3.76E-03
	Caltrain North - Skip Station	CLTRS40	8.2	0.1	9.47E-07	7.52E-06	7.5	0.1	8.72E-07	6.92E-06
	Passenger - Caltrain South	CLTRSK40	54.4	13.6	1.57E-04	1.25E-03	50.0	12.5	1.44E-04	1.15E-03
	Freight Trains	FRIEGHT	19.3	4.8	5.58E-05	4.43E-04	17.8	4.4	5.13E-05	4.07E-04
	Total	**-**	**266.7**	**63.0**	**7.29E-04**	**5.79E-03**	**245.3**	**57.9**	**6.71E-04**	**5.32E-03**
2026-2033	Caltrain North - Near Station	CLTRN10	105.5	25.4	2.94E-04	2.33E-03	97.0	23.4	2.71E-04	2.15E-03
	Caltrain North - Skip Station	CLTRS40	4.7	0.0	5.41E-07	4.29E-06	4.3	0.0	4.97E-07	3.95E-06
	Passenger - Caltrain South	CLTRSK40	31.0	7.7	8.96E-05	7.11E-04	28.5	7.1	8.24E-05	6.54E-04
	Freight Trains	FRIEGHT	8.2	2.1	2.38E-05	1.89E-04	7.6	1.9	2.19E-05	1.74E-04
	Total	**-**	**149.4**	**35.2**	**4.08E-04**	**3.24E-03**	**137.4**	**32.4**	**3.75E-04**	**2.98E-03**
2034-2041	Caltrain North - Near Station	CLTRN10	51.2	12.3	1.43E-04	1.13E-03	47.1	11.4	1.31E-04	1.04E-03
	Caltrain North - Skip Station	CLTRS40	2.3	0.0	2.63E-07	2.08E-06	2.1	0.0	2.42E-07	1.92E-06
	Passenger - Caltrain South	CLTRSK40	15.1	3.8	4.35E-05	3.45E-04	13.9	3.5	4.00E-05	3.18E-04
	Freight Trains	FRIEGHT	4.0	1.0	1.15E-05	9.16E-05	3.7	0.9	1.06E-05	8.43E-05
	Total	**-**	**72.6**	**17.1**	**1.98E-04**	**1.57E-03**	**66.8**	**15.8**	**1.82E-04**	**1.45E-03**
2042-2052	Caltrain North - Near Station	CLTRN10	36.2	8.7	1.01E-04	8.00E-04	33.3	8.0	9.28E-05	7.36E-04
	Caltrain North - Skip Station	CLTRS40	1.6	0.0	1.85E-07	1.47E-06	1.5	0.0	1.71E-07	1.35E-06
	Passenger - Caltrain South	CLTRSK40	10.6	2.7	3.07E-05	2.44E-04	9.8	2.4	2.82E-05	2.24E-04
	Freight Trains	FRIEGHT	2.8	0.7	8.15E-06	6.47E-05	2.6	0.6	7.50E-06	5.95E-05
	Total	**-**	**51.2**	**12.1**	**1.40E-04**	**1.11E-03**	**47.1**	**11.1**	**1.29E-04**	**1.02E-03**

Notes: Assumes 1 locomotive per train and engine load at 60%.

[1] CARB fuel factors = 0.709 (passenger); 0.84 (freight)
[2] Locomotive horsepower = 3,467 (passenger); 2,300 (freight)
[3] $PM_{2.5}$ to DPM Ratio = 0.92 (CARB CEIDERS)
[4] Assumes 75% of Caltrain passenger fleet is electrified and 25% are diesel by 2023.

4.0 Air Dispersion Modeling

Consistent with BAAQMD guidance, the air toxics analysis evaluated health risks and $PM_{2.5}$ concentrations imposed by the proposed project on the surrounding community per year of construction and under full operational conditions. The American Meteorological Society/EPA Regulatory Model (AERMOD) dispersion model (Version 19191) was used to estimate pollutant concentrations at specific distances from emission sources using 5 years (2009-2014) of hourly meteorological data from the San Carlos Airport station, consistent with BAAQMD guidance and 1409 El Camino Real health risk modeling. The predominant wind flow is to the southeast, as shown by the 5-year wind rose (**Figure 6**).

Terrain elevations were obtained from commercially available digital terrain elevations developed by the U.S. Geological Survey by using its 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 U.S. Geological Survey specifies coordinates in North American Datum 83, UTM Zone 10. Lakes Environmental software was used to process the NED data and assign elevations to the receptor locations and sources.

Receptor Locations

Receptor locations for on-site and off-site receptors under the proposed project are shown in **Figures 3** and **4**, respectively. A single childcare facility currently resides within 1,000 ft of the proposed project at 1500 El Camino Real (approximately 120 feet to the west-southwest of Parcels A through E). Sensitive receptors were assigned a flagpole height of 1.5 meters for the ground-level and 6.0 meters for second-floor residences. Since concentrations generally decrease with height from near ground-level sources, the highest flagpole height used was 6.0 meters. A grid of receptors with 20-meter spacing was modeled for both on-site and off-site receptors.

Further information regarding exposure scenarios evaluated for these receptor locations is provided in **Section 4.0**, “Health Risk Analysis.”

Construction Sources

Off-road construction equipment was represented by area sources. The locations of the area sources vary by construction phase. Demolition, excavation and rough and fine grading were represented by a separate area source of the same footprint as each of the parcel sites (A through F). For construction of the project buildings, multiple adjacent volume sources were located over areas of the project site where buildings are proposed to be built. To account for potential turbulent mixing that can occur with exhaust releases by construction equipment, an initial vertical dimension of 1.4 meters for each area source was used.

On-road emissions from construction worker vehicles, haul trucks, material delivery trucks, and on-site work trucks traveling to and from the project site were modeled as adjacent volume sources. The release height of these sources was set to 2 meters and the initial vertical dimension was set to 2.3 meters. The initial lateral dimensions vary depending on roadway width. Based on consultation with Fehr & Peers, the route modeled for the on-road traffic consisted of a primary and secondary route. The primary access route was off El Camino Real. The alternate route would occur from Main Street to the project site. The primary route was assigned 80% of on-road emissions, while 20% were assigned to the alternative route. Both primary and alternate on-road traffic routes used the same route on route-84. On-road traffic within 1,000 feet of the project site was modeled.

Figure 6: San Carlos Airport Wind Rose (2009-2014)

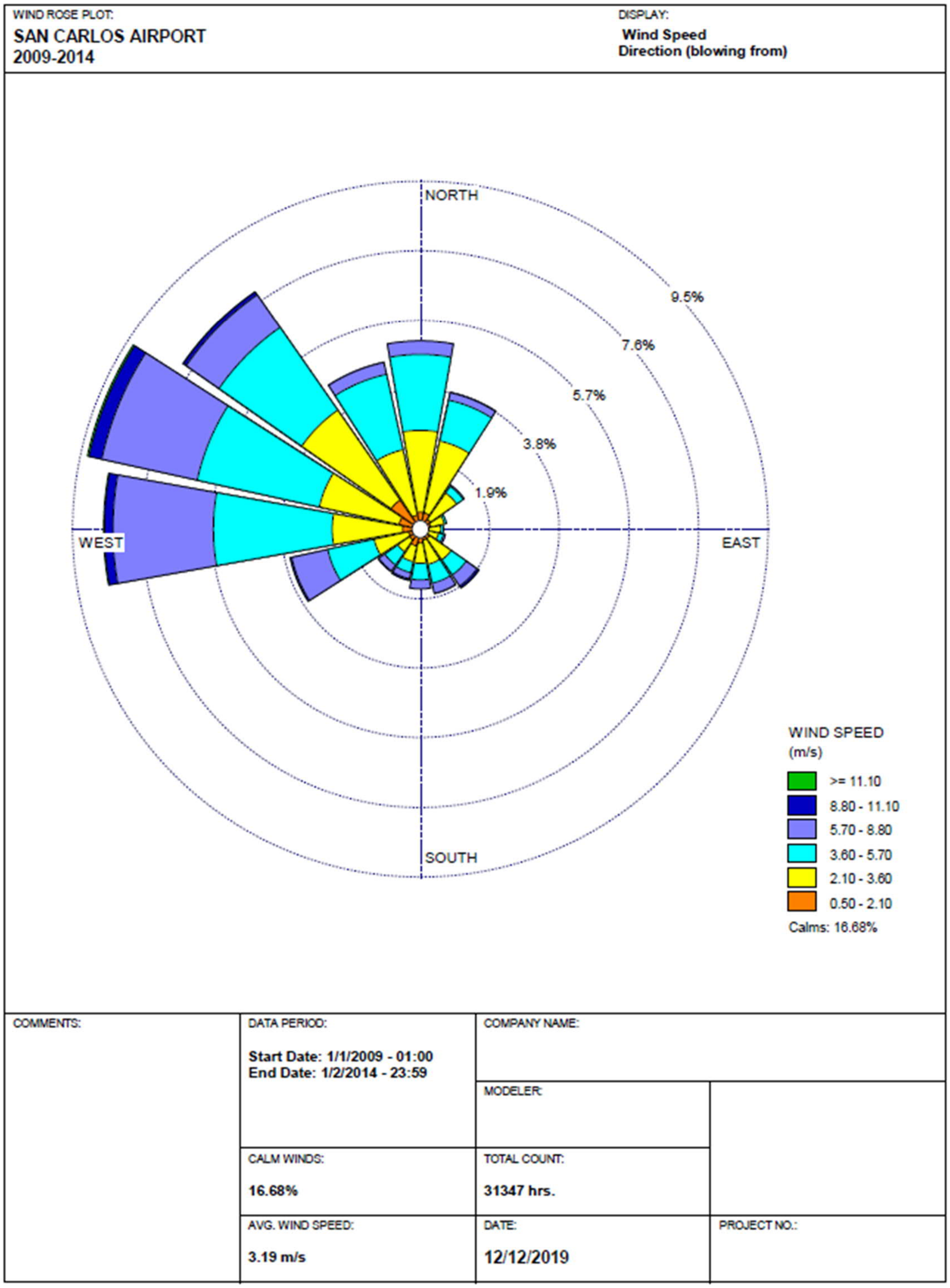


Figure 7 illustrates the on-road vehicle route modeled for project construction. The modeling parameters for the area and roadway sources are summarized in **Appendix B**.

Construction is anticipated to occur Monday through Friday from 8 a.m. to 7 p.m. (3,380 hours per year); therefore, those hours were modeled in AERMOD using the EMISFACT HRDOW keywords. For the proposed project, this includes construction diesel PM and $PM_{2.5}$ emissions.

Construction emissions associated with the new underground water and sewer pipelines is expected to consist of both off-road and on-road equipment. Construction of the two pipelines would be concurrent. It is estimated that over the course of 27 days, 150 feet per day for each new pipeline would be installed with a total length of approximately 3,200 feet for each pipeline. The pipeline construction emissions account for less than 1.5% of the average daily of the project $PM_{2.5}$ emissions in 2022. Given that construction activities directly associated parcel development would drive modeled concentrations from the project, the health risk assessment includes the pipeline segments within 1,000 ft of the project parcels (A through F). **Figure 8** shows the pipeline segments modeled.

Consistent with the construction of parcels A through F, on-road emissions from construction worker vehicles, haul trucks, material delivery trucks, and on-site work trucks traveling to and from the pipeline construction area were modeled as adjacent volume sources. The release height of these sources was set to 2 meters and the initial vertical dimension was set to 2.3 meters. The initial lateral dimensions vary depending on roadway width. The route modeled for on-road traffic supporting the pipeline installation is shown in **Figure 9**. On-road traffic within 1,000 feet of the project site was modeled.

The modeling parameters for the pipeline area and supporting roadway sources are summarized in **Appendix B**.

Operational Sources

Operational emission sources evaluated in the dispersion modeling included on-road vehicles, firewater pumps, emergency generators, and boiler. AECOM modeled the on-road emissions from operational vehicles associated with the project site as adjacent volume sources. The release height of these sources was set to 2 meters and the initial vertical dimension was set to 2.3 meters. The initial lateral dimensions vary depending on roadway width. Project-generated on-road traffic within 1,000 feet of the project site was modeled. The source parameters are summarized in **Appendix B**. Based on consultation with Fehr & Peers, on-road traffic was modeled for routes within 1,000 ft of the project. **Figure 10** illustrates the on-road vehicles routes modeled for project operation. AECOM used the EMFAC Gasoline Total Organic Gases Speciation to model TACs from non-diesel vehicles as shown in **Table 23**.

TABLE 23
PROPOSED EMFAC GASOLINE TOTAL ORGANIC GASES SPECIATION

Toxic Compounds	EMFAC Gasoline TOG Speciation (% of TOG)
Acetaldehyde	0.28%
Acrolein	0.13%
Benzene	2.47%
1,3-Butadiene	0.55%
Ethylbenzene	1.05%
Formaldehyde	1.58%
Hexane	1.60%
Methanol	0.12%
Methyl Ethyl Ketone	0.02%
Naphthalene	0.05%
Propylene	3.06%
Styrene	0.12%
Toluene	5.76%
Xylenes	4.80%

Notes: EMFAC = Emission FACtors; TOG = total organic gases
Source: BAAQMD, 2012.

Figure 7: On-Road Vehicle Route (Construction Phase)

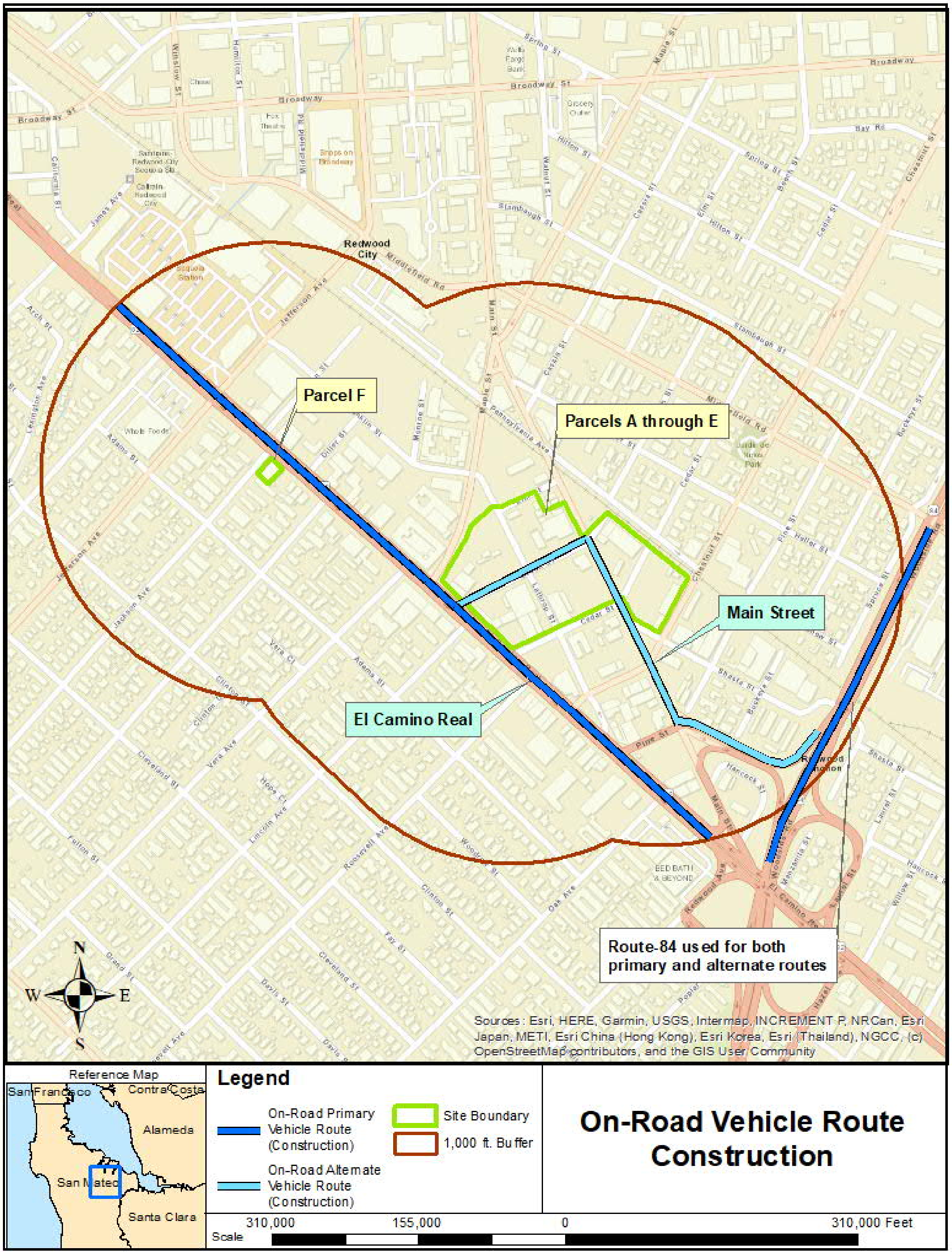


Figure 8: Proposed Water & Sewer Pipeline (Construction Phase)

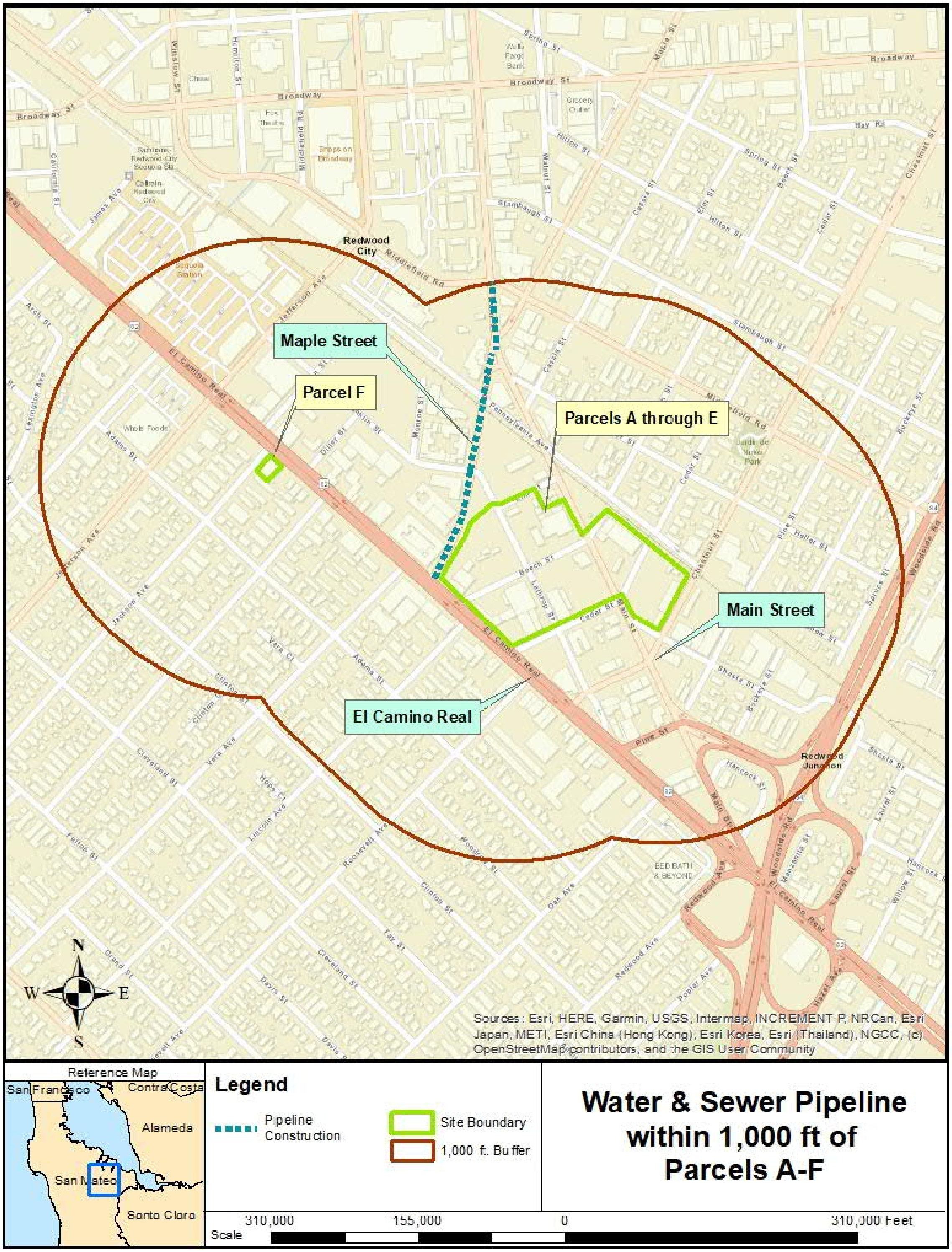


Figure 9: Proposed Water & Sewer Pipeline On-Road Vehicle Route (Construction Phase)

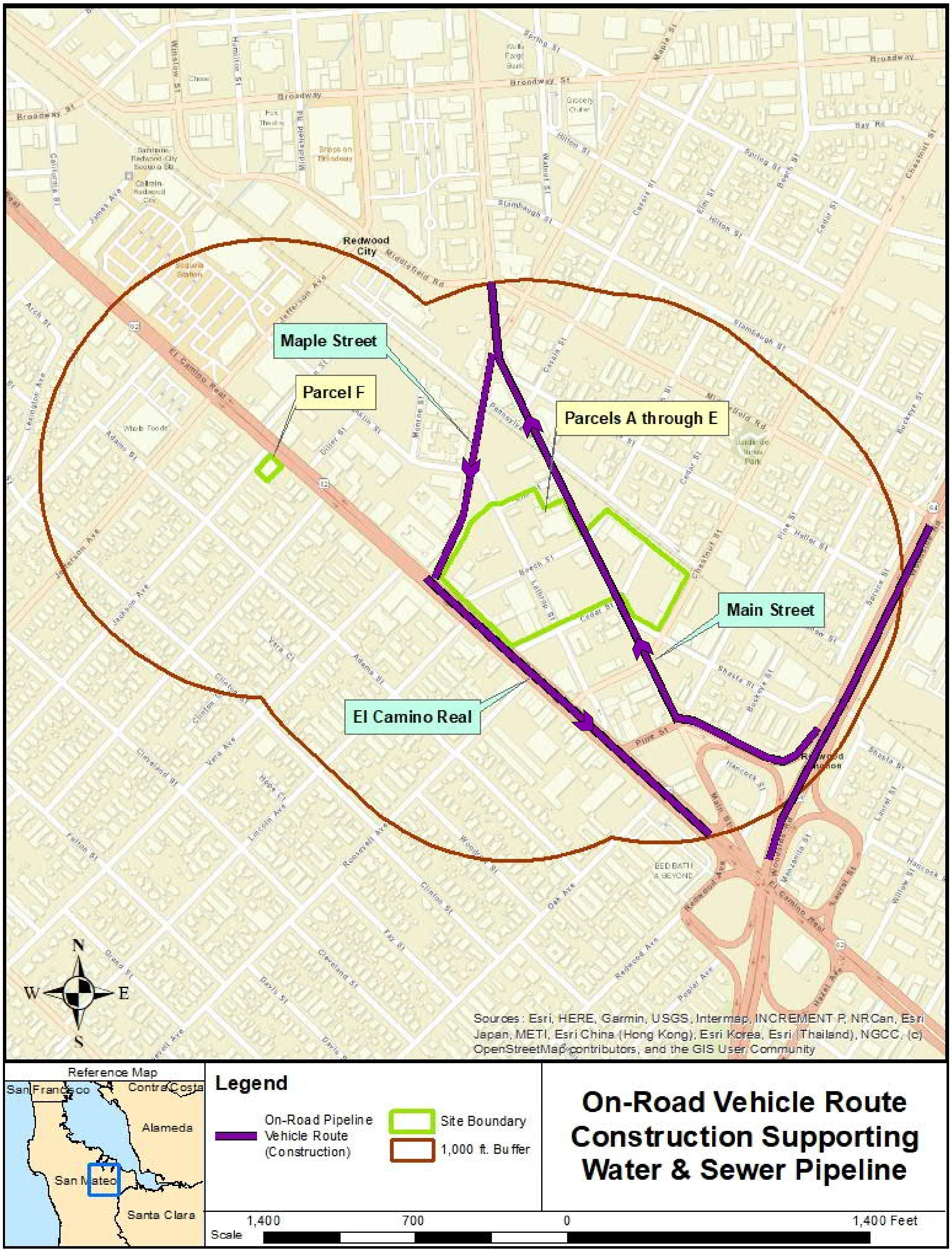
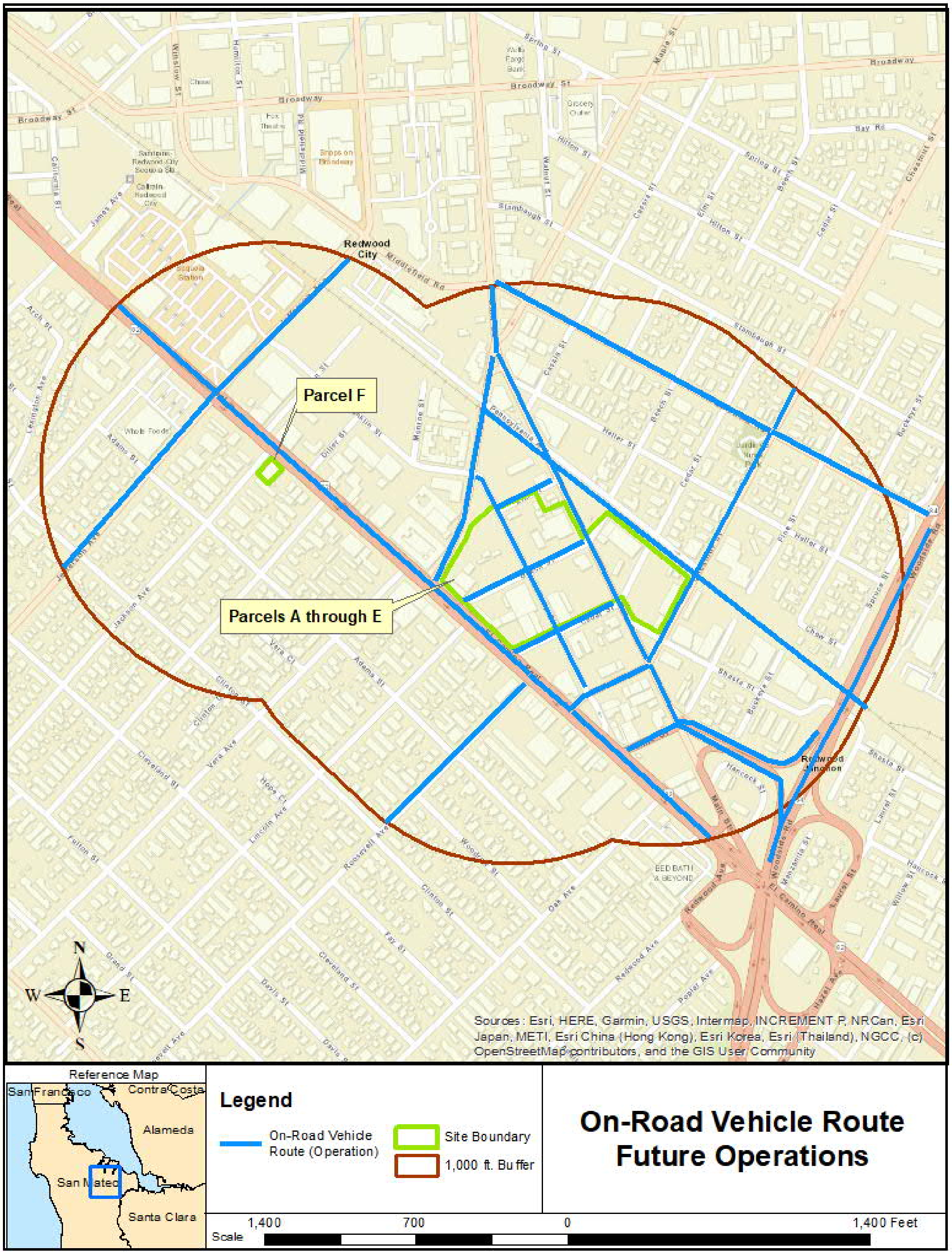


Figure 10: On-Road Vehicle Routes (Operational Phase)



AECOM assumed that operational emissions from the proposed project would include the operation of up to eight emergency generators and one boiler. These sources were modeled as point sources. The stack height for the generators varied. Two generators at building E will be located at ground-level, while the remaining six generators exhausted 2-feet above the nearest building height. The stack heights for the two building E generators were set to 3.66 meters, consistent with San Francisco Planning Department's draft 2020 Citywide HRA (SFDPH, 2020). The stack height for the boilers and fire water pumps were set to 2-feet above the nearest building height. For the boiler and fire water pump at building A the stack height was set to 26.2 meters and for the boiler and fire water pump at building D the stack height was set to 23.3 meters. Other stack parameters included the modeling for the generators are presented in **Table 24**. Since no specific information on the boilers or fire water pumps were available at the time of this analysis, draft 2020 Citywide HRA guidance for sources that have incomplete modeling information were used for the remaining stack parameters of the boiler (**Table 25**).

TABLE 24
PROPOSED EMERGENCY GENERATOR DEFAULT STACK PARAMETERS[1]

Stack Parameter	Default Value
Stack Height[1]	3.66 (12 ft)
Stack Diameter	0.183 m (0.6 ft)
Stack Temperature	739.8K (872°F)
Stack Velocity	45.33 m/sec (8,923 ft/min)

Notes: °F = degrees Fahrenheit; K = Kelvin; ft = feet; ft/min = feet per minute; m = meter; m/sec = meters per second
[1] Two generators at building E used the default stack height value. The remaining six generators were modeled with a stack height 2-feet above the nearest building height.
[2]Source: SFDPH, 2020

TABLE 25
PROPOSED BOILER DEFAULT STACK PARAMETERS

Stack Parameter	Default Value
Stack Height[1]	2 ft above nearest building height
Stack Diameter[2]	0.305 m (1 ft)
Stack Temperature[2]	644.26K (700°F)
Stack Velocity[2]	17.8 m/sec (3,500 ft/min)

Notes: °F = degrees Fahrenheit; K = Kelvin; ft = feet; ft/min = feet per minute; m = meter; m/sec = meters per second
[1] Source: Compiled by AECOM in 2020
[2] Source: SFDPH, 2020 for sources that have incomplete modeling information.

Caltrain Rail Line Sources

As discussed in Section 3.0 the close proximity (approximately 100 ft at shortest distance) of the Caltrain rail line to the proposed project, impacts to the proposed on-site receptors were evaluated as part of this HRA. In 2017, Illingworth & Rodkin evaluated TAC impacts to a multi-family residential project at El Camino Real and Diller Street in Redwood City. For consistency, AECOM modeled the rail line sources (Caltrain passenger trains and freight trains) in a similar manner as only a few blocks separate the two projects.

Caltrain and freight train emissions were modeled within about 1,000 feet of the proposed project site as adjacent volume sources. The release height of these sources was set to 5 meters and the initial vertical dimension was set to 2.3 meters. The initial lateral dimension was set to 1.72 meters, based upon track width of 3.7 meters. The modeling separated track segments based upon train speed. As discussed in Section 3.0, rail line sources were assessed separately for sensitive receptors in Parcels A through E and for Parcel F. **Tables 26** and **27** summarizes the modeled parameters for the Caltrain sources for Parcels A through E and Parcel F, respectively. **Figures 11** and **12** illustrates each of these segments used in the modeling for each of the parcel groups. Caltrain and freight train emissions were not modeled for off-site receptors as these emissions are not due to project sources.

TABLE 26
CALTRAIN PASSENGER AND FREIGHT TRAIN MODELED SOURCE PARAMETERS – PARCELS A THROUGH E

Description	Model ID	No. Lines	Link Width (ft)	Link Length (ft)	Link Length (miles)	Release Height (m)	No. Trains per Day	Train Travel Speed (mph)
Caltrain North - Near Station	CLTRN10	1	12	641	0.12	5.0	17	10
Caltrain North - Skip Station	CLTRS40	1	12	2249	0.43	5.0	3	40
Passenger - Caltrain South	CLTRSK40	1	12	2,882	0.55	5.0	20	40
Freight Trains	FRIEGHT	1	12	2,882	0.55	5.0	4	40
Total	**-**	**1**	**12**	**2,882**	**0.55**	**5.0**	**44**	**-**

TABLE 27
CALTRAIN PASSENGER AND FREIGHT TRAIN MODELED SOURCE PARAMETERS – PARCEL F

Description	Model ID	No. Lines	Link Width (ft)	Link Length (ft)	Link Length (miles)	Release Height (m)	No. Trains per Day	Train Travel Speed (mph)
Caltrain North - Near Station	CLTRN10	1	12	1272	0.24	5.0	17	10
Caltrain North - Skip Station	CLTRS40	1	12	53	0.01	5.0	3	40
Passenger - Caltrain South	CLTRSK40	1	12	1317	0.25	5.0	20	40
Freight Trains	FRIEGHT	1	12	1317	0.25	5.0	4	40
Total	**-**	**1**	**12**	**2,882**	**0.55**	**5.0**	**44**	**-**

Figure 11: Caltrain Passenger and Freight Train Segments – Parcels A through E

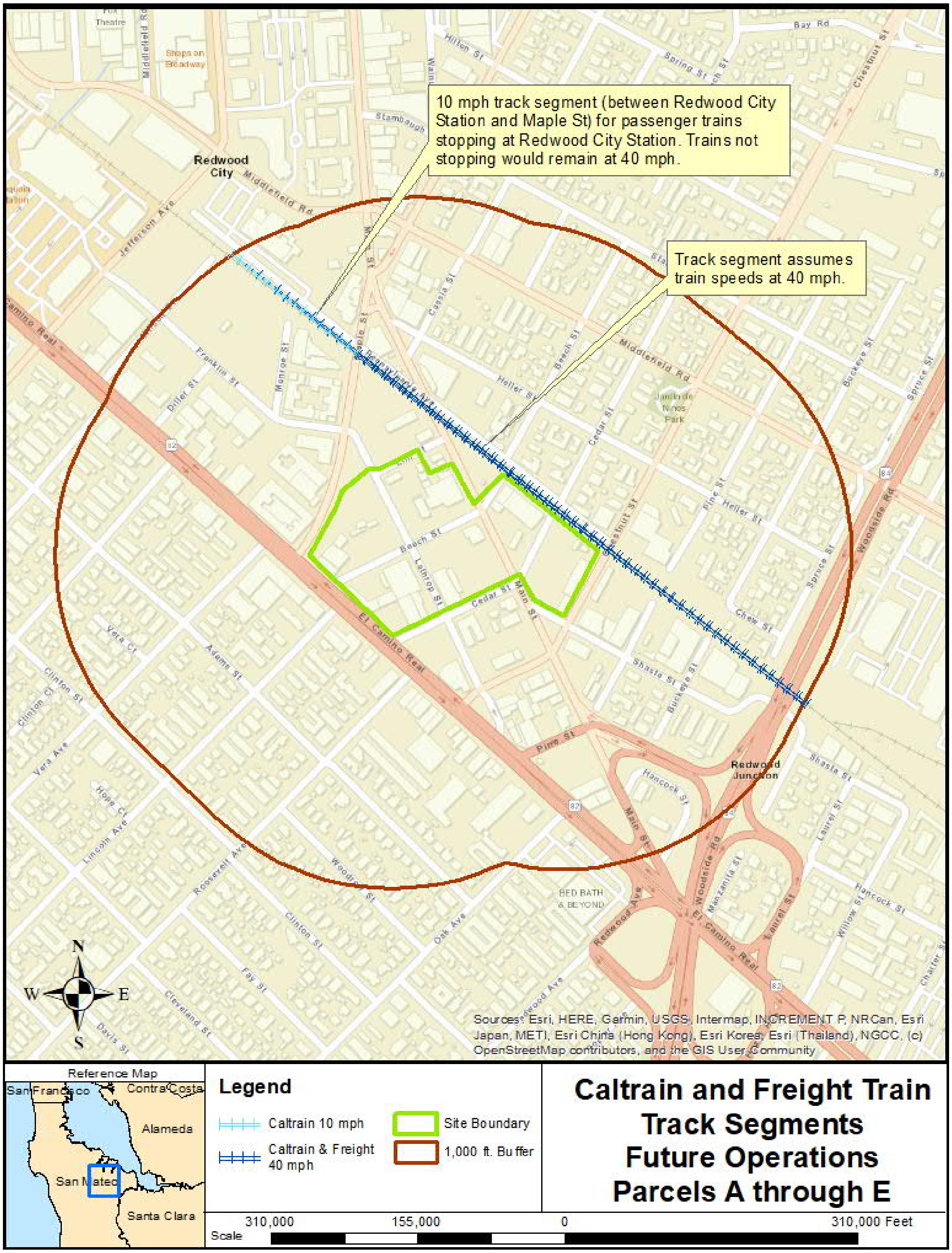
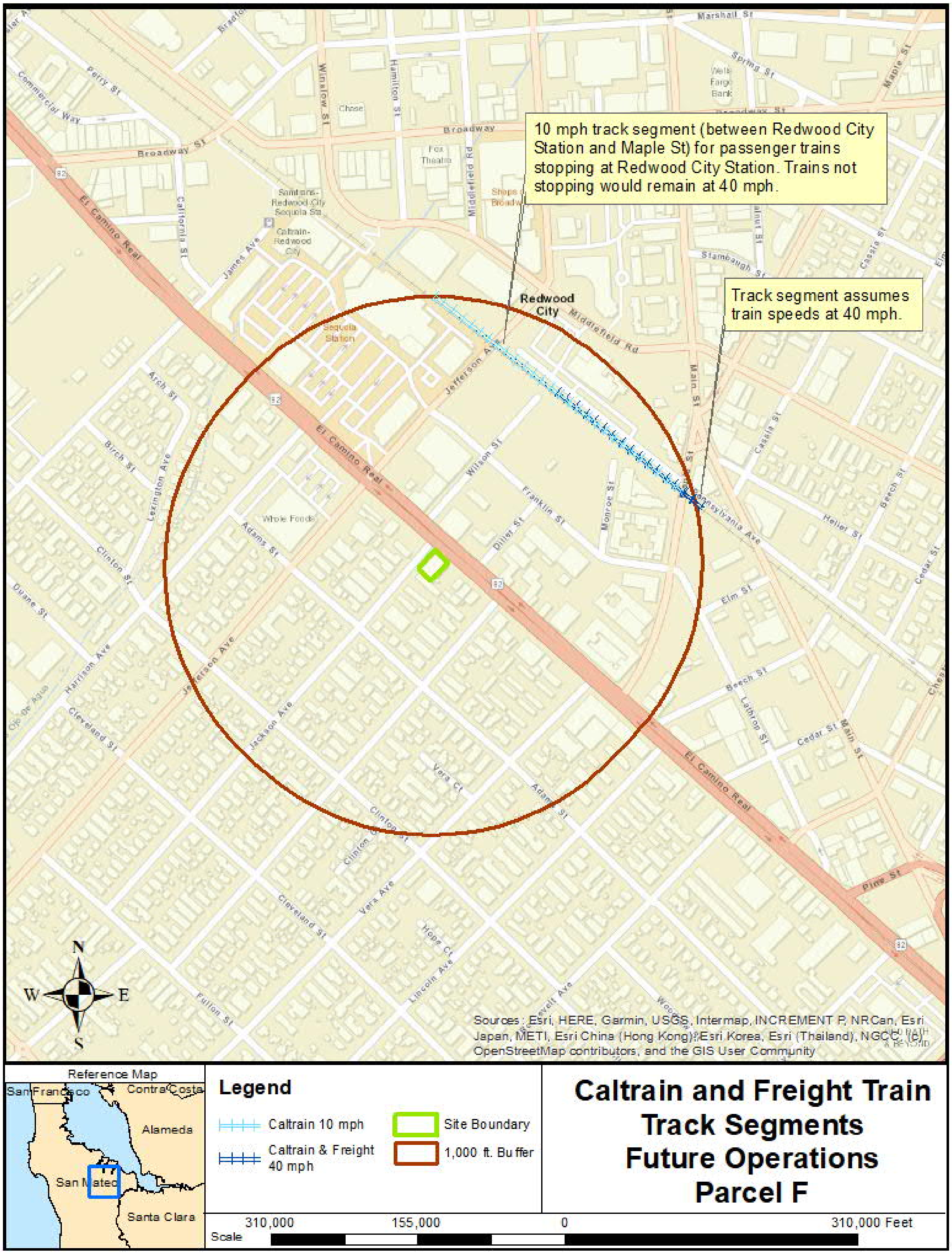


Figure 12: Caltrain Passenger and Freight Train Segments – Parcel F



<u>DISPERSION MODELING RESULTS</u>

Uncontrolled Scenario

Results of the annual $PM_{2.5}$ modeling analysis using the uncontrolled emissions are summarized in **Tables 28** and **29** for project construction and operation scenarios, respectively**.** A map is provided to illustrate the location of the maximum annual $PM_{2.5}$ concentrations for the controlling project construction year and operations in **Figure 13**. For all three years of construction, the maximum concentrations due to uncontrolled construction emissions are located directly across the street from the project (to the southeast) on Cedar St.

TABLE 28
MAXIMUM PROJECT CONSTRUCTION CONDITIONS (UNCONTROLLED) MODELED $PM_{2.5}$ ANNUAL CONCENTRATIONS ON OFF-SITE RESIDENTIAL RECEPTORS

Year	Proposed Project – Nearby Parcels A-E ($\mu g/m^3$)[1]	Proposed Project – Nearby Parcel F ($\mu g/m^3$)[2]
2020	0.51	0.25
2021	0.80	0.59
2022[3]	0.21	< 0.01

Notes:

1. Receptor location: X (UTM) = 568,560.65, Y (UTM) = 4,148,382.33.
2. Receptor location: X (UTM) = 568,100.65, Y (UTM) = 4,148,582.33.
3. Pipeline construction not included since BAAQMD threshold exceeded inparcel A through F modeling and mitigation is already required.

Source: Compiled by AECOM in 2020.

BAAQMD regulates backup emergency generators, fire pumps, and other sources of TACs through its New Source Review (Regulation 2, Rule 5) permitting process. Although emergency generators are intended to be used only during power outages, each generator must be tested monthly. However, BAAQMD limits testing to no more than 50 hours per year. It is assumed in this analysis that the backup diesel generators would meet or exceed the emission standards for Tier 2–certified engines.

For the operations scenario, the maximum modeled concentration is located at an on-site receptor where residential dwelling will exist in Building A and at an off-site sensitive receptor located approximately 150 feet south of Parcels A-E near the intersection of Cedar Street and Lathrop Street. **Table 29** summarizes the results and **Figure 13** identifies the location of maximum concentrations for the operations scenario for annual $PM_{2.5}$. The Caltrain sources are included in the annual $PM_{2.5}$ concentrations for on-site sensitive receptors. For operations, annual $PM_{2.5}$ concentrations are below the BAAQMD threshold, therefore no controlled scenario is needed.

TABLE 29
MAXIMUM PROJECT OPERATIONS CONDITIONS MODELED $PM_{2.5}$ ANNUAL CONCENTRATIONS

Scenario	Proposed Project – Nearby Parcels A-E ($\mu g/m^3$)[1]	Proposed Project – Nearby Parcel F ($\mu g/m^3$)[2]
Operations – On-Site Receptor	0.25	0.05
Operations – Off-site Receptor	0.22	

Notes: Caltrain source emissions are included along with the project sources.
1. Receptor location: X (UTM) = 568,360.65, Y (UTM) = 4,148,442.33.
2. Receptor location: X (UTM) = 568,120.65, Y (UTM) = 4,148,602.33.
3. Receptor location: X (UTM) = 568,540.65, Y (UTM) = 4,148,342.33.

Source: Compiled by AECOM in 2020.

Controlled Scenario

Results of the annual $PM_{2.5}$ modeling analysis using the controlled emissions are summarized in **Table 30** for project construction**.** A map is provided to illustrate the location of the maximum annual $PM_{2.5}$ concentrations for the controlling project construction year in **Figure 13**. For all three years of construction, the maximum concentrations due to uncontrolled construction emissions are located directly across the street from the project (to the southeast) on Cedar St (same location as in the uncontrolled scenario).

TABLE 30
MAXIMUM PROJECT CONSTRUCTION CONDITIONS (CONTROLLED) MODELED $PM_{2.5}$ ANNUAL CONCENTRATIONS

Year	Proposed Project – Nearby Parcels A-E ($\mu g/m^3$)[1]	Proposed Project – Nearby Parcel F ($\mu g/m^3$)[2]
2020	0.05	0.02
2021	0.12	0.06
2022[3]	0.04	<0.01

Notes:
1. Receptor location: X (UTM) = 569,560.65, Y (UTM) = 4,148,382.33.
2. Receptor location: X (UTM) = 568,100.65, Y (UTM) = 4,148,582.33.
3. Includes pipeline construction (March 2022 – August 2022).

Source: Compiled by AECOM in 2020.

As stated above, annual $PM_{2.5}$ concentrations are below the BAAQMD threshold for operations, therefore no controlled scenario is needed.

FIGURE 13
LOCATIONS OF MAXIMUM MODELED $PM_{2.5}$ ANNUAL CONCENTRATIONS FOR CONSTRUCTION AND OPERATION SCENARIOS AT SENSITIVE RECEPTORS

5.0 Health Risk Analysis

Pollutant Concentrations

AERMOD was run using unit emissions. Each source was modeled assuming emissions of 1 gram per second (g/s) for point sources, 1 g/s divided by the number of volume sources in a road segment, or 1 g/s divided by the area source in square meters. 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 with corresponding TAC emission rates for each phase of construction as well as the project operational emissions to calculate project concentration contributions. These concentrations were then used to estimate the long-term effects of TACs on nearby and future on-site residential locations.

Receptor Exposure and Health Risk Calculations

Exposure factors were used to calculate dose associated with exposure to the estimated unit concentration results obtained using AERMOD. ARB 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 30-year cancer risk for resident receptors through the inhalation, soil ingestion, mother's milk, and homegrown produce pathways, using the OEHHA-Derived Method. The 3-year construction period of the project was also evaluated for cancer risk for existing residence receptors within 1,000 feet of the project. 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:

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

Where:

$RISK_{inh\text{-}res}$	= Residential inhalation cancer risk
$DOSE_{air}$	= Daily inhalation dose (milligrams per 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
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 third trimester to age 2, 3 for ages 2–16, 1 for ages 16–30
ED	= 0.25 year for third trimester, 2 years for ages 0–2, 7 years for ages 2–9, 14 years for ages 2–16, 14 years for ages 16–30
AT	= 30 years

The inhalation risk calculation utilized the advanced (or refined) Tier 2 fraction of time at residence per the OEHHA 2015 guidance.

FAH	= 0.85 for third trimester to age 2, 0.72 for ages 2-16, and 0.73 for ages 16-30.

The daily inhalation dose is defined as:

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

Where:

$DOSE_{air}$	= Dose through inhalation (mg/kg-day)
C_{air}	= Concentration in air (µg/m^3)
{BR/BW}	= Daily breathing rate normalized to body weight (Liters per 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 was calculated in HARP2 using OEHHA 2015–recommended default values for these parameters:

C_{air}	= Concentration as calculated from AERMOD
{BR/BW}	= OEHHA-derived method (i.e., 95th-percentile) estimates (361 for third trimester, 1,090 for ages 0–2, 745 for ages 2–16, 335 for ages 16–30)
A	= 1
EF	= 0.96 (350 days/365 days in a year for a resident)

SUMMARY OF HEALTH RISKS AND MODELING RESULTS

Health risks were calculated for off-site receptors for the project construction scenario (3-years) and for on-site and off-site receptors for the operational scenario (30-years). Risks to existing off-site receptors were calculated assuming exposure during each year of the entire construction period. For future on-site receptors, AECOM assumed that these receptors would be occupied at the completion of the 3-year construction period.

For the operational scenario, cumulative risks were estimated by adding these project contributions to the BAAQMD background risks, Caltrain, other nearby sources, and vehicle traffic.

Project Construction Health Risks

The excess cancer risks attributable to uncontrolled construction sources from project conditions are depicted in **Table 31.** The excess cancer risks for this scenario were compared against the single-source BAAQMD threshold (10 in-a-million). Project conditions attributable to uncontrolled construction sources would exceed the BAAQMD threshold of 10 in-a-million. Therefore, a controlled construction scenario was modeled using the mitigation measures outlined in Section 3.0. **Table 32** summarizes the excess cancer risks attributed to controlled construction source from the project. **Figure 14** indicates the location of the maximum exposed sensitive off-site receptor relative to Parcels A through F for both the uncontrolled and controlled scenarios.

TABLE 31
PROJECT CONSTRUCTION (UNCONTROLLED) MAXIMUM MODELED EXCESS CANCER RISK CONCENTRATIONS AT EXISTING OFF-SITE SENSITIVE RECEPTORS

Year	Years of Age	Nearest to Project Parcels A-E (in a million)[1]	Nearest to Project Parcel F (in a million)[2]
2020	Third trimester to 1	33.50	25.00
2021	1–2	41.80	54.70
2022[3]	2–3	1.89	---
Total Excess Cancer Risk	**3 years**	**77.19**	**79.70**
BAAQMD Threshold	---	10	10
Exceeds Threshold?	---	**Yes**	**Yes**

Notes: BAAQMD = Bay Area Air Quality Management District; HRA = health risk assessment; UTM = Universal Transverse Mercator
1. Receptor location: X (UTM) = 569,560.65, Y (UTM) = 4,148,382.33.
2. Receptor location: X (UTM) = 568,100.65, Y (UTM) = 4,148,582.33.
3. Pipeline construction not included since BAAQMD threshold was exceeded in parcel A through F modeling and mitigation is already required.

Source: Compiled by AECOM in 2020.

TABLE 32
PROJECT CONSTRUCTION (CONTROLLED) MAXIMUM MODELED EXCESS CANCER RISK CONCENTRATIONS AT EXISTING OFF-SITE SENSITIVE RECEPTORS

Year	Years of Age	Nearest to Project Parcels A-E (in a million)[1]	Nearest to Project Parcel F (in a million)[2]
2020	Third trimester to 1	2.72	2.02
2021	1–2	6.06	5.76
2022[3]	2–3	0.29	---
Total Excess Cancer Risk	**3 years**	**9.07**	**7.78**
BAAQMD Threshold	---	10	10
Exceeds Threshold?	---	**No**	**No**

Notes: BAAQMD = Bay Area Air Quality Management District; HRA = health risk assessment; UTM = Universal Transverse Mercator
1. Receptor location: X (UTM) = 569,560.65, Y (UTM) = 4,148,382.33.
2. Receptor location: X (UTM) = 568,100.65, Y (UTM) = 4,148,582.33.
3. Pipeline construction included (March 2022 – August 2022).

Source: Compiled by AECOM in 2020.

FIGURE 14
LOCATIONS OF MAXIMUM 3-YEAR PERIOD EXCESS CANCER RISK FROM PROJECT CONSTRUCTION CONDITIONS ON EXISTING OFF-SITE SENSITIVE RECEPTORS

Project Operations Health Risks

Future stationary emission sources (i.e. emergency generators, boilers and fire water pumps) along with net traffic increases associated with the project were assessed and compared against the single-source BAAQMD threshold (10 in-a-million). The excess cancer risks attributable to uncontrolled operation sources from project conditions and Caltrain are depicted in **Table 33.**

The proposed project also includes a daycare center located in the southeast section of building B. Therefore, a 9-year child cancer risk exposure period was assessed using a starting year of the 3rd trimester for the operations scenario. Results of the 9-year child cancer risk is presented in **Table 33**.

Project conditions attributable to operation sources would not exceed the BAAQMD threshold of 10 in-a-million at either the childcare sensitive receptors in Parcel B or residential sensitive receptors.

For the off-site receptors, excess cancer risk due to project sources only were analyzed to determine if the project exceeded the BAAQMD threshold. One off-site receptor exceeds the BAAQMD threshold of 10 in-a-million and control measures will be required. Two proposed control measures were evaluated: (1) Modifying the ground-level generator (emergency generator 6) next to building E (south) to be Tier 4 instead of Tier 2. (2) Reduce the number of hours permitted for maintenance and testing of the four building E generators to 26 hours from 50 hours. The results of the analysis are summarized in **Table 34**.

A 9-year child cancer risk exposure period was also assessed, similarly to the on-site childcare proposed by the project. Results of the 9-year child cancer risk is presented in **Tables 33** and **34**.

Figure 15 indicates the location of the maximum exposed sensitive off-site and on-site receptors.

TABLE 33
PROJECT OPERATION CONDITIONS MAXIMUM MODELED EXCESS CANCER RISK CONCENTRATIONS AT ON-SITE AND OFF-SITE SENSITIVE RECEPTORS

Year	Years of Age	Project Parcels A-E (in a million)	Project Parcel F (in a million)[3]
On-Site Receptors			
Operations – Residential	Third trimester – 30 (30 years)	5.55[1]	1.21
Operations – Childcare	Third trimester – 9 (9 Years)	7.90[2]	---
BAAQMD Threshold	---	10	10
Exceeds Threshold?	---	No	No
Off-Site Receptors			
Operations - Residential[4]	Third trimester – 30 (30 years)	11.30	
BAAQMD Threshold	---	10	
Exceeds Threshold?	---	**Yes**	
Operations – Childcare[5]	Third trimester – 9 (9 Years)	1.82	
BAAQMD Threshold	---	10	
Exceeds Threshold?	---	No	

Notes: BAAQMD = Bay Area Air Quality Management District; HRA = health risk assessment; UTM = Universal Transverse Mercator

1. Receptor location: X (UTM) = 568,460.65, Y (UTM) = 4,148,542.33.
2. Receptor location: X (UTM) = 568,460.65, Y (UTM) = 4,148,402.33.
3. Receptor location: X (UTM) = 568,120.65, Y (UTM) = 4,148,602.33.
4. Receptor location: X (UTM) = 568,600.65, Y (UTM) = 4,148,382.33.
5. Receptor location: X (UTM) = 568,320.65, Y (UTM) = 4,148,622.33.

Source: Compiled by AECOM in 2020.

TABLE 34
PROJECT OPERATION CONDITIONS MAXIMUM MODELED EXCESS CANCER RISK CONCENTRATIONS AT ON-SITE AND OFF-SITE SENSITIVE RECEPTORS

Year	Years of Age	Project Parcels A-E (in a million)	Project Parcel F (in a million)[3]
On-Site Receptors			
Mitigation Scenario 1			
Operations – Residential	Third trimester – 30 (30 years)	5.45[1]	1.19
Operations – Childcare	Third trimester – 9 (9 Years)	7.85[2]	---
BAAQMD Threshold	---	10	10
Exceeds Threshold?	---	No	No
Mitigation Scenario 2			
Operations – Residential	Third trimester – 30 (30 years)	5.32[1]	1.14
Operations – Childcare	Third trimester – 9 (9 Years)	7.66[2]	---
BAAQMD Threshold	---	10	10
Exceeds Threshold?	---	No	No
Off-Site Receptors			
Mitigation Scenario 1			
Operations[4]	Third trimester – 30 (30 years)	9.76	
Operations – Childcare[5]	Third trimester – 9 (9 Years)	1.80	
BAAQMD Threshold	---	10	
Exceeds Threshold?	---	No	
Mitigation Scenario 2			
Operations[4]	Third trimester – 30 (30 years)	6.72	
Operations – Childcare[5]	Third trimester – 9 (9 Years)	1.72	
BAAQMD Threshold	---	10	
Exceeds Threshold?	---	No	

Notes: BAAQMD = Bay Area Air Quality Management District; HRA = health risk assessment; UTM = Universal Transverse Mercator
1. Receptor location: X (UTM) = 568,360.65, Y (UTM) = 4,148,442.33.
2. Receptor location: X (UTM) = 568,460.65, Y (UTM) = 4,148,402.33.
3. Receptor location: X (UTM) = 568,120.65, Y (UTM) = 4,148,602.33.
4. Receptor location: X (UTM) = 568,600.65, Y (UTM) = 4,148,382.33.
5. Receptor location: X (UTM) = 568,320.65, Y (UTM) = 4,148,622.33.
Source: Compiled by AECOM in 2020.

Figure 15
LOCATIONS OF MAXIMUM 30-YEAR PERIOD EXCESS CANCER RISK FROM PROJECT OPERATIONS CONDITIONS ON OFF-SITE AND FUTURE ON-SITE SENSITIVE RECEPTORS

Cumulative Health Risks

This HRA also assesses cumulative $PM_{2.5}$ concentrations and excess cancer risk at on-site sensitive receptors that could result from existing sources, project operational sources, and other nearby projects.

Existing Conditions. As discussed in Section 2.0, BAAQMD has generated gridded datasets, across the entire air district domain, representing existing health risk conditions for both cancer risk and annual $PM_{2.5}$. These files were downloaded and used to determine the existing conditions at the maximum project impact on-site receptors as part of the cumulative modeling. Since the maximum excess cancer risk location varies between uncontrolled and controlled scenarios for Parcels A through E, the maximum existing cancer risk of the two locations has been selected. **Table 35** summarizes the results for Parcels A though E and Parcel F, respectively.

TABLE 35
EXISTING CONDITIONS AT MAXIMUM PROJECT ON-SITE RECEPTORS

Parcels	Project Scenario	BAAQMD Cancer Risk (in-a-mil)[1]	BAAQMD Annual $PM_{2.5}$ ($\mu g/m^3$)[2]
Parcels A-E	Operations	16.06	0.48
Parcel F	Operations	16.79	0.38

1. Cancer risk includes the sum of highway cancer risk and roadway cancer risk.
2. Annual $PM_{2.5}$ concentration includes the sum of highway $PM_{2.5}$ and roadway $PM_{2.5}$.

Concurrent Nearby Construction Projects. There are 4 other projects located within 1,000 feet of the proposed project site (Parcel A through E and F) as summarized in **Table 36** and shown in **Figure 16**. Of these 4 projects, only the 1305 and 1409 El Camino Real completed air quality analyses. The 1305 El Camino Real has already been built, while the others have a current status of under construction. The 103 Wilson Street was expected to have substantial occupancy by Summer 2018 and 1409 El Camino Real had substantial occupancy date of Spring 2019. Based on Google Earth images, it appears as though the 1629 Main St project has been completed or is near completion. Therefore, sensitive receptors were included as part of the off-site health risk analysis at all of these locations. Only the 1409 El Camino Real project provided an air quality analysis for future operations of excess cancer risk and annual $PM_{2.5}$. The 1409 El Camino Real HRA did not provide a breakdown of net project excess cancer risk and annual $PM_{2.5}$ concentration, instead it listed a total future of project and existing. As a result, it's difficult to quantify what the project contributions would be to the receptors. Since the existing excess cancer risk and annual $PM_{2.5}$ BAAQMD files, discussed above in existing conditions, exceed the values provided in the 1409 El Camino Real HRA, we will use these higher values to be conservative. It is assumed that the remaining 3 projects would be less than the single source BAAQMD thresholds. The highest impacts due to these projects will be located in close proximity to the projects and the impacts would be less at the maximum impact location of the proposed project.

TABLE 36
CUMULATIVE PROJECTS LOCATED WITHIN 1,000 FEET OF THE PROPOSED PROJECT SITE

Project	Description
103 Wilson St	175 multi-family residential units; 202 parking spaces
1305 El Camino Real	137-unit multi-family residential units
1409 El Camino Real	350 for-rent residential units
1629 Main	24,700 sf office; 2 residential units

Caltrain Rail Line Sources. As discussed earlier in Sections 3.0 and 4.0, passenger and freight sources operating along the Caltrain line within 1,000 feet of Parcels A through E and Parcel F were assessed for future health risk impacts. The results from modeling these sources are summarized in **Table 37** for Parcels A through F.

TABLE 37
CANCER RISK EXPOSURE AT ON-SITE RESIDENTIAL RECEPTORS FROM CALTRAIN SOURCES

Parcels	2023-2025	2026-2033	2034-2041	2042-2052	2023-2052 (30 Years)	BAAQMD Threshold	Exceeds Threshold?
Parcels A-E[1]	6.31	1.65	0.55	0.12	**8.62**	10	No
Parcel F[2]	1.35	0.36	0.12	0.03	**1.85**	10	No

1. Receptor location: X (UTM) = 568,520.65, Y (UTM) = 4,148,542.33.
2. Receptor location: X (UTM) = 568,120.65, Y (UTM) = 4,148,602.33.

Table 38 below presents the cumulative $PM_{2.5}$ concentration at the project's on-site sensitive receptors during operation of the proposed project. **Tables 39** and **40** presents the cumulative 30-year excess cancer risk impacts at the project's on-site sensitive receptors during operation of the proposed project for mitigated scenarios 1 and 2, respectively.

FIGURE 16
CUMULATIVE PROJECTS LOCATED WITHIN 1,000 FEET OF THE PROPOSED PROJECT SITE

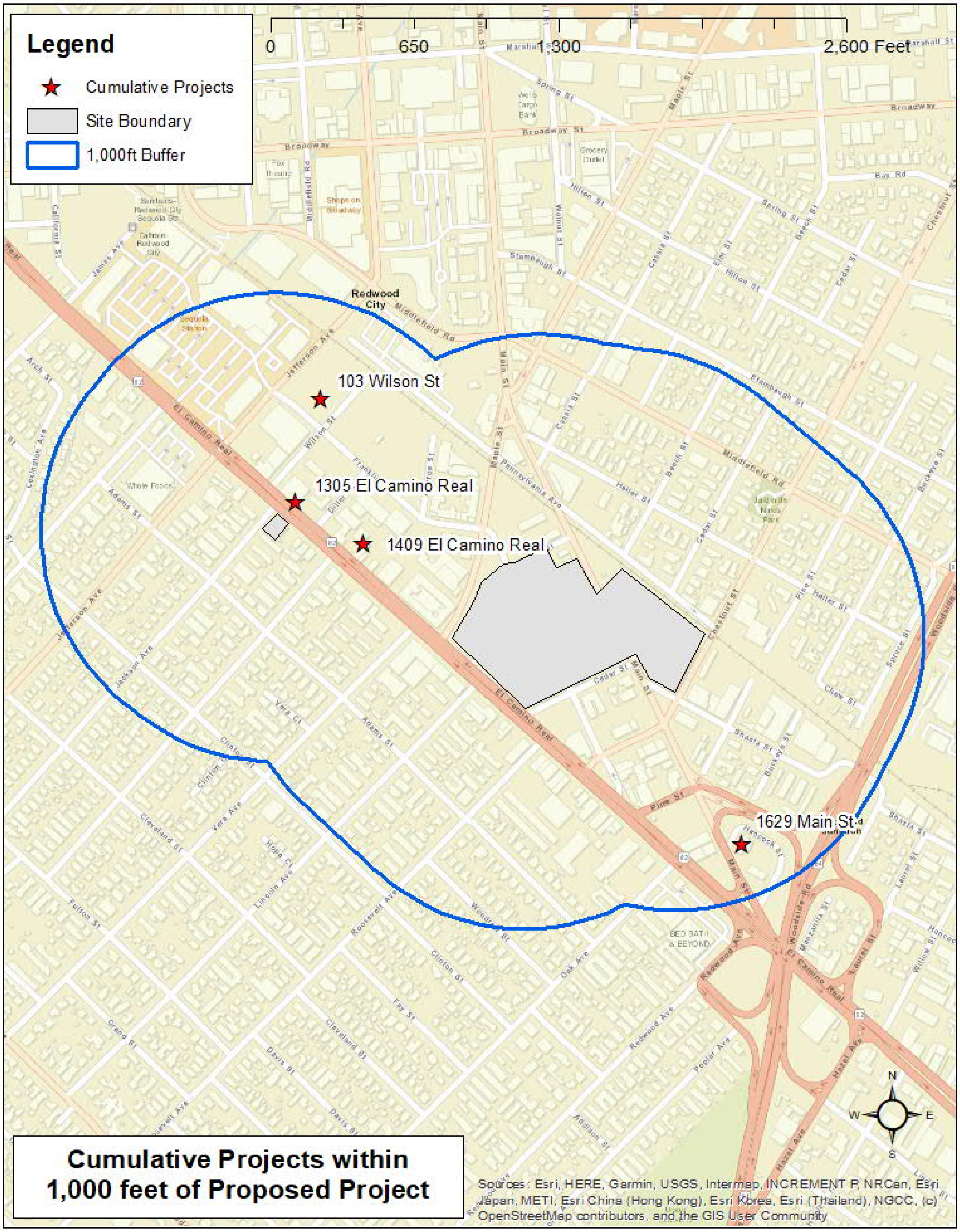


Table 38. Cumulative Plus Project Conditions Maximum Modeled Annual $PM_{2.5}$ Concentrations at On-Site Residential Receptors

	Parcels A-E	Parcel F
Cumulative Operations Scenario	**Annual Average $PM_{2.5}$ Concentration (µg/m^3)**	**Annual Average $PM_{2.5}$ Concentration (µg/m^3)**
Existing Conditions (BAAQMD [2014])[1]	0.48	0.38
Operations[2]	0.25	0.05
Existing Nearby Stationary Sources[3]	0.002	0.005
Cumulative operations PM2.5 concentration	0.73	0.44
BAAQMD Combined Source Threshold	0.8	0.8
Exceeds Threshold?	No	No

Notes: The maximum for existing conditions and operations occurs in the same location on the project site. The existing nearby stationary source value is the maximum impact on the project site. µg/m^3 = micrograms per cubic meter; HRA = health risk assessment; $PM_{2.5}$ = particulate matter with aerodynamic diameter less than 2.5 microns; UTM = Universal Transverse Mercator

1. BAAQMD health risk assessment for Existing Conditions plus nearby existing sources.
2. Caltrain rail way sources have been included as part of the Project Operations scenario.
3. From Table 6 of this HRA.

Source: Compiled by AECOM in 2020.

Table 39. Cumulative Plus Project (Controlled – Mitigated Scenario 1) Conditions Maximum Modeled Excess Cancer Risk Concentrations at On-Site Residential Receptors

Cumulative Operations Scenario	Years of Age	Parcels A-E	Parcel F
		Residential Project (in a million)[4]	Residential Project (in a million)[4]
Existing Conditions (BAAQMD [2014])[1]	–	16.06	16.79
Operations (Controlled – Mitigated 1)	Third Trimester – 30 (30 years)	5.45	1.19
Existing Nearby Stationary Sources[2]	–	1.096	3.55
Caltrain Rail Sources	30	8.62	1.85
Total Excess Cancer Risk	30	31.23	23.38
BAAQMD Combined Source Threshold	---	100	100
Exceeds Threshold?	---	No	No

Notes: The maximum for each source does not occur in the same location on the project site. Therefore, the total excess cancer risk computed is a conservative worst-case assessment. HRA = health risk assessment; UTM = Universal Transverse Mercator

1. BAAQMD health risk assessment for Existing Conditions plus nearby existing sources.
2. From Table 7 of this HRA.

Source: Compiled by AECOM in 2020.

Table 40. Cumulative Plus Project (Controlled – Mitigated Scenario 2) Conditions Maximum Modeled Excess Cancer Risk Concentrations at On-Site Residential Receptors

Cumulative Operations Scenario	Years of Age	Parcels A-E	Parcel F
		Residential Project (in a million)[4]	Residential Project (in a million)[4]
Existing Conditions (BAAQMD [2014])[1]	–	16.06	16.79
Operations (Controlled – Mitigated 2)	Third Trimester – 30 (30 years)	5.32	1.14
Existing Nearby Stationary Sources[2]	–	1.096	3.55
Caltrain Rail Sources	30	8.62	1.85
Total Excess Cancer Risk	30	31.10	23.33
BAAQMD Combined Source Threshold	---	100	100
Exceeds Threshold?	---	No	No

Notes: The maximum for each source does not occur in the location on the project site. Therefore, the total excess cancer risk computed is a conservative worst-case assessment. HRA = health risk assessment; UTM = Universal Transverse Mercator

3. BAAQMD health risk assessment for Existing Conditions plus nearby existing sources.

4. From Table 7 of this HRA.

Source: Compiled by AECOM in 2020.

6.0 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 HRA methodology.

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. Uncertainties also exist in estimating operational TAC emissions from potential stationary sources associated with the emergency generators, boilers and fire water pumps. The specific uses of these spaces, types of processes, and potential types and quantities of emissions have not been determined at this time.

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 EPA, 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 (EPA, 2017). AECOM's 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, AECOM uses source parameters that are either recommended as defaults or expected to produce more conservative 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.

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 HRA are high-end estimates. For example, it is assumed that residential receptors would be exposed to project emissions during the entire construction duration and to cumulative emissions sources 13 hours per day for 350 days per year. This assumption is highly 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.

The OEHHA Cancer Potency Factor (CPF) for diesel PM is used to estimate cancer risks associated with exposure to diesel PM from the project and off-site 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 (IARC), a branch of the World Health Organization, had classified diesel PM as Probably Carcinogenic to Humans (Group 2); EPA had also concluded that the existing data did not provide an adequate basis for quantitative risk assessment (EPA, 2002). However, based on two recent scientific studies (Benbrahim-Tallaa et al., 2012; Attfield et al, 2012), IARC recently reclassified diesel PM as Carcinogenic to Humans (Group 1) (IARC, 2012), 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 IARC's carcinogen classification scheme. This determination by IARC may provide additional impetus for EPA to identify a quantitative dose/response relationship between exposure to diesel PM and cancer.

OEHHA 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 (OEHHA, 2015). The estimated risks in this HRA 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.

7.0 References

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