QUANTITATIVE PM2.5 AND PM10 HOT-SPOT ANALYSIS

Interstate 10 Corridor Project

San Bernardino and Los Angeles Counties

07-LA-10 PM 44.9/48.3
08-SBD-10 PM 0.0/R37.0

EA 0C2500
EFIS ID 0800000040

August 2015

STATE OF CALIFORNIA
Department of Transportation

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ABBREVIATIONS/ACRONYMS

AERMOD ..... American Meteorological Society/Environmental Protection Agency Regulatory Model
Basin ..... South Coast Air Basin
CARB ..... California Air Resources Board
CBSA ..... Core Based Statistical Area
DV ..... Design Value
FEM..... Federal Equivalent Method
FRM ..... Federal Reference Method
FHWA..... Federal Highway Administration
FTA ..... Federal Transit Administration
FTIP ..... Federal Transportation Improvement Program
HOV ..... High Occupancy Vehicle
HOT..... High Occupancy Toll
I-10 ..... Interstate 10
ITE..... Institute of Transportation Engineers
LA/SB ..... Los Angeles/San Bernardino
NAAQS..... National Ambient Air Quality Standards
PL..... Project Level
PM..... Particulate Matter
PM2.5..... Particulate Matter of 2.5 Micrometers and Smaller
PM10..... Particulate Matter of 10 Micrometers or Smaller
POAQC ..... Project of Air Quality Concern
ROD ..... Record of Decision
ROW ..... Right-of-Way
RTP ..... Regional Transportation Plan
SBTAM..... San Bernardino County Transportation Analysis Model
SCAG ..... Southern California Association of Governments
SCAQMD ..... South Coast Air Quality Management District
SCS..... Sustainable Communities Strategy
SRA..... Source/Receptor Area
TCWG ..... Transportation Conformity Working Group
USEPA ..... U.S. Environmental Protection Agency

Summary

The California Department of Transportation, in cooperation with the San Bernardino Associated Governments, proposes to add freeway lanes through all or a portion of the 33-mile stretch of Interstate 10 (I-10) from the Los Angeles/San Bernardino (LA/SB) County Line to Ford Street in San Bernardino County. The project limits including transition areas extend from approximately 0.4 miles west of White Avenue in the City of Pomona at Post Mile (PM) 44.9 to Live Oak Canyon Road in the City of Yucaipa at Post Mile PM 37.0.

The proposed project is located within the South Coast Air Basin (Basin), which is in non-attainment for particulate matter of 2.5 micrometers and smaller ($PM_{2.5}$) and in maintenance for particulate matter of 10 micrometers or smaller (PM_{10}). The proposed project has participated in the Interagency Consultation Process and the Transportation Conformity Working Group (TCWG) identified the project as a Project of Air Quality Concern (POAQC) on June 24, 2014.. Therefore, a project-level quantitative particulate matter (PM) hot-spot analysis is required.

Alternatives 2 (Project ID 4H01001) and 3 (Project IDs 4122004 and 4122005) are listed in the 2012-2035 financially constrained Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) Amendment #2. The 2015 Federal Transportation Improvement Program (FTIP) includes Alternative 2 identified by FTIP ID 0C2500. The FTIP does not include Alternative 3, and an amendment will be required if Alternative 3 is selected as the preferred alternative.

The hot-spot analysis demonstrates that the build alternatives would not increase the $PM_{2.5}$ and PM_{10} design values (DV). The proposed project meets transportation conformity hot-spot requirements.

Description Of The Alternatives

This environmental analysis evaluated a No Build Alternative and two build alternatives.

Alternative 1 - No Build Alternative: Alternative 1 (No Build) would maintain the existing lane configuration of I-10 within the proposed project limits with no additional mainline General Purpose lanes or associated improvements to be provided.

Alternative 2 - One HOV Lane in Each Direction: Alternative 2 would extend the existing High Occupancy Vehicle (HOV) lane in each direction of I-10 from the current HOV terminus near Haven Avenue in the City of Ontario to Ford Street in the City of Redlands, a distance of approximately 25 miles.

Alternative 3 - Two Express Lanes in Each Direction: Alternative 3 would provide two Express Lanes in each direction of I-10 from the LA/SB County Line to California Street (near State Route-210) in the City of Redlands and one Express Lane in each direction from California Street to Ford Street in the City of Redlands, a distance of approximately 33 miles. The Express Lanes would be priced managed lanes in which vehicles not meeting the minimum occupancy requirement would pay a toll. West of Haven Avenue, a single new lane would be constructed and combined with the existing HOV lane to provide two Express Lanes in each direction; east of Haven Avenue all Express Lanes would be constructed by the project.

Protocol Purpose and Methodology

In November 2013, U.S. Environmental Protection Agency (USEPA) released the final *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (Guidance) for quantifying the local air quality impacts of transportation projects and comparing them to the $PM_{2.5}$ and PM_{10} National Ambient Air Quality Standards (NAAQS) (75 Federal Regulation 79370). This modeling protocol details the key data sources, modeling tools, and analytical assumptions used in preparing the project-level quantitative $PM_{2.5}$ and PM_{10} hot-spot analysis for the proposed project based on the above-referenced Guidance. A modeling protocol was submitted to TCWG on October 8, 2014 and USEPA comments were received on November 17, 2014. The South Coast Air Quality Management District (SCAQMD) provided comments on December 2, 2014. Approval to begin the analysis was provided verbally at the December 2, 2014 TCWG meeting.

The project-level hot-spot analysis has been completed using the above-referenced Guidance. The methodology is briefly summarized below and explained in detail within this section of the Protocol.

- Build Alternatives and No Build Alternative emissions rates were calculated using project-specific traffic data and EMFAC2011-PL emission factors, then modeled using the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD).
- Pursuant to the approved work plan, instead of modeling the entire length of the project, four worst-case segments in terms of emissions were modeled as being representative of the project corridor. Since conformity was demonstrated along the worst-case segments, it can be assumed that conformity is met along the entire length of the proposed project. Selection of these four segments was performed according to emission profiles (amount of emissions as a function of distance measured from the beginning of the project in the east) that were developed based on the traffic data and emission factors obtained from EMFAC2011-PL for all build alternatives. Based on these emission profiles, modeling segments were selected at locations along the length of the alignment where the localized emissions peaked or the one-mile moving average of the emissions consistently showed elevated emissions across different alternatives.
- The four selected modeling segments are as follows:
  - **Segment 1:** Cedar Avenue to Riverside Avenue (1.48 miles);
  - **Segment 2:** Cherry Avenue to Sierra Avenue (3.67 miles);
  - **Segment 3:** Milliken Avenue to Haven Avenue (1.37 miles); and
  - **Segment 4:** Central Avenue on- and off-ramps (0.66 miles).
- In addition to emissions from freeway sources, emissions from nearby sources such as warehouse/distribution centers and their connecting roads to the freeway, Union Pacific West Colton Railyard, and arterials overlapping with a 1,000 meter buffer around the centerline of each segment were included in the modeling.
- The surface and profile meteorological data were obtained from SCAQMD for the Fontana-Arrow Highway Meteorological Station for Segments 1 and 2 and the Upland Meteorological Station for Segments 3 and 4).

- A series of volume sources were generated as traffic links to characterize freeway and arterial sources; area sources were used to characterize emissions from warehouse/distribution center locations and the Union Pacific West Colton Railyard. Each source was assigned the appropriate release height above ground and initial height of the area source plume.
- Modeling included a fine grid and a coarse grid at the same time to eliminate the possibility of missing areas of exceedance. A 25×25 meter grid to a distance of 100 meters from the freeway right-of-way (ROW) and a 100×100 meter grid to a distance of 500 meters from the freeway ROW were used. A line of receptors was also placed at the ROW line.
- Since the Build Alternative DVs for $PM_{2.5}$ and PM_{10} were greater than the NAAQS, the No Build Alternative was modeled using the same methodology described above, except that No Build Alternative traffic data was used.

Particulate Matter Standards Evaluated

The San Bernardino portion of the Basin has been designated a federal nonattainment area for $PM_{2.5}$ (24-hour standard and annual standard); and a maintenance area for PM_{10} (24-hour standard). As such, this hot-spot analysis evaluates the project against the following federal standards: 24-hour $PM_{2.5}$, annual $PM_{2.5}$, and 24-hour PM_{10}.

Emissions Inventory

Project Level (PL) EMFAC2011 (EMFAC-PL) was utilized to estimate $PM_{2.5}$ and PM_{10} emissions from exhaust, brake wear, and tire wear. Re-entrained road dust is a significant contributor to regional $PM_{2.5}$ and PM_{10} emissions, and such emissions were estimated using the AP-42 Compilation of Air Pollutant Emission Factors equation with California Air Resources Board (CARB) inputs for silt loading, precipitation, and $PM_{2.5}$ k factor.[1,2] EMFAC-PL uses activity data from EMFAC2011-SG module (EMFAC-LDV and EMFAC-HD modules) to calculate emission rates consistent with the default fleet distributions in the region, including running, idling, and start-up exhaust emissions as well as PM tire and brake wear. This proposed project does not meet the following criteria required to complete the detailed approach, therefore, the analysis will utilize the USEPA-approved simplified approach (EMFAC2011-PL):

- Regional temperature and/or relative humidity profiles differ from EMFAC default;
- Vehicle age distributions different from EMFAC defaults; or
- Project involves vehicle start and idling emissions.

One EMFAC-PL run for year 2035 was developed to obtain emission rates for the two Build Alternatives and No-Build Alternative. Since PM emission rates do not vary with temperature and humidity in EMFAC2011-PL, it is not necessary to run multiple EMFAC2011 scenarios to capture seasonal variation in emission rates. Emission rates were developed for truck and non-truck vehicles speeds, ranging from 5 to 70 miles per hour.

This hot-spot analysis considered mainline and ramp links. It is not anticipated that the proposed project would directly or significantly increase volumes on surface streets near I-10.

[1]USEPA, AP-42, Fifth Edition, *Volume I, Chapter 13: Miscellaneous Sources, Section 13.2.1, Fugitive Dust Sources, Paved Roads*, January 2011. Available: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf.

[2]CARB, *Miscellaneous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust* (Revised and updated, April 2014). Available: http://www.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2014.pdf.

However, 12 arterials have been identified with high volumes of truck traffic. As such, these arterials were included in the analysis and modeling: Mountain Avenue, Vineyard Avenue. Archibald Avenue, Haven Avenue, Milliken Avenue, Etiwanda Avenue, Cherry Avenue, Sierra Avenue, Cedar Avenue, Riverside Avenue, Mount Vernon Avenue, and Mountain View Avenue.

The traffic data are from the San Bernardino County Transportation Analysis Model (SBTAM) model, a regional travel demand forecasting model that is a focused area model based on the Southern California Association of Governments (SCAG) RTP model, which is the basis for regional air quality conformity determinations. Both the SBTAM and the SCAG RTP models include the SCAG truck model. The traffic data show that the proposed project would increase total average daily traffic on I-10 and alter the mix of vehicles by class. There are two identified reasons why this occurs. First, the East-West Truck Corridor included in the SCAG RTP and planned to parallel SR-60 to the south of I-10 and west of I-15 is anticipated to draw longer distance heavy trucks away from I-10. Secondly, the proposed build alternatives compared to the no build alternative (Alternative 1) will add capacity (HOV lanes in Alternative 2 and Express Lanes in Alternative 3) usable only by autos and light-trucks. As a result, while the total traffic increases, the total truck volumes for the alternatives remain fairly constant. In addition, the assignment of truck traffic to the various corridors results in a different distribution of sub-truck categories between the proposed alternatives. This results in reductions in the percent of total traffic composed of medium- and heavy-trucks for the build alternatives.

Traffic forecasts include traffic volumes, travel speeds, and vehicle classifications for peak and off-peak hours. The data are provided for four time periods:

- 3-Hour AM Peak Period (6:00 a.m. – 9:00 a.m.);
- 6-Hour Daytime Off-Peak Period (9:00 a.m. – 3:00 p.m.);
- 4-Hour PM Peak Period (3:00 p.m. – 7:00 p.m.); and
- 11-Hour Night Off-Peak Period (7:00 p.m. – 6:00 a.m.).

This data were used to estimate emissions for highway and ramp links that are detailed in Attachments A and B. Each link represents a change in volumes and/or configuration. Link emissions were estimated based on truck and non-truck emission rates, volumes, and travel speeds. Hourly truck percentage averages were calculated using the hourly truck and total traffic hourly volumes for the traffic links. Subsequently, four emission rates associated with each peak and off-peak period were estimated for each link. These emission rates were assigned to their corresponding volume sources.

Traffic data has been provided for years 2025 and 2035. Two factors determine the amount of the project future year emissions: fleet emission rates and traffic volumes. New, more efficient engines and better emissions control technologies, combined with retirement of older vehicles, lead to lower grams per mile exhaust emissions rates; while traffic volume growth contribute to increases in overall emissions. An analysis was conducted using project-specific traffic data, EMFAC-PL emission rates, and the AP-42 re-entrained road dust methodology to determine if more emissions are anticipated in 2020 or 2035. It was determined that for all the alternatives emissions during year 2035 would exceed year 2020 emissions along all roadway segments. As such, only year 2035 was required to be modeled.

The construction phase would not last more than five years; therefore, no construction emissions were included in this analysis.

Dispersion Modeling

The hot-spot analysis was completed using AERMOD version 14134, which was published on May 14, 2014.

MODELING DOMAIN

Due to the alignment length and the number of alternatives, the hot-spot analysis focuses on multiple smaller locations that are expected to have the highest air quality concentrations and consequently the most probable new or worsened PM NAAQS violations. If modeling can show that conformity is demonstrated at these locations, then it can be assumed that conformity is met in the entire project area. These locations or the project sub-domains have their own independent model runs including source/receptor grids and use relevant meteorological and background concentration data as discussed below.

There are at least two traffic links associated with each given point/location along the length of the alignment. One link is related to the westbound direction and one to the eastbound direction.

According to the data from the traffic study these traffic links do not start and end at the same point, therefore, an analysis was performed using a script developed in R Statistical Package to calculate the overlapping localized emissions (lb/day/mile) as a function of distance (mile) from the beginning of the project alignment on the east (Post Mile).[3] The analysis resulted in total emissions from neighboring segments on both east and westbound directions.

According to the results, the project emissions would clearly peak between the Post Miles 16 and 19. In addition to this segment, two other segments consistently resulted in the highest localized emissions, and were selected for this analysis based on proximity to the Union Pacific West Colton Railyard and warehouse facilities.

The modeling segments are shown in **Figures 1A** through **1E**. PM_{10} and $PM_{2.5}$ one-mile moving average (lb/mile), localized emissions (lb/mile), and density plot of the emissions (lb/mile) associated with 2035 traffic data for Alternatives 2 and 3 are included in Attachment E. The one-mile moving average represents the average per mile of emissions from any given point on the alignment/x-axis to a mile passed that point towards the east.

Detailed data regarding total traffic volumes, truck traffic volumes, and grams per mile emissions rates for each of the I-10 freeway segments is provided in Attachment A.

SOURCES

Vehicular Emissions. The ESRI ArcGIS geographic information system was utilized for modeling of the sources. A series of volume sources were created for each traffic link identified by a change in traffic volumes, speeds, or highway alignment. The volume sources representing the freeway lanes are extended 0.5 miles passed the beginning and end of the selected segments in order to avoid underestimating the concentrations at the start and end locations of the segments. The volume sources representing the ramps are assumed to be an additional

[3] R Core Team (2014). *R: A Language and Environment for Statistical Computing.* R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

lane that extends parallel to the highway main lanes and gradually merges with the rest of the lanes.

Warehouse Emissions. Nearby warehouses overlapping with a 1,000 meter buffer around the centerline of each segment are included in this analysis. Locations of the warehouses were obtained from the County of San Bernardino land use map.[4] The outline of each warehouse was modified to conform with the actual property lines and where the trucks have access based on the aerial photos.

As recommended by the SCAQMD, truck trip generation rates associated with warehouses were estimated according to the Institute of Transportation Engineers (ITE) trip rates.[5] The trip rates are based on the 1,000 square feet of the ITE category of high-cube warehouses. The current analysis is based on the square footage of the warehouse and uses the following formulae to estimate the truck generation rates:

$$Truck\ trip\ generation\ rate = 1{,}000\ square\ feet\ of\ the\ warehouse\ \times \begin{cases} 1.68 & Non-Truck \\ 0.64 & Truck \end{cases}$$

In addition to Running Exhaust emissions factors, EMFAC-PL outputs the Idling and Starting emissions factors for trucks/non-trucks. These emission factors were used to calculate the daily average grams per square meter of emissions for each warehouse. Consistent with SCAQMD recommendations, 15 minutes of idle time per truck was assumed (5 minutes for start-up/warm-up, 5 minutes for the load-up, and 5 minutes before turning off the engine). Running exhaust emissions related to on-site and off-site operation of trucks are included in the modeling. The off-site running exhaust emission factors along with the traffic volumes and length of roadway segments were used to estimate the off-site running exhaust emissions.

Railyard Emissions. The Union Pacific West Colton Railyard, a hump classification yard, is located directly south of Segment 1. The rail yard is surrounded by commercial, industrial and residential land uses. As discussed in the modeling protocol, PM_{10} and $PM_{2.5}$ emission rates of 0.59 and 0.57 pounds per hour were used for modeling the rail yard in 2035 per USEPA *Emission Factors for Locomotives* (EPA-420-F-09-025, April 2009)

RECEPTORS

A 25x25 meter receptor grid was placed from the freeway ROW to a distance of 100 meters; and a 100x100 meter grid was placed to a distance 500 meters from the freeway ROW. The receptor grid included a line of receptors at the ROW. Since no areas of restricted public access are present outside of the freeway ROW, no receptors were excluded from this hot-spot analysis.

METEOROLOGICAL DATA

The SCAQMD maintains a network of 27 meteorological monitoring stations located throughout the Basin, providing data for use in AERMOD dispersion modeling. The five SCAQMD meteorological stations that are located in the general project vicinity are identified below in **Table 1**, and identified in the **Figure 2**.

[4]San Bernardino County, *Land-use Map Shapefiles*, http://cms.sbcounty.gov/gis/FTPServices.aspx, accessed July 10, 2014.

[5]Institute of Transportation Engineers, *Trip Generation*, 9th Edition, Volume 2 of 3.

TABLE 1: METEOROLOGICAL STATION DATA

Meteorological Station	Average Wind Speed	Calm Winds	Data Availability	Years	Surface Albedo	Surface Roughness	Bowen Ratio
Fontana	2.47	0.04%	98.70%	2008-12	0.19	0.240	1.0
Pomona	1.38	0.79%	98.99%	2008-12	0.18	0.470	1.0
San Bernardino	1.69	0.08%	99.22%	2007-11	0.18	0.315	1.0
Redlands	1.23	0.01%	99.01%	2008-12	0.20	0.331	1.0
Upland	1.73	0.02%	98.49%	2008-12	0.18	0.334	1.0

Since the project is modeled using the AERMOD regulatory default option, the surface roughness factor used for dispersion modeling is 1.0 meter.
SOURCE: SCAQMD, 2015.

There are three meteorological stations located within an approximate five-mile radius of Segments 1 and 2, specifically Fontana-Arrow Highway, Rubidoux, and San Bernardino Meteorological Stations. Although the Rubidoux Meteorological Station is near the two segments, it is separated from the alignment by a line of mountains on the south; therefore, this monitoring station was not included in the analysis.

The San Bernardino Meteorological Station is close to Segment 1 (approximately five miles) but far from Segment 2 (approximately nine miles). Similar to the Upland Meteorological Station west of the project alignment, the San Bernardino Meteorological Station is located where the line of mountains on the south and the north converge towards the east, therefore the wind direction changes traversing towards the east.

Both Segments 1 and 2 are located in the City of Fontana, and have the most similar land-use and surface characteristics to those of the Fontana-Arrow Highway Meteorological Station. The City of Fontana neighbors the Union Pacific Rail Yard (Segment 1) in the City of Colton and includes the majority of the warehouses (Segment 2). The Fontana-Arrow Highway Station is two and five miles to the north of the Segments 1 and 2, respectively, and best represents the meteorological conditions along the alignment. Therefore, meteorological data from the Fontana-Arrow Highway Meteorological Station was used in the modeling of Segments 1 and 2. This conclusion is based on the distance, prevailing winds patterns, and surface characteristics.

Pomona and Upland Meteorological Stations are nearest to Segment 4 and are both located approximately 3.3 miles from the segment's limits, respectively. Both stations have similar surface and land use characteristics compared to Segment 4. However, the width of the area confined by the mountains on the west, north, and south decreases going from Segment 4 on I-10 toward the Pomona Meteorological Station. The area's minimum width of 5 miles is reached where the Pomona Meteorological Station is located. This sudden change in topography is capable of significantly affecting local wind direction. The width of the area confined by the mountains where the Segment 4 is located reaches to approximately 10 miles making it less affected by the topography of the area and more similar to the wind conditions at the Upland Meteorological Station. Therefore, the Upland Meteorological Station was used for the modeling of Segment 4.

Segment 3 is on the west side adjacent to Ontario International Airport. Due to frequent landing and take-off activities of airplanes at the airport, excess generated heat, and dissimilar airport surface characteristics, the vertical wind and temperature profiles are not comparable to those of Segment 3. In addition, SCAQMD frequently prepares and publishes AERMOD-ready meteorological data for a network of 27 monitoring stations across the Basin, 5 of which are located within close vicinity of the proposed project site and have an approximate spacing of six

miles. The Upland Meteorological Station is 3.6 miles away and has similar land use and surface characteristics. Therefore, the Upland Meteorological Station was used for the modeling of Segment 3.

Albedo is a dimensionless quantity which represents the average reflectivity of the surface. Typical values of albedo can range from 0.1 (10 percent reflection) for darkly colored surfaces to 0.9 (90 percent reflection) for white/other bright surfaces. The Bowen ratio is a dimensionless quantity which represents the relationship of the sensible heat flux to the latent heat flux. The amount of soil moisture available for evaporation drives the value of the Bowen ratio, typically ranging from 0.3 for water surfaces to 10 or more for very dry, desert surfaces. The surface roughness length is typically expressed in centimeters or meters and represents the average height of obstructions to wind flow. The values for surface roughness range from 0.001 meter for water surfaces to one meter or more for urban areas. As shown in **Table 1** and according to the data obtained from the SCAQMD's website, the albedo within the project site for the select segments varies from 0.18 to 0.20. The SCAQMD assumes that the Bowen ratios for all the air monitoring sites are 1.0. Despite the availability of specific surface roughness data, SCAQMD requires that the regulatory surface roughness value of 1.0 meter be used for the modeling of all segments.

Particulate Matter Monitoring Stations

CARB and SCAQMD maintain a network of air quality monitoring stations throughout the Basin. These stations are used to characterize the air quality environment in the Basin by measuring and recording pollutant concentrations in the local ambient air. The Basin is divided into 38 source/receptor areas (SRAs). The proposed project corridor extends along 33 miles of I-10, which passes through SRAs 32 (Upland), 33 (Ontario), 34 (San Bernardino, Fontana), and 35 (Redlands) and along the border of SRAs 23 (Riverside, Rubidoux) and 24 (Perris). The SCAQMD General Forecast Areas and Air Monitoring Areas are shown in **Figure 3**.

The seven SCAQMD ambient air monitoring stations that are located in the general project vicinity are identified in **Table 2** and **Figure 2**. Starting from the west side of the project, the Upland and Pomona Monitoring Stations are equal distances from Segment 4. However, according to the USEPA Air Data Website, the Pomona Monitoring Station does not monitor PM_{10} and $PM_{2.5}$. The Upland Monitoring Station is located upwind of the Segment 4 with measurement scale of 3-50 kilometers according to the USEPA Air Data.

TABLE 2: PROJECT VICINITY PARTICULATE MATTER MONITORING STATIONS

Air Monitoring (ID) CBSA/Address	Measurement Scale (km)	Sampling Duration (hr)	Sampling Frequency	Sample Collection Method	Sample Analysis Method	Monitor Type	FRM / FEM
Upland (06-071-1004) /Riverside-San Bernardino-Ontario, CA / 1350 San Bernardino Road, Upland, CA	4 -50	1	Every day	Instrumental	Ultra Violet Absorption	SLAMS	Yes
	-	1	Every 6th day	Instrumental-R&P Sa246b-Inlet	Teom-Gravimetric	OTHER	Yes
	-	1	Every day	Instrument Met One 4 Models	Beta Attenuation	SLAMS	Yes
Fontana (06-071-2002) /Riverside-San Bernardino-Ontario	4 -50	1		Instrumental	Ultra Violet Absorption	SLAMS	Yes
	0.5 -50	24		Hi-Vol Sa/Gmw-1200	Gravimetric	SLAMS	Yes

TABLE 2: PROJECT VICINITY PARTICULATE MATTER MONITORING STATIONS

Air Monitoring (ID) CBSA/Address	Measurement Scale (km)	Sampling Duration (hr)	Sampling Frequency	Sample Collection Method	Sample Analysis Method	Monitor Type	FRM / FEM
/14360 Arrow Highway Boulevard, Fontana, CA	-	24	Every 3rd day	Andersen RAAS2.5-300 $PM_{2.5}$ SEQ W/WINS	GRAVIMETRIC	SLAMS	Yes
	-	24	Every 6th day	Andersen RAAS2.5-300 $PM_{2.5}$ SEQ W/WINS	GRAVIMETRIC	SLAMS	Yes
Ontario Fire Station (06-071-0025) /Riverside-San Bernardino-Ontario/1408 Francis St.	-	24	Every 6th day	Hi-Vol Sa/Gmw-1200	Gravimetric	SLAMS	Yes
	-	24	Every 3rd day	Andersen RAAS2.5-300 $PM_{2.5}$ SEQ W/WINS	GRAVIMETRIC	SLAMS	Yes
	-	24	Every 6th day	Hi-Vol Sa/Gmw-1200	Gravimetric	SLAMS	Yes
Rubidoux (06-065-8001) /Riverside-San Bernardino-Ontario, CA /5888 Mission Boulevard, Rubidoux, CA	-	1	Every day	Met One BAM-1020 Mass Monitor W/VSCC	Beta Attenuation	SLAMS	Yes
	-	24	Every day	Andersen RAAS2.5-300 $PM_{2.5}$ SEQ W/WINS	GRAVIMETRIC	SLAMS	Yes
	-	24	Every 6th day	Andersen RAAS2.5-300 $PM_{2.5}$ SEQ W/WINS	GRAVIMETRIC	SLAMS	Yes
	4 -50	1	Every day	Instrument Met One 4 Models	Beta Attenuation	SLAMS	Yes
	0.5 -50	1	Every day	Met One BAM-1020 Mass Monitor W/VSCC	Beta Attenuation	SLAMS	Yes
	-	1	Every day	Instrumental-R&P Sa246b-Inlet	Teom-Gravimetric	SLAMS	Yes
	-	24 r	Every 6th day	Lo-Vol-Dichotomous-Sa246b-Inlt	Gravimetric	SLAMS	Yes
	0.5 -50	24	Every 6th day	Hi-Vol Sa/Gmw-1200	Gravimetric	SLAMS	Yes
	0.5 -50	24	Every 6th day	Hi-Vol Sa/Gmw-1200	Gravimetric	SLAMS	Yes
San Bernardino (06-071-9004) /Riverside-San	0.5 -50	24	Every 6th day	Hi-Vol Sa/Gmw-120	Gravimetric	SLAMS	Yes

TABLE 2: PROJECT VICINITY PARTICULATE MATTER MONITORING STATIONS

Air Monitoring (ID) CBSA/Address	Measurement Scale (km)	Sampling Duration (hr)	Sampling Frequency	Sample Collection Method	Sample Analysis Method	Monitor Type	FRM / FEM
Bernardino-Ontario/24302 4th Street, San Bernardino, CA	-	1	Every day	Instrumental-R&P Sa246b-Inlet	Teom-Gravimetric	SLAMS	Yes
	-	24	Every 3rd day	Andersen RAAS2.5-300 $PM_{2.5}$ SEQ W/WINS	GRAVIMETRIC	SLAMS	Yes
Redlands (06-071-4003) /Riverside-San Bernardino-Ontario, CA/ 500 N. Dearborn, Redlands, CA	0.5 -50	24	Every 6th day	Hi-Vol Sa/Gmw-1200	Gravimetric	SLAMS	Yes
Ontario-Airport (06-071-6001) /Riverside-San Bernardino-Ontario, CA/ Ontario Airport	0.5 -50	24	Every 6th day	Hi-Vol Sa/Gmw-1200	Gravimetric	NAMS	Yes

Note: CBSA = Core Based Statistical Area; FRM = Federal Reference Method; FEM - Federal Equivalent Method;
SOURCE: USEPA AirData website (http://www.epa.gov/airdata/ad_maps.html); compiled by Terry A. Hayes Associates, January 2015.

Based on the data from the Fontana-Arrow Highway Monitoring Station as shown in **Table 3**, background 98th percentile 24-hour $PM_{2.5}$ concentrations for the 1st, 2nd, and 3rd year of data were 32.7, 34.3, and 27.7 µg/m^3, respectively. The annual $PM_{2.5}$ concentration averaged 12.4 µg/m^3. The maximum 24-hour PM_{10} concentration was 90 µg/m^3.

TABLE 3: BACKGROUND CONCENTRATIONS

Pollutant	Data Availability/Completeness	Background and Design Value Conc. (µg/m^3)
UPLAND AIR MONITORING STATION		
24-hr $PM_{2.5}$	Daily Mean (90.7%) 1/1/2011-12/31/2013 (3 years)	(98th percentiles) 1st year: 35.0 2nd Year: 37.3 3rd Year: 44.2 ---------- Design value:[1] 38.8
Annual $PM_{2.5}$	Daily Mean (90.7%) 1/1/2011-12/31/2013 (3 years)	19.3 (3-yr average)
24-hr PM_{10}	Daily Mean (97.2%) 1/1/2011-12/31/2013	96 (max 24-hr) Expected exceedance: 0
ONTARIO-FIRE STATION AIR MONITORING STATION		
24-hr $PM_{2.5}$	Daily Mean (31.8%) 1/1/2011-12/31/2013 (3 years)	(98th percentiles) 1st year: 26.8 2nd Year: 26.8 3rd Year: 34.2 ---------- Design value: 29.2
Annual $PM_{2.5}$	Daily Mean (31.8%) 1/1/2011-12/31/2013	12.5 (3-yr average)

	(3 years)	
24-hr PM_{10}	Daily Mean (33.6%) 1/1/2011-12/31/2013	117 (max 24-hr) Expected exceedance: 0
FONTANA-ARROW HIGHWAY AIR MONITORING STATION		
24-hr $PM_{2.5}$	Daily Mean (33.6%) 1/1/2011-12/31/2013 (3 years)	1st year: 32.7 2nd Year: 34.3 3rd Year: 27.7 (98th percentiles) ---------- Design value: 31.6
Annual $PM_{2.5}$	Daily Mean (33.6%) 1/1/2011-12/31/2013 (3 years)	12.4 (3-yr average)
24-hr PM_{10}	Daily Mean (16.5%) 1/1/2011-12/31/2013	90 (max 24-hr) Expected exceedance: 0

[1] Design value here is the average of the three consecutive years' 98th percentile concentrations of 24-hr values. EPA, PM Hotspot Training, Module 7, Calculating Design Values and Determining Conformity, p.34.
[2] EPA Air Trends, http://www.epa.gov/airtrends/values.html, accessed Nov 18, 2014.

Similarly, for the Ontario-Fire Station Monitoring Station, 98th percentile 24-hour $PM_{2.5}$ concentrations for the 1st, 2nd, and 3rd year of data was 26.8, 26.8, and 34.2 µg/m^3, respectively. The annual $PM_{2.5}$ background concentration averaged 12.5 µg/m^3. The maximum 24-hour PM_{10} concentration was 117 µg/m^3.

The Fontana and Ontario-Fire Station Monitoring Stations are located in an urban setting in close vicinity of the I-10. This includes areas with a mix of residential, commercial, and industrial land uses. In conclusion, the Fontana-Arrow Highway (Segments 1 and 2) and Ontario-Fire Station (Segment 3) Monitoring Stations accurately characterize PM background concentrations along the alignment for the selected segments. The Upland Monitoring Station was used for Segment 4.

Calculation of Design Values for Conformity Determination

Using the Build Alternative and No Build Alternative modeled $PM_{2.5}$ and PM_{10} concentrations and the background concentration values identified above, DV were calculated for the annual $PM_{2.5}$, 24-hour $PM_{2.5}$, and 24-hour PM_{10} concentrations using the step-by-step calculation procedures detailed in the Guidance, Section 9.3. AERMOD modeling outputs are provided in the Attachment D.

The 24-hour $PM_{2.5}$ and PM_{10} NAAQS are 35 and 150 µg/m^3, respectively. The annual $PM_{2.5}$ NAAQS was recently strengthened from 15.0 to 12.0 µg/m^3. Transportation-conformity hot-spot analyses may comply with the 15.0 µg/m^3 if the Record of Decision (ROD) for proposed projects is provided by April 15, 2016. The ROD is not anticipated until after April 15, 2016, which would result in compliance with the 12.0 µg/m^3 NAAQS. The annual $PM_{2.5}$ NAAQS used in the analysis is not pertinent as background concentrations exceed both standards and the analysis must compare Build to No Build concentrations.

ANNUAL $PM_{2.5}$

For annual $PM_{2.5}$ concentrations, the DV rounds to the nearest 0.1 µg/m^3. The worst-case annual $PM_{2.5}$ DVs are provided in **Table 4**. DV calculations for all receptor locations are provided in Attachment E; contour plots of the concentrations are provided in Attachment B.

TABLE 4: ANNUAL $PM_{2.5}$ DESIGN VALUES

	Build Alternative Concentrations (µg/m^3)	No Build Alternative Concentrations (µg/m^3)
ALTERNATIVE 2[1]		
Modeled Concentration	6.91	8.43
Background Concentration	12.56	12.56
Total Concentration	19.47	20.99
Design Value	19.5	21.0
ALTERNATIVE 3[2]		
Modeled Concentration	7.96	8.01
Background Concentration	19.02	19.02
Total Concentration	26.98	27.03
Design Value	27.0	27.0

[1] Receptor with the highest concentration is located in Segment 3.
[2] Receptor with the highest concentration is located in Segment 4.

24-HOUR $PM_{2.5}$

For 24-hour $PM_{2.5}$ concentrations, the DV rounds to the nearest 1.0 µg/m^3. The worst-case 24-hour $PM_{2.5}$ DVs are provided in **Table 5**. DV calculations for all receptor locations are provided in Attachment E.

TABLE 5: 24-HOUR $PM_{2.5}$ DESIGN VALUES

	Build Alternative Concentrations (µg/m^3)	No Build Alternative Concentrations (µg/m^3)
ALTERNATIVE 2[1]		
Modeled Concentration	11.9	13.6
Background Concentration	29.2	29.2
Total Concentration	41.1	42.8
Design Value	41	43
ALTERNATIVE 3[2]		
Modeled Concentration	18.9	18.9
Background Concentration	29.2	29.2
Total Concentration	48.1	48.1
Design Value	48	48

NOTE: 24-hr $PM_{2.5}$ design values are calculated using Tier 2 approach and USEPA's MySQL script. Hence, the maximum modeled concentrations are estimated using 3-year average 98th percentile of the daily $PM_{2.5}$ background concentrations and the total concentrations.
[1] Receptor with the highest concentration is located in Segment 3.
[2] Receptor with the highest concentration is located in Segment 4.

24-HOUR PM_{10}

For 24-hour PM_{10} concentrations, the DV rounds to the nearest 10.0 µg/m^3. The 24-hour PM_{10} DVs are provided in **Table 6**. DV calculations for all receptor locations are provided in Attachment E.

TABLE 6: 24-HOUR PM_{10} DESIGN VALUES

	Build Alternative Concentrations (µg/m^3)	No Build Alternative Concentrations (µg/m^3)
ALTERNATIVE 2[1]		
Modeled Concentration	40	50
Background Concentration	117	117
Total Concentration	157	167
Design Value	160	170
ALTERNATIVE 3[2]		
Modeled Concentration	45	46
Background Concentration	117	117
Total Concentration	162	163
Design Value	160	160

[1] Receptor with the highest concentration is located in Segment 3.
[2] Receptor with the highest concentration is located in Segment 4.

Shown above in **Tables 4** through **6**, the DVs for both Alternatives 2 and 3 do not exceed the No Build Alternative DV for $PM_{2.5}$ or PM_{10}. As such, project-level $PM_{2.5}$ and PM_{10} conformity is demonstrated for both Alternatives 2 and 3.

References

R Core Team (2014). *R: A Language and Environment for Statistical Computing.* R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL http://www.R-project.org/.

Institute of Transportation Engineers, *Trip Generation*, 9th Edition, Volume 2 of 3.

U.S. Environmental Protection Agency, *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas*. November 2013.

USEPA, *AP-42, Fifth Edition, Volume I, Chapter 13: Miscellaneous Sources, Section 13.2.1, Fugitive Dust Sources, Paved Roads*, January 2011. Available: http://www.epa.gov/ttn/chief/ap42/ch13/final/c13s0201.pdf.

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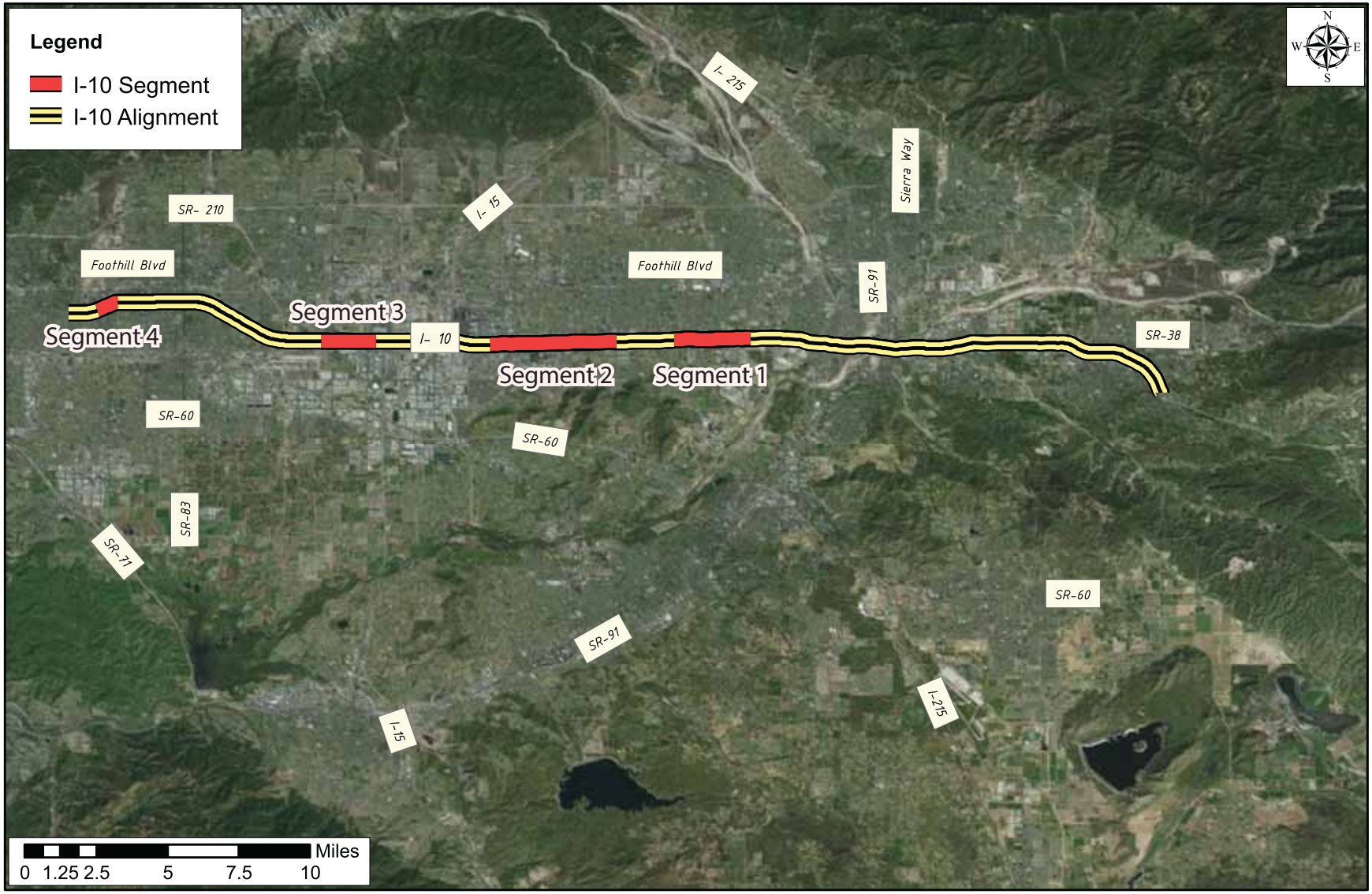
Contribution: AERMOD Modeler and Preparation of the Hot-Spot Report.



SOURCE: STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION AND TAHA, 2014.

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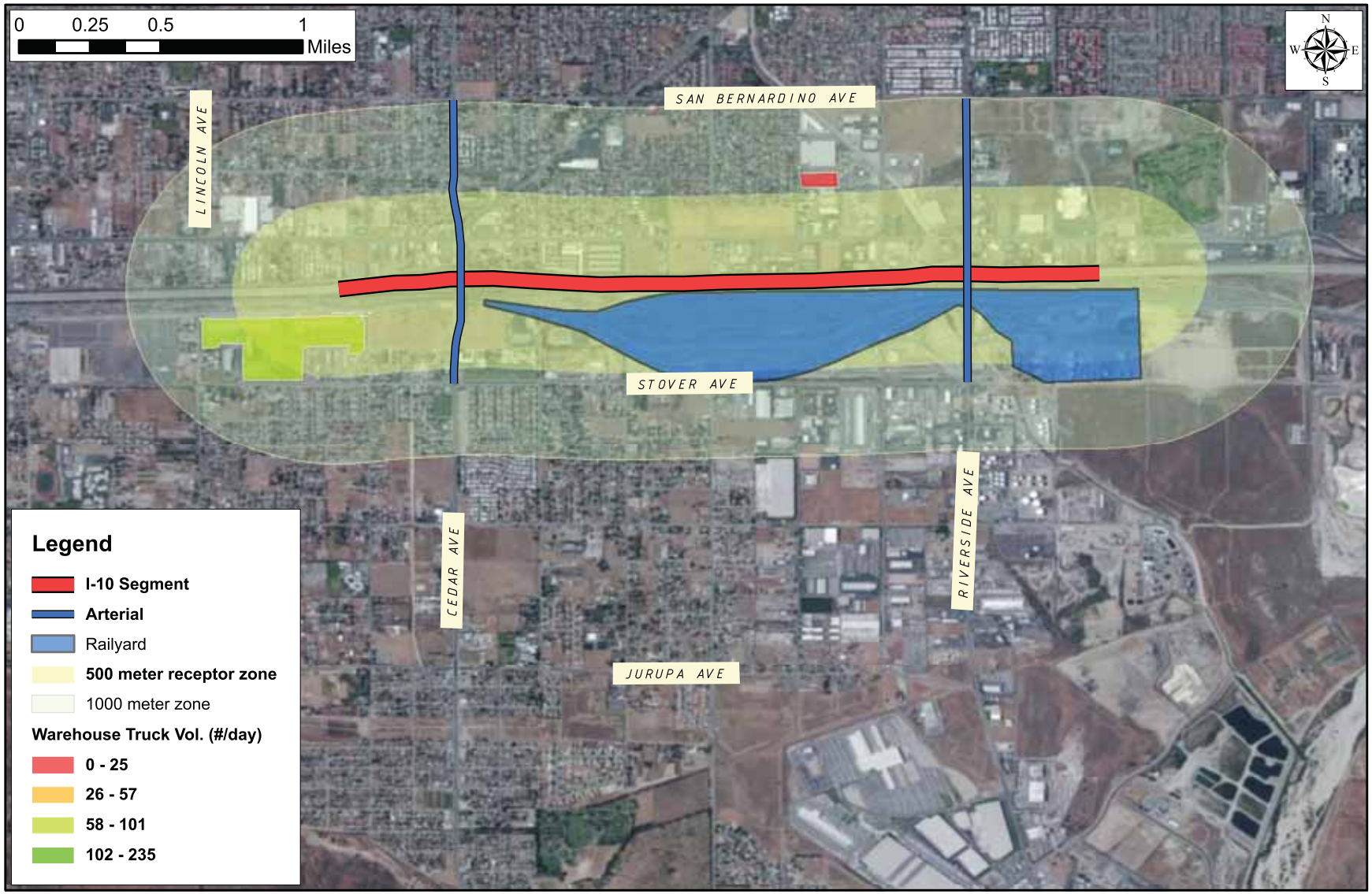
FIGURE 1A

MODELING SEGMENTS



SOURCE: STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION AND TAHA, 2014.

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FIGURE 1B

MODELING SEGMENT 1

SOURCE: STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION AND TAHA, 2014.

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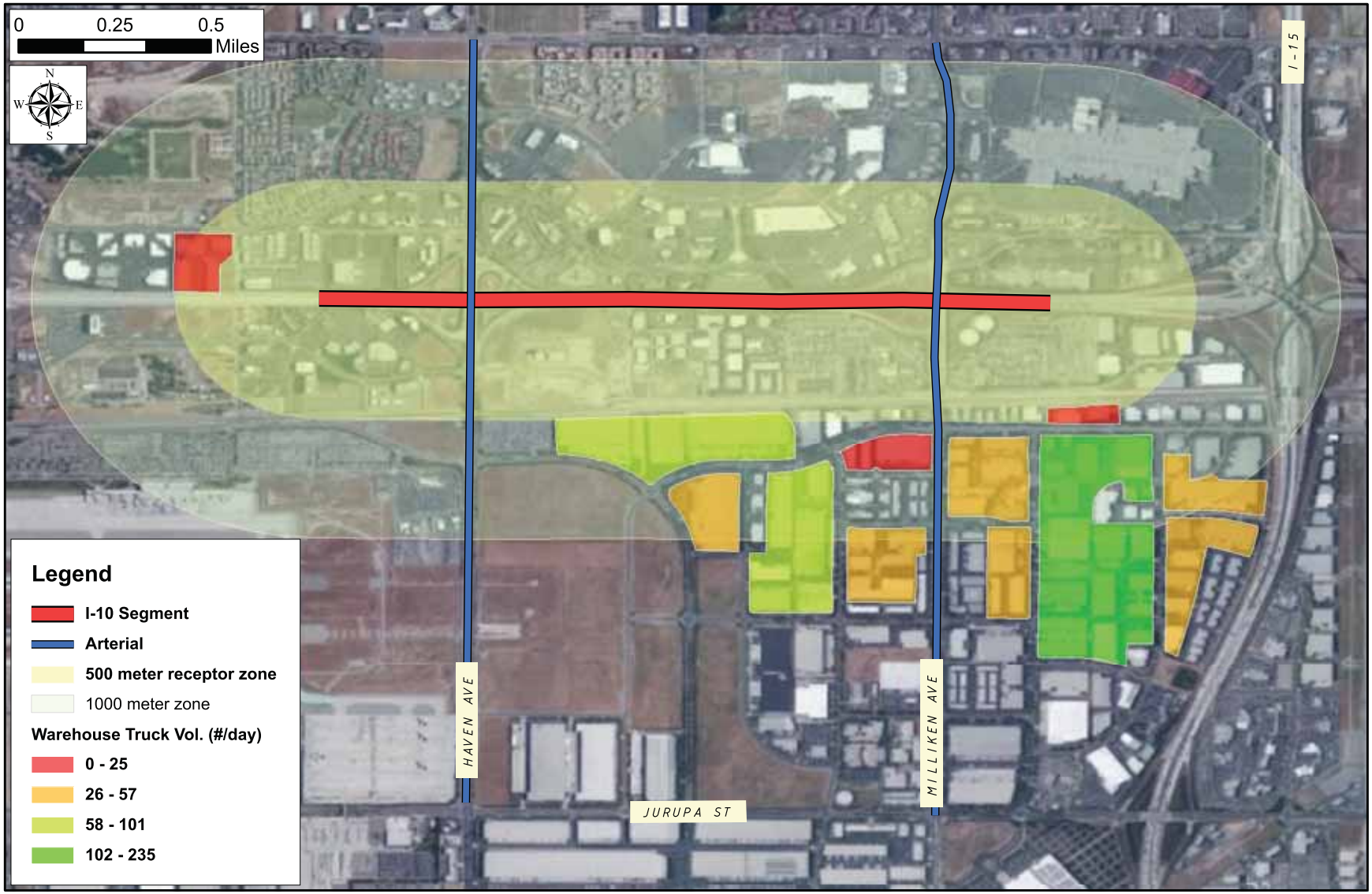
FIGURE 1C

MODELING SEGMENT 2



SOURCE: STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION AND TAHA, 2014.

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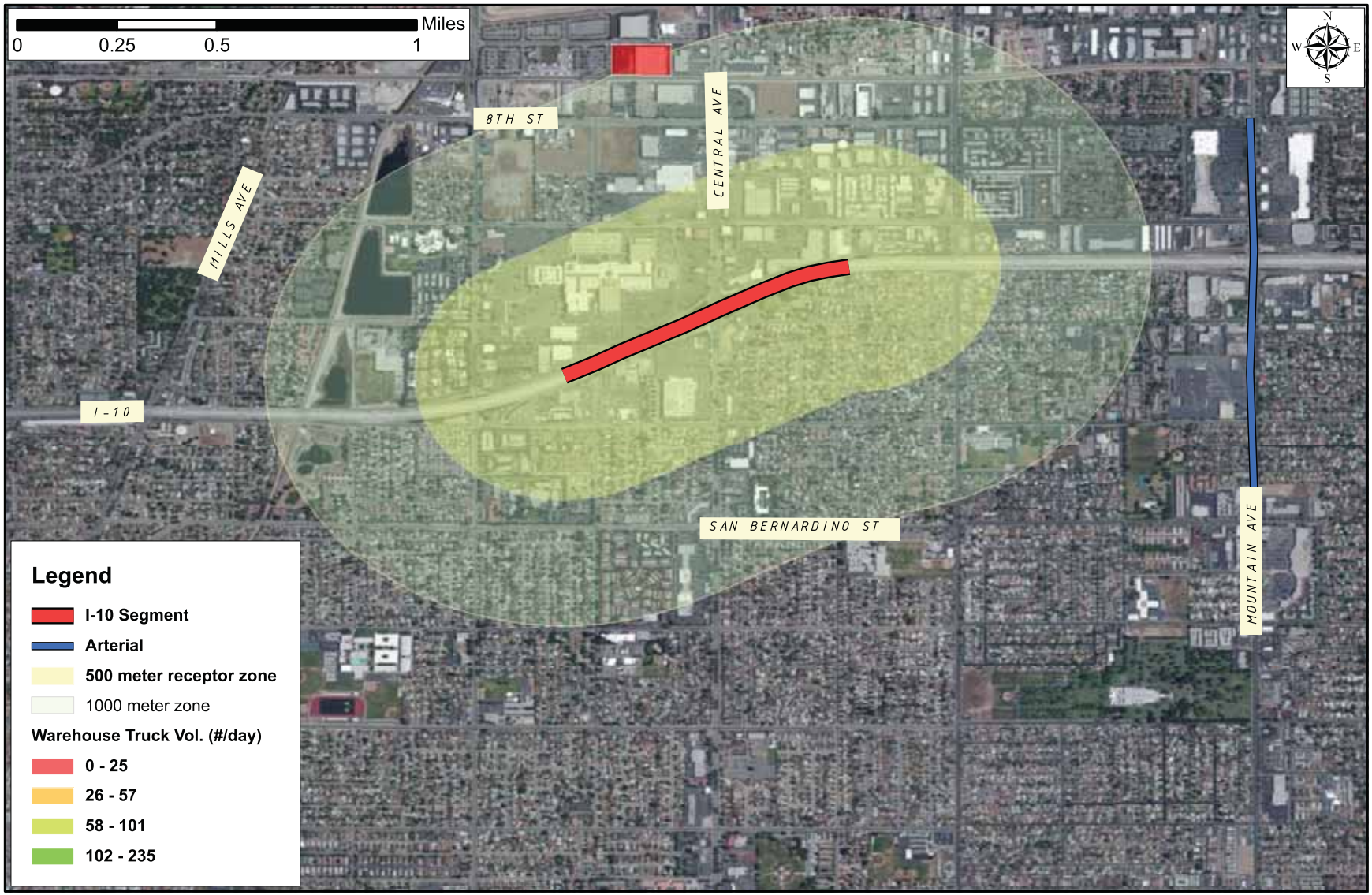
FIGURE 1D

MODELING SEGMENT 3



SOURCE: STATE OF CALIFORNIA, DEPARTMENT OF TRANSPORTATION AND TAHA, 2014.

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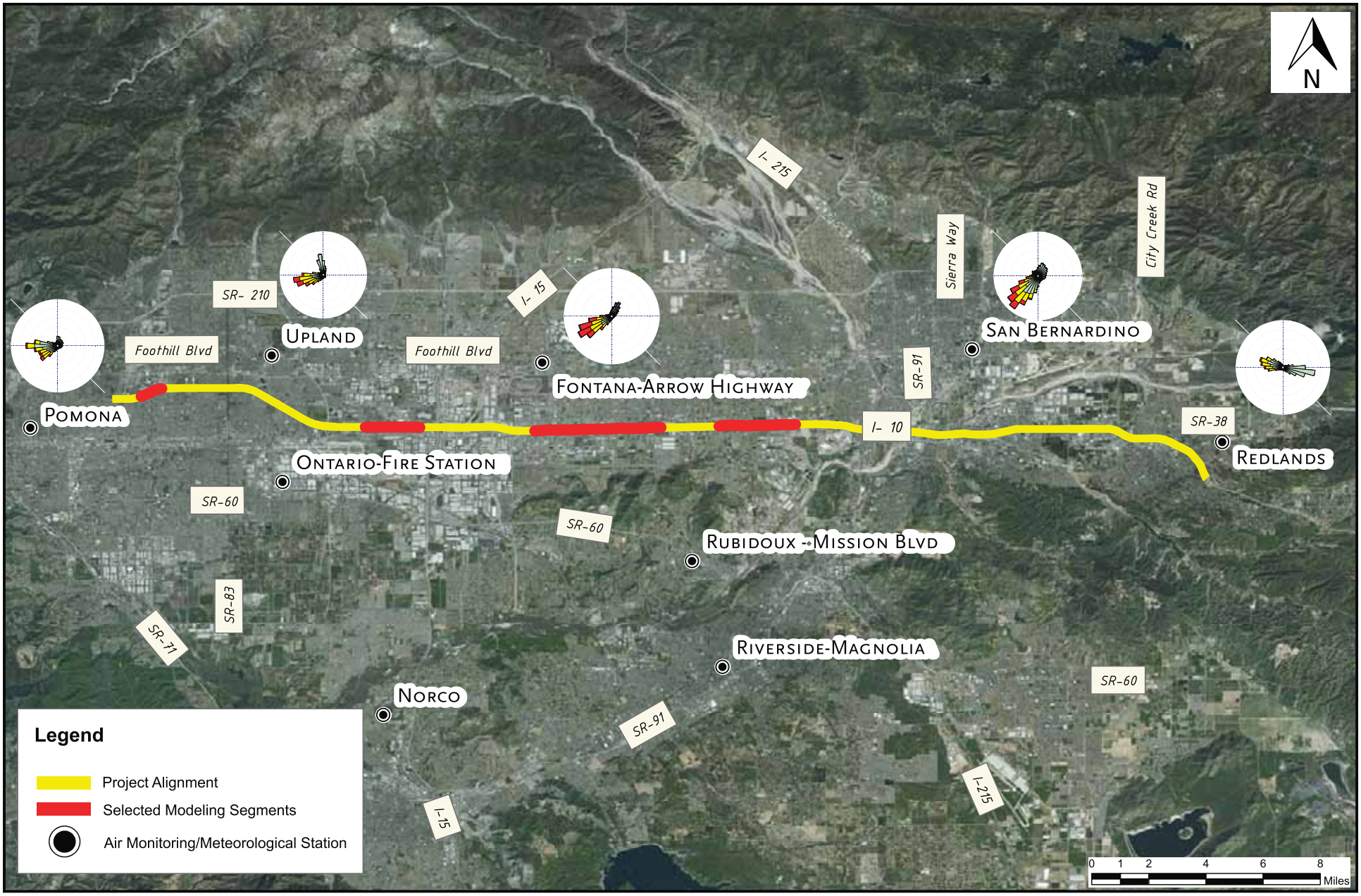
FIGURE 1E

MODELING SEGMENT 4



SOURCE: State of California, Department of Transportation and TAHA, 2014.

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FIGURE 2

AIR MONITORING/
METEOROLOGICAL STATIONS

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT

21865 Copley Drive, Diamond Bar, CA 91765-4182
Information: 1-800-CUT-SMOG (1-800-288-7664)
Internet: http://www.aqmd.gov

Air Quality Reporting

Since 1977, the South Coast Air Quality Management District has served as the local government agency responsible for measuring, reporting and taking steps to improve air quality.

To inform the AQMD's 15 million residents about air quality conditions, the AQMD issues an air quality forecast each day and reports current air quality conditions for each numbered Monitoring Area and General Forecast Area depicted here.

This air quality information is transmitted to the public through newspapers, television, radio and pager services, through faxes to schools, through recorded messages on the AQMD's toll-free Smog Update telephone line, 1-800-CUT-SMOG, and on the AQMD's Internet Website http://www.aqmd.gov.

Newspapers, television and radio stations typically will report air quality information using the General Forecast Areas, shown in color below, which are larger groupings of the more specific Air Monitoring Areas.

The 1-800-CUT-SMOG (1-800-288-7664) line also provides smog forecast and current smog level information by ZIP code.

The AQMD's Internet Website provides both forecasts as well as smog levels for that day and the previous day. Forecasts for the next day normally are posted by noon.

General Forecast Areas & Air Monitoring Areas

Coastal

Northwest Los Angeles County Coastal	2
Southwest Los Angeles County Coastal	3
South Los Angeles County Coastal	4
North Orange County Coastal	18
Central Orange County Coastal	20

Metropolitan

Central Los Angeles County	1
Southeast Los Angeles County	5
South Central Los Angeles County	12
North Orange County	16

San Fernando Valley

West San Fernando Valley	6
East San Fernando Valley	7
Santa Clarita Valley	13

San Gabriel Valley

West San Gabriel Valley	8
East San Gabriel Valley	9
Pomona/Walnut Valley	10
South San Gabriel Valley	11

Inland Orange County

Central Orange County	17
Saddleback Valley	19
Capistrano Valley	21

Riverside Valley

Corona/Norco Area	22
Metropolitan Riverside	23

San Bernardino Valley

Northwest San Bernardino Valley	32
Southwest San Bernardino Valley	33
Central San Bernardino Valley	34
East San Bernardino Valley	35

Hemet/Elsinore Area

Perris Valley	24
Lake Elsinore	25
Hemet/San Jacinto Valley	28

Temecula/Anza Area

Temecula Valley	26
Anza Area	27

San Gabriel Mountains 15

San Bernardino Mountains

West San Bernardino Mountains	36
Central San Bernardino Mountains	37

Big Bear Lake 38

Banning Pass Area 29

Coachella/Low Desert

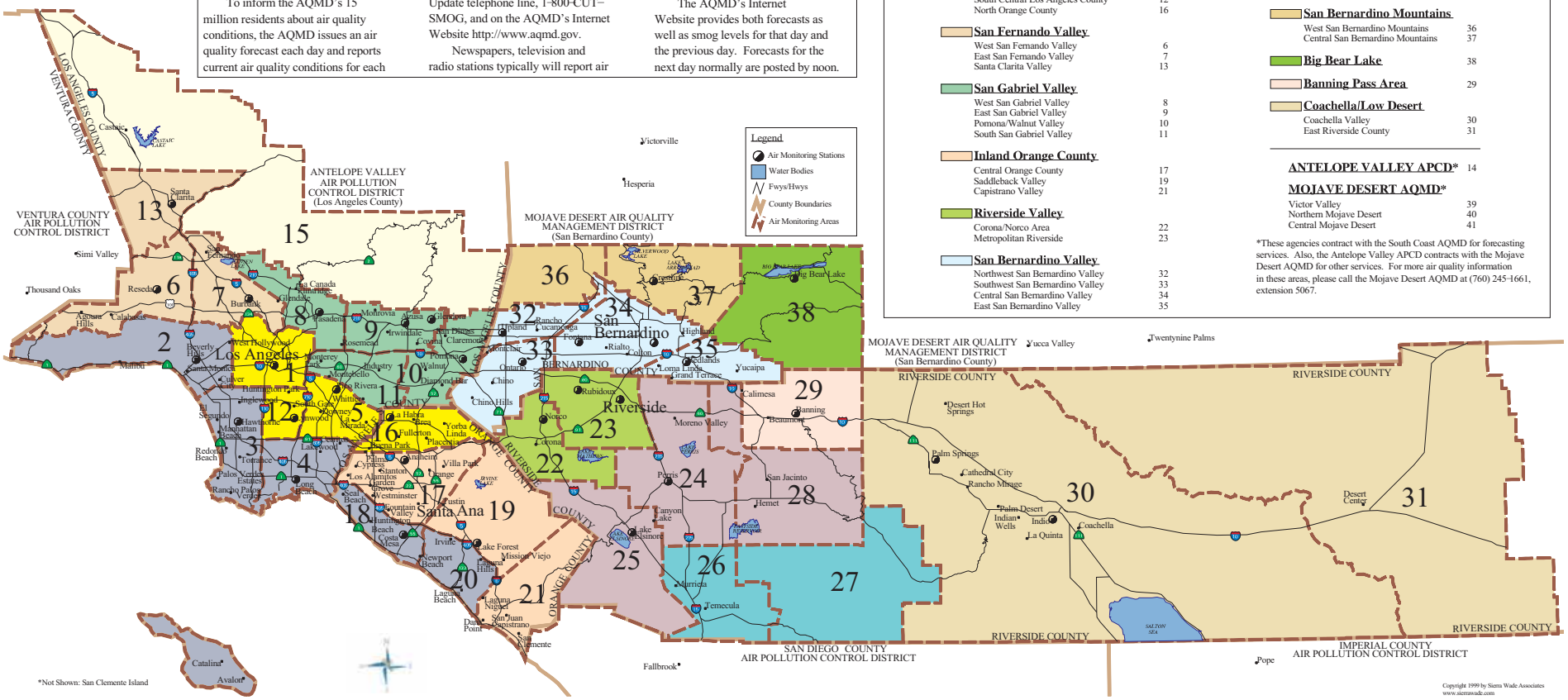
Coachella Valley	30
East Riverside County	31

ANTELOPE VALLEY APCD* 14

MOJAVE DESERT AQMD*

Victor Valley	39
Northern Mojave Desert	40
Central Mojave Desert	41

*These agencies contract with the South Coast AQMD for forecasting services. Also, the Antelope Valley APCD contracts with the Mojave Desert AQMD for other services. For more air quality information in these areas, please call the Mojave Desert AQMD at (760) 245-1661, extension 5067.



SOURCE: South Coast Air Quality Management District, 2015.

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FIGURE 3

SCAQMD AIR MONITORING AREAS