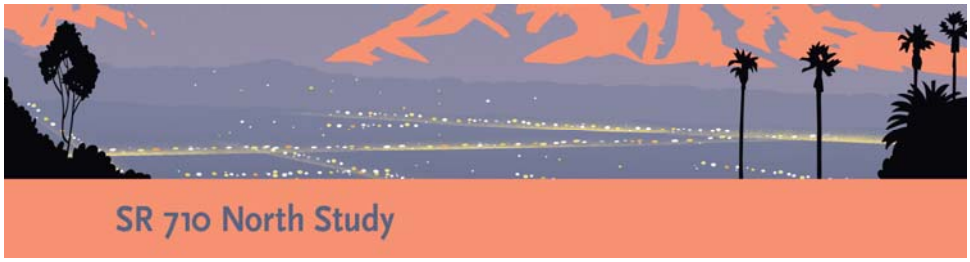
Water Quality Assessment Report



State Route 710 North Study (SR 710 North Study)
Los Angeles County, California
07-LA-710 / PM 26.7/32.1
EA 187900
EFIS 0700000191

May 2014

Caltrans
CALIFORNIA DEPARTMENT OF TRANSPORTATION

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STATE OF CALIFORNIA
Department of Transportation

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Executive Summary

The purpose of this Water Quality Assessment Report (WQAR) is to identify the physical setting of the study area and the existing water quality, specify the regulatory framework with respect to water quality, identify potential water quality impacts associated with the project, and make recommendations for avoidance and minimization measures for potentially adverse impacts. Further, the analysis developed in this WQAR would fulfill the requirements of the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

The California Department of Transportation (Caltrans), in cooperation with the Los Angeles County Metropolitan Transportation Authority (Metro) proposes transportation improvements to improve mobility and relieve congestion in the area between State Route 2 (SR 2) and Interstates 5, 10, 210 and 605 (I-5, I-10, I-210, and I-605, respectively) in east/ northeast Los Angeles and the western San Gabriel Valley. The study area for the State Route 710 (SR 710) North Study is approximately 100 square miles and generally bounded by I-210 on the north, I-605 on the east, I-10 on the south, and I-5 and SR 2 on the west. Caltrans is the Lead Agency under NEPA and CEQA.

The lack of continuous north-south transportation facilities in the study area has the following consequences, which have been identified as the elements of need for the project:

- Degradation of the overall efficiency of the larger regional transportation system
- Congestion on freeways in the study area
- Congestion on the local streets in the study area
- Poor transit operations within the study area

The purpose of the proposed action is to effectively and efficiently accommodate regional and local north-south travel demands in the study area of the western San Gabriel Valley and east/northeast Los Angeles, including the following considerations:

- Improve efficiency of the existing regional freeway and transit networks.
- Reduce congestion on local arterials adversely affected due to accommodating regional traffic volumes.
- Minimize environmental impacts related to mobile sources.

The proposed alternatives for the project include the No Build Alternative, the Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative, the Bus Rapid Transit (BRT) Alternative, the Light Rail Transit (LRT) Alternative, and the Freeway

Tunnel Alternative. Components of the TSM/TDM Alternative will also be included with the BRT, LRT, and Freeway Tunnel Alternatives.

The No Build Alternative includes projects/planned improvements through 2035 that are contained in the Federal Transportation Improvement Program (FTIP), as listed in the Southern California Association of Governments (SCAG) 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) Measure R and the funded portion of Metro's 2009 Long Range Transportation Plan (LRTP). The No Build Alternative does not include any planned improvements to the SR 710 Corridor.

The TSM/TDM Alternative consists of strategies and improvements to increase efficiency and capacity for all modes in the transportation system with lower capital cost investments and/or lower potential impacts. The TSM/TDM Alternative is designed to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. TSM strategies include Intelligent Transportation Systems (ITS), local street and intersection improvements, and Active Traffic Management (ATM). The TDM strategies include expanded bus service, bus service improvements, and bicycle improvements.

The BRT Alternative would provide high-speed, high-frequency bus service through a combination of new, dedicated, and existing bus lanes and mixed-flow traffic lanes to key destinations between East Los Angeles and Pasadena.

The LRT Alternative would include passenger rail operated along a dedicated guideway, similar to other Metro light rail lines. The LRT Alternative would begin on Mednik Avenue adjacent to the existing East Los Angeles Civic Center Station on the Metro Gold Line and end at Raymond Avenue adjacent to the existing Fillmore Station on the Metro Gold Line.

The Freeway Tunnel Alternative would start at the existing southern stub of SR 710 in Alhambra, just north of I-10, and connect to the existing northern stub of SR 710, south of the I-210/State Route 134 (SR 134) interchange in Pasadena. The Freeway Tunnel Alternative has two design variations: a dual-bore tunnel and a single-bore tunnel. Five operational variations for the Freeway Tunnel Alternative include the freeway tunnel alternative without tolls, freeway tunnel alternative with trucks excluded, freeway tunnel alternative with tolls, the freeway tunnel alternative with tolls and trucks excluded, and the freeway tunnel alternative with toll and express bus.

The existing surface drainage/storm drain system within the study area is comprised of dikes, curbs, gutters, curb opening inlets, cross-culverts, lateral pipes, a pump station, a pump

station screen, main trunk line pipes, and a concrete channel that direct storm water to the County of Los Angeles storm drain system. The storm drains eventually drain surface storm water to the Los Angeles River, which drains to the Pacific Ocean. Surface drainage/storm water runoff under the Build Alternatives would require extension and modification of the existing drainage systems. The proposed modifications to the surface drainage/storm drain system would involve the relocation, removal, and/or installation of catch basins, curb opening inlets, lateral pipes, cross culverts, Best Management Practices (BMPs), a pump station and storage chamber, a sump pump, deck drains, and underdrains under each track in the train yard. The proposed surface drainage system would be linked to the existing drainage system and would preserve the existing drainage pattern as much as possible, including draining all storm water to the Los Angeles River and then on to the Pacific Ocean, which is consistent with current conditions.

As noted above, storm water runoff from the Build Alternatives would be conveyed via existing and proposed catch basins, lateral pipes, curb opening inlets, cross culverts, bioswales, and a pump station to receiving waters, which include the Dorchester Channel, the Laguna Regulating Basin, Arroyo Seco, and Rio Hondo, all of which are tributaries to the Los Angeles River, which connects directly to the Pacific Ocean. Los Angeles River Reach 2, Arroyo Seco Reach 1, and Rio Hondo Reach 2 are all listed on the 2010 California 303(d) List of Water Quality Limited Segments. The Los Angeles River Reach 2 (Carson Street to Figueroa Street) is listed as impaired for ammonia, coliform bacteria, copper, lead, nutrients (algae), oil, and trash. Arroyo Seco Reach 1 (Los Angeles River to West Holly Avenue) is listed as impaired for benthic-macroinvertebrate bioassessments, coliform bacteria, and trash. Rio Hondo Reach 2 (at Spreading Grounds) is listed as impaired for coliform bacteria and cyanide.

Potential impacts during construction activities are that excavated soil would be exposed, and therefore there would be an increased potential for soil erosion compared to existing conditions. In addition, chemicals, liquid products, petroleum products (e.g., paints, solvents, and fuels), and concrete-related waste may be spilled or leaked and have the potential to be transported via storm runoff into receiving waters. The total disturbed area during construction would be 21.34 acres (ac) for the TSM/TDM Alternative (i.e., the sum of approximately 5.75 ac within Caltrans right of way (ROW) and approximately 15.59 ac outside Caltrans ROW). The total disturbed area during construction would be 34.48 ac for the BRT Alternative (i.e., the sum of approximately 1.00 ac within Caltrans ROW and approximately 33.48 ac outside of Caltrans ROW). The total disturbed area during construction would be 33.31 ac for the LRT Alternative (i.e., the sum of approximately 3.89 ac within Caltrans ROW and approximately 29.42 outside of Caltrans ROW). The total

disturbed area during construction would be 80.59 ac and 92.96 ac within Caltrans ROW for the Freeway Tunnel Alternative single-bore and dual-bore tunnel design variations, respectively.

A Storm Water Pollution Prevention Plan (SWPPP) would be prepared and implemented during construction as required by the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit [CGP], Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ; NPDES No. CAS000002 or any subsequent permit). The construction SWPPP would identify the specific Best Management Practices (BMPs) to be implemented during project construction so as not to cause or contribute to an exceedance of any applicable water quality standard contained in the Los Angeles Regional Water Quality Control Board (LARWQCB) Basin Plan. These BMPs would be designed to meet the technology requirement as stipulated in the NPDES CGP.

Groundwater dewatering during construction would be required for the LRT and Freeway Tunnel Alternatives. Construction site dewatering for the LRT and Freeway Tunnel Alternatives would be required to comply with Order No. R4-2013-0095 (NPDES No. CAG994004). Order No. R4-2013-0095 covers general waste discharge permits for discharges to surface waters from activities involving groundwater extraction. It covers treated or untreated groundwater generated from permanent or temporary dewatering operations or other appropriate wastewater discharge not specifically covered in other general NPDES permits in the Los Angeles region. Under this order, permittees are required to monitor their discharges from groundwater extraction waste from construction to ensure that effluent limitations for constituents are not exceeded.

Pollutants of concern during operation of the Build Alternatives include nutrients, pesticides, suspended solids/sediments, heavy metals, oil and grease, toxic organic compounds, and trash and debris. The Build Alternatives would result in a permanent net increase in impervious surface area of 3.8 ac for the TSM/TDM Alternative (i.e., the result of a decrease of approximately -0.15 ac within Caltrans ROW and an increase of approximately 3.95 ac outside of Caltrans ROW); 1.14 ac for the BRT Alternative (i.e., the result of an increase of approximately 0.08 ac within Caltrans ROW and an increase of approximately 1.06 ac outside of Caltrans ROW); 16.42 ac for the LRT Alternative (i.e., the result of an increase of approximately 5.46 ac within Caltrans ROW and an increase of approximately 10.96 ac outside of Caltrans ROW); and 1.68 ac and 13.54 ac within Caltrans ROW for the Freeway Tunnel Alternative single-bore and dual-bore tunnel design variations, respectively. An

increase in impervious area would increase the volume of runoff during a storm, which would more effectively transport pollutants to receiving waters.

The Build Alternatives would implement Caltrans-approved Design Pollution Prevention and Treatment BMPs within Caltrans ROW, and Site Design, Source Control, and Treatment Control BMPs outside Caltrans ROW as required by the Los Angeles County Standard Urban Storm Water Mitigation Plan (SUSMP) to reduce the discharge of pollutants of concern to the maximum extent practical. The overall strategy to treat runoff from new impervious surface areas would be to use design features that reduce mobilization of sediment and other pollutants in storm water, increase the detention time to allow for infiltration, reduce overall pollutant loads by reducing volumetric discharges, and provide ancillary filtration and infiltration within vegetated conveyances.

Caltrans-approved Treatment BMPs being proposed as part of the project would include biofiltration swales and gross solid removal devices (GSRDs). Caltrans-approved Design BMPs include preservation of existing vegetation, slope/surface protection systems (permanent soil stabilization and replanting of vegetation), asphalt concrete dikes, toe-of-fill ditches, and downdrains/overside drains.

Site Design, Source Control, and Treatment Control BMPs as required by the Los Angeles County SUSMP would include tree box filters, catch basins, curb inlet filters, media filters, and bioretention facilities.

In addition, for impacts to jurisdictional areas, a Dredge and Fill Permit from the United States Army Corps of Engineers (USACE), a Lake and Streambed Alteration Agreement with the California Department of Fish and Wildlife (CDFW), and a Section 401 Water Quality Certification from the LARWQCB would be required.

Under the No Build Alternative, no improvements to the SR 710 corridor would be made. Therefore, the No Build Alternative would not result in any short-term water quality impacts from construction-related activities. In addition, under the No Build Alternative, there would be no increases in impervious surface area in the SR 710 study area. Therefore, the No Build Alternative would not result in long-term water quality impacts from operational activities.

With the application of Storm Water Permit Waste Discharge Requirements, including BMPs, during construction and operation of the Build Alternatives, as stipulated in Measures WQ-1 through WQ-6, the Build Alternatives are not anticipated to result in adverse impacts to water quality.

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List of Abbreviations and Acronyms

°F	degrees Fahrenheit
ac	acre/acres
ADA	Americans with Disabilities Act
ATM	Active Traffic Management
bgs	below ground surface
BMPs	Best Management Practices
BRT	Bus Rapid Transit
BSA	biological study area
Cal State LA	California State University, Los Angeles
Cal Water	California Water Surface Company
Caltrans	California Department of Transportation
CCR	California Code of Regulations
Cd	cadmium
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CGP	Construction General Permit
CMS	changeable message signs
CTR	California Toxics Rule
Cu	copper
CWA	Clean Water Act
DSA	Disturbed Soil Area
ELAC	East Los Angeles College
EPA	United States Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FIRM	Federal Insurance Rate Map
ft	foot/feet
FTIP	Federal Transportation Improvement Program
GSRD	gross solid removal device
HA	Hydrological Area
HSA	Hydrologic Subarea

HU	Hydrologic Unit
I-5	Interstate 5
I-10	Interstate 10
I-105	Interstate 105
I-110	Interstate 110
I-210	Interstate 210
I-405	Interstate 405
I-605	Interstate 605
I-710	Interstate 710
IEN	Information Exchange Network
LARWQCB	Los Angeles Regional Water Quality Control Board
LEDPA	least environmentally damaging practicable alternative
Los Angeles DPW	City of Los Angeles Department of Public Works
LRT	Light Rail Transit
LRTP	Long Range Transportation Plan
MBTA	Migratory Bird Treaty Act
MDL	maximum disturbance limit
Metro	Los Angeles County Metropolitan Transportation Authority
mg/L	milligrams per liter
mgd	million gallons per day
mi	mile/miles
mph	miles per hour
MS4	Municipal Separate Storm Sewer System
MSA	Metropolitan Statistical Area
MTBE	methyl-t-butyl ether
MWD	Metropolitan Water District of Southern California
NEPA	National Environmental Policy Act
NES	Natural Environment Study
NPDES	National Pollutant Discharge Elimination System
NRCS	National Resources Conservation Service
O&M	operations and maintenance
OAL	Office of Administrative Law

Pb	lead
PCE	perchloroethylene
POTWs	publically owned treatment works
PS&E	planning, specifications, and estimates
ROW	right of way
RSP	rock slope protection
RTP	Regional Transportation Plan
RUSLE	Revised Universal Soil Loss Equation
RWQCB	Regional Water Quality Control Board
SCAG	Southern California Association of Governments
SCS	Sustainable Communities Strategy
Se	selenium
sf	square foot/feet
sq mi	square mile/miles
SR 2	State Route 2
SR 22	State Route 22
SR 57	State Route 57
SR 60	State Route 60
SR 91	State Route 91
SR 110	State Route 110
SR 118	State Route 118
SR 134	State Route 134
SR 170	State Route 170
SR 710	State Route 710
SUSMP	Standard Urban Storm Water Mitigation Plan
SWMP	Storm Water Management Plan
SWMP	Storm Water Management Plan
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resources Control Board
TAP	Transit Access Pass
TBM	tunnel boring machine
TCE	trichloroethylene

TDM	Transportation Demand Management
TDS	Total Dissolved Solids
TMDLs	Total Maximum Daily Loads
TSM	Transportation System Management
U.S.	United States
US-101	United States Route 101
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
USLE	Universal Soil Loss Equation
VOCs	volatile organic compounds
WDRs	Waste Discharge Requirements
WER	water-effect ration
WLAs	waste load allocations
WMA	Watershed Management Area
WPCP	Water Pollution Control Plan
WQAR	Water Quality Assessment Report
WQMP	Water Quality Management Plan
Zn	zinc

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1. Introduction

1.1. Project Description

The California Department of Transportation (Caltrans), in cooperation with the Los Angeles County Metropolitan Transportation Authority (Metro) proposes transportation improvements to improve mobility and relieve congestion in the area between State Route 2 (SR 2) and Interstates 5, 10, 210 and 605 (I-5, I-10, I-210, and I-605, respectively) in east/northeast Los Angeles and the western San Gabriel Valley. The study area for the State Route 710 (SR 710) North Study as depicted on Figure 1-1 is approximately 100 square miles and generally bounded by I-210 on the north, I-605 on the east, I-10 on the south, and I-5 and SR 2 on the west. Caltrans is the Lead Agency under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA).

1.2. Purpose and Need

1.2.1. Purpose of the Project

Due to the lack of continuous north-south transportation facilities in the study area, there is congestion on freeways, cut-through traffic that affects local streets, and low-frequency transit operations in the study area. Therefore, the following project purpose has been established.

The purpose of the proposed action is to effectively and efficiently accommodate regional and local north-south travel demands in the study area of the western San Gabriel Valley and east/northeast Los Angeles, including the following considerations:

- Improve efficiency of the existing regional freeway and transit networks.
- Reduce congestion on local arterials adversely affected due to accommodating regional traffic volumes.
- Minimize environmental impacts related to mobile sources.

1.2.2. Need for the Project

The study area is centrally located within the extended urbanized area of Southern California. With few exceptions, the area from Santa Clarita in the north to San Clemente in the south (a distance of approximately 90 miles [mi]) is continuously urbanized. Physical features such as the San Gabriel Mountains and Angeles National Forest on the north, and the Puente Hills and Cleveland National Forest on the south, have concentrated urban activity between the

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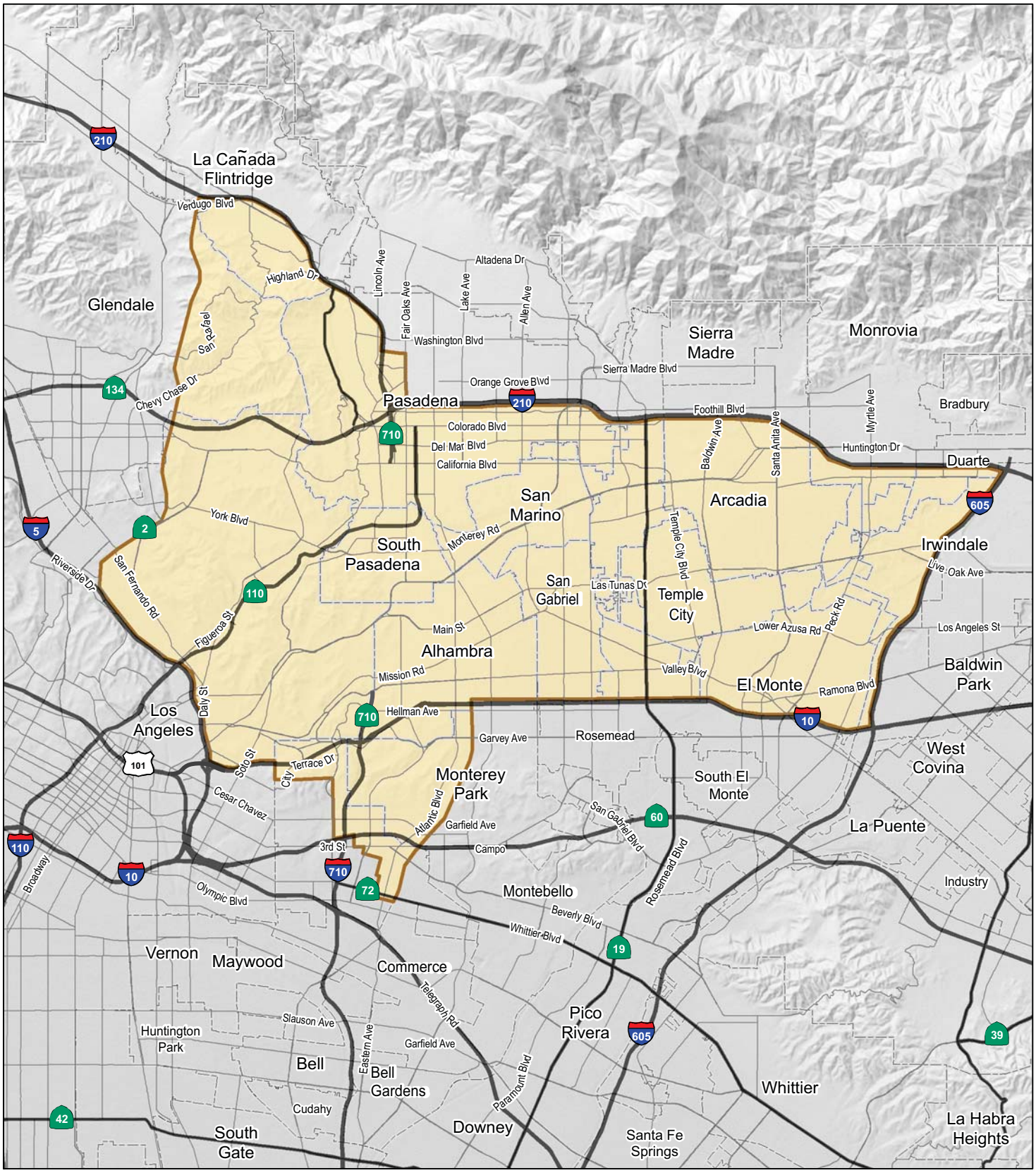

LEGEND

SR 710 North Study Area

FIGURE 1-1

N

0 1.25 2.5

MILES

SOURCE: ESRI (2008); LSA (2013)

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Pacific Ocean and these physical constraints. This urbanized area functions as a single social and economic region that is identified by the Census Bureau as the Los Angeles-Long Beach-Santa Ana Metropolitan Statistical Area (MSA).

There are seven major east-west freeway routes:

- State Route 118 (SR 118)
- United States Route 101 (US-101)/State Route 134 (SR 134)/I-210
- I-10
- State Route 60 (SR 60)
- Interstate 105 (I-105)
- State Route 91 (SR 91)
- State Route 22 (SR 22)

There are seven major north-south freeway routes:

- Interstate 405 (I-405)
- US-101/State Route 170 (SR 170)
- I-5
- Interstate 110 (I-110)/State Route 110 (SR 110)
- Interstate 710 (I-710)
- I-605
- State Route 57 (SR 57)

All of these major routes are located in the central portion of the Los Angeles-Long Beach-Santa Ana MSA. Of the seven north-south routes, four are located partially within the study area (I-5, I-110/SR 110, I-710, and I-605), two of which (I-110/SR 110 and I-710) terminate within the study area without connecting to another freeway. As a result, a substantial amount of north-south regional travel demand is concentrated on a few freeways, or diverted to local streets within the study area. This effect is exacerbated by the overall southwest-to-northeast orientation of I-605, which makes it an unappealing route for traffic between the southern part of the region and the urbanized areas to the northwest in the San Fernando Valley, the Santa Clarita Valley, and the Arroyo-Verdugo region.

The lack of continuous north-south transportation facilities in the study area has the following consequences, which have been identified as the elements of need for the project:

- Degradation of the overall efficiency of the larger regional transportation system
- Congestion on freeways in the study area

- Congestion on the local streets in the study area
- Poor transit operations within the study area

1.3. Alternatives

The proposed alternatives include the No Build Alternative, the Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative, the Bus Rapid Transit (BRT) Alternative, the Light Rail Transit (LRT) Alternative, and the Freeway Tunnel Alternative. These alternatives are each discussed below.

1.3.1. No Build Alternative

The No Build Alternative includes projects/planned improvements through 2035 that are contained in the Federal Transportation Improvement Program (FTIP), as listed in the Southern California Association of Governments (SCAG) 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), Measure R, and the funded portion of Metro's 2009 Long Range Transportation Plan (LRTP). The No Build Alternative does not include any planned improvements to the SR 710 Corridor. Figure 1-2 illustrates the projects in the No Build Alternative.

1.3.2. Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative

The TSM/TDM Alternative consists of strategies and improvements to increase efficiency and capacity for all modes in the transportation system with lower capital cost investments and/or lower potential impacts. The TSM/TDM Alternative is designed to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. Components of the TSM/TDM Alternative are shown on Figure 1-3. TSM strategies increase the efficiency of existing facilities (i.e., TSM strategies are actions that increase the number of vehicle trips which a facility can carry without increasing the number of through lanes).

1.3.2.1. Transportation System Management

TSM strategies include Intelligent Transportation Systems (ITS), local street and intersection improvements, and Active Traffic Management (ATM):

SR 710 North – No Build Alternative (DRAFT)
2035 Programmed Projects

- 1AL04-LAF3125
- 1C0401
- 1HL08D01-LA0G138
- 1HL08D01-LA0G139
- 1TR0404
- 1TR0705
- 1TR1011
- 7120010
- High Speed Rail
- LA000357
- LA000358
- LA000548
- LA01342
- LA0B408
- LA0B7234
- LA0B875
- LA0C8012
- LA0C8046
- LA0C8054
- LA0C8055
- LA0C8063
- LA0C8064
- LA0C8087
- LA0D198
- LA0D31
- LA0D328
- LA0D441
- LA0D442
- LA0F003
- LA0F021
- LA0F098
- LA0G626
- LA29202W
- LA29212XY
- LA960018
- LA996425
- LAE0039
- LAE2515
- LAE2517
- LAE3085
- LAF1197
- LAF1455
- UT101
- Rail

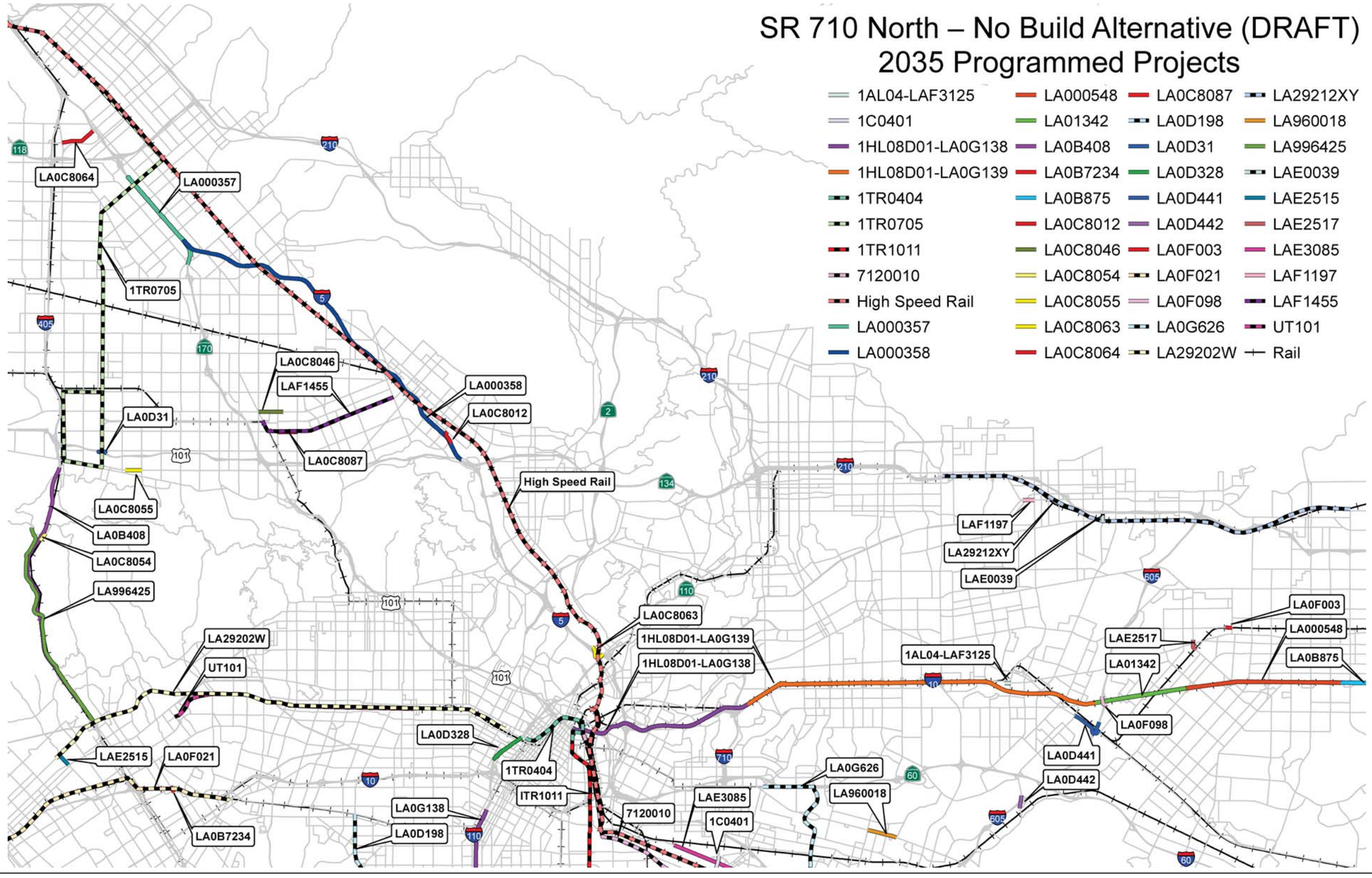

FIGURE 1-2

NOT TO SCALE

SOURCE: CH2M HILL (2013)

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No Build Alternative

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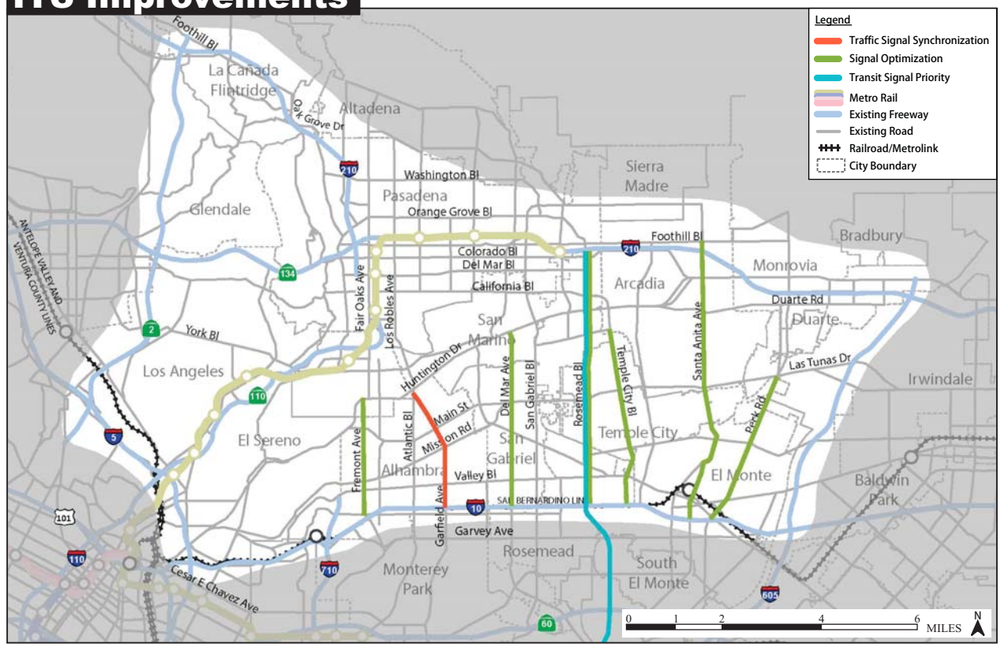
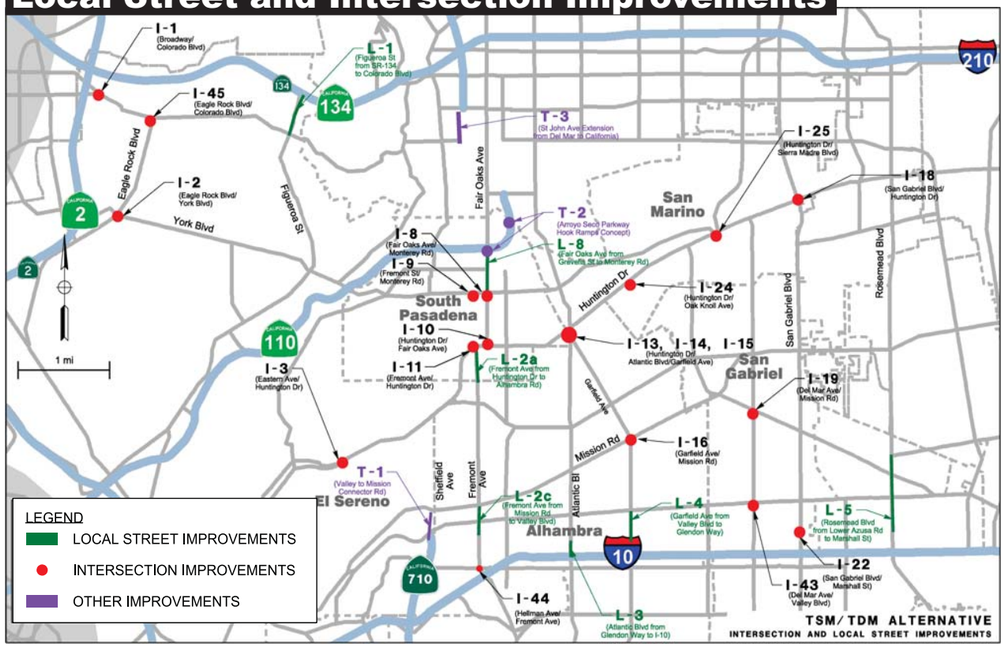
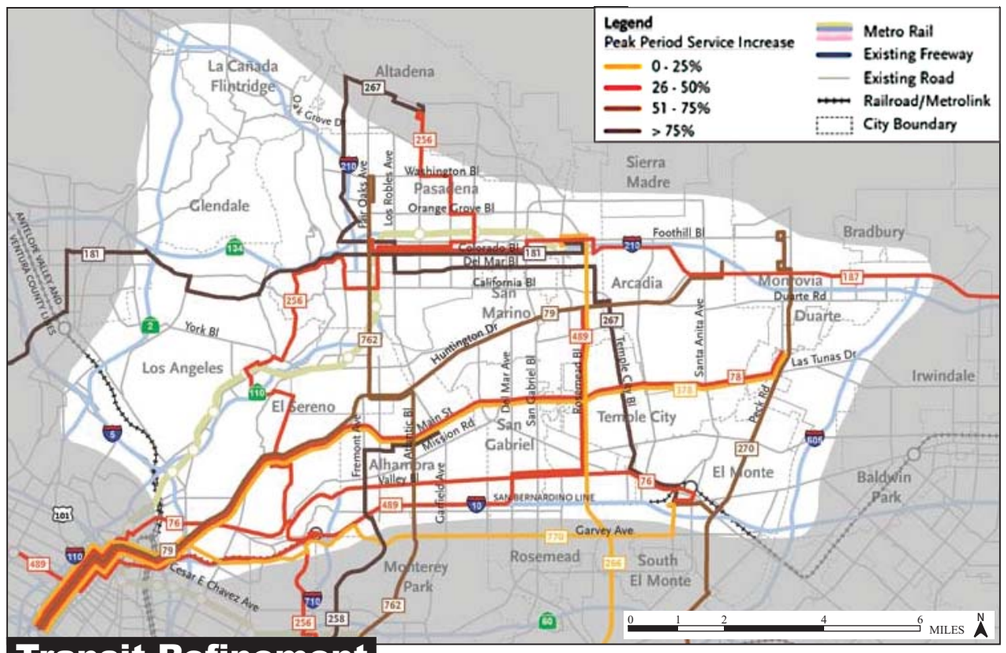
ITS Improvements

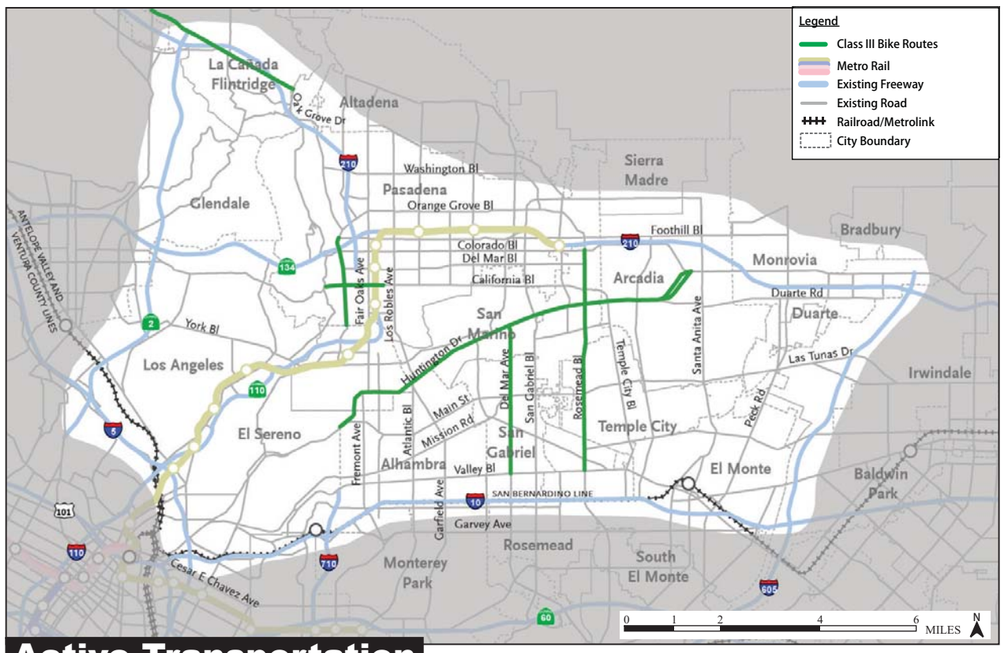


Local Street and Intersection Improvements





Transit Refinement



Active Transportation

FIGURE 1-3

SR 710 North Study
TSM/TDM Alternative
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SOURCE: CH2M HILL (2013)
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- **ITS Improvements:** ITS improvements include traffic signal upgrades, synchronization and transit prioritization, arterial changeable message signs (CMS), and arterial video and speed data collection systems. The TSM/TDM Alternative includes signal optimization on corridors with signal coordination hardware already installed by Metro's Traffic Signal Synchronization Program (TSSP). These corridors include Del Mar Avenue, Rosemead Boulevard, Temple City Boulevard, Santa Anita Avenue, Fair Oaks Avenue, Fremont Avenue, and Peck Road. The only remaining major north-south corridor in the San Gabriel Valley in which TSSP has not been implemented is Garfield Avenue; therefore, TSSP on this corridor is included in the TSM/TDM Alternative. The locations are shown in Table 1.1. The following provide a further explanation of the ITS elements listed above:
    - Traffic signal upgrades include turn arrows, vehicle and/or bicycle detection, pedestrian countdown timers, incorporation into regional management traffic center for real-time monitoring of traffic and updating of signal timing.
    - Synchronization is accomplished through signal coordination to optimize travel times and reduce delay.
    - Transit signal prioritization includes adjusting signal times for transit vehicles to optimize travel times for public transit riders.
    - Arterial CMS are used to alert travelers about unusual road conditions, special event traffic, accident detours, and other incidents.
    - Video and speed data collection includes cameras and other vehicle detection systems that are connected to a central monitoring location, allowing for faster detection and response to traffic incidents and other unusual traffic conditions.

Table 1.1 TSM/TDM Alternative Elements

ID No.	Description	Location
ITS Improvements		
ITS-1	Transit Signal Priority	Rosemead Boulevard (from Foothill Boulevard to Del Amo Boulevard)
ITS-2	Install Video Detection System on SR 110	SR 110 north of US-101
ITS-3	Install Video Detection System at Intersections	At key locations in study area
ITS-4	Arterial Speed Data Collection	On key north/south arterials
ITS-5	Install Arterial CMS	At key locations in study area
ITS-6	Traffic Signal Synchronization on Garfield Avenue	Huntington Drive to I-10
ITS-7	Signal optimization on Del Mar Avenue	Huntington Drive to I-10
ITS-8	Signal optimization on Rosemead Boulevard	Foothill Boulevard to I-10
ITS-9	Signal optimization on Temple City Boulevard	Duarte Road to I-10
ITS-10	Signal optimization on Santa Anita Avenue	Foothill Boulevard to I-10
ITS-11	Signal optimization on Peck Road	Live Oak Avenue to I-10
ITS-12	Signal optimization on Fremont Avenue	Huntington Drive to I-10

CMS = changeable message signs
I-10 = Interstate 10
ITS = Intelligent Transportation Systems
SR 110 = State Route 110
TDM = Transportation Demand Management
TSM = Transportation System Management
US-101 = United States Route 101

- **Local Street and Intersection Improvements:** The local street and intersection improvements are within the Cities of Los Angeles, Pasadena, South Pasadena, Alhambra, San Gabriel, Rosemead, and San Marino. Table 1.2 outlines the location of the proposed improvements to local streets, intersections, and freeway ramps as well as two new local roadways.

Table 1.2 Local Street and Intersection Improvements of the TSM/TDM Alternative

ID No.	Description	Location
Local Street Improvements		
L-1	Figueroa Street from SR 134 to Colorado Boulevard	City of Los Angeles (Eagle Rock)
L-2a	Fremont Avenue from Huntington Drive to Alhambra Road	City of South Pasadena
L-2c	Fremont Avenue from Mission Road to Valley Boulevard	City of Alhambra
L-3	Atlantic Boulevard from Glendon Way to I-10	City of Alhambra
L-4	Garfield Avenue from Valley Boulevard to Glendon Way	City of Alhambra
L-5	Rosemead Boulevard from Lower Azusa Road to Marshall Street	City of Rosemead
L-8	Fair Oaks Avenue from Grevelia Street to Monterey Road	City of South Pasadena
Intersection Improvements		
I-1	West Broadway/Colorado Boulevard	City of Los Angeles (Eagle Rock)
I-2	Eagle Rock Boulevard/York Boulevard	City of Los Angeles (Eagle Rock)
I-3	Eastern Avenue/Huntington Drive	City of Los Angeles (El Sereno)
I-8	Fair Oaks Avenue/Monterey Road	City of South Pasadena
I-9	Fremont Street/Monterey Road	City of South Pasadena
I-10	Huntington Drive/Fair Oaks Avenue	City of South Pasadena
I-11	Fremont Avenue/Huntington Drive	City of South Pasadena
I-13	Huntington Drive/Garfield Avenue	Cities of Alhambra/South Pasadena/San Marino
I-14	Huntington Drive/Atlantic Boulevard	Cities of Alhambra/South Pasadena/San Marino
I-15	Atlantic Boulevard/Garfield Avenue	Cities of Alhambra/South Pasadena/San Marino
I-16	Garfield Avenue/Mission Road	City of Alhambra
I-18	San Gabriel Boulevard/Huntington Drive	City of San Marino/Unincorporated Los Angeles County (East Pasadena/East San Gabriel)
I-19	Del Mar Avenue/Mission Road	City of San Gabriel
I-22	San Gabriel Boulevard/Marshall Street	City of San Gabriel
I-24	Huntington Drive/Oak Knoll Avenue	City of San Marino
I-25	Huntington Drive/San Marino Avenue	City of San Marino
I-43	Del Mar Avenue/Valley Boulevard	City of San Gabriel
I-44	Hellman Avenue/Fremont Avenue	City of Alhambra
I-45	Eagle Rock Boulevard/Colorado Boulevard	City of Los Angeles (Eagle Rock)
Other Road Improvements		
T-1	Valley Boulevard to Mission Road Connector Road	Cities of Alhambra/Los Angeles (El Sereno)
T-2	SR 110/Fair Oaks Avenue Hook Ramps	Cities of South Pasadena/Pasadena
T-3	St. John Avenue Extension between Del Mar Boulevard and California Boulevard	City of Pasadena

I-10 = Interstate 10
I-710 = Interstate 710
NB = northbound
SB = southbound
SR 110 = State Route 110
SR 134 = State Route 134
TDM = Transportation Demand Management
TSM = Transportation System Management

- **Active Traffic Management:** ATM technology and strategies are also included in the TSM/TDM Alternative. The major elements of ATM are arterial speed data collection and CMS. Data on arterial speeds would be collected and distributed through Los Angeles County's Information Exchange Network (IEN). Many technologies are available for speed data collection or the data could be purchased from a third-party provider. Travel time data collected through this effort could be provided to navigation system providers for distribution to the traveling public. In addition, arterial CMS or "trailblazer" message signs would be installed at key locations to make travel time and other traffic data available to the public.

1.3.2.2. Transportation Demand Management

TDM strategies focus on regional means of reducing the number of vehicle trips and vehicle miles traveled as well as increasing vehicle occupancy. TDM strategies facilitate higher vehicle occupancy or reduce traffic congestion by expanding the traveler's transportation options in terms of travel method, travel time, travel route, travel costs, and the quality and convenience of the travel experience. The TDM strategies include reducing the demand for travel during peak periods, reducing the use of motor vehicles, shifting the use of motor vehicles to uncongested times of the day, encouraging rideshare and transit use, eliminating trips (i.e., telecommuting), and improved transportation options. The TDM strategies include expanded bus service, bus service improvements, and bicycle improvements:

- **Expanded Bus Service and Bus Service Improvements:** Transit service improvements included in the TSM/TDM Alternative are summarized in Tables 1.3 and 1.4 and illustrated on Figure 1-3. The transit service improvements enhance bus headways between 10 and 30 minutes during the peak hour and 15 to 60 minutes during the off-peak period. Bus headways are the amount of time between consecutive bus trips (traveling in the same direction) on the bus route. Some of the bus service enhancements almost double existing bus service.
- **Bicycle Facility Improvements:** The bicycle facility improvements include on-street Class III bicycle facilities that support access to transit facilities through the study area and expansion of bicycle parking facilities at existing Metro Gold Line stations. Proposed bicycle facility improvements are outlined in Table 1.4.

Table 1.3 Transit Refinements of the TSM/TDM Alternative

Bus Route	Operator	Route Type	Route Description	Existing Headways		Enhanced Headways	
				Peak	Off-Peak	Peak	Off-Peak
70	Metro	Local	From Downtown Los Angeles to El Monte via Garvey Avenue	10-12	15	10	15
770	Metro	Rapid	From Downtown Los Angeles to El Monte via Garvey Avenue/Cesar Chavez Avenue	10-13	15	10	15
76	Metro	Local	From Downtown Los Angeles to El Monte via Valley Boulevard	12-15	16	10	15
78	Metro	Local	From Downtown Los Angeles to Irwindale via Las Tunas Drive	10-20	16-40	10	15
378	Metro	Limited	From Downtown Los Angeles to Irwindale via Las Tunas Drive	18-23	-	20	30
79	Metro	Local	From Downtown Los Angeles to Santa Anita via Huntington Drive	20-30	40-45	15	30
180	Metro	Local	From Hollywood to Altadena via Los Feliz/ Colorado Boulevard	30	30-32	15	30
181	Metro	Local	From Hollywood to Pasadena via Los Feliz/ Colorado Boulevard	30	30-32	15	30
256	Metro	Local	From Commerce to Altadena via Hill Avenue/ Avenue 64/Eastern Avenue	45	45	30	40
258	Metro	Local	From Paramount to Alhambra via Fremont Avenue/Eastern Avenue	48	45-55	20	30
260	Metro	Local	From Compton to Altadena via Fair Oaks Avenue/Atlantic Boulevard	16-20	24-60	15	30
762[1]	Metro	Rapid	From Compton to Altadena via Atlantic Boulevard	25	30-60	15	30
266	Metro	Local	From Lakewood to Pasadena via Rosemead Boulevard/Lakewood Boulevard	30-35	40-45	15	30
267	Metro	Local	From El Monte to Pasadena via Temple City Boulevard/Del Mar Boulevard	30	30	15	30
485	Metro	Express	From Union Station to Altadena via Fremont/ Lake Avenue	40	60	30	60
487	Metro	Express	From Westlake to El Monte via Santa Anita Avenue/Sierra Madre Boulevard/San Gabriel Boulevard	18-30	45	15	30
489	Metro	Express	From Westlake to East San Gabriel via Rosemead Boulevard	18-20	-	15	-
270	Metro	Local	From Norwalk to Monrovia via Workman Mill/ Peck Road	40-60	60	30	60
780	Metro	Rapid	From West LA to Pasadena via Fairfax Avenue/ Hollywood Boulevard/Colorado Boulevard	10-15	22-25	10	20
187	Foothill	Local	From Pasadena to Montclair via Colorado Boulevard/Huntington Drive/Foothill Boulevard	20	20	15	15

[1] This route would not be included as part of the BRT Alternative because the BRT Alternative would replace this service.
BRT = Bus Rapid Transit
Express = Express Bus
Foothill = Foothill Transit
Metro = Los Angeles County Metropolitan Transportation Authority
Rapid = Bus Rapid Transit
TDM = Transportation Demand Management
TSM = Transportation System Management

Table 1.4 Active Transportation and Bus Enhancements of the TSM/TDM Alternative

ID No.	Description	Location
Bus Service Improvements		
Bus-1	Additional bus service	See Table 1.3 and Figure 1-3
Bus-2	Bus stop enhancements	Along routes listed in Table 1.3
Bicycle Facility Improvements		
Bike-1	Rosemead Boulevard bike route (Class III)	Colorado Boulevard to Valley Boulevard (through Los Angeles County, Temple City, Rosemead)
Bike-2	Del Mar Avenue bike route (Class III)	Huntington Drive to Valley Boulevard (through San Marino, San Gabriel)
Bike-3	Huntington Drive bike route (Class III)	Mission Road to Santa Anita Avenue (through the City of Los Angeles, South Pasadena, San Marino, Alhambra, Los Angeles County, Arcadia)
Bike-4	Foothill Boulevard bike route (Class III)	In La Cañada Flintridge
Bike-5	Orange Grove bike route (Class III)	Walnut Street to Columbia Street (in Pasadena)
Bike-6	California Boulevard bike route (Class III)	Grand Avenue to Marengo Avenue (in Pasadena)
Bike-7	Add bike parking at transit stations	Metro Gold Line stations
Bike-8	Improve bicycle detection at existing intersections	Along bike routes in study area

Metro = Los Angeles County Metropolitan Transportation Authority
TDM = Transportation Demand Management
TSM = Transportation System Management

1.3.3. Bus Rapid Transit (BRT) Alternative

The BRT Alternative would provide high-speed, high-frequency bus service through a combination of new, dedicated, and existing bus lanes, and mixed-flow traffic lanes to key destinations between East Los Angeles and Pasadena. The proposed route length is approximately 12 mi. Figure 1-4 illustrates the BRT Alternative.

The BRT Alternative includes the BRT trunk line arterial street and station improvements, frequent bus service, new bus feeder services, and enhanced connecting bus services. BRT includes bus enhancements identified in the TSM/TDM Alternative, except for improvements to Route 762.

Buses are expected to operate every 10 minutes during peak hours and every 20 minutes during off-peak hours. The BRT service would generally replace, within the study area, the existing Metro Route 762 service. The 12 mi route would begin at Atlantic Boulevard and Whittier Boulevard to the south, follow Atlantic Boulevard, Huntington Drive, Fair Oaks Avenue, Del Mar Boulevard, and end with a terminal loop in Pasadena to the north. Buses operating in the corridor would be given transit signal priority from a baseline transit signal priority project that will be implemented separately by Metro.

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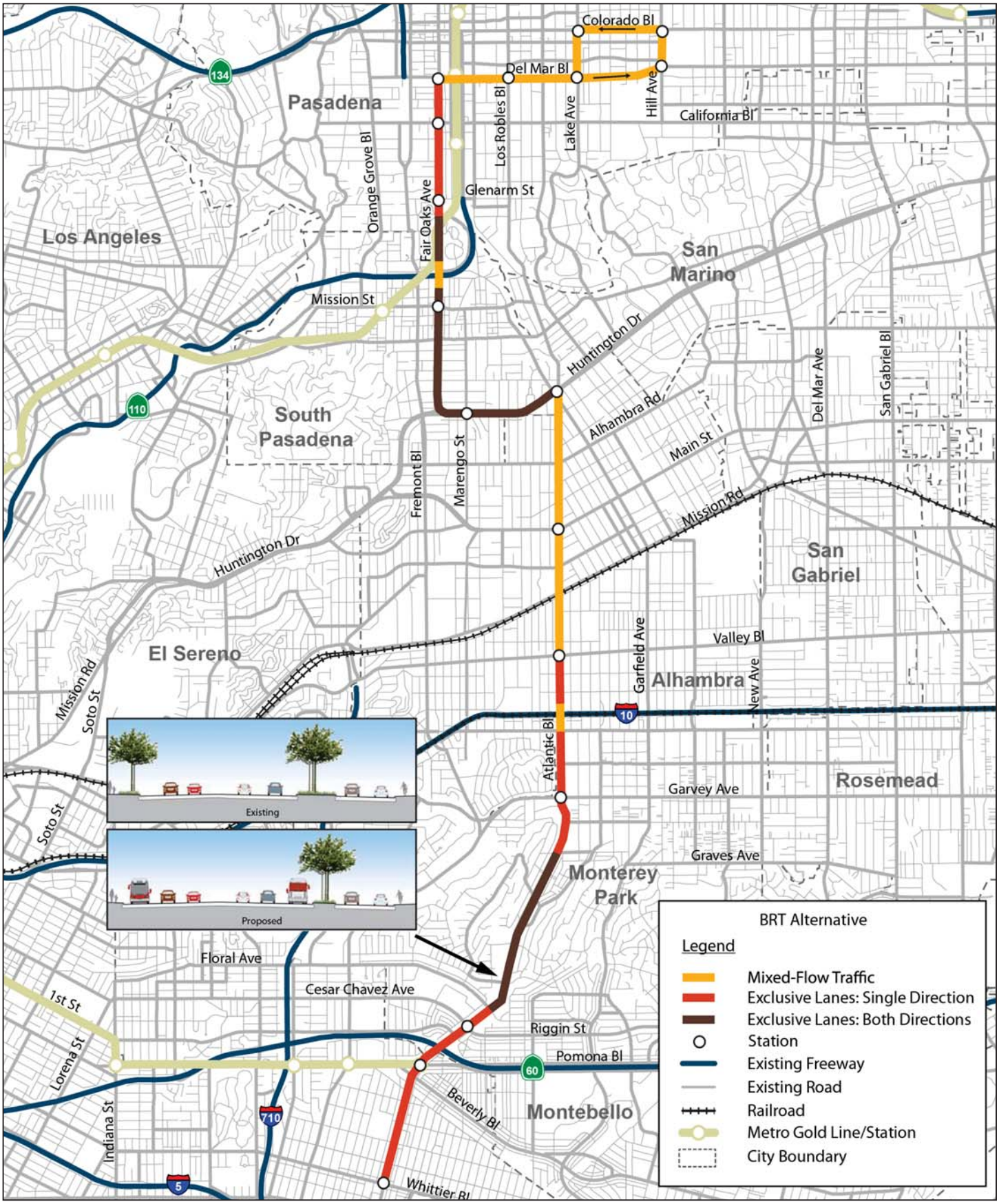

FIGURE 1-4

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SR 710 North Study

BRT Alternative

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Where feasible, buses would run in dedicated bus lanes adjacent to the curb, either in one direction or both directions, during peak periods. The new dedicated bus lanes would generally be created within the existing street rights of way (ROW) through a variety of methods that include restriping the roadway, restricted on-street parking during peak periods, narrowing medians, planted parkways, or sidewalks. Buses would share existing lanes with other traffic in cases where there is not enough ROW. The exclusive lanes would be exclusive to buses and right-turning traffic during a.m. and p.m. peak hours only. At other times of day, the exclusive lanes would be available for on-street parking use.

A total of 17 BRT stations with amenities would be placed on average, at approximately 0.8 mi intervals at major activity centers and cross streets. Typical station amenities would include new shelters, branding elements, seating, wind screens, leaning rails, variable message signs (next bus information), lighting, bus waiting signals, trash receptacles, and stop markers. Some of these stops will be combined with existing stops, while in some cases, new stops for BRT will be provided. The BRT service would include 60-foot (ft) articulated buses with three doors, and would have the latest fare collection technology such as on-board smart card (Transit Access Pass [TAP] card) readers to reduce dwell times at stations. The BRT stops would be provided at the following 17 locations:

- Atlantic Boulevard at Whittier Boulevard
- Atlantic Boulevard between Pomona Boulevard and Beverly Boulevard
- Atlantic Boulevard at Cesar Chavez Avenue/Riggin Street
- Atlantic Boulevard at Garvey Avenue
- Atlantic Boulevard at Valley Boulevard
- Atlantic Boulevard at Main Street
- Huntington Drive at Garfield Avenue
- Huntington Drive at Marengo Avenue
- Fair Oaks Avenue at Mission Street
- Fair Oaks Avenue at Glenarm Street
- Fair Oaks Avenue at California Boulevard
- Fair Oaks Avenue at Del Mar Boulevard
- Del Mar Boulevard at Los Robles Avenue
- Del Mar Boulevard at Lake Avenue
- Del Mar Boulevard at Hill Avenue (single direction only)
- Colorado Boulevard at Hill Avenue (single direction only)
- Colorado Boulevard at Lake Avenue (single direction only)

Additionally, this alternative would include bus feeder routes that would connect additional destinations with the BRT mainline. Two bus feeder routes are proposed: one that would run along Colorado Boulevard, Rosemead Boulevard, and Valley Boulevard to the El Monte transit station; and another bus feeder route that would travel from Atlantic Boulevard near the Gold Line station to the Metrolink stations in the City of Commerce and Montebello via Beverly Boulevard and Garfield Avenue. In addition, other existing bus services in the study area would be increased in frequency and/or span of service. The El Sol shuttle improvements are an existing bus service that would be increased in frequency. The headways on the El Sol shuttle "City Terrace/East Los Angeles College (ELAC)" route that connect ELAC to the proposed Floral Station would be reduced from 60 minutes to 15 minutes.

The TSM/TDM Alternative improvements would also be constructed as part of the BRT Alternative, except as noted below. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. Local Street Improvements L-8 (Fair Oaks Avenue from Grevelia Street to Monterey Road) and the reversible lane component of L-3 (Atlantic Boulevard from Glendon Way to I-10) would not be constructed with the BRT Alternative.

1.3.4. Light Rail Transit (LRT) Alternative

The LRT Alternative would include passenger rail operated along a dedicated guideway, similar to other Metro light rail lines. The LRT alignment is approximately 7.5 mi long, with 3 mi of aerial segments and 4.5 mi of bored tunnel segments. Figure 1-5 illustrates the LRT Alternative.

The LRT Alternative would begin at an aerial station on Mednik Avenue adjacent to the existing East Los Angeles Civic Center Station on the Metro Gold Line. The alignment would remain elevated as it travels north on Mednik Avenue, west on Floral Drive, north across Corporate Center Drive, and then along the west side of I-710, primarily in Caltrans ROW, to a station adjacent to the California State University, Los Angeles (Cal State LA). The alignment would descend into a tunnel south of Valley Boulevard and travel northeast to Fremont Avenue, north under Fremont Avenue, and easterly to Fair Oaks Avenue. The alignment would then cross under SR 110 and end at an underground station beneath Raymond Avenue adjacent to the existing Fillmore Station on the Metro Gold Line.

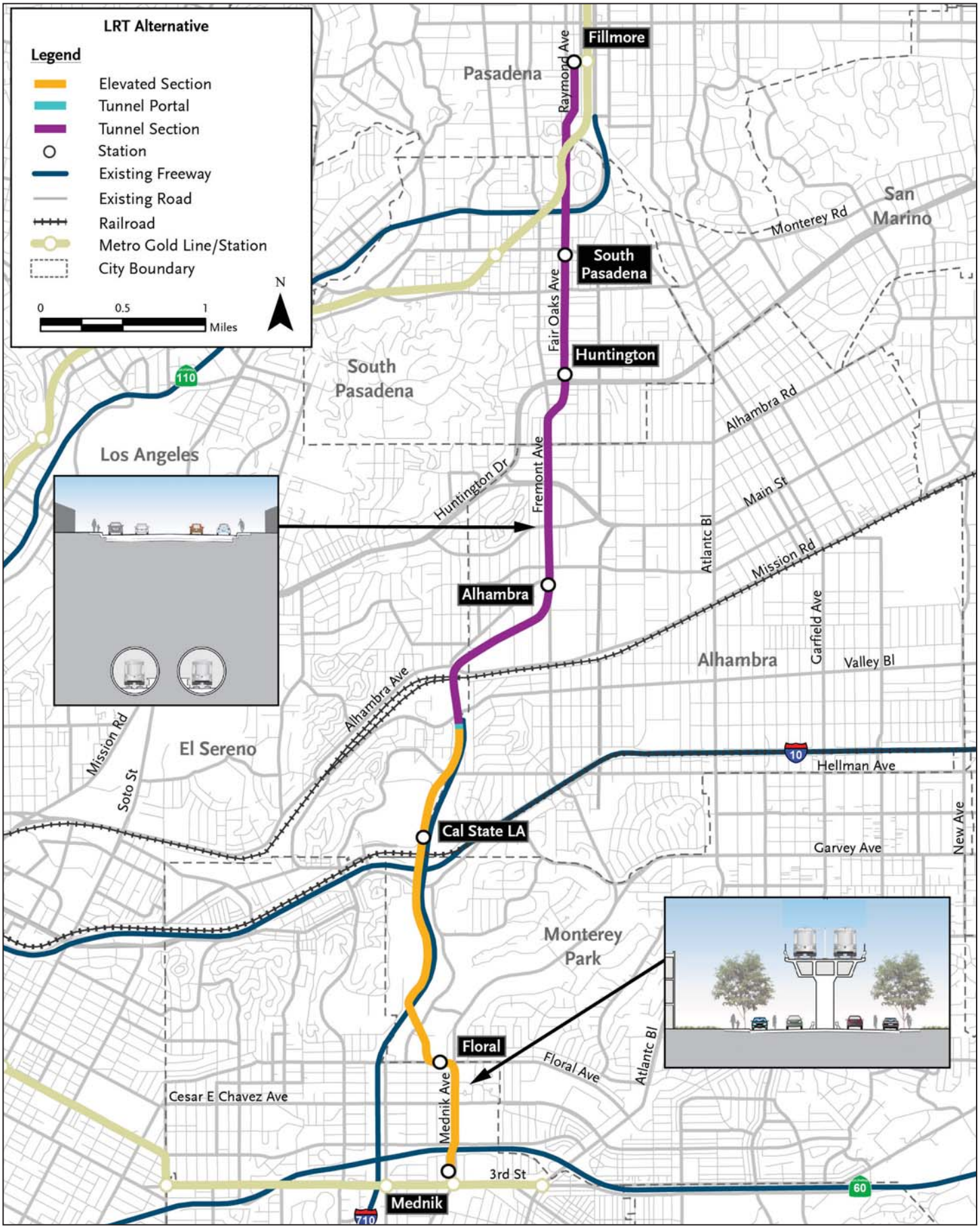

FIGURE 1-5

SR 710 North Study
LRT Alternative
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SOURCE: AECOM (2013)

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Two directional tunnels are proposed with tunnel diameters approximately 20 ft each, located approximately 60 ft below the ground surface. Other supporting tunnel systems include emergency evacuation cross passages for pedestrians, a ventilation system consisting of exhaust fans at each portal and an exhaust duct along the entire length of the tunnel, fire detection and suppression systems, communications and surveillance systems, and 24-hour monitoring, similar to the existing LRT system. Trains would operate at speeds of up to 65 miles per hour (mph) approximately every 5 minutes during peak hours and 10 minutes during off-peak hours.

Seven stations would be located along the LRT alignment at Mednik Avenue in East Los Angeles, Floral Drive in Monterey Park, Cal State LA, Fremont Avenue in Alhambra, Huntington Drive in South Pasadena, Mission Street in South Pasadena, and Fillmore Street in Pasadena. The Fremont Avenue Station, the Huntington Drive Station, the Mission Street Station, and the Fillmore Street Station would be underground stations. New Park-and-Ride facilities would be provided at all of the proposed stations except for the Mednik Avenue, Cal State LA, and Fillmore Street stations.

A maintenance yard to clean, maintain, and store light rail vehicles would be located on both sides of Valley Boulevard at the terminus of SR 710. A track spur from the LRT mainline to the maintenance yard would cross above Valley Boulevard.

Two bus feeder services would be provided. One would travel from the Commerce Station on the Orange County Metrolink line and the Montebello Station on the Riverside Metrolink line to the Floral Station, via East Los Angeles College. The other would travel from the El Monte Bus Station to the Fillmore Station via Rosemead and Colorado Boulevards. In addition, other existing bus services in the study area would be increased in frequency and/or span of service.

As part of the LRT Alternative, the I-710 northbound off-ramp at Valley Boulevard would be modified.

The TSM/TDM Alternative improvements would also be constructed as part of the LRT Alternative. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. The only component of the TSM/TDM Alternative improvements that would not be constructed with the LRT Alternative is Other Road Improvement T-1 (Valley Boulevard to Mission Road Connector Road).

1.3.5. Freeway Tunnel Alternative

The alignment for the Freeway Tunnel Alternative starts at the existing southern stub of SR 710 in Alhambra, just north of I-10, and connects to the existing northern stub of SR 710, south of the I-210/SR 134 interchange in Pasadena. The Freeway Tunnel Alternative would include the following tunnel support systems: emergency evacuation for pedestrians and vehicles, air scrubbers, a ventilation system consisting of exhaust fans at each portal, an exhaust duct along the entire length of the tunnel and jet fans within the traffic area of the tunnel, fire detection and suppression systems, communications and surveillance systems, and 24-hour monitoring. An operations and maintenance (O&M) building would be constructed at the northern and southern ends of the tunnel. There would be no operational restrictions for the tunnel, with the exception of vehicles carrying flammable or hazardous materials. As part of both design variations of the Freeway Tunnel Alternative, the I-710 northbound off-ramp and southbound on-ramp at Valley Boulevard would be modified.

The TSM/TDM Alternative improvements would also be constructed as part of the Freeway Tunnel Alternative, including either the dual-bore or single-bore design variations. These improvements would provide the additional enhancements to maximize the efficiency of the existing transportation system by improving capacity and reducing the effects of bottlenecks and chokepoints. The only components of the TSM/TDM Alternative improvements that would not be constructed with the Freeway Tunnel Alternative are Other Road Improvements T-1 (Valley Boulevard to Mission Road Connector Road) and T-3 (St. John Avenue Extension between Del Mar Boulevard and California Avenue).

1.3.5.1. Design Variations

The Freeway Tunnel Alternative includes two design variations. These variations relate to the number of tunnels constructed. The dual-bore design variation includes two tunnels that independently convey northbound and southbound vehicles. The single-bore design variation includes one tunnel that carries both northbound and southbound vehicles. Figure 1-6 illustrates the dual-bore and single-bore tunnel design variations for the Freeway Tunnel Alternative. Each of these design variations is described below.

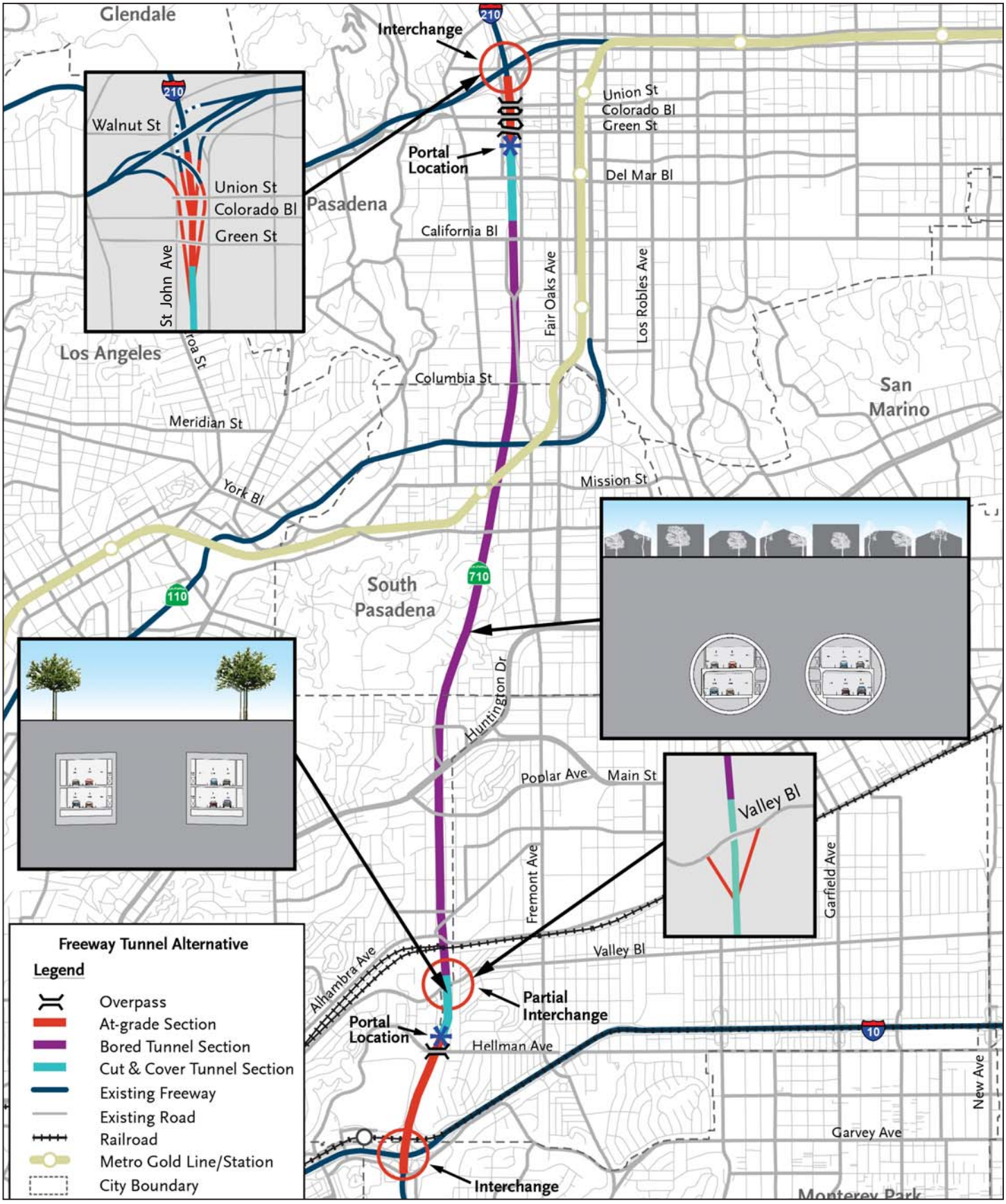

FIGURE 1-6

SR 710 North Study
Freeway Tunnel Alternative
Single and Dual Bore
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SOURCE: CH2M HILL (2013)

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- **Dual-Bore Tunnel:** The dual-bore tunnel design variation is approximately 6.3 mi long, with 4.2 mi of bored tunnel, 0.7 mi of cut-and-cover tunnel, and 1.4 mi of at-grade segments. The dual-bore tunnel design variation would consist of two side-by-side tunnels (the east tunnel would convey northbound traffic, and the west tunnel would convey southbound traffic). Each tunnel would have two levels with traffic traveling in the same direction. Each tunnel would consist of two lanes of traffic on each level, traveling in one direction, for a total of four lanes in each tunnel. The eastern tunnel would be constructed for northbound traffic, and the western tunnel would be constructed for southbound traffic. Each bored tunnel would have an outside diameter of approximately 58.5 ft and would be located approximately 120 to 250 ft below the ground surface. Vehicle cross passages would be provided throughout this tunnel variation that would connect one tunnel to the other tunnel for use in an emergency situation. Figure 1-6 illustrates the dual-bore tunnel variation of the Freeway Tunnel Alternative.

  Short segments of cut-and-cover tunnels would be located at the south and north termini to provide access via portals to the bored tunnels. The portal at the southern terminus would be located south of Valley Boulevard. The portal at the northern terminus would be located north of Del Mar Boulevard. No intermediate interchanges are planned for the tunnel.

- **Single-Bore Tunnel:** The single-bore tunnel design variation is also approximately 6.3 mi long, with 4.2 mi of bored tunnel, 0.7 mi of cut-and-cover tunnel, and 1.4 mi of at-grade segments. The single-bore tunnel design variation would consist of one tunnel with two levels. Each level would have two lanes of traffic traveling in one direction. The northbound traffic would traverse the upper level, and the southbound traffic would traverse the lower level. The single-bore tunnel would provide a total of four lanes. The single-bore tunnel would also have an outside diameter of approximately 58.5 ft and would be located approximately 120 to 250 ft below the ground surface. The single-bore tunnel would be in the same location as the northbound tunnel in the dual-bore tunnel design variation. Figure 1-7 illustrates the single-bore tunnel variation cross section of the Freeway Tunnel Alternative.

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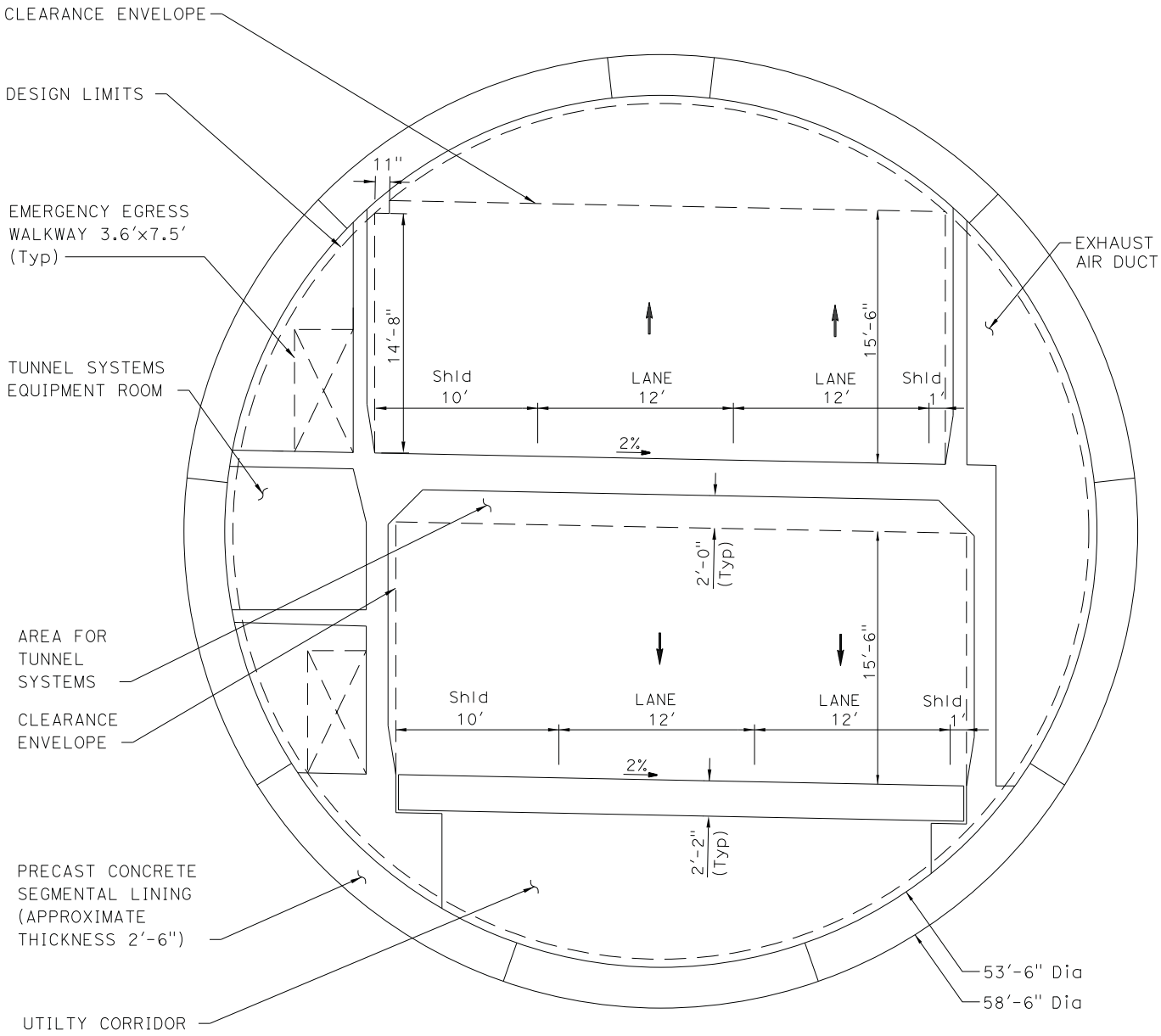

FIGURE 1-7

SR 710 North Study
Freeway Tunnel Alternative
Single Bore Cross Section
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EFIS 0700000191

SOURCE: CH2M HILL (2014)

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1.3.5.2. Operational Variations

There were three different parameters related to the operational variations of the Freeway Tunnel Alternative:

- **Tolling:** Tolls could be charged for vehicles using the tunnel, or it could be free for all drivers (a conventional freeway).
- **Trucks:** Trucks could be prohibited or allowed.
- **Express Bus:** A dedicated Express Bus could be operated using the tunnel. The Express Bus route would start at the Commerce Station on the Orange County Metrolink line, and then serve the Montebello Station on the Riverside Metrolink line and East Los Angeles College before entering I 710 at Floral Drive. The bus would travel north to Pasadena via the proposed freeway tunnel, making a loop serving Pasadena City College, the California Institute of Technology, and downtown Pasadena before re-entering the freeway and making the reverse trip.

The following operational variations have been studied for the Freeway Tunnel Alternative:

- **Freeway Tunnel Alternative without Tolls:** The facility would operate as a conventional freeway with lanes open to all vehicles. Trucks would be allowed and there would be no Express Bus service. This operational variation would be considered for only the dual-bore tunnel design variation.
- **Freeway Tunnel Alternative with Trucks Excluded:** The facility would operate as a conventional freeway; however, trucks would be excluded from using the tunnel. There would be no Express Bus service. Signs would be provided along I-210, SR 134, I-710, and I-10 to provide advance notice of the truck restriction. This operational variation would be considered for the dual-bore tunnel only.
- **Freeway Tunnel Alternative with Tolls:** All vehicles, including trucks, using the tunnel would be tolled. There would be no Express Bus service. This operational variation would be considered for both the dual- and single-bore tunnels described above.
- **Freeway Tunnel Alternative with Trucks Excluded and with Tolls:** The facility would be tolled for all automobiles. There would be no Express Bus service. Trucks would be excluded from using the tunnel. Signs would be provided along I-210, SR 134, I-710, and I-10 to provide advance notice of the truck restriction. This operational variation would be considered for the single-bore tunnel only.
- **Freeway Tunnel Alternative with Toll and Express Bus:** The freeway tunnel would operate as a tolled facility and include an Express Bus component. The Express Bus would be allowed in any of the travel lanes in the tunnel; no bus-restricted lanes would be

provided. Trucks would be permitted. This operational variation would be considered for the single-bore tunnel only.

1.3.6. Proposed Storm Water Features Associated with All Build Alternatives

The total existing impervious surface area for the TSM/TDM Alternative is 103.47 ac with approximately 11.85 ac and 91.62 ac within and outside Caltrans ROW, respectively. The total existing impervious surface area for the BRT Alternative is 116.93 ac, with approximately 5.76 ac and 111.17 ac within and outside Caltrans ROW, respectively. The total existing impervious surface area for the LRT Alternative is 23.17 ac, with approximately 2.60 ac and 20.57 ac within and outside Caltrans ROW, respectively. The existing impervious surface area for the single-bore and dual-bore tunnel design variations of the Freeway Tunnel Alternative, all of which is within Caltrans ROW, is approximately 34.95 ac and 41.63 ac, respectively.

As noted in Table 1.5, the TSM/TDM Alternative would result in a permanent net increase of impervious surface area of 3.8 ac. The TSM/TDM Alternative would result in a permanent decrease of approximately 0.15 ac within Caltrans ROW and a permanent increase of approximately 3.95 ac outside Caltrans ROW. The BRT Alternative would result in a permanent net increase of impervious surface area of 1.14 ac with increases of approximately 0.08 ac and approximately 1.06 ac within and outside Caltrans ROW, respectively. The LRT Alternative would result in a permanent net increase of impervious surface area of 16.42 ac with increases of approximately 5.46 ac and approximately 10.96 ac within and outside Caltrans ROW, respectively. For the Freeway Tunnel Alternative, the single-bore tunnel design variation would result in a permanent net increase of impervious surface area of approximately 1.68 ac within Caltrans ROW, and the dual-bore tunnel design variation would result in a permanent increase of impervious surface area of approximately 13.54 ac within Caltrans ROW. There would be no increase in impervious surfaces under the No Build Alternative. There are cut-and-fill slopes in the study area that are steeper than 2 horizontal (H):1 vertical (V). The Build Alternatives have the following acreages of slopes steeper than 2H:1V: the TSM/TDM Alternative has approximately 0.12 ac, the BRT Alternative has approximately 0.07 ac, theLRT Alternative has approximately 5.6 ac, and the Freeway Tunnel Alternative has approximately 15.8 ac.

Table 1.5 Existing and Proposed Impervious Surface Area Within and Outside Caltrans ROW

Alternative	Existing Impervious Surface Area (ac)	Proposed Total Impervious Surface Area (ac)	Net New Impervious Surface Area (ac)
Within Caltrans ROW			
TSM/TDM	11.85	11.70	-0.15
BRT	5.76	5.84	0.08
LRT	2.60	8.06	5.46
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	34.95	36.63	1.68
Dual-Bore Tunnel Design Variation	41.63	55.17	13.54
Outside Caltrans ROW			
TSM/TDM	91.62	95.57	3.95
BRT	111.17	112.23	1.06
LRT	20.57	31.53	10.96
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	0	0	0
Dual-Bore Tunnel Design Variation	0	0	0

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
LRT = Light Rail Transit
ROW = right of way
TDM = Transportation Demand Management
TSM = Transportation System Management

1.3.6.1. Existing Drainage Systems

The existing drainage systems for the TSM/TDM Alternative include curb and gutters, curb opening inlets, lateral pipes, and main trunk line pipes to the County of Los Angeles storm drain systems. The TSM/TDM Alternative would drain to Arroyo Seco, Rio Hondo, and the Los Angeles River.

The existing drainage systems for the BRT Alternative include curbs, gutters, curb opening inlets, lateral pipes, and main trunk line pipes to the County of Los Angeles storm drain systems. The BRT Alternative would drain to Rio Hondo and the Los Angeles River.

The existing drainage systems for the LRT Alternative include curbs, gutters, curb opening inlets, lateral pipes, main trunk line pipes, and a concrete channel to the County of Los Angeles storm drain systems. The LRT Alternative would drain to Rio Hondo and the Los Angeles River.

The existing drainage systems for the Freeway Tunnel Alternative include dikes, curb opening inlets, cross-culverts, lateral pipes, a pump station, a pump station screen, main trunk line pipes, and a concrete channel to the County of Los Angeles storm drain systems. The Freeway Tunnel Alternative would drain to Arroyo Seco and the Los Angeles River.

1.3.6.2. Proposed Drainage Systems

The Build Alternatives would impact the existing drainage systems and drainage features. The Build Alternatives would require extension and modification of the existing drainage systems; however, the proposed drainage systems would preserve the existing drainage systems as much as possible. Therefore, runoff from the alignments would end up draining into the existing storm drain systems.

The proposed drainage systems for the TSM/TDM Alternative include the relocation and removal of existing catch basins, curb opening inlets, and lateral pipes. Future runoff would continue in the existing flow patterns and drain into Arroyo Seco, Rio Hondo, the Los Angeles River, and eventually the Pacific Ocean.

The proposed drainage systems for the BRT Alternative include relocation of existing catch basins to the new curb line. Future runoff would continue in the existing flow patterns and drain into Rio Hondo, the Los Angeles River, and eventually the Pacific Ocean.

The proposed drainage systems for the LRT Alternative include installation of a deck drain, pipes, a pump, underdrains under each track in the train yard, and swales and catch basins. Future runoff would continue in the existing flow patterns and drain into Rio Hondo, the Los Angeles River, and eventually the Pacific Ocean.

The proposed drainage systems for the Freeway Tunnel Alternative include: (a) removal of curb opening inlets and pipes; (b) installation of curb opening inlets, cross culverts, pipes, a sump pump, and treatment trains (i.e., a pump station, a gross solid removal device [GSRD], and a biofiltration swale adjacent to southbound SR 710 at Valley Boulevard and adjacent to northbound SR 710 at the north portal near Pasadena Avenue); and (c) relocation of existing pipes and the existing pump station and storage chamber south of Del Mar Boulevard to the north of Del Mar Boulevard (CH2M HILL, 2014b).

Runoff from new impervious areas would be managed using design features that reduce mobilization of sediment and other pollutants in storm water, increase the detention time to allow for infiltration, reduce overall pollutant loads by reducing volumetric discharges, and provide ancillary filtration and infiltration within vegetated conveyances (CH2M HILL, 2014c). The proposed best management practices (BMPs) are described below for each Build Alternative.

1.3.6.3. TSM/TDM Alternative

A biofiltration swale is proposed in the I-110 southbound on-ramp at State Street as part of Other Road Improvement T-2 (SR 110/Fair Oaks Avenue Hook Ramps). Tree box filters are proposed as part of: (a) Other Road Improvements T-1 (Valley Boulevard to Mission Road Connector Road) and T-2 (SR 110/Fair Oaks Avenue Hook Ramps); (b) Intersection Improvements I-22 (San Gabriel Boulevard/Marshall Street), I-5 (I-710 northbound off-ramp/Valley Boulevard), I-10 (Huntington Drive/Fair Oaks Avenue), and I-19 (Del Mar Avenue/Mission Road); and (c) Local Street Improvement L-5 (Rosemead Boulevard from Lower Azusa Road to Marshall Street).

Catch basin screens and filter inserts are proposed at new inlet locations as part of: (a) Other Road Improvement T-3 (St. John Avenue Extension between Del Mar Boulevard and California Avenue); (b) Intersection Improvements I-4 (I-710 southbound on-ramp/Valley Boulevard) and I-16 (Garfield Avenue/Mission Road); and (c) Local Street Improvement L-5 (Rosemead Boulevard from Lower Azusa Road to Marshall Street).

1.3.6.4. BRT Alternative

Tree box filters are proposed at new catch basins along the BRT alignment where the sidewalk width is at least 7 ft wide, as required to meet Americans with Disabilities Act (ADA) standards. Catch basin screens and curb inlet filters are proposed along the BRT alignment at locations with a new inlet where the sidewalk is less than 7 ft wide. A biofiltration swale is proposed within Caltrans ROW where the BRT alignment crosses SR 60.

1.3.6.5. LRT Alternative

BMPs are only proposed in areas outside the tunnel. Most of the LRT alignment outside the tunnel is on an elevated track above steep terrain, where BMPs are infeasible. Four biofiltration swales are proposed where the LRT alignment is within Caltrans ROW near the I-710/I-10 interchange. Tree box filters are proposed at multiple locations along the LRT alignment. Catch basin screens and filter inserts are proposed at new inlet locations along the LRT alignment. Within the rail yard, bioretention facilities are proposed for the parking lot areas, and media filters are proposed to treat the ballast areas.

1.3.6.6. Freeway Tunnel Alternative

Three biofiltration swales and two GSRDs are proposed for the single-bore tunnel design variation of the Freeway Tunnel Alternative. A biofiltration swale is proposed to be located

adjacent to northbound SR 710 at the Laguna Regulating Basin. Treatment trains consisting of a pump station, a GSRD, and a biofiltration swale are proposed adjacent to southbound SR 710 at Valley Boulevard and adjacent to northbound SR 710 at the north portal near Pasadena Avenue. The pump stations would be designed such that the lower flows would be treated by the BMPs and larger flows would bypass the BMPs.

Four biofiltration swales and two GSRDs are proposed for the dual-bore tunnel design variation of the Freeway Tunnel Alternative. BMPs are only proposed in areas outside the tunnel. Biofiltration swales are proposed to be located in the SR 710 North to I-10 East loop ramp at the south portal and adjacent to northbound SR 710 at the Laguna Regulating Basin. Treatment trains consisting of a pump station, a GSRD, and a biofiltration swale are proposed adjacent to southbound SR 710 at Valley Boulevard and adjacent to northbound SR 710 at the north portal near Pasadena Avenue. The pump stations would be designed such that the lower flows would be treated by the BMPs and larger flows would bypass the BMPs.

As noted in Table 1.6, during construction, the total disturbed soil areas for the TSM/TDM Alternative would be approximately 5.75 ac and 15.59 ac within and outside Caltrans ROW, respectively. The total disturbed soil areas for the BRT Alternative would be approximately 1.00 ac and 33.48 ac within and outside Caltrans ROW, respectively. The total disturbed soil areas for the LRT Alternative would be approximately 3.89 ac and 29.42 ac within and outside Caltrans ROW, respectively. The total disturbed soil areas for the single-bore and dual-bore tunnel design variations of the Freeway Tunnel Alternative within Caltrans ROW would be approximately 80.59 ac and 92.96 ac, respectively.

Table 1.6 Total Disturbed Soil Area During Construction

Alternative	Disturbed Soil Area During Construction (ac)		
	Within Caltrans ROW	Outside Caltrans ROW	Total
TSM/TDM	5.75	15.59	21.34
BRT	1	33.48	34.48
LRT	3.89	29.42	33.31
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	80.59	0	80.59
Dual-Bore Tunnel Design Variation	92.96	0	92.96

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
LRT = Light Rail Transit
ROW = right of way
TDM = Transportation Demand Management
TSM = Transportation System Management

For the construction phase of the Build Alternatives, the contractor would be required to develop a Storm Water Pollution Prevention Plan (SWPPP) – Risk Level 2 – in accordance with the California Statewide Construction General Permit (CGP) Order No. 2009-0009-DWQ, as amended by 2010-0014-DWQ, National Pollutant Discharge Elimination System (NPDES) No. CAS000002, the Caltrans Statewide NPDES Storm Water Permit, Order No. 2012-0011-DWQ, NPDES No. CAS000003, and Los Angeles Regional Water Quality Control Board (LARWQCB) Waste Discharge Requirements (WDRs) for Municipal Separate Storm Sewer System (MS4) Order No. R4-2012-0175, NPDES No. CAS004001. The requirements of the CGP are based on the risk level of the project. The Build Alternatives would be a Risk Level 2 (medium risk).

1.4. Approach to Water Quality Assessment

The purpose of the Water Quality Assessment Report (WQAR) is to identify the physical setting of the study area and the existing water quality, specify the regulatory framework with respect to water quality, identify potential water quality impacts associated with the project, and make recommendations for avoidance and minimization measures for potentially adverse impacts. Further, the analysis developed in this WQAR will fulfill the requirements of NEPA and CEQA. The document includes a discussion of the Build Alternatives, the No Build Alternative, the physical setting of the study area, and the regulatory framework with respect to water quality; it also provides data on surface water and groundwater resources within the study area and the water quality of these waters, describes water quality impairments and beneficial uses, identifies potential water quality impacts/benefits associated with the Build Alternatives, and recommends avoidance and/or minimization measures for potentially adverse impacts.

This WQAR determines whether the construction and operation of the SR 710 North Study Project would have an adverse impact on water quality. The determination of impacts is based on the anticipated change in pollutant loads due to changes in land use and impervious area percentages between the existing condition and the post-project condition. The analysis includes consideration of BMPs to be implemented as part of the Build Alternatives. This assessment also discusses existing water quality regulations and how the Build Alternatives would comply with those regulations. The report format is based on the Caltrans *Water Quality Assessment Report Content and Recommended Format* (June 2012).

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2. Regulatory Setting

2.1. Federal Laws and Requirements

Clean Water Act

In 1972 Congress amended the Federal Water Pollution Control Act, making the addition of pollutants to the waters of the United States (U.S.) from any point source unlawful unless the discharge is in compliance with a NPDES permit. Known today as the Clean Water Act (CWA), Congress has amended it several times. In the 1987 amendments, Congress directed dischargers of storm water from municipal and industrial/construction point sources to comply with the NPDES permit scheme. Important CWA sections are:

- Sections 303 and 304 require states to promulgate water quality standards, criteria, and guidelines.
- Section 401 requires an applicant for a federal license or permit to conduct any activity, which may result in a discharge to waters of the U.S., to obtain certification from the State that the discharge will comply with other provisions of the act. (Most frequently required in tandem with a Section 404 permit request. See below).
- Section 402 establishes the NPDES, a permitting system for the discharges (except for dredge or fill material) of any pollutant into waters of the U.S. Regional Water Quality Control Boards (RWQCB) administer this permitting program in California. Section 402(p) requires permits for discharges of storm water from industrial/construction and Municipal Separate Storm Sewer Systems (MS4s).
- Section 404 establishes a permit program for the discharge of dredge or fill material into waters of the U.S. This permit program is administered by the U.S. Army Corps of Engineers (USACE).

The objective of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

USACE issues two types of 404 permits: Standard and General permits. For General permits there are two types: Regional permits and Nationwide permits. Regional permits are issued for a general category of activities when they are similar in nature and cause minimal environmental effect. Nationwide permits are issued to authorize a variety of minor project activities with no more than minimal effects.

There are also two types of Standard permits: Individual permits and Letters of Permission. Ordinarily, projects that do not meet the criteria for a Nationwide Permit may be permitted

under one of USACE's Standard permits. For Standard permits, the USACE decision to approve is based on compliance with U.S. Environmental Protection Agency's (EPA) Section 404 (b)(1) Guidelines (U.S. EPA CFR 40 Part 230), and whether permit approval is in the public interest. The 404(b)(1) Guidelines were developed by the U.S. EPA in conjunction with USACE, and allow the discharge of dredged or fill material into the aquatic system (waters of the U.S.) only if there is no practicable alternative which would have less adverse effects. The Guidelines state that USACE may not issue a permit if there is a least environmentally damaging practicable alternative (LEDPA), to the proposed discharge that would have less effects on waters of the U.S., and not have any other significant adverse environmental consequences. Per Guidelines, documentation is needed that a sequence of avoidance, minimization, and compensation measures have been followed, in that order. The Guidelines also restrict permitting activities that violate water quality or toxic effluent standards, jeopardize the continued existence of listed species, violate marine sanctuary protections, or cause "significant degradation" to waters of the U.S. In addition, every permit from the USACE, even if not subject to the 404(b)(1) Guidelines, must meet general requirements. See 33 CFR 320.4.

2.2. State Laws and Requirements

Porter-Cologne Water Quality Control Act

California's Porter-Cologne Act, enacted in 1969, provides the legal basis for water quality regulation within California. This Act requires a "Report of Waste Discharge" for any discharge of waste (liquid, solid, or gaseous) to land or surface waters that may impair beneficial uses for surface and/or groundwater of the State. It predates the CWA and regulates discharges to waters of the State. Waters of the State include more than just waters of the U.S., like groundwater and surface waters not considered waters of the U.S. Additionally, it prohibits discharges of "waste" as defined and this definition is broader than the CWA definition of "pollutant". Discharges under the Porter-Cologne Act are permitted by Waste Discharge Requirements (WDRs) and may be required even when the discharge is already permitted or exempt under the CWA.

The State Water Resources Control Board (SWRCB) and RWQCBs are responsible for establishing the water quality standards (objectives and beneficial uses) required by the CWA, and regulating discharges to ensure compliance with the water quality standards. Details regarding water quality standards in a project area are contained in the applicable RWQCB Basin Plan. In California, Regional Boards designate beneficial uses for all water body segments in their jurisdictions, and then set criteria necessary to protect these uses. Consequently, the water quality standards developed for particular water segments are based

on the designated use and vary depending on such use. In addition, the SWRCB identifies waters failing to meet standards for specific pollutants, which are then state-listed in accordance with CWA Section 303(d). If a state determines that waters are impaired for one or more constituents and the standards cannot be met through point source or non-source point controls (NPDES permits or Waste Discharge Requirements), the CWA requires the establishment of Total Maximum Daily Loads (TMDLs). TMDLs specify allowable pollutant loads from all sources (point, non-point, and natural) for a given watershed.

State Water Resources Control Board and Regional Water Quality Control Boards

The SWRCB adjudicates water rights, sets water pollution control policy, and issues water board orders on matters of statewide application, and oversees water quality functions throughout the state by approving Basin Plans, TMDLs, and NPDES permits. RWQCBs are responsible for protecting beneficial uses of water resources within their regional jurisdiction using planning, permitting, and enforcement authorities to meet this responsibility.

- **National Pollution Discharge Elimination System (NPDES) Program**

  Municipal Separate Storm Sewer Systems (MS4)

  Section 402(p) of the CWA requires the issuance of NPDES permits for five categories of storm water dischargers, including MS4s. The U.S. EPA defines an MS4 as "any conveyance or system of conveyances (roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, human-made channels, and storm drains) owned or operated by a state, city, town, county, or other public body having jurisdiction over storm water, that are designed or used for collecting or conveying storm water." The SWRCB has identified Caltrans as an owner/operator of an MS4 pursuant to federal regulations. Caltrans' MS4 permit covers all Caltrans rights-of-way, properties, facilities, and activities in the state. The SWRCB or the RWQCB issues NPDES permits for five years, and permit requirements remain active until a new permit has been adopted.

  The Caltrans' MS4 Permit, currently under revision, contains three basic requirements:

  1. Caltrans must comply with the requirements of the CGP (see below);
  2. Caltrans must implement a year-round program in all parts of the State to effectively control storm water and non-storm water discharges; and
  3. Caltrans storm water discharges must meet water quality standards through implementation of permanent and temporary (construction) Best Management Practices (BMPs) to the Maximum Extent Practicable, and other measures as the SWRCB determines to be necessary to meet the water quality standards.

To comply with the permit, Caltrans developed the Statewide Storm Water Management Plan (SWMP) to address storm water pollution controls related to highway planning, design, construction, and maintenance activities throughout California. The SWMP assigns responsibilities within Caltrans for implementing storm water management procedures and practices as well as training, public education and participation, monitoring and research, program evaluation, and reporting activities. The SWMP describes the minimum procedures and practices Caltrans uses to reduce pollutants in storm water and non-storm water discharges. It outlines procedures and responsibilities for protecting water quality, including the selection and implementation of BMPs. The proposed project will be programmed to follow the guidelines and procedures outlined in the latest SWMP to address storm water runoff.

Construction General Permit

Construction General Permit (Order No. 2009-009-DWQ, as amended by 2010-0014-DWG), adopted on November 16, 2010, became effective on February 14, 2011. The permit regulates storm water discharges from construction sites which result in a Disturbed Soil Area (DSA) of one acre or greater, and/or are smaller sites that are part of a larger common plan of development. For all projects subject to the CGP, applicants are required to develop and implement an effective Storm Water Pollution Prevention Plan (SWPPP). In accordance with the Caltrans' Standard Specifications, a Water Pollution Control Plan (WPCP) is necessary for projects with DSA less than one acre.

By law, all storm water discharges associated with construction activity where clearing, grading, and excavation results in soil disturbance of at least one acre must comply with the provisions of the CGP. Construction activity that results in soil disturbances of less than one acre is subject to this CGP if there is potential for significant water quality impairment resulting from the activity as determined by the RWQCB. Operators of regulated construction sites are required to develop storm water pollution prevention plans; to implement sediment, erosion, and pollution prevention control measures; and to obtain coverage under the CGP.

The CGP separates projects into Risk Levels 1, 2, or 3. Risk levels are determined during the planning and design phases, and are based on potential erosion and transport to receiving waters. Requirements apply according to the Risk Level determined. For example, a Risk Level 3 (highest risk) project would require compulsory storm water runoff pH and turbidity monitoring, and pre- and post-construction aquatic biological assessments during specified seasonal windows.

Section 401 Permitting

Under Section 401 of the CWA, any project requiring a federal license or permit that may result in a discharge to a water of the United States must obtain a 401 Certification, which certifies that the project will be in compliance with State water quality standards. The most common federal permit triggering 401 Certification is a CWA Section 404 permit, issued by USACE. The 401 permit certifications are obtained from the appropriate RWQCB, dependent on the project location, and are required before USACE issues a 404 permit.

In some cases the RWQCB may have specific concerns with discharges associated with a project. As a result, the RWQCB may issue a set of requirements known as Waste Discharge Requirements (WDRs) under the State Water Code (Porter-Cologne Act) that define activities, such as the inclusion of specific features, effluent limitations, monitoring, and plan submittals that are to be implemented for protecting or benefiting water quality. WDRs can be issued to address both permanent and temporary discharges of a project.

2.3. Regional and Local Requirements

General WDR Permit for Groundwater Discharges

The LARWQCB requires a permit (LARWQCB, 2013b) for discharging wastes to surface waters from activities involving groundwater extraction. Order No. R4-2013-0095 (NPDES No. CAG994004) covers treated or untreated groundwater generated from permanent or temporary dewatering operations or other appropriate wastewater discharge not specifically covered in other general NPDES permits in the Los Angeles region. To be covered under this order, a discharger must:

1. Demonstrate that pollutant concentrations in the discharge shall not cause violation of any applicable water quality objective for the receiving waters, including discharge prohibitions;
2. Demonstrate that discharge shall not exceed the applicable water quality objectives/criteria for the receiving waters; and
3. Conduct water quality screening of a representative sample of the discharge to prove that a reasonable potential for discharge of toxics does not exist.

In addition, the permit covers discharge from dewatering operations in the vicinity of creeks where the groundwater is hydrologically connected and has similar water chemistry to the surface water body to which the groundwater would be discharged.

However, if groundwater discharge in the project area is found to exceed the water quality screening levels for general permits, the project would be subject to this General Permit and treatment of the wastewater would be required to treat the groundwater to meet effluent limitations contained in the permit prior to discharge.

Los Angeles Regional Water Quality Control Board WDRs for Municipal Separate Storm Sewer System

A municipal NPDES storm water permit (LARWQCB, 2012c) was issued to the County of Los Angeles and 84 incorporated cities (with the exception of the City of Long Beach) under Order No. R4-2012-0175, NPDES Permit No. CAS004001 by the LARWQCB on November 8, 2012. Prior to the issuance of Order No. R4-2012-0175, Order No. 01-182 served as the NPDES Permit for MS4 storm water and non-storm water discharges within the Coastal Watersheds of the County of Los Angeles. Until guidance documents for Order No. R4-2012-0175 are adopted, the guidance documents for Order No. 01-182 will remain in effect. All of the cities and unincorporated County directly impacted by the project are covered under the LARWQCB MS4 permit. Portions of the Build Alternatives outside Caltrans ROW would be subject to the requirements of this permit.

Order No. 01-182 specifies that all new development and redevelopment projects that fall under specific priority project categories must comply with the Los Angeles County Standard Urban Storm Water Mitigation Plan (SUSMP, March 2000). The SUSMP for Los Angeles County and the cities in Los Angeles County was adopted by the LARWQCB on March 8, 2000, under Resolution No. R-00-02 and was amended by the SWRCB on October 5, 2000, by Order WQ 2000-11. The SUSMP was developed as part of the municipal storm water program to address storm water pollution from new development and redevelopment projects.

The following projects are subject to SUSMP requirements:

- Single-family hillside residential developments of 1 acre (ac) or more of surface area
- Housing developments of 10 units or more
- 100,000 square feet (sf) or more of impervious surface area industrial /commercial development
- Automotive service facilities
- Retail gasoline outlets
- Restaurants
- Parking lots with 5,000 sf or more of surface area or with 25 or more parking spaces
- Redevelopment projects in subject categories that meet redevelopment thresholds

- New development or redevelopment projects located in or directly adjacent to, or discharging directly into, an environmentally sensitive area where the development will: discharge storm water and urban runoff that are likely to impact a sensitive biological species or habitat; and create 2,500 sf or more of impervious surface area

These categories of development are considered "priority" because it has been determined by the RWQCB that they have the greatest potential to degrade water quality.

The SUSMP includes requirements for Site Design BMPs, Source Control BMPs, and Treatment Control BMPs. As labeled, Site Design BMPs are BMPs that are incorporated into the design of the project (e.g., conserving natural areas and properly designing trash storage areas). Source Control BMPs are pollution prevention BMPs that can be structural or nonstructural practices (e.g., good housekeeping, stenciling of catch basins, protecting slopes from erosion, maintenance of BMPs). Treatment Control BMPs are physical devices that remove pollutants from storm water (e.g., biofilters, water quality inlet devices, detention basins)

The specific SUSMP requirements are as follows:

- Post-development peak storm water runoff discharge rates shall not exceed the estimated predevelopment rate for developments where the increased peak storm water discharge rate will result in increased potential for downstream erosion.
- Conserve natural areas.
- Minimize storm water pollutants of concern. This requires the incorporation of a BMP or combination of BMPs best suited to maximize the reduction of pollutant loadings in that runoff to the maximum extent practicable.
- Properly design outdoor material storage areas.
- Properly design trash storage areas.
- Provide proof of ongoing BMP maintenance.
- Protect slopes and channels from erosion.
- Provide storm drain stenciling and signage.
- Design post-construction structural or Treatment Control BMPs (unless specifically exempted) to mitigate (infiltrate or treat) a set volume of runoff using any of four methods. In general, the 85th percentile storm in a 24-hour period method is used.

Collectively, the proposed project's Site Design, Source Control, and Treatment Control BMPs are required to address the pollutants of concern identified for the proposed project. Metro would maintain BMPs located within their ROW. BMPs located in City ROW would be maintained by the City they are located in.

Municipal Codes for Impacted Jurisdictions[1]

Alhambra Code of Ordinances. Chapters 16.34 (Storm Water and Urban Runoff Pollution Control) and 16.36 (Standard Urban Storm Water Mitigation Plan Implementation) (City of Alhambra, 2013) set forth standards to protect and improve the water quality of the City's receiving waters. These standards include: prohibiting illicit discharges and connections, including spills, dumping, and disposal; controlling pollutants from sites of industrial activities; requiring BMPs; implementing construction activity storm water measures; and implementing an SUSMP.

Los Angeles County Code and Flood Control District Code. The Los Angeles County Code applies to the unincorporated areas that are directly impacted by the Build Alternatives, including the unincorporated communities of East Pasadena, East San Gabriel, and East Los Angeles. Chapter 21 (Stormwater and Runoff Pollution Control) (County of Los Angeles, 2013) sets forth standards to regulate the storm water and non-storm water discharges to the facilities of the Los Angeles County Flood Control District in order to protect those facilities, the water quality of the waters in and downstream of those facilities, and the quality of the water that is being stored in water-bearing zones underground.

Monterey Park Municipal Code. Chapter 6.30 (Stormwater and Urban Runoff Pollution Prevention Controls) (City of Monterey Park, 2013a) sets forth standards to protect the health, safety, and general welfare of the citizens of the City of Monterey Park. These standards include: regulating non-storm water discharge; controlling spillage, dumping or disposal of materials into the storm water system; and reducing pollutants in storm water and urban runoff to the maximum extent practicable.

Pasadena Code of Ordinances. Chapter 8.70 (Stormwater Management and Discharge Control) (City of Pasadena, 2013a) sets forth standards to ensure the future health, safety, and general welfare of the residents of Pasadena who recreate in and consume from the waters of the United States, and to protect marine habitats and ecosystems. These standards include: regulating non-storm water discharges to the municipal storm water system; providing for the control of spillage, dumping or disposal of materials into the municipal storm water system; and reducing pollutants in storm water and urban runoff to the maximum extent practicable.

[1] Section includes only the cities and unincorporated areas that would be directly impacted by the Build Alternatives.

City of Rosemead Code of Ordinances. Chapter 13.16 (Storm Water Management) (City of Rosemead, 2013a) sets forth standards to protect and improve the water quality of the City's receiving waters. These standards include prohibiting illicit connections and discharges, controlling urban runoff, and inspecting sources of discharge into any public drainage system.

San Gabriel Municipal Code. Chapter 53 (Stormwater and Urban Runoff Pollution Prevention) (City of San Gabriel, 2013) sets forth standards to protect and improve the water quality of the City's receiving waters. These standards include: reducing illicit discharges to the municipal storm water system to the maximum extent practicable; eliminating illicit connections to the municipal storm water system; eliminating spillage, dumping, and disposal of pollutant materials into the municipal storm water system; and reducing pollutant loads in storm water and urban runoff from land uses and activities identified in the municipal NPDES permit.

San Marino City Code. Chapter 10.03.06 (Pollution of Water Supply) (City of San Marino, 2013) sets forth standards to protect and improve the water quality of the City's receiving waters. These standards include prohibiting discharges of oils, gasoline, chemicals, or waste materials that may pollute the water supply and prohibit or render unwholesome or contaminate the water of any drinking fountain, hydrant, water line or place within the City.

South Pasadena Municipal Code. Chapter 23 (Stormwater and Urban Runoff Pollution Control) (City of South Pasadena, 2013) sets forth standards to protect and improve the water quality of the City's receiving waters. These standards include: reducing illicit discharges to the municipal storm water system to the maximum extent practicable; eliminating illicit connections to the municipal storm water system; eliminating spillage, dumping, and disposal of pollutant materials into the municipal storm water system; and reducing pollutant loads in storm water and urban runoff from land uses and activities identified in the municipal NPDES permit.

See Table 2.1 for a summary of stormwater management regulatory procedures.

Table 2.1 Summary of Stormwater Management Regulatory Requirements

Type of Permit	Caltrans	County of Los Angeles and Incorporated Cities[1]
Construction	The NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ; NPDES No. CAS000002	The NPDES General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) Order 2009-0009-DWQ, as amended by 2010-0014-DWQ and 2012-0006-DWQ; NPDES No. CAS000002
Operation	The NPDES Permit, Statewide Storm Water Permit, Waste Discharge Requirements for the State of California, Department of Transportation Order No. 2012-0011-DWQ, NPDES No. CAS000003	Waste Discharge Requirements for Municipal Separate Storm Sewer System (MS4) Discharges Within the Coastal Watersheds of Los Angeles County, Except Those Discharges Originating from the City of Long Beach MS4 Order No. R4-2012-0175, NPDES No. CAS004001
Dewatering	Waste Discharge Requirements for Discharges of Groundwater from Construction and Project Dewatering to Surface Waters in Coastal Watershed of Los Angeles and Ventura Counties, Order No. R4-2013-0095, NPDES No. CAG994004.	Waste Discharge Requirements for Discharges of Groundwater from Construction and Project Dewatering to Surface Waters in Coastal Watershed of Los Angeles and Ventura Counties, Order No. R4-2013-0095, NPDES No. CAG994004.

Source: Caltrans (2012), LARWQCB (2012b), and LARWQCB (2013b).
[1] Except for the City of Long Beach.
Caltrans = California Department of Transportation
DWQ = Department of Water Quality
NPDES = National Pollutant Discharge Elimination System

3. Affected Environment

3.1. Introduction

The study area is generally bounded by Interstate 210 (I-210) on the north, Interstate 605 (I-605) on the east, Interstate 10 (I-10) on the south, and Interstate 5 (I-5) and State Route 2 (SR 2) on the west in Los Angeles County. The cities and unincorporated areas directly impacted by the Build Alternatives include Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, South Pasadena, and the unincorporated communities of East Los Angeles, East Pasadena, and East San Gabriel. Because the mix of transportation options and alignments are different for each Build Alternative, each Alternative would pass through a different set of cities and unincorporated areas. The Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative would pass through the Cities of Alhambra, Los Angeles, Pasadena, Rosemead, San Gabriel, San Marino, and South Pasadena, and would also include portions of unincorporated communities in East Pasadena and East San Gabriel. The Bus Rapid Transit (BRT) Alternative would pass through the cities of Alhambra, Monterey Park, Pasadena, San Marino, and South Pasadena, and would also include portions of unincorporated East Los Angeles. The Light Rail Transit (LRT) Alternative would pass through the Cities of Alhambra, Los Angeles, Monterey Park, Pasadena, and South Pasadena, and would include portions of unincorporated East Los Angeles. The Freeway Tunnel Alternative would pass through the Cities of Alhambra, Los Angeles, Monterey Park, Pasadena, and South Pasadena, and would include a portion of unincorporated East Los Angeles.

3.2. General Setting

3.2.1. Population and Land Use

There is a range of existing land uses within and adjacent to the study area, including transportation, residential, commercial, industrial, infrastructure, and recreational land uses (Sapphos Environmental, 2014b).

According to the U.S. Census Bureau (U.S. Census Bureau, 2013), in 2010 the population of Los Angeles County was approximately 9,818,605 persons, which includes the 2010 populations from the following cities and unincorporated communities:

- Alhambra, 83,039 persons
- Monterey Park, 60,269 persons
- Pasadena, 137,122 persons

- Rosemead, 53,764 persons
- San Gabriel, 39,718 persons
- San Marino, 13,147 persons
- South Pasadena, 25,619 persons
- Unincorporated East Los Angeles, 126,496 persons
- Unincorporated East Pasadena, 6,144 persons
- Unincorporated East San Gabriel, 14,874 persons

3.2.2. Topography

The study area primarily consists of the western San Gabriel Valley, the southernmost San Rafael Hills, and the Repetto Hills. These areas are within the transition zone between the northwest-southeast-trending Peninsular Ranges physiographic/geological province on the south, and the east-west-trending Transverse Ranges province on the north (CH2M HILL, 2014a).

The western portion of the SR 710 North Study area consists of the Repetto Hills, a group of small hills and valleys between the Santa Monica Mountains (Transverse Ranges) and the Puente Hills (Peninsular Ranges) on the southeast. The Repetto Hills include Mount Washington, Monterey Park Hills, and the Montebello Hills, as well as several unnamed hills along the western edge of the San Gabriel Valley. In the study area, elevations within the Repetto Hills range from approximately 870 feet (ft) between Monterey Road and State Route 110 (SR 110), to 200 ft at the western toe of the hills near Rosemead Boulevard. The San Rafael Hills are located between the Repetto Hills and the Verdugo Hills, and border the study area on the northwest. Elevations in the San Rafael Hills portion of the study area range from approximately 1,000 ft near State Route 134 (SR 134) and Arroyo Seco, to 600 ft in the vicinity of SR 110 and Arroyo Seco (CH2M HILL, 2014a).

The eastern portion of the SR 710 North Study area is within the San Gabriel Valley, which is bordered by the Puente Hills and San Jose Hills on the south and east, and by the San Gabriel Mountains on the north. The San Gabriel Valley is a relatively flat-floored valley between the San Gabriel Mountains on the north, the San Jose Hills on the east, the Puente Hills on the south, and the Repetto/Verdugo/San Rafael Hills on the west. The northern margin of the valley is characterized by a series of ancient alluvial fans emanating from the San Gabriel Mountains. The valley floor gently descends southerly from elevations of 700 ft to 1,000 ft along the northern margin to approximately 300 to 400 ft in the south. The gradual descent is interrupted locally by an arcuate escarpment (ranging from about 10 to 150 ft in height) extending from the Monrovia area to the South Pasadena area and westerly into the

hills of Glendale and Los Angeles. Associated with this escarpment are closed depressions, springs, reverse-tilted fan surfaces, and small ridges. All of these features are due to fault displacement by the Raymond Fault (CH2M HILL, 2014a).

3.2.3. Hydrology

3.2.3.1. Regional Hydrology

The study area is within LARWQCB Region 4 (LARWQCB, 2013a). The Los Angeles Region has jurisdiction over all coastal drainages flowing to the Pacific Ocean between Rincon Point and the eastern Los Angeles County line, as well as the drainages of the five coastal islands (Anacapa, San Nicolas, Santa Barbara, Santa Catalina, and San Clemente). It is the State's most industrialized and densely populated region. The Los Angeles Region is too large and complex to be managed as a single watershed. Therefore, for the purpose of watershed planning, the Los Angeles Region has been divided into 10 Watershed Management Areas (WMAs). The study area is within the Los Angeles River Watershed, which covers a land area of approximately 834 square miles (sq mi) and is one of the largest watersheds in the region (Figure 3-1). The eastern portion spans from the Santa Monica Mountains to the Simi Hills and in the west from the Santa Susana Mountains to the San Gabriel Mountains. The watershed encompasses and is shaped by the path of the Los Angeles River, which flows from its headwaters in the mountains eastward to the northern corner of Griffith Park. Here the channel turns southward through the Glendale Narrows before it flows across the coastal plain and into San Pedro Bay near Long Beach. The Los Angeles River has evolved from an uncontrolled, meandering river that provided a valuable source of water for early inhabitants to a major flood protection waterway (LACDPW, 2013).

For regulatory purposes the LARWQCB designates watershed areas in Hydrologic Units (HUs) that are further divided into Hydrological Areas (HAs) and Hydrologic Subareas (HSAs). As designated by LARWQCB Region 4, the study area is located within the Los Angeles-San Gabriel HU, Raymond HA, Pasadena HSA (405.31), Coastal Plain HA, Central HSA Split (405.15), and the San Fernando HA, Eagle Rock HSA (405.25). The Los Angeles-San Gabriel HU covers approximately 1,608 sq mi within Los Angeles County and small areas in Ventura County (LARWQCB, 2007c).

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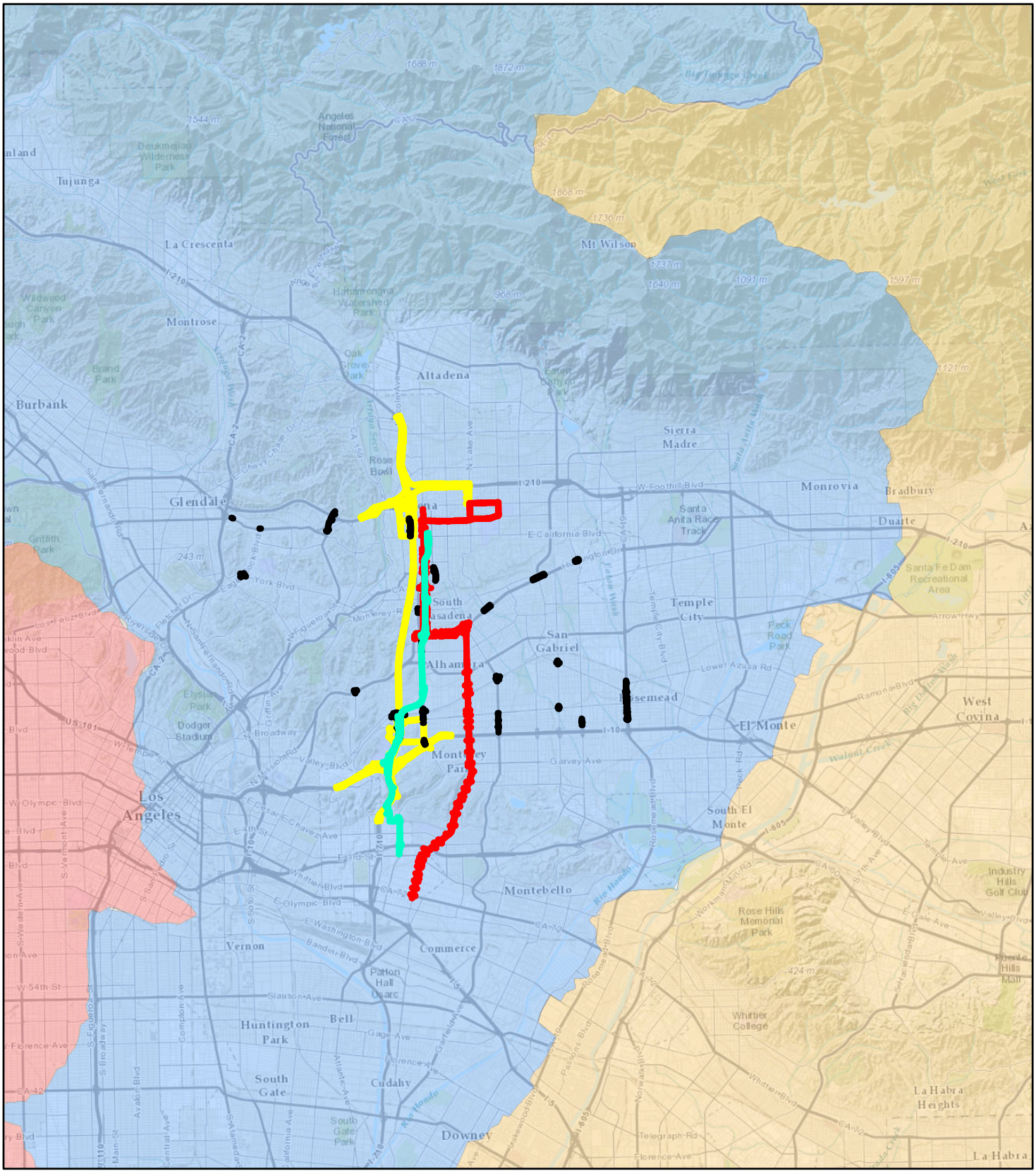

LEGEND

Watersheds

- Los Angeles
- Santa Monica Bay
- San Gabriel

- Light Rail Alternative (LRT)
- Bus Route Alternative (BRT)
- TSM/TDM (Potential Wall Removal)
- Freeway Tunnel Alternative (F7)

FIGURE 3-1

N

0 1.5 3

Miles

SOURCE: ESRI (c. 2010); Los Angeles County Dept of Public Works; Water Resources Division (2/2013)

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SR 710 North Study

Los Angeles River Watershed

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3.2.3.2. Local Hydrology

The major drainages adjacent to the study area are the Los Angeles River in the west and Rio Hondo and the San Gabriel River in the east (CH2M HILL, 2014a). Rio Hondo drains to the Los Angeles River, which drains to the Pacific Ocean. The San Gabriel River drains directly to the Pacific Ocean. In addition to these major drainages, there are smaller intermittent drainages adjacent to the study area that include, from west to east, Arroyo Seco in the Repetto and San Rafael Hills, and the Alhambra/San Pasqual Wash, Rubio Wash, Eaton Wash, Arcadia Wash, and Santa Anita Wash in the western and central parts of the San Gabriel Valley (CH2M HILL, 2014a). The major drainages in the study area include Arroyo Seco and Dorchester Channel (Laguna Channel). The Arroyo Seco and Dorchester Channel both drain to the Los Angeles River, which in turn drains to the Pacific Ocean.

Runoff from the TSM/TDM Alternative would drain into the Arroyo Seco, Rio Hondo, and Los Angeles River. Runoff from the BRT Alternative would drain into the Rio Hondo and Los Angeles River. Runoff from the LRT Alternative would drain into the Rio Hondo and Los Angeles River. Runoff from the Freeway Tunnel Alternative would drain into the Arroyo Seco and Los Angeles River (Figure 3-2).

3.2.3.2.1. Precipitation and Climate

The climate in the study area is classified as Mediterranean (i.e., semiarid climate with hot and dry summers and moderately mild and wet winters). Overall, the climate of the area is relatively mild (temperatures typically range between 40 and 90 degrees Fahrenheit [°F] [Western Regional Climate Center, 2013]). Summer daytime high temperatures average about 82°F with overnight lows of 63°F. Winter daytime high temperatures average 63°F with overnight lows of 48 °F. Rain is common in this area during the winter. The rainy season is October 1 through May 1. Precipitation in the region generally occurs as rainfall with an annual average of 15 inches. Most of the precipitation and storms occur from November to March (CH2M HILL, 2014c).

3.2.3.2.2. Surface Streams

The Alhambra Wash, Arroyo Seco, and Dorchester Channel were identified within the study area. The Alhambra Wash drains directly into the Rio Hondo, which drains into the Los Angeles River and eventually into the Pacific Ocean. The Arroyo Seco drains into the Los Angeles River, which in turn drains into the Pacific Ocean. The Arroyo Seco is an 80 ft wide,

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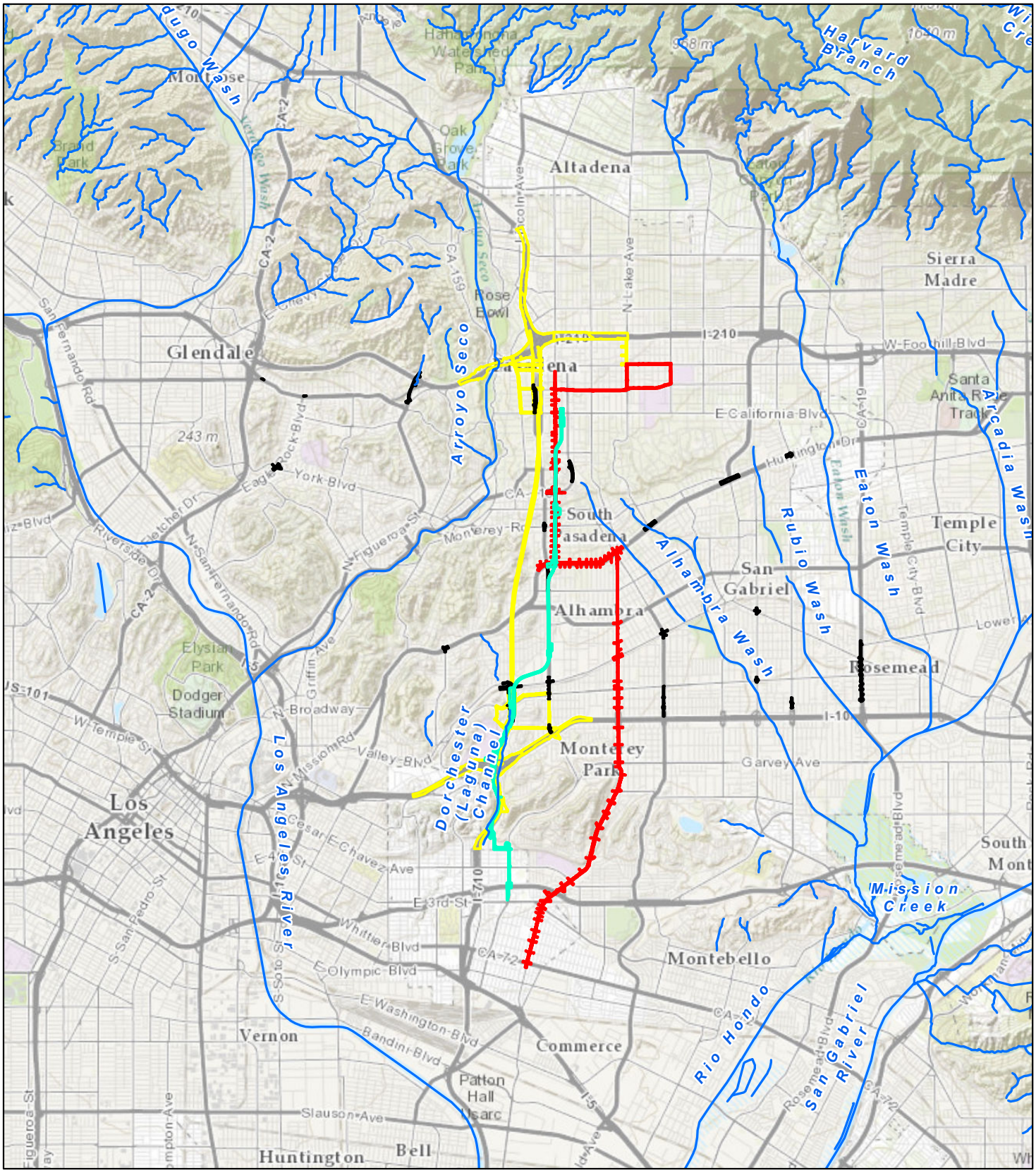

LEGEND

- Surface Waters
- Light Rail Alternative (LRT)
- Bus Route Alternative (BRT)
- TSM/TDM (Potential Wall Removal)
- Freeway Tunnel Alternative (F7)

N

0 1 2
MILES

SOURCE: ESRI (2008); LSA (2013); USGS NHD (4/2010)

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FIGURE 3-2

SR 710 North Study
Surface Waters
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usually shallow stream with an earthen bottom. The Dorchester Channel is a tributary of the Los Angeles River, which drains into the Pacific Ocean. The Dorchester Channel is mostly channelized in a concrete-lined box channel (Sapphos Environmental, 2014b). In addition, there are a total of 29 potential jurisdictional drainages, wetlands, and associated riparian habitats within the study area (Sapphos Environmental, 2014a). The Jurisdictional Delineation Report identified 19 aboveground nonjurisdictional drainage features, 8 jurisdictional drainage features, and 2 wetlands that were also delineated (Sapphos Environmental, 2014a). These potential drainage features eventually discharge into the Los Angeles River, which drains directly to the Pacific Ocean in the City of Long Beach.

3.2.3.2.3. Floodplains

There are no Federal Emergency Management Agency (FEMA) designated 100-year floodplains in the study area (FEMA, 2013). Information about the floodplains is based on available engineering documents (e.g., As-Built plans). Two floodplains were identified within the study area: Laguna Regulating Basin and Dorchester Channel. The Los Angeles Department of Public Works indicated there has never been an overtopping flood in the Laguna Regulating Basin since it was constructed, even during wet years. Therefore, the highest possible inundated area prior to spillway activity is assumed to be the flood of record, which is the basis for analyzing impacts to the existing floodplain. The data available for Dorchester Channel indicate that design flows for this system were based on a 50-year frequency, also known as the Capital Flood. The Capital Flood is based on the design storm falling on a saturated watershed and is the basis for most Federal Insurance Rate Maps (FIRMs) in Los Angeles County. In most cases, the Capital Flood would exceed the 100-year flood if it were based on stream gage records. However, for these regional facilities, no historic stream gage data or FEMA FIRMs are available. For the purpose of floodplain discussion, the Capital Flood can be considered a 100-year flood for Caltrans (LSA, 2013).

3.2.3.2.4. Municipal Supply

The cities and unincorporated areas that are directly impacted by the Build Alternatives include Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, South Pasadena, unincorporated East Los Angeles, unincorporated East Pasadena, and unincorporated East San Gabriel. A discussion of the municipal water supply for each city is below.

The City of Alhambra's main source of water supply consists of groundwater pumped from the Main San Gabriel Groundwater Basin. In addition, the City can purchase imported water from the Metropolitan Water District of Southern California (MWD), which is drawn from

the Colorado River and Northern California. The City is not a member agency of MWD but can still receive imported water, thereby reducing the extraction of water from the Main San Gabriel Groundwater Basin (City of Alhambra, 2011). Additional water is also imported from the San Gabriel Valley Municipal Water District (San Gabriel Municipal Water District, 2013).

The City of Monterey Park Water System receives its water supply from local groundwater in the Main San Gabriel Groundwater Basin or is imported by the San Gabriel Valley Municipal Water District. The water is produced by 12 City-owned wells with a total capacity of 20 million gallons per day (mgd) (City of Monterey Park, 2013a).

The City of Pasadena and the unincorporated East Pasadena area receive their water supply from Pasadena Power &Water. About 41percent of the supply is groundwater from the Raymond Groundwater Basin and is pumped out of 16 deep wells located throughout Pasadena. In addition, 58 percent of the water is imported from the MWD. The remaining 1 percent is purchased from neighboring water agencies that combine surface water and groundwater (City of Pasadena, 2013b).

The City of Rosemead receives its water supply from six water companies including the Main San Gabriel Groundwater Basin. The six water companies that supply the city are: Adams Ranch Mutual Water Company, Amarillo Mutual Water, California-American Water Company, Golden State Water, San Gabriel County Water District, and San Gabriel Valley Water Company (City of Rosemead, 2013b).

The City of San Gabriel receives its water supply from San Gabriel Valley Water Company (San Gabriel Valley Water Company, 2010a), San Gabriel County Water District (San Gabriel Valley Water District, 2010), Upper San Gabriel Valley Municipal Water District, and groundwater pumped from the Main San Gabriel Groundwater Basin (Golden State Water Company, 2013). In addition, East San Gabriel is one of the unincorporated areas in San Gabriel Valley and is bordered by the community of East Pasadena to the north, the City of San Marino to the west, the City of San Gabriel to the southwest, the City of Temple City to the southeast, and the City of Arcadia to the northeast. Water is supplied by the San Gabriel County Water District (San Gabriel County Water District, 2010) and the Upper San Gabriel Municipal Water District (San Gabriel Valley Water Company, 2010b).

The City of San Marino receives its water supply from California-American Water Company (Metropolitan Water District of Southern California, 2012) and the San Gabriel Valley Municipal Water District (San Gabriel Valley Municipal Water District, 2013). Local water is drawn from the Raymond Groundwater Basin and the Upper San Gabriel Valley

Groundwater Basin. The City uses very little MWD water directly; however, the Main San Gabriel Groundwater Basin is recharged partly by water supplied by the MWD (Metropolitan Water District of Southern California, 2012).

The City of South Pasadena receives its water supply from groundwater pumped from wells in the Main San Gabriel Groundwater Basin, surface water imported from the MWD, and groundwater from the City of Pasadena, which includes MWD water that is supplied to only the City's Pasadena Zone (City of South Pasadena, 2012). Furthermore, additional water is imported from the Upper San Gabriel Valley Municipal Water District (Upper San Gabriel Valley Municipal Water District, 2013).

The unincorporated East Los Angeles area receives its water supply from the California Water Surface Company (Cal Water). Cal Water receives its water supply from local groundwater and purchased water from the MWD.

3.2.3.2.5. Groundwater Hydrology

The SR 710 North Study is located across four alluvial groundwater basins of the South Coast Hydrologic Region as defined by the Department of Water Resources. The subject groundwater basins include the Central Coastal Plain of the Los Angeles Basin, San Fernando Valley Basin, San Gabriel Valley Basin, and the Raymond Basin (California's Groundwater Bulletin 118, 2013) (Figure 3-3). The groundwater basins are separated by bedrock upland areas and/or faults. The bedrock upland areas within the study area are generally considered non-water bearing. However, perched groundwater might be locally present within faulted and/or fractured zones (CH2M HILL, 2014a).

The Central Coastal Plain of the Los Angeles Basin is bounded on the north by a surface divide called the La Brea high, and on the northeast and east by emergent less permeable Tertiary rocks of the Elysian, Repetto, Merced, and Puente Hills. The southeast boundary between the Central Basin and the Orange County Groundwater Basin roughly follows Coyote Creek, which is a regional drainage province boundary. The southwest boundary is formed by the Newport-Inglewood Fault system and the associated folded rocks of the Newport-Inglewood uplift. The Los Angeles and San Gabriel Rivers drain inland basins and pass across the surface of the Central Basin on their way to the Pacific Ocean (California's Groundwater Bulletin 118, 2004a).

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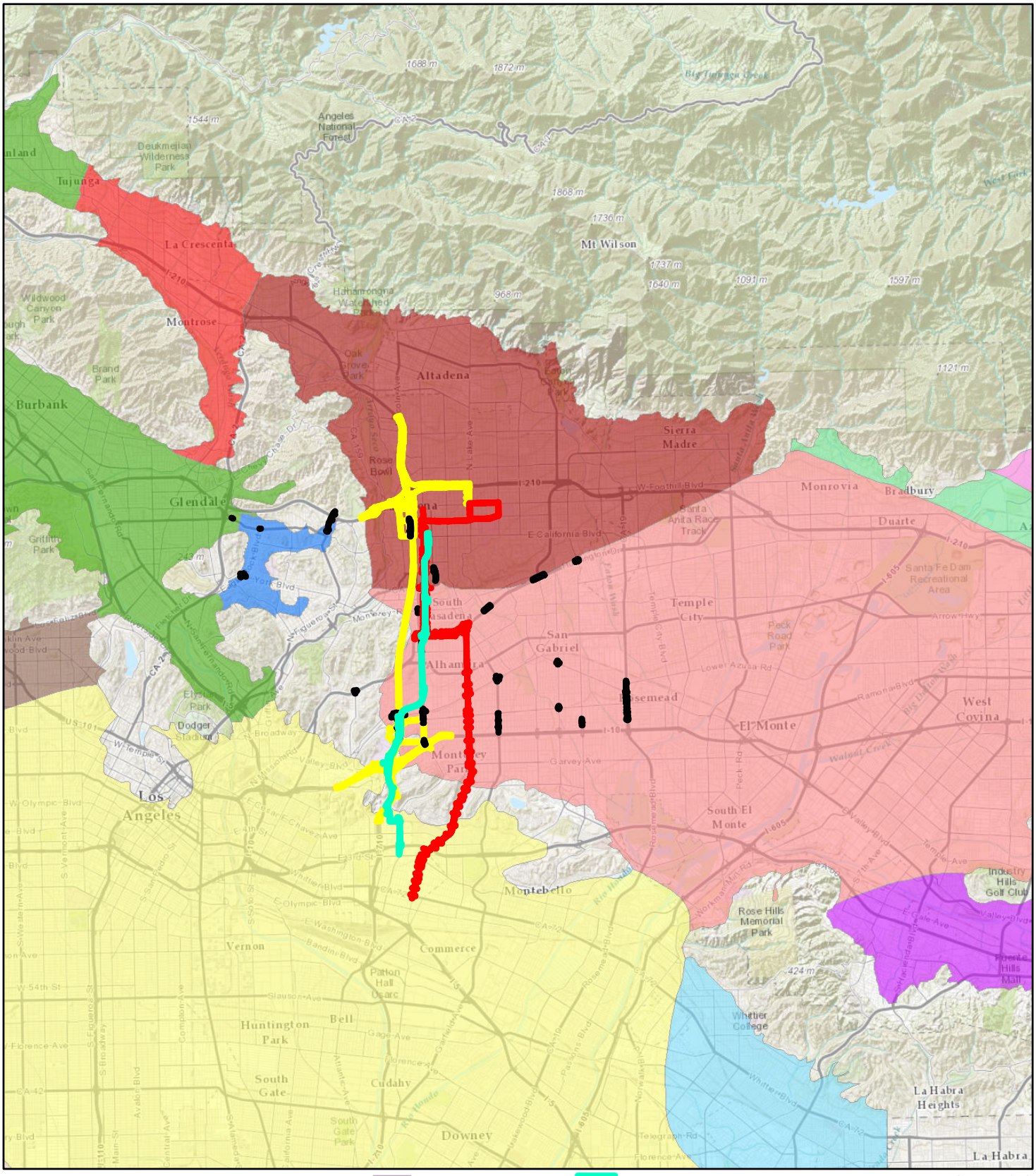

FIGURE 3-3

SR 710 North Study

Groundwater Management Areas

07-LA-710 (SR 710)
EA 187900
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SOURCE: ESRI (c. 2010); Los Angeles County Dept of Public Works; Water Resources Division (7/2013)

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The San Fernando Valley Groundwater Basin includes water-bearing sediments beneath the San Fernando Valley, Tujunga Valley, Browns Canyon, and the alluvial areas surrounding the Verdugo Hills near La Crescenta and Eagle Rock. The basin is bounded on the north and northwest by the Santa Susana Mountains, on the north and northeast by the San Gabriel Mountains, on the east by the San Rafael Hills, on the south by the Santa Monica Mountains and Chalk Hills, and on the west by the Simi Hills. The valley is drained by the Los Angeles River and its tributaries (California's Groundwater Bulletin 118, 2004c).

The San Gabriel Valley Basin includes water-bearing sediments underlying most of the San Gabriel Valley and a portion of the upper Santa Ana Valley that lies in Los Angeles County. This basin is bounded on the north by the Raymond Fault and the contact between Quaternary sediments and consolidated basement rocks of the San Gabriel Mountains. Exposed consolidated rocks of the Repetto, Merced, and Puente Hills bound the basin on the south and west, and the Chino Fault and San Jose Fault form the eastern boundary. The Rio Hondo and San Gabriel drainages have their headwaters in the San Gabriel Mountains, then surface water flows southwest across the San Gabriel Valley and exits through the Whittier Narrows, which is a gap between the Merced and Puente Hills (California's Groundwater Bulletin 118, 2004d).

The Raymond Groundwater Basin includes the water-bearing sediments bounded by the contact with consolidated basement rocks of the San Gabriel Mountains on the north and the San Rafael Hills on the southwest. The west boundary is delineated by a drainage divide at Pickens Canyon Wash and the southeast boundary is the Raymond Fault (California's Groundwater Bulletin 118, 2004b).

For regulatory purposes, the LARWQCB in its Basin Plan further divided the groundwater basins into the Los Angeles Coastal Plain Central Basin, Main San Gabriel Basin Western Area, Raymond Basin Pasadena Area, San Fernando Basin East of Highway 405 (overall), and Eagle Rock Basin (LARWQCB, 1995).

Groundwater levels for the overall study area range from 5 to 450 ft below ground surface (bgs). Historically, highest groundwater levels range from 10 ft to 200 ft bgs (CH2M HILL, 2014a).

3.2.4. Geology/Soils

3.2.4.1. Soil Erosion Potential

The study area has a diverse geology. Quaternary-age alluvium occurs as narrow valley fill in the valleys of the Repetto Hills and over the entire San Gabriel Valley. Alluvium is present at the northern portion of the zone, where it is approximately 500 to 600 ft thick, and at the southern portion of the zone where it is much thinner and on the order of 0 to 50 ft thick. Alluvium at the northern portion of the zone is expected to consist of clay, silt, and sand with a major component of gravels and cobbles and some boulders, all composed of igneous and metamorphic rocks. The alluvium in the small valleys of the Repetto Hills is more silty and clayey with a smaller proportion of sand and gravel (CH2M HILL, 2014c).

The central portion of the study area is composed of the Puente and Topanga Formations, separated by a fault on the north flank of the South Pasadena Anticline. The Puente Formation ranges from soft to moderately hard, well-bedded siltstone, mudstone, and sandstone, and minor local zones of carbonate-cemented beds from hard rock. The Puente Formation in the southern portion of the study area and includes white to very pale-brown, soft, siliceous shale and thin-bedded mudstone. The Topanga Formation occurs in the northern portion of the study area and includes a wide variety of rock types that range from coarse-grained rocks to fine-grained sandstone and siltstone with minor claystone (mudstone). The portion of the Topanga Formation south of the Raymond Fault is predominantly thin- to thick-bedded siltstone with thin interbeds of sandstone and shale. The Topanga Formation north of the Raymond Fault is predominantly sandstone, conglomerate, and breccias (CH2M HILL, 2014c).

The National Resources Conservation Service (NRCS) classifies soil types into four broad categories. Group A soils have low runoff potential and high infiltration rates. Group B soils have moderate runoff potential and moderate infiltration rates. Group C soils have moderately high runoff potential and low infiltration rates. Group D soils have very low infiltration rates and high runoff potential (USDA, 2007). Soil types for the study area are predominantly classified in Group D.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water, transportability of the sediment, and the amount and rate of runoff given a particular rainfall input as measured under a standard condition. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic

matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.05 to 0.65. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water. The soils found within the study area have a soil erosion factor K of 0.32, which indicates moderate susceptibility to particle detachment and moderate runoff rates.

3.2.5. Biological Communities

3.2.5.1. Aquatic Habitat

Areas of potential jurisdiction were evaluated according to United States Army Corps of Engineers (USACE), California Department of Fish and Wildlife (CDFW), and Regional Water Quality Control Board (RWQCB) criteria as part of the Jurisdictional Delineation prepared for the study area. Field investigations were conducted in the biological study area (BSA) between April and October in 2013. The BSA includes an approximate 200 ft buffer on all parcels for which any temporary or permanent impacts may occur as a result of the implementation of one or more of the Build Alternatives. The BSA was surveyed for areas supporting species of plant life that are potentially indicative of wetlands. In addition, hydrological conditions such as surface inundation, saturated soils, groundwater levels, and/or other wetland hydrology indicators were noted. According to the Jurisdictional Delineation prepared for the study area, two wetlands were delineated and mapped based on surface hydrology, soil conditions, and the presence or absence of hydrophytic vegetation.

A total of 29 potential drainage features, wetlands, and associated riparian habitats were evaluated for the Build Alternatives. The Jurisdictional Delineation identified 4.56 acres (ac) of drainages potentially subject to USACE jurisdiction, 9.77 ac potentially subject to CDFW jurisdiction, and 5.65 ac potentially subject to RWQCB jurisdiction within the BSA. Two drainages, the Arroyo Seco and the Dorchester Channel, were identified as meeting USACE criteria for jurisdiction, and both drain directly into the Los Angeles River. All the areas identified as meeting criteria for USACE jurisdiction also meet the criteria for CDFW jurisdiction. In addition, one wetland (which abuts Dorchester Channel) and one area of nonwetland riparian vegetation (Arroyo Seco Stream) were identified as meeting the criteria for CDFW jurisdiction. All of the areas meeting criteria for USACE jurisdiction also meet the criteria for RWQCB jurisdiction. In addition, the 1.09 ac isolated wetland at the Del Mar Pump Station was identified as subject to RWQCB jurisdiction. The Del Mar Pump Station wetland originates from storm water that is actively pumped into the area, which then percolates into the ground. The Del Mar Pump Station wetland has no surface or subsurface connection to waters of the United States and therefore is not under USACE jurisdiction.

In addition, a total of 19 aboveground nonjurisdictional ditch features were identified within the BSA (Sapphos Environmental, 2014a). The Jurisdictional Delineation prepared for the study area provides expanded analysis of the individual drainages.

3.2.5.1.1. Special-Status Species

Biological resource surveys were conducted as part of the Natural Environment Study (NES) throughout the entire BSA from April 2013 to October 2013. Wildlife species that occur within the BSA are generally limited to species that are well adapted to human-modified environments and are species typically associated with urbanized habitats. No federally and/or State-listed plant species, nor suitable habitat for these plants, were identified within the BSA. Two sensitive plants species were observed within the Freeway Tunnel Alternative area of the BSA: Coulter's goldfields and Southern California walnut. No federally and/or State-listed endangered or threatened, or proposed endangered or threatened, or considered Fully Protected wildlife species by the State of California were identified within the BSA. Marginally suitable habitat for American peregrine falcon (Fully Protected in California) was identified within the BSA. Marginally suitable habitat for riparian obligate special-status birds including least Bell's vireo (federally and State endangered), southwestern willow flycatcher (federally and State endangered), western yellow-billed cuckoo (federal candidate, State endangered), and yellow-breasted chat (California Species of Special Concern) was identified within the BSA. No special-status bat species were identified within the BSA. Special-status wildlife and bird species observed within the BSA include Cooper's hawk, Allen's hummingbird, Nuttall's woodpecker, oak titmouse, black-crowned night heron, California gull, double-crested cormorant, great blue heron, great egret, sharp-shinned hawk, and Vaux's swift, although these occurrences were purely transient in nature and no nesting resources are being used within the BSA by these species (Sapphos Environmental, 2014b).

3.2.5.1.2. Stream/Riparian Habitats

Aquatic resources within the BSA are limited due to the urbanized nature of the area. Most of the impacted drainages in the BSA are predominantly channelized and have limited ecological characteristics for aquatic species (Sapphos Environmental, 2014a). The Arroyo Seco, however, is an 80 ft wide stream with an earthen bottom that carries relatively permanent waters. Adjacent to the Arroyo Seco, 4.12 ac of associated nonwetland riparian plant communities were identified and mapped, some of which were recorded at the site of the Arroyo Seco Low-Flow Stream Restoration Project (Sapphos Environmental, 2014a). Riparian plant communities occur along the Arroyo Seco within the BSA, providing potential habitat for riparian-associated plants and animals. The main channel of Arroyo Seco provides habitat for aquatic plants and animals that do not require deep pools (Sapphos

Environmental, 2014b). Due to the urbanized character of the BSA and the limited water available, it is unlikely that aquatic wildlife species would depend upon the conveyance of water through the study area.

There are no known migration corridors or wildlife linkages within the BSA.

3.2.5.1.3. Wetlands

The wetland associated with the Dorchester Channel is located on both sides of the Dorchester Channel, at the south end of the study area north of Floral Drive, as an abutting wetland configuration. The wetland plants and hydrology are contiguous with the main stream channel. According to the biological resource surveys, the soils in the wetland contained large amounts of fill material, including bricks and rock. The wetland provides potential habitat for plants and wildlife and is under the jurisdiction of the USACE. A second wetland, associated with the Del Mar Pump Station, was also identified. This isolated wetland is man-made due to the pumping of storm water into the area and is not subject to USACE jurisdiction because it drains into the groundwater. This wetland also does not have a connection to waters of the United States (Sapphos Environmental, 2014a). Habitat for plants and wildlife is present at this wetland but limited due to the artificial and maintained (mowed) nature of the habitat (Sapphos Environmental, 2014b).

3.2.5.1.4. Fish Passage

It is unlikely that the highly disturbed, predominantly nonvegetated, ephemeral flow of the drainages within the study area would provide the necessary habitat to support fish. Historically, the Los Angeles River Watershed served as habitat to the federally endangered steelhead salmon. However, due to the dramatic population decline of this species, as well as river modifications such as channelization and alterations associated with flood control and metropolitan development, it is very unlikely that steelhead salmon would be present within the BSA (Sapphos Environmental, 2014b).

3.3. Water Quality Objectives/Standards and Beneficial Uses

3.3.1. Surface Water Quality Objectives/Standards and Beneficial Uses

Surface water quality objectives for all inland waters in the Los Angeles region as documented in the LARWQCB Basin Plan, are listed in Table 3.1.

Table 3.1 Surface Water Quality Objectives for Inland Surface Waters

Constituent	Basin Plan Objectives
Ammonia	Shall not be present at levels that when oxidized to nitrate, pose a threat to groundwater. Numerical ammonia concentrations for inland surface waters are contained in Table 3-1 through 3-4 of the LARWQCB Basin Plan.
Bacterial, Coliform	**REC-1:** Fecal coliform concentration shall not exceed a log mean of 200/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of samples collected during any 30-day period exceed 400/100 ml. **REC-2 (and not designated REC-1):** Fecal coliform concentration shall not exceed a log mean of 2,000/100 ml (based on a minimum of not less than four samples for any 30-day period), nor shall more than 10 percent of samples collected during any 30-day period exceed 4,000/100 ml.
Bioaccumulation	Toxic pollutants shall not be present at levels that will bioaccumulate in aquatic life to levels that are harmful to aquatic life or human health.
Biological Oxygen Demand (BOD)	Waters shall be free of substances that result in increases in the BOD, which adversely affect beneficial uses.
Biostimulatory Substances	Waters shall not contain biostimulatory substances in concentrations that promote aquatic growth to the extent that such growth causes nuisance or adversely affects beneficial uses.
Chemical Constituents	Surface waters shall not contain concentrations of chemical constituents in amounts that adversely affect any designated beneficial use. Waters designated for domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents in excess of the limits specified in Title 22 CCR and incorporated by reference into Tables 3-5, 3-6, and 3-7 of the LARWQCB Basin Plan.
Chlorine, Total Residual	Chlorine residual shall not be present in surface water discharges at concentrations that exceed 0.1 mg/L and shall not persist in receiving waters at any concentration that causes impairment of beneficial uses.
Color	Waters shall be free of coloration that causes nuisance or adversely affect beneficial uses.
Exotic Vegetation	Exotic vegetation shall not be introduced around stream courses to the extent that such growth causes nuisance or adversely affect beneficial uses.
Floating Material	Waters shall not contain floating materials, including solids, liquids, foams, and scum, in concentrations that cause nuisance or adversely affect beneficial uses.
Methylene Blue Activated Substances (MBAS)	Waters shall not have MBAS concentrations greater than 0.5 mg/L in waters designated MUN.
Mineral Quality	Numerical mineral quality objectives for individual inland surface waters are contained in Table 3-8 of the LARWQCB Basin Plan.
Nitrogen (Nitrate, Nitrite)	Waters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen, 45 mg/L as nitrate, 10 mg/L as nitrate-nitrogen, or 1 mg/L as nitrite-nitrogen.
Oil and Grease	Waters shall not contain oils, greases, waxes, or other materials in concentrations that result in a visible film or coating on the surface of the water or on objects in the water that cause nuisance or adversely affect beneficial uses.
Oxygen, Dissolved	The mean annual dissolved oxygen concentration of all waters shall be greater than 7 mg/L, and no single determination shall be less than 5 mg/L, except when natural conditions cause lesser concentrations. The dissolved oxygen content of all surface waters designated as WARM shall not be depressed below 5 mg/L.
Pesticides	No individual pesticide or combination of pesticides shall be present in concentrations that adversely affect beneficial uses. There shall be no increase in pesticide concentrations found in bottom sediments or aquatic life. Waters designated for use as domestic or municipal supply (MUN) shall not contain concentration of pesticides in excess of the limiting concentrations specified in Table 64444-A of Section 64444 of Title 22 CCR, which is incorporated by reference into the LARWQCB Basin Plan.
pH	Inland water shall not be depressed below 6.5 or raised above 8.5 as a result of waste discharges. Ambient percentage of hydrogen (pH) levels shall not be changed more than 0.5 unit from natural conditions as a result of waste discharge.
Polychlorinated Biphenyls (PCBs)	Pass-through or uncontrollable discharges to waters, or at locations where the waste can subsequently reach waters, are limited to 70 pg/L (30-day average) for protection of human health and 14 ng/L (daily average) to protect aquatic life in inland fresh waters.

Table 3.1 Surface Water Quality Objectives for Inland Surface Waters

Constituent	Basin Plan Objectives
Radioactive Substances	Radionuclides shall not be present in concentrations that are deleterious to human, plant, animal, or aquatic life or that result in the accumulation of radionuclides in the food web to an extent that presents a hazard to human, plant, animal, or aquatic life. Waters designated for use as domestic or municipal supply (MUN) shall not contain concentration of radionuclides in excess of the limits specified in Table 4 of Section 64443 of Title 22 CCR, which is incorporated by reference into Table 3-9 of the LARWQCB Basin Plan.
Solid, Suspended, or Settleable Materials	Waters shall not contain suspended or settleable material in concentrations that cause nuisance or adversely affect beneficial uses.
Tastes and Odors	Waters shall not contain taste or odor-producing substances in concentrations that impart undesirable tastes or odors to fish flesh or other edible aquatic resources, cause nuisance, or adversely affect beneficial uses.
Temperature	The natural receiving water temperature of all waters shall not be altered unless it can be demonstrated that such alteration in temperature does not adversely affect beneficial uses.
Toxicity	All waters shall be free of toxic substances in concentrations that are toxic to, or that produce detrimental physiological responses in, human, plant, animal, or aquatic life.
Turbidity	Waters shall be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. Increases in natural turbidity attributable to controllable water quality factors shall not exceed the following limits: • Where natural turbidity is between 0 and 50 NTU, increases shall not exceed 20%. • Where natural turbidity is greater than 50 NTU, increases shall not exceed 10%.

Source: Los Angeles Regional Water Quality Control Board. 1995. *Water Quality Control Plan – Los Angeles Region*.
CCR = California Code of Regulations
LARWQCB = Los Angeles Regional Water Quality Control Board
mg/L = milligrams per liter
ml = milliliter
MUN = municipal and domestic supply
ng/L = nanograms per liter
NTU = National Turbidity Units
pg/L = picograms per liter
WARM = warm freshwater habitat

The Los Angeles River above Figueroa Street has the following site-specific water quality objectives:

- **Total Dissolved Solids (TDS):** 950 milligrams per liter (mg/L)
- **Sulfate:** 300 mg/L
- **Chloride:** 150 mg/L
- **Nitrogen:** 8 mg/L

Rio Hondo above the Santa Ana Freeway has the following site-specific water quality objectives:

- **TDS:** 750 mg/L
- **Sulfate:** 300 mg/L
- **Chloride:** 150 mg/L
- **Nitrogen:** 8 mg/L

There are no numeric site-specific water quality objectives for below the Arroyo Seco spreading grounds.

Beneficial uses of inland surface waters form the cornerstone of water quality protection under the LARWQCB Basin Plan. They are defined in the Basin Plan as those necessary for the survival of well-being of humans, plants, and wildlife. Examples of beneficial uses include swimming, fishing, drinking water supplies, industrial water supply, and the support of freshwater and marine habitats and their organisms.

The existing, potential, and intermittent beneficial uses for the Los Angeles River, Rio Hondo to Spreading Grounds, Arroyo Seco South of Devil's Gate Lower (L), and Arroyo Seco South of Devil's Gate Upper (U) as identified in the LARWQCB Basin Plan are identified in Table 3.2.

Table 3.2 Receiving Waters Beneficial Uses

Beneficial Use	Los Angeles River	Rio Hondo to Spreading Grounds	Arroyo Seco South of Devil's Gate Lower (L)[1]	Arroyo Seco South of Devil's Gate Upper (U)[2]
Municipal and Domestic Supply (MUN)	P[3]	P[3]	P[3]	P[3]
Industrial Service Supply (IND)	P	–	–	–
Groundwater Recharge (GWR)	E	I	–	–
Water Contact Recreation (REC-1)	E[4]	I[5]	I	I[5]
Non-Contact Water Recreation (REC-2)	E	E	I	I
Warm Freshwater Habitat (WARM)	E	P	P	P
Wildlife Habitat (WILD)	P	I	P	P
Rare, Threatened, or Endangered Habitat (RARE)	–	–	–	E

Source: Los Angeles Regional Water Quality Control Board. 1995. *Water Quality Control Plan – Los Angeles Region*.

[1] The Arroyo Seco South of Devil's Gate Lower is located in Central HSA Split of the Los Angeles Coastal Plain.

[2] The Arroyo Seco South of Devil's Gate upper is located in the Pasadena HSA of the Raymond HA.

[3] MUN designations are designated under SB-88-63 and RB89-03. Some designations may be considered for exemptions at a later date.

[4] Access prohibited by Los Angeles County Department of Public Works.

[5] Access prohibited by Los Angeles County Department of Public Works in concrete-channelized areas.

HSA = Hydrologic Subarea
HA = Hydrologic Area
P= potential beneficial uses
E= existing beneficial uses
I= intermittent beneficial uses

3.3.2. Groundwater Quality Objectives/Standards and Beneficial Uses

The groundwater quality objectives for the Los Angeles Region as designated in the LARWQCB Basin Plan are provided in Table 3.3. The Build Alternatives are located across three Regional Groundwater Basins: Los Angeles Coastal Plain, San Fernando Valley, and San Gabriel Valley. Each regional groundwater basin is comprised of smaller sub-basins. The Los Angeles Coastal Plain includes the Central Basin, the San Fernando Valley includes the San Fernando Basin (east of Highway 405 [overall]) and Eagle Rock Basin, and the San

Table 3.3 Groundwater Quality Objectives

Constituent	Basin Plan Objectives
Bacteria	In groundwaters used for domestic or municipal supply (MUN) the concentration of coliform organisms over any 7-day period shall be less than 1.1/100 mL.
Chemical Constituents and Radioactivity	Groundwaters designated for use as domestic or municipal supply (MUN) shall not contain concentrations of chemical constituents and radionuclides in excess of the limits specified in Title 22 CCR and incorporated by reference into Tables 3-5, 3-6, 3-7, and 3-9 of the LARWQCB Basin Plan.
Nitrogen (Nitrate, Nitrite)	Groundwaters shall not exceed 10 mg/L nitrogen as nitrate-nitrogen plus nitrite-nitrogen, 10 mg/L as nitrate-nitrogen, or 1 mg/L as nitrite-nitrogen.
Taste and Odor	Groundwaters shall not contain taste or odor-producing substances in concentrations that cause nuisance or adversely affect beneficial uses.

Source: Los Angeles Regional Water Quality Control Board. 1995. Water Quality Control Plan – Los Angeles Region.
CCR = California Code of Regulations
LARWQCB = Los Angeles Regional Water Quality Control Board
mg/L = milligrams per liter
mL = milliliters
MUN = municipal and domestic water supply

Gabriel Valley includes the Raymond Basin Pasadena Area and the Main San Gabriel Basin Western Area (LARWQCB, 1995). The site-specific groundwater quality objectives for the groundwater basins are listed below:

- **Los Angeles Coastal Plain Central Basin:**
  - TDS: 700 mg/L
  - Sulfate: 250 mg/L
  - Chloride: 150 mg/L
  - Boron: 1.0 mg/L
- **Main San Gabriel Basin Western Area:**
  - TDS: 450 mg/L
  - Sulfate: 100 mg/L
  - Chloride: 100 mg/L
  - Boron: 0.5 mg/L
- **Raymond Basin Pasadena Area:**
  - TDS: 450 mg/L
  - Sulfate: 100 mg/L
  - Chloride: 100 mg/L
  - Boron: 0.5 mg/L
- **San Fernando Basin East of Highway 405 (overall):**
  - TDS: 700 mg/L
  - Sulfate: 300 mg/L

- Chloride: 100 mg/L
- Boron: 1.5 mg/L

- **Eagle Rock Basin:**
  - TDS: 800 mg/L
  - Sulfate: 150 mg/L
  - Chloride: 100 mg/L
  - Boron: 0.5 mg/L

The existing beneficial uses for the Los Angeles Coastal Plain Central Basin, Main San Gabriel Basin Western Area, Raymond Basin Pasadena Area, San Fernando Basin East of Highway 405, and Eagle Rock Basin are listed below:

- **MUN**: Waters are used for community, military, or individual water supply systems.
- **AGR:** Waters are used for farming, horticulture or ranching.
- **IND:** Industrial activities that do not depend primarily on water quality (mining).
- **PROC:** Industrial activities that depend primarily on water quality.

3.4. Existing Water Quality

3.4.1. Regional Water Quality

3.4.1.1. Surface Water Quality

The surface waters in the study area are within the Los Angeles River Watershed. Pollutants from dense clusters of residential, industrial, and other urban activities have impaired water quality in the middle and lower watershed. Added to this complex mixture of pollutant sources (in particular, pollutants associated with urban and storm water runoff), is the high number of point source discharges. Water quality issues in the Los Angeles River Watershed include protection and enhancement of fish and wildlife habitat, removal of exotic vegetation, enhancement of recreational areas, attaining a balance between water reclamation and minimum flows to support habitat, management of storm water quality, assessment of other nonpoint sources (e.g., horse stables, golf courses, and septic systems), pollution from contaminated groundwater, groundwater recharge with reclaimed water, contamination of groundwater by volatile organic compounds (VOCs), leakage of methyl-t-butyl ether (MTBE) from underground storage tanks, groundwater contamination with heavy metals, particularly hexavalent chromium, and contaminated sediments within the Los Angeles River estuary (LARWQCB, 2007c).

3.4.1.2. Groundwater Quality

TDS in the Los Angeles Coastal Plain Central Basin range from 200 to 2,500 milligrams per liter (mg/L) and average 453 mg/L according to data from 293 public supply wells (California's Groundwater Bulletin 118, 2004a). Groundwater is impaired by VOCs from industry and nitrates from subsurface sewage disposal and past agricultural activities. These are the primary pollutants in much of the groundwater through the Central Basin (LARWQCB, 1995).

In the western part of the San Fernando Valley Groundwater Basin, calcium sulfate-bicarbonate character is dominant, and calcium bicarbonate character dominates the eastern part of the Basin (California Groundwater Bulletin 118, 2004c). VOCs from industry and nitrates from subsurface sewage disposal and past agricultural activities are the primary pollutants in much of the groundwater through the Basin (LARWQCB, 1995). A number of investigations have determined contamination of VOCs such as trichloroethylene (TCE), perchloroethylene (PCE), petroleum compounds, chloroform, nitrate, sulfate, and heavy metals. TCE, PCE, and nitrate contamination occurs in the eastern part of the Basin and elevated sulfate concentration occurs in the western part of the Basin. TDS range from 326 mg/L to 615 mg/L and average 499 mg/L according to data from 125 public supply wells (California's Groundwater Bulletin 118, 2004c).

Water within the San Gabriel Valley Groundwater Basin is primarily calcium bicarbonate in character. Four areas of the San Gabriel Valley Groundwater Basin are Superfund Sites. TCE, PCE, and carbon tetrachloride contaminate the Whittier Narrows, Puente Basin, Baldwin Park, and El Monte areas (California's Groundwater Bulletin 118, 2004d). VOCs from industry and nitrates from subsurface sewage disposal and past agricultural activities are the primary pollutants in much of the groundwater through the Basin (LARWQCB, 1995). In the north, west, and central regions of the Basin, TDS range from 90 mg/L to 4,288 mg/L and average around 367 mg/L. In the southern portion of the Basin, TDS average around 1,222 mg/L. TDS content ranges from 500 mg/L to 1,500 mg/L in the eastern part of the Basin, and from 200 mg/L to 500 mg/L in the northeastern part. Data from 259 public supply wells show an average TDS content of 318 mg/L (California's Groundwater Bulletin 118, 2004d).

Water in the Raymond Groundwater Basin is typically calcium bicarbonate in character. Fluoride content occasionally exceeds recommended levels of 1.6 mg/L near the San Gabriel Mountain front. High nitrate concentrations are found in water from some wells near Pasadena. VOCs are detected in wells near Arroyo Seco. The average TDS content in the

Pasadena portion of the Basin is about 400 mg/L with a high of 600 mg/L (California's Groundwater Bulletin 118, 2004b).

3.4.2. List of Impaired Waters

The SWRCB approved the 2010 Integrated Report (Clean Water Act [CWA] Section 303(d) List/305(b) Report) on August 4, 2010. On November 12, 2010, the United States Environmental Protection Agency (EPA) approved the 2010 California 303(d) List of Water Quality Limited Segments. On October 11, 2011, the EPA issued its final decision regarding water bodies and pollutants added to California's 2010 303(d) List. Table 3.4 shows the 303(d) listed receiving waters within the area of the Build Alternatives (SWRCB, 2013b). As shown in Table 3.4, Los Angeles River Reach 2 (Carson Street to Figueroa Street) is listed on the 2010 California 303(d) List as impaired for ammonia, coliform bacteria, copper, lead, nutrients (algae), oil, and trash. Arroyo Seco Reach 1 (Los Angeles River to West Holly Avenue) as impaired for benthic-macroinvertebrate bioassessments, coliform bacteria, and trash. Rio Hondo Reach 2 (at Spreading Grounds) as impaired for coliform bacteria and cyanide.

Table 3.4 2010 Clean Water Act Section 303(d) Listing for Project Receiving Water Bodies

Water Body	Pollutant	Expected TMDL Completion Date	Potential Source
Los Angeles River Reach 2 (Carson Street to Figueroa Street)	Ammonia	EPA Approval 2007	Point and nonpoint sources
	Coliform bacteria	2009	Point and nonpoint sources
	Copper	EPA Approval 2007	Source unknown
	Lead	EPA Approval 2007	Point and nonpoint sources
	Nutrients (algae)	EPA Approval 2007	Point and nonpoint sources
	Oil	2019	Nonpoint source
	Trash	EPA Approval 2007	Urban runoff/storm sewers, nonpoint source, and surface runoff
Arroyo Seco Reach 1 (Los Angeles River to West Holly Avenue)	Benthic-macroinvertebrate bioassessments	2021	Source unknown
	Coliform bacteria	2009	Nonpoint source
	Trash	EPA Approval 2007	Nonpoint source, surface runoff, and urban runoff/storm sewers
Rio Hondo Reach 2 (at Spreading Grounds)	Coliform bacteria	2009	Point and nonpoint sources
	Cyanide	2021	Other

Source: State Water Resources Control Board. 2010. *Integrated Report* (Clean Water Act Section 303(d) List/305(b) Report).
EPA = United States Environmental Protection Agency
TMDL= Total Maximum Daily Load

3.4.2.1. TMDL Requirements

The following TMDLs apply to Los Angeles River Reach 2, Arroyo Seco Reach 1, and Rio Hondo Reach 2.

3.4.2.1.1. Trash

A trash TMDL per Resolution No. 2001-013 became effective August 28, 2002, and was approved by the LARWQCB, SWRCB, Office of Administrative Law (OAL), and the EPA. The City and County of Los Angeles filed petitions and complaints challenging the trash TMDL. In addition, 22 other cities sued the LARWQCB and the SWRCB to set aside the TMDL. On June 8, 2006, the LARWQCB set aside the trash TMDL per Resolution No. 2006-013. A TMDL for trash in the Los Angeles River Watershed became effective on September 23, 2008, per Resolution No. 2007-012 (LARWQCB, 2007b). Storm water discharge from nonpoint sources (e.g., direct deposition of trash by people or wind) is the major source of trash in the watershed. A numeric target of zero trash in all water bodies was established.

This TMDL would be implemented through storm water permits and via the authority vested in the Executive Officer by Section 13267 of the Porter-Cologne Water Quality Control Act: Water Code Section 13000 et seq. (LARWQCB, 2007a).

3.4.2.1.2. Metals

The Los Angeles River and tributaries metals TMDL became effective on January 11, 2006. On September 6, 2007, the RWQCB re-adopted the TMDL by Resolution No. 2007-014 in compliance with a writ of mandate issued by the Los Angeles County Superior Court. The re-adopted TMDL became effective on October 29, 2008 and replaced the previous implementation deadlines with specific dates (SWRCB, 2007). On November 3, 2011, an amendment to revise the TMDL to adjust the numeric target for certain reaches and the corresponding waste load allocations (WLAs) for the publically owned treatment works (POTWs) based on the 2008 water-effect ration (WER) study per Resolution No. 2010-003 became effective (LARWQCB, 2010b). Targeted pollutants are total copper (Cu), lead (Pb), zinc (Zn), cadmium (Cd), and selenium (Se). The TMDL numeric targets and WLAs are based on criteria in the California Toxics Rule (CTR) (LARWQCB, 2010b). The targets are expressed in terms of total recoverable metals and are separated for dry and wet weather because hardness values and flow conditions in the Los Angeles River and tributaries differ between dry and wet weather (LARWQCB, 2010a). The regulatory mechanisms used to implement the TMDL would include the Los Angeles Municipal Separate Storm Sewer

System (MS4), the City of Long Beach MS4, the Caltrans storm water permit, major National Pollutant Discharge Elimination System (NPDES) permits, minor NPDES permits, general NPDES permits, general industrial storm water NPDES permits, and general construction storm water NPDES permits (LARWQCB, 2010a).

3.4.2.1.3. Nutrients

The Los Angeles River Nitrogen Compounds and Related Effects of TMDL became effective March 23, 2004, per Resolution No. 2003-009 (SWRCB, 2013a). A revision to the amendment to revise interim ammonia effluent limits contained within a TMDL for nitrogen compounds per Resolution No. 2003-016 became effective on September 27, 2004 (SWRCB, 2004). On December 6, 2012, the LARWQCB adopted Resolution No. R12-010, an amendment to the Basin Plan, to revise the TMDL for Nitrogen Compounds and Related Effects in the Los Angeles River Watershed (SWRCB, 2013d). The LARWQCB's goal in amending the TMDL to incorporate site-specific objectives for select reaches and tributaries of the Los Angeles River Watershed was to take into account site-specific conditions in the Los Angeles River that affect the toxicity of ammonia to aquatic life while maintaining protection (LARWQCB, 2012b). The SWRCB approved the amendment on June 4, 2013, but it has not been approved by the EPA; therefore, it is not in effect yet (SWRCB, 2013a). Numeric targets to address narrative objectives required to protect warm freshwater and wildlife habitats are intended to implement the narrative objectives and may be revised based on the results of monitoring and studies conducted pursuant to the Implementation Plan (LARWQCB, 2012a). The Implementation Plan includes upgrades to the Water Reclamation Plants discharging to the Los Angeles River for removal of ammonia, nitrate, and nitrite. The Implementation Plan also includes additional studies to evaluate the effectiveness of nitrogen reductions on related effects such as algae growth, odors, and scum. Ammonia and nitrate reductions would be regulated through effluent limits prescribed in NPDES permits (LARWQCB, 2012A).

3.4.2.1.4. Indicator Bacteria

On July 9, 2010, the LARWQCB adopted Resolution No. R10-007 amending the Basin Plan to incorporate a TMDL for indicator bacteria in the Los Angeles River Watershed (SWRCB, 2011). The TMDL for indicator bacteria became effective on March 23, 2012 (SWRCB, 2013a). The TMDL has a multi-part numeric target based on the bacteriological water quality objectives for freshwater to protect the water contact recreation use. The Basin Plan objectives and these targets are based on an acceptable health risk for fresh recreational waters of eight illnesses per 1,000 exposed individuals as recommended by the EPA. The regulatory mechanisms used to implement the TMDL would include general NPDES

permits, individual NPDES permits, MS4 Permits covering jurisdictions within the Los Angeles River Watershed, the Statewide Industrial Storm Water General Permit, the Statewide Construction Activity Storm Water General Permit, the Statewide Storm Water Permit for Caltrans Activities, and the authority contained in Sections 13263 and 13267 of the California Water Code. For each discharger assigned a WLA, the appropriate Regional Board Order shall be reopened or amended when the order is reissued, in accordance with applicable laws, to incorporate the applicable WLA as a permit requirement (LARWQCB, 2011).

3.4.3. Areas of Special Biological Significance

Areas of Special Biological Significance (ASBS) are a subset of State water quality protection areas, and require special protection as determined by the SWRCB pursuant to the California Ocean Plan. There are no ASBS, as defined by the SWRCB, in the study area. There are a total of six ASBS in Los Angeles County but only one (Laguna Point to Latingo Point ASBS), is located along the coast of the mainland (SWRCB, 2013c). This ASBS is located along the coastlines of both Los Angeles County and Ventura County. It is the largest mainland ASBS in Southern California and is comprised of 24 miles (mi) of coastland from north of Point Mugu State Park to south of Malibu. Runoff from the Build Alternatives area does not drain into this ASBS.

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4. Environmental Consequences

4.1. Introduction

Pollutants of concern during construction include sediments, trash, petroleum products, concrete waste (dry and wet), sanitary waste, and chemicals. During construction activities, excavated soil would be exposed, and there would be an increased potential for soil erosion compared to existing conditions. In addition, chemicals, liquid products, and petroleum products (e.g., paints, solvents, and fuels), and concrete-related waste may be spilled or leaked and thereby have the potential to be transported via storm runoff into receiving waters.

Pollutants of concern during operation of the Build Alternatives include suspended solids/ sediments, nutrients, pesticides, heavy metals, oil and grease, toxic organic compounds, and trash and debris.

In 2003, Caltrans completed a comprehensive set of studies designed to characterize storm water runoff from transportation facilities throughout the State of California. These study results were published in a report titled *Stormwater Monitoring & Data Management, Discharge Characterization Study Report*. Table 4.1 presents the concentrations of typical pollutants found on State highways based on the monitoring conducted as part of Caltrans 2003 Statewide Discharge Characterization Study Report.

Table 4.1 Summary Statistics for Water Quality Data for Highway Facilities

Constituent	Concentration
pH	7.1
Total Suspended Solids (TSS)	112.7 mg/L
Ammonia (NH3-N)	1.08
Nitrate (NO3-N)	1.07 mg/L
Total Kjeldahl Nitrogen (TKN)	2.06 mg/L
Ortho-phosphate	0.11 mg/L
Dissolved Copper	14.9 µg/L
Dissolved Zinc	68.8 µg/L
Dissolved Lead	7.6 µg/L
Total Copper	33.5 µg/L
Total Zinc	187.1 µg/L
Total Lead	47.8 µg/L

Source: Caltrans, 2003. *Discharge Characterization Study Report* (CTSW-RT-03-065.51.42).
µg/L= micrograms per liter
Caltrans = California Department of Transportation
mg/L = milligrams per liter

4.2. Alternatives

There are four Build Alternatives being proposed for this project: the Transportation System Management/Transportation Demand Management (TSM/TDM) Alternative, the Bus Rapid Transit (BRT) Alternative, the Light Rail Transit (LRT) Alternative, and the Freeway Tunnel Alternative. Refer to Tables 4.2 and 4.3 for information regarding the impervious surfaces, disturbed areas, and areas to be treated by the Build Alternatives for within Caltrans right of way (ROW) and outside Caltrans ROW, respectively. The Los Angeles County Municipal Separate Storm Sewer System (MS4) Permit and Standard Urban Storm Water Mitigation Plan (SUSMP) require Best Management Practice (BMP) treatment for all newly created or replaced impervious surface area. Caltrans Statewide Storm Water Permit only requires the treatment of new impervious surface area.

Table 4.2 Within Caltrans Right of Way

Alternative	Disturbed Soil Area (ac)	Existing Impervious Surface Area (ac)	Proposed Total Impervious Surface Area (ac)	Net New Impervious Surface Area (ac)	Impervious Surface Area Treated (ac)	Water Quality Volume Treated (cf)	Percentage of Net New Impervious Surface Area Treated
TSM/TDM	5.75	11.85	11.70	-0.15	0.99	2,426	N/A[1]
BRT	1.00	5.76	5.84	0.08	0.46	1,127	575%
LRT	3.89	2.60	8.06	5.46	1.71	4,190	31%
Freeway Tunnel:							
Single-Bore Tunnel DV	80.59	34.95	36.63	1.68	89.88	220,228	5,350%
Dual-Bore Tunnel DV	92.96	41.63	55.17	13.54	95.44	233,852	705%

[1] This Build Alternative does not result in the creation or replacement of impervious surface area.

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
cf = cubic feet
DV = Design Variation
LRT = Light Rail Transit
N/A = Not Applicable
TDM = Transportation Demand Management
TSM = Transportation System Management

Table 4.3 Outside Caltrans Right of Way

Alternative	Disturbed Soil Area (ac)	Existing Impervious Surface Area (ac)	Proposed Total Impervious Surface Area (ac)	Net New Impervious Surface Area (ac)	Creation or Replacement of Impervious Surface Area (ac)	Impervious Surface Area Treated (ac)	Water Quality Volume Treated (cf)	Percentage of New and Replaced Impervious Surface Area Treated
TSM/TDM	15.59	91.62	95.57	3.95	14.29	10.83	26,541	76%
BRT	33.48	111.17	112.23	1.06	31.93	36.32	88,985	114%
LRT	29.42	20.57	31.53	10.96	31.43	14.70	36,021	47%
Freeway Tunnel:								
Single-Bore Tunnel DV	0	0	0	0	0	124.53	305,130	N/A[1]
Dual-Bore Tunnel DV	0	0	0	0	0	124.53	305,130	N/A[1]

[1] This Build Alternative does not result in the creation or replacement of impervious surface area.

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
cf = cubic feet
DV = Design Variation
LRT = Light Rail Transit
N/A = Not Applicable
TDM = Transportation Demand Management
TSM = Transportation System Management

4.2.1. TSM/TDM Alternative

The TSM/TDM Alternative is primarily located outside of Caltrans ROW with a few on-/off-ramp locations within Caltrans ROW. The TSM/TDM Alternative would disturb a total of 21.34 acres (ac) and would result in a total net increase of impervious surface area of 3.8 ac (i.e., the result of a decrease of 0.15 ac within Caltrans ROW and an increase of approximately 3.95 ac outside Caltrans ROW). An increase in impervious surface area would increase the volume of runoff during a storm, which would more effectively transport pollutants to receiving waters. The approximately 3.8 ac increase of impervious surface area associated with the TSM/TDM Alternative would result in an increase in the volume of storm water runoff and pollutants over existing conditions. The improvements included as part of the TSM/TDM Alternative would also be constructed as part of the BRT, LRT, and Freeway Tunnel Alternatives. Therefore, changes in impervious surface area discussed as part of the TSM/TDM Alternative also apply to the other three Build Alternatives.

4.2.2. BRT Alternative

The BRT Alternative would be primarily located outside of Caltrans ROW. The BRT Alternative would disturb a total of 34.48 ac and would result in a total net increase of impervious surface area of 1.14 ac (i.e., the sum of increases of approximately 0.08 ac within Caltrans ROW and approximately 1.06 ac outside Caltrans ROW). An increase in impervious surface area would increase the volume of runoff during a storm, which would more effectively transport pollutants to receiving waters. The approximate 1.14 ac increase of impervious surface area associated with the BRT Alternative would result in an increase in the volume of storm water runoff and pollutants over the existing conditions. As noted above, build components associated with the TSM/TDM Alternative, such as changes in impervious surface area, would also apply to the BRT Alternative.

4.2.3. LRT Alternative

The LRT Alternative is located within and outside of Caltrans ROW. The LRT Alternative would disturb a total of 33.31 ac and would result in a total net increase of impervious surface area of 16.42 ac (i.e., the sum of increases of 5.46 ac within Caltrans ROW and approximately 10.96 ac outside Caltrans ROW). An increase in impervious surface area would increase the volume of runoff during a storm, which would more effectively transport pollutants to receiving waters. The approximate 16.42 ac increase of impervious surface area associated with the LRT Alternative would result in an increase in the volume of storm water runoff and pollutants over the existing conditions. As noted above, build components

associated with the TSM/TDM Alternative, such as changes in impervious surface area, would also apply to the LRT Alternative.

4.2.4. Freeway Tunnel Alternative

The Freeway Tunnel Alternative single-bore and dual-bore tunnel design variations are located primarily within Caltrans ROW. The Freeway Tunnel Alternative single-bore and dual-bore tunnel design variations would disturb a total of 80.59 ac and 92.96 ac, respectively, and would result in net increases in impervious surface area of 1.68 ac and 13.54 ac, respectively. An increase in impervious surface area would increase the volume of runoff during a storm, which would more effectively transport pollutants to receiving waters. For either tunnel design variation, the increase of impervious surface area associated with the Freeway Tunnel Alternative would result in an increase in the volume of storm water runoff and pollutants over the existing conditions. As noted above, build components associated with the TSM/TDM Alternative, such as changes in impervious surface area, would also apply to the Freeway Tunnel Alternative.

4.2.5. No Build Alternative

Under the No Build Alternative, no improvements to the SR 710 corridor would be made. Therefore, the No Build Alternative would not result in any ground disturbances or increases in impervious surface area. Hence, under the No Build Alternative, there would be no increases in the volume of storm water runoff and pollutants over the existing conditions.

Under the No Build Alternative, the temporary and permanent impacts discussed above for the Build Alternatives would not occur; however, impacts to water quality in other areas could occur for the projects included in the No Build Alternative that would require grading or excavation or that would increase impervious surface area. Water quality impacts of the individual projects included in the No Build Alternative would be expected to be similar to the Build Alternatives because construction and operational BMPs would be implemented to treat pollutants of concern in storm water runoff.

4.3. Best Management Practices

4.3.1. TSM/TDM Alternative

The TSM/TDM Alternative would result in a net increase of impervious surface area of 3.8 ac (i.e., the result of a decrease of approximately 0.15 ac within Caltrans ROW and an increase of approximately 3.95 ac outside Caltrans ROW). The TSM/TDM Alternative would treat approximately 76 percent of the newly created or replaced impervious surface

area. The newly created or replaced impervious surface area would be treated with the following BMPs:

- A biofiltration swale as part of Other Road Improvement T-2 (State Route 110 [SR 110]/ Fair Oaks Avenue Hook Ramps)
- Tree box filters as part of:
  - Other Road Improvement T-1 (Valley Boulevard to Mission Road Connector Road)
  - Other Road Improvement T-2 (SR 110/Fair Oaks Avenue Hook Ramps)
  - Intersection Improvement I-22 (San Gabriel Boulevard/Marshall Street)
  - Intersection Improvement I-5 (Interstate 710 [I-710] northbound off-ramp/Valley Boulevard)
  - Intersection Improvement I-10 (Huntington Drive/Fair Oaks Avenue)
  - Intersection Improvement I-19 (Del Mar Avenue/Mission Road)
  - Local Street Improvement L-5 (Rosemead Boulevard from Lower Azusa Road to Marshall Street)
- Catch basin screens and filter inserts at new inlet locations as part of:
  - Other Road Improvement T-3 (St. John Avenue Extension between Del Mar Boulevard and California Avenue)
  - Intersection Improvement I-4 (I-710 southbound on-ramp/Valley Boulevard)
  - Intersection Improvement I-16 (Garfield Avenue/Mission Road)
  - Local Street Improvement L-5 (Rosemead Boulevard from Lower Azusa Road to Marshall Street)

The BMPs incorporated in the TSM/TDM Alternative would also be included as part of the other three Build Alternatives.

4.3.2. BRT Alternative

The BRT Alternative would result in a net increase of impervious surface area of approximately 1.14 ac (i.e., the sum of increases of approximately 0.08 ac within Caltrans ROW and approximately 1.06 ac outside Caltrans ROW). The BRT Alternative would treat approximately 575 percent of the new impervious surface area within Caltrans ROW and approximately 114 percent of the newly created or replaced impervious surface outside Caltrans ROW. Newly created or replaced impervious surface area would be treated with the following BMPs:

- A biofiltration swale within Caltrans ROW where the BRT alignment crosses State Route 60 (SR 60)

- Tree box filters at new catch basins along the BRT alignment where the sidewalk width is at least 7 feet (ft) wide, as required to meet Americans with Disabilities Act (ADA) standards
- Catch basin screens and curb inlet filters along the BRT alignment at locations where the sidewalk is less than 7 ft wide

As noted above, build components associated with the TSM/TDM Alternative would also be included in the BRT Alternative, including proposed TSM/TDM Alternative BMPs.

4.3.3. LRT Alternative

The LRT Alternative would result in a net increase of impervious surface area of approximately 16.42 ac (i.e., the sum of increases of approximately 5.46 ac within Caltrans ROW and approximately 10.96 ac outside Caltrans ROW). BMPs are only proposed in areas outside the tunnel. Most of the LRT alignment outside the tunnel is on an elevated track above steep terrain, where BMPs are infeasible. Therefore, the LRT Alternative would treat approximately 31 percent of the new impervious surface area within Caltrans ROW and approximately 47 percent of the newly created or replaced impervious surface area outside Caltrans ROW. Newly created or replaced impervious surface area would be treated with the following BMPs:

- Four biofiltration swales within Caltrans ROW near the I-710/Interstate 10 (I-10) interchange
- Tree box filters at multiple locations along the LRT alignment
- Catch basin screens and filter inserts at new inlet locations along the LRT alignment
- Bioretention facilities within the rail yard for the parking lot areas
- Media filters at the ballast areas

As noted above, build components associated with the TSM/TDM Alternative would also be included in the LRT Alternative, including proposed TSM/TDM Alternative BMPs.

4.3.4. Freeway Tunnel Alternative

4.3.4.1. Single-Bore Tunnel Design Variation

The single-bore tunnel design variation would result in an increase in impervious surface area of approximately 1.68 ac, all of which would be within Caltrans ROW. The single-bore tunnel design variation would treat approximately 5,350 percent of the net new impervious surface area. BMPs are only proposed in areas outside the tunnel. The tunnel section would not be treated because it does not have the potential to create any storm water impacts. New

impervious surface area would be treated with three biofiltration swales and two gross solid removal devices (GSRDs). A biofiltration swale is proposed to be located adjacent to northbound State Route 710 (SR 710) at the Laguna Regulating Basin. Treatment trains consisting of a pump station, a GSRD, and a biofiltration swale are proposed adjacent to southbound SR 710 at Valley Boulevard and adjacent to northbound SR 710 at the north portal near Pasadena Avenue. The pump stations would be designed such that the lower flows would be treated by the BMPs and larger flows would bypass the BMPs. Two GSRDs are proposed to be located downstream of the pump stations at both the north and south portals.

As noted above, build components associated with the TSM/TDM Alternative would also be included in the single-bore tunnel design variation, including proposed TSM/TDM Alternative BMPs.

4.3.4.2. Dual-Bore Tunnel Design Variation

The dual-bore tunnel design variation would result in an increase in impervious surface area of approximately 13.54 ac, all of which would be within Caltrans ROW. The dual-bore tunnel design variation would treat approximately 705 percent of the net new impervious surface area. BMPs are only proposed in areas outside the tunnel. The tunnel section would not be treated because it does not have the potential to create any storm water impacts. New impervious surface area would be treated with four biofiltration swales and two GSRDs. Biofiltration swales are proposed to be located in the SR 710 North to I-10 East loop ramp at the south portal and adjacent to northbound SR 710 at the Laguna Regulating Basin. Treatment trains consisting of a pump station, a GSRD, and a biofiltration swale are proposed adjacent to southbound SR 710 at Valley Boulevard and adjacent to northbound SR 710 at the north portal near Pasadena Avenue. The pump stations would be designed such that the lower flows would be treated by the BMPs and larger flows would bypass the BMPs.

As noted above, build components associated with the TSM/TDM Alternative would also be included in the dual-bore tunnel design variation, including proposed TSM/TDM Alternative BMPs.

4.4. Potential Impacts to Water Quality

In Section 4.4, where the potential impacts differ substantially among Build Alternatives, the impacts are discussed by Build Alternative. Where the potential impacts are similar for each of the Build Alternatives, the discussions are combined.

4.4.1. Anticipated Changes to the Physical/Chemical Characteristics of the Aquatic Environment

4.4.1.1. Substrate

4.4.1.1.1. TSM/TDM Alternative

The TSM/TDM Alternative drains into Arroyo Seco, Rio Hondo, and the Los Angeles River. Portions of the main channel of Arroyo Seco have an earthen bottom, and it drains directly into the Los Angeles River (Sapphos Environmental, 2014a). Rio Hondo is primarily a concrete-lined channel. The Los Angeles River is also a concrete-lined channel, which eventually drains into the Pacific Ocean. A portion of the project's storm water is discharged into surface waters with earthen bottoms (i.e., Arroyo Seco); therefore, if storm water volumes and velocities increase, there is a potential for on-site erosion and for the substrate of Arroyo Seco to be carried to downstream receiving waters.

Construction activities disturb soil and increase the potential for soil erosion. During intersection, street, and freeway ramp improvements, there is potential for soil to be disturbed and an increase in the potential for erosion and the downstream transport of sediment to occur. During construction, the TSM/TDM Alternative would comply with the requirements of the Construction General Permit (CGP). Under the CGP, the project would be required to prepare a Storm Water Pollution Prevention Plan (SWPPP) and implement construction BMPs including, but not limited to, Erosion Control and Sediment Control BMPs designed to minimize erosion and retain sediment on site. Therefore, there is a low potential for construction-related activities associated with the TSM/TDM Alternative to adversely affect the downstream substrate.

The TSM/TDM Alternative would be primarily located outside of Caltrans ROW, with a few proposed improvements located within Caltrans ROW. The TSM/TDM Alternative would result in a net increase of impervious surface area of 3.8 ac (i.e., the result of a decrease of approximately 0.15 ac within Caltrans ROW and an increase of approximately 3.95 ac outside Caltrans ROW). The TSM/TDM Alternative would reduce impervious surface area within Caltrans ROW by approximately 0.15 ac and therefore would not result in significant changes to surface runoff within Caltrans ROW. The TSM/TDM Alternative would increase impervious area outside of Caltrans ROW by approximately 3.95 ac. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm, which can more effectively transport pollutants and sediments to receiving waters. The downstream transport of pollutants and/or sediments may change the substrate of the downstream receiving waters. During operation, the TSM/TDM Alternative would treat storm water

runoff within Caltrans ROW with Caltrans-approved treatment BMPs (e.g., biofiltration swales). During operation, the TSM/TDM Alternative would treat storm water runoff outside of Caltrans ROW with tree box filters, catch basin screens and new inlets with filter inserts, where feasible. Biofiltration swales, tree box filters, and catch basin screens and filter inserts would provide flow volume and duration control functions, thereby reducing the energy of the flow of storm water runoff and reducing the downstream transport of sediment. Therefore, there is a low potential for operational activities associated with the TSM/TDM Alternative to adversely affect the downstream substrate.

4.4.1.1.2. BRT Alternative

The BRT Alternative drains into Rio Hondo and the Los Angeles River. Rio Hondo is primarily a concrete-lined channel. The Los Angeles River is also a concrete-lined channel, which eventually drains into the Pacific Ocean. Therefore, there is a minimal amount of substrate to erode and to be carried downstream. Because a majority of the project's storm water is discharged to a concrete-lined channel rather than a natural channel, there is limited opportunity for on-site erosion and accretion to occur.

Construction activities disturb soil and increase the potential for soil erosion. During widening of the road, grading, paving, and excavation, land and vegetation would be cleared, exposing soil to the potential for erosion and downstream transport of sediment to occur. As discussed above under the TSM/TDM Alternative, during construction, the BRT Alternative would comply with the requirements of the CGP. Therefore, there is a low potential for construction-related activities associated with the BRT Alternative to adversely affect the downstream substrate.

The BRT Alternative would be located primarily outside Caltrans ROW and would result in an increase in impervious surface area of approximately 1.14 ac (i.e., the sum of increases of approximately 0.08 ac within Caltrans ROW and approximately 1.06 ac outside Caltrans ROW), through the creation of arterial streets, station improvements, and overall road widening. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm, which can more effectively transport pollutants and sediments to receiving waters. The downstream transport of pollutants and/or sediments may change the substrate of the downstream receiving waters. During operation, the small section of the BRT Alternative within Caltrans ROW would treat the storm water runoff with Caltrans-approved treatment BMPs such as with a biofiltration swale. During operation, the portion of the BRT Alternative outside of Caltrans ROW would follow the Los Angeles County MS4 permit specifications, which require the project to retain storm water on site through infiltration, bioretention, and/or rainfall harvest and use. Site constraints make some of these strategies

infeasible. For example, the types of soil in the BRT Alternative area are not appropriate for infiltration. However, the BRT Alternative would treat storm water runoff by installing flow-through modular treatments (i.e., tree box filters). Locations with a new inlet where the sidewalk is less than 7 ft wide would have a catch basin screen and curb inlet filter assembly. The curb inlet filter assembly would have a filter liner and support basket for sediment removal. A biofiltration swale, tree box filters, and catch basin screens and curb inlet filters would provide flow volume and duration control functions, thereby reducing the energy of the flows of storm water runoff and reducing the downstream transport of sediment. Therefore, there is a low potential for operational activities associated with the BRT Alternative to adversely affect the downstream substrate.

4.4.1.1.3. LRT Alternative

The LRT Alternative drains into Rio Hondo and the Los Angeles River. Rio Hondo is primarily a concrete-lined channel. The Los Angeles River is also a concrete-lined channel, which eventually drains into the Pacific Ocean. Therefore, there is a minimal amount of substrate to erode and be carried downstream. Because a majority of the project's storm water is discharged to a concrete-lined channel rather than a natural channel, there is limited opportunity for on-site erosion and accretion to occur.

Construction activities disturb soil and increase the potential for soil erosion. During widening of the road, grading, paving, construction of tunnels, and excavation, land and vegetation would be cleared, thereby exposing soil to the potential for erosion and downstream transport of sediments to occur. As discussed above under the TSM/TDM Alternative, during construction, the LRT Alternative would comply with the requirements of the CGP. Therefore, there is a low potential for construction-related activities associated with the LRT Alternative to adversely affect the downstream substrate.

The LRT Alternative would be located both inside and outside Caltrans ROW on an elevated track. The LRT Alternative would result in a net increase in impervious surface area of approximately 16.42 ac (i.e., the sum of increases of approximately 5.46 ac within Caltrans ROW and approximately 10.96 ac outside Caltrans ROW) through the boring of tunnels, the creation of new rail stations, park-and-ride facilities, a maintenance yard and track spurs. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm, which can more effectively transport pollutants and sediments to receiving waters. The downstream transport of pollutants and/or sediments may change the substrate of the downstream receiving waters.

The LRT Alternative would only treat impervious areas outside the tunnel. The tunnel section would not be treated because it would not have the potential to create storm water impacts. Water in the tunnel (e.g., during a fire or to clean a spill) would drain to a low point in the tunnel, where a sump would be located. The water would then be pumped up to a storage tank and hauled away and disposed of as hazardous waste. During operation, the LRT Alternative would treat storm water runoff within Caltrans ROW with Caltrans-approved treatment BMPs such as biofiltration swales. Outside of Caltrans ROW, much of the elevated track is proposed above steep terrain and treatment is not technically feasible; however, the LRT Alternative would treat storm water runoff with tree box filters, catch basin screens and filter inserts at new inlet locations (where feasible), bioretention facilities for the proposed parking lot areas, and media filters in the ballast areas. Biofiltration swales, tree box filters, catch basin screens and filter inserts, bioretention facilities, and media filters would provide flow volume and duration control functions, thereby reducing the energy of the flow of storm water runoff and reducing the downstream transport of sediment. Therefore, there is a low potential for operational activities associated with the LRT Alternative to adversely affect the downstream substrate.

4.4.1.1.4. Freeway Tunnel Alternative

The Freeway Tunnel Alternative drains into either Dorchester Channel/Laguna Regulating Basin or Arroyo Seco, all of which eventually drain into the Los Angeles River. Dorchester Channel is a concrete-lined channel and therefore has no substrate to be eroded and carried downstream. The Laguna Regulating Basin has an earthen bottom above the ordinary high water mark, and portions of the main channel of Arroyo Seco also have earthen bottoms (Sapphos Environmental, 2014a). As noted above, Arroyo Seco and Dorchester Channel/ Laguna Regulating Basin drain directly into the Los Angeles River. The Los Angeles River is a concrete-lined channel that drains into the Pacific Ocean.

A portion of the project's storm water is discharged into surface waters with earthen bottoms (i.e., Arroyo Seco and Laguna Regulating Basin); therefore, if storm water volumes and velocities increase, there is a potential for on-site erosion and for the substrate of Arroyo Seco and the Laguna Regulating Basin to be carried to downstream receiving waters.

Construction activities disturb soil and increase the potential for soil erosion and the downstream transport of sediment. During widening of the road, grading, paving, excavation, and construction of retaining walls, bridges, tunnels, and cut slopes, land and vegetation would be cleared, exposing soil to the potential for erosion and downstream transport of sediments to occur. As discussed above under the TSM/TDM Alternative, during construction, the Freeway Tunnel Alternative would comply with the requirements of the

CGP. Therefore, there is a low potential for construction-related activities associated with the Freeway Tunnel Alternative to adversely affect the downstream substrate.

The Freeway Tunnel Alternative is located wholly within Caltrans ROW. The single-bore and dual-bore tunnel design variations of the Freeway Tunnel Alternative would increase impervious surface area through the boring of tunnels, the development of portals, intersection and ramp improvements, and the overall road widening. The single-bore and dual-bore tunnel design variations would result in net increases of impervious surface area within Caltrans ROW of approximately 1.68 ac and approximately 13.54 ac, respectively. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm, which can more effectively transport pollutants and sediments to receiving waters. The downstream transport of pollutants and/or sediments may change the substrate of the downstream receiving waters through erosion and accretion.

The Freeway Tunnel Alternative would only treat impervious areas outside of the tunnels. The tunnel section would not be treated because it would not have the potential to create storm water impacts. Water in the tunnel (e.g., during a fire or to clean a spill) would drain to a low point in the tunnel, where a sump would be located. The water would then be pumped up to a storage tank and would be hauled away and disposed of as hazardous waste. No water from the tunnels would go to the storm drain system.

The Freeway Tunnel Alternative would require the creation of new 2:1 and 4:1 cut-and-fill slopes. The slopes would be stabilized with vegetation or other hard-surface methods. Retaining walls would be incorporated to reduce steepness of slopes or to shorten slopes and the slopes would be rounded and shaped to reduce concentrated flows. Furthermore, concrete slopes may be proposed at abutment locations. New slopes of 2:1 or flatter would use erosion control strategies (e.g., vegetative cover), and new slopes of 4:1 or steeper or where sheet flow from the roadway is not possible or must be avoided (e.g., asphalt concrete dikes, toe of fill ditches, and downdrains/overside drains) would be used to control runoff and sediment. All existing planting that is removed or disturbed due to construction would be replaced following the Caltrans Replacement Planting Policy Procedure, and all disturbed areas would be minimized to the maximum extent possible.

During operation, the Freeway Tunnel Alternative would treat storm water runoff using BMPs consistent with the Caltrans Project Planning and Design Guide and current Caltrans NPDES requirements (e.g., biofiltration swales and GSRDs) to provide flow volume and duration control functions, thereby reducing the energy of the flow of storm water runoff and reducing the downstream transport of sediment. Therefore, there is a low potential for

operational activities associated with the Freeway Tunnel Alternative to adversely affect the downstream substrate.

4.4.1.2. Currents, Circulation, or Drainage Patterns

4.4.1.2.1. TSM/TDM Alternative

The TSM/TDM Alternative would modify the existing drainage system in the study area through intersection, street, and freeway ramp improvements, and bicycle and bus service improvements. The TSM/TDM Alternative would be located primarily outside Caltrans ROW with a few proposed improvements located within Caltrans ROW. The TSM/TDM Alternative would result in a net increase of impervious surface area of 3.8 ac. The TSM/TDM Alternative would reduce impervious surface area within Caltrans ROW by approximately 0.15 ac and therefore would not result in significant changes to surface runoff within Caltrans ROW. The TSM/TDM Alternative would increase impervious surface area outside of Caltrans ROW by approximately 3.95 ac. Increases in impervious area can change on-site drainage patterns, decrease infiltration, and increase the volume and rate of runoff during a storm. During operation, the TSM/TDM Alternative would treat storm water runoff outside of Caltrans ROW with tree box filters and catch basin screens and filter inserts at new inlet locations, where feasible. The TSM/TDM Alternative would treat storm water runoff within Caltrans ROW with Caltrans-approved BMPs such as biofiltration swales. Tree box filters, catch basin screens and filter inserts, and biofiltration swales would be linked to the existing drainage system and provide flow volume and duration control functions to offset the increased flows associated with the increase in impervious surface from the TSM/TDM Alternative. The proposed BMPs would also help to prevent an increase in the velocity of storm water flows. By preserving existing drainage patterns to the extent practicable and adding tree box filters, catch basin screens and filter inserts, and biofiltration swales to the existing drainage system, storm water flow concentrations associated with the TSM/TDM Alternative would be similar to current conditions. Therefore, the TSM/TDM Alternative would result in a negligible increase in flow velocities and volumes. Therefore, there is a low potential for the TSM/TDM Alternative to adversely affect currents, circulation, and drainage patterns.

4.4.1.2.2. BRT Alternative

The BRT Alternative would modify the existing drainage system in the study area through the creation of arterial streets, station improvements, and overall road widening. The BRT Alternative would be located primarily outside Caltrans ROW. The BRT Alternative would result in a net increase of impervious surface area of 1.14 ac (i.e., the sum of increases of

approximately 0.08 ac within Caltrans ROW and approximately 1.06 ac outside Caltrans ROW). Increases in impervious area can change on-site drainage patterns, decrease infiltration, and increase the volume and rate of runoff during a storm. The BRT Alternative would widen the existing street on both sides to add a bus lane in some locations. This widening would alter the existing flow line outside to the new proposed curb line and would require the relocation of the existing catch basins to the curb line. Although the BRT Alternative would relocate portions of the existing drainage system and features, the BRT Alternative would preserve the existing drainage system and pattern as much as possible. Outside of Caltrans ROW, the BRT Alternative would treat storm water runoff with tree box filters at locations where the sidewalk is at least 7 ft wide, and with catch basin screens and curb inlet filter assemblies at locations with a new inlet where the sidewalk is less than 7 ft wide. Within Caltrans ROW, the BRT Alternative would treat storm water runoff with a Caltrans-approved BMP (e.g., a biofiltration swale). Tree box filters, catch basin screens and curb inlet filters, and a biofiltration swale would be linked to the existing drainage system and provide flow volume and duration control functions to offset the increased flows associated with the increase in impervious surface area from the BRT Alternative. The proposed BMPs would also help to prevent an increase in the velocity of storm water flows. By preserving existing drainage patterns to the extent practicable and adding tree box filters, catch basin screens and curb inlet filters, and a biofiltration swale to the existing drainage system, storm water flow concentrations associated with the BRT Alternative would be similar to current conditions. Therefore, the BRT Alternative would result in only a negligible increase in flow velocities and volumes. Therefore, there is a low potential for the BRT Alternative to adversely affect currents, circulation, and drainage patterns.

4.4.1.2.3. LRT Alternative

The LRT Alternative would modify the existing drainage system in the study area through the boring of tunnels, the creation of new rail stations, park-and-ride facilities, a maintenance yard, and track spurs. The LRT Alternative would be located within and outside Caltrans ROW. The LRT Alternative would result in a net increase of impervious surface area of 16.42 ac (i.e., the sum of increases of approximately 5.46 ac within Caltrans ROW and approximately 10.96 ac outside Caltrans ROW). Increases in impervious surface area can change on-site drainage patterns, decrease infiltration, and increase the volume and rate of runoff during a storm. As discussed previously, the LRT Alternative would only treat impervious areas outside the tunnels. Outside Caltrans ROW, the LRT Alternative would treat storm water runoff with tree box filters, catch basin screens and filter inserts at new inlet locations (where feasible), bioretention facilities for the proposed parking lot areas, and media filters in the ballast areas. Within Caltrans ROW, the LRT Alternative would treat

storm water runoff with Caltrans-approved BMPs (e.g., biofiltration swales). Biofiltration swales, tree box filters, catch basin screens and filter inserts, and bioretention facilities would be linked to the existing drainage system and provide flow volume and duration control functions to offset the increased flows associated with the increase in impervious surface area from the LRT Alternative. The proposed BMPs would also help to prevent an increase in the velocity of storm water flows. By preserving existing drainage patterns to the extent practicable and adding biofiltration swales, tree box filters, catch basin screens and filter inserts, and bioretention facilities to the existing drainage system, storm water flow concentrations associated with the LRT Alternative would be similar to current conditions. Therefore, the LRT Alternative would result in only a negligible increase in flow velocities and volumes, and there is a low potential for the LRT Alternative to adversely affect currents, circulation, and drainage patterns.

4.4.1.2.4. Freeway Tunnel Alternative

The Freeway Tunnel Alternative would modify the existing drainage system in the study area through the boring of tunnels, the development of portals, intersection and ramp improvements, and overall road widening The Freeway Tunnel Alternative would be located wholly within Caltrans ROW. The single-bore and dual-bore tunnel design variations would increase impervious surface area within Caltrans ROW by approximately 1.68 ac and approximately 13.54 ac, respectively. Increases in impervious surface area can change on-site drainage patterns, decrease infiltration, and increase the volume and rate of runoff during a storm. A portion of Dorchester Channel would be reconfigured from a reinforced concrete channel to a reinforced concrete box. In addition, the Freeway Tunnel Alternative would remove curb opening inlets and pipes, install new curb opening inlets, cross culverts, pipes, swales, a pump station, a sump pump, and relocate existing pipes and the existing pump station and storage chamber south of Del Mar Boulevard. Although the Freeway Tunnel Alternative would replace and modify portions of the existing drainage system and features, the Freeway Tunnel Alternative would preserve the existing drainage system and pattern as much as possible. As discussed previously, the Freeway Tunnel Alternative would only treat impervious surface areas outside the tunnels. The Freeway Tunnel Alternative includes up to four biofiltration swales (i.e., three biofiltration swales for the single-bore tunnel design variation and four biofiltration swales for the dual-bore tunnel design variation) and two GSRDs. These biofiltration swales and GSRDs would be linked to the existing drainage system. The proposed biofiltration swales and GSRDs would provide flow duration, volume, and rate control functions to offset the increased flows associated with the increase in impervious surface area from the Freeway Tunnel Alternative. The biofiltration swales and GSRDs would also help to prevent an increase in the velocity of storm water flows. By

preserving existing drainage patterns to the extent practicable and adding biofiltration swales and GSRDs to the existing drainage system, storm water flow concentrations associated with the Freeway Tunnel Alternative would be similar to current conditions. Therefore, the Freeway Tunnel Alternative would result in only a negligible increase in flow velocities and volumes. Therefore, there is a low potential for the Freeway Tunnel Alternative to adversely affect currents, circulation, and drainage patterns.

4.4.1.3. Suspended Particulates (Turbidity)

Natural sediment loads are important to downstream environments by providing habitat, substrate, and nutrition; however, increased sediment loads can result in several negative effects to downstream environments. Excessive sediment can be detrimental to aquatic life by interfering with photosynthesis, respiration, growth, and reproduction. In addition, pollutants that adhere to sediment such as nutrients, trace metals, and hydrocarbons can have other harmful effects on aquatic environment when they occur in elevated levels.

Each of the Build Alternatives involves construction activities that would disturb soil and increase the potential for soil erosion. During intersection, street, and freeway ramp improvements, road widening, grading, paving, excavation, and construction of retaining walls, bridges, tunnels, and cut slopes, land and vegetation would be cleared, exposing soil to the potential for erosion. Suspended particles can also be generated from vehicles operating on a roadway during construction activities. When soil erodes, the potential for sediments/suspended particles to enter surface waters increases, and an increase in sediment/suspended particles in turn increases turbidity (water cloudiness). During construction, the Build Alternatives would comply with the requirements of the CGP. Under the CGP, the project would be required to prepare a SWPPP and implement construction BMPs including, but not limited to, Erosion Control and Sediment Control BMPs designed to minimize erosion and retain sediment on site.

During operation of the Build Alternatives, increases in impervious surface area would increase the volume and velocity of runoff during a storm, which would increase the potential for pollutants to be transported to receiving waters and may lead to downstream erosion and an increase in turbidity. In addition, vehicles operating on a roadway for maintenance activities can also generate suspended particles and sediment that can increase turbidity. During operation, the Build Alternatives would treat storm water runoff within Caltrans ROW with biofiltration swales and GSRDs. As discussed previously, the Build Alternatives that include a tunnel component (i.e., the LRT and Freeway Tunnel Alternatives) would only treat impervious surface areas outside the tunnels. During

operation, the Build Alternatives would treat storm water runoff outside Caltrans ROW with tree box filters and catch basin screens with curb inlet filters, where feasible, as well as bioretention facilities for the proposed parking lot areas and media filters in the ballast areas. Biofiltration swales, tree box filters, and catch basin screens with curb inlet filters, bioretention facilities, and media filters would prevent an increase in erosive velocities and reduce suspended particles. Therefore, there is a low potential for the Build Alternatives to contribute to adverse effects related to suspended particles.

4.4.1.4. Oil, Grease, and Chemical Pollutants

Heavy metals, pesticides, petroleum hydrocarbons (oil and grease), and organic compounds can be toxic to aquatic life. In addition, some of these compounds can bioaccumulate (i.e., concentrate within the body) over several years, resulting in health problems for the affected organism. For example, these compounds can effect reproduction, the nervous system, and other biological functions.

Each of the Build Alternatives includes the use of construction equipment for construction of retaining walls, bridges, and drainage systems, boring of tunnels, road widening, intersection improvements, paving and pavement delineation, and the installation of traffic control devices. Construction equipment becomes a source of chemicals, liquid products, and petroleum products if the equipment leaks. Chemicals, liquid products, and petroleum products (e.g., paints, solvents, and fuels), and related waste may be spilled or leaked and have the potential to be transported via storm water runoff into receiving waters. The Build Alternatives would comply with the requirements of the CGP. Under the CGP, the Build Alternatives would be required to prepare a SWPPP and implement construction BMPs including, but not limited to, Good Housekeeping BMPs to prevent spill, leaks, and discharge of construction debris and waste into receiving waters.

During operation of the Build Alternatives, oil and grease and toxic organic compounds are pollutants of concern. These pollutants of concern can be generated from maintenance activities as well as vehicles operating on the facility. The LRT Alternative would be an electric facility on a raised track; therefore, the electric track would not generate pollutants of concern. However, the LRT Alternative includes the development of new parking areas that could generate pollutants of concern during maintenance/repair activities (e.g., repairing pavement, fertilizing vegetation) or by vehicles operating on the facility. Each of the Build Alternatives would include one or more of the following BMPs as appropriate to treat storm water runoff from the project site and reduce pollutants of concern, including oil, grease, and chemical pollutants: biofiltration swales, GSRDs, tree box filters, catch basins, curb inlet

filters, media filters, and bioretention facilities. Therefore, there is a low potential for the Build Alternatives to contribute to adverse effects related to oil, grease, and chemical pollutants.

4.4.1.5. Temperature, Oxygen Depletion, and Other Parameters

Water temperature can affect survival, spawning success, and metabolic rates of aquatic animals. In addition, increased water temperature decreases the availability of dissolved oxygen, promotes algal and bacterial growth, and increases sensitivity of organisms to pollution, parasites, and diseases. Water detained on construction sites has the potential to reach ambient air temperature, which could increase surface water temperature if discharged during storm events. In addition, non-storm water discharges (such as groundwater dewatering activities) have the potential to change surface water temperatures. During operation, storm water falling on or flowing over warm pavement can increase the temperature of runoff.

Nutrients are typically composed of phosphorus and/or nitrogen. Elevated levels in surface waters cause algal blooms and excessive vegetative growth. As nutrients are absorbed, the vegetative growth decomposes, utilizing oxygen in the process and reducing dissolved oxygen levels. Dissolved oxygen is critical for support of aquatic life. The ammonium form of nitrogen (found in wastewater discharges) converts to nitrite and nitrate in the presence of oxygen, further reducing the dissolved oxygen levels in water. Temporary or portable sanitary facilities provided for construction workers could be a source of sanitary waste (i.e., nutrients that would be a pollutant of concern during construction). Nutrients would also be a pollutant of concern during operation due to the presence of on-site landscaping, which may require the application of fertilizers to establish and maintain vegetation. Sources of phosphorus that may be present in highway and roadway runoff include tree leaves, surfactants and emulsifiers, and natural sources (e.g., the mineralized organic matter in soils). Potential sources of nitrogen in highway and road runoff include atmospheric fallout, nitrite discharges from automobile exhausts, fertilizer runoff, and natural sources such as mineralized soil organic matter.

Trash and debris can interfere with aquatic life respiration and can be harmful or hazardous to aquatic animals that mistakenly ingest floating debris. Construction workers can generate trash and debris (i.e., food wrappers) and construction waste and debris (e.g., broken concrete and wood, rocks, reclaimed asphalt). During operation, trash and debris are pollutants of concern that are generated from maintenance/repair activities (e.g., maintenance workers and vehicles using the roads).

During construction, the Build Alternatives would comply with the requirements of the CGP. Under the CGP, the Build Alternatives would be required to prepare a SWPPP and implement construction BMPs detailed in the SWPPP during construction activities. Construction BMPs would include, but not be limited to, Good Housekeeping BMPs to prevent spills, leaks, and discharge of construction debris and waste into receiving waters.

In addition, when appropriate, the Build Alternatives would include biofiltration swales, GSRDs, tree box filters, catch basins and curb inlet filters, media filters, and bioretention facilities that would target and process pollutants of concern from the operation of transportation facilities, including nutrients and debris. Therefore, there is a low potential for the Build Alternatives to contribute to adverse effects related to temperature, oxygen depletion, trash, and debris.

4.4.1.6. Flood Control Functions

The TSM/TDM, BRT, and LRT Alternatives would not be located within a 100-year floodplain and therefore would not have an adverse effect on flood control functions of surface waters or storm drain facilities in or downstream of the study area.

The single-bore tunnel design variation alignment of the Freeway Tunnel Alternative crosses the Laguna Regulating Basin floodplain. The dual-bore tunnel design variation alignment of the Freeway Tunnel Alternative crosses the Laguna Regulating Basin floodplain and Dorchester Avenue Storm Drain (Dorchester Channel) floodplain. There are no published Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRMs) for the area that include the Laguna Regulating Basin and the Dorchester Channel floodplain. Information about the floodplains of these two facilities is based on available engineering documents (e.g., As-Built plans) and design reports gathered from the Los Angeles County Department of Public Works and Caltrans.

Both the single-bore and dual-bore tunnel design variations of the Freeway Tunnel Alternative would encroach horizontally into the west side of the Laguna Regulating Basin. The encroachment would result in slight modifications to the floodplain boundary, but the basin floodplain elevation would not change. The encroachment involves excavating beneath a bridge structure. It is therefore likely that the encroachment would, in fact, increase and not decrease the basin storage volume, thereby increasing the flood control function of the Laguna Regulating Basin. The Freeway Tunnel Alternative's single-bore and dual-bore design variations would also require reconstruction of the existing maintenance road along the west side of the Laguna Regulating Basin. The existing maintenance road would be constructed in an area outside the current floodplain boundary; therefore, rebuilding the

maintenance road would not affect the flood control functions of the Laguna Regulating Basin. Therefore, the Freeway Tunnel Alternative's single-bore and dual-bore design variations would not have the potential to negatively affect the flood control functions of the Laguna Regulating Basin.

The single-bore tunnel design variation of the Freeway Tunnel Alternative would not encroach into the Dorchester Channel, but the dual-bore tunnel design variation would encroach into Dorchester Channel and would require portions of the Dorchester Channel floodplain boundary north of Hellman Avenue to be narrowed. The encroachment into Dorchester Channel would increase the water surface elevation in the Channel in the locations where the floodplain boundary is being narrowed; the water surface elevation in the upstream Channel would not be altered. While the floodplain encroachment would result in a change to the water surface elevation in the portion of Dorchester Channel that would be altered by the dual-bore tunnel design variation, the water surface elevation of the reconstructed portion of Dorchester Channel would still be contained within the reconstructed Channel. Therefore, the dual-bore tunnel design variation would not have the potential to negatively affect the flood control functions of Dorchester Channel.

Neither the single-bore nor dual-bore tunnel design variations of the Freeway Tunnel Alternative would have the potential to adversely affect flood control functions of surface waters or storm drain facilities in or downstream of the study area.

4.4.1.7. Storm, Wave, and Erosion Buffers

Wetlands serve as buffer zones that shield upland areas from wave actions, storm damage, and erosion. Two wetlands were identified and delineated in the study area: (1) the Del Mar Pump Station isolated wetland (1.09 ac), and (2) the wetland abutting Dorchester Channel (0.44 ac). The Del Mar Pump Station was not identified as being subject to United States Army Corps of Engineers (USACE) jurisdiction because it is isolated and does not connect to other waters of the United States. The wetland abutting the Dorchester Channel was identified to be subject to USACE jurisdiction.

There are no wetlands within the TSM/TDM, BRT, and LRT Alternative study areas. Therefore, the TSM/TDM, BRT, and LRT Alternatives would not change existing storm, wave, or erosion buffers within the TSM/TDM, BRT, and LRT Alternative study areas, and there would be no potential for adverse effects related to storm, wave, and erosion buffers.

The Freeway Tunnel Alternative would impact the entire 1.09 ac of the Del Mar Pump Station wetland. The Del Mar Pump Station wetland is man-made and originates from storm

water that is actively pumped into the area. There are no surface or subsurface connections between the Del Mar Pump Station wetland and other surface or subsurface waters. Furthermore, the Del Mar Pump Station wetland is completely isolated. Therefore, this wetland does not serve as a storm, wave, or erosion buffer. The Freeway Tunnel Alternative would not impact the wetland abutting Dorchester Channel. Therefore, there would be no potential for adverse effects related to storm, wave, and erosion buffers.

4.4.1.8. Erosion and Accretion Patterns

4.4.1.8.1. TSM/TDM Alternative

The TSM/TDM Alternative drains into Arroyo Seco, Rio Hondo, and the Los Angeles River. Portions of the main channel of Arroyo Seco have earthen bottoms, and Arroyo Seco drains directly into the Los Angeles River (Sapphos Environmental, 2014a). Rio Hondo, a primarily concrete-lined channel, also drains into the Los Angeles River. In turn, the Los Angeles River, which is also a concrete-lined channel, eventually drains into the Pacific Ocean. A portion of the project's storm water is discharged into surface waters with earthen bottoms (i.e., Arroyo Seco); therefore, if storm water volumes and velocities increase, there is a potential for on-site and off-site erosion and accretion to occur.

Construction activities disturb soil and increase the potential for soil erosion. During intersection, street, and freeway ramp improvements, there is potential for soil to be disturbed, thereby exposing soil to the potential for erosion. During construction, the TSM/TDM Alternative would comply with the requirements of the CGP. Under the CGP, the project would be required to prepare a SWPPP and implement construction BMPs including, but not limited to, Erosion Control and Sediment Control BMPs designed to minimize erosion and accretion and retain sediment on site. Therefore, there is a low potential for construction-related activities associated with the TSM/TDM Alternative to adversely affect erosion and accretion patterns.

The TSM/TDM Alternative would be primarily located outside Caltrans ROW with a few proposed improvements located within Caltrans ROW. The TSM/TDM Alternative would reduce impervious surface area within Caltrans ROW by approximately 0.15 ac, and therefore would not result in significant changes to surface runoff within Caltrans ROW. The TSM/TDM Alternative would increase impervious surface area outside Caltrans ROW by approximately 3.95 ac. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm, which can lead to changes in downstream erosion and accretion patterns. During operation, the TSM/TDM Alternative would treat storm water runoff within Caltrans ROW with biofiltration swales. During operation, the TSM/TDM

Alternative would treat storm water runoff outside of Caltrans ROW with tree box filters and catch basin screens and new inlets with filter inserts, where feasible. Biofiltration swales, tree box filters, and catch basin screens and filter inserts would provide flow volume and duration control functions that would minimize increases in velocity and volume of runoff, reduce the movement of sediment to downstream receiving waters, and minimize erosion. Because the TSM/TDM Alternative would include measures to offset increases in velocity and volume of runoff and to minimize erosion, there is a low potential for the TSM/TDM Alternative to adversely affect downstream erosion and accretion patterns.

4.4.1.8.2. BRT Alternative

The BRT Alternative drains into Rio Hondo and the Los Angeles River. Rio Hondo is primarily a concrete-lined channel. The Los Angeles River is also a concrete-lined channel, which eventually drains into the Pacific Ocean. Therefore, there is a minimal amount of substrate to erode and be carried downstream. Because a majority of the project's storm water is discharged to a concrete-lined channel rather than a natural channel, there is limited opportunity for on-site and off-site erosion and accretion to occur.

Construction activities disturb soil and increase the potential for soil erosion. During widening of the road, grading, paving, and excavation, land and vegetation would be cleared, exposing soil to the potential for erosion. As discussed above under the TSM/TDM Alternative, during construction, the BRT Alternative would comply with the requirements of the CGP. Therefore, there is a low potential for construction-related activities associated with the BRT Alternative to adversely affect erosion and accretion patterns.

The BRT Alternative would be located primarily outside Caltrans ROW. The BRT Alternative would increase impervious surface area through the creation of arterial streets, station improvements, and overall road widening. The BRT Alternative would result in a net increase of impervious surface area of 3.8 ac (i.e., the sum of increases of approximately 0.08 ac within Caltrans ROW and 1.06 ac outside Caltrans ROW). An increase in impervious surface area decreases infiltration and increases the volume of runoff during a storm, which can lead to changes in downstream erosion and accretion patterns. During operation, the small section of the BRT Alternative that is within Caltrans ROW would treat the storm water runoff with a biofiltration swale. During operation, the portion of the BRT Alternative that is outside Caltrans ROW would treat storm water runoff with tree box filters. Locations with a new inlet where the sidewalk is less than 7 ft wide would have a catch basin screen and curb inlet filter assembly. The curb inlet filter assembly would have a filter liner and support basket for sediment removal. A biofiltration swale, tree box filters, and catch basin screens and curb inlet filters would provide flow volume and duration control functions that

minimize increases in velocity and volume of runoff, reduce the movement of sediment to downstream receiving waters, and minimize erosion. Because the BRT Alternative would include measures to offset increases in velocity and volume of runoff and minimize erosion, there is a low potential for the BRT Alternative to adversely affect downstream erosion and accretion patterns.

4.4.1.8.3. LRT Alternative

The LRT Alternative drains into Rio Hondo and the Los Angeles River. Rio Hondo is primarily a concrete-lined channel. The Los Angeles River is also a concrete-lined channel, which eventually drains into the Pacific Ocean. Therefore, there is a minimal amount of substrate to erode and be carried downstream. Because a majority of the project's storm water is discharged to a concrete-lined channel rather than a natural channel, there is limited opportunity for on-site and off-site erosion and accretion to occur.

Construction activities disturb soil and increase the potential for soil erosion. During widening of the road, grading, paving, tunnel construction, and excavation, land and vegetation would be cleared, exposing soil to the potential for erosion. As discussed above under the TSM/TDM Alternative, during construction, the LRT Alternative would comply with the requirements of the CGP. Therefore, there is a low potential for construction-related activities associated with the LRT Alternative to adversely affect erosion and accretion patterns.

The LRT Alternative would be located both within and outside Caltrans ROW on an elevated track. The LRT Alternative would result in a net increase of impervious surface area of 16.42 ac (i.e., the sum of increases of approximately 5.46 ac within Caltrans ROW and approximately 10.96 ac outside Caltrans ROW) through the boring of tunnels, the creation of new rail stations, park-and-ride facilities, a maintenance yard and track spurs, and overall roadway widening. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm, which can lead to changes in downstream erosion and accretion patterns. As discussed previously, the LRT Alternative would only treat impervious surface areas outside the tunnel. During operation, the LRT Alternative would treat storm water runoff within Caltrans ROW with biofiltration swales. Much of the elevated track outside Caltrans ROW is proposed above steep terrain, and treatment is not technically feasible; however, the LRT Alternative would treat storm water runoff with tree box filters, catch basin screens and filter inserts at new inlet locations (where feasible), bioretention facilities for the proposed parking lot areas, and media filters in the ballast areas. Biofiltration swales, tree box filters, catch basin screens and filter inserts, bioretention facilities, and media filters would provide flow volume and duration control functions that would minimize

increases in velocity and volume of runoff, reduce the movement of sediment to downstream receiving waters, and minimize erosion. Because the LRT Alternative would include measures to offset increases in velocity and volume of runoff and to minimize erosion, there is a low potential for the LRT Alternative to adversely affect downstream erosion and accretion patterns.

4.4.1.8.4. Freeway Tunnel Alternative

The Freeway Tunnel Alternative drains into either Dorchester Channel/Laguna Regulating Basin or Arroyo Seco, all of which eventually drain into the Los Angeles River. Dorchester Channel is a concrete-lined channel and therefore has no substrate to be eroded and carried downstream. The Laguna Regulating Basin has an earthen bottom above the ordinary high water mark, and portions of the main channel of Arroyo Seco also have earthen bottoms (Sapphos Environmental, 2014a). As noted above, Arroyo Seco and the Dorchester Channel/Laguna Regulating Basin drain directly into the Los Angeles River, which is a concrete-lined channel that eventually drains into the Pacific Ocean.

A portion of the project's storm water is discharged into surface waters with earthen bottoms (i.e., Arroyo Seco and Laguna Regulating Basin); therefore, if storm water volumes and velocities increase, there is a potential for on-site or off-site erosion and accretion to occur.

Construction activities disturb soil and increase the potential for soil erosion. During widening of the road, grading, paving, excavation, construction of retaining walls, bridges, tunnels, and cut slopes, land and vegetation would be cleared, exposing soil to the potential for erosion. As discussed above under the TSM/TDM Alternative, during construction, the Freeway Tunnel Alternative would comply with the requirements for the CGP. Therefore, there is a low potential for construction-related activities associated with the Freeway Tunnel Alternative to adversely affect erosion and accretion patterns.

The Freeway Tunnel Alternative would be located wholly within Caltrans ROW. The single-bore and dual-bore tunnel design variations would increase impervious surface area within Caltrans ROW by approximately 1.68 ac and approximately 13.54 ac, respectively. Increases in impervious surface area decrease infiltration and increase the volume of runoff during a storm, which can lead to changes in downstream erosion and accretion patterns. As discussed previously, the Freeway Tunnel Alternative would only treat impervious areas outside the tunnels. Additionally, the Freeway Tunnel Alternative would require the creation of new 2:1 and 4:1 cut-and-fill slopes. The slopes would be stabilized with vegetation or other hard-surface methods. Retaining walls would be incorporated to reduce the steepness of or to shorten slopes, and the slopes would be rounded and shaped to reduce concentrated flows.

Furthermore, concrete slopes may be proposed at abutment locations. New slopes of 2:1 or flatter would use erosion control strategies (e.g., vegetative cover), and new slopes of 4:1 or steeper, or where sheet flow from the roadway is not possible or must be avoided (e.g., asphalt concrete dikes, toe of fill ditches, and downdrains/overside drains), would be used to control runoff and sediment. Furthermore, all existing planting that is removed or disturbed due to construction would be replaced following Caltrans Replacement Planting Policy Procedure, and all disturbed areas would be minimized to the maximum extent possible. During operation, the Freeway Tunnel Alternative would treat storm water runoff with biofiltration swales and GSRDs, which would provide flow volume and duration control functions that would minimize increases in velocity and volume of runoff, reduce the movement of sediment to downstream receiving waters, and minimize erosion. Because the Freeway Tunnel Alternative would include measures to offset increases in velocity and volume of runoff and minimize erosion, there is a low potential for the Freeway Tunnel Alternative to adversely impact downstream erosion and accretion patterns.

4.4.1.9. Aquifer Recharge/Groundwater

4.4.1.9.1. TSM/TDM Alternative

Neither construction nor operational activities for the TSM/TDM or BRT Alternative would require groundwater dewatering.

Groundwater dewatering may be required during construction/excavation of the LRT Alternative and the Freeway Tunnel Alternative. During tunnel excavation, groundwater could flow into the tunnel through the face of the excavation; however, it would be mitigated by the use of a pressurized-face tunnel boring machine (TBM). The TBM provides face pressure as it excavates to counterbalance earth and hydrostatic loads so groundwater does not enter the excavation. In addition, as the ground is excavated, a bolted and gasketed segmental lining would be installed immediately behind the TBM that would prevent any water from entering the tunnel during the construction phase. Additionally, during excavation, groundwater monitoring wells would be used to monitor local groundwater levels.

Permanent groundwater dewatering for the LRT Alternative and Freeway Tunnel Alternative would not be required.

Through intersection, street and freeway ramp improvements, bicycle and bus service improvements, the creation of arterial streets, station improvements, and overall road widening, the Build Alternatives would increase impervious surface area on site, which can

decrease infiltration. However, soils throughout most of the project site have very low infiltration rates. Therefore, because infiltration is very low in existing conditions, replacing low infiltrating soils with impervious pavement would not substantially decrease infiltration. In addition, operation of the Build Alternatives would not require permanent groundwater extraction. Therefore, the potential for the Build Alternatives to deplete groundwater supplies or interfere with groundwater recharge is low.

During the operational phase of the proposed tunnels, there are two potential ways for the tunnels to affect the groundwater: infiltration of water into the tunnel, and the flow of water along the excavated tunnel. The LRT and Freeway Tunnel Alternative would have a lining of bolted, gasketed, precast-concrete segments installed as the final lining. The segmental lining would be designed for the anticipated ground and hydrostatic loads. Infiltration along the segmental lining would be negligible, precluding groundwater intrusion into the tunnel so as not to cause drawdown of the local groundwater tables. (The rubber gaskets between the tunnel segments would help prevent water leakage into the tunnel.) If unexpected infiltration occurs, grouting can be performed to stop the unexpected leakage. Another possible operational effect on groundwater is water flowing along the tunnel lining. Backfill grouting operations performed during the construction phase would mitigate potential contaminant migration by filling gaps between the tunnel lining and the excavated ground around the tunnel that could be used for groundwater migration. Therefore, the potential for the LRT Alternative and Freeway Tunnel Alternative to deplete groundwater supplies or interfere with groundwater recharge is low.

4.4.1.10. Baseflow

Baseflow is the streamflow resulting from precipitation that infiltrates into the soil and eventually moves through the soil to the stream channel. This is also referred to as groundwater flow or dry-weather flow. As discussed above, soils throughout the study area are classified as Hydrologic Soil Group D. Soils classified as Hydrologic Soil Group D have low infiltration rates and are poorly drained. With little to no potential for rainfall to infiltrate the soil, there is little or no baseflow in the study area. Because of the low soil infiltration rates, there would also be little to no potential for creating dry-weather flows from additional irrigation water used for landscaping for the Build Alternatives.

4.4.2. Anticipated Changes to the Biological Characteristics of the Aquatic Environment

4.4.2.1. Special Aquatic Sites

Two wetlands were identified within the study area: (1) the wetland abutting both sides of Dorchester Channel (0.44 ac), which is under USACE jurisdiction; and (2) the isolated Del Mar Pump Station wetland (1.09 ac), which is not subject to USACE jurisdiction and therefore is not considered a special aquatic site. None of the Build Alternatives would impact the wetland abutting Dorchester Channel.

4.4.2.2. Habitat for Fish and Other Aquatic Organisms

No habitat for fish or other aquatic organisms exists on site. Therefore, no habitat for fish or other aquatic organisms would be impacted by the Build Alternatives.

4.4.2.3. Wildlife Habitat

4.4.2.3.1. Black Cottonwood Forest

Within the biological study area (BSA), 0.8 ac of black cottonwood forest (*Populus trichoncarpa* Forest Alliance), a natural community of special concern, was observed where SR 134 crosses the Arroyo Seco in Pasadena. While in the BSA, this community does not fall within any construction impact zones for the Build Alternatives and therefore would not be impacted by any of the Build Alternatives.

4.4.2.3.2. Southern California Walnut

A single young Southern California walnut (*Juglans californica* var. *californica)* was observed within the impact area of the Freeway Tunnel Alternative. No other individuals of this species were identified within the BSA. If it is selected, the Freeway Tunnel Alternative would have the potential to permanently affect the individual young Southern California walnut tree through disturbance of the tree. Avoidance and minimization measures for Southern California walnut are provided in the Natural Environment Study (NES).

4.4.2.3.3. Engelmann Oak

A single Engelmann oak is within the BSA. While in the BSA, this community does not fall within any construction impact zones for the Build Alternatives and therefore would not be impacted by any of the Build Alternatives.

4.4.2.3.4. American Peregrine Falcon Habitat

No American peregrine falcons were observed in the BSA during focused bird surveys conducted in 2013, although suitable nesting habitat may occur within the BSA. In general, the BSA contains tall buildings that may provide suitable nesting habitat for American peregrine falcon, although no known nesting locations in the region are located within the BSA. Due to the low probability of the American peregrine falcon nesting in and near the BSA, the lack of any proposed impacts to tall buildings with potentially suitable nest sites within the BSA, and habituation of urban nesting American peregrine falcons to noise and human activity, no additional avoidance or minimization measures are recommended.

4.4.2.3.5. Riparian Vegetation

Two areas of riparian vegetation were identified within the BSA and were determined to include marginally suitable habitat for least Bell's vireo, southwestern willow flycatcher, western yellow-billed cuckoo, and yellow-breasted chat. While suitable habitat is present within the BSA for these four species, the plant communities representing these habitats do not fall within or near any construction impact zones for the Build Alternatives. As a result, even though these species are potentially present in other areas of the BSA, they would not occur in impact areas; therefore, no impacts to these four species are anticipated.

4.4.2.3.6. Bat Habitat

Five bridges and one nearby foraging area within the BSA were identified as having potential suitable bat habitat. Although the passive and active acoustic bat surveys provided no evidence of roosting bat use, bats were detected acoustically near all bridge locations. The Build Alternatives would not directly impact any known bat populations due to the absence of current bat utilization of the bridges proposed for demolition and/or widening, as determined through focused bat habitat assessment surveys. While suitable habitat for bats is present, no appreciable amount of habitat would be removed as a result of implementation of the Build Alternatives. However, due to the presence of potentially suitable roosting habitat for bats, avoidance and minimization measures are required. Avoidance and minimization measures for bats are provided in the NES.

4.4.2.3.7. Other Special-Status and Protected Wildlife Species Habitat

The special-status wildlife and bird species observed within the BSA include Cooper's hawk, Allen's hummingbird, Nuttall's woodpecker, oak titmouse, black-crowned night heron, California gull, double-crested cormorant, great blue heron, great egret, sharp-shinned hawk, and Vaux's swift. These occurrences were purely transient in nature and there was no

evidence that nesting resources are being used within the BSA by these species. Bird species protected under the Migratory Bird Treaty Act (MBTA) were observed within the BSA during 2013 surveys. However, these species are not expected to remain in the area during construction. While the Build Alternatives are not expected to have direct or permanent impacts on these species, in order to avoid potential negative impacts to the birds protected under the MBTA, avoidance and minimization efforts shall be implemented. Avoidance and minimization measures for birds protected under the MBTA are provided in the NES.

4.4.2.4. Endangered or Threatened Species

Marginally suitable habitat for least Bell's vireo and southwestern willow flycatcher (both of which are federally and State-listed endangered species) as well as western yellow-billed cuckoo (a federal candidate and State endangered species) were determined to be present within the BSA although the species were not observed. No impacts to these three species are expected because the probability of their occurrence is considered extremely low, although the impacts and presence of the species can only be ruled out if seasonally appropriate surveys are done immediately before construction is scheduled to begin. However, Build Alternative activities are not expected to contribute to any additional disturbance factors that are not already present within the riparian areas of the BSA, and these activities are not anticipated to impact the suitable habitat. While impacts to the species and habitat are not anticipated, informal consultation with the United States Fish and Wildlife Service (USFWS) would be appropriate to ensure that appropriate surveys and avoidance measures are implemented. Such measures may include focused protocol surveys in the appropriate seasons, pre-construction surveys, and monitoring and mitigation for impacts to riparian habitat. Avoidance and minimization measures for endangered or threatened species are provided in the NES.

4.4.2.5. Invasive Species

Exotic plant species are present throughout the BSA and are primarily found within the Freeway Tunnel Alternative. A total of 81 exotic plant species, subspecies, and/or varieties were identified within the BSA. In compliance with Executive Order 13112, the Build Alternatives must implement all feasible and prudent measures to prevent the introduction and spread of invasive species. Avoidance and minimization measures to reduce the introduction and/or spread of exotic species are provided in the NES.

4.4.3. Anticipated Changes to the Human Use Characteristics of the Aquatic Environment

4.4.3.1. Existing and Potential Water Supplies, Water Conservation

Water within the project limits is provided by the Cities of Alhambra, Monterey Park, Pasadena, Rosemead, San Gabriel, San Marino, and South Pasadena, and the areas of unincorporated East Los Angeles, unincorporated East Pasadena, and unincorporated East San Gabriel. Each of these cities and unincorporated areas would provide connections for irrigation for landscaping associated with the Build Alternatives within each of their respective jurisdictions. Landscaped areas would be vegetated with drought-tolerant plants to minimize the demand for additional irrigation water. There are no other demands for harvested water associated with implementation of the Build Alternatives.

4.4.3.2. Recreational or Commercial Fisheries

Changes in water quality can affect the survival of fish and other aquatic organisms that would have deleterious impacts to recreational and commercial fisheries. The Build Alternatives drain into Arroyo Seco, Rio Hondo, the Dorchester Channel/Laguna Regulating Basin, and the Los Angeles River. None of the receiving waters are used for recreational or commercial fishing; however, they all eventually drain into the Pacific Ocean, which is approximately 20 mi downstream from the Build Alternatives and is used for recreational and commercial fishing. During operation, the Build Alternatives would treat storm water runoff within Caltrans ROW with biofiltration swales and GSRDs. In addition, during operation, the Build Alternatives would treat storm water runoff outside Caltrans ROW with tree box filters and catch basin screens with curb inlet filters, where feasible, as well as bioretention facilities for the proposed parking lot areas and media filters in the ballast areas. Biofiltration swales, tree box filters, and catch basin screens with curb inlet filters, bioretention facilities, and media filters would target and remove pollutants of concern before the storm water reaches downstream receiving waters. Because runoff from the Build Alternatives would be treated using BMPs and because of the Alternatives' distance from the Pacific Ocean, there is low potential for the Build Alternatives to have adverse effects on recreational or commercial fishing.

4.4.3.3. Other Water-Related Recreation

Trash and debris, oil and grease, nutrients, and sediment can decrease the recreational value and safety of a water body for contact and noncontact recreational activities. The Build Alternatives drain into Arroyo Seco, Rio Hondo, the Dorchester Channel/Laguna Regulating

Basin, and the Los Angeles River. The LARWQCB Basin Plan does not designate beneficial uses for the Dorchester Channel/Laguna Regulating Basin. Water in Arroyo Seco (lower), Arroyo Seco (upper), Rio Hondo, and the Los Angeles River is used for both body and non-body contact recreation. Body and non-body contact in Arroyo Seco (lower) and Arroyo Seco (upper) are listed as intermittent beneficial uses, and body contact recreation in Rio Hondo is listed as an intermittent beneficial use. Body contact recreation in Arroyo Seco (upper) and Rio Hondo is prohibited by the City of Los Angeles Department of Public Works (Los Angeles DPW) in only concrete-channelized areas; however, body contact in the Los Angeles River is prohibited by the Los Angeles DPW for all of Reach 2.

Pollutants of concern during construction include sediments, trash, and petroleum products. All aspects of a construction project can generate trash, debris, and petroleum products. Construction workers can generate trash, and construction trash and debris can be the result of intersection, street, and freeway ramp improvements and road widening. Chemicals, liquid products, and petroleum products (e.g., paints, solvents, and fuels), and concrete-related waste may be spilled or leaked and therefore have the potential to be transported via storm runoff into receiving waters. The Build Alternatives require construction vehicles and activities that use chemicals, liquid products, and petroleum products. The Build Alternatives would be required to develop and implement an effective SWPPP to address storm water pollution controls during project construction.

Pollutants of concern during operation of the Build Alternatives include suspended solids/ sediments, nutrients, pesticides, oil and grease, and trash and debris. These pollutants can be introduced by maintenance/repair activities during operation of the project (e.g., repairing pavement, fertilizing vegetation) or by vehicles operating on the facility. During operation, the Build Alternatives would treat storm water runoff within Caltrans ROW with biofiltration swales and GSRDs. In addition, during operation, the Build Alternatives would treat storm water runoff outside Caltrans ROW with tree box filters and catch basin screens with curb inlet filters, where feasible, as well as bioretention facilities for the proposed parking lot areas and media filters in the ballast areas. Biofiltration swales, tree box filters, and catch basin screens with curb inlet filters, bioretention facilities, and media filters would target pollutants of concern emanating from the Build Alternatives, including nutrients, sediments, oil and grease, and trash and debris. In addition, the Build Alternatives would implement operational BMPs aimed at reducing pollutants of concern in the storm water runoff. Therefore, there is a low potential for the Build Alternatives to have an adverse effect on other water-related recreation.

4.4.3.4. Aesthetics of the Aquatic Ecosystem

The study area includes 34 drainage features that discharge into three receiving waters: Arroyo Seco, Rio Hondo, and the Los Angeles River. Arroyo Seco and Rio Hondo both drain directly into the Los Angeles River, which eventually drains into the Pacific Ocean. Most of the impacted drainages within the study area are already highly disturbed, are predominantly urban, are channelized, contain only ephemeral flows, and have only small, isolated areas of natural vegetation. Therefore, in their current state, the drainages within the study area have little aesthetic value.

Trash and debris, oil and grease, nutrients, and sediment can detract from the aesthetics of a water body. Trash and debris can accumulate within the waterways. Oil and grease float on the water surface and often have a distinctive sheen and/or smell. Sediment increases turbidity and can turn water a murky brown color. Nutrients can promote algal blooms and reduce the clarity of surface waters.

Pollutants of concern during construction include sediments, trash, and petroleum products. Chemicals, liquid products, and petroleum products (e.g., paints, solvents, and fuels), and concrete-related waste may be spilled or leaked and therefore have the potential to be transported via storm runoff into receiving waters. Sediment, trash, petroleum products, chemicals, liquid products, and concrete-related waste would be generated from all aspects of the Build Alternatives. The Build Alternatives would comply with the requirements of the CGP. Under the CGP, the Build Alternatives would be required to prepare and implement an effective SWPPP to address storm water pollution controls during project construction.

Pollutants of concern during operation of the project include suspended solids/sediments, nutrients, pesticides, oil and grease, and trash and debris. As with construction activities, these pollutants can be introduced during all aspects of the operation of the Build Alternatives, including repair/maintenance activities or vehicles operating on the facility.

Each of the Build Alternatives would include one or more of the following BMPs, as appropriate, to treat runoff from the project site and reduce pollutants of concern: biofiltration swales, GSRDs, tree box filters, catch basins, curb inlet filters, media filters, and bioretention facilities. Therefore, there is a low potential for the Build Alternatives to have an adverse effect on the aesthetics of the aquatic ecosystem.

4.4.3.5. Parks, National and Historic Monuments, National Seashores, Wild and Scenic Rivers, and Wilderness Areas

There are no national or historic monuments, national seashores, or wild or scenic rivers in the vicinity of the study area. Additionally, there are no federal or State wildlife refuges, game refuges, or ecological reserves in the vicinity of the study area. There are approximately 42 parks within 0.5 mi of the study area. Arroyo Seco, Rio Hondo, and the Los Angeles River run through and along multiple parks. However, all four Build Alternatives would implement one or more of the following BMPs, as appropriate: tree box filters, catch basins and curb inlet filters, biofiltration swales, bioretention facilities, and media filters that would target pollutants of concern emanating from the study area. In addition, all Build Alternatives would implement construction and operational BMPs aimed at reducing pollutants of concern in the storm water runoff. Therefore, there is a low potential for the Build Alternatives to have an adverse effect on parks in the vicinity of the study area.

4.4.3.6. Traffic/Transportation Patterns

Although construction of the Build Alternatives would affect traffic and transportation patterns in the study area, the aquatic resources in the study area are not used for transportation. Therefore, there is no potential for the Build Alternatives to have an adverse effect on aquatic traffic/transportation patterns.

4.4.3.7. Energy Consumption or Generation

Waters in the study area are not used for energy generation. Therefore, there is no potential for the Build Alternatives to have an adverse effect on energy consumption or energy generation within the study area.

4.4.3.8. Navigation

The Los Angeles River is designated as a navigable waterway and its waters are administered under USACE jurisdiction. The section of the Los Angeles River to which the project drains is primarily a concrete-lined channel and is not used for navigation. Furthermore, the LARWQCB Basin Plan does not identify navigation as a beneficial use for the Los Angeles River (LARWQCB, 1995). Therefore, there is no potential for the Build Alternatives to have an adverse effect on navigation within the study area.

4.4.3.9. Safety

As discussed previously, the Build Alternatives include a comprehensive drainage system in which an increase in impervious surface area would not result in an increase in volume and velocity of storm water flows. The TSM/TDM, BRT, and LRT Alternatives would not result in an encroachment into any floodplains; therefore, the TSM/TDM, BRT, and LRT Alternatives would not result in any adverse effects on safety. The single-bore and dual-bore tunnel design variations for the Freeway Tunnel Alternative would include a minor encroachment into the Laguna Regulating Basin in order to widen SR 710. The dual-bore tunnel design variation would also include a minor encroachment into Dorchester Channel to widen SR 710. However, the Freeway Tunnel Alternative would not alter the existing flood control functions along SR 710, and the Laguna Regulating Basin and Dorchester Channel would provide the same flood control functions as currently provided. Therefore, the risk to life and property resulting from the proposed encroachment is considered low, and there is a low potential for the Freeway Tunnel Alternative to result in adverse effects on safety.

4.4.4. Short-Term Impacts During Construction

During construction, the total disturbed area associated with each of the Build Alternatives would be as shown in Table 4.4.

Table 4.4 Disturbed Soil Area for Each Build Alternative

Alternative	Disturbed Soil Area		
	Inside Caltrans ROW (ac)	Outside Caltrans ROW (ac)	Total (ac)
TSM/TDM	5.75	15.59	21.34
BRT	1.00	33.48	34.48
LRT	3.89	29.42	33.31
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	80.59	0	80.59
Dual-Bore Tunnel Design Variation	92.96	0	92.96

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
LRT = Light Rail Transit
ROW = right of way
TDM = Transportation Demand Management
TSM = Transportation System Management

Construction activities would include the following (CH2M HILL, 2014b):

- Construction of retaining walls
- Road widening
- Grading activities
- Paving activities

- Installation of traffic control devices
- Permanent water quality BMPs
- Construction of tunnels
- Construction of bridges
- Construction of drainage systems
- Pavement delineation

The following sections summarize the potential for short-term effects of the Build Alternatives to the physical/chemical characteristics, the biological characteristics, and the human use characteristics of the aquatic environment.

4.4.4.1. Physical/Chemical Characteristics of the Aquatic Environment

Pollutants of concern during construction include sediments, trash, petroleum products, concrete waste (dry and wet), sanitary waste, and chemicals. Construction activities associated with the Build Alternatives include grading, excavation, paving, construction of retaining walls, tunnels, and bridges, installation of drainage systems, and pavement delineation. During construction of the Build Alternatives, activities such as grading and excavation could expose soil and increase the potential for soil erosion, which could be a source of downstream sediment. As noted above, when sediment enters a receiving water body, it can increase turbidity, smother bottom dwelling organisms, and suppress aquatic vegetation growth. When new structures are installed or modified (e.g., retaining walls, tunnels, and bridges), concrete and/or asphalt applications could be a source of fine sediment, metals, and chemicals that could change the pH levels in downstream water bodies. Grading and other earth-moving activities during construction could be a source of petroleum products and heavy metals if the equipment engines leak. Furthermore, temporary or portable sanitary facilities provided for construction workers could be a source of sanitary waste. Under the CGP, the Build Alternatives would be required to prepare a SWPPP and implement construction BMPs aimed at reducing pollutants of concern in the storm water runoff. Therefore, the potential for short-term water quality impacts associated with construction to adversely affect the physical/chemical characteristics of the on-site or downstream aquatic environment during construction is considered to be low.

4.4.4.2. Biological Characteristics of the Aquatic Environment

The highly disturbed nature of the drainages in the study area result in limited biological resources that would be able to support a healthy and functioning on-site aquatic environment. However, the Build Alternatives drain into receiving waters such as the Pacific Ocean, which depends on the biological characteristics of the aquatic environment in order to

sustain a functioning aquatic ecosystem, an ecosystem that supports the biological (e.g., fish) and human environment (e.g., recreation). Under the CGP, the Build Alternatives would be required to prepare a SWPPP and implement construction BMPs aimed at reducing pollutants of concern in storm water runoff. Therefore, the potential for short-term water quality impacts during construction to adversely affect the biological characteristics of the on-site or downstream aquatic environment during construction is considered to be low.

4.4.4.3. Human Use Characteristics of the Aquatic Environment

The disturbed and predominantly concrete-lined nature of the drainages in the study area preclude beneficial uses associated with human activities such as contact and noncontact recreation. The Los Angeles DPW prohibits contact recreation in the Los Angeles River and in the channelized portions of Rio Hondo and Arroyo Seco. However, the Build Alternatives drain into receiving waters such as the Pacific Ocean in Long Beach, which has beneficial uses associated with human activities that include contact and noncontact recreation. Under the CGP, the Build Alternatives would be required to prepare a SWPPP and implement construction BMPs aimed at reducing pollutants of concern in the storm water runoff. Consequently, the Build Alternatives would result in negligible changes in the quality of runoff reaching downstream receiving waters during construction. Therefore, the potential for short-term water quality impacts during construction to adversely affect the human use characteristics of the on-site or downstream aquatic environment during construction is considered to be low.

4.4.5. Long-Term Impacts During Operation and Maintenance

Caltrans' Statewide National Pollutant Discharge Elimination System (NPDES) Permit and Storm Water Management Plan (SWMP) provide framework for management of storm water discharges and water quality controls within Caltrans ROW. The LARWQCB NPDES Permit covers storm water discharges and water quality controls outside Caltrans ROW. The roadway and drainage improvements associated with the Build Alternatives include road widening, construction of retaining walls, bridges, tunnels, grading, excavation, paving, pavement delineations, installation of traffic control devices, and permanent water quality treatment BMPs that would result in increased impervious surface area. For the changes in impervious surface area within and outside Caltrans ROW for each Build Alternative, refer to Table 4.5. Increases in impervious surface area would cause long-term increases in velocity at outlets and increases in the amount of pollutants typically generated by operating and maintaining a transportation facility (i.e., Total Dissolved Solids [TDS], nutrients, trash/litter, oil and grease, heavy metals). The Build Alternatives would also include vegetated areas that

Table 4.5 Impervious Surface Area Within and Outside Caltrans ROW

Alternative	Existing Impervious Surface Area (ac)	Proposed Total Impervious Surface Area (ac)	Net New Impervious Surface Area (ac)
Within Caltrans ROW			
TSM/TDM	11.85	11.70	-0.15
BRT	5.76	5.84	0.08
LRT	2.60	8.06	5.46
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	34.95	36.63	1.68
Dual-Bore Tunnel Design Variation	41.63	55.17	13.54
Outside Caltrans ROW			
TSM/TDM	91.62	95.57	3.95
BRT	111.17	112.23	1.06
LRT	20.57	31.53	10.96
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	0	0	0
Dual-Bore Tunnel Design Variation	0	0	0

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
LRT = Light Rail Transit
ROW = right of way
TDM = Transportation Demand Management
TSM = Transportation System Management

would need fertilizer to encourage plant growth and pesticides to control pests. As noted above, increases in sediment and other pollutants in a water body can increase turbidity, smother bottom dwelling organisms, suppress aquatic vegetation growth, and alter the temperature and pH of a water body. Fertilizers could be a source of nutrients, causing oxygen depletion and a rise in water temperature, and pesticides could be a source of organic chemicals, causing adverse effects to fish and other aquatic organisms. The following section summarizes the potential for long-term effects to the physical/chemical characteristics, the biological characteristics, and the human use characteristics during operation and maintenance of the Build Alternatives.

4.4.5.1. Physical/Chemical Characteristics of the Aquatic Environment

Primary pollutants of concern are pollutants that are expected to be or have the potential to be in project runoff based on proposed land uses, and which also have been identified as causing impairments to receiving waters on the most recent 303(d) list or have an established Total Maximum Daily Load (TMDL). Other pollutants of concern are those that are expected to be or have the potential to be in project runoff but do not have an established TMDL for receiving waters and have not been identified as causing impairments to receiving waters. Pollutants of concern during operation of the Build Alternatives include the following:

- Trash and debris
- Heavy metals

- Nutrients
- Bacteria
- Oil and grease
- Copper
- Benthic-macroinvertebrate bioassessments
- Cyanide

These pollutants of concern are typically generated during the operation of a transportation facility. Through road widening, construction of retaining walls, bridges, tunnels, grading, excavation, paving, pavement delineations, installation of traffic control devices, and permanent water quality treatment BMPs, the Build Alternatives would increase impervious surface area. An increase in impervious surface area would increase the volume of runoff during a storm, thereby more effectively transporting pollutants to receiving waters, which in turn causes turbidity and downstream erosion or accretion. Increases in chemical pollutants and changes in temperature and pH may lead to detrimental effects to downstream receiving waters. The Build Alternatives would include one or more of the following BMPs as appropriate to treat runoff from the project site and reduce pollutants of concern: biofiltration swales, GSRDs, tree box filters, catch basins, curb inlet filters, media filters, and bioretention facilities. The proposed BMPs would treat runoff from the Build Alternatives and reduce pollutants of concern. For the TSM/TDM Alternative, the proposed BMPs would treat 76 percent of the new impervious surface area. For the BRT Alternative, the proposed BMPs would respectively treat 575 percent and 114 percent of the new impervious surface area within and outside Caltrans ROW. As discussed previously for the LRT Alternative, BMPs are only proposed in areas outside the tunnel, and most of the LRT alignment outside the tunnel is on an elevated track above steep terrain where BMPs are infeasible. Therefore, for the LRT Alternative, the proposed BMPs would respectively treat 31 percent and 47 percent of the new impervious surface area within and outside Caltrans ROW. The proposed BMPs for the Freeway Tunnel Alternative single-bore and dual-bore tunnel design variations would respectively treat 5,350 percent and 705 percent of the new impervious surface area within Caltrans ROW. Because the Build Alternatives would implement effective BMPs that would treat the proposed new impervious surface area as well as portions of the existing impervious surface area, there is a low potential for the Build Alternatives to have an adverse effect on the physical/chemical characteristics of the on-site or downstream aquatic environment.

4.4.5.2. Biological Characteristics of the Aquatic Environment

As indicated above, there are no biological resources present on site that are dependent on aquatic resources. However, there are biological resources dependent on aquatic resources

downstream of the study area (e.g., the Pacific Ocean). As noted above, the Build Alternatives would increase the amount of impervious surface area, resulting in an increase in volume of runoff, thereby increasing the energy of the flows and increasing the downstream transport of pollutants to downstream receiving waters. The Build Alternatives would include one or more of the following BMPs as appropriate to treat runoff from the project site and reduce pollutants of concern: biofiltration swales, GSRDs, tree box filters, catch basins, curb inlet filters, media filters, and bioretention facilities. The proposed BMPs would treat runoff from the project site and reduce pollutants of concern. The Build Alternatives would also be required to implement operational BMPs aimed at reducing pollutants of concern in the storm water runoff. Because the study area is in an urbanized area and no biological resources were identified on site that depend on aquatic resources, and because the Build Alternatives would implement effective BMPs that would treat storm water runoff from the project site, there is a low potential for the Build Alternatives to have an adverse effect on the biological characteristics of the on-site or downstream aquatic environment. Therefore, no long-term water quality impacts to biological characteristics of the aquatic environment are anticipated.

4.4.5.3. Human Use Characteristics of the Aquatic Environment

The disturbed and predominantly concrete-lined nature of the drainages within the study area precludes beneficial uses associated with human activities (e.g., contact and noncontact recreation). As noted above, according to the LARWQCB Basin Plan, the three receiving waters have designated beneficial uses for contact and noncontact recreation. However, the Los Angeles DPW prohibits contact recreation in the Los Angeles River and in concrete-channelized portions of Arroyo Seco and Rio Hondo. However, the Build Alternatives drain into receiving waters such as the Pacific Ocean that have beneficial uses associated with human activities, including contact and noncontact recreation. The Build Alternatives would include one or more of the following BMPs as appropriate to treat runoff from the project site and reduce pollutants of concern: biofiltration swales, GSRDs, tree box filters, catch basins, curb inlet filters, media filters, and bioretention facilities. Therefore, the Build Alternatives would result in negligible changes in the quality of runoff that reaches downstream receiving waters during operation of the Build Alternatives. Therefore, there is a low potential for the Build Alternatives to have an adverse effect on human use characteristics of the on-site or downstream aquatic environment.

4.5. Impact Assessment Methodology

This WQAR analyzes the differences between the existing condition and the Build Alternatives' condition with respect to water quality impacts. The WQAR takes the following into consideration:

- Pollutant sources (changes in land uses)
- Changes in the amount of impervious areas and the relationship to the amount of runoff (increase or decrease)
- Application of BMPs (number of BMPs, new technologies, effectiveness)
- Discharges into impaired waters (listed pursuant to Section 303(d) of the Clean Water Act [CWA])

4.6. Alternative-Specific Impact Analysis

4.6.1. No Build

Under the No Build Alternative, the temporary and permanent impacts discussed below for the Build Alternatives would not occur; however, impacts to water quality in other areas could occur for the projects included in the No Build Alternative that would require grading or excavation or that would increase impervious surface area. The No Build Alternative includes projects/planned improvements through 2035 that are contained in the Federal Transportation Improvement Program (FTIP), as listed in the Southern California Association of Governments (SCAG) 2012 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS), Measure R, and the funded portion of Metro's 2009 Long Range Transportation Plan (LRTP). Each of the No Build Alternatives would be required to implement construction BMPs consistent with the requirements of the Construction General Permit and operational BMPs consistent with Caltrans, City, or County policies and guidelines. Water quality impacts of the individual projects included in the No Build Alternative would be expected to be similar to the Build Alternatives because construction and operational BMPs would be implemented to treat pollutants of concern in storm water runoff.

4.6.2. Build Alternatives

4.6.2.1. Construction

Pollutants of concern during construction include sediments, trash, petroleum products, concrete waste (dry and wet), sanitary waste, and chemicals. During construction activities,

excavated soil would be exposed, and there would be an increased potential for soil erosion compared to existing conditions. Additionally, during a storm event, soil erosion could occur at an accelerated rate. The total disturbed area during construction for each Build Alternative is summarized in Table 4.4.

During construction, there is also the potential for construction-related pollutants to be spilled, leaked, or transported via storm runoff into drainages adjacent to the study area and thereby into downstream receiving waters. The following construction-related pollutants have the potential to impact water quality: chemicals, liquid products, petroleum products (e.g., paints, solvents, and fuels), and concrete-related waste may be spilled or leaked and have the potential to be transported via storm runoff into receiving waters.

As specified in Measure WQ-1 (Chapter 5), all Build Alternatives would comply with the requirements of the CGP. Under the CGP, the project would be required to prepare a SWPPP and implement construction BMPs detailed in the SWPPP during construction activities to minimize erosion and prevent spills. Construction BMPs would include, but not be limited to, Erosion Control and Sediment Control BMPs designed to minimize erosion and retain sediment on site, and Good Housekeeping BMPs to prevent spills, leaks, and discharge of construction debris and waste into receiving waters. The SWPPP would be developed and construction BMPs selected and implemented to target pollutants of concern during construction. Because the construction BMPs would be designed to retain sediment and other pollutants on the project site so they would not reach receiving waters, storm water discharges and authorized non-storm water discharges are not anticipated to cause or contribute to any violations of applicable water quality standards or objectives, or adversely impact human health or the environment. In addition, because Construction BMPs would be designed to retain sediment and other pollutants in the study area so they would not reach receiving waters, runoff during construction would not contain pollutants in quantities that would create a condition of nuisance or adversely affect beneficial uses of waters of the State. When Construction BMPs are properly designed, implemented, and maintained to address pollutants of concern, as required in Measure WQ-1, pollutants of concern would be retained in the study area and would not reach receiving waters; therefore, there is low potential for adverse water quality impacts during construction of any of the Build Alternatives.

Groundwater dewatering would be required during construction of the LRT Alternative and the Freeway Tunnel Alternative single-bore and dual-bore tunnel design variations. As specified in Measure WQ-2 (Chapter 5), during construction, the LRT Alternative and the Freeway Tunnel Alternative single-bore and dual-bore tunnel design variations would be

required to comply with the requirements of Order No. R4-2013-0095 (NPDES No. CAG994004). Order No. R4-2013-0095 covers general waste discharge permits for discharges to surface waters from activities involving groundwater extraction. It covers treated or untreated groundwater generated from permanent or temporary dewatering operations or other appropriate wastewater discharge not specifically covered in other general NPDES permits in the Los Angeles Region. Under this order, permittees are required to monitor their discharges from groundwater extraction waste from construction to ensure that effluent limitations for constituents are not exceeded.

As previously discussed, Los Angeles River Reach 2 (Carson Street to Figueroa Street) is listed on the 2010 California 303(d) List as impaired for ammonia, coliform bacteria, copper, lead, nutrients (algae), oil, and trash. Arroyo Seco Reach 1 (Los Angeles River to West Holly Avenue) as impaired for benthic-macroinvertebrate bioassessments, coliform bacteria, and trash. Rio Hondo Reach 2 (at Spreading Grounds) as impaired for coliform bacteria and cyanide. The pollutants of concern during construction of all the Build Alternatives include sediments, trash, petroleum products, concrete waste (dry and wet), sanitary waste, and chemicals; therefore, construction activities have the potential to contribute to the downstream nutrient and toxicity impairments. However, as discussed above, Construction BMPs would be implemented to target pollutants of concern, including nutrients and chemicals. As a result, there is a low potential for construction of the Build Alternatives to contribute to any existing water quality impairments.

When the Build Alternatives are compared to one another, construction of the TSM/TDM Alternative would involve the least amount of disturbed area. Therefore, the TSM/TDM Alternative would involve the least amount of exposed soil and would result in the lowest potential for soil erosion and downstream sedimentation. Because the TSM/TDM Alternative would result in the least amount of disturbed area, the duration of construction would be shorter, and there would be less opportunity for construction-related pollutants to spill, leak, and otherwise affect on-site drainages and downstream receiving waters when compared to the other Build Alternatives.

Construction of the LRT Alternative would result in the fourth-least amount of disturbed area. Therefore, the LRT Alternative would have the fourth-least amount of exposed soil and would result in the fourth highest potential for soil erosion and downstream sedimentation when compared to the other Build Alternatives. Because the LRT Alternative would involve less disturbed area than the Freeway Tunnel Alternative and the BRT Alternative, there would be less opportunity for construction-related pollutants to spill, leak, and otherwise affect on-site drainages and downstream receiving waters when compared to the Freeway

Tunnel and BRT Alternatives, but there would be more opportunity for construction-related pollutants to spill, leak, and otherwise affect on-site drainages and downstream receiving waters when compared to the TSM/TDM Alternative.

Construction of the BRT Alternative would result in the third-least amount of disturbed area. Therefore, the BRT Alternative would have the third-least amount of exposed soil and would result in the third highest potential for soil erosion and downstream sedimentation when compared to the other Build Alternatives. Because the BRT Alternative would involve less disturbed area than the Freeway Tunnel Alternative, there would be less opportunity for construction-related pollutants to spill, leak, and otherwise affect on-site drainages and downstream receiving waters when compared to the Freeway Tunnel Alternative, but there would be more opportunity for construction-related pollutants to spill, leak, and otherwise affect on-site drainages and downstream receiving waters when compared to the TSM/TDM and LRT Alternatives.

Construction of the Freeway Tunnel Alternative design variations would involve the greatest amount of disturbed area. The dual-bore tunnel design variation would involve the greatest amount of disturbed area. The single-bore tunnel design variation would involve the second greatest amount of disturbed area. Therefore, the Freeway Tunnel Alternative would involve the largest amount of exposed soil and consequently has the highest potential for soil erosion and downstream sedimentation when compared to the other Build Alternatives. Because the Freeway Tunnel Alternative would involve the largest amount of disturbed area of all the Build Alternatives, there would also be a greater opportunity for construction-related pollutants to spill, leak, and otherwise affect on-site drainages and downstream receiving waters when compared to the other Build Alternatives.

4.6.2.2. Operation

Pollutants of concern during operation of the Build Alternatives include suspended solids/ sediments, nutrients, pesticides, heavy metals, oil and grease, toxic organic compounds, and trash and debris. Pollutants of concern during operation could be introduced through maintenance/repair activities or vehicles operating on the facility. The LRT Alternative would be an electric facility on a raised track; therefore, the electric track portion of the project would not generate pollutants of concern. However, the LRT Alternative includes the development of new parking areas that could generate pollutants of concern during maintenance/repair activities (e.g., repairing pavement, fertilizing vegetation) or by vehicles operating on the facility. Overall, all of the Build Alternatives would result in permanent increases in impervious surface area, which are summarized in Table 4.5. An increase in

impervious surface area would increase the volume of runoff during a storm, which would more effectively transport pollutants to downstream receiving waters. Also, increases in impervious surface area would also increase the total amount of pollutants in the storm water and non-storm water runoff, which in turn would increase the amount of pollutants traveling to on-site drainages and downstream receiving waters.

As specified in Measure WQ-4 (Chapter 5), the Build Alternatives would be required to implement Source Control and Treatment BMPs to reduce the discharge of pollutants of concern to the maximum extent practicable to comply with the LARWQCB SUSMP for improvements proposed outside Caltrans ROW.

As specified in Measures WQ-5 and WQ-6 (Chapter 5), the Build Alternatives would implement Caltrans-approved Design and Treatment BMPs to reduce the discharge of pollutants of concern to the maximum extent practicable for improvements proposed within Caltrans ROW. Design Pollution Prevention BMPs are measures that focus on reducing or eliminating runoff and controlling sources of pollutants during operation of the project. Treatment BMPs utilize treatment mechanism to remove pollutants that have entered storm water runoff. The Design Pollution Prevention BMPs being proposed as part of the project include the following:

- **Consideration of Downstream Effects Related to Potentially Increased Flow:**
  - Potential increased erosion from higher runoff flows would be minimized using erosion control measures such as rock slope protection (RSP) for portions of the Build Alternatives within Caltrans ROW.
- **Slope/Surface Protection Systems:**
  - New slopes would be provided by using either vegetative or hard-surface methods. Hard-surface methods include retaining walls to reduce steepness of slopes or shortening slopes to be rounded and shaped to reduce concentrated flow.
  - Vegetation and landscaping on existing slopes would be preserved to the greatest extent feasible.
  - Concrete slopes may be proposed at abutment locations.
  - The Erosion Prediction Procedure would be used to validate erosion control design at the planning, specifications, and estimates (PS&E) stage.
  - Approval of the Erosion Control Plan by Landscape Architecture and Maintenance would be pursued at PS&E.
- **Concentrated Flow Conveyance Systems:**
  - In locations where cut slopes steeper than 4:1 or where sheet flow from the roadway is not possible or must be avoided, asphalt concrete dikes, toe-of-fill ditches, and

downdrains/overside drains would be used to control runoff and minimize gullies and scour.

- In locations where cross culverts convey on-site and off-site runoff under the highway, flared end sections would be specified at the inlet/outlet of the culverts, and RSP would be provided at the culvert outlets to minimize scour and erosion at cross-culvert transitions.

- **Preservation of Existing Vegetation:**
  - All existing planting that is removed or disturbed due to construction would be replaced following Caltrans Replacement Planting Policy and Procedure.
  - Disturbed area would be minimized to the maximum extent possible.

As previously discussed, Los Angeles River Reach 2 (Carson Street to Figueroa Street) is listed on the 2010 California 303(d) List as impaired for ammonia, coliform bacteria, copper, lead, nutrients (algae), oil, and trash; Arroyo Seco Reach 1 (Los Angeles River to West Holly Avenue) is listed as impaired for benthic-macroinvertebrate bioassessments, coliform bacteria, and trash; and Rio Hondo Reach 2 (at Spreading Grounds) is listed as impaired for coliform bacteria and cyanide. Therefore, operation of the Build Alternatives has the potential to contribute to the downstream nutrient load, metals, copper, bacteria, oil and trash, cyanide, and benthic-macroinvertebrate bioassessments. As shown in Tables 4.6 and 4.7, respectively, the proposed Treatment BMPs would be implemented both within and outside Caltrans ROW for each Build Alternative to target pollutants of concern. As a result, none of the Build Alternatives would be a substantial source of pollutants that would contribute to any existing impairments, and therefore, there is a low potential for any of the Build Alternatives to adversely affect water quality. The Build Alternatives would all increase the existing amount of impervious surface area and would all treat the proposed new impervious surface area.

Table 4.6 Percentage of Impervious Surface Area Treated Within Caltrans ROW

Alternative	Net New Impervious Surface Area (ac)	Impervious Surface Area Treated (ac)	Percentage of Impervious Surface Area Treated (ac)
TSM/TDM	-0.15	0.99	N/A[1]
BRT	0.08	0.46	575%
LRT	5.46	1.71	31%
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	1.68	89.88	5,350%
Dual-Bore Tunnel Design Variation	13.54	95.44	705%

[1] This Build Alternative does not result in the creation or replacement of impervious surface area.

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
LRT = Light Rail Transit
N/A = not applicable
ROW = right of way
TDM = Transportation Demand Management
TSM = Transportation System Management

Table 4.7 Percentage of Impervious Surface Area Treated Outside Caltrans ROW

Alternative	Creation or Replacement of Impervious Surface Area (ac)	Impervious Surface Area Treated (ac)	Percentage of Impervious Surface Area Treated (ac)
TSM/TDM	14.29	10.83	76%
BRT	31.93	36.32	114%
LRT	31.43	14.70	47%
Freeway Tunnel:			
Single-Bore Tunnel Design Variation	0	0	N/A[1]
Dual-Bore Tunnel Design Variation	0	0	N/A[1]

[1] This Build Alternative does not result in the creation or replacement of impervious surface area.

ac = acres
BRT = Bus Rapid Transit
Caltrans = California Department of Transportation
LRT = Light Rail Transit
N/A = not applicable
ROW = right of way
TDM = Transportation Demand Management
TSM = Transportation System Management

The Build Alternatives that treat the greatest amount of new impervious surface area would provide greater overall water quality benefits to on-site drainages and downstream receiving waters. For the Freeway Tunnel Alternative, the single-bore tunnel design variation would treat the largest percentage of new impervious area, and the dual-bore tunnel design variation would treat the second-largest percentage of new impervious area. The BRT Alternative would treat the third-largest percentage of new impervious area, the LRT Alternative would treat the fourth-largest percentage, and the TSM/TDM Alternative would treat the smallest percentage. As stated above, the Treatment BMPs would target constituents of concern from transportation facilities. Therefore, when construction and operational BMPs are implemented in accordance with NPDES Permit requirements as stipulated in Measures WQ-1, WQ-3, and WQ-4 (Chapter 5), there is a low potential for the Build Alternatives to adversely affect water quality.

4.7. Cumulative Impacts

Cumulative development in the study area is a continuation of the existing urban pattern of development that has already resulted in extensive modifications to watercourses in the area. The area's watercourses have been channelized, and drainage systems have been put into place to respond to past urbanization that has occurred. For all cumulative analysis related to hydrology and water quality, the cumulative projects being considered include all potential projected development discharging to the Los Angeles-San Gabriel Hydrologic Unit (HU). Because cumulative hydrology and water quality impacts are caused by build out of properties that increase impervious surface area and pollutant loads, cumulative development is considered to be the build out of the Los Angeles-San Gabriel HU over an extended period of time, which would result in development of all the available parcels.

New development and redevelopment can result in increased urban pollutants in dry weather and storm water runoff from project sites. Each project must comply with NPDES permitting requirements and must include BMPs to avoid impacts to water quality and local hydrology in compliance with Caltrans requirements and local ordinances and plans adopted to comply with the MS4 Permit and other permits (e.g., CGP). Each Build Alternative must consider impaired receiving waters and annual TMDL loads for receiving waters. The TMDL program is designed to identify all constituents that adversely affect the beneficial uses of water bodies and then identify appropriate reductions in pollutant loads or concentrations from all sources so that the receiving waters can maintain/attain the beneficial uses in the LARWQCB Basin Plan. Thus, by complying with TMDLs, the project's contribution to overall water quality improvement in the watershed in the context of the regulatory programs is designed to account for cumulative impacts.

The Build Alternatives are being proposed in an area that is currently urbanized and developed. Many of the proposed road improvements would be located on existing paved or already disturbed areas. The Build Alternatives include a series of biofiltration swales, GSRDs, tree box filters, new inlets with catch basin screens and curb inlet filters, bioretention facilities, and media filters that would reduce pollutant concentrations from runoff from the Build Alternatives.

Regional programs and BMPs such as TMDL programs and the MS4 Permit Program have been designed under an assumption that the Los Angeles-San Gabriel HU would continue its pattern of urbanization. The LARWQCB measures contemplate cumulative effects of proposed development. The Build Alternatives would be required to comply with the regulations in effect at the time the grading permits are issued. Compliance with these regional programs and the CGP constitute compliance with programs intended to address cumulative water quality impacts. Each cumulative project would be required to develop a SWPPP and Water Quality Management Plans (WQMPs), and would be evaluated individually to determine appropriate BMPs and treatment measures to avoid impacts to surface water quality. Because the project includes BMPs to reduce pollutants of concern in runoff from the study area during construction and operation, and the proposed storm drain system is sized for the built-out condition, the Build Alternatives' contributions to cumulative water quality impacts are not anticipated to be substantial.

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5. Avoidance and Minimization Measures

The following regulatory requirements would be implemented with the Build Alternatives and would reduce or avoid impacts related to water quality:

5.1. Construction Requirements

WQ-1 The project will comply with the provisions of the National Pollutant Discharge Elimination System (NPDES) General Permit for Storm Water Discharges Associated with Construction and Land Disturbance Activities (Construction General Permit) Order No. 2009-0009-DWQ, as amended by 2010-2014-DWQ and 2012-0006-DWQ, NPDES No. CAS000002, or any subsequent permit. The project shall comply with the Construction General Permit by preparing and implementing a Storm Water Pollution Prevention Plan (SWPPP) to address all construction–related activities, equipment, and materials that have the potential to impact water quality for the appropriate Risk Level. The SWPPP will identify the sources of pollutants that may affect the quality of storm water and include best management practices (BMPs) to control the pollutants, such as sediment control, catch basin inlet protection, temporary soil stabilization, construction materials management, and non-storm water BMPs.

WQ-2 If dewatering is required, construction site dewatering will comply with the requirements of Order No. R4-2013-0095 (NPDES No. CAG994004). Order No. R4-2013-0095 covers general waste discharge permits for discharges to surface waters from activities involving groundwater extraction. It covers treated or untreated groundwater generated from permanent or temporary dewatering operations or other appropriate wastewater discharge not specifically covered in other general NPDES permits in the Los Angeles region. Under this order, permittees are required to monitor their discharges from groundwater extraction waste from construction to ensure that effluent limitations for constituents are not exceeded.

5.2. Operational Requirements

WQ-3 The project will comply with the provisions of the NPDES Permit, Statewide Storm Water Permit, Waste Discharge Requirements (WDRs) for the State of

California, Department of Transportation Order No. 2012-0011-DWQ, NPDES No. CAS000003 (Caltrans Permit) or any subsequent permit.

WQ-4 In compliance with the Standard Urban Storm Water Mitigation Plan (SUSMP) prepared for the Los Angeles Regional Water Quality Control Board (LARWQCB) WDRs for Municipal Separate Storm Sewer System (MS4) Order No. R4-2012-0175, NPDES Permit No. CAS004001, as amended, a final project-specific SUSMP shall be prepared. The final project-specific SUSMP shall include implementation of Site Design, Source Control, and Treatment Control BMPs to the maximum extent practicable. Site Design, Source Control, and Treatment Control BMPs include tree box filters, catch basins, curb inlet filters, media filters, and bioretention facilities.

WQ-5 Caltrans-approved Design Pollution Prevention BMPs will be implemented to the maximum extent practicable consistent with the requirements of the Caltrans Permit and Project Planning and Design Guide. Design Pollution Prevention BMPs include preservation of existing vegetation, slope/surface protection systems (permanent soil stabilization and replanting of vegetation), asphalt concrete dikes, toe-of-fill ditches, and downdrains/overside drains.

WQ-6 Caltrans-approved Treatment BMPs will be implemented to the maximum extent practicable consistent with the requirements of the Caltrans Permit and Project Planning and Design Guide. Treatment BMPs include biofiltration swales and gross solid removal devices (GSRDs).

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