4.8 Geologic Hazards

The information provided in this section was taken from the *Westside Subway Extension Geotechnical and Hazardous Materials Technical Report*. Additional information and details are provided in that report.

4.8.1 Regulatory Setting

This section provides the state, and local regulations that are applicable to the geologic concerns of the Project and its Study Area. The Project would run through the incorporated cities of Los Angeles, Beverly Hills, West Hollywood and Santa Monica, and unincorporated portions of Los Angeles County.

In addition to the National Environmental Policy Act of 1969, a Federal regulation, the following are applicable State and local regulations.

State

California Environmental Quality Act of 1970

The California Environmental Quality Act (CEQA) establishes a means to maintain and restore environmental quality for the public welfare. Under CEQA, the focus of the environmental analysis is on the physical change resulting from a project. However, the analysis of such changes may be traced back to non-physical changes, such as a revision in the use of an area that would cause physical changes.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Earthquake Fault Zoning Act (Public Resource Code [PRC]. 2621 et seq.) is the principal California state guidance to prevent the construction of habitable structures on the surface trace of active earthquake faults. The Alquist-Priolo Earthquake Fault Zoning Act only addresses the hazard of surface fault rupture and does not consider other earthquake hazards.

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990 (PRC 2690-2699.6) addresses non-surface fault rupture earthquake hazards, including liquefaction and seismically induced landslides.

Surface Mining and Reclamation Act

The Surface Mining and Reclamation Act (PRC 2710 et seq.) was established by the State Mining and Geology Board to regulate areas that are known to contain mineral deposits judged to be important in meeting the future needs of the region.

California Health and Safety Code

Section 25316 and 25317 of the California Health and Safety Code identify hazardous material, substances and wastes that require removal, including petroleum and petroleum by-products.

Local

Municipal Regulatory Approach

The incorporated cities of Los Angeles, Beverly Hills, West Hollywood and Santa Monica, and Los Angeles County have engineering departments that administer and oversee geotechnical, subsurface, and seismic concerns. Each of these entities have general plan geologic elements and zoning codes to address geotechnical, subsurface and seismic concerns. Existing Conditions/Affected Environment

Study Area Topography

All the Project alternatives are located on the coastal plain of the Los Angeles Basin in an area that ranges between one-third and three miles south of the Santa Monica Mountains. Study Area elevations range between 400 and 85 feet above mean sea level (AMSL) from east to west. Study Area topography is mildly undulated to relatively flat from east to west. Table 4-40 shows the amount of topographic change in the Study Area. As shown in the table, the greatest difference in elevation of any one alignment segment is 215 feet over an approximate 4-mile segment.

Table 4-40. Topography of Alternatives along Wilshire Boulevard

Segment		Approximate Distance (in miles)	Approximate Change in Elevation (in feet)
From	To		
Alternatives Running Along Wilshire Boulevard			
Western Avenue	La Brea Avenue	2	-5
La Brea Avenue	Santa Monica Blvd and Wilshire intersection	3.75	+73
Santa Monica Blvd and Wilshire Boulevard intersection	Westwood	2.25	+40
Westwood	405 Freeway	0.5	+10
405 Freeway	W. Project Terminus at 4th Street	4	-215
Alternatives Originating at Hollywood/Highland Station			
Hollywood/ Highland Station	Santa Monica Boulevard / San Vicente Boulevard Intersection	3.25	-170
Santa Monica Boulevard / San Vicente Boulevard Intersection	San Vicente Boulevard / Wilshire Boulevard Intersection	1.5	-70

Sources: Section 3.1 Draft Geotechnical and Hazardous Material Technical Report with distances checked in GIS.

Study Area Geology

Geological Setting

The Project area lies at the northern end of the northwesterly trending Peninsular Ranges physiographic province, to the south of the east-west trending Transverse Ranges physiographic province. The Peninsular Ranges physiographic province includes the nearby San Jacinto and Santa Ana mountains. The Transverse Ranges physiographic province includes the Santa Monica Mountains.

The Los Angeles Basin which lies between the two physiographic provinces is an elongated northwest trending, sediment filled trough that is nearly 6 miles deep. At its surface the Los Angeles Basin is an alluvial coastal plain, comprised mainly of river deposited sediments originating from the nearby mountains. In the Project area the sediments originated primarily from the south flank of the Santa Monica Mountains.

Geology

A geological unit is a volume of rock of an identifiable origin and age that is defined by its distinctive and dominant features. Five to six geologic units exist within the tunnel and station depth horizon within the Project area. These are shown below in Table 4-41. Surficial geology in the Project area is shown on Figure 4-46. Surficial geology in relation to the Project tunnel is shown on Figure 4-47.

Table 4-41. Geologic Units[1]

Age	Geologic Formation (age)	Age (1000's of years)	Symbol	Composition	Location in Project Area	Alternatives Underlain
Youngest	Younger Alluvium (Holocene)	Recent to 1-12	Qal1 Qal2	Poorly consolidated, interlayered silts, clays, and silty sands with some sand layers and gravel	Western half of Beverly Hills, West Hollywood -Hollywood/ Highland down to Wilshire Boulevard; La Jolla to Carmelina; and younger-alluvium-filled ravines from Western to La Jolla.	1-5
	Older Alluvium (Late Pleistocene)	12-80	Qao	Non-marine and marine sediments.	All areas	1-5
	Lakewood (Pleistocene)	12-80	Qalo	Upper portion: Interbedded silts and clays, sands, silty sands with some clayey sand layers. Lower portion: interlayered silts and sandy clays with some silty sand.	Hancock Park/La Brea Tar Pits area to an area between South Crescent Heights and South La Jolla Boulevards	1, 2 and 3
	San Pedro (Pleistocene)	2-500	Qsp	Fine-grained sand and silty sand with few interbeds of medium- to course-grained sand and some local silt layers. Some asphaltic sand found.	Wilshire Boulevard. from Western to La Jolla	1,2, and 3
	Fernando (Pliocene)	1,500-2,500	Tf	Predominantly massive siltstone and claystone with few rare sandstone interbed	Hancock Park Area, Windsor to Fairfax Avenue	1
Oldest	Puente (Miocene)	5,500-10,000	Tp	Massive siltstone and intervals of claystone that are Interbedded with thin sandstone and siltstone laminae	Near bottom of tunnel from Windsor to Fairfax	1

Sources: Section 3.2.2 Draft Geotechnical and Hazardous Material Technical Report.

[1]Units appearing at any depths ranging from the ground surface to bottom of the tunnel

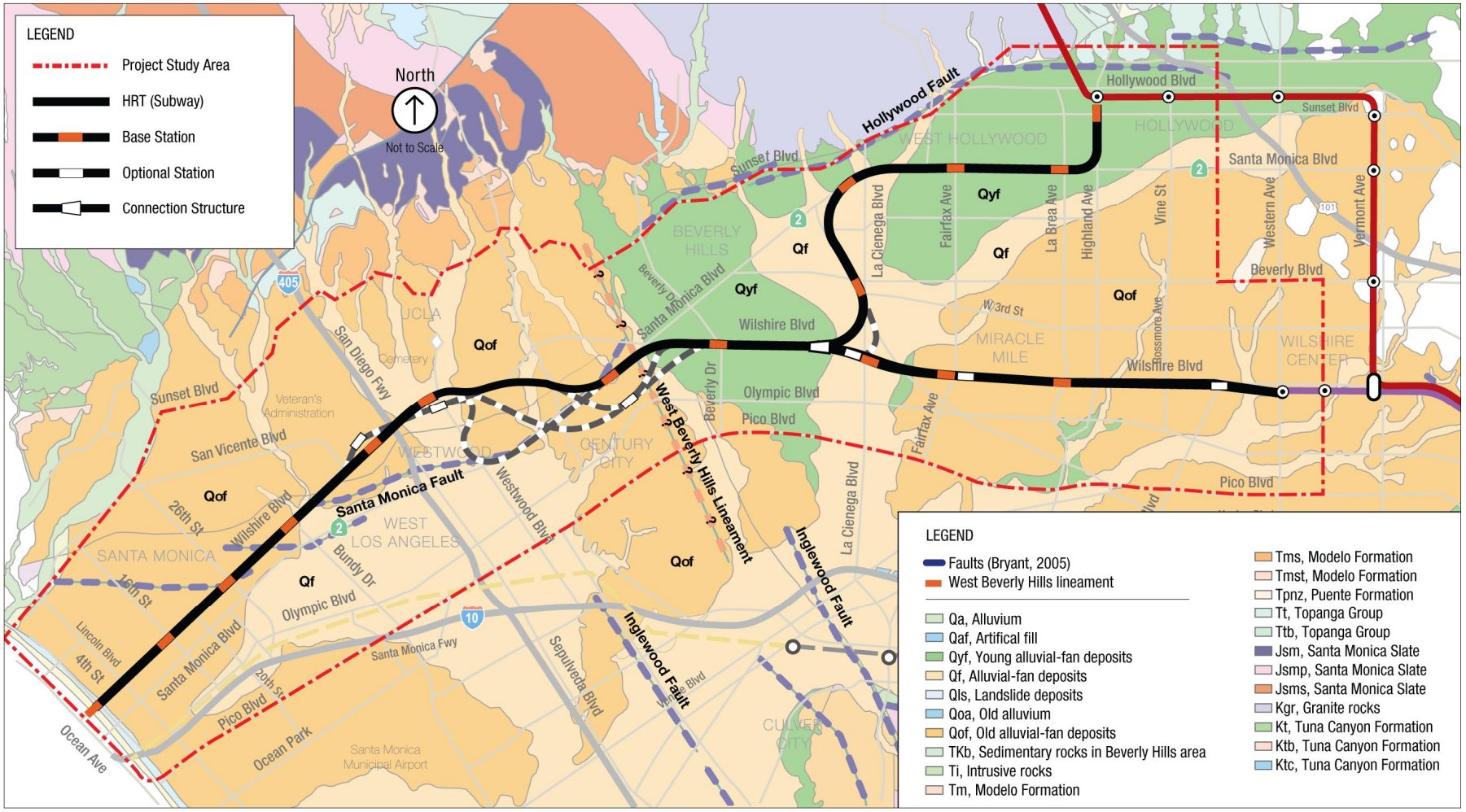


Figure 4-46. Surface Geology and Earthquake Faults

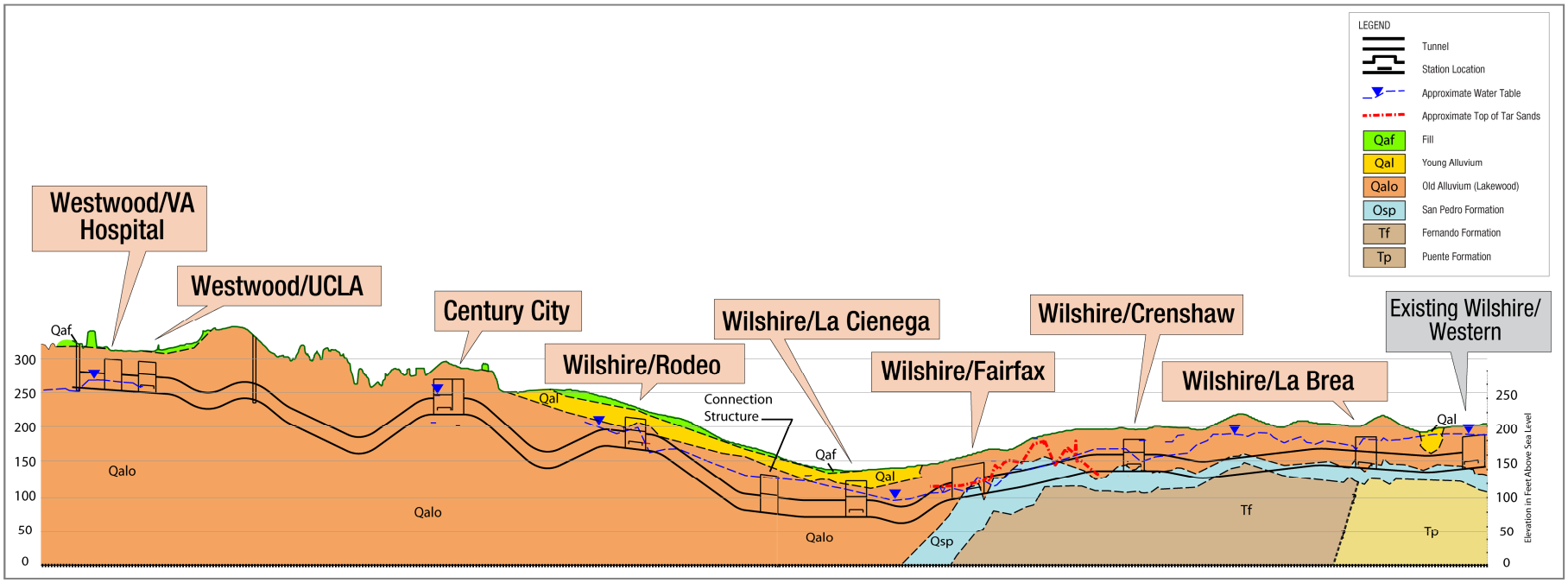


Figure 4-47. Geological Cross Section

Study Area Faulting, Seismicity, Seismic Hazards and Other Hazards

The project Study Area lies within a seismically active region. The most significant seismic sources to the Project are listed in Table 4-42. Fault traces are delineated by the United States and California Geological Surveys (USGS and CGS). The locations of the faults shown in Table 4-42, and those in the Study Area are also shown in Figure 4-46.

Table 4-42. Active Faults and Fault Segments

Fault or Fault Segment	Approximate Distance to Study Area (in miles)[1]	Approximate Maximum Credible Earthquake Magnitude (Mw)[2]
Santa Monica	0	6.6
Hollywood	0.25	6.4
Newport-Inglewood	1.75	7.1
Malibu Coast	2	6.7
Upper Elysian Park	2	6.4
Puente Hills	2..5	6.6—single segment rupture 7.1—multi-segment rupture
Raymond	4.5	6.5
Palos Verdes	5.5	7.3
Compton	6	6.8
Verdugo-Eagle Rock	10	6.9
Sierra Madre	11	7.2
Anacapa-Dume	11.75	7.5
Northridge	13.75	7.0
San Fernando	14.25	6.7
Whittier	14.75	6.8
Santa Susana	17	6.7
San Andreas (Mojave)	33	7.4

Source: Table 3.1: Summary of Potential Seismic Sources in Section 3.2.4 Draft Geotechnical and Hazardous Material Technical Report. Distances shown originally in kilometers were converted to miles and approximated.

[1]Distances represent the distance from the closest trace of the fault to the closest portion of any of the Project alternative alignments.

[2]The moment magnitude scale (denoted as Mw) is now used by seismologists rather than the former Richter scale. Magnitude is based on the moment of the earthquake, which is equal to the rigidity of the Earth multiplied by the average amount of slip on the fault and the size of the area that slipped. The scale retains the familiar Magnitude scale of 1 to 10 defined by Richter.Faults Crossing the Project Area

Known faults crossing the Project area include multiple segments of the Santa Monica Fault. The Santa Monica Fault is an east-west trending fault that is part of the Southern Boundary Fault System of the aforementioned Transverse Ranges Physiographic Province. It has not produced any moderate or large earthquakes in the historic record. However, it has been suggested that the fault has had at least six rupture events in the last 50,000 years, with the most recent being between 1,000 and 3,000 years ago. Based on evident changes in the area's geologic structure, it appears that active segments of the Santa Monica Fault would cross portions of Alternatives 1 (MOS 2), 2, 3, 4 and 5. As shown above, the Santa Monica Fault could have a maximum credible earthquake magnitude of 6.6 magnitude (Mw).

In addition to the Santa Monica Fault, the West Beverly Hills Lineament is a northwest trending geomorphic lineament (feature) that would cross the Westside Subway Extension alignment in the vicinity of the intersection of Moreno Drive and Santa

Monica Boulevard in the Century City area. It has been delineated by discontinuous east-facing scarps. Various interpretations have been proposed for the West Beverly Hills Lineament. For example, Dolan et al (1997) speculated that it may represent an east-dipping normal fault associated with extension along the left step between the Hollywood and Santa Monica faults or a fold scarp along the northern extension of the back limb of the gently east-dipping Compton blind thrust fault. However others, Lang (1994) reported that subsurface mapping within the Cheviot Hills and Beverly Hills oil fields, constrained by dense subsurface control, precludes the existence of the West Beverly Hills Lineament. Thus the prospect that the West Beverly Hills Lineament is the surface manifestation of an active fault has not been confirmed and it has not been included in the table above. Further evaluation of the West Beverly Hills Lineament and its significance to the Project would be performed during design level investigations for the Project.

Surface Fault Rupture

As indicated above, segments of the Santa Monica fault cross the Project alignment alternatives at various locations. Additionally, the West Beverly Hills Lineament crosses the alignment alternatives in one location. These locations could represent earthquake fault rupture hazards to the Project.

Seismic Ground Shaking

The intensity of ground motion is dependent on the distance from the fault rupture. Ground motions induced by a seismic event are typically characterized by a value of horizontal peak ground acceleration (PGA) which is expressed as a fraction (or multiple) of the acceleration of gravity (g). Metro design criteria uses a probabilistic seismic hazard analysis (PSHA) taking into account the combined effects of all nearby faults to estimate ground shaking. United States Geologic Survey (USGS) PSHA computations were used as the basis for evaluating the ground motion levels along the alternative alignments. Two different levels of ground shaking hazard are considered: the Operating Design Earthquake (ODE), having a 50% probability of exceedance in 100 years; and the Maximum Design Earthquake (MDE), having a 1% probability of exceedance in 100 years.

The probability of exceedance is the chance that the level of shaking computed would be exceeded during the timeframe specified. One hundred years is considered the design life of the Metro underground structures. The guiding philosophy of earthquake design for the Project is to provide a high level of assurance that the overall system would continue operating safely during and after an Operating Design Earthquake (ODE) and would provide a high level of assurance that public safety would be maintained during and after a Maximum Design Earthquake (MDE).

An alternative way (but mathematically equal) to consider the ground shaking hazard levels, is to compute the average time between ground shaking of the specified level; computed in this manner, the Operating Design Earthquake has a return time of about 150 years, and the MDE has an average return time of about 2,500 years. The peak ground acceleration for the Operating Design Earthquake along the alignment ranges from 0.26g to 0.32g, and the peak ground acceleration for the Maximum Design

Earthquake along the alignment ranges from 0.81g to 0.98g. The values are also presented in Table 4-43.

Table 4-43. Estimated Ground Shaking Levels

Earthquake Level	Probability of Exceedance in 100 Years	Average Return Period (Years)[1]	Peak Ground Acceleration (g)
ODE	50%	150	0.26—0.32
MDE	1%	2,500	0.81—0.98

[1]Return period is the average time between occurrences of ground shaking at this level

Differential Seismic Settlement

Differential seismic settlement occurs when seismic shaking causes one type of soil or rock to settle more than another type. This is most likely to occur at transitions between rock formations and lower density; more recently deposited alluvial soils or artificially placed fills. However, since the tunnel reaches are located below the recently deposited alluvium and fill, and the stations are also subterranean, differential seismic settlement is not considered to be a significant impact.

Liquefaction and Lateral Spreading

Liquefaction is a phenomenon that causes water-saturated, cohesionless granular materials to change into a fluid-like state when subjected to powerful shaking, thus loosing the ability to support overlying structures. Lateral spreading is a condition wherein soil moves laterally as the result of shaking or water saturation. Figure 4-48 shows the liquefaction hazard zones in and around the Westside Project area, excluding the Maintenance Yard areas. The Seismic Hazards Zones Map (CDC 1999), also indicates that the Los Angeles Transportation Center (LATC) yard area is in an area of potentially liquefiable soil.

Subsidence

Subsidence is the collapsing of pore space in the ground that was formerly occupied by a fluid such as oil or water, or in some cases, organic materials. When this occurs, the ground elevation becomes lower and can become unstable for structural support. The Project area runs near oil extraction areas and is in a basin with water extraction activities. However, no current subsidence problems have been noted for the Project area. Construction dewatering that could lead to subsidence would be considered a construction hazard and is addressed in construction mitigations.

Tsunamis

Tsunamis are large ocean waves are generated by earthquakes or underwater landslides. The waves are of a very long period, meaning that when the wave reaches the coastline, the tsunami is observed as a retreat of water away from the coastline and/or a surge of water similar to a flood. Tsunamis are a hazard in low-lying coastal areas.

Tsunami modeling along the Los Angeles County coastline by the University of Southern California (USC) has been jointly published by the California Emergency Management Agency, California Geological Survey, and USC (CEMA/CGS/USC, 2009). The modeling utilizes a computational program which allows for wave evolution over a variable bathymetry and topography. A suite of tsunami source events was used in the

Figure 4-48. Liquefaction Hazard Zones

model, representing realistic local and distant earthquakes and hypothetical extreme near-shore sub-marine landslides (CEMA/CGS/USC, 2009). These tsunami sources are listed on the individual Tsunami Inundation Quadrangle Maps (CEMA/CGS/USC, 2009).

The Tsunami Inundation Map of the Beverly Hills Quadrangle (CEMA/CGS/USC, 2009) indicates the location of the modeled tsunami inundation area and line along Santa Monica Beach, located about 500 feet west of the western end of the Wilshire alignment at the Second Street Station. The tsunami inundation line is shown on the map along Santa Monica Beach at approximately 20 feet above sea level, located adjacent to Pacific Coast Highway, and near the base of the ocean-front bluff below Ocean Avenue. Along the western portion of the Wilshire alignment, the lowest elevation is approximately 95 feet above sea level at the proposed Second Street Station in Santa Monica. Thus, the Second Street Station and western end of the Wilshire Alignment is about 70 feet above the tsunami inundation line shown on the referenced map. Therefore, based on the published mapping, the likelihood of a potential tsunami causing inundation of the Second Street Station is considered remote. Other stations or portions of the subway are at higher elevations and further inland, and thus would not be subject to tsunami hazard.

Landsliding

Landsliding can occur when the stability of slopes underlain by soil or bedrock is decreased during periods of prolonged rainfall or by other factors including seismic activity. The terrain within the Study Area is relatively flat-lying where landslides would not be expected to occur. Therefore, landsliding is not considered a significant geologic hazard for the Project.

Unsuitable Soils

Some soils may expand as water content increases, some may collapse or settle upon being wetted, and others may be corrosive to building materials. The Project would respond to such conditions by removing, replacing and compacting structurally unsuitable soils and would incorporate corrosion protection measures into the Project design.

Study Area Groundwater

Groundwater Basins in the Project Study Area

The Study Area traverses three of the four main groundwater basins of the coastal plain of Los Angeles County. From east to west these are the Hollywood, Central and Santa Monica Basins. Groundwater in the Hollywood Basin is found within the sands and gravels of several aquifers of the aforementioned Lakewood and San Pedro Formations.

Shallower groundwater may be found at or near the surface in the north and east portions of the Hollywood basin. Deeper groundwater is found in the Central Basin which is also within the sands and gravels of the Lakewood and San Pedro Formations. Some relatively shallow areas of groundwater may be found in this basin overlying more recent alluvium. The Santa Monica Basin is separated from the Hollywood and Central

Basins to the east by the Newport-Inglewood fault which acts as a barrier to groundwater.

Local Groundwater Conditions

The Project area includes several locations where water will rest on top of a lens of impermeable geologic material above the underlying groundwater basins (perched aquifers). In these locations groundwater will be found to be closer to the surface that the groundwater in the underlying basin. Table 4-44 shows the areas and depths of local groundwater. Because groundwater may fluctuate based on seasonal, yearly and geologic conditions, the dates that the various groundwater depths were observed has been included in the table.

The West Hollywood area has historically had high groundwater, with substantial marshlands and artesian wells. West Hollywood's General Plan EIR (1988) indicated that groundwater depths were as shallow as 0 to 10 feet below grade in parts of the city. The Santa Monica area has been observed that to have groundwater that has come closer to the surface within the last four decades. This may be attributed to decreased groundwater pumping in the area.

Table 4-44. Groundwater Measurements

General Location		Approximate Depth to Groundwater (in feet below grade)		
From	To	From	To	Year Observed
Alternatives Running Along Wilshire Boulevard				
Western Avenue	Fairfax Avenue	10	35	1977 and 1981
		16	44	2009
Crenshaw Boulevard	Burnside Avenue	12	40	2007
Curson Avenue	Orange Grove Avenue	5	10	1983
Fairfax Avenue	Santa Monica Boulevard	21	59	2009
Santa Monica Boulevard	405 Freeway	16	69	2009
405 Freeway	Bundy Drive	21	31	2008-09
		40	75	1974-75
Bundy Drive	West Project Terminus	21	>50	2009-10
Alternatives Originating at Hollywood/Highland Station				
Hollywood and Highland Station	Santa Monica Boulevard / Fairfax Avenue Intersection	20	87	2010
Santa Monica Boulevard / Fairfax Avenue Intersection	Fairfax Avenue / Wilshire Boulevard Intersection	1	20	2010

Sources: Section 3.2.3 Draft Geotechnical and Hazardous Material Technical Report

Study Area Subsurface Gas Conditions and Oil Wells

The Project alternative alignments would pass through or near several active or abandoned oil fields. The rocks and soils overlying these oil fields are known to commonly contain naturally occurring methane and/or hydrogen sulfide gases. In addition, existing oil wells (active and abandoned) are present in the Study Area. Methane and hydrogen sulfide are considered hazardous because of their explosive properties. Additionally, hydrogen sulfide is highly toxic when inhaled. These gases can

seep into tunnels and other excavations through soil and also through discontinuities (fractures, faults, etc.) in bedrock. Figure 4-49 shows the oil fields in and around the Project area.

The City of Los Angeles, Department of Public Works, Bureau of Engineering has mapped Potential Methane Zones and "buffer zones", and most recently updated this map in 2004 and shown with respect to the Study Area in Figure 4-50. The City's Municipal Code, Chapter IX, Building Regulations, Article 1, Division 71, Methane Seepage Regulations, requires construction projects located within the Methane Zone or Methane Buffer Zone to comply with the City's Methane Mitigation Standards to control methane intrusion emanating from geologic formations. Mitigation requirements are determined according to the actual methane levels and pressures detected on a site. Mitigation measures include both active and passive ventilation systems to ensure exchange of air, gas barriers, (membranes around basements and foundations) and sensors in interior spaces to monitor the presence of gas and its pressure. Several existing buildings have been constructed with up to 5 levels of underground parking the Wilshire/Fairfax Area. Construction of the subterranean walls has included a water and gas proof membrane.

As part of this study, Metro examined existing data along the Study Area and installed new gas monitoring wells at 25 locations along the proposed alternative alignments to evaluate the presence of hazardous gases and their potential to affect construction of the Project. Locations of gas monitoring wells were selected in known methane areas referenced above. Based on the readings from the Metro monitoring wells, the segment of Wilshire Boulevard from South Burnside Avenue to South La Jolla Avenue indicated high gas measurements and levels of pressure for methane and hydrogen sulfide gases. This segment of Wilshire Boulevard is near the La Brea Tar Pits and is characterized by having extensive tar sands. Other areas of the Project alternative alignments have gas concentrations ranging from very low to non-detectable.

In some areas near the La Brea tar pits, methane can reach up to 90 to 100 percent by volume of the vapor phase (the explosive range is 5 to 15 percent in air). Hydrogen sulfide (H_2S) gas concentrations have been measured in the range of 10 to 1000 parts per million (ppm) in the Wilshire/Fairfax station area. Gas pressures, measured in the equivalent depth of water in inches, ranged from less than 1 inch, to 844 inches (about 74 feet). For perspective, the existing Metro Red Line was constructed in areas where methane gas measurements were up to 79 percent in the Civic Center area, with pressures less than 1 inch.

According to American Conference of Governmental Industrial Hygienists,[1] hydrogen sulfide gas has an exposure limit or Threshold Limit Value-Time Weighted Average of 10 parts per million (ppm) for continuous exposure and 15 ppm for Threshold Limit Value—Short Term Exposure Limit. This threshold limit value is the concentration to

[1] Industrial Ventilation: A Manual of Recommended Practice 24th Edition, 2001, American Conference of Governmental Industrial Hygienists (ACGIH), 1330 Kemper Meadow Drive, Cincinnati, Ohio 45240-1634, USA.

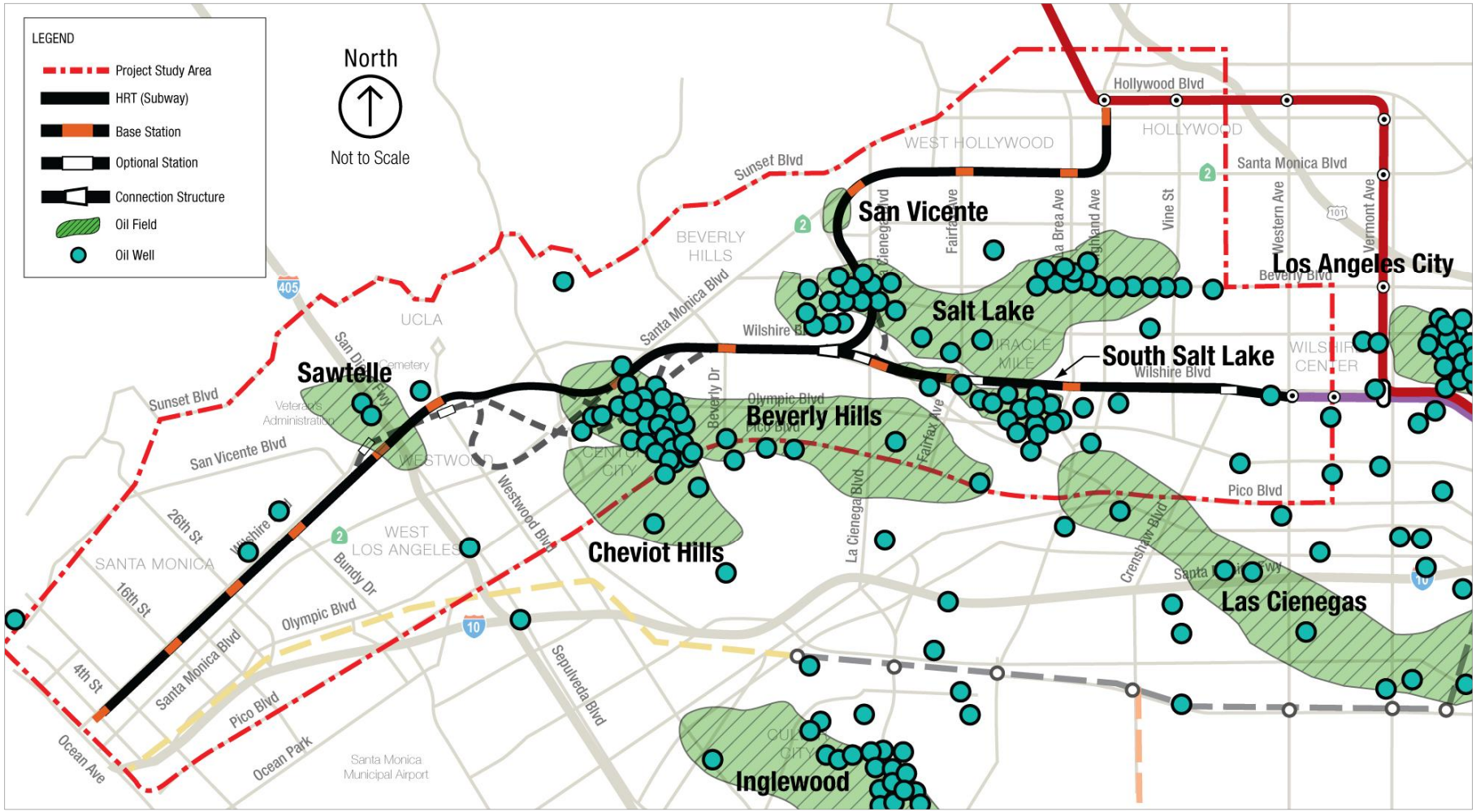


Figure 4-49. Oil Fields/Wells

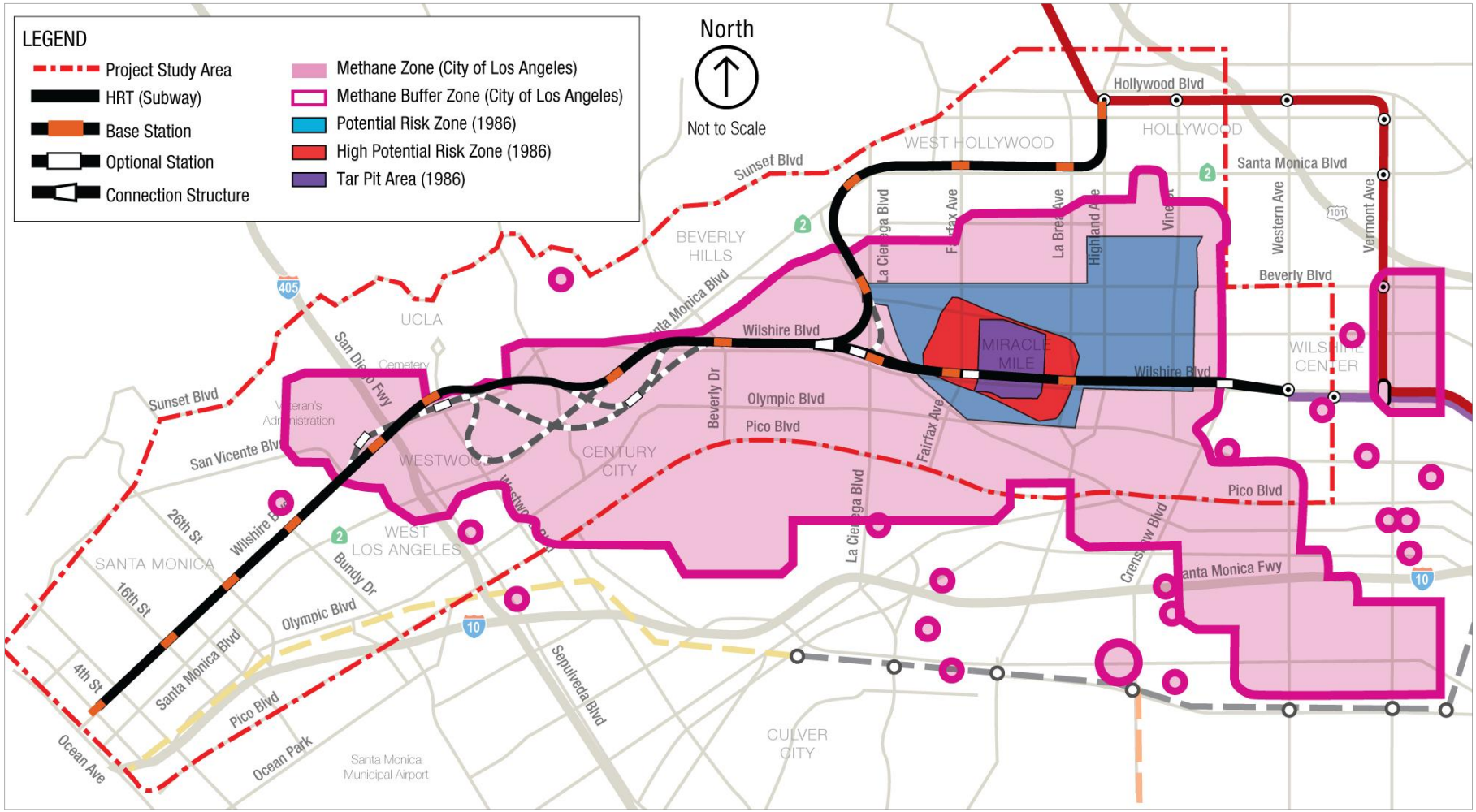
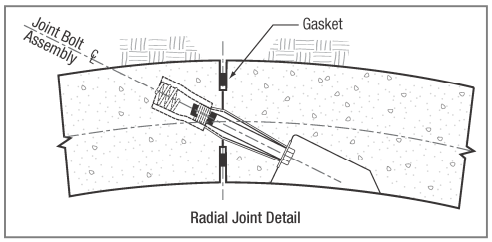


Figure 4-50. Methane Risk Zone

which it is believed that workers can be exposed continuously for a short period of time without suffering from 1) irritation, 2) chronic or irreversible tissue damage, or 3) narcosis of sufficient degree to increase the likelihood of accidental injury, impair self-rescue ability or materially reduce work efficiency, and provided that the daily exposure limit is not exceeded. A Short Term Exposure Limit is defined as a 15-minute total weighted average exposure that should not be exceeded at any time during a workday. Methane gas, while explosive, is not highly toxic. Rather, it is considered an asphyxiant, when oxygen is displaced. A total weighted average exposure of 1000 ppm (0.1percent) has recently been added to American Conference of Governmental Industrial Hygienists' recommended practices. Under normal atmospheric pressure, the minimal oxygen content should be 18 percent by volume.

Radon is gas that can cause lung cancer and other health problems. Los Angeles is located in an area with indoor radon potential of between 2.0 and 4.0 pico Curies per liter of air (pCi/l). The EPA action level for radon is above 4.0 pCi/l; hence radon is not a large concern for the Project area.



Double-gasketed tunnel segment

Metro has extensively studied the characteristics of methane and hydrogen sulfide with respect to their effects on the construction and operation of its facilities, as Methane and Hydrogen Sulfide are present in the ground surrounding the existing Red and Purple Lines. As far back as 1984, Metro has been developing documents and methods for reducing or eliminating hazardous conditions in its facilities under construction and in operation. Some of these are discussed below.

- In 1984, Metro developed Alerting Report on Tunneling Liners, which included tunnel construction methods, lining methods, and ventilation requirements for the proposed 1983 alignment of the Red Line tunnels (along Wilshire Boulevard and Fairfax Avenue).
- In 1985, Metro commissioned the development of the Congressionally Ordered Reengineering Study that established methane conditions along alternative alignments and led to the re-alignment of the then proposed Metro Red Line into its current alignment.
- Metro designed a "two-pass" tunnel lining system for the Red Line that included a high-density polyethylene water and gas barrier in tunnel construction.
- Metro undertook a study for the Mid-City area to locate and monitor gas bearing geologic formations to determine the extent of the gas reservoirs, examine methods of treatment for pre-tunneling and tunneling timeframes, and recommend tunnel and station configurations to avoid the most gaseous areas.
- Metro implemented a double-gasketed tunnel liner that can "flex" enough to protect the tunnel from gas intrusion before, during and after an earthquake.
- Metro continuously monitors for gaseous environment in its tunnels and has emergency ventilation.

- During Construction Metro's contractors strictly adhere to California's Tunnel Safety Orders (California Code of Regulations, Title 8, Tunnel Safety Orders), including additional ventilation and "spark proof" equipment.

4.8.2 Oil Wells

A review of the State of California Division of Oil, Gas, and Geothermal Resources (DOGGR) Online Mapping System (DOMS 2010) identified oil wells listed in Table 4-45. For each alternative, the table shows oil wells within 100 feet of the outer edge of the proposed tunnel or station alignments and those that may be located within the tunnel area. The locations noted in the tables are approximate, since the DOMS maps are representational and are intended for general public use.

Table 4-45. Identified Oil Wells

Well Name/API No.	Location	Plan Sheet (Appendix A)	Approximate Station	Well Status
Alternatives 1, 2, and 3				
Wilton Corehole API 03706346	100 feet north of Wilshire and 50 feet west of Bronson	C-102	24+00-25+00	uncompleted and abandoned
Highland Corehole 1 and 2 API 03701151 API 03720045	100 feet south of Wilshire and 100 feet east of orange	C-105	94+00-96+00	uncompleted and abandoned
Chevron USA 10 API 0314970	50 feet north of Wilshire and 100 feet west of Fairfax	C107	157+00-159+00	idle
Chevron USA 49 API 03715144	50 feet north of Wilshire at McCarthy	C107	168+00-169+00	abandoned
Kansas Crude Co 1 API 03700991	10 feet north of North Santa Monica Blvd at Ensley	C114	346+00-348+00	abandoned
Kansas Crude Co 3 API 03700993	50 feet west of Warnall 200 feet north of North Santa Monica Blvd	C114	35+00-353+00	idle
Alternatives 4 and 5—				
Chevron Laurel Corehole 2 API 03706325	100 feet south of Santa Monica Blvd, west of Flores St	C205	13+00-135+00	abandoned
Chevron USA Arden PE 4 API: 03721199 Arden PE 1 API: 03716759 Arden Corehole 8 API: 03721237	South of Santa Monica Blvd curve to San Vicente	C207	176+00-183+00	abandoned
Beverly Oil Co. 9 API: 03714611	Within alignment	C208	206+00-209+00	abandoned
McDor Oil Co. 3 API: 03725120	20 feet east Sherbourne and south of Bonner	C208	206+00-20+009	abandoned
McDor Oil Co. 1 API: 03726465	50 feet east of Sherbourne and 50 feet north of Beverly Drive	C208	207+00-210+00	idle
Chevron USA Beverly 11 API: 03714613 Pico 3	Within alignment	C208	21+00-215+00	abandoned

Table 4-45. Identified Oil Wells (continued)

Well Name/API No.	Location	Plan Sheet (Appendix A)	Approximate Station	Well Status
API: 03714545				
Plains Exploration and Oil Co S-93 API: 03714616 Beverly A1 API: 03722000	10 to 20 feet east of alignment. Plains also has other multiple active and idle oil wells within 100 to 500 feet to the east of the alignment	C209	217+00-223+00	 idle active
Chevron USA Picot 2 API: 03714544	Within alignment 100 feet north of 3rd	C209	220+00-222+00	abandoned
Chevron USA Picot 1 API: 03714543	Within 10 feet west of alignment and 20 feet north of 3rd	C209	222+00-223+00	abandoned
Chevron USA Beverly 2 API: 03714604	Within 20 feet east of alignment and 30 feet north of 3rd	C209	222+00-223+00	abandoned
Chevron USA 139 API: 03715172	Within 20 feet east of alignment and 50 feet south of 3rd	C209	225+00-227+00	abandoned
Option 3 – Wilshire La Cienega – West with Transfer Station				
Chevron USA Rodeo 1 API: 03714549	20 feet east of San Vicente and 200 feet south of Maryland	C701 C	247+00-249+00	idle
Option 4—Constellation Station				
Chevron USA Rodeo 107 API: 03701069	Beverly Hills High School, 100 feet south of alignment at Constellation and 200 feet east of Century Park East	C-702 G	247+00-249+00	abandoned
Chevron USA Wolfskill 23 API: 03701104	On alignment 100 feet east of Century Park East	C-702 G	324+00-325+00	abandoned
Chevron USA Aladdin wells API: 03716545 Wolfskill wells API: 03701105 20th Century Fox Wells API: 03700985 Community Wells API: 03717552	On alignment and 50 feet north at NE corner of Constellation and Avenue of the Stars	C703G	335+00-336+00	abandoned
Option 4 Century City Santa Monica to UCLA East Route				
Kansas Crude Co 1 API 03700991	10 feet north of North Santa Monica Blvd at Ensley	C701 K	345+00-347+00	abandoned
Kansas Crude Co 3 API 03700993	50 feet west of Warnall 200 feet north of North Santa Monica Blvd	C701 K	350+00-352+00	buried idle
Option 4—Santa Monica to UCLA Middle and West Routes				
Union Oil Co. Gabel 2 API: 03701113	On north side of Santa Monica Blvd 300 feet east of Beverly Glen, within 30 feet of alignment	C701 L C701 M C701 N C701 O	356+00-358+00	abandoned

Table 4-45. Identified Oil Wells (continued)

Well Name/API No.	Location	Plan Sheet (Appendix A)	Approximate Station	Well Status
Option 4—Century City/ Constellation to UCLA, East route				
Chevron USA Wolfskill 23 API: 03701104	On alignment 100 feet east of Century Park East	C701 P C701Q	340+00-342+00	abandoned
Chevron USA Aladdin wells API: 03716545 Wolfskill wells API: 03701105 20th Century Fox Wells API: 03700985 Community Wells API: 03717552	On alignment and 50 feet north at NE corner of Constellation and Avenue of the Stars	C701P C701Q	340+00-342+00	abandoned
Union Oil Co. Gabel 2 API: 03701113	On Santa Monica Blvd 300 feet east of Beverly Glen Approximately 5- feet south of alignment	C701 P C701Q	358+00-360+00	abandoned
Option 4—Century City/ Constellation to UCLA, Middle and West Routes				
Chevron USA Wolfskill 23 API: 03701104	On alignment 100 feet east of Century Park East	C-701 R C-701 S C-701 T C701 U	340+00-342+00	abandoned
Chevron USA Aladdin wells API: 03716545 Wolfskill wells API: 03701105 20th Century Fox Wells API: 03700985 Community Wells API: 03717552	On alignment and 50 feet north at NE corner of Constellation and Avenue of the Stars	C-701 R C-701 S C-701 T C-701 U	340+00-342+00	abandoned

4.8.3 Impacts

No Build

Under the No Build Alternative, no new infrastructure would be built within the Study Area, aside from projects currently under construction or projects funded for construction, environmentally cleared, planned to be in operation by 2035, and identified in the Metro LRTP (Metro, 2010). Projects in the No Build Alternative may be subject to the identified hazards discussed above; however, the alternative would not result in increased risk or exposure of people or property to the hazards discussed above.

TSM Alternative

This alternative enhances the No Build Alternative by expanding the Metro Rapid bus services operating in the Westside Transit Corridor. The TSM Alternative will be subject to the identified hazards discussed above; however, the alternative would not result in increased risk or exposure of people or property to the hazards discussed above.

Build Alternatives

Surface Fault Rupture

Multiple segments of the Santa Monica Fault cross all of the Build Alternatives. In addition to the Santa Monica Fault, the West Beverly Hills Lineament crosses the Study Area in the vicinity of the intersection of Moreno Drive and Santa Monica Boulevard in the Century City area. Alternative 3 and 5 are also subject to impact from surface fault rupture hazard at three additional locations: the vicinity of Wilshire Boulevard and Bundy Drive, Wilshire Boulevard between Stanford and Harvard Streets, and Wilshire Boulevard between Chelsea and 21st Streets.

No known faults cross the maintenance yards. Therefore, hazard from surface fault rupture does not pose a substantial hazard in these areas.

Because surface faulting is generally confined to a relative narrow zone 10s to several hundred feet wide, avoidance can be a practical means of avoiding surface fault rupture hazards for facilities such as stations. However, for linear facilities such as the tunnels, avoidance may not be possible. Where possible, design would allow for the tunnels to cross the faults as perpendicular to the fault line as possible to limit the area of potential damage. Depending on the predicted fault off set and area over which the movement is distributed, some distortion may be accommodated by the structure.

Implementation of **GEO-1** and **GEO-2** allow for easier and more expedient repair of the tunnels and tracks following damage from fault rupture. Where fault rupture displacement may be distributed over a longer distance, more flexible tunnel lining such as steel tunnel lining segments that can accommodate some strain will be considered.

Seismic Ground Shaking

The Build Alternatives, the maintenance yards, and the Rail Operations Center, like most sites in southern California, are susceptible to strong ground shaking generated during earthquakes on nearby faults. Based on probabilistic estimates of ground motion, the peak ground acceleration for the operating design earthquake along the alignment was shown in Table 4-43.

Differential Seismic Settlement

The subway train tracks are located between 50 and 130 feet below the ground surface. Figure 4-47 shows a schematic geologic profile along the corridor in relation to the depth of the tunnel from Wilshire/Western Station to the Westwood/VA Hospital Station (Alternative 2). More detailed geologic profiles for Alternatives 3 and 4 may be found in the *Westside Subway Extension Geotechnical and Hazardous Materials Technical Report*.

Sedimentary bedrock units of the Miocene-age Puente Formation underlie the San Pedro Formation along Alternatives 1 through 3 and MOS 1 and 2 from the Western Avenue Station west to about South Windsor Boulevard. However, the Puente Formation is expected to underlie the Fernando Formation at depths greater than 210 feet below ground surface (bgs) west of Crenshaw Boulevard.

The geology along the corridors from Westwood/VA Hospital to Wilshire/4th Street Station and from Hollywood/Highland to the connection structure between Wilshire/La

Cienega and Wilshire/Rodeo Station are similar. Old Alluvium (also described as the Lakewood Formation in some areas) is overlain by fill or Young Alluvium. In these areas, the Project tunnel would primarily be located with Old Alluvium and at depths below the recently deposited alluvium or artificial fill as shown in Figure 4-47. The tunnels will not be subject to differential seismic settlement. Likewise, the stations are subterranean and therefore, hazard from differential seismic settlement is not considered to be a significant impact for any of the alignment alternatives.

The West Hollywood portion of Alternatives 4 and 5 will encounter Pleistocene age Lakewood Formation and older alluvial sediments overlain by variable thicknesses of Holocene (younger) alluvial sediments. The other alternatives will encounter several geologic units that range in age from Miocene to Holocene. The geologic units that may be encountered in tunnel excavations are, from oldest to youngest, the Miocene-age Puente Formation, the Pliocene-age Fernando Formation, the Pleistocene age San Pedro and Lakewood Formations, Pleistocene (older) alluvium, and Holocene (younger) alluvium. The Puente, Fernando and San Pedro Formations would be encountered at variable depths in the subsurface beneath a variable thickness of Holocene and late Pleistocene sediments (Lakewood Formation and older alluvium) between the existing Wilshire/Western Station to Wilshire/Fairfax Station.

In general, the Project tunnel would primarily be located with Old Alluvium and at depths below the recently deposited alluvium or artificial fill as shown in . The tunnels will not be subject to differential seismic settlement. Likewise, the stations are subterranean and therefore, hazard from differential seismic settlement is not considered to be a significant impact for any of the alignment alternatives.

Liquefaction

Since the tunnels will be developed below potentially liquefiable surficial Holocene soils, liquefaction is not considered a potential seismic hazard to the tunnel components of the Project. However, due to the presence of shallow groundwater and young surficial alluvial deposits, there may be potential adverse impacts from liquefaction adjacent to the upper portions of some station walls at the Wilshire/La Cienega, Westwood/UCLA, Wilshire/VA, Wilshire/Bundy Station, Santa Monica/San Vicente and Beverly Center Stations.

The Union Pacific Los Angeles Transportation Center Rail Yard is located on potentially liquefiable soils. Therefore, hazard from liquefaction potentially poses a potentially significant impact to this yard. Liquefaction is not considered a significant hazard at the Turnback Facility and the Storage Yard Expansion.

Subsidence

No current substantial subsidence problems related to petroleum or groundwater extraction have been identified in the vicinity of the Project alignment. Therefore the subsidence related to extraction of petroleum and groundwater is not considered a significant hazard to the Project. There is however the potential for ground subsidence related to construction activities such as tunneling and dewatering at station areas along the full lengths of all the proposed alignment alternatives. Therefore, tunneling and construction dewatering induced subsidence poses a potentially adverse impact Impacts

due to subsidence are discussed in Section 4.15. Subsidence is not considered an impact during operations.

No current substantial subsidence problems related to oil or groundwater pumping has been identified in the vicinity of the maintenance yards. Therefore, the subsidence related to extraction of petroleum and groundwater is not considered a substantial hazard at any of the yards.

Hazardous Subsurface Gas and Oil Fields

Methane and hydrogen sulfide are present in concentrations higher than those encountered in Metro's Red Line Construction, along about 1.1 mile along Wilshire Boulevard from about South Burnside Avenue on the east to about South La Jolla Avenue on the west. The entire alignment passes through an area characterized by oil and gas fields and thus the possibility of encountering gaseous conditions cannot be completely discounted for any portion of the alignment. Therefore, hazardous subsurface gasses pose a significant hazard for all the Build Alternatives. The expanded Division 20 yard is located adjacent to the Union Station Oil field. As such, there is some potential that methane and hydrogen sulfide are present in this area. However, it is not anticipated that the maintenance yards will require construction of any subterranean structures. Therefore, hazardous subsurface gasses are not considered to pose a significant hazard to the maintenance yards.

Abandoned oil wells have been identified near or within the proposed alternative alignments. There is a potential for encountering wells during construction if the tunnel is not aligned to avoid these wells or the wells are not identified and re-abandoned prior to tunneling. The presence of existing oil wells is not considered a hazard for design or operation of the tunnels, and mitigations are discussed in Section 4.15, Construction Impacts and Mitigation

4.8.4 Mitigation Measures

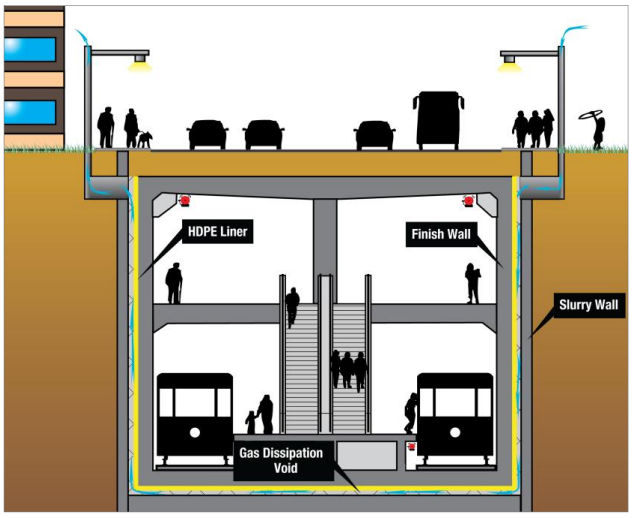
Construction and design would be performed in accordance with the latest Federal and State seismic and environmental requirements as well as State and local building codes. By compliance with these standards, potential impacts from these hazards would not be substantial significant. Tunnels and stations would be designed to provide a redundant protection system against gas intrusion hazard. The following measures are also included to avoid and minimize impacts:

- GEO-1—To minimize impacts related to repair of damage from surface fault rupture, the strategy used for the Red Line North Hollywood Extension would be applied. During design, geotechnical investigations would be undertaken to study the fault characteristics (location, width of zone, expected offset, etc.). Where sections cross a fault, a "Seismic Section" would be defined. At these Seismic Sections, alternatives for design would be dependent on the fault properties. Design alternatives could include oversized for a distance of longer than the fault zone so as to facilitate an expedient repair of the tunnel, realignment of the tracks, and reinstatement of train operations in the event of damage from ground rupture.

Another possible alternative to tunneling through a fault crossing—where the tunnel is relatively shallow—is to construct widened cut-and-cover box structures at those locations and incorporate a resilient and easily repaired support system for the trackwork as discussed above. If offset occurs over a longer distance a more flexible liner—such as steel segments—may be designed accommodate strain.

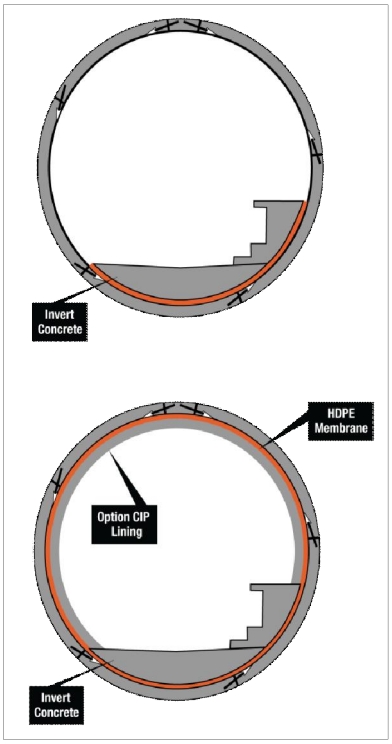
- GEO-2—Potential operational impact from fault rupture (i.e. derailment) to the safety of subway riders cannot be entirely mitigated. Increase in safety would be gained by installing linear monitoring systems along the tunnels within the zone of potential rupture to provide early warning triggered by strong ground motions and allow temporary control of subway traffic to reduce derailment risks. Metro would implement measures to provide uninterruptible fire, power, lighting and ventilation systems to increase safety.
- GEO-3—The only subway structures that are likely to be potentially affected by liquefaction of the surrounding soils are the upper portions of some station walls. This potential impact can be mitigated by designing the upper portions of the station walls to resist greater lateral earth pressures. If soils are found to be liquefiable at the LATC yard, several measures could be considered to mitigate liquefaction. For example, foundations for structures could require ground improvement prior to construction or pile design to reach non-liquefiable zones.
- GEO -4—Ground shaking: The structural elements of the alignment alternatives would be designed and constructed to resist or accommodate appropriate site-specific ground motions and conform to Metro Design Standards for the operating design earthquake and maximum design earthquake.
- GEO-5—The City of Los Angeles Municipal Code, Chapter IX, Building Regulations, Article 1, Division 71, Methane Seepage Regulations, requires construction projects located within the Methane Zone or Methane Buffer Zone to comply with the City's Methane Mitigation Standards to control methane intrusion emanating from geologic formations. Mitigation requirements are determined according to the actual methane levels and pressures detected on a site.
- GEO-6—As for the existing Red and Purple Lines, and the Metro Gold Line Eastside Extension, tunnels and stations would include gas monitoring and detection systems with alarms, as well as special ventilation equipment to dissipate gas. Measures include but are not limited to the following for both tunnel and station operation:
  - High volume ventilation systems with back-up power sources
  - Gas detection systems with alarms
  - Emergency ventilation triggered by the gas detection systems
  - Automatic equipment shut-off
  - Maintenance and Operations personnel training.

- GEO-7—The gassy conditions present are higher in gas concentrations and pressures than those encountered previously during design and construction of the Metro Red line and Gold line Eastside Extension underground structures. Thus Metro has undertaken special studies to develop comprehensive recommendations for analysis and testing during design phases. These include the following:



Station with Secondary Walls

  - Tunnels and stations would be designed to provide a redundant protection system against gas intrusion hazard. The primary protection from hazardous gases during operations is provided by the physical barriers (tunnel and station liner membranes) which keep gas out of tunnels and stations. As for the existing Metro Red and Purple Lines, and the Metro Gold Line Eastside Extension, tunnels and stations would include gas monitoring and detection systems with alarms, as well as special ventilation equipment to dissipate gas.
  - At the stations, it is anticipated that construction would be accomplished using slurry walls—or similar methods described above—to provide a reduction of gas inflows both during and after construction than would be possible with conventional soldier piles and lagging.
  - Other station design concepts to reduce gas and water leakage include additional barriers, and use of flexible sealants, such as poly-rubber gels, along with the high-density polyethylene that is used today on Metro's underground stations. Consideration of secondary station walls to provide an active system (low or high pressure barrier) would also be further studied. The evaluations would include laboratory testing programs such as those conducted for the Metro Goldline Eastside Extension during development of the double gasket system.



Double Liner Concept

Gas and waterproofing systems to be considered in preliminary and final design include:

- Specially designed precast concrete liners used for the primary tunnel lining and barrier

designed with the possibility of adding of a secondary liner as needed if leakage occurs at some future time.

- Lining to include thicker segments than what has been provided to date, so that wider gaskets can be used to increase the performance of the gasket seals.
- Reduced permeability tunnel segment concrete—The segments may include steel fibers or other types of fiber reinforcement for denser concrete as well as coatings.
- Double gasket design. The double gasket system provides a second seal for a more redundant system. This also facilitates post-installation repair of leaks (if needed) by grouting the areas between the gaskets.
- Segment Insert Materials—use of non-corrosive plastics, for example plastic dowels, at segment circumferential joints
- Rapid repair methods such as pre-installed grout tubes within water proofing systems.
- Other methods for gas and waterproofing would be added for evaluation as they are identified.

Metro's Tunnel Advisory Panel and other industry experts would review the specific testing program to be implemented as part of the Project. Specific Testing Programs would include:

- Segment leakage testing—gasket seal under pressure before, during, and after seismic movements. This would include various gasket materials and profiles (height and width)
- Gasket material properties –effective life and resistance to deterioration when subjected to man-made and natural contaminants, including methane, asphaltic materials and hydrogen sulfide.
- Concrete permeability
- Materials testing of high-density polyethylene, and alternative products such as poly-rubber gels, now in use in ground containing methane in other cities.
- New testing methods for high-density polyethylene joints. These are now being used for landfill liners and water tunnels under internal water pressure.
- Ground modification methods—ground treatment to reduce/neutralize, extraction or venting to remove, grouting to capture contaminants such as man-made contaminants, natural contaminants, methane, H2S, and the like.

4.8.5 CEQA Determination

Would the project

- Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:
  - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the State Geologist for the area or based on other substantial evidence of a known fault
  - Strong seismic ground shaking
  - Seismic-related ground failure, including liquefaction
  - Landslides
- Result in substantial soil erosion or the loss of topsoil

- Be located on a geologic unit or soil that is unstable or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction or collapse
- Be located on expansive soil, creating substantial risks to life or property
- Have soils incapable of adequately supporting the use of septic tanks or alternative wastewater disposal systems where sewers are not available for the disposal of wastewater

4.8.6 All Build Alternatives

The Project traverses the Santa Monica Fault Zone as well as some potential liquefaction zones. The Project would not result in an increased exposure to the risk associated with ground shaking, nor would it exacerbate pre-existing seismic conditions. This crossing of the Santa Monica fault would be a potentially significant impact; however, the mitigation measures described above would reduce impacts to less-than-significant levels.

4.8.7 Impacts Remaining After Mitigation

Implementation of the recommended mitigation measures would reduce the impacts related to geologic hazards and hazardous materials during the construction and operational phases of the Project to less than significant for all of the alternatives.

4.9 Hazardous Waste and Materials

This section summarizes the *Site Assessment Study* (Metro 2009) and the *Westside Subway Extension Geotechnical and Hazardous Materials Technical Report.* Additional information and details are provided in those reports.

4.9.1 Regulatory Setting

This section provides the Federal, State, and local regulations that are applicable to the hazardous materials concerns of the Project and its Study Area. The Project would extend through the incorporated cities of Los Angeles, Beverly Hills, West Hollywood, and Santa Monica, as well as unincorporated portions of Los Angeles County.

Federal

In addition to the National Environmental Policy Act of 1969, the following Federal regulations are applicable to the project.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) of 1980, otherwise known as the "Superfund Act," provides a Federal fund to identify, characterize, and remediate hazardous material sites. Through the Superfund Act, the U.S. Environmental Protection Agency (EPA) was granted the authority to identify and obtain the cooperation of parties responsible for hazardous material incidents and conditions.

U.S. Environmental Protection Agency All Appropriate Inquiry Rule

In November 2006, EPA adopted a final rule that established specific requirements for conducting all appropriate inquiries into previous site ownership, uses, and environmental conditions for qualifying for landowner liability protections under the Superfund Act. This rule recognizes the standard discussed below as a means to assess and indicate site hazardous material conditions.

American Society of Testing and Materials International (ASTM) E-1527-05

American Society of Testing and Materials International E-1527-05 is not a Federal regulation but a professional society standard for hazardous material site assessment that has become the national standard. It is recognized by the EPA as a means to assess and indicate a site's hazardous material conditions.

State

California Environmental Quality Act of 1970

The California Environmental Quality Act (CEQA) establishes a means to maintain and restore environmental quality for the public welfare. Under CEQA, the focus of the environmental analysis is on the physical change resulting from a project. However, the analysis of such changes may be traced back to non-physical changes, such as a revision in the use of an area that would cause physical changes.

California Health and Safety Code

Section 25316 and 25317 of the California Health and Safety Code identify hazardous material, substances, and wastes that require removal, including petroleum and petroleum byproducts.

Local

Municipal Regulatory Approach

The incorporated cities of Los Angeles, Beverly Hills, West Hollywood, and Santa Monica, as well as Los Angeles County, have departments that administer and oversee hazardous material concerns. Each of these entities has a general plan and zoning codes to address hazardous material concerns; they are most often administered through the County Fire Department and city emergency services.

4.9.2 Existing Conditions/Affected Environment

The alignments and maintenance yards are located within urban areas, Los Angeles, West Hollywood, Hollywood, Beverly Hills and Santa Monica. The urban areas around the alignments are characterized by paved streets, commercial office buildings, retail businesses, medical office buildings, museum property, Federal property, and residential homes and apartments.

The maintenance yards are located within an industrial area that includes parking lots, commercial buildings, existing railroad yards or railroad right-of-way. The proposed maintenance yard sites are currently active rail yards. Metro stores and maintains its Red Line/Purple Line vehicle fleet at the existing Division 20 Maintenance Facility at the site bound by 1st Avenue on the north, the Los Angeles River on the east, 4th Street on the south, and Santa Fe Avenue on the west. The Union Pacific Railroad Los Angeles Transportation Center Rail Yard is on the east side of the Los Angeles River and between the U.S. 101 and Interstate 5 highways. This rail yard supports the Union Pacific rail operations.

Study Area Hazardous Materials Conditions

Hazardous materials may be defined as solids, liquids, or gases that can harm humans, animals, property, or the environment. Often within urban environments, the more prevalent hazardous materials include petroleum products from gasoline stations and automotive service areas, cleaning solvents from dry cleaning operations, and various other hazardous materials at manufacturing and storage properties. Methane and hydrogen sulfide gas that may be naturally present in the soil are considered geologic hazards and are discussed in Section 4.8.

The activities undertaken to identify hazardous material conditions in the Study Area include reviewing historic topographic maps, aerial photos, fire insurance maps, and city directories; searches of government environmental databases; and site reconnaissance. A records search was conducted for hazardous wastes and materials within a 500-foot radius of the alignments and station areas, to assess whether activities on or near the alignments have the potential to create recognized environmental conditions onsite. For the maintenance yards, the search was limited to a 200-foot radius because the yards will be affected by conditions primarily at the surface. The complete list of databases reviewed is provided in the *Geotechnical and Hazardous Materials Technical Report* (Metro 2010). The results of the records search are discussed below.

Hazardous Material Properties Found in Topographic Maps, Fire Insurance Maps, Aerial Photographs, and City Directories

Review of Sanborn Maps, historic topographic maps, fire insurance maps, aerial photographs, and city directories was conducted to identify the former presence of properties of potential hazardous material concern. The historical review results in two histories based on the information reviewed: a history of the past use of the site and a history of the past use of the adjacent/nearby properties. The earliest historical references typically consulted date from 1940 or from the first developed use of the site or nearby properties.

The station locations are all located in urbanized areas of Los Angeles County. In many cases, the proposed station locations and adjacent properties have been developed since the early 1900s. The historical use on adjacent properties to each of the stations has ranged from residential, retail, commercial and light industrial. Additionally, a majority of the stations are located adjacent to properties that are/were occupied by businesses commonly associated with soil and ground water contamination (namely, automotive service stations, dry cleaners and light industrial operations).

Hazardous Material Properties Cited in Environmental Regulatory Databases

A review of government environmental regulatory databases is the most effective method of determining if properties within a study area have documented hazardous material concerns and what the state of such concerns may be. Table 4-46 includes a record of the results of the consultant's review of Federal, State, and local environmental regulatory databases.

A number of sites identified within the alignment as "closed" or "no further action" cases are listed as having less than significant impact based on the closed or no further action status. Table 4-46 lists those properties with a high level of potential for hazardous material impacts in the Study Area, including the following types of properties: 1) properties where documented releases have occurred and additional assessment is required or remediation is ongoing; 2) properties with residual contamination after regulatory agency closure; and 3) properties where additional information is needed because limited data are available in readily accessible environmental agency databases.

Reconnaissance

Reconnaissance of properties within, adjacent, and surrounding the project site was performed from public right-of-ways and other publically accessible areas. Concerns that may be observed in a reconnaissance included evidence of older transformers; drums and chemical containers; pits, ponds and septic areas; evidence of pesticide use; stressed vegetation; and monitoring wells. Certain businesses or occupations like dry-cleaning operations may typically use hazardous substances or generate hazardous waste. Other signs of potential environmental concerns include underground storage tanks (USTs), unusual odors, pools of liquids, drums, unidentified containers, illegal dumping sites, items that may contain polychlorinated biphenyls (PCBs), stains or corrosion, and drains or sumps.

Table 4-46. Properties with High Potential for Hazardous Material Impacts in the Study Area as Indicated in Environmental Regulatory Databases

Property	Hazardous Material Concern
Properties along Alternative 1	
3807 Wilshire Boulevard	Groundwater was affected by volatile organic compounds at this property with no apparent regulatory closure.
4180 Wilshire Boulevard	A gasoline release occurred in 1982 and gasoline was found floating on top of the groundwater at this property. The environmental regulatory listing shows that this property is currently undergoing remediation.
5034 Wilshire Boulevard	A release of perchloroethylene affected groundwater at this property and the property is shown as currently undergoing remediation.
5020 Wilshire Boulevard	A release of "other solvent or non-petroleum product" affected groundwater at this property, and the environment regulatory listing shows this property is currently undergoing assessment.
5151 Wilshire Boulevard	This property has an environmental regulatory listing as having a leaking underground storage tank, but does not indicate the date or the material released. The property showed as being "open-assessment and interim remedial action" as of January 13, 2009.
5220 Wilshire Boulevard	This property has an environmental regulatory listing as "open-site assessment" as of November 2008, with potential media affected and contaminants of concern not being reported and additional information not available.
5779 W. Wilshire Boulevard	This property was reported by the Los Angeles Fire Department in the environmental regulatory databases to have methane gas flowing at a rate of approximately 4 liters per minute near Curson Avenue and had reportedly been doing so for years.
8567 Wilshire Boulevard	A gasoline release affected groundwater at this property in 1990. Although the property was granted regulatory closure in January 2010, residual benzene remains in groundwater.
9988 Wilshire Boulevard	A gasoline release affected groundwater at this property in 1998, and elevated levels of tertiary butyl alcohol are reported as being present in groundwater. The environmental regulatory listing shows the property as being under "open-site assessment" as of August 8, 2007, with no apparent regulatory closure.
9815 Wilshire Boulevard	Releases of gasoline, waste oil, motor oil, hydraulic fluid, and lubricating oil affected this site. The potential media affected is listed as "under investigation," and the environmental regulatory listing indicates that the property is under "open-site assessment" as of June 2009 with no regulatory closure cited.
10301 Santa Monica Boulevard	The environmental regulatory listing for this property indicates that is under "open-site assessment" as of July 18, 2002, with the potential media affected and contaminants of concern not reported. Other environmental databases indicate that this property has ongoing assessment activities and groundwater monitoring is under way.
10389 Santa Monica Boulevard	A release of diesel affected groundwater at this property in 1987. Environmental regulatory listings show that the property is under "open-site assessment" as of May 4, 2006, with other environmental databases showing that groundwater remediation is ongoing at this site to remove elevated levels of total petroleum hydrocarbons as gasoline, benzene, methyl tertiary-butyl ether, and tertiary butyl alcohol. Gasoline was also observed floating on top of groundwater at this property.
Properties along Alternative 2	
No additional properties were identified in the environmental regulatory database searches that indicate potential for hazardous material-related concern to the Project in the additional area of Alternative 2.	
Properties along Alternative 3	
11666 Wilshire Boulevard	A gasoline release affected groundwater at this property in 2000. The environmental regulatory listing indicates that the property is under "open–remediation" as of November 8, 2007, and other environmental database listings indicate that groundwater monitoring is being performed at this site.

Table 4-46. Properties with High Potential for Hazardous Material Impacts in the Study Area as Indicated in Environmental Regulatory Databases (continued)

Property	Hazardous Material Concern
12054 Wilshire Boulevard	A gasoline release affected groundwater at this property in 1987 and the leaking underground storage tanks environmental regulatory databases showed it as being "completed–case closed" as of October 2009. However, another environmental regulatory database indicates that the property has residual benzene contamination in groundwater.
432 Wilshire Boulevard	A gasoline release affected soil only at this property at an unspecified time and the leaking underground storage tanks environmental regulatory databases showed it as being "open–site assessment" as of January 2009, with no further information found after the January 2009 timeframe.
Properties along Alternative 4	
7116 Santa Monica Boulevard	A release of an unspecified contaminant affected this property at an unspecified time. Environmental regulatory databases indicate that the property is under "open–site assessment" as of April 2008, with no further information available after April 2008.
7144 Santa Monica Boulevard	A release of gasoline affected this property in 1991. Environmental regulatory databases indicate that the property is under "open–site assessment" as of May 2001, with no further information available after May 2001.
7564 Santa Monica Boulevard	A release of "hydrocarbon," gasoline, and diesel affected this property in 1991 and 2001. Environmental regulatory databases indicate that the property is under "open–site assessment" as of September 5, 2001. Additional environmental regulatory databases indicate that no groundwater data are available related to this case and that groundwater monitoring wells are required.
7643 Santa Monica Boulevard	A release of gasoline affected this property in 1994 with the media affected not being reported. Environmental regulatory databases indicate that the property is listed as "leak being confirmed" as of May 2001 and soil sampling being performed in 2003 with no further information found.
1154 N. La Brea Avenue	A release of gasoline affected this property at an unspecified time, with the media affected not being reported. Environmental regulatory databases indicate that the property is under "open–site assessment" as of April 25, 2008, with the extent of groundwater contamination not being determined and elevated levels of total petroleum hydrocarbons as gasoline and benzene being present in groundwater. Four groundwater monitoring wells are located on this site.
8032 Santa Monica Boulevard	A release of perchloroethylene affected groundwater at this property. Environmental regulatory databases indicate that the property is under "open–site assessment" as of June 12, 2006, with no further information found after 2006.
8100 Santa Monica Boulevard	A release of volatile organic compounds affected this property at an unspecified time, with the media affected not being reported. Environmental regulatory databases indicate that the property is under "open–site assessment" as of November 16, 1999, with no further information available after 2009.
8122 Santa Monica Boulevard	A release of volatile organic compounds affected this property at an unspecified time. Environmental regulatory databases indicate that the property is an open case, with notices of violation for failure to provide work plans.
8380 Santa Monica Boulevard	A gasoline release affected groundwater at this property at an unspecified time. Environmental regulatory databases indicate that the property is under "open–remediation" as of February 5, 2004, with groundwater being indicated as impacted with elevated levels of methyl tertiary-butyl ether and remediation ongoing.
8725 Santa Monica Boulevard	A release of volatile organic compounds affected this property at an unspecified time. Environmental regulatory databases indicate that the property obtained regulatory closure for volatile organic compound soil remediation in 2003, but groundwater remains impacted with perchloroethylene, which shows as being under "open–remediation" as of March 30, 2009, with no further information found.
8800 Santa Monica Boulevard	A release of diesel affected groundwater at this property in 1985. Environmental regulatory databases indicate that the property is under "open–site assessment" as of October 19, 2004, with groundwater being impacted with diesel floating on top, which is being removed. No post-2004 information was found.

Table 4-46. Properties with High Potential for Hazardous Material Impacts in the Study Area as Indicated in Environmental Regulatory Databases (continued)

Property	Hazardous Material Concern
NW Corner 8655 Beverly Boulevard	This property is identified as a closed solid waste disposal site with the date of closure not being reported. The California Solid Waste Information System indicates that the property's last inspection was performed on November 13, 2007. Although no violations or areas of concern were reported in 2007, the exact location of this former solid waste disposal site cannot be determined based on the information available.
8550 W. 3rd St., Suite 100	A release of volatile organic compounds affected groundwater and soil at this property at an unspecified time. Environmental regulatory databases indicate that the property is under "open–remediation" as of January 20, 2009. Groundwater is impacted with perchloroethylene, trichloroethylene and volatile organic compounds, and monitoring and remediation are ongoing.
300 S. La Cienega Boulevard	A gasoline release affected groundwater at this property in 1999, with environmental regulatory databases indicating the property is under "open–remediation" as of June 9, 2008. Groundwater is impacted with elevated levels of total petroleum hydrocarbons as gasoline, benzene, methyl tertiary-butyl ether, and tertiary butyl alcohol, and remediation is underway.
Properties along Alternative 5	
Alternative Alignment 5 includes Alternatives 1 through 4. Because of this, the citations above for Alternatives 1 through 4 cover sites that would be along Alternative 5.	
MOS 1 (Fairfax Extension) and MOS 2 (Century City Extension)	
MOS 1 and MOS 2 are included in Alternative 1; Because of this, the citations above for Alternative 1 cover sites that would be along MOS 1 and MOS 2.	
Union Pacific Los Angeles Transportation Center Maintenance Yard	
1430 Bolero Lane	Releases of TPH, volatile organic compounds, and metals including arsenic and chromium affected this property at unspecified times, with the media affected not being specified. Environmental regulatory databases indicate that the property is under "open–site assessment" as of June 13, 2000, with additional information found.
490, 496, 498 Bauchet Street	This property was historically the location of a large manufactured gas plant, with soils reportedly being impacted by petroleum hydrocarbons, volatile organic compounds, metals (including arsenic and lead), and polynuclear aromatic hydrocarbons. Remediation of this property was performed to risk-based cleanup levels, and the property was granted regulatory closure. However, since soils are at risk-based levels, they could still affect the Project.
Keller Yard south of Caesar Chavez	This property was part of a manufactured gas plant. Its soils were impacted by petroleum hydrocarbons, volatile organic compounds, metals (including arsenic and lead), and polynuclear aromatic hydrocarbons. Environmental regulatory databases indicate that the property remains open and remediation has not been completed.
Expanded Division 20 Yard and Turnback Facility	
590 S. Santa Fe Avenue	This property was used historically for the manufacture of paints and inks using solvents. Numerous underground storage tanks were operated onsite. Soil and groundwater were affected by contaminants such as benzene, ethylbenzene, dichloroethane, and other chemicals. Environmental regulatory databases indicate that this property is an active voluntary cleanup site, but there is no indication that remedial action has occurred. The proposed Turnback Facility is located within the Division 20 Maintenance Yard. Because of this, the citations above for the Expanded Division 20 Yard cover sites that would potentially impact the proposed Turnback Facility location. No additional properties were identified in the environmental regulatory database searches that indicate a high potential for hazardous material related concern to the project Turnback Facility location.

Sources: Tables 3.4.1 through 3.4.9 of the Geotechnical and Hazardous Material Technical Report (Metro 2010)

No dry cleaning activities were observed on the sites, but several were observed adjacent to many of the sites. Evidence of stored hazardous substances or petroleum products was not observed on the sites during the reconnaissance. Additionally, obvious evidence of surficial spills or leaks migrating from properties onto the Project sites was not noted. Motor oil staining from vehicles was noted on the asphalt/concrete surface of each site. Although, asbestos and lead-based paints are typically concerns to be observed, they are largely building-specific. The reconnaissance revealed no concerns with respect to most of the above-listed issues, with the exception of some gasoline stations with USTs and adjacent dry-cleaning operations, nearly all of which are shown in Figure 4-51 and Figure 4-52 as well as discussed in Table 4-46.

4.9.3 Environmental Impacts/Environmental Consequences

No Build

Under the No Build Alternative, no new infrastructure would be built within the Study Area, aside from projects currently under construction or projects funded for construction, environmentally cleared, planned to be in operation by 2035, and identified in the Metro Long Range Transportation Plan (Metro 2010). The No Build Alternative would not result in the potential for risk of long-term hazardous material exposure.

TSM Alternative

The TSM Alternative enhances the No Build Alternative by expanding the Metro Rapid bus services operating in the Westside Transit Corridor. The TSM Alternative would not include activities that would result in the potential for risk of long-term hazardous material exposure. Therefore, no adverse effects are anticipated.

Build Alternatives

As shown in Table 4-46, several gas stations, dry cleaners and other facilities with a history of hazardous materials incidences occur within the Study Area. The alignments of the Build Alternatives are in close proximity to areas where underground storage tanks, volatile organic compounds and oil exploration sites also occur. Oil exploration and natural oil seeps occur along Wilshire Boulevard between La Brea and La Cienega Boulevards and also within Century City. All of these areas have the potential for contaminated soils and/or groundwater.

In most cases, the tunnel is expected to be under the lowest point of contaminated soils; there would be no or low potential impact. However, if contaminants were in groundwater, the Project has a high likelihood of encountering these contaminants due to shallow water tables. Dewatering could be necessary during the operation of the Build Alternatives. Any water intrusion in the tunnels or stations would be pumped out and treated in accordance with applicable permits prior to discharge or disposal. In general operations of facilities would be conducted in accordance with all Federal and State regulatory requirements that are intended to prevent or manage hazards. Therefore, Project operations would not result in any adverse effects related to hazardous materials.

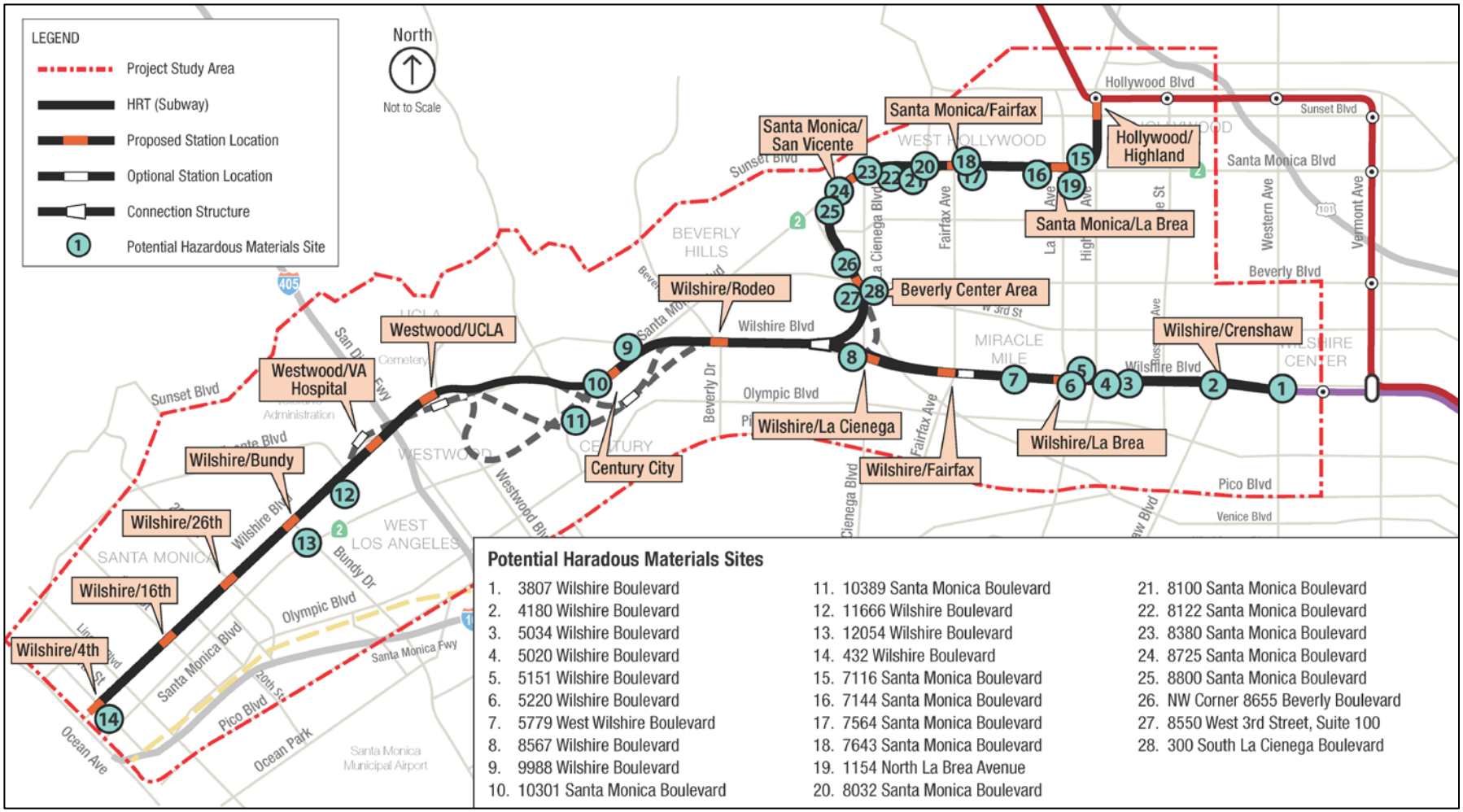


Figure 4-51. Potential Hazardous Materials Sites near the Project Corridor

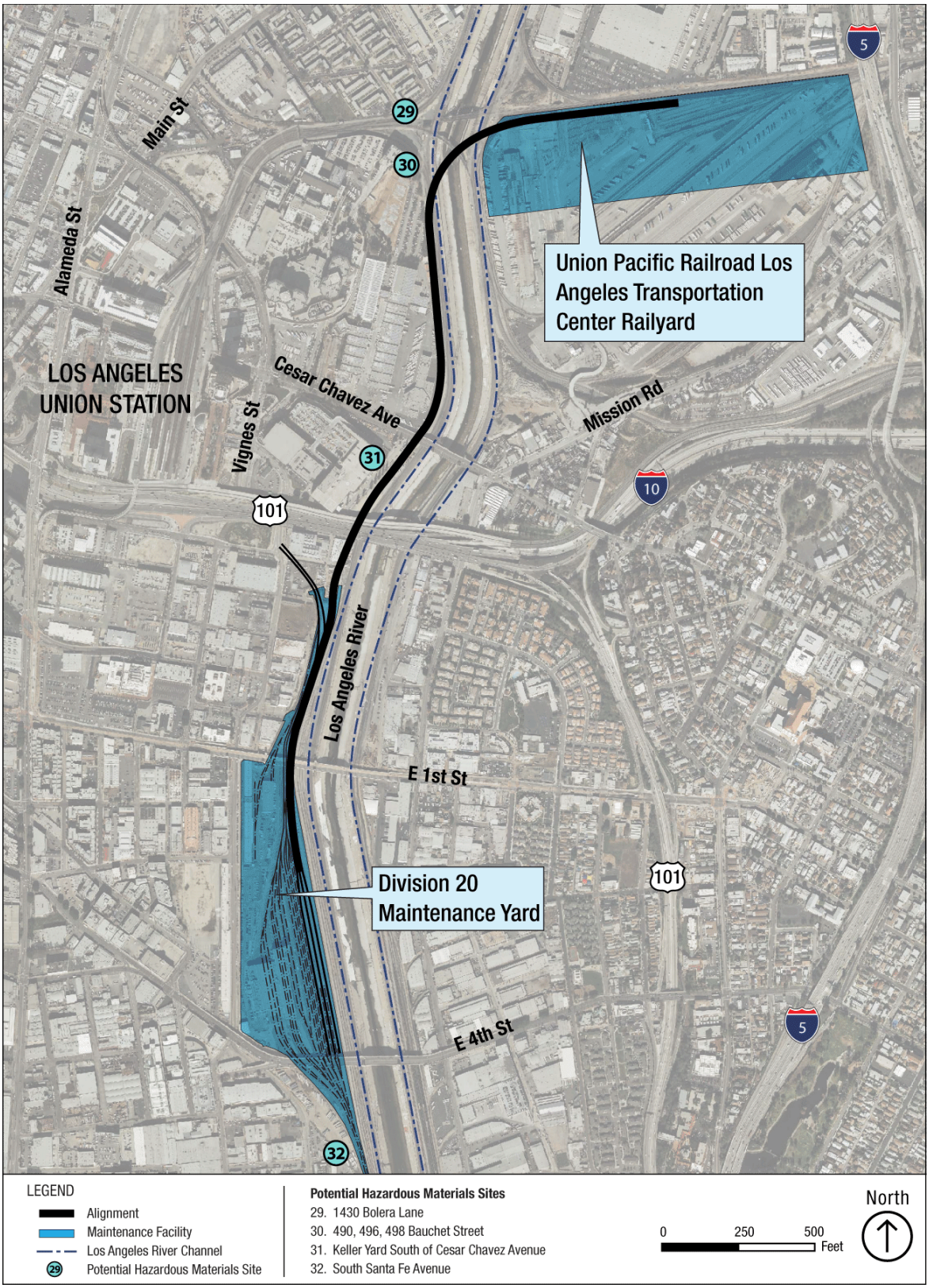


Figure 4-52. Potential Hazardous Materials Sites near the Proposed Maintenance Facilities

Although, asbestos and lead-based paints are typically concerns to be observed, they are largely building-specific and would not have a major bearing on project implementation because the Project is largely subterranean. Asbestos and lead-based paints may be encountered in buildings to be demolished for the staging and station access sites (See Section 4.15).

Maintenance Yards

Features included in the maintenance yard sites will require storing hazardous materials/waste on-site and consist of a storage yard for the heavy rail transit vehicles, a maintenance area, a car wash building, and other support for the yard and shop. Operations and maintenance will require routine transport, use, or disposal of hazardous materials. These materials would typically include fuel, oil, solvents, cleansers and other materials, which are not considered acutely hazardous.

There is the potential for hazardous materials/waste spills to occur; however, it is assumed that the storage and disposal of hazardous materials/waste will be conducted in accordance with all Federal and State regulatory requirements that are intended to prevent or manage hazards and that if a spill does occur, it will be remediated accordingly. No long-term hazardous material impacts are anticipated.

4.9.4 Mitigation Measures

The No Build and TSM are not expected to result in impacts related to hazardous materials. In addition to the measures outlined for geologic hazards, measures for hazardous materials for the Build Alternatives include the following:

- **HAZ-1**—Continued treatment of groundwater from underground structures, if necessary
- **HAZ-2**—Emergency response would be developed in conformance with Federal, State and local regulations in the unlikely event of a major hazardous materials release close to or within the vicinity of the proposed Project, particularly the maintenance facilities.

4.9.5 California Environmental Quality Act (CEQA) Determination

Categories of potential hazardous material impacts are set forth by the California Public Resources Code, and CEQA Guidelines. For the purposes of this analysis, an impact was considered to be significant if it would result in any of the following:

- Creates a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.
- Creates a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment.
- Located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.
- Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within 0.25 mile of an existing or proposed school

- Would result in a safety hazard for people residing or working in the project area (applies to a project located within an airport land use plan or, where such a plan has not been adopted, within 2 miles of a public airport or public use airport)
- For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?
- Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan
- Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands

Operations and maintenance would require routine transport, use, or disposal of hazardous materials. These materials would typically include fuel, oil, solvents, cleansers and other materials, which are not considered acutely hazardous. Operation of the Build Alternatives is not anticipated to result in exposure to acutely hazardous materials. The Build Alternatives are not located within 2 miles of an airport or airport strip and would not result in a safety hazard for people working in the area.

The Project operations would not impair implementation of or physically interfere with an adopted emergency response or evacuation plans. The Build Alternatives would not expose people or structures to a significant risk of loss, injury, or death involving wildland fires. The Project would be implemented in accordance with all Federal and State requirements. Therefore, a less-than-significant impact is anticipated for exposure to hazardous materials.

Potential impacts associated with hazardous materials associated with facilities along the alignment and maintenance yards would be less than significant with the implementation of HAZ-1 and HAZ-2.

4.10 Ecosystems/Biological Resources

Information in this section is summarized from the *Westside Subway Extension Ecosystems/Biological Resources Technical Report*, where additional detailed information and species lists are provided.

4.10.1 Regulatory Setting

Federal

Endangered Species Act

The Endangered Species Act (ESA) conserves endangered and threatened species and the ecosystems they depend upon (USC 1995). Section 7 requires Federal agencies to aid in conserving listed species, and to ensure that activities of Federal agencies will not jeopardize the continued existence of listed species or adversely modify designated critical habitat. The U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration Fisheries Service (NOAA/FS) administer the ESA.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act decrees that all migratory birds and their parts (including eggs, nests, and feathers) are fully protected (USC 1918). Taking, killing, or possessing migratory birds is unlawful. Projects that affect birds protected under the Migratory Bird Treaty Act will require a take permit from the USFWS.

State

California Coastal Act

The California Coastal Act of 1976 established policies for protecting the natural resources and ecosystems within the coastal zone and established the California Coastal Commission to regulate coastal zone development. In the City of Santa Monica, the Coastal Act applies to the small portion of the project area within the coastal zone.

California Endangered Species Act

The California Department of Fish and Game (CDFG) is responsible for administering the California Endangered Species Act (CESA). For projects that affect State and Federal listed species, compliance with the ESA will satisfy the CESA if the CDFG determines that the Federal incidental take authorization is "consistent" with the CESA. Projects that result in a take of a State-only listed species require a take permit under the CESA.

California Fish and Game Code Sections 3500—3705, Migratory Bird Protection

Sections 3500-3705 regulate the taking of migratory birds and their nests. These codes prohibit taking nesting birds, their nests, eggs, or any portion thereof during the nesting season, typically, from March 1st through August 30th.

Local

The following is a description of local applicable regulations.

- **Los Angeles County General Plan Conservation and Open Space** element identifies Significant Ecological Areas and sets forth the goal of conserving these areas.

- **City of Los Angeles General Plan Conservation Element** sets forth objectives and policies for protecting biological resources, including endangered species and habitats.
- **City of Los Angeles Native Tree Protection Ordinance No. 177,404** protects native tree habitat. Removing protected trees requires a Board of Public Works permit, and any act that may cause the failure or death of a protected tree requires a City Urban Forestry Division inspection.
- **City of West Hollywood Municipal Code** has an ordinance protecting trees and other plant species on public property. The ordinance requires a permit to alter any plant species on public property.
- **City of Beverly Hills General Plan** protects biological and ecological resources with natural and open space protection, urban forest management, and retention of trees of significance.
- **City of Beverly Hills Municipal Code** requires a tree removal permit for a protected tree. Native trees that are removed must be replaced. Section 10-3-2905 requires protection of native trees during construction with fencing or other measures.
- **City of Santa Monica Municipal Code** protects trees from damage or removal during construction projects. A permit is required for any removal or damage, and the permit may require replacing removed or damaged trees.

4.10.2 Affected Environment/Exisiting Conditions

The Study Area for ecosystems/biological resources is defined as the specific area that has the potential to be affected by a Project alternative. The Study Area for the No Build and TSM Alternatives is the overall Study Area. For the Build Alternatives, the Study Area is the area within one-quarter mile of each proposed alignment, station, and maintenance and operations site.

The California Natural Diversity Database (CNDDB) was searched to identify sensitive plants and animals with the potential to occur in the Study Area. A visual review of parks and other public open spaces to identify ecosystems and biological resources was also conducted. A visual review consists of observation and photographic documentation of parks and open space areas as well as mature trees and wildlife, including birds, observed within the Study Area. General field reconnaissance work was conducted to identify habitat features within the project area. Habitat was generally assessed as to its quality and suitability for wildlife species, including threatened and endangered species.

As shown in Table 4-47, 41 Federal- and/or State-listed threatened, endangered, species of concern, and/or candidate plant or wildlife species were reported by the CNDDB and California Native Plant Society (CNPS) as occurring within the 7.5-minute U.S. Geological Survey topographic quadrangles comprising the Study Area. However, none of these special status species were observed in the Study Area, including in the vicinity of proposed station areas, within station construction footprints, or in the vicinity of the maintenance and operations facility sites. In addition, no suitable habitat for any of these special status species was observed in the Study Area. The Study Area is within a densely developed and urbanized area with limited ecosystems/biological resources.

Table 4-47. Special Status Wildlife and Plant Species Potentially in the Study Area

	Common Name	Scientific Name	Status
Birds	Burrowing Owl	*Athene cunicularia*	SC
	Southwestern Willow Flycatcher	*Empidonax traillii extimus*	FE, CE
	Coastal California Gnatcatcher	*Polioptila californica californica*	FT, SC
Mammals	Pallid Bat	*Antrozous pallidus*	SC[1]
	Western Mastiff Bat	*Eumops perotis californicus*	SC[1]
	Silver-haired bat	*Lasionycteris noctivagans*	None
	Hoary Bat	*Lasiurus cinereus*	None
	Big Free-tailed Bat	*Nyctinomops macrotis*	SC
	South Coast Marsh Vole	*Microtus californicus stephensi*	SC
	American Badger	*Taxidea taxus*	SC
Reptiles	Coast (San Diego) Horned Lizard	*Phrynosoma coronatum (blainvillii* population*)*	SC
	Coastal whiptail	*Aspidoscelis tigris stejnegeri*	None
Invertebrates	Busck's Gallmoth	*Carolella busckana*	None
	Sandy Beach Tiger Beetle	*Cicindela hirticollis gravida*	None
	Globose Dune Beetle	*Coelus globosus*	None
	Monarch Butterfly	*Danaus plexippus*	None
	Gertsch's socalchemmis spider	*Socalchemmis gertschi*	None
Plants	Marsh Sandwort	*Arenaria paludicola*	FE, CE, PEC
	Braunton's Milk-vetch	*Astragalus brauntonii*	FE, PEC
	Ventura Marsh Milk-vetch	*Astragalus pycnostachyus* var. *lanosissimus*	FE, CE, PEC
	Coastal Dunes Milk-vetch	*Astragalus tener* var. *titi*	FE, CE, PEC
	Parish's Brittlescale	*Atriplex parishii*	PEC
	Davidson's Saltscale	*Atriplex serenana* var. *davidsonii*	FEC
	Round-leaved Filaree	*California macrophylla*	PEC
	Plummer's Mariposa-lily	*Calochortus plummerae*	FEC
	Santa Barbara Morning-glory	*Calystegia sepium* ssp. *binghamiae*	PEC
	Southern Tarplant	*Centromadia parryi* ssp. *australis*	SEC
	Salt Marsh Bird's-beak	*Cordylanthus maritimus* ssp. *maritimus*	FE, CE, FEC
	Beach Spectaclepod	*Dithyrea maritima*	CT, SEC
	Many-stemmed Dudleya	*Dudleya multicaulis*	FEC
	Los Angeles Sunflower	*Helianthus nuttallii* ssp. *parishii*	PEC
	Mesa Horkelia	*Horkelia cuneata* ssp. *puberula*	SEC
	Orcutt's Linanthus	*Linanthus orcuttii*	NVEC
	Mud Nama	*Nama stenocarpum*	RTECCE
	Gambel's Water Cress	*Nasturtium gambelii*	FE, CT, SEC
	Prostrate Vernal Pool Navarretia	*Navarretia prostrata*	SEC
	White Rabbit-tobacco	*Pseudognaphalium leucocephalum*	RTECCE
	Parish's Gooseberry	*Ribes divaricatum* var. *parishii*	PEC
	Salt Spring Checkerbloom	*Sidalcea neomexicana*	RTECCE
	San Bernardino Aster	*Symphyotrichum defoliatum*	FEC
	Greata's Aster	*Symphyotrichum greatae*	NVEC

Source: California Natural Diversity Database, July 31, 2009.

CE = California Endangered (CDFG)
CT = California Threatened (CDFG)
FE = Federally Endangered (USFWS)
FEC = Fairly Endangered in California (CNPS)
FT = Federally Threatened (USFWS)
NVEC = Not Very Endangered in California (CNPS)
PEC = Presumed Extinct in California (CNPS)
RTECCE = Rare, Threatened or Endangered in California but More Common Elsewhere (CNPS)
SC = Species of Concern in California (CDFG)
SEC = Seriously Endangered in California (CNPS)

Land cover in the Study Area is predominantly urban development with irrigated and maintained landscaping and some mature trees. Some migratory bird species may use these trees during migration. Native trees, including southern coast live oak riparian forest, California walnut woodland, and southern sycamore alder riparian and walnut forest have the potential to occur in the Study Area. No sensitive vegetation communities were observed.

The Study Area is composed of and surrounded by residential, commercial, and industrial uses and heavily travelled arterials. There are no habitat conservation plans and no significant ecological areas in the Study Area. As such, the Study Area does not link significant wildlife habitat and does not contain wildlife corridors that would support movement of wildlife species other than birds. Due to their mobility, some sensitive bird species may utilize existing mature trees during migration but would not be supported as residents within this urbanized setting.

Two locations along Wilshire Boulevard have open space that supports mature trees and other vegetation. One location is Hancock Park, where most of the vegetation is non-native, although some native trees, including sycamores, are present. The other location with open space is the Los Angeles Country Club, where the golf course contains mature, primarily non-native, vegetation that supports bird and wildlife habitat. Furthermore, California sycamore trees were observed in areas proposed for the following stations: Wilshire/La Brea, Santa Monica/La Brea, Santa Monica/San Vicente, and Beverly Center Area. Also, Santa Monica Beach provides some foraging habitat for coastal and marine species. However, human use limits native wildlife use and prohibits nesting of special-status bird species.

Division 20, the site of the existing maintenance and storage facility and proposed expansion is almost entirely paved, and the existing vegetation is non-native vegetation. The Union Pacific Los Angeles Transportation Center Rail Yard, another potential maintenance facility site, supports some native vegetation (including several toyon and laurel sumac trees along the southern portion of the rail yard) and limited wildlife habitat. Several large, non-native trees line North Mission Road along the southern periphery. The bluff along the southern portion of the rail yard supports native vegetation, including toyon, mulefat, and other species.

The Rail Operations Center is in a densely developed urban land area. Vegetation consists of non-native areas of grass, shrubs, and ornamental trees.

No wetland areas are in the Study Area. However, the Los Angeles River is located in the vicinity of the Division 20 Rail Yard and the Union Pacific Los Angeles Transportation Center Rail Yard. The river is a concrete-lined channel and is considered “waters of the United States” and subject to U.S. Army Corps of Engineers (USACE) regulations (see Section 4.11, Water Resources). No fish are expected to be present.

4.10.3 Environmental Impacts/Environmental Consequences

No Build Alternative

No impacts to ecosystems/biological resources would occur with the No Build Alternative.

TSM Alternative

No impacts to ecosystems/biological resources would occur with the TSM Alternative.

Build Alternatives

The Project is located in a densely developed urban land area. Some removal or pruning of California sycamore trees may occur at the Wilshire/La Brea, Santa Monica/La Brea, Santa Monica/San Vicente, and Beverly Center Area Stations. As these trees are protected under native tree protection ordinance or municipal code, a tree removal permit may be required. Removal and replacement of these trees would be conducted in compliance with applicable regulations and tree protection ordinances of the Cities of Los Angeles, Beverly Hills, and West Hollywood. During operation, no direct or indirect impacts to ecosystems/biological resources would be anticipated.

Station and Segment Options

As the alignment options consist of various underground routes, and impacts to ecosystems/biological resources are related only to surface disruptions, there would be no additional impacts related to the various alignment options themselves.

Maintenance Facilities and Rail Operations Center

Operation of either proposed maintenance facility and the Rail Operations Center would not result in ecosystems/biological resources impacts because existing resources are limited.

The Union Pacific Los Angeles Transportation Center Rail Yard construction would involve a new crossing of the Los Angeles River north of the East Cesar Chavez Bridge. The Los Angeles River is considered navigable waters by the USACE. No impacts related to sensitive ecosystems/biological resources are anticipated. The piers and abutments are expected to result in approximately 74,260 square feet (1.7 acres) of temporary impact and 4,312 square feet (0.1 acre) of permanent impact within the river channel. The Project would require a Clean Water Act Section 404 permit and Section 14 Rivers and Harbors Act (33 USC 408) approval from USACE, a Streambed Alteration Agreement from CDFG, and Section 401 Water Quality Certification from LARWQCB. Operations would not affect the Los Angeles River, which is channelized and does not support ecosystems/biological resources.

4.10.4 Mitigation Measures

None of the alternatives would result in impacts to ecosystems/biological resources; therefore, no mitigation measures would be required.

4.10.5 California Environmental Quality Act Determination

Based on Section C of the *Los Angeles CEQA Thresholds Guide,* a project would have a significant impact on ecosystems/biological resources if it would

- Result in the loss of individuals, or the reduction of existing habitat, of a State- or Federally listed endangered, threatened, rare, protected, or candidate species, or a Species of Special Concern, or Federally-listed critical habitat
- Result in the loss of individuals, the reduction of existing habitat of a locally designated species, or a reduction in a locally designated natural habitat or plant community
- Interfere with habitat such that normal species behaviors are disturbed (e.g., from introducing noise, light) to a degree that may diminish the chances for long-term survival of a sensitive species

The Project is located in a densely developed urban land area. No impacts to sensitive ecosystems/biological resources would occur under any alternative during Project operation. No mitigation measures would be required.

4.11 Water Resources

This section presents the potential changes in water quality resulting from the Project and measures to avoid, minimize, or mitigate potential water quality impacts are also presented. The information in this section is based on the *Westside Subway Extension Hydrology and Water Quality Technical Report*

4.11.1 Regulatory Setting

The following Federal, State, and local regulations protect water resources and this section briefly summarizes key regulations applicable to the Project.

Federal

The Clean Water Act of 1977 (33 USC 1251-1376) establishes the basic structure for regulating pollutant discharges into U.S. waters. Clean Water Act Section 303(d) requires states, territories, and authorized tribes to develop a list of waterways and waterway segments that have impaired water quality and do not meet water quality standards. Section 401 requires a State Water Quality Certification to show that a proposed project would comply with state water quality standards. The Section 402, National Pollutant Discharge Elimination System (NPDES) permit process controls point-source discharges to surface waters of the U.S. Section 404 regulates the discharge of dredged or fill materials into waters of the U.S. It requires a permit from the U.S. EPA and the USACE.

Under Federal Emergency Management Agency (FEMA) Executive Order 11988 Federal agencies must avoid, to the extent possible, adverse impacts associated with modifying floodplains and avoid supporting floodplain development to the extent practicable.

Section 10 of the Rivers and Harbors Act of 1899 (33 USC 401-403) provides for the protection of navigable waters and prohibits the obstruction or alteration of navigable waters of the United States. Any work performed in, over, or under navigable waters of the U.S. must obtain a Section 10 Permit from the United States Army Corps of Engineers. The Los Angeles River is designated as a navigable water by the United States Environmental Protection Agency. Section 14 of this Act (33 USC 408) requires projects, which alter bulkhead, jetty, dike, levee, wharf, pier, or other work built by the United States, to be approved by the USACE.

State

In accordance with Clean Water Act Section 402, the State Water Resources Control Board adopted a General Permit applicable to all stormwater discharges associated with construction activity.

The Project would require an Industrial General Permit under Category 8, which includes; “Transportation facilities that conduct any type of vehicle maintenance…” (Water Quality Order No. 97-03-DWQ).

Coastal Zone Management Act of 1972 (16 USC 1451.302) manages and protects U.S. coastline resources and established the California Coastal Commission. The California Coastal Commission would issue any permits because the City of Santa Monica does not have an adopted Local Coastal Program.

Local

Los Angeles County Municipal Separate Storm Sewer System Permit (Order No. 01-182, NPDES No. CAS004001) encompasses the Los Angeles County Flood Control District and the 84 incorporated cities within the district, including West Hollywood, Beverly Hills, and Santa Monica and the County of Los Angeles, for their contributions to discharges of stormwater and urban runoff from municipal separate storm sewer systems.

Construction General Permit specifies additional minimum BMPs. The Project would disturb more than 1 acre and therefore would be subject to these permit requirements.

Waste Discharge Requirements for Specified Discharges to Groundwater in Santa Clara and Los Angeles River Basins (Order No. 93-010) requires that wastewater be analyzed prior to being discharged to surface or groundwater to determine if it contains pollutants exceeding the applicable basin plan water quality objectives and to comply with applicable water quality standards. The Project would include dewatering during construction and subterranean seepage dewatering during operations.

4.11.2 Existing Conditions/Affected Environment

Municipal Water Supply

The Los Angeles Department of Water and Power (LADWP) is the primary municipal water supplier in the Study Area. The West Basin Municipal Water District provides water to West Hollywood, Beverly Hills, unincorporated areas of Los Angeles County, and the Metropolitan Water District of Southern California which, in turn, provides water to the City of Santa Monica.

Surface Water Hydrology

The Study Area lies within the Santa Monica Bay Watershed and the Los Angeles River Watershed. The Alternatives are in the Santa Monica Bay Watershed Management Area, which includes the Ballona Creek Watershed, the largest tributary to Santa Monica Bay. Ballona Creek is about 1 to 3 miles southeast of and roughly parallel to the proposed project alignments.

The proposed vehicle and maintenance yards are in the Los Angeles River Watershed, which extends from the Santa Monica Mountains, Simi Hills, and Santa Susana Mountains in the west to the San Gabriel Mountains in the east. Although the upper portion of the watershed is forest and open space, almost one-half of the same watershed is densely developed.

Santa Monica Bay is considered a significant national and state natural resource and is protected under the Natural Estuary Program. It is a Federal navigable water body and is listed under the Clean Water Act as a Section 303d impaired water body.

The Rancho La Brea Tar Pits, known for its paleontological resources, also has a small lake on the grounds. The tar pits are located in Hancock Park, north of Wilshire Boulevard and east of Fairfax Avenue.

Groundwater

The Study Area groundwater consists of underground streams and, primarily, the Los Angeles Coastal Plain Groundwater Basins. Groundwater uses include municipal and domestic supply, industrial service supply, industrial process supply, agricultural supply, and aquaculture.

Rainfall occurs typically between November and March, averaging from 12.5 inches along the coast to 15.5 inches in Downtown Los Angeles. This rainfall replenishes groundwater supplies by direct percolation through the surface, stream flow, and subsurface flow. Percolation and groundwater replenishment are limited by impervious surfaces resulting from paving and urban development.

Groundwater along Wilshire Boulevard varies in depth and inflow rate. In certain areas, such as Westwood, groundwater appears to be under artesian pressure and major dewatering has been necessary for previous underground construction projects. Since 1980, groundwater has been recorded at various locations along Wilshire Boulevard and varies from 5 to 10 feet below the ground surface to approximately 12 to 40 feet below the ground surface. In the 1970s, water ranged from 40 to 75 feet below the surface. Since then, groundwater pumping has decreased and may have contributed to rising water levels.

Part of the Santa Monica Fault Zone lies under the Study Area and acts as a vertical barrier to groundwater. As a result, west of Stanford Street in Santa Monica, groundwater is generally deeper and below the planned subway depth.

Along Santa Monica Boulevard, 2009 groundwater monitoring recorded depths from 1.3 feet to 87.7 feet below the ground surface. In the past, groundwater has ranged from 10 to 150 feet below the ground surface.

Drainage

The urbanized Study Area is covered with impervious surfaces such as asphalt, concrete, and buildings, so storm runoff is channeled into multiple storm drains and drainages. Almost all local streams and rivers (including the Los Angeles River) are channelized and/or are culverts and serve primarily as storm runoff channels. The City and the Los Angeles County Flood Control District construct and maintain the City of Los Angeles storm drains. The city system is designed to accommodate a 10-year storm event and the county system is designed for a 50-year storm event.

Drainage along the proposed alignment in the West Hollywood area is generally southwest through the municipal separate storm sewer system and into Ballona Creek, which ultimately drains into Santa Monica Bay. The proposed alternatives do not cross any major aboveground drainage features.

The proposed maintenance yards are near the Los Angeles River Basin, which is comprised primarily of the Los Angeles County coastal areas south of the San Gabriel and Santa Susana Mountains. The City of Los Angeles divides the Los Angeles River Basin into three drainage areas: the Upper Los Angeles River area, the Santa Monica Bay area, and the Central area. Runoff rates and volumes are influenced by urbanization and the associated impervious cover.

Flooding

Los Angeles and nearby cities are located in a relatively flat alluvial plain, about 30 miles wide and surrounded by mountain ranges. FEMA has prepared flood maps identifying areas that are subject to flooding during 100-year and 500-year storm events. Figure 4-53 through Figure 4-55 show the flood maps for the project Study Area, maintenance yards, and Rail Operations Center (ROC).

The alternatives are within the FEMA-designated 500-year floodplains (Zone B) and 100-year floodplains (Zone A). Areas within a 500-year floodplain include portions of Wilshire Boulevard, South San Vicente Boulevard, and Santa Monica Boulevard. Areas within a 100-year floodplain include North La Cienega Boulevard, near Burton Way, and an area adjacent to Santa Monica Boulevard south of Wilshire Boulevard.

The Rail Operations Center/Bus Operation Center is located in an area of no flooding (Zone X). The nearest floodplain is Compton Creek, a channel-contained 100-year flood Zone A located approximately 1 mile west.

Part of the proposed Division 20 yard and the Union Pacific Railroad Los Angeles Transportation Center Rail Yard is in the Los Angeles River 100-year floodplain, Zone AE. The Los Angeles River is channelized and primarily a storm runoff channel. The majority of the river floodplain is within the channel, and FEMA has designated the flood zone as Zone A (100-year floodplain, channel contained).

Water Quality

Urban runoff typically has negative impacts on surface water quality because it carries deposits from vehicles, pet waste, pesticides, and street litter into the storm drain system. The Los Angeles Regional Water Quality Control Board (LARWQCB) develops basin plans to protect and enhance water quality and the beneficial uses of regional waters. The LARWQCB Basin Plan (Basin Plan) that includes the Study Area lists beneficial uses for Ballona Creek as non-contact water recreation and wildlife habitat. However, Ballona Creek in the Study Area does not meet the water quality standard for beneficial uses. Therefore, it is on the 303(d) list of Water Quality Limited Segments, and the Basin Plan lists Total Maximum Daily Loads for coli form bacteria; copper, dissolved; cyanide; lead; selenium; shellfish harvesting advisory; toxicity; trash; viruses (enteric); and zinc.

The Basin Plan lists beneficial uses for the Los Angeles River as groundwater recharge, water contact recreation, and warm freshwater habitat. In the Study Area, the Los Angeles River does not meet water quality standards for its beneficial uses and is listed as a Section 303(d) impaired water body. Total Maximum Daily Loads have been developed for ammonia, copper, lead, nutrients (algae), and trash.

Groundwater quality in the main producing aquifers of the Los Angeles Coastal Plain Groundwater Basins is good. Volatile organic compounds are present in the Central and West Coast Basins but are at low concentrations and below enforceable regulatory levels.

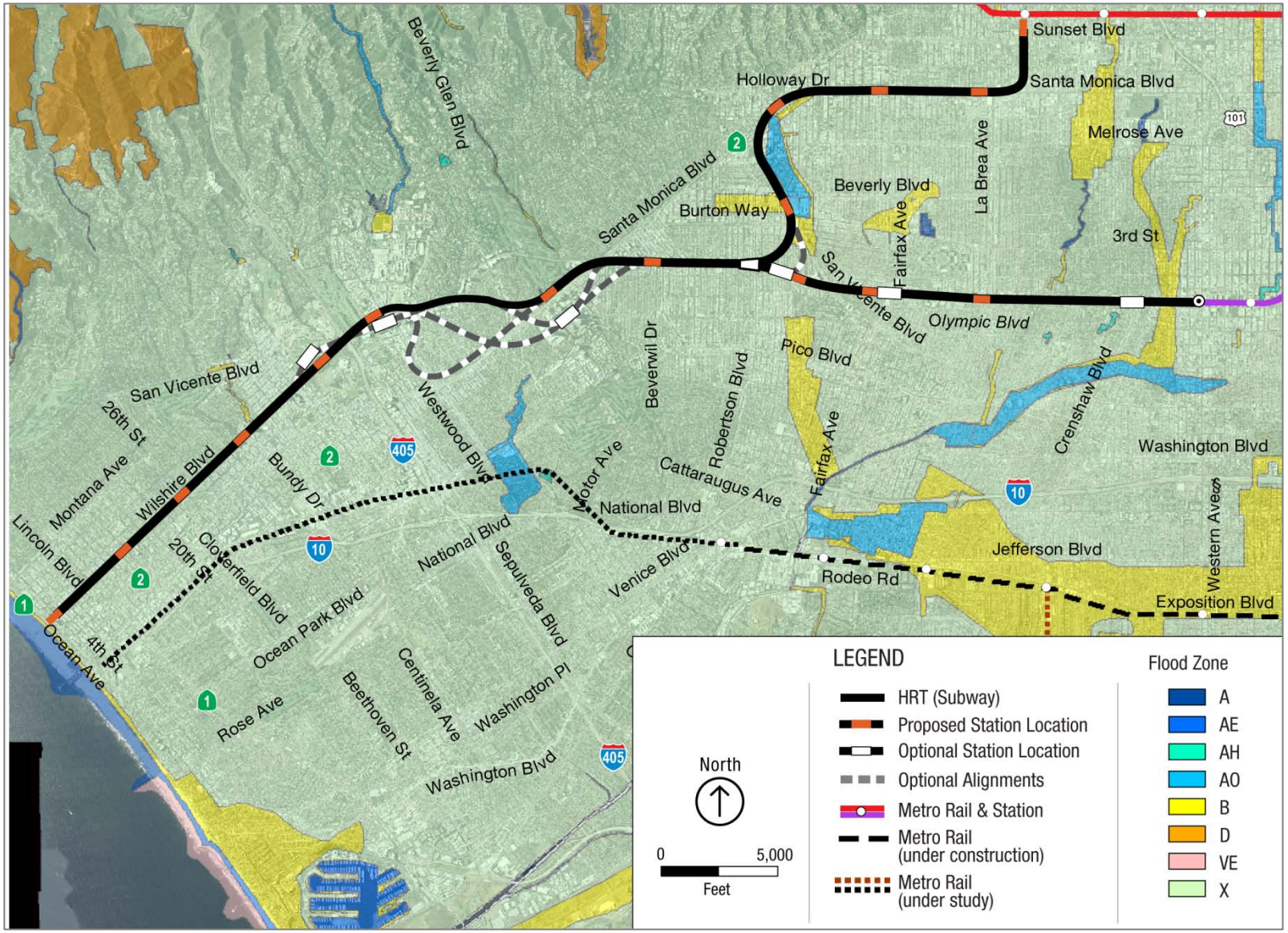


Figure 4-53. Floodplains—Study Area

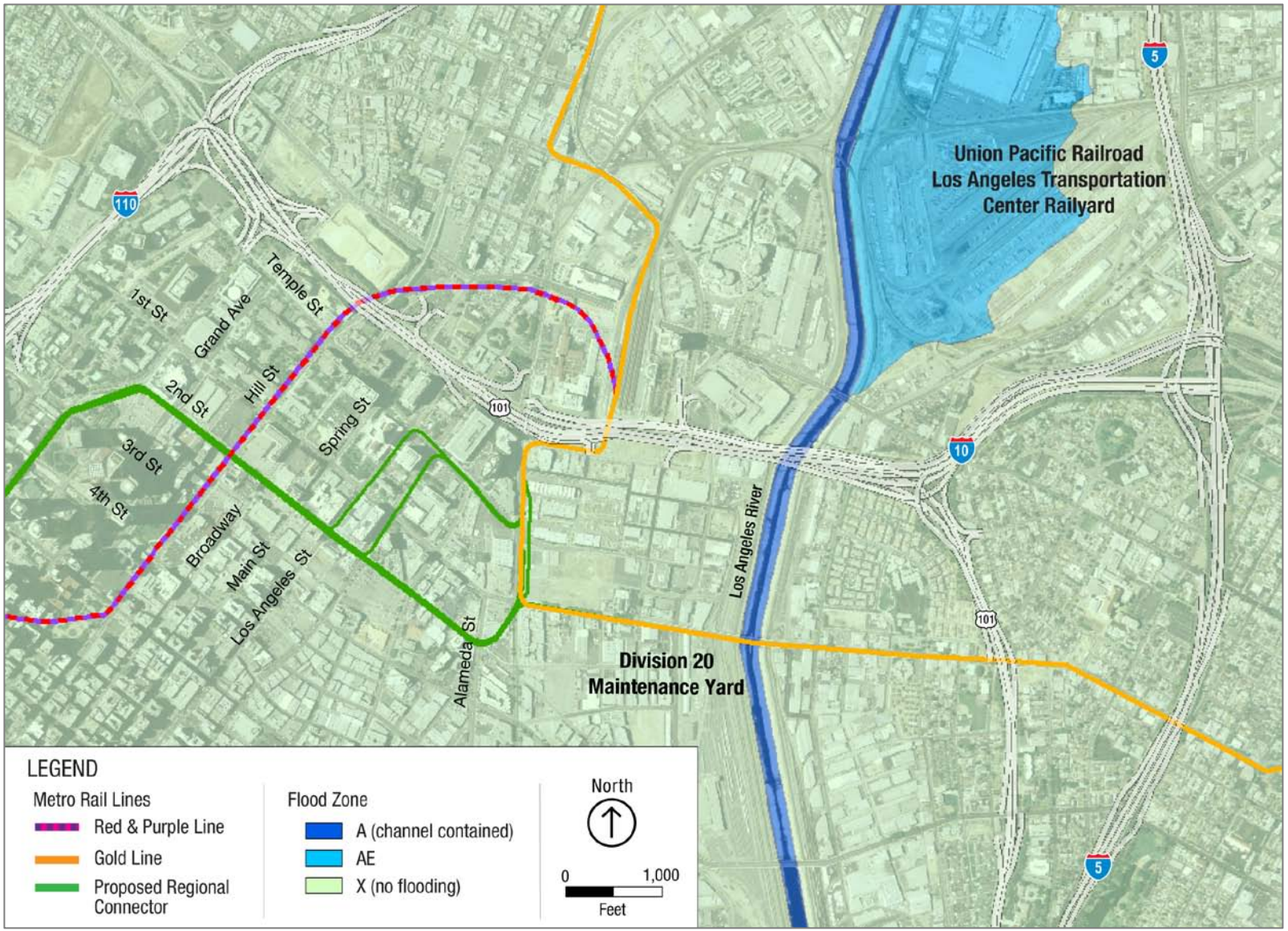


Figure 4-54. Floodplains—Maintenance Yards

Figure 4-55. Floodplains—Rail Operations Center

4.11.3 Environmental Impacts/Environmental Consequences

Mass transportation projects have the potential to affect water quality by increasing runoff or altering surface or sub-surface drainage patterns. Hydrology and water quality impacts potentially resulting from the Project are evaluated based on hydrology, drainage patterns, water quality, and floodplain data; water quality and beneficial uses in Study Area watersheds; compliance with applicable water quality regulations; and in accordance with NEPA and CEQA significance criteria.

No Build Alternative

The No Build Alternative consists of existing and committed highway and transit services that would continue as planned. The No Build Alternative would not include any activities that would result in any adverse effects to water resources.

Transportation System Management Alternative

The TSM Alternative would expand bus services and would not affect water resources. This alternative would result in negligible increases in typical vehicular runoff contaminants (i.e., oil, grease, and metals) that collect on streets and drain from the Study Area. However, these increased pollutant loadings would not be adverse and the TSM Alternative would not result in adverse water quality impacts.

Build Alternatives

The Build Alternatives would result in similar impacts to water resources and water quality. During operations, stations would use water for routine maintenance and cleaning. Stations would not include public restrooms, so water use would be negligible, and LADWP is expected to have sufficient supply. Water use required for the Project could be reduced by using standard water conservation measures, such as water-saving devices for faucets and hoses. Stations and trains would not require substantial amounts of water. Therefore, no adverse impact to the municipal water supply is anticipated.

Santa Monica Bay is at the western termini of Alternatives 3 and 5, along Wilshire Boulevard, approximately one-half mile west of the Wilshire/4th Street Station. The coastal zone boundary runs along the inland side of 4th Street. Therefore, Alternatives 3 and 5 would occur within the coastal zone and would require a Coastal Development Permit. Operation would comply with applicable Federal, State, and local regulations. As a result, there would be no adverse impacts.

The proposed alignments do not cross any surface water bodies. The small lake at the Rancho La Brea Tar Pits in Hancock Park at Wilshire Boulevard and South Fairfax Avenue are in the vicinity of the Study Area, but will not be directly affected by the Project. No adverse effects to surface water hydrology are anticipated.

Groundwater is encountered at varying depths throughout the Study Area. In the Study Area, shallow groundwater occurs at depths from 10 feet to more than 40 feet below ground, and in some areas as shallow as 5 to 10 feet below ground. Stations would be constructed from 50 to 60 feet below ground, while subway tunnels would be constructed between 40 and 80 feet below ground. Dewatering would not be necessary during operation of the Build Alternatives. Along alignment areas where stations would

extend below groundwater, the foundation system would include a conventional mat-type foundation or spread footings interconnected with a substantial structural slab. The mat-type foundation combined with a high-density polyethylene membrane would waterproof the station structures where shallow groundwater exists. Therefore, no adverse impacts to groundwater resources would be anticipated during operations.

All the Build Alternatives are within areas of a 500-year floodplain along Wilshire Boulevard near the Wilton Place intersection and adjacent to areas of a 100-year floodplain. A portion of Alternative 4 extends north of Wilshire Boulevard into West Hollywood through a section of 500-year floodplain and an area of 100-year floodplain designated as Zone AO (sheet flood depths of 1 to 3 feet). Alternatives 3 and 5 would be located through an additional area of 500-year floodplain at Wilshire Boulevard between South Sepulveda Boulevard and 26th Street. The Build Alternatives are primarily subterranean and would not affect floodplain elevations. The Study Area is predominately impervious surfaces and has an extensive urban drainage infrastructure. Therefore, implementing mitigation measure **WQ3** would result in no adverse impacts related to flooding. Therefore, the Build Alternatives, alignment options, and stations would not adversely affect water quality.

Maintenance Facilties

The proposed sites for the maintenance and operations facilities are in dense, urbanized areas comprised primarily of impervious surfaces within the established underground drainage infrastructure. Two options for the maintenance facility are (1) south of the existing Division 20 facility or (2) constructing a facility at the Union Pacific Los Angeles Transportation Center Rail Yard, connected by 1.3 miles of yard lead tracks to the Division 20 facility. The Division 20 facility is on the west bank of the Los Angeles River between the 1st and 4th Street bridges. The proposed additional property for the Division 20 yard is between the 4th and 6th Street Bridges. The Union Pacific Los Angeles Center Rail Yard is located on the east side of the Los Angeles River, between Mission Road and Alhambra Avenue.

During operations, water use at the selected maintenance facility would increase as a result of the additional rail cars being stored and maintained there. Water use would also increase as a result of the additional employees for the maintenance facility. The increased water requirements are expected to be within the LADWP's capacity. The additional requirements could be reduced through standard water conservation measures, such as water-saving devices for irrigation, water-flow restrictors for restrooms, and recycling for rail car washes. No adverse impacts are anticipated.

Division 20 is located in a dense, urbanized area comprised primarily of impervious surfaces with established underground drainage infrastructure. Constructing and operating Division 20 would not involve below-grade structures. Above-ground activities would be implemented in accordance with applicable permits and regulations. Therefore, no adverse impacts would occur to drainage capacity or infrastructure. The northwestern portion of the Division 20 facility is within the 100-year floodplain. Proposed improvements would not increase impervious cover at the facility or result in runoff that exceeds the current drainage and flood control capacity of the storm drain

system. As a result, the proposed improvements would not impede or redirect flood flows. With the above improvements, drainage would be properly conveyed to avoid ponding or flooding on Division 20 or adjacent properties. Implementing mitigation measure **WQ3** would result in no adverse impacts related to flooding.

Placing the maintenance yard at the Union Pacific location would require construction of a new bridge across the Los Angeles River, north of the East Cesar Chavez Bridge. The new bridge would be considered an encroachment on the floodplain. The bridge piers and abutments would result in approximately 74,260 square feet (1.7 acres) of temporary impact within the river channel. Bridge construction would require temporary flow diversions. Bridge piers and abutments would result in approximately 4,312 square feet (0.1 acre) of permanent impact within the river channel and result in a small river flow change. Coordination with the Los Angeles County Flood Control District and the USACE would ensure that the new bridge would not adversely impact flood-control structures.

The new bridge would require the following permits:

- Clean Water Act Section 401 Water Quality Certification (Los Angeles Regional Water Quality Control Board)
- Clean Water Act Section 404 Permit for filling or dredging waters of the United States (USACE)
- Section 14 of the Rivers and Harbors Act (33 USC 408) for approval to alter bulkhead, jetty, dike, levee, wharf, pier, or other work built by the United States (USACE)
- Streambed Alteration Agreement (California Department of Fish and Game)
- Approval for right-of-way acquisition (Union Pacific Railroad)

Operation of the maintenance yards would not involve any below-grade structures. Above-ground activities would be implemented in accordance with applicable permits and regulations. Therefore, no adverse impacts from maintenance yard operations would occur to drainage capacity or infrastructure.

Since both proposed maintenance yard sites are primarily covered by impervious surfaces, the proposed improvements at either maintenance facility site would not substantially increase impervious cover at the existing facility or result in runoff that exceeds the current drainage and flood-control capacity of the storm drain system. As a result, the improvements would not impede or redirect flood flows. The adjacent property south of the Division 20 yard is not in a floodplain, so the expansion would have no adverse impact on the floodplain.

Drainage would be properly conveyed to avoid ponding or flooding on the maintenance yards or adjacent properties. Implementation of mitigation measure **WQ3** would result in no adverse impacts related to flooding from improvements to the maintenance yards.

During operation of the maintenance yards, runoff would be conveyed to permanent treatment facilities. Therefore, no adverse impacts to water quality are anticipated.

Rail Operations Center

Operation of the expanded ROC would increase water use as a result of additional employees at the site. This would not adversely affect the municipal water supply.

Operation would be conducted in accordance with applicable regulatory requirements and permits. Therefore, no adverse impacts to surface water would occur. Proposed improvements to the ROC would not require significant excavation below the ground surface. Therefore, no adverse impacts to groundwater would be anticipated.

The proposed ROC improvements would not contribute to runoff that would exceed the drainage and flood-control capacity of the storm drain system and would not significantly impede or redirect flood flows. The area around the ROC is urbanized with mostly impervious surfaces. Improving this facility would not expose people or property to flood-related hazards. No impacts related to flooding would be expected from construction or operation of the ROC.

During operation of the ROC, stormwater runoff would be conveyed to permanent treatment facilities. Mitigation Measure WQ4 would be implemented prior to off-site discharge. Therefore, no adverse impacts to water quality are anticipated.

4.11.4 Mitigation Measures

No substantial water quality or resource-related impacts would result from the Project. Operation of the Project must comply with Title III and Title IV of the Clean Water Act and NPDES standards. The following mitigation measures would be implemented in addition to the standard BMPs and other measures required for compliance with Federal, State, and local requirements.

- **WQ2**—In the event contaminated groundwater is encountered in test borings and it is determined there is potential for spreading contamination, this concern would be mitigated during project design and engineering. For example, impermeable concrete-based grouting materials can be used to fill the gap between the tunnel and the surrounding earth. The permeability of the grouting materials is lower than surrounding soil types and would reduce the possibility that the tunnel shall serve as a preferential pathway for contaminant migration. Additional BMPs that would address potential impacts from encountering shallow groundwater and contaminated groundwater are proposed in the *Geotechnical and Environmental Report Technical Memorandum*. These include the following:
  - Station foundation design—Along areas where stations extend below groundwater without permanent dewatering systems, a mat-type foundation combined with a High Density Polyethylene membrane would provide an adequate barrier for water intrusion (see also Mitigation Measure WQ3).
  - Shoring systems—In areas of shallow groundwater, a secant/tangent pile system, consisting of alternating overlapping drilled piles, could be used to create an effective barrier to groundwater.
- **WQ3**—A drainage control plan would be developed to properly convey drainage from the Study Area and to avoid ponding on adjacent properties. The flood capacity of existing drainage or water conveyance features would not be reduced in a way that would cause ponding or flooding during storms.

- **WQ8**—The following permanent treatment BMPs would be considered for incorporation into the Project, as appropriate:
  - **BMP1: Extended/dry detention basins or underground detention tanks**—These measures are depressed basins that temporarily store some storm water runoff following a storm. They function like detention basins but are located underground. These systems remove particulate pollutants and reduce maximum runoff values associated with development to their pre-development levels and may be comprised of corrugated metal pipe, concrete pipes, or vaults.
  - **BMP2: Infiltration basins/trenches**—Infiltration basins are surface ponds that capture first-flush storm water and treat it by allowing it to percolate into the ground and through permeable soils. Infiltration trenches are excavated trenches that have been lined with filter fabric and backfilled with stone to form an underground basin that allows runoff to infiltrate into the soil. As the water percolates through the ground, physical, chemical, and biological processes occur to remove sediments and soluble pollutants. Pollutants are trapped in the upper soil layers and the water is released to groundwater. Infiltration basins are generally dry except immediately following storms, but a low-flow channel may be necessary, if a constant base flow is present.
  - **BMP3: Bioretention facilities**—Soils and woody and herbaceous plants may be used to remove pollutants from storm water runoff. Runoff must be reduced to sheet flow as it moves to the treatment area, which consists of a grassy buffer strip, sand bed, ponding area, organic or mulch layer, planting soil, and plants. Runoff passes through the sand bed, which decreases the runoff velocity and distributes it evenly along the ponding area length. These areas are applicable as on-lot retention facilities that are designed to mimic forested systems that naturally control hydrology.
  - **BMP4: Media filtration**—Media filters are two-stage constructed treatment systems, including pretreatment setline basins and a filter bed containing sand or other filter media. The filters are not designed to treat the entire storm volume, but the water volume that contains higher pollutant levels.
  - **BMP5: Porous pavement**—This asphalt-based paving material allows storm water to quickly infiltrate the surface pavement layer to enter into a high-void aggregate sub-base layer. The captured runoff is stored in this "reservoir" layer until it either infiltrates into the underlying soil strata or is routed through an under drain system to a conventional storm water conveyance system. Porous pavement is typically applicable only in low-traffic areas.
  - **BMP6: Vegetated filter strips**—These are typically similar to grassed swales, except they are essentially flat with low slopes and are designed only to accept runoff overland sheet flow. Vegetation filter strips can appear in any form, from grassland to forest, and are designed to intercept upstream flow, lower flow velocity, and spread water out as sheet flow. The filter strips facilitate conventional pollutant removal through detention, filtration by vegetation, and infiltration to soil. These are most useful in watershed areas where peak runoff velocities are low.

4.11.5 California Environmental Quality Act Determination

Based on CEQA guidelines, a significant impact to hydrology and water quality would occur if an alternative would result in any of the following:

- Violate any applicable water quality standards or waste discharge requirements, including those defined in Section 13050 of the Clean Water Act
- Affect the rate or change the direction of movement of existing groundwater contaminants, or expand the area affected by contaminants
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table
- Substantially alter the existing drainage pattern of the site or area, including the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site
- Create or contribute runoff water that would exceed the capacity of existing or planned storm water drainage systems or provide substantial additional sources of polluted runoff
- Otherwise substantially degrade water quality
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows
- Expose people to a significant risk of loss, injury, or death involving flooding

No Build Alternative

The No Build Alternative would have no impact on water resources.

TSM Alternative

The TSM Alternative does not include construction activities. The enhancement to bus services as part of the TSM Alternative would result in negligible increases in oil, grease, and other vehicular runoff contaminants. However, these pollutant loadings would not be substantial and impacts to water resources would be less than significant.

Build Alternatives

No significant impacts to groundwater resources would be anticipated during operations of the Build Alternatives. Operation of the Build Alternatives could result in impacts related to polluted storm water runoff. The incremental water quality impact would be minor since the Study Area is already densely urbanized with extensive impervious surfaces, and any added runoff would be minor. All alternatives, alignment options, and stations are required to comply with NPDES permit requirements. In addition, implementation of mitigation measures **WQ1** through **WQ3** would avoid significant long-term water resources and water quality impacts. Therefore, implementation of the proposed mitigation measures would reduce potential impacts to a less-than-significant level.

The Study Area is comprised of predominately impervious surfaces and has an extensive urban drainage infrastructure. The Build Alternatives would not substantially alter drainage patterns. Therefore, implementing mitigation measure **WQ3** would result in no adverse impacts related to flooding.

In addition, Alternatives 3 and 5 would comply with any necessary Coastal Development Permit to reduce potential impacts to Santa Monica Bay to a less-than-significant level.

Maintenance Facilities

Operation of the maintenance facilities is not anticipated to result in significant adverse water resources impacts. The maintenance facility at the Union Pacific Los Angeles Transportation Center Rail Yard would require construction of a new bridge over the Los Angeles River, which is within a 100-year floodplain. Compliance with applicable permits and regulations and implementation of mitigation measures **WQ1** through **WQ3**, in addition to construction measures identified in Section 4.15, as applicable, would reduce potential impacts at the proposed maintenance yard sites to less-than-significant levels.

Rail Operations Center

ROC operation would not result in significant adverse water resources impacts. Compliance with applicable permits and regulations and implementation of mitigation measures **WQ1** through **WQ3**, as applicable, would reduce potential impacts to less-than-significant levels.

After implementation of mitigation measures, potential impacts on water resources resulting from the Build Alternatives and other elements of the Build Alternatives (maintenance yards and rail operations center) would be reduced to less-than-significant levels.

4.12 Safety and Security

This section addresses safety and security issues, including an evaluation of accident prevention, crime prevention, and emergency response and potential mitigation measures for the Project.

System safety refers to the prevention of accidents to the riding public, employees, or others present on Metro transit facilities, which include stations, tracks, pedestrian walkways, trains, and the trackway. Areas addressed for this Project include safety of passengers and pedestrians in locations where they would cross the streets/rights-of-way, enter the stations, or encounter other transit facilities.

Security relates to protection of people from intentional acts that could injure or harm them and protection of property from deliberate acts. Topics discussed include crime prevention, law enforcement, and protection against terrorism.

4.12.1 Regulatory Setting

Both Federal and State regulatory requirements dictate the safety and security aspects of various transit facilities and systems. Federal requirements include those published by the Federal Transit Administration (FTA). The FTA created a state-managed oversight program for rail transit safety and security. The program is applicable to all states that have within their boundaries a fixed guideway rail system not regulated by the Federal Railroad Administration. The rule requires that transit agencies address the safety and security of their passengers and employees by preparing a system safety program plan conforming to the state-managed system safety program standard. In California, the State requirements include those contained in State laws administered by the California Public Utilities Commission (CPUC).

Metro has developed safety criteria, and the Metro Board adopted policies that are to be used in designing elements for the Project. Industry guidelines are also used in developing the system design features. In addition, a formal threat and vulnerability assessment (TVA) is needed to assess threat types and identify the design and procedural mitigations to reduce the likelihood of criminal activity.

4.12.2 Existing Conditions/Affected Environment

Metro oversees the operation of bus and rail transit services throughout Los Angeles County. Metro is also responsible for implementing its own System Safety ProgramPlan and System Security Plan during operational phases of projects, which help to maintain and improve the safety and security of commuter operations, mitigate accidents, and comply with Federal and State regulations.

Metro's Corporate Safety Department is responsible for ensuring that safety procedures are established and implemented and for monitoring safety performance. The Corporate Safety Department is empowered to develop, implement, and administer a comprehensive and coordinated System Safety Program Plan. The program emphasizes preventive activities and responsibilities of each department in an effort to identify, control, and resolve hazards during the design, development, and operation of transit service.

Currently, Metro contracts security and law enforcement services with the Los Angeles County Sheriff's Department's Transit Services Bureau, now part of the Homeland Security Division. Security, cameras, and law enforcement for MTA facilities is provided 24 hours per day, seven days per week. Criminal reports or arrests, other than those accomplished by special enforcement deputies, remain the jurisdiction of the local law enforcement agency where the activity occurs.

The Study Area encompasses police departments for the cities of Los Angeles, Beverly Hills, and Santa Monica, as well as police departments that cover UCLA and the VA Hospital site. The Federal Protective Service is responsible for police patrols of the Federal Building (also known as the Los Angeles General Services Administration (GSA) Building), located east of Interstate 405 and Sepulveda Blvd and adjacent to the intersection of Wilshire Boulevard and Veteran Avenue. The Los Angeles County Sheriff's Department patrols unincorporated portions of Los Angeles County and West Hollywood. In addition, Metro implements security and law enforcement services through a contract with the Los Angeles County Sheriff's Department's Transit Services Bureau, which is part of the Homeland Security Division.

The Build Alternative alignments would pass through one or more of the fire department jurisdictions for Los Angeles County and the cities of Los Angeles, Beverly Hills, West Hollywood, and Santa Monica. Local fire departments are the primary responders in the event of fire on the Metro system and would assume overall command of any fire scene in close liaison with the Metro Rail Operations Center (ROC).

4.12.3 Environmental Impact/Environmental Consequences

This section analyzes the environmental consequences related to safety and security associated with the TSM Alternative and each Build Alternative, including the MOSs, which are compared to the No Build Alternative.

Potential safety and security impacts related to the TSM Alternative and the Build Alternatives, including the MOSs, are provided by topic area below. Areas of potential impacts include accident prevention, construction safety, seismic safety, fire protection and safety, methane and hydrogen sulfide gas leak protection, suicide prevention at stations, security preventing criminal activity, security preventing terrorist attacks, and emergency response. Proposed mitigation measures to address these adverse/significant impacts are discussed in Section 4.12.4.

No Build Alternative

It is anticipated that under the No Build Alternative, safety and security in the Study Area would remain at current levels or follow current trends. Therefore, no adverse or significant impacts to accident prevention, crime prevention, or emergency response are anticipated for the No Build Alternative and no mitigation is required.

TSM Alternative

Under the TSM Alternative, additional Metro Rapid and local bus services would be provided to meet increased demand in the future. The TSM is not expected to result in impacts to employee safety. Under the TSM alternative, the additional Metro Rapid and local bus services operating in the Westside Transit Corridor would not result in any

pedestrian/bicyclist safety impacts. There is a statistical possibility of increased bus and passenger accidents due to increased service that would be mitigated through careful implementation of the safety programs.

Build Alternatives

Accident Prevention

Passenger Safety

The Build Alternatives and the MOSs are all underground heavy rail transit (HRT) systems. Once the passengers enter the system, they may be exposed to safety hazards that can be divided into the following areas: 1) Fire/Life Safety (hazards resulting in accidents involving injuries, fatality, or property damage due to fire, smoke, explosion, or toxics due to these causes) and, 2) System Safety (hazards resulting in accidents involving injuries, fatality, or property damage due to system design, equipment operations and maintenance, testing, and material selection). The presence of any of the hazards in these categories would have adverse/significant impact on passenger safety and would require implementation of a well designed system safety and fire/life safety program.

Employee Safety

The operation and maintenance of the Build Alternatives, including MOSs, would be similar to the existing Metro Red and Purple lines. Operation of any of the alternatives would be conducted in accordance with Occupational Safety and Health Administration (OSHA), California Occupational Safety and Health Administration (CALOSHA), CPUC, and Metro policies and practices. Metro's Employee Safety Program includes a wide range of occupational safety and health, injury and illness prevention, hazard communication, industrial hygiene, fire and life safety, emergency preparedness, and operational safety programs. No impacts are anticipated under the Build Alternatives.

Construction Safety

Safety of construction workers and the general public would be a key element of construction activities associated with all Build Alternatives and the MOSs. The Build Alternatives and the MOSs would result in a risk of pedestrians and/or bicyclists becoming injured in proximity to construction sites. Construction effects would be temporary and limited in area as construction proceeds along the length of the project alignment. Construction of any of the alternatives would be conducted in accordance with OHSA, CALOSHA, CPUC, and Metro policies and practices. A Construction Safety and Security Plan would be implemented to avoid and minimize impacts related to construction safety.

Seismic Safety

All Build Alternatives and the MOSs contain structures, including stations and tunnels, along the proposed alignments that may be susceptible to ground shaking and seismically induced settlement. Therefore, a potential for adverse effects would be anticipated for these design options.

Fire Protection Safety

All Build Alternatives and the MOSs would be an HRT underground system. Such a system typically consists of major project elements/activities that have a potential risk of fire and related hazards, including station facilities, underground guideway (tunnels), construction, passenger vehicles, maintenance and storage facility, and rail operations center. These elements carry electrical equipment and/or combustible materials and introduce a risk of potential fire and adverse impact on the safety of workers and patrons using the system.

Methane and Hydrogen Sulfide Gas Leak Protection

All Build Alternatives and the MOSs would result in some potential ground disturbances during excavation activities. During construction subsurface gases could be encountered in areas where tunneling and excavation would occur, which may include the release of methane and hydrogen sulfide gas. The presence of methane and hydrogen sulfide would have an adverse/significant impact on project safety during construction and operations.

Pedestrian and Bicycle Safety at Stations

Each of the proposed subway stations would be accessed via stairways, escalators, and elevators descending from the ground level to the subway's mezzanine and platform levels. When provided within an existing sidewalk, station portals reduce the effective sidewalk width available for pedestrians. None of the proposed subway stations would substantially reduce the effective sidewalk widths since most of the station portals would be located away from the sidewalks. Emergency exits will be located away from the main station portals and may require a sidewalk to accommodate a steel hatch to access the exit. However, the establishment of these exits does not affect pedestrian access on the sidewalks.

The passenger demand at the proposed stations would not cause substantial overcrowding on public sidewalks or create unsafe conditions for pedestrians/bicyclists. All stations would be constructed below grade, so no on-street sidewalks would be permanently removed to accommodate the project stations or alignment, therefore no adverse impacts related to the pedestrian/bicyclist safety would occur and no mitigation is required for the Build Alternatives or the MOSs.

Suicide Prevention at Stations

All Build Alternatives and the MOSs would be an HRT underground system. Transit systems are by nature open to all of the public without consideration of a passenger's mental health. This creates a situation where transit agencies have limited control of the use of their system and to prevent any hazardous activity, such as a suicide attempt by a determined person.

Crime Prevention and Security

Security Preventing Criminal Activity

An adverse impact to law enforcement services located along the Build Alternatives and the MOSs could occur if there is a rise in criminal activity due to an increase in pedestrian circulation in areas near at-grade station portals and sub-grade stations.

Another adverse impact to law enforcement services would be that criminal activity could travel by rail throughout the system from one station to another with peak volumes of circulation during high demand hours. In some cases, however, increased foot traffic around station areas could deter criminal activity.

Metro's facility design requirements provide for natural surveillance, natural access control, and territoriality principles associated with Crime Prevention Through Environmental Design that are implemented in facility designs to monitor and minimize criminal activity. Mitigation measures would be required to minimize adverse impact to law enforcement and reduce risk to community pedestrians and Metro passengers.

Security Preventing Terrorist Attacks

Mass transit systems could be a target for terrorists due to their large ridership and the potential to inflict mass casualties and cause significant damage or disrupt critical infrastructures. A significant impact to law enforcement agencies located along the Build Alternatives would occur from a potential terrorist threat targeting the increase in pedestrian circulation and critical infrastructures at or near at-grade station portals and sub-grade station platforms.

In addition, the Project may require underground easements and construction easements that encroach onto Federal facilities at the following locations:

- Federal Building (GSA Building)
- Veterans Administration (VA) Medical Center
- U.S. Army Reserve Facility

Emergency Response

A significant impact on fire and police services would occur if a Build Alternative or and MOS would overtax a department's services, emergency response, and major disaster response resources by resulting in unacceptable service ratios, response times, the need for additional personnel or additional training, or a reduction in other performance objectives. The Build Alternatives and the MOSs have a potential of adverse effect on local community safety services due to increase demands on fire, medical emergency response, and police services.

Station and Segment Options

The impacts related to safety and security for the station and segment options are the same as the Build Alternatives.

4.12.4 Mitigation Measures

Proposed mitigation measures are summarized below for each adverse/significant impact identified in Section 4.12.3. Detailed discussion of the proposed mitigation measures are contained in the *Safety and Security Hazards and Threat Assessment Technical Report.*

Accident Prevention

Passenger Safety

- **SS-1**—Implementation of public safety awareness and employee training program.
- **SS-2a**—Station design in accordance with the California Building Code (CBC) and Metro Fire/Life safety criteria.
- **SS-2b**—Tunnel design in accordance with CBC and Metro Fire/Life safety criteria.
- **SS-2c**—Development and implementation of project-specific safety certification plan.
- **SS-2d**—Safety certification of all certifiable project elements.

With implementation of the proposed mitigation measures, impacts on passenger safety would be less than adverse/less than significant.

Construction Safety

- **SS-3**—Implement safety rules, procedures, and policies to protect workers and work sites during construction.

With implementation of the proposed mitigation measure, impacts on workers' safety would be less than adverse/less than significant.

- **SS-4**—Provide warning and/or notification signs, detours, and barriers.

The proposed measure would minimize the potential for accidents and reduce the construction period's safety impacts to less than adverse/less than significant.

Seismic Safety

- **SS-5**—Implement Metro design criteria, safety rules, procedures, and policies to protect workers and work sites during construction and provide employees and public safety in operations.

With implementation of the proposed mitigation measure, impacts on workers, employees, and public safety would be less than adverse/less than significant.

Fire Protection and Safety

- **SS-6**—Design in accordance with Metro Fire/Life safety criteria, CBC, and other applicable Federal, State, and local rules and regulations.

With implementation of the proposed mitigation measure, impacts would be reduced to less than adverse/less than significant.

Methane and Hydrogen Sulfide Gas Leak Protection

- **SS-7**—Design in accordance with Metro Fire/Life safety criteria, Metro ventilation criteria, and according to the findings in the *Geotechnical/Subsurface/Seismic/Hazardous Materials Report*.

With implementation of the proposed mitigation measure, impacts would be reduced to less than adverse/less than significant.

Suicide Prevention at Stations

- **SS-8**—Implementation of public safety awareness, employee training program, and system design features.

With implementation of the proposed mitigation measure and considering almost no suicide attempts on the existing Metro heavy rail system, impacts would be reduced to less than adverse/less than significant.

Crime Prevention and Security

Security Preventing Criminal Activity

- **SS-9**—Implementation of security features, including lighting, communication devices (e.g., passenger telephones), closed circuit television, signs and other design features, and law enforcement officers to reduce criminal activities. In addition, expand the Rail Operations Center to provide an integrated control facility that would allow monitoring of an expanded rail network.

With implementation of the proposed mitigation measures and considering Part 1 reported crimes in the jurisdictions of the Build Alternative, impacts would be reduced to less than adverse/less than significant.

Security Preventing Terrorist Attacks

- **SS-10**—Implementation of security features, including security education and employee training specific to terrorism awareness, lighting, communication devices (e.g., passenger telephones), closed circuit television, signs and other design features to reduce terrorism activities.

In addition, Metro is committed to following risk assessment processes performed by Federal agencies of their sites; the effort and time it may take an agency to complete an assessment; and potential risk security countermeasures that may be recommended by a Federal agency to reduce risk at their site.

With implementation of the proposed mitigation measures, impacts would be reduced to less than adverse/less than significant.

Emergency Response

- **SS-11**—Development and implementation of a comprehensive emergency preparedness plan, employee and emergency responders training, and system design features.

With implementation of the proposed mitigation measures, impacts would be reduced to less than adverse/less than significant.

4.12.5 California Environmental Quality Act Determination

A summary of significant impacts related to safety and security is discussed in Section 4.12.3. Implementation of the recommended mitigation measures summarized in Section 4.12.4 would reduce the impacts related to safety during the construction and operational phases of the Project to less than significant for all of the alternatives.