SECTION 5

Groundwater Evaluation

5.1 Review of Groundwater Data

Readily available groundwater reports, publications, and/or data were compiled from public agencies including the CDWR, the CGS (formerly CDMG), the City of Los Angeles, the LADPW, MSGW, and the RBMB. Also, unpublished reports available in company files and technical reports by other consultants were reviewed. In addition, groundwater information collected from piezometers installed during this study was evaluated to determine the groundwater conditions within the project study zones. A complete list of the references compiled and reviewed is presented in Section 16 of this report.

The groundwater conditions for Zone 1 are reported in the following references. As part of their report on geologic aspects of tunneling in the Los Angeles area, Yerkes et al. (1977) provide general groundwater depth information for areas along the Los Angeles River. More specific groundwater monitoring data for the Los Angeles River, for the period of December 1993 to December 2006, are provided as part of the study of the Pollock Area of the San Fernando Superfund site (CH2M HILL, 2007). Approximately seven groundwater monitoring wells have been monitored on a quarterly or annual basis. Groundwater information from seven borings drilled in Zone 1 also was compiled.

Groundwater level data for Zone 2 were obtained from the LACDPW Web site for the northwesternmost portion (LACDPW, 2009). Groundwater data for the Arroyo Seco area were obtained from the City of Los Angeles (2006a and 2006b) and PET (2004). These later sources not only provide groundwater data but also present detailed boring logs and cross sections that interpret the hydrogeologic conditions in that area. Groundwater information also was collected from five borings drilled in this zone.

Groundwater levels for Zones 3, 4, and 5, and the entire San Gabriel and Raymond groundwater basins, were obtained from the MSGW (2006) and the RBMB (2006 and 2007). Geologic, groundwater, environmental and aquifer data for the west and central portions of the San Gabriel basin were obtained from CDM (1998, 2006, 2008a and 2008b), GeoSyntec (2006a and 2006b), CH2M HILL (2003, 2006, and 2009c), and Stetson (2005). Groundwater information for Zone 3 was obtained from 12 borings drilled as part of this study and 3 borings drilled as part of the Metro Study. In particular, the CH2M HILL (2009c) report provides a detailed discussion of the groundwater conditions for the Alhambra area of Zones 3, 4, and 5. These reports not only provide groundwater and environmental data but also present cross sections interpreting the hydrogeologic conditions.

5.2 Site Setting

The five study zones for the SR-710 Tunnel Technical Study are located across several alluvial groundwater basins, which are separated by bedrock upland areas. The study zones

are located in the San Fernando, Eagle Rock, Central, Raymond, and San Gabriel groundwater basins. The study zones, groundwater basins, and bedrock upland areas are shown in Figure 5-1.

The groundwater basins contain permeable alluvial materials that can transmit large amounts of groundwater. Groundwater from these basins is a primary source of the water supply for the region. The basins are adjudicated as a result of historical overdraft conditions. A brief description of these basins is provided below (CDWR, 2003).

- The San Fernando Valley Groundwater Basin includes the water-bearing sediments beneath the San Fernando Valley, Tujunga Valley, Browns Canyon, and the alluvial areas surrounding the Verdugo Mountains near La Crescenta and Eagle Rock. The basin is bounded on the north and northwest by the Santa Susana Mountains, on the north and northeast by the San Gabriel Mountains, on the east by the San Rafael Hills, on the south by the Santa Monica Mountains and Chalk Hills, and on the west by the Simi Hills. The water-bearing sediments consist of the lower Pleistocene Saugus Formation (not observed within the project study area), and Pleistocene and Holocene alluvium. The groundwater in this basin is mainly unconfined with some confinement within the Saugus Formation in the western part of the basin and in the Sylmar and Eagle Rock areas.
- The Raymond Basin includes the water-bearing sediments bounded by the contact with consolidated basement rocks of the San Gabriel Mountains on the north and the San Rafael Hills on the southwest. The west boundary is delineated by a drainage divide at Pickens Canyon Wash. The southeast boundary is the Raymond fault, which acts as a barrier to groundwater flow southward into the San Gabriel Basin. The water-bearing materials of the Raymond Basin are dominated by unconsolidated Quaternary alluvial gravel, sand, and silt deposited by streams flowing out of the San Gabriel Mountains. Water in the alluvium is typically unconfined.
- The San Gabriel Valley Groundwater Basin includes the water-bearing sediments underlying most of the San Gabriel Valley. This basin is bounded on the north by the Raymond fault and the contact between Quaternary sediments and consolidated basement rocks of the San Gabriel Mountains. Exposed consolidated rocks of the Repetto, Merced, and Puente Hills bound the basin on the south and west. The Chino fault and the San Jose fault form the eastern boundary. The water-bearing materials of this basin are dominated by unconsolidated to semi-consolidated alluvium deposited by streams flowing out of the San Gabriel Mountains. These deposits include Pleistocene and Holocene alluvium and the lower Pleistocene San Pedro Formation (not observed within the project study area).
- The Central Basin is bounded on the north by a surface divide called the La Brea high, and on the northeast and east by emergent less-permeable Tertiary rocks of the Elysian, Repetto, Merced, and Puente Hills. Throughout the Central Basin, groundwater occurs in Holocene and Pleistocene sediments. The Central Basin is historically divided into forebay and pressure areas. In the study area, the Los Angeles forebay of the Central Basin has unconfined groundwater conditions.

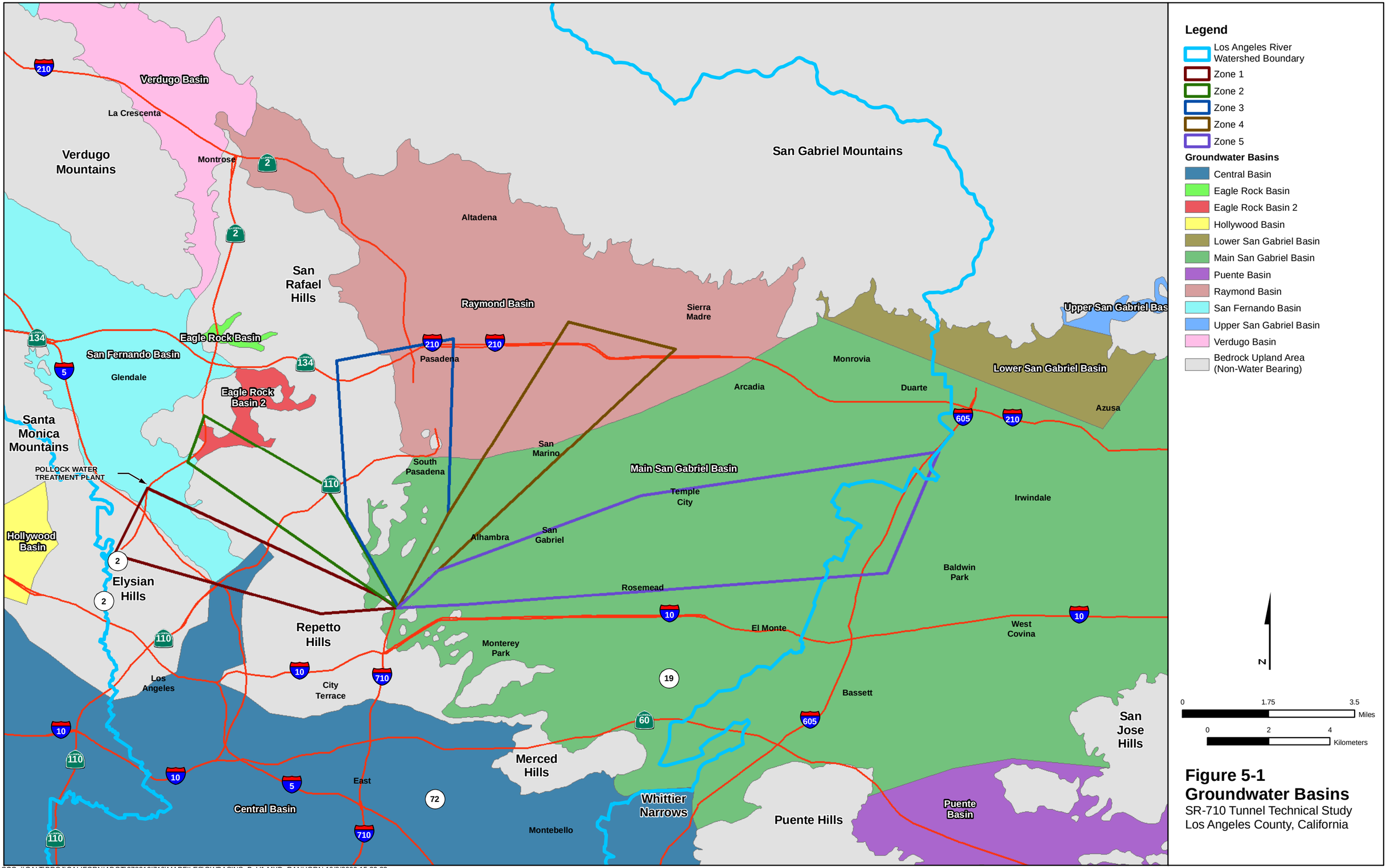

Figure 5-1
Groundwater Basins
SR-710 Tunnel Technical Study
Los Angeles County, California

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5.3 Use of Water Resources

5.3.1 Groundwater

A multitude of groundwater production wells and several groundwater monitoring wells and geotechnical borings have been drilled and/or installed within all the five groundwater basins by the CDWR, City of Los Angeles, Los Angeles County Department of Public Works (LACDPW), USEPA, and different consulting firms. As a result, it is concluded that the Los Angeles River portion of Zone 1, the eastern half of Zone 3, and the entire Zones 4 and 5 are located in active groundwater extraction basins that have constituted a very important local source of groundwater since the foundation of the communities throughout the area.

The unconfined aquifer along the Los Angeles River is being utilized by the LACDPW through wells located at their Pollock Treatment Plant. The Pollock Treatment Plant extracts and treats groundwater for local distribution to water users in the City of Los Angeles. Groundwater is being extracted by LACDPW via a minimum of two active water wells located at the northwestern portion of Zone 2. The very shallow unconfined aquifer along the Arroyo Seco does not appear to be used for water consumption (LACDPW, 2009).

The unconsolidated alluvial sediments of the San Gabriel and the Raymond groundwater basins constitute important groundwater basins in Southern California. The deep aquifers in both groundwater basins have been actively exploited for the last few decades by local communities as a source of groundwater. A multitude of groundwater extraction wells are located throughout the basin and are used by different water management boards and water districts. Bedrock units are generally considered to be non-water bearing. The study zones, groundwater basins, and bedrock upland areas are shown in Figure 5-1.

5.3.2 Surface Water

The five study zones for the SR-710 technical study area located within the Los Angeles River Watershed, which covers over 834 square miles from the eastern portions of Santa Monica Mountains to the San Gabriel River Watershed in the east. **T**he San Gabriel River Watershed covers approximately 640 square miles. The study zones and surface water features are shown in Figure 5-2.

The Los Angeles River flows from its headwaters in the mountains in northwestern Los Angeles County into the San Fernando Valley and eastward to the northern corner of Griffith Park where the channel turns southward through the Los Angeles Narrows before it flows south across the coastal plain to the Pacific Ocean. The Los Angeles River is confined within a concrete and riprap-lined aqueduct in most of the SR-710 tunnel study area; however, small portions are open and allow infiltration into the alluvium underlying the aqueduct. Major tributaries in the study area drain the San Gabriel Mountains and include Arroyo Seco, Compton Creek, and Rio Hondo. There are spreading grounds and open quarries along these tributaries that capture surface water for groundwater recharge.

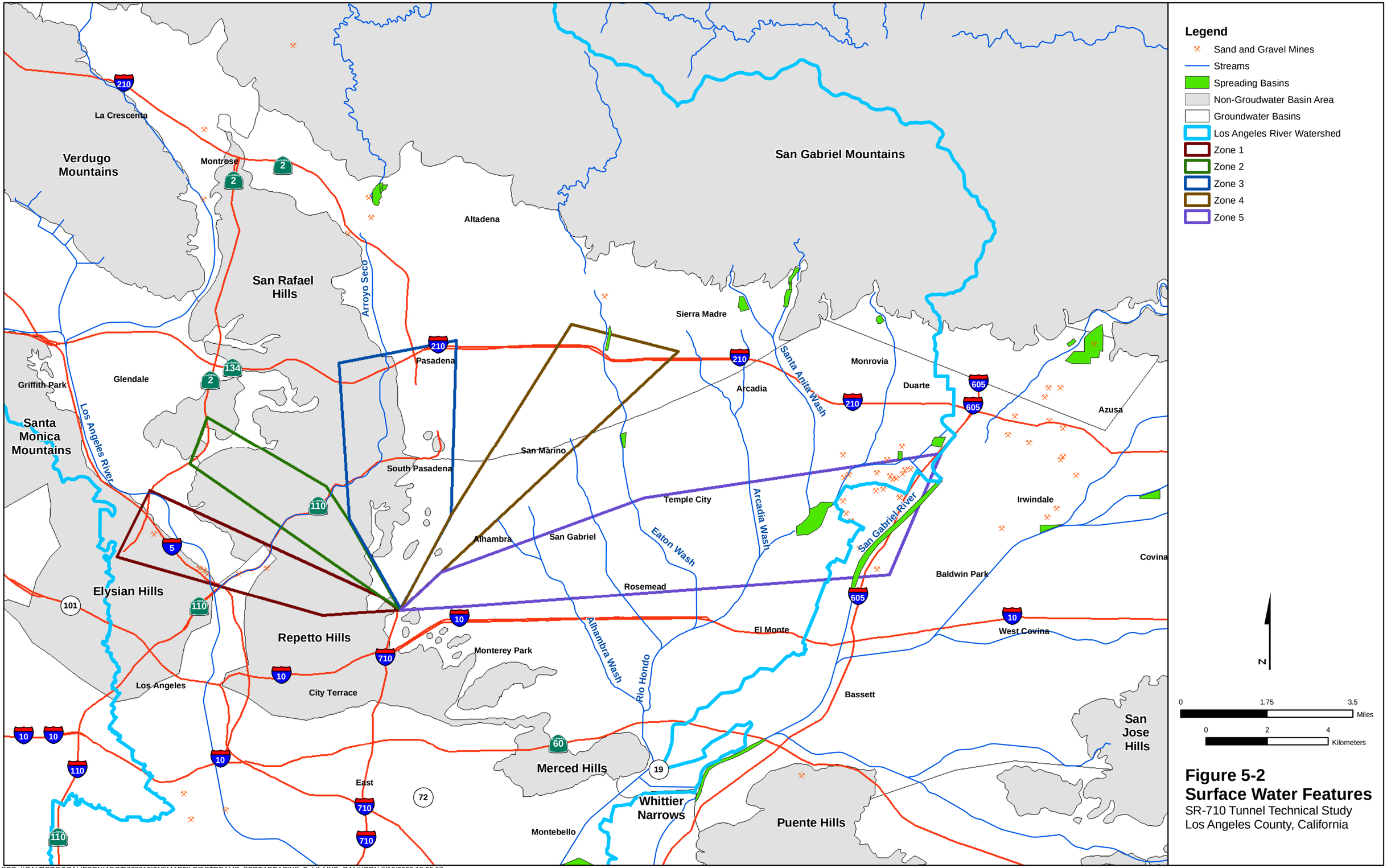

Figure 5-2
Surface Water Features
SR-710 Tunnel Technical Study
Los Angeles County, California

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The San Gabriel River flows from its headwaters in the San Gabriel Mountains southward through the Whittier Narrows before it flows south across the Coastal Plain to the Pacific Ocean. Channel flows pass through different sections in the San Gabriel River, diverting from the riverbed into four different spreading grounds for controlled flow and groundwater recharge above the Whittier Narrows Dam.

Flow in the Los Angeles River, San Gabriel River, and tributary washes occur primarily in the winter months in response to precipitation. These surface water features within the five study zones for SR-710 tunnel study are ephemeral and/or concrete lined. Surface water recharges the alluvial groundwater basins when storm flows occur mostly by gravity drainage because the water table elevations are below the bottom of the riverbeds and washes. The water within the channels either flows downstream or infiltrates into the subsurface. In general, there is no base flow of groundwater to surface water after storm flows recede because groundwater is below the bottom of these surface water features. Therefore, any lowering of the water table in alluvial areas due to groundwater dewatering from construction or operations and maintenance activities associated with proposed SR-710 tunnel activities likely would not affect the surface water features present in any of the five proposed zones.

5.4 Groundwater Conditions

Zones 1 through 5 straddle five separate groundwater basins of the South Coast Hydrologic Region. Impact to groundwater should be kept minimal during tunnel construction and operation. Tunnel construction technology should be selected to provide minimal impact to the groundwater resources. The groundwater basin and surface water features in each zone are described below.

Zone 1: The eastern portion of Zone 1 is mainly in bedrock of the Repetto Hills with small portions in the Main San Gabriel Groundwater Basin. The western portion of Zone 1 is mainly in the San Fernando and the Central Groundwater Basins. The bedrock is comprised of the lower-permeability Puente Formation. The Los Angeles River and Arroyo Seco are surface water bodies located within Zone 1. The Los Angeles River flows through the western portion of Zone 1; Arroyo Seco flows through the central portion of Zone 1. The Los Angeles River and Arroyo Seco are concrete-lined channels. No springs are known to occur in the upland bedrock areas.

Zone 2: This zone is mainly located in bedrock of the San Rafael Hills. A small portion of Zone 2 is located in the Eagle Rock Groundwater Basin 2, San Fernando, and Main San Gabriel Groundwater Basins. The northwestern portion of Zone 2 is located in the Eagle Rock Groundwater Basin 2 and the San Fernando Groundwater Basin. The southeastern portion of Zone 2 is located in the Main San Gabriel Groundwater Basin. The bedrock is comprised of the lower-permeability Puente and Topanga Formations. Arroyo Seco runs through the central portion of Zone 2. No springs are known to occur in the upland bedrock areas.

Zone 3: The western portion of Zone 3 is located in bedrock of the San Rafael Hills. The eastern portion of Zone 3 is located in the Raymond and Main San Gabriel Groundwater Basins. The bedrock is comprised of the lower-permeability Puente, Topanga,

and Fernando Formations. Arroyo Seco runs through the northwestern portion of Zone 3. No springs are known to occur in the upland bedrock areas.

Zone4: The northern portion of Zone 4 is located within the Raymond Groundwater Basin. The southern portion of Zone 4 is located within the Main San Gabriel Groundwater Basin. Upland bedrock areas do not occur in this zone. Eaton Wash runs through the northeastern portion of Zone 4.

Zone 5: This zone is located in the Main San Gabriel Groundwater Basin. From west to east, surface water features located within Zone 5 include Alhambra Wash, Easton Wash, Arcadia Wash, and Rio Hando. The San Gabriel River and Santa Fe Flood Control Basin are located in the eastern portion of Zone 5.

5.5 Contaminated Groundwater Conditions

Contaminated groundwater zones occur within the study area. The biggest contamination issues are the existence of the two National Priority List (NPL) sites within Zones 1, 4, and 5. These two NPL sites (also known as Superfund Sites) are the San Fernando Valley Superfund Site (Zone 1) and the San Gabriel Valley Superfund sites (Zones 4 and 5). Most of the groundwater contamination is due to chlorinated volatile organic compounds (VOCs) that are the result of past industrial activities in the area. The approximate locations of the Superfund sites are shown on Figure 6-1. A more-detailed description of groundwater and soil contamination within the individual zones is provided under Section 6 and in Appendix F. Zone-specific descriptions of the groundwater conditions are provided in the Groundwater Conditions subsections of Sections 7 through 11.