2. Affected Environment

This section presents information on Hydrology and Water Quality conditions in Kern, Los Angeles, Orange, and San Bernardino Counties. Section 2.1 describes the data collection methodology and lists the resources used to gather the applicable data. Section 2.2 describes the Regional Setting for the proposed Project and alternatives and provides information on the baseline conditions in the Project region. Section 2.3 describes the baseline conditions for Hydrology and Water Quality within the proposed Project study area. Sections 2.4 through 2.8 describe the baseline conditions for Hydrology and Water Quality applicable to the alternative study areas.

2.1 Baseline Data Collection Methodology

Data collection was conducted through review of the following resources: aerial photographs; United States Geological Survey (USGS) topographic maps; National Hydrography Dataset (NHD) and CalWater GIS data; SCE's Proponent's Environmental Assessment (PEA); basin plans from the Lahontan, Los Angeles and Santa Ana Regional Water Quality Control Boards (RWQCBs); the 2006 Clean Water Act (CWA) Section 303(d) List of Water Quality Limited Segments from the State Water Resources Control Board (SWRCB); groundwater basin data from Bulletin 118 – Update 2003 published by the Department of Water Resources (DWR); groundwater well data from the USGS National Water Information System (NWIS); climate data from the National Oceanographic and Atmospheric Administration (NOAA); flood hazard data from the Federal Emergency Management Agency (FEMA); soil data from the Natural Resources Conservation Service (NRCS); and field reconnaissance data.

The study area was defined as the set of existing water resources crossed or overlain by the proposed Project and alternatives. The current condition and quality of these water resources was used as the baseline against which to compare potential impacts of the proposed Project and alternatives. Additionally, because pollutants that enter these water bodies can be transported downstream or down-gradient to sensitive receiving waters, downstream receiving waters were also considered.

2.2 Regional Setting

For analysis of Hydrology and Water Quality impacts, the proposed Project has been organized into the following three general geographic regions: Northern Region, Central Region, and Southern Region. The Northern Region generally includes all Project components located between the Windhub Substation in southern Kern County to Vincent Substation located in unincorporated Los Angeles County. The Central Region includes all portions of the TRTP extending from Vincent Substation to the southern boundary of the Angeles National Forest (ANF). The Southern Region includes all Project components located south of the ANF within Los Angeles, Orange and San Bernardino Counties.

The State of California uses a hierarchical naming and numbering convention to define watershed areas for management purposes. Watershed boundaries are defined according to size and topography, with multiple sub-watersheds within larger watersheds. A general description of how watershed levels are defined is provided below, in Table 2.2-1. The NRCS, which is part of the U.S. Department of Agriculture (USDA), is responsible for maintaining the California Interagency Watershed Mapping Committee (IWMC), formerly the CalWater Committee. The IWMC has defined a set of naming and numbering conventions applicable to all watershed areas in the State, for the purposes of interagency cooperation and management. Table 2.2-1 shows the primary watershed classification levels used by the State of California, as defined by the IWMC, which are applicable to this analysis.

Table 2.2-1. State of California Watershed Hierarchy Classifications

Watershed Level	Approximate Square Miles	Description
Hydrologic Region (HR)	12,735	Defined by large-scale topographic and geologic considerations. The State of California is divided into ten HRs.
Hydrologic Unit (HU)	672	Defined by surface drainage; may include a major river watershed, groundwater basin, or closed drainage.
Hydrologic Area (HA)	244	Major subdivisions of hydrologic units, such as by major tributaries, groundwater attributes, or stream components.
Hydrologic Sub-area (HSA)	195	A major segment of an HA with significant geographical characteristics or hydrological homogeneity.

Source: CalWater, 2007

The proposed Project would cross the South Lahontan and South Coast Hydrologic Regions. Within these two Hydrologic Regions (HRs), the proposed Project would cross the following Hydrologic Units (HUs): the Antelope HU, the Santa Clara-Calleguas HU, the Los Angeles River HU, the San Gabriel River HU, and the Santa Ana River HU. (CalWater, 2004)

Northern Region

The Northern Region lies within the Antelope Valley, which is located in the western Mojave high desert. This region is mostly within the southwestern-most portion of the South Lahontan HR and also includes a small area within the north-central portion of the South Coast HR, as illustrated in Figure 2-1. Water quality regulation for this area is governed by the Lahontan and Los Angeles RWQCBs. This area includes both the Antelope and Santa Clara-Calleguas HUs, and is bounded by the San Gabriel Mountains to the south and by the Tehachapi and Diablo ranges to the north. Within the Antelope HU, the proposed Project and alternatives cross five Hydrologic Areas (HAs), including: Chafee HA, Willow Springs HA, Neenach HA, Lancaster HA, and Rock Creek HA. The Antelope HU is a closed watershed, which means that precipitation falling within this watershed never reaches any ocean or other watershed (LACSD, 2005). The topography of the Antelope Valley is a flat desert floor between 2,300 to 3,500 feet above sea level that is cut by numerous small, mostly dry creeks and washes that drain generally in an easterly direction toward several dry lakebeds. The portion of the Santa Clara-Calleguas HU that lies within the Northern Region drains to the Santa Clara River and eventually to the Pacific Ocean. Within the Santa Clara-Calleguas HU, the proposed Project and alternatives cross the Acton Hydrologic Sub-Area (HSA). The topography of this area is comprised of mostly undeveloped foothills that form the headwaters of the Upper Santa Clara River (CalWater, 2004; DWR, 2003).

The climate in this region is characterized by hot, dry summers, mild to cool winters, and sparse rainfall. Average annual temperature for the region ranges between a high of 80 degrees Fahrenheit (°F) in July to a low of 45 °F in December (City-Data.com, 2007b). Average precipitation within the Antelope Watershed ranges between five and 10 inches per year, from less than five inches per year along the northerly boundary of the Antelope Valley to about 10 inches per year along the southerly boundary. Most precipitation occurs between October and March, although short duration thunderstorms sometimes occur during the summer months (LADPW, 2005a). Average precipitation in the Santa Clara-Calleguas HU portion of the Northern Region, as measured at the city of Acton, is approximately nine inches per year (City-Data.com, 2007a).

Over time, land uses in the Antelope Valley have been transitioning from agricultural to residential and commercial. The Antelope Valley is also mined for various minerals, including borate, aggregate, and salt. Employment within this area is limited, with a large percentage of the population commuting to jobs in the southerly portions of Los Angeles County. The population within the Northern Region is projected to increase rapidly over the next twenty years from approximately 285,000 persons in 2006 to approximately 550,000 persons in 2025 (AVEK, 2005). Land use in the Santa Clara-Calleguas HU portion of the Northern Region is mostly open space with sparse residential development (USDA, 2005a).

Surface Water

Water Bodies

As shown in Figure 2-1, the Northern Region is contained within the Antelope and Santa Clara-Calleguas HUs (CalWater, 2004). Stream channels in this region are well defined but typically ephemeral in the foothills, and become less defined washes upon reaching the desert floor. The flat topography and lack of defined channels can lead to unconfined overland flow during storm events. Major named drainages in the region include Amargosa Creek, Anaverde Creek, Cottonwood Creek, Oak Creek, and the Upper Santa Clara River (USGS, 2007). Precipitation within the Antelope Watershed that does not evaporate or infiltrate to the groundwater flows to several usually dry lakes, known as playa lakes. Playa lakes are formed when precipitation fills a shallow depression on a flat surface, such as a desert floor. These lakes are endorheic, which means that they have no outlet. The playa lakes in this region include Rosamond Lake, Rogers Dry Lake, and Buckhorn Dry Lake (LACSD, 2005). Precipitation within the Santa Clara-Calleguas Watershed that does not evaporate or infiltrate to the groundwater eventually flows to the Pacific Ocean. In addition to the major drainages and playa lakes, other notable hydrologic features in the region include Palmdale Lake, Little Rock Reservoir, the California Aqueduct, and the Los Angeles Aqueduct. The TRTP also crosses approximately 50 unnamed streams and numerous small gullies and washes in this region (USGS, 2007). Santa Clara River Reach 7, which also crosses through the Northern Region, is listed as impaired for coliform bacteria on the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments (SWRCB, 2006).

Floodplains

In addition to the defined drainage channels and water bodies within the Northern Region, floodplains are an important part of the hydrologic network. A floodplain is a geographic area of relatively level land that is occasionally subject to inundation by surface water from rivers or streams that occur within the floodplain. A "100-year flood" refers to the maximum level of water that is expected to inundate a floodplain ten times every 1,000 years. FEMA has estimated the boundaries for 100-year floodplains for several drainages in the Northern Region, as shown in Figure 2-2. FEMA has also created Flood Insurance Rate Maps (FIRMs), which define the predicted boundaries of 100-year floods (SCE, 2007). FEMA refers to 100-year floodplains, such as those seen on Figure 2-2, as "Flood Hazard Areas." Not all streams have floodplain mapping by FEMA or any other agency. This does not mean the floodplain is not there, only that the floodplain has not been mapped. Any housing or residential that is constructed in a Flood Hazard Area must comply with floodplain management ordinances (FEMA, 2005).

Groundwater

As shown in Figure 2-3, the Northern Region is underlain by the Antelope Valley Groundwater Basin and the Fremont Valley Groundwater Basin.

Antelope Valley Groundwater Basin

The Antelope Valley Groundwater Basin underlies approximately 1,580 square miles of alluvial valley in the western Mojave Desert. The basin is bounded on the northwest by the Garlock fault zone at the base of the Tehachapi Mountains and on the southwest by the San Andreas fault zone at the base of the San Gabriel Mountains. The basin is bounded on the east by ridges, buttes, and low hills that form a surface and groundwater drainage divide. On the north, the basin is bounded by the Fremont Valley Groundwater Basin at a groundwater divide approximated by a southeastward-trending line from the mouth of Oak Creek through Middle Butte to exposed bedrock near Gem Hill. Farther east, the Antelope Valley Groundwater Basin is bounded by the Rand Mountains. Runoff in Big Rock and Little Rock Creeks from the San Gabriel Mountains and in Cottonwood Creek from the Tehachapi Mountains flows toward a closed basin at Rosamond Lake. Rogers Lake is a closed basin in the northern part of Antelope Valley that collects ephemeral runoff from surrounding hills (DWR, 2003).

Recharge to the Antelope Valley Groundwater Basin is primarily accomplished by perennial runoff from the surrounding mountains and hills. Most recharge occurs at the foot of the mountains and hills by percolation through the head of alluvial fan systems. Big Rock and Little Rock Creeks, in the southern part of the basin, contribute about 80 percent of runoff into the basin. Other minor recharge is from return of irrigation water and septic system effluent (DWR, 2003).

The primary water-bearing materials in the Antelope Valley Groundwater Basin are Pleistocene and Holocene age unconsolidated alluvial and lacustrine deposits that consist of compact gravels, sand, silt, and clay. Coarse alluvial deposits form the two main aquifers of the basin: a lower aquifer and an upper aquifer. The upper aquifer, which is the primary source of groundwater for the valley, is generally unconfined whereas the lower aquifer is generally confined (DWR, 2003).

Total basin storage capacity is approximately 70,000,000 acre-feet (af), with a range in annual natural recharge of 31,200 to 59,100 af/year. Because of increased pumping since the 1920s, groundwater use has exceeded estimated natural recharge, resulting in overdraft conditions (USGS, 2003). This overdraft has caused water levels to decline by more than 200 feet in some areas and by at least 100 feet in most of the Antelope Valley. Water data collected in 1996 shows that depth to water within the Antelope Valley Groundwater basin ranges between 100 feet and 500 feet below ground surface (bgs) (USGS, 2003).

The USEPA and the California Department of Public Health regulate drinking water quality under the Safe Drinking Water Act of 1974. This Act sets health-based standards, known as Maximum Contaminant Levels (MCLs), which are used to assess the suitability of groundwater supply for use as drinking water (SCE, 2007). In the Antelope Valley Groundwater Basin, MCLs are exceeded in several wells throughout the basin for the following contaminants: inorganics, radiology, nitrates, pesticides, volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs) (DWR, 2003).

Freemont Valley Groundwater Basin

The Fremont Valley Groundwater Basin underlies 523 square miles of alluvial valley in eastern Kern County and northwestern San Bernardino County. The basin is bounded on the northwest by the Garlock fault zone against impermeable crystalline rocks of the El Paso Mountains and the Sierra Nevada. This basin is bounded on the east by crystalline rocks of the Summit Range, Red Mountain, Lava Mountains, Rand Mountains, Castle Butte, Bissel Hills, and Rosamond Hills. The basin is bounded on the southwest by the Antelope Valley Groundwater Basin along a groundwater divide approximated by a line connecting the mouth of Oak Creek through Middle Butte to exposed basement rock near Gem Hill (DWR, 2003).

Natural recharge of the Fremont Valley Groundwater Basin includes the percolation of ephemeral streams that flow from the Sierra Nevada. The general groundwater flow direction is toward Koehn Lake at the center of the valley. There is no appreciable quantity of groundwater flowing out of the basin (DWR, 2003).

The water-bearing materials of the Fremont Valley Groundwater Basin are dominated by Quaternary alluvium and lacustrine deposits. Groundwater in the alluvium is generally unconfined, although locally confined conditions occur near Koehn Lake (DWR, 2003).

The total storage capacity of the basin is calculated to be approximately 4,800,000 af. Hydrographs indicate that groundwater elevations declined in the southwestern part of the basin by approximately nine feet between 1957 and 1999 (DWR, 2003). Depth to groundwater in the southern portion of the basin is greater than 100 feet bgs (USGS, 2003).

In the Fremont Valley Groundwater basin, no primary MCLs are exceeded. However, groundwater in parts of the basin has high concentrations of Total Dissolved Solids (TDS), including fluoride and sodium (DWR, 2003).

Central Region

The Central Region lies within the ANF, which is located north of the City of Los Angeles, in the San Gabriel Mountains. This mountain range is aligned in a general east-west direction and forms the northern portion of the South Coast HR, as illustrated in Figure 2-1. Water quality regulation for this area is governed by the Los Angeles RWQCB (LARWQCB). This region includes the Santa Clara-Calleguas, Los Angeles River, and San Gabriel River HUs, and is bounded by the ANF administrative boundaries to the north and south. Although a portion of the ANF lies within the South Lahontan HR and drains to the Antelope Valley, all of the ANF land that is within the Central Region near TRTP drains to the South Coast HR and eventually to the Pacific Ocean. Within the Santa Clara-Calleguas HU, the proposed Project and alternatives cross the Acton HSA. Within the Los Angeles River HU, the proposed Project and alternatives cross four Hydrologic Sub-Areas, including: Tujunga HSA, Monk Hill HSA, Pasadena HSA, and Santa Anita HSA. Within the San Gabriel River HU, the proposed Project and alternatives cross the Upper Canyon HSA. Topography in the Central Region is generally rugged with deep, V-shaped canyons separated by sharp dividing ridges. Steep walled canyons with side slopes of 70 percent or more are common. The gradient of principal canyons ranges from 150 to 850 feet per mile. Stream channels are typically unimproved and defined by the natural drainage of the landscape (LADPW, 2005b).

The climate within the Central Region varies between subtropical on the Pacific Ocean side of the San Gabriel Mountain range to semi-arid on the Mojave Desert side. Nearly all precipitation occurs during the months of December through March. Precipitation during summer months is infrequent and rainless periods of several months are common. Average annual rainfall for the San Gabriel Mountains is approximately 27 inches (LADPW, 2005b). Snowfall at elevations above 5,000 feet is frequently experienced during winter storms, but the snow melts rapidly except on higher peaks and northern slopes. Mount Islip along the crest of the ANF has annual rainfall highs of approximately 42 inches (SCE, 2007). January and July are the coldest and warmest months of the year, respectively. At Mount Wilson (elevation 5,850 feet), the 30-year average daily minimum temperature for January is 35 °F and the average daily maximum temperature for July is 80 °F (LADPW, 2005b).

The ANF is predominantly characterized by undeveloped lands and open space which is managed by the USDA Forest Service for the purposes of recreation and natural resources management, among various other uses. The principal vegetative cover of upper mountain areas consists of various species of brush and shrubs known as chaparral. Most trees found on mountain slopes are oak, with alder, willow, and sycamore found along streambeds at lower elevations. Pine, cedar, and juniper are found in ravines at higher elevations and along high mountain summits (LADPW, 2005b).

Surface Water

Water Bodies

As shown in Figure 2-1, the Central Region is contained within the Los Angeles River, San Gabriel River, and Santa Clara-Calleguas HUs (CalWater, 2004). In this mountainous area, the steep canyon slopes and channel gradients promote a rapid concentration of stormwater runoff. Depression storage and detention storage effects are minor in the rugged terrain. Precipitation during periods of soil moisture deficiency is nearly entirely absorbed by soils, and except for periods of extremely intense rainfall, significant runoff does not occur until soils are wetted to capacity. Due to high infiltration rates and porosity of mountain soils, runoff occurs primarily as subsurface flow or interflow in addition to direct runoff (LADPW, 2005b). Major named drainages in the Central Region include Alder Creek, Arroyo Seco, Big Tujunga Creek, Clear Creek, Eaton Wash, Fall Creek, Monte Cristo Creek, North Fork Mill Creek, Tujunga Wash, and the West Fork San Gabriel River. The TRTP also crosses approximately 65 unnamed streams and countless rills and small gullies in this region (USGS, 2007). Many of these unnamed drainages may qualify as Riparian Conservation Areas (RCAs). Please refer to the EIR/EIS, Section 3.4 (Biological Resources), for further information on RCAs. None of the streams or other water bodies in the Central Region is listed as impaired on the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments (SWRCB, 2006).

Floodplains

FEMA has estimated the boundaries for 100-year floodplains for several drainages in the Central Region, as shown in Figure 2-4. The floodplains in the Central Region are relatively narrow compared to those of the Northern Region due to the steep terrain and deeply incised stream channels.

Groundwater

As shown in Figure 2-3, the edges of the Central Region are underlain by the Antelope Valley Groundwater Basin to the north and the Raymond Groundwater Basin to the south. The rest of the Central Region is not underlain by a named/identified groundwater basin. The Antelope Valley Groundwater Basin is described above.

Raymond Groundwater Basin

The Raymond Groundwater Basin underlies approximately 50 square miles of the northwest part of the San Gabriel Valley. The west boundary is delineated by a drainage divide at Pickens Canyon Wash and the southeast boundary is the Raymond fault. The Raymond fault trends east-northeast and acts as a groundwater barrier along the southern boundary of the Raymond Groundwater Basin. This fault acts as a complete barrier along its western end and becomes a less effective barrier eastward. East of Santa Anita Wash, this fault ceases to be an effective barrier and the flow of groundwater southward into the San Gabriel Valley Groundwater Basin becomes essentially unrestricted. A north trending divide paralleling the Eaton Wash separates both surface and subsurface water flow in the eastern portion of the basin (DWR, 2003).

Natural recharge to the Raymond Groundwater Basin is mainly from direct percolation of precipitation and percolation of ephemeral streamflow from the San Gabriel Mountains in the north. The principal streams bringing surface inflow are the Arroyo Seco, Eaton Creek and Santa Anita Creek. Some stream runoff is diverted into spreading grounds and some is impounded behind small dams, allowing the water to infiltrate and contribute to groundwater recharge of the basin. An unknown amount of underflow enters the basin from the San Gabriel Mountains through fracture systems (DWR, 2003).

The water-bearing materials of Raymond Groundwater Basin are dominated by unconsolidated Quaternary alluvial gravel, sand, and silt deposited by streams flowing out of the San Gabriel Mountains. Water in the older alluvium is typically unconfined and sediment sizes range from coarser to finer moving away from the San Gabriel Mountains. However, confined groundwater conditions have existed locally in the basin, particularly along the Raymond fault near Raymond Hill, where layers of finer grained sediments are more abundant (DWR, 2003).

The total storage capacity of Raymond Groundwater Basin is approximately 1,450,000 af. No estimates of available storage have recently been made. In 1970, the available amount of stored water was estimated to be 1,000,000 af, leaving approximately 450,000 af of storage space available. Because this basin is managed, the present amount of stored water and storage space available should be similar to the amount available in 1970 (DWR, 2003). Depth to groundwater is at least 200 feet bgs throughout the basin (MWD, 2007).

In the Raymond Groundwater Basin, MCLs are exceeded in several wells for the following contaminants: total dissolved solids, nitrate, VOCs, and perchlorate (MWD, 2007). As discussed above, MCLs are exceeded in the Antelope Valley Groundwater Basin for the following contaminants: inorganics, radiology, nitrates, pesticides, VOCs and SVOCs (DWR, 2003).

Southern Region

The Southern Region lies within the Greater Los Angeles Basin, within the South Coast HR, as illustrated in Figure 2-1. Water quality regulation for this area is governed by the Los Angeles and Santa Ana RWQCBs. This region includes the Los Angeles River, San Gabriel River, and Santa Ana River HUs. Within the Los Angeles River HU, the proposed Project and alternatives cross the Pasadena HSA and the Los Angeles HA. Within the San Gabriel River HU, the proposed Project and alternatives cross the Upper San Gabriel HA and four HSAs, including: Lower Canyon HSA, Central HSA, La Habra HSA, and Yorba Linda HSA. Within the Santa Ana River HU, the proposed Project and alternatives cross the Chino HSA and the Santa Ana Narrows HSA. The Southern Region encompasses much of the San Gabriel Valley and the southwestern portion of San Bernardino County. The topography is variable, but is generally formed by flat or gently sloping coastal plains and valleys with areas of rolling hills.

Differences in topography are responsible for large variations in temperature, humidity, precipitation, and cloud cover throughout the Southern Region. The coastal plains, with mild rainy winters and warm dry summers, are noted for their subtropical "Mediterranean" climate, while the inland slopes and basins of the Transverse Ranges are characterized by more extreme temperatures and little precipitation. With prevailing winds from the west and northwest, moist air from the Pacific Ocean is carried inland through the Southern Region until it is forced upward by the mountains. The resulting storms, common from November through March, are followed by dry periods during summer months. The average maximum and minimum winter (January) temperatures in downtown Los Angeles are 67°F and 49°F respectively, and in Ontario are 68°F and 45°F, respectively. The average maximum and minimum summer (July) temperatures in downtown Los Angeles are 83°F and 63°F respectively, and in Ontario are 95°F and

62°F, respectively. Precipitation in the Southern Region generally occurs as rainfall; snowfall is rare. Most precipitation occurs during just a few major storms. Average annual rainfall in the City of Los Angeles is approximately 16 inches (SCE, 2007).

Most of the Southern Region is a highly developed urban landscape, with a mix of industrial, commercial, and residential land uses. Residential development is nearly continuous throughout the greater Los Angeles Basin, and is only broken by a few preserved open spaces, such as the Chino Hills and Puente Hills.

Surface Water

Water Bodies

As shown in Figure 2-1, the Southern Region is contained within the Los Angeles River, San Gabriel River, and Santa Ana River HUs (CalWater, 2004). Streams are generally dry in the summer months, but it is common for perennial flows to be present, especially in the larger streams which are fed by the San Gabriel Mountains or urban runoff. Many of the drainages in this region have been lined with concrete to serve as flood control channels, or otherwise altered to conform to the urban landscape. Flood-control and debris-control dams have been built on many of the larger channels, especially at the interface between the mountains and the urban area, such as the Whittier Narrows Flood Control Basin and the Santa Fe Flood Control Basin. With the exception of several smaller or headwater drainages in undeveloped areas such as the Chino Hills and Puente Hills, few streams remain in a natural state. Major named drainages in the region include Alhambra Wash, Avocado Creek, Chino Creek, Cucamonga Creek, Eaton Wash, La Cañada Verde Creek, Little Chino Creek, Mission Creek, Rio Hondo, Rubio Wash, and the San Gabriel River. The TRTP crosses approximately 50 unnamed streams in this region (USGS, 2007). Several of the streams and other water bodies in the Southern Region are listed as impaired on the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments, including: Reach 3 of the San Gabriel River for toxicity; Reach 2 of the Rio Hondo for coliform and NH3; Reach 1 of San Jose Creek for algae and coliform; and Reach 2 of Chino Creek for coliform (SWRCB, 2006).

Floodplains

FEMA has estimated the boundaries for 100-year floodplains for several drainages in the Southern Region, as shown in Figure 2-5. The floodplains in the Southern Region are relatively narrow compared to those of the Northern Region due to the extensive flood control infrastructure throughout the greater Los Angeles Basin.

Groundwater

As shown in Figure 2-3, the Southern Region is underlain by the Raymond and San Gabriel Valley Groundwater Basins, the Central Subbasin of the Coastal Plain of Los Angeles Groundwater Basin, and the Chino Subbasin of the Upper Santa Ana Valley Groundwater Basin. The Raymond Groundwater Basin is described above.

San Gabriel Valley Groundwater Basin

The San Gabriel Valley Groundwater Basin underlies 255 square miles of eastern Los Angeles County. This basin is bounded on the north by the Raymond fault and the contact between Quaternary sediments and consolidated basement rocks of the San Gabriel Mountains. Exposed consolidated rocks of the

Repetto, Merced, and Puente Hills bound the basin on the south and west, and the Chino fault and the San Jose fault form the eastern boundary (DWR, 2003).

Recharge of the San Gabriel Groundwater Basin is mainly from direct percolation of precipitation and percolation of stream flow. Stream flow is a combination of runoff from the surrounding mountains, imported water conveyed in the San Gabriel River channel to spreading grounds in the Central Subbasin of the Coastal Plain of Los Angeles Groundwater Basin, and treated sewage effluent. Subsurface flow enters from the Raymond Groundwater Basin, from the Chino Subbasin and from fracture systems along the San Gabriel Mountain front (DWR, 2003).

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. Upper Pleistocene alluvium deposits form most of the productive water-bearing deposits in this basin. They consist of unsorted, angular to sub-rounded sedimentary deposits ranging from boulder-bearing gravels near the San Gabriel Mountains to sands and silts in the central and western parts of the basin. The lower Pleistocene San Pedro Formation consists of interbedded marine sand, gravel, and silt. This formation bears fresh water and may grade eastward into continental deposits indistinguishable from the overlying Pleistocene age alluvium. (DWR, 2003)

The storage capacity of the San Gabriel Valley Groundwater Basin is approximately 9,000,000 af, and approximately 8,500,000 af are currently stored in the basin (MWD, 2007). The depth to groundwater varies from about 150 to 350 feet bgs (USEPA, 2004).

In the San Gabriel Valley Groundwater basin, MCLs are exceeded in several wells throughout the basin for the following contaminants: TDS, nitrate, VOCs, perchlorate, and N-nitrosodimethylamine (NDMA) (DWR, 2003).

Central Subbasin

The Central Subbasin underlies 277 square miles in the southeastern part of the Coastal Plain of Los Angeles Groundwater Basin. This subbasin is commonly referred to as the “Central Basin” and is bounded on the north by a surface divide called the La Brea High, and on the northeast and east by emergent less permeable Tertiary rocks of the Elysian, Repetto, Merced and Puente Hills. The southeast boundary between the Central Basin and the Orange County Groundwater Basin roughly follows Coyote Creek, which is a regional drainage province boundary. The southwest boundary of the Central Basin is formed by the Newport Inglewood fault system and the associated folded rocks of the Newport Inglewood uplift (DWR, 2003).

Groundwater enters the Central Basin through surface and subsurface flow and by direct percolation of precipitation, stream flow, and applied water; replenishment of the aquifers occurs mainly in the forebay areas where permeable sediments are exposed at ground surface. Natural replenishment of the basin’s groundwater supply is largely from surface inflow through Whittier Narrows (and some underflow) from the San Gabriel Valley. Percolation into the Los Angeles Forebay Area is restricted due to paving and development of the surface of the forebay. Imported water purchased from the Metropolitan Water District (MWD) and recycled water from Whittier and San Jose Treatment Plants are used for artificial recharge in the Montebello Forebay at the Rio Hondo and San Gabriel River spreading grounds. Saltwater intrusion is a problem in areas where recent or active river systems have eroded through the Newport Inglewood uplift. A mound of water to form a barrier is formed by injection of water in wells along the Alamitos Gap (DWR, 2003).

Throughout the Central Basin, groundwater occurs in Holocene and Pleistocene age sediments at relatively shallow depths. The Central Basin is historically divided into forebay and pressure areas. The Los Angeles forebay is located in the northern part of the Central Basin where the Los Angeles River enters the Central Basin through the Los Angeles Narrows from the San Fernando Groundwater Basin. The Montebello forebay extends southward from the Whittier Narrows where the San Gabriel River encounters the Central Basin and is the most important area of recharge in the subbasin. Both forebays have unconfined groundwater conditions and relatively interconnected aquifers that extend up to 1,600 feet deep to provide recharge to the aquifer system of this subbasin. The Whittier area extends from the Puente Hills south and southwest to the axis of the Santa Fe Springs-Coyote Hills uplift and contains up to 1,000 feet of freshwater-bearing sediments. The Central Basin pressure area is the largest of the four divisions, and contains many aquifers of permeable sands and gravels separated by semi-permeable sandy clay and impermeable clay, that extend to about 2,200 feet below the surface. Throughout much of the subbasin, the aquifers are confined, but areas with semipermeable aquicludes allow some interaction between the aquifers (DWR, 2003).

Total storage capacity of the Central Basin is approximately 13,800,000 af (DWR, 2003). The Water Replenishment District of Southern California requires that groundwater levels be maintained at a level of approximately 75 feet or more bgs (MWD, 2007).

In the Central Subbasin, MCLs are exceeded in several wells throughout the basin for the following contaminants: inorganics, radiology, nitrates, VOCs and SVOCs (DWR, 2003).

Chino Subbasin

The Chino Subbasin underlies 240 square miles of the northwestern portion of the upper Santa Ana River Watershed in San Bernardino County and portions of western Riverside and northern Los Angeles Counties (MWD, 2007). The Chino Subbasin is bounded on the east by the Rialto-Colton fault; on the southeast by the contact with impermeable rocks forming the Jurupa Mountains and low divides connecting the exposures. On the south, the Chino Subbasin is bounded by contact with impermeable rocks of the Puente Hills and by the Chino fault; on the northwest by the San Jose fault; and on the north by impermeable rocks of the San Gabriel Mountains and by the Cucamonga fault (DWR, 2003).

Groundwater recharge to this subbasin occurs by direct infiltration or precipitation on the subbasin floor, by infiltration of surface flow, and by underflow of ground water from adjacent basins (DWR, 2003).

The water-bearing units in the Chino Subbasin include Holocene and Upper Pleistocene alluvium. The Pleistocene alluvium is exposed mainly in the northern part of the subbasin and supplies most of the water to wells in the subbasin. The alluvium contains interfingering finer alluvial-fan deposits and coarser fluvial deposits. Most of the wells producing water from the eastern half of Chino Subbasin draw from the coarse portion of the Pleistocene alluvium (DWR, 2003).

Total storage within this subbasin is approximately 18,300,000 af, and approximately 5,300,000 af are currently stored in the basin (DWR, 2003). The depth to groundwater near the TRTP route is approximately 75 feet or greater bgs (CBW, 2006).

In the Chino Subbasin, MCLs are exceeded in several wells throughout the basin for the following contaminants: TDS, inorganics, radiology, nitrates, pesticides, VOCs and perchlorate (MWD, 2007).

2.3 Alternative 2: SCE's Proposed Project

This section describes specific water resources, including streams and associated underlying groundwater basins, crossed by the proposed Project. Stream crossings were identified through GIS analysis of National Hydrography Dataset High Resolution data and verified using USGS 7.5 Minute Quadrangles. Underlying groundwater basins were identified through GIS analysis of DWR Bulletin 118 groundwater data.

Northern Region

Surface Water

Streams crossed by the proposed Project within the Northern Region are listed in Table 2.3-1. Stream channels in this region are well defined but typically ephemeral in the foothills, and become less defined washes along the desert floor. The flat topography and lack of defined channels on the desert floor can lead to unconfined overland flow during storm events. Major named drainages in this region that are crossed by the proposed Project include Amargosa Creek, Anaverde Creek, the California Aqueduct, Cottonwood Creek, the Los Angeles Aqueduct, Oak Creek, and the Upper Santa Clara River (USGS, 2007). The proposed Project also crosses approximately 50 identified unnamed streams in this region (USGS, 2007). Numerous other minor gullies and washes exist along the route.

Table 2.3-1. Proposed Project Northern Region Stream Crossings

Segment	Mile Post	Stream Crossing	Underlying Groundwater Basin
10	0.1	Unnamed	Freemont Valley
10	0.3	Unnamed	Freemont Valley
10	2.0	Oak Creek	Antelope Valley
10	2.35	U/N (tributary to Oak Creek)[1]	Antelope Valley
10	4.0	Unnamed	Antelope Valley
10	4.16	Unnamed	Antelope Valley
10	5.58	Unnamed	Antelope Valley
10	6.04	Unnamed	Antelope Valley
10	6.4	Unnamed	Antelope Valley
10	6.63	Unnamed	Antelope Valley
10	6.82	Los Angeles Aqueduct	Antelope Valley
10	6.9	Unnamed	Antelope Valley
10	7.75	Unnamed	Antelope Valley
10	8.85	Unnamed	Antelope Valley
10	9.03	Unnamed	Antelope Valley
10	9.38	Unnamed	Antelope Valley
10	10.69	Unnamed	Antelope Valley
10	10.88	Unnamed	Antelope Valley
10	11.18	Unnamed	Antelope Valley
10	11.37	Unnamed	Antelope Valley
10	11.94	Unnamed	Antelope Valley
10	12.97	Unnamed	Antelope Valley
10	13.15	Unnamed	Antelope Valley
10	13.88	Unnamed	Antelope Valley
10	14.27	Unnamed	Antelope Valley
10	14.97	Cottonwood Creek	Antelope Valley
10	15.18	Unnamed	Antelope Valley
4	0.43	Unnamed	Antelope Valley
4	1.97	Los Angeles Aqueduct	Antelope Valley
4	2.26 – 2.34	Unnamed	Antelope Valley
4	2.43	Unnamed	Antelope Valley
4	8.9	Unnamed	Antelope Valley
4	10.61	U/N (in Broad Canyon)	Antelope Valley

Table 2.3-1. Proposed Project Northern Region Stream Crossings

Segment	Mile Post	Stream Crossing	Underlying Groundwater Basin
4	10.91	Unnamed	Antelope Valley
4	12.93	Unnamed	Antelope Valley
4	15.5	U/N (downstream of confluence of U/N streams in Myrick and Willow Springs Canyons)	Antelope Valley
4	16.58	Unnamed	Antelope Valley
4	16.93	Unnamed	Antelope Valley
5	1.32	Unnamed	Antelope Valley
5	3.65	Unnamed	Antelope Valley
5	4.43	California Aqueduct	Antelope Valley
5	7.76	Amargosa Creek	Antelope Valley
5	8.52	U/N (tributary to Amargosa Creek)	None
5	9.04	U/N (tributary to Amargosa Creek)	Antelope Valley
5	9.87	Anaverde Creek	Antelope Valley
5	10.29	U/N (tributary to Anaverde Creek)	Antelope Valley
5	11.85	U/N (tributary to Anaverde Creek)	Antelope Valley
5	12.98	U/N (tributary to Anaverde Creek)	Antelope Valley
5	13.54	U/N (tributary to Anaverde Creek)	None
5	15.1	Unnamed	None
5	15.75	Unnamed	Antelope Valley
5	16.1	Unnamed	Antelope Valley
5	17.33	Santa Clara River	Antelope Valley

1 U/N = Unnamed stream

Additionally, named and/or unnamed drainages may be crossed by new and/or upgraded access and spur roads. Although the precise location of these roads is unknown at this time, it is likely that the same named and unnamed drainages that would be crossed by the right-of-way of the proposed Project would also be crossed by the new and/or improved access and spur roads. The location of any drainage that would be crossed by access and/or spur roads will be identified prior to commencement of any construction activities. Also, the Hydrology and Water Quality analysis for the proposed Project and alternatives addresses potential impacts associated with drainage crossings by access and/or spur roads.

Santa Clara River Reach 7 is listed as impaired for coliform bacteria on the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments (SWRCB, 2006). The upstream limits of Reach 7 are near Lang Station, which is over 15 miles downstream of the Segment 5 crossing and the Vincent Substation (SCE, 2007).

Groundwater

As described in Section 2.2, the Northern Region is underlain by the Antelope Valley Groundwater Basin and the Fremont Valley Groundwater Basin. Depth to water in the Antelope Valley Groundwater Basin ranges between 100 feet and 500 feet bgs in the areas crossed by the proposed Project (USGS, 2003). Maximum contaminant levels are exceeded in several wells throughout the Antelope Valley Groundwater Basin for inorganics, radiology, nitrates, pesticides, VOCs and SVOCs (DWR, 2003).

In the Fremont Valley Groundwater Basin, depth to groundwater near the Windhub Substation is greater than 100 feet bgs (USGS, 2003), and no primary MCLs are exceeded (DWR, 2003).

Central Region

Surface Water

Streams crossed by the proposed Project within the Central Region are listed in Table 2.3-2. In this mountainous area, the steep canyon slopes and channel gradients promote a rapid concentration of storm runoff. Major named drainages in the region include Alder Creek, Arroyo Seco, Big Tujunga Creek, Clear Creek, Eaton Wash, Fall Creek, Monte Cristo Creek, North Fork Mill Creek, Tujunga Wash, and the West Fork San Gabriel River. The proposed Project crosses approximately 65 identified unnamed streams in this region (USGS, 2007). Also, countless small rills and gullies exist along the route.

Table 2.3-2. Proposed Project Central Region Stream Crossings

Segment	Mile Post	Stream Crossing	Underlying Groundwater Basin
11	0.27	U/N (tributary to Santa Clara River, in Kentucky Springs Canyon)[1]	Antelope Valley
11	1.63 – 1.66	U/N (tributary to Santa Clara River)	None
11	2.59	U/N (unnamed pipeline)	Antelope Valley
11	3.5	U/N (tributary to Santa Clara River, in Aliso Canyon)	Antelope Valley
11	5.25	U/N (tributary to Santa Clara River)	None
11	5.87	U/N (tributary to Santa Clara River)	None
11	6.27	U/N (tributary to Santa Clara River)	None
11	6.94	U/N (tributary to Santa Clara River)	None
11	7.19	U/N (tributary to Santa Clara River)	None
11	7.68	U/N (tributary to Santa Clara River)	None
11	9.38	North Fork Mill Creek (upstream of Big Tujunga Reservoir)	None
11	9.84	U/N (tributary to North Fork Mill Creek, upstream of Big Tujunga Reservoir)	None
11	11.34	Fall Creek (upstream of Big Tujunga Reservoir)	None
11	12.27	U/N (tributary to Fall Creek, upstream of Big Tujunga Reservoir)	None
11	13.14	Big Tujunga Creek (at inlet to Big Tujunga Reservoir)	None
11	13.79	U/N (tributary to Big Tujunga Creek, upstream of Big Tujunga Reservoir)	None
11	14.77	Clear Creek	None
11	15.32	U/N (tributary to Clear Creek)	None
11	16.47	U/N (tributary to Arroyo Seco)	None
11	16.94	U/N (tributary to Arroyo Seco, in Dark Canyon)	None
11	17.32	U/N (tributary to Arroyo Seco, in Twin Canyon)	None
11	17.59	U/N (tributary to Arroyo Seco, in Brown Canyon)	None
11	17.94	U/N (tributary to Arroyo Seco, in Falls Canyon)	None
11	18.5	U/N (tributary to Arroyo Seco, in Agua Canyon)	None
11	19.31	Arroyo Seco (upstream of Devil's Gate Reservoir)	None
11	19.79	U/N (tributary to Arroyo Seco, in Fern Canyon, upstream of Devil's Gate Reservoir)	None
11	19.97	U/N (tributary to Arroyo Seco, upstream of Devil's Gate Reservoir)	None
11	20.24	U/N (tributary to Arroyo Seco, in Prieto Canyon, upstream of Devil's Gate Reservoir)	None
11	20.58	U/N (tributary to Arroyo Seco, in Millard Canyon, upstream of Devil's Gate Reservoir)	None
11	21.63	Unnamed	None
11	21.96	U/N (in Chiquita Canyon)	None
11	22.52	U/N (in Las Flores Canyon)	None
11	22.93	U/N (in Rubio Canyon)	None

Table 2.3-2. Proposed Project Central Region Stream Crossings

Segment	Mile Post	Stream Crossing	Underlying Groundwater Basin
11	23.24	Unnamed	None
11	24.05	Eaton Wash (upstream of Eaton Wash Debris Basin)	Raymond
11	24.5	U/N (tributary to Eaton Wash, upstream of Eaton Wash Debris Basin)	None
6	0.19	U/N (tributary to Santa Clara River, in Kentucky Springs Canyon)	Antelope Valley
6	0.20	U/N (tributary to Santa Clara River, in Kentucky Springs Canyon)	Antelope Valley
6	1.19	U/N (tributary to Santa Clara River, in Kentucky Springs Canyon)	None
6	2.22	U/N (tributary to Santa Clara River, in Kentucky Springs Canyon)	Antelope Valley
6	2.42	U/N (tributary to Santa Clara River, in Kentucky Springs Canyon)	Antelope Valley
6	3.19	U/N (tributary to Santa Clara River, in Kentucky Springs Canyon)	None
6	4.24	U/N (tributary to Santa Clara River)	None
6	4.54	U/N (tributary to Santa Clara River)	None
6	4.62	U/N (tributary to Santa Clara River)	None
6	5.15	U/N (tributary to Santa Clara River)	None
6	6.02	U/N (tributary to Santa Clara River, in Aliso Canyon)	Antelope Valley
6	6.45	U/N (tributary to Santa Clara River, in Aliso Canyon)	Antelope Valley
6	6.6	U/N (tributary to Santa Clara River, in Aliso Canyon)	None
6	7.19 – 7.23	U/N (tributary to Santa Clara River, in Aliso Canyon)	None
6	8.27	U/N (tributary to Mill Creek)	None
6	8.72	U/N (tributary to Mill Creek)	None
6	8.79	U/N (tributary to Mill Creek)	None
6	10.75	Monte Cristo Creek (tributary to Mill Creek)	None
6	11.4	U/N (tributary to Big Tujunga Creek)	None
6	11.65	U/N (tributary to Big Tujunga Creek)	None
6	12.28	U/N (tributary to Big Tujunga Creek, in Lynx Gulch)	None
6	12.36	U/N (tributary to Big Tujunga Creek)	None
6	13.54	Alder Creek (tributary to Big Tujunga Creek)	None
6	14.39	U/N (tributary to Big Tujunga Creek)	None
6	15.05	U/N (tributary to Big Tujunga Creek)	None
6	15.53	U/N (tributary to Big Tujunga Creek)	None
6	15.8	U/N (tributary to Big Tujunga Creek)	None
6	16.36	Big Tujunga Creek	None
6	17.02	U/N (tributary to West Fork San Gabriel River, in Shortcut Canyon, upstream of Cogswell Reservoir)	None
6	17.19	U/N (tributary to West Fork San Gabriel River, upstream of Cogswell Reservoir)	None
6	17.92	U/N (tributary to West Fork San Gabriel River, upstream of Cogswell Reservoir)	None
6	18.8	West Fork San Gabriel River (upstream of Cogswell Reservoir)	None
6	18.9	U/N (tributary to West Fork San Gabriel River, upstream of Cogswell Reservoir)	None
6	20.43	U/N (tributary to West Fork San Gabriel River, upstream of Cogswell Reservoir)	None
6	21.5	U/N (tributary to Santa Anita Wash)	None
6	23.53	U/N (tributary to San Gabriel River)	None

Table 2.3-2. Proposed Project Central Region Stream Crossings

Segment	Mile Post	Stream Crossing	Underlying Groundwater Basin
6	24.5	U/N (tributary to San Gabriel River, in Cold Springs Canyon)	None
6	26.56	MWD Upper Feeder (pipeline)	None
6	26.74	U/N (tributary to San Gabriel River, upstream of Santa Fe Flood Control Basin)	None

1 U/N = Unnamed stream

In addition, roughly 152 named and/or unnamed drainages would be crossed by new and/or upgraded access and spur roads in the ANF. The locations of these drainage crossings by access and spur roads were mapped as part of a special survey that was conducted for the EIR/EIS Biological Resources analysis (see Section 3.4, Biological Resources). Also, the location and a description of these drainage crossings by access and/or spur roads can be found under the discussion of Riparian Conservation Areas in the EIR/EIS, Section 3.4 (Biological Resources). Although the Hydrology and Water Quality analysis for the proposed Project and alternatives does not identify the location of drainage crossings by access and/or spur roads, the impacts of such crossings are addressed based on analysis of the hydrology of the Project study area, the likely construction methods for access and/or spur roads, and the likely locations of those roads, as identified in Section 3.4 (Biological Resources) of the EIR/EIS, as well as in the *Riparian Conservation Area Report* (Aspen Environmental Group, 2008).

None of the streams or other water bodies in this region of the project study area is listed as impaired on the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments (SWRCB, 2006).

Groundwater

As described in Section 2.2, the edges of the Central Region are underlain by the Antelope Valley Groundwater Basin to the north and the Raymond Groundwater Basin to the south. Depth to water in the Antelope Valley Groundwater Basin ranges between 100 feet and 500 feet bgs within the areas crossed by the proposed Project (USGS, 2003). Maximum contaminant levels are exceeded in several wells throughout the Antelope Valley Groundwater Basin for inorganics, radiology, nitrates, pesticides, VOCs and SVOCs (DWR, 2003).

Depth to groundwater throughout the Raymond Groundwater Basin is 200 feet bgs or more (MWD, 2007). Maximum contaminant levels are exceeded in several wells throughout the basin for the following contaminants: total dissolved solids, nitrate, VOCs, and perchlorate (MWD, 2007).

Southern Region

Surface Water

Streams crossed by the proposed Project within the Southern Region are listed in Table 2.3-3. Streams in this region are generally dry in the summer months, but it is common for perennial flows to be present, especially in the larger streams, which are fed by the San Gabriel Mountains or urban runoff. Many of the drainages in the Southern Region have been lined with concrete to serve as flood control channels, or otherwise altered to conform to the urban landscape; few streams remain in a natural state. Major named drainages in the region include Alhambra Wash, Avocado Creek, Chino Creek, Cucamonga Creek, Eaton Wash, La Cañada Verde Creek, Little Chino Creek, Mission Creek, Rio Hondo, Rubio Wash, the San Gabriel River, and San Jose Creek. The TRTP also crosses approximately 50 unnamed streams in this region (USGS, 2007).

Additionally, named and/or unnamed drainages may be crossed by new and/or upgraded access and spur roads, such as those in the Puente and Chino Hills. Although the precise location of these roads is unknown at this time, it is likely that the same named and unnamed drainages that would be crossed by the right-of-way of the proposed Project would also be crossed by the new and/or improved access and spur roads. The location of any drainage that would be crossed by access and/or spur roads will be identified prior to commencement of any construction activities. Also, the Hydrology and Water Quality analysis for the proposed Project and alternatives will address the potential impacts associated with drainage crossings by access and/or spur roads.

Several of the streams and other water bodies in this region are listed as impaired on the 2006 Clean Water Act Section 303(d) List of Water Quality Limited Segments, including: Reach 3 of the San Gabriel River for toxicity; Reach 2 of the Rio Hondo for coliform and NH3; Reach 1 of San Jose Creek for algae and coliform; and Reach 2 of Chino Creek for coliform (SWRCB, 2006).

Table 2.3-3. Proposed Project Southern Region Stream Crossings

Segment	Mile Post	Stream Crossing	Underlying Groundwater Basin
11	24.83	U/N (tributary to Eaton Wash, upstream of Eaton Wash Debris Basin)[1]	None
11	25.15	U/N (tributary to Eaton Wash, upstream of Eaton Wash Debris Basin)	Raymond
11	25.56	U/N (tributary to Eaton Wash, upstream of Eaton Wash Debris Basin)	Raymond
11	25.92 – 26.08	(In Eaton Wash Debris Basin)	Raymond
11	26.65	U/N (underground pipeline)	Raymond
11	28.25 – 28.32	Eaton Wash (upstream of Whittier Narrows Flood Control Basin)	Raymond
11	29.02 – 29.05	Eaton Wash (upstream of Whittier Narrows Flood Control Basin)	San Gabriel Valley
11	29.87 – 29.88	Eaton Wash (upstream of Whittier Narrows Flood Control Basin)	San Gabriel Valley
11	32.39	Rubio Wash (upstream of Whittier Narrows Flood Control Basin)	San Gabriel Valley
11	34.03	Alhambra Wash (upstream of Whittier Narrows Flood Control Basin)	San Gabriel Valley
11	35.06	Unnamed	San Gabriel Valley
7	3.03 – 3.27	(In Santa Fe Flood Control Basin)	San Gabriel Valley
7	4.31	U/N (Buena Vista Channel)	San Gabriel Valley
7	5.68 – 5.85	San Gabriel River	San Gabriel Valley
7	8.52 – 8.65	Walnut Creek	San Gabriel Valley
7	9.58	Avocado Creek	San Gabriel Valley
7	10.55	Unnamed	San Gabriel Valley
7	10.57 – 10.7	San Gabriel River	San Gabriel Valley
7	11.5 – 13.75	(In Whittier Narrows Flood Control Basin)	San Gabriel Valley
7	12.75	Mission Creek	San Gabriel Valley
7	13.39	U/N (tributary to Mission Creek)	San Gabriel Valley
7	13.57	Rio Hondo	San Gabriel Valley
7	13.74	U/N (tributary to Rio Hondo)	San Gabriel Valley
7	14.56	U/N (tributary to Rio Hondo, in Sycamore Canyon)	San Gabriel Valley
8A	1.28	U/N (tributary to Rio Hondo)	San Gabriel Valley
8A	2.1 – 4.25	(In Whittier Narrows Flood Control Basin)	San Gabriel Valley
8A	2.12	U/N (tributary to Rio Hondo)	San Gabriel Valley
8A	2.33	Rio Hondo	San Gabriel Valley
8A	2.52	U/N (tributary to Mission Creek)	San Gabriel Valley
8A	2.54	Mission Creek	San Gabriel Valley
8A	3.43	Unnamed	San Gabriel Valley
8A	3.73	San Gabriel River	San Gabriel Valley
8A	4.5	San Jose Creek (tributary to San Gabriel River)	San Gabriel Valley

Table 2.3-3. Proposed Project Southern Region Stream Crossings

Segment	Mile Post	Stream Crossing	Underlying Groundwater Basin
8A	4.8 – 4.87	U/N (tributary to San Jose Creek)	San Gabriel Valley
8A	6.13	U/N (tributary to San Gabriel River)	None
8A	7.61	U/N (in Turnbull Canyon)	None
8A	8.7	La Cañada Verde Creek	None
8A	10.3	Unnamed	None
8A	10.55	Unnamed	None
8A	12.55	Unnamed	None
8A	12.76	Unnamed	None
8A	12.92	Unnamed	None
8A	13.56	U/N (in Powder Canyon)	None
8A	13.9	Unnamed	None
8A	14.7	U/N (tributary to San Jose Creek)	None
8A	14.73	U/N (tributary to San Jose Creek)	None
8A	15.67	Unnamed	None
8A	16.31	U/N (tributary to Brea Creek)	None
8A	16.65	U/N (tributary to Brea Creek)	None
8A	16.98	U/N (tributary to Brea Creek)	None
8A	17.1	U/N (tributary to Brea Creek, in Brea Canyon)	None
8A	17.81	U/N (tributary to Brea Creek)	None
8A	18.35	U/N (tributary to Brea Creek)	None
8A	18.53	U/N (tributary to Brea Creek, in Tonner Canyon)	None
8A	19.08	U/N (tributary to Brea Creek)	None
8A	19.36	U/N (tributary to Brea Creek)	None
8A	19.6	U/N (tributary to Brea Creek)	None
8A	20.76 – 20.8	U/N (tributary to Brea Creek)	None
8A	21.15 – 21.2	U/N (tributary to Carbon Canyon Creek)	None
8A	21.33	U/N (tributary to Carbon Canyon Creek)	None
8A	21.74	U/N (tributary to Carbon Canyon Creek)	None
8A	22.2	U/N (tributary to Carbon Canyon Creek)	None
8A	22.33	U/N (tributary to Carbon Canyon Creek)	None
8A	23.03	U/N (tributary to Little Chino Creek, upstream of Prado Flood Control Basin)	None
8A	23.83	Little Chino Creek (upstream of Prado Flood Control Basin)	None
8A	24.58	Little Chino Creek (upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8A	24.62	Little Chino Creek (upstream of Prado Flood Control Basin)	None
8A	24.72	Little Chino Creek (upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8A	25.22 – 26.0	Little Chino Creek (upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8A	26.01 – 26.04	Chino Creek (upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8A	29.23	U/N (tributary to Chino Creek, upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8A	32.91	Cucamonga Creek (tributary to Mill Creek, upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8B	0.77	U/N (tributary to Chino Creek, upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8B	4.5	Cucamonga Creek (tributary to Mill Creek, upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8B	4.9	U/N (upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8C	0.78	U/N (tributary to Chino Creek, upstream of Prado Flood Control Basin)	Upper Santa Ana Valley
8C	4.46	Cucamonga Creek (tributary to Mill Creek, upstream of Prado Flood Control Basin)	Upper Santa Ana Valley

1 U/N = Unnamed stream

Groundwater

As described in Section 2.2, the Southern Region is underlain by the Raymond Groundwater Basin, the San Gabriel Valley Groundwater Basin, the Central Subbasin of the Coastal Plain of Los Angeles Groundwater Basin, and the Chino Subbasin of the Upper Santa Ana Valley Groundwater Basin. Depth to groundwater throughout the Raymond Groundwater Basin is 200 feet bgs or more (MWD, 2007). Maximum contaminant levels are exceeded in several wells throughout the basin for the following contaminants: total dissolved solids, nitrate, VOCs, and perchlorate (MWD, 2007).

Within the San Gabriel Valley Groundwater Basin, depth to groundwater varies from about 150 to 350 feet bgs (USEPA, 2004). Maximum contaminant levels are exceeded in several wells throughout the basin for the following contaminants: TDS, nitrate, VOCs, perchlorate and NDMA (DWR, 2003).

For the Central Subbasin, the Water Replenishment District of Southern California requires that groundwater levels be maintained at a level of approximately 75 feet or more bgs (MWD, 2007). Maximum contaminant levels are exceeded in several wells throughout the basin for the following contaminants: inorganics, radiology, nitrates, VOCs and SVOCs (DWR, 2003).

For the Chino Subbasin depth to groundwater near the TRTP route is at least 75 feet bgs (CBW, 2006). Maximum contaminant levels are exceeded in several wells throughout the basin for the following contaminants: TDS, inorganics, radiology, nitrates, pesticides, VOCs and perchlorate (DWR, 2003).

2.4 Alternative 3: West Lancaster Alternative

This alternative includes one deviation from the proposed Project route, which would extend for 3.4 miles along Segment 4, between S4 MP 14.9 and MP 17.9. This re-route is located in the Northern Region of the Project Area. No other portion of the proposed Project route would be changed under Alternative 3.

Northern Region

The portion of the proposed Project that would be replaced by Alternative 3 (Segment 4, MP 14.9 - 17.9) would cross three unnamed streams. The Alternative 3 re-route would cross the same three unnamed streams, as well as two additional unnamed streams. No named streams would be crossed by the Alternative 3 re-route. All other aspects of the Affected Environment, including climate, topography, land use, floodplains, and groundwater basins, are the same as the proposed Project for the Northern Region, as described in Section 2.3.

Central Region

Affected Environment for the Central Region of Alternative 3 would be exactly the same as Affected Environment for the Central Region of the proposed Project, as described in Section 2.3.

Southern Region

Affected Environment for the Southern Region of Alternative 3 would be exactly the same as Affected Environment for the Southern Region of the proposed Project, as described in Section 2.3.

2.5 Alternative 4: Chino Hills Route Alternatives

Under Alternative 4, the proposed transmission line would follow the same route as the proposed Project through the Northern and Central Regions. In the Southern Region, Alternative 4 would diverge from the proposed Project route at S8A MP 19.2 and turn to the southeast, crossing through part of Orange County before entering San Bernardino County and the Chino Hills State Park (CHSP/Park).

Northern Region

Affected Environment for the Northern Region of Alternative 4 would be exactly the same as Affected Environment for the Northern Region of the proposed Project, as described in Section 2.3.

Central Region

Affected Environment for the Central Region of Alternative 4 would be exactly the same as Affected Environment for the Central Region of the proposed Project, as described in Section 2.3.

Southern Region

As described above, the Affected Environment of Alternative 4 is identical to the Affected Environment of the proposed Project (Section 2.3) for all Segments except Segment 8A, in the Southern Region. The Affected Environment of Segment 8A would be different than that of the proposed Project from S8A MP 19.2 to 35.2. In addition, the upgrades associated with Segments 8B would still occur; therefore Affected Environment characteristics associated with Hydrology and Water Quality for this segment would be the same as the proposed Project.

Impacts to several surface and groundwater resources would be avoided and/or introduced under each routing option. Table 2.5-1 (Stream Crossings that would be Avoided by Alternative 4), below, lists the surface and groundwater resources that would be affected by the proposed Project but would be avoided under the routing options for Alternative 4.

Table 2.5-1. Stream Crossings that would be Avoided by Alternative 4

Segment	Mile Post	Stream Crossing Avoided by Alternative 4	Underlying Groundwater Basin Avoided by Alternative 4
8A	19.36	Unnamed	None
8A	19.6	Unnamed	None
8A	20.76 – 20.8	Unnamed	None
8A	21.15 – 21.2	Unnamed	None
8A	21.33	Unnamed	None
8A	21.74	Unnamed	None
8A	22.2	Unnamed	None
8A	22.33	Unnamed	None
8A	23.03	Unnamed	None
8A	23.83	Little Chino Creek	None
8A	24.58	Little Chino Creek	Upper Santa Ana Valley
8A	24.62	Little Chino Creek	None
8A	24.72	Little Chino Creek	Upper Santa Ana Valley
8A	25.22	Little Chino Creek	Upper Santa Ana Valley
8A	26.02	Chino Creek	Upper Santa Ana Valley
8A	29.23	Unnamed	Upper Santa Ana Valley
8A	32.91	Cucamonga Creek	Upper Santa Ana Valley
8C	0.78	Unnamed	Upper Santa Ana Valley
8C	4.46	Cucamonga Creek	Upper Santa Ana Valley

Although Table 2.5-1 represents surface water and groundwater resources that would be avoided by the Alternative 4 routing options, these options would likewise introduce new stream crossings. Milepost information for these routes is not available, and it is anticipated that the location of one or more of the Alternative 4 routing options could change depending on final engineering. Therefore, it is not possible to provide accurate tables of stream crossings that would occur under each Alternative 4 routing option. Instead, a rough estimate of the number of stream crossings, including any named stream crossings, is provided here for each routing option.

The proposed routes for Alternative 4 would cross through parts of Orange County and San Bernardino County, which the proposed Project (Alternative 2) would not enter. The routing options for Alternative 4 would also cross through the CHSP and would include a new switching station either within or outside the Park. In addition, several new roads would be constructed, including an all-weather road to provide access to the new switching station. The four different routing options (Routes A through D and Route C Modified) which are included under Alternative 4 are discussed in further detail below.

Route A

This alternative would deviate from the proposed Project route at Segment 8A MP 19.2 and run parallel to the existing Mira Loma-Walnut/Olinda 220-kV transmission line for 6.2 miles, 2.3 miles of which would be within the CHSP. Route A would be situated within an existing utility corridor, but would require that the corridor be widened by 150 feet along the length of Route A. In addition, Route A would require the installation of a new switching station within the CHSP. The size of new switching station would be a minimum of four to five acres in size, using gas-insulated technology. Five unnamed streams would be crossed by Route A.

Route B

Route B would follow the same path as Route A into the CHSP, but instead of terminating at the new switching station described above, Route B would continue to just beyond the eastern Park boundary, eventually terminating at a new switching station outside of the CHSP. As with the Route A alternative, the new switching station for Route B would be a minimum of four to five acres in size. Route B would travel through the CHSP for approximately 4.3 miles. Eight streams would be crossed by Route B, including Aliso Creek and seven unnamed streams.

Route C

The proposed Route C alternative would involve the construction of a new transmission line just north of the CHSP, the re-routing of two existing lines within the CHSP, the removal of existing transmission lines from within the CHSP, and the construction of a new switching station just north of the Park. The removal of existing transmission lines would be considered part of this alternative because removal activities would affect water quality. Ten unnamed streams would be crossed by Route C.

Route C Modified

The proposed Route C Modified is very similar to the original Route C, described above, with the exception that the switching station would be situated approximately 2,500 feet northwest of the location analyzed under the original Route 4C. As such, access roads to the new switching station for Route C Modified would have slightly different configuration to accommodate the new location. Re-routing of the same transmission lines described under Route C would occur under Route C Modified and the same effects to water quality would occur. Route 4C Modified would traverse twelve unnamed streams.

Route D

The proposed Route D alternative would follow the same path as the proposed Route C alternative, but instead of terminating at a switching station at approximately Segment 8A MP 24.7, Route D would continue to follow the northern boundary of CHSP for approximately 4.0 miles, before crossing through part of the Park in a southeasterly direction and terminating at a new switching station just outside the eastern Park boundary. The proposed switching station for Route D would be in the same location as that proposed for the Route B alternative. Four streams would be crossed by Route D, including Aliso Creek and three unnamed streams.

2.6 Alternative 5: Partial Underground Alternative

Under Alternative 5, the proposed transmission line (T/L) would follow the same route as the proposed Project through the Northern and Central Regions. In the Southern Region, Alternative 5 would place 3.5 miles of Segment 8A underground beneath the same corridor as the proposed aboveground T/L, from MP 21.9 to MP 25.4.

Northern Region

Affected Environment for the Northern Region of Alternative 5 would be exactly the same as Affected Environment for the Northern Region of the proposed Project, as described in Section 2.3.

Central Region

Affected Environment for the Central Region of Alternative 5 would be exactly the same as Affected Environment for the Central Region of the proposed Project, as described in Section 2.3.

Southern Region

Under this alternative, the existing 220-kV T/L along Segment 8A would be left in place from MP 21.9 to MP 25.4. Several streams that would be crossed by the proposed Project along Segment 8A, between MP 21.9 to MP 25.4, would not be crossed by Alternative 5 because the transmission infrastructure would be placed well below those streams. Table 2.6-1, below, lists the streams that would be avoided under this alternative. In addition, this alternative would affect the underlying groundwater basin because the transmission infrastructure would be placed below the depth to groundwater. Table 2.6-1 shows the groundwater basin (Upper Santa Ana Valley) that would be affected under this alternative but avoided under the proposed Project. Please see Section 2.2 for a description of the Chino Subbasin of the Upper Santa Ana Valley groundwater basin.

Table 2.6-1. Stream Crossings that would be Avoided by Alternative 5

Segment	Mile Post	Stream Crossing Avoided by Alternative 5	Underlying Groundwater Basin Affected by Alternative 5
8A	22.2	Unnamed	None
8A	22.33	Unnamed	None
8A	23.03	Unnamed	None
8A	23.83	Little Chino Creek	None
8A	24.58	Little Chino Creek	Upper Santa Ana Valley
8A	24.62	Little Chino Creek	None
8A	24.72	Little Chino Creek	Upper Santa Ana Valley
8A	25.22	Little Chino Creek	Upper Santa Ana Valley

2.7 Alternative 6: Maximum Helicopter Construction in the ANF Alternative

Alternative 6 includes the maximum amount of helicopter construction on the ANF (Segments 6 and 11). This alternative follows the same route for the transmission line as the proposed Project in all three regions, as described in Section 1.2.6. This alternative would require ten helicopter staging and landing areas ranging in size from two acres to over four acres. All of the locations identified for these areas, with the exception of Site 9, appear to have well-maintained access roads leading to them and should be accessible for the delivery and staging of materials, equipment, and personnel. Site 9 would require a new access road. Improvements at each of the staging and landing areas would be required and would include clearing of vegetation, grading, and potential cut and fill activities.

Due to the weight capacities and fuel limitations for the helicopters that would be used under this alternative, only those tower locations within an approximate 2.5-mile radius of the staging areas were considered viable candidates for helicopter construction. For the purpose of obtaining a maximum number of tower locations subject to helicopter construction, all of the tower locations that occur within the 2.5-mile radius of each staging area were assumed to require helicopter construction. As a result of this alternative, the construction and/or improvements to many of the access roads and all of the spur roads associated with these tower locations that would be required under SCE's proposed Project (Alternative 2) would not occur.

Northern Region

Affected Environment for the Northern Region of Alternative 6 would be exactly the same as Affected Environment for the Northern Region of the proposed Project, as described in Section 2.3.

Central Region

Affected Environment for the Central Region of Alternative 6 would be very similar to the Affected Environment for the Central Region of the proposed Project, as described in Section 2.3. However, under this alternative, 148 new 500-kV towers would be constructed by helicopter under this alternative, 92 within Segment 6 and 56 within Segment 11. As a result of helicopter construction, approximately 42 miles (±15% range of 49 to 36 miles) of new and upgraded access and spur roads (includes new, reconstruction, and maintenance road types), which would be required as part of SCE's proposed Project (Alternative 2), would not be created or upgraded for ground access to the helicopter constructed towers. However, ground-access to wire stringing sites (pulling/tensioner/splicing) would continue to be required for this alternative as equipment for these activities can only be brought in by truck.

Several streams that would be crossed by access and spur roads within the ANF would no longer be affected under Alternative 6. The locations of these drainage crossings by access and spur roads that would be avoided under Alternative 6 were mapped as part of the *Riparian Conservation Area Report* (Aspen, 2008). Also, the location and a description of these drainage crossings by access and/or spur roads that would be avoided under Alternative 6 can be found under the discussion of Riparian Conservation Areas in the EIR/EIS, Section 3.4 (Biological Resources). Although the Hydrology and Water Quality analysis for the proposed Project and alternatives does not identify the location of drainage crossings by access and/or spur roads, nor the drainage crossings that would be avoided under this alternative, the impacts of such crossings are addressed based on analysis of the hydrology of the Project study area, the likely construction methods for access and/or spur roads, and the likely locations of those roads, as identified in the EIR/EIS, Section 3.4 (Biological Resources).

Southern Region

Affected Environment for the Southern Region of Alternative 6 would be exactly the same as Affected Environment for the Southern Region of the proposed Project, as described in Section 2.3.

2.8 Alternative 7: 66-kV Subtransmission Alternative

Under Alternative 7, the proposed T/L would follow the same route as the proposed Project through the Northern and Central Regions. In the Southern Region, Alternative 7 would place one mile of 66-kV subtransmission line underground beneath the same corridor as the proposed aboveground T/L, from Segment 7 MP 8.9 to MP 9.9, and would re-route and place underground several sections of 66-kV subtransmission lines through the Whittier Narrows Recreation Area.

Northern Region

Affected Environment for the Northern Region of Alternative 7 would be exactly the same as Affected Environment for the Northern Region of the proposed Project, as described in Section 2.3.

Central Region

Affected Environment for the Central Region of Alternative 7 would be exactly the same as Affected Environment for the Central Region of the proposed Project, as described in Section 2.3.

Southern Region

Under this alternative, four 66-kV subtransmission line elements would be undergrounded and/or re-routed: (1) Undergrounding the 66-kV subtransmission line in Segment 7 through the River Commons or Duck Farm Project (between Valley Boulevard – S7 MP 8.9 and S7 MP 9.9); (2) Re-routing and undergrounding the 66-kV subtransmission line around the Whittier Narrows Recreation Area in Segment 7 (S7 MP 11.4 to 12.025), (3) Re-routing the existing 66-kV subtransmission line through the Whittier Narrows Recreation Area in Segment 7 (S7 MP 12.0 to 13.6) immediately north of the existing 220-kV ROW to reduce the number of structures required (20-foot expanded ROW required); and (4) Re-routing the 66-kV subtransmission line around the Whittier Narrows Recreation Area in Segment 8A between the San Gabriel Junction (S8A MP 2.2) and S8A MP 3.8.

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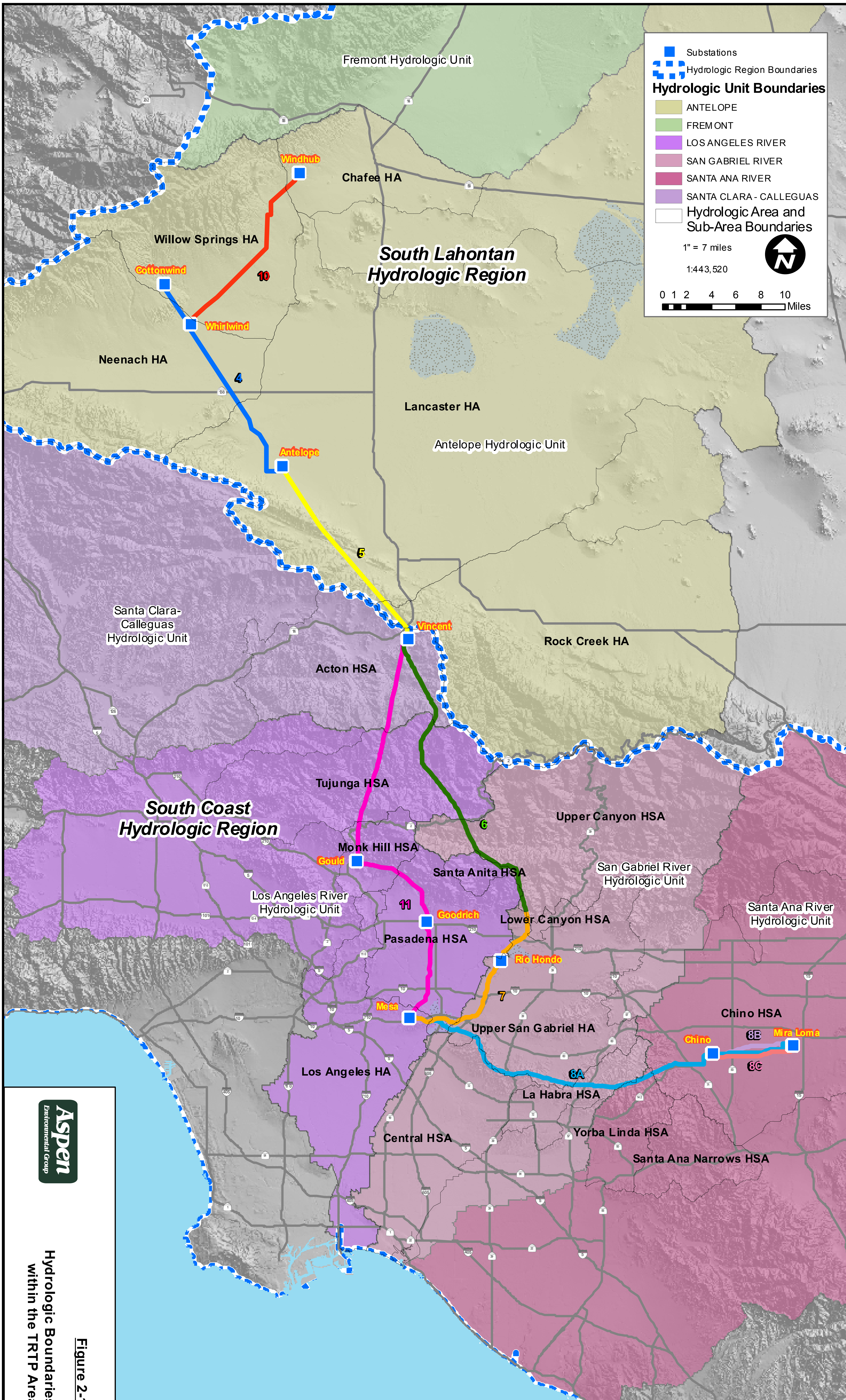

Figure 2-1
Hydrologic Boundaries within the TRTP Area

August 2009

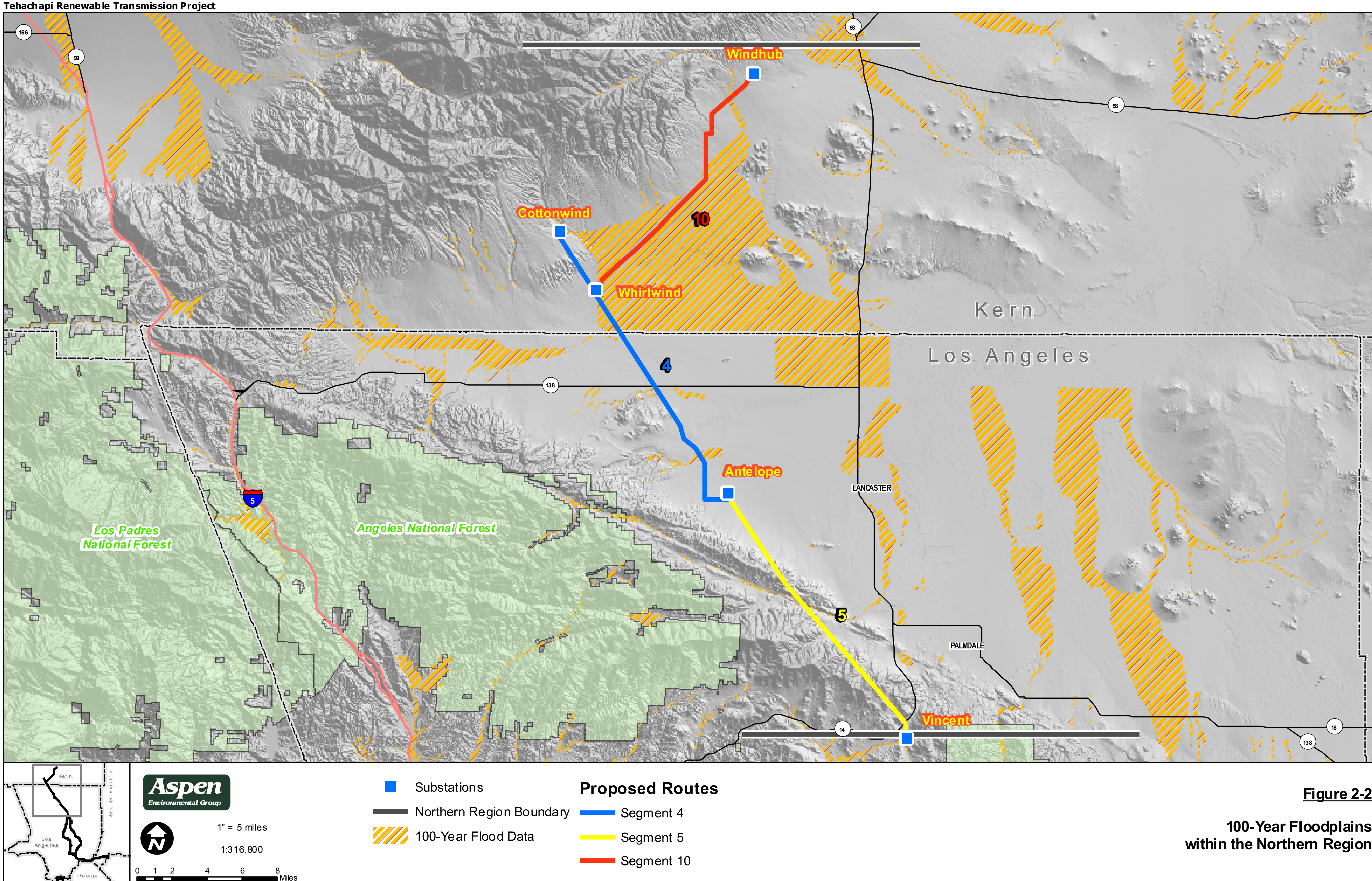

Figure 2-2
100-Year Floodplains within the Northern Region

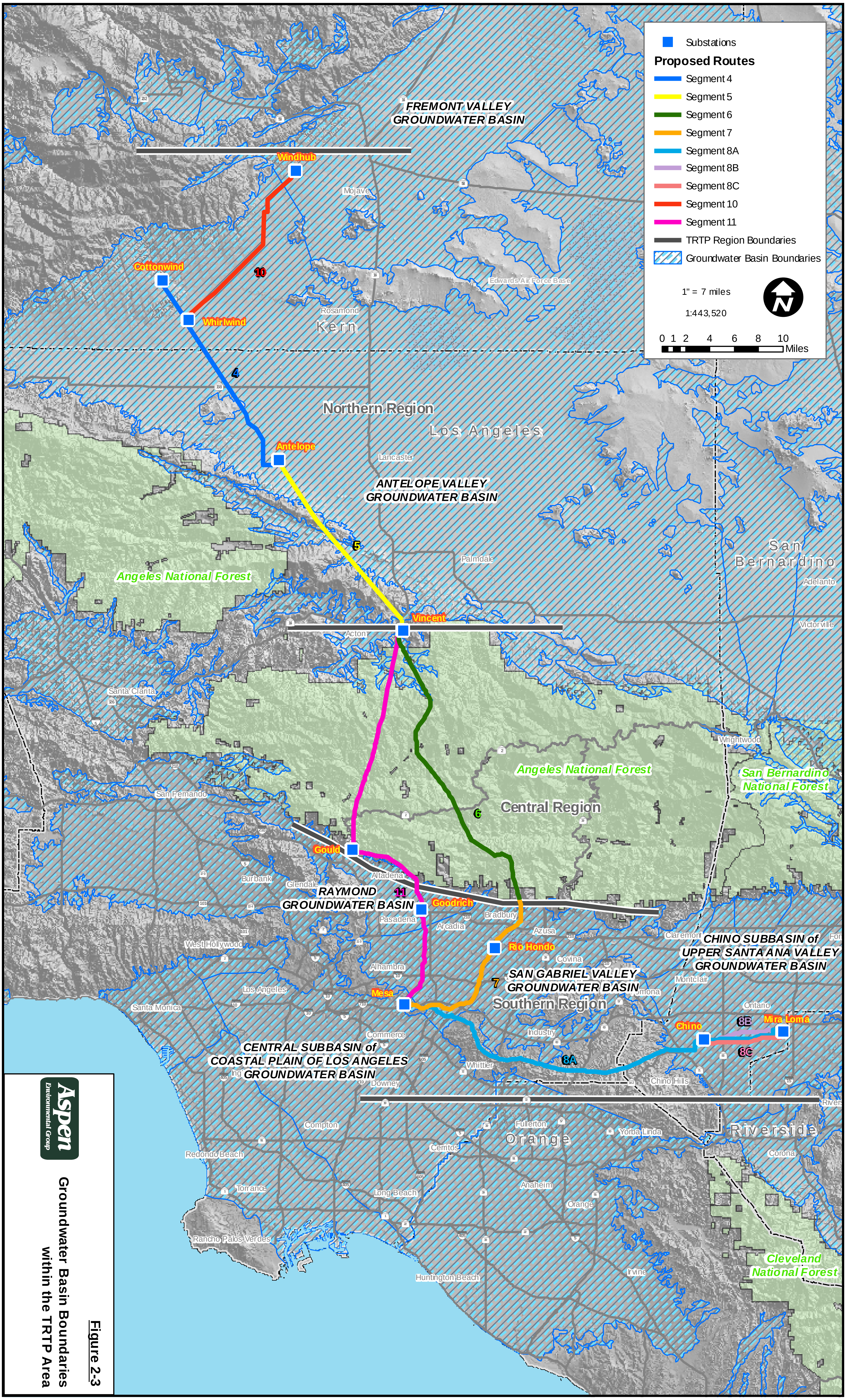

Figure 2-3
Groundwater Basin Boundaries within the TRTP Area

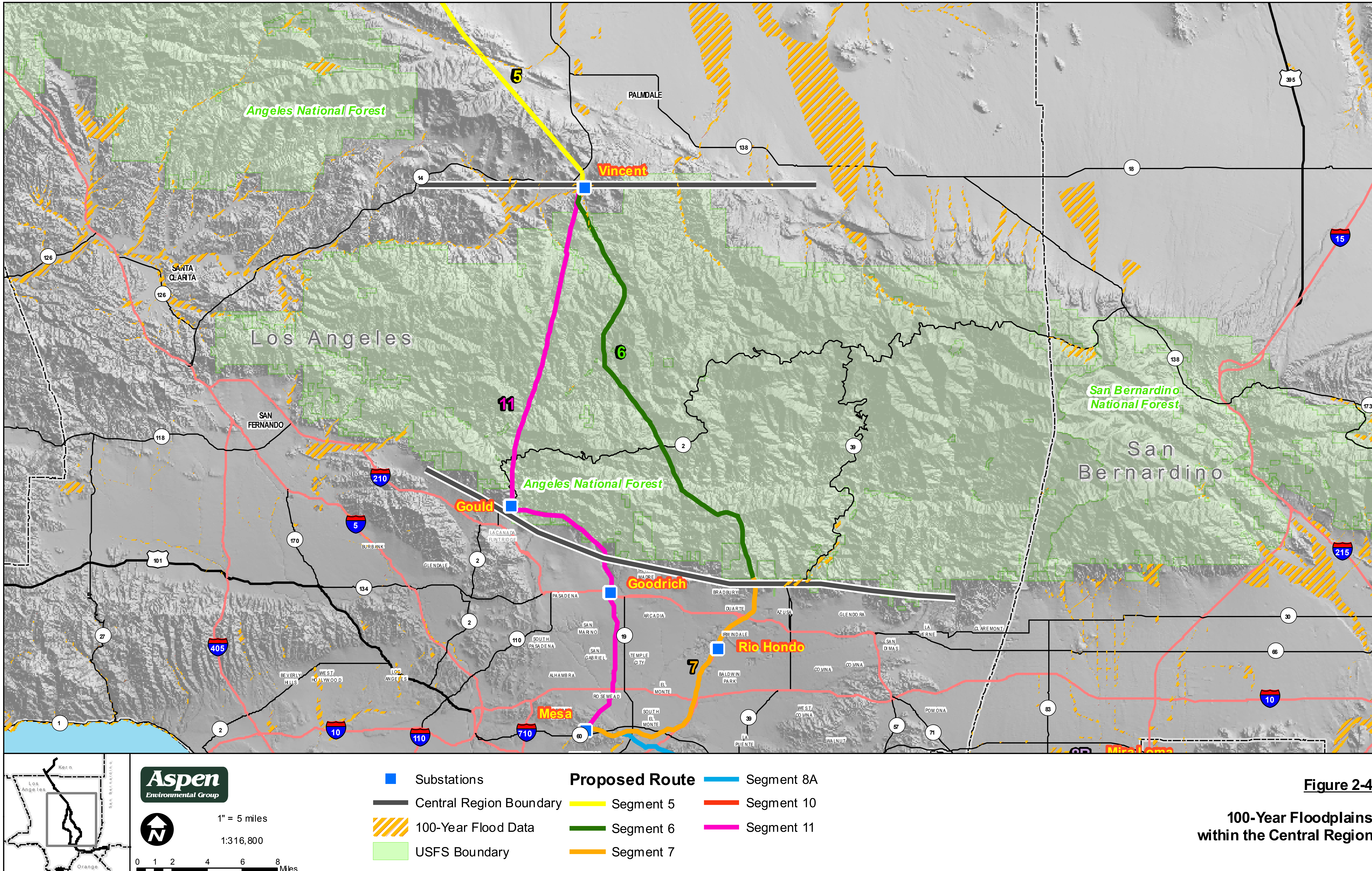

Figure 2-4

100-Year Floodplains within the Central Region

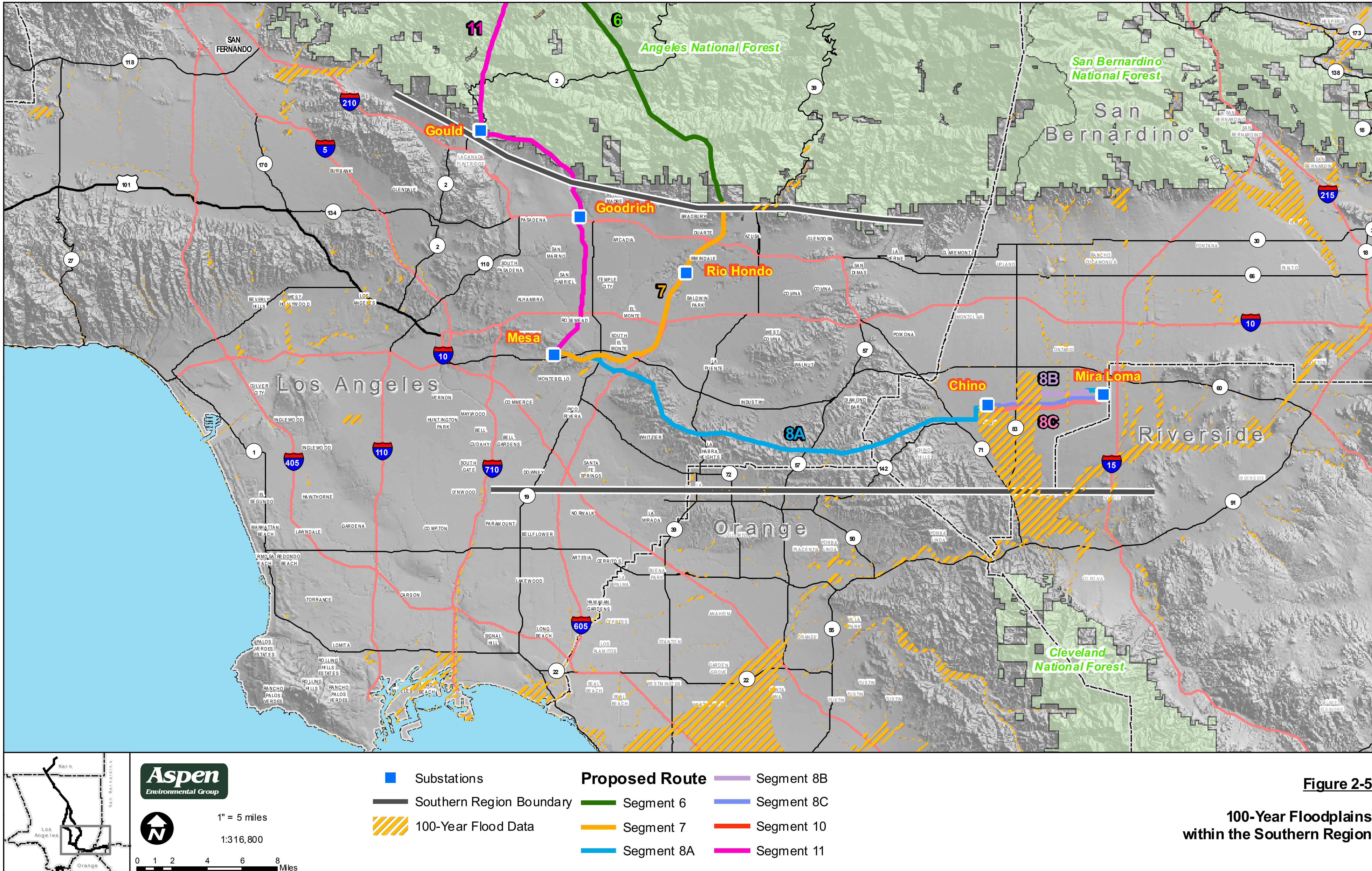

Figure 2-5

100-Year Floodplains within the Southern Region