CHAPTER 16

HYDROLOGY

INTRODUCTION

This chapter presents an analysis of the hydrological impacts associated with the expansion of the VWRP. In order to provide a better understanding of the flow dynamics of the Santa Clara River, several discharge scenarios were analyzed. A hydrological analysis of multiple flow scenarios was necessary since discharge to the river is expected to change over time as new users connect to the SCVJSS and as the demand for reclaimed water reuse increases.

A strong interrelationship exists between the hydrology, water quality, and biological resources of the Santa Clara River. Changes in discharge from the WRPs to the Santa Clara River may affect receiving water quality. Furthermore, varying levels of discharge could potentially have an impact on fisheries and other sensitive biological resources due to changes in water velocity and depth.

This chapter will focus only on those impacts related to changes in flood flow capacity, the morphology of the river channel, and the extent of groundwater recharge. Potential impacts of the proposed expansion of the VWRP on water quality and biological resources are considered in Chapters 17 and 18, respectively. Due to the minor nature of the proposed upgrades at the SWRP and VWRP (refer to Chapters 7 and 8), discussion of the existing conditions at the SWRP is not included in this chapter, and only the potential hydrological impacts associated with the construction and operation of these upgrades are addressed.

SETTING

Regulatory Setting

The federal government has recognized that costly flood control facilities to allow development in floodplains is not economical. It is generally more feasible to keep development out of flood hazard areas than to keep floods away from development. Congress, in response to the increasing costs of disaster relief, passed the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. The intent of these acts is to reduce the need for large, public-funded flood control structures and disaster relief by discouraging development within the floodplain. The Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program (NFIP) to provide subsidized flood insurance to communities that comply with FEMA regulations limiting development in flood-plains. FEMA issues flood insurance rate maps for communities participating in the NFIP. These maps delineate flood hazard zones in the community.

County of Los Angeles General Plan

The *1988 County of Los Angeles General Plan* includes nonstructural flood management goals and policies for receiving FEMA subsidized flood insurance. These policies restrict development within floodplains when such development would cause an increase in water surface elevation. However, the policies do not expressly prohibit siting structures designed for human occupancy within floodplains. In Los Angeles County, siting of projects within or adjacent to floodplains is regulated by the County Department of Public Works (DPW). The DPW implements the policies of the County General Plan and reviews projects for consistency with flood control planning and projects.

Regional Setting

Climate

The Santa Clarita Valley experiences a semi-arid, Mediterranean-type climate characterized by long, dry summers and relatively short, wet winters. Maritime influences in the valley tend to moderate temperature extremes. Typical temperatures range from highs of approximately 100°F in summer to lows of 30°F in winter. Mean monthly temperatures range between 72°F in summer to 55°F in winter. In the Newhall-Saugus-Valencia area, July daytime temperatures average 92°F, with average nighttime lows of 57°F. Winters are mild, and the coldest month is January, with average nighttime lows of 40°F. Winter daytime temperatures average 70°F.

Approximately 80 percent of the average annual precipitation in the valley occurs between November and March. Winter precipitation tends to increase with altitude. Mean seasonal precipitation in the Santa Clara River watershed ranges from eight inches near Acton to 25 inches in the San Gabriel Mountains. Although precipitation often falls as snow in higher elevations, snowfall rarely occurs in the valley.

Precipitation in the Santa Clarita Valley results from three types of storms: winter storms, thunderstorms, and occasional cyclonic intrusions. Winter storms cause the major floods in the areas. Thunderstorms, which cover comparatively small areas and last for short periods of time, are more common at higher elevations. Tropical storms can occur in the late summer or early fall, but they have not resulted in any major floods during the period of record.

The historical maximum annual precipitation for Saugus was 43.73 inches in water year 1983, and the historical minimum was 8.01 inches in water year 1961. The long-term mean seasonal precipitation at Saugus is 18.45 inches. Annual precipitation is highly variable; it is far more common in any given year to have significantly more or less precipitation than average.

Hydrogeology

Geological units in the Santa Clarita Valley in descending stratigraphic order, are as follows:

- Quaternary alluvium and terrace deposits.
- Saugus Formation of late Pliocene to early Pleistocene geologic age.
- Pico, Castaic, Towsley, and Mint Canyon Formations of Miocene geologic age.

The Quaternary alluvium and the Saugus Formation form the main aquifers of the Eastern Groundwater Basin. Generally, the alluvium forms a relatively thin veneer of sediments that directly overlies the Saugus Formation along the Santa Clara River within the groundwater basin (Figure 16-1). Most of the information that follows has been summarized and condensed from Slade, 1986 and 1988, and Kennedy/Jenks Consultants, 1996.

Groundwater movement in the Eastern Groundwater Basin is generally from east to west. There is no subsurface inflow from the adjacent Acton Aquifer. Outflow from the Eastern Groundwater Basin to the adjacent Piru Groundwater Basin occurs either as subsurface outflow or as rising water. The Eastern Groundwater Basin is replenished by stream percolation, penetration of direct precipitation, and unconsumed portions of applied irrigation water. Another source of water to the basin is treated effluent from water reclamation plants.

Most of the surface-water runoff enters the Eastern Groundwater Basin as winter flood flow from the narrow mountain canyon creeks, which are tributaries to the Santa Clara River. As this runoff moves downstream, groundwater recharge occurs. Perennial base runoff in most of the mountain canyons usually percolates into the streambed before reaching the Santa Clara River. As a result, most of the area stream channels are dry during the summer. The considerable fluctuation in precipitation in the Santa Clarita Valley is an important factor in determining groundwater elevations of the aquifers.

Alluvial Aquifer

The Alluvial Aquifer consists of unconsolidated recent (Holocene geologic age) stream deposits of clay, silt, sand, and gravel. Historically, the quantity of groundwater in storage in the Alluvial Aquifer has ranged from 107,000 AF in a relatively dry hydrologic period, to 201,000 AF in a relatively wet hydrologic period. The estimated groundwater storage capacity of the aquifer is approximately 239,900 AF. Historical groundwater elevations in the Santa Clara Valley have ranged from 1,635 feet above sea level (asl) on the east side of the aquifer, to 825 feet asl on the west, during a relatively dry hydrologic period. During a relatively wet hydrologic period, groundwater elevations have ranged from 1,696 feet asl on the east to 885 feet asl on the west (see Figure 16-2).

Recharge to the Alluvial Aquifer occurs primarily from infiltration of surface-water runoff within the Santa Clara River and from deep percolation of precipitation on the exposures of alluvium along canyon streams. These recharge areas are largely formed by canyon tributaries north of the basin, such as the Bouquet, Dry, and San Francisquito Canyon tributaries, and by those south of the basin such as Placerita, Whitney, Gavin, and Pico Canyon tributaries. On the eastern extremity of the basin, Iron, Oak Spring, Bee, Tick, and Mint Canyons form the recharge areas for the aquifer.

Several water purveyors, such as the Santa Clarita Water Company, the Valencia Water Company, the Newhall County Water District (NCWD), and Los Angeles County Waterworks District No. 36, have historically extracted groundwater from the basin for water-supply purposes. Each of the water companies or water districts extracts and treats groundwater for municipal-supply purposes. For the years 1987 to 1994, total annual groundwater extractions by these purveyors from the Alluvial Aquifer ranged between approximately 12,000 AF to 21,000 AF (these quantities do not include agriculture and other local pumping).

Saugus Aquifer

The Saugus Aquifer system is composed largely of claystone, siltstone, and sandstone that was originally deposited in a non-marine environment; these strata are of late Pliocene to early Pleistocene geologic age. It has been estimated that the total quantity of usable groundwater in storage in the Saugus Aquifer is approximately 1,413,000 AF (Slade, 1988). Data from water-supply wells in the Saugus Aquifer have shown that groundwater elevations have ranged from 1,101 feet asl in the southern portion of the aquifer to 947 feet asl in the western portion, during a relatively dry hydrologic period. For a relatively wetter hydrologic period, groundwater elevations ranged from 1,293 feet asl in the southern portion of the aquifer to 1,055 feet asl in the western portion.

Recharge to the groundwater in the Saugus Aquifer system takes place by two main methods: direct precipitation and deep percolation of rainfall on outcrops in the highland areas surrounding the aquifer, and through infiltration of groundwater from the saturated sections of the overlying Alluvial Aquifer within the river valley itself. Thus, the recharge areas for the Saugus Aquifer include a large area of the Eastern Groundwater Basin, outside the aquifer itself. However, it is apparent that the greatest amount of groundwater replenishment to the Saugus Aquifer occurs directly from the Alluvial Aquifer. Recharge that takes place in areas not directly associated with the Alluvial Aquifer occurs largely through joints, fractures, and bedding planes in the Saugus Aquifer (Kennedy/ Jenks Consultants, 1996).

The Santa Clarita Water Company, Valencia Water Company, NCWD, and Wayside Honor Rancho extract groundwater from the Saugus Aquifer. For the years 1987 to 1994, total annual groundwater extractions from the Saugus Aquifer by these purveyors ranged from approximately 8,000 AF to 14,500 AF.

Surface Waters of the Santa Clarita Valley

Surface waters of the Santa Clarita Valley include the Santa Clara River, tributaries of the river, and a number of storage reservoirs, some of which seasonally release stored water into the river. In addition to winter rainfall in the valley, the discharges from the VWRP and SWRP contribute greatly to the overall flow of the Santa Clara River.

Santa Clara River

The Santa Clara River is the largest river system in Southern California that remains in a relatively natural state. Beginning in the San Gabriel Mountains east of the City of Santa Clarita, the Santa Clara River flows approximately 84 miles westward to the Pacific Ocean. The Santa Clara River drains the northwestern central mountains, including the slope of the western San Gabriel Mountains and most of the northwestern mountains and hills. In the Lake Hughes area, the Santa Clara tributaries drain the northern slopes of the central mountains and the southern central slopes of Portal Ridge. The river traverses Ventura County and meets the Pacific Ocean at Ventura. The Santa Clara River exists within and traverses the Eastern Groundwater Basin. The river, along its entire course, consists of typical braided stream characteristics such as point bar deposits, gravelly stream bottoms, and broad, wide washes. Geologically, such characteristics manifest themselves in cut and fill structures and interbedded silt, sand, and gravel lenses in the sedimentary section. In addition, a relatively wide floodplain area forms the surrounding flat-lying areas of the river. In these areas, finer-grained material comprises the dominant sediment size.

The Santa Clara River has been formed largely by stormwater runoff originating in highland areas and caused by storms of short duration and high intensity. Particle sizes of sediment in the streambed generally range from coarse sand sizes to gravel (pebble, cobble, and boulder size). The reach of the Santa Clara River, upstream from the Bouquet Canyon Road overpass to Lang, is typically dry except in periods following storms. However, in wetter years, flows may persist until early summer. Downstream from the confluence with the South Fork of the Santa Clara River, the combination of shallow bedrock and a reduced cross-sectional flow area creates rising groundwater. Historically, the rising groundwater supported a perennial flow condition in the river westward from I-5 past the Los Angeles/Ventura County line. More recently, the perennial reach has extended approximately three miles farther upstream to the Bouquet Canyon Road overpass, presumably as a result of discharge of reclaimed water from the SWRP (see Figure 16-3).

Principal tributaries of the upper Santa Clara River (defined as the main course of the river upstream of the Los Angeles/Ventura County line) include the creeks within Mint Canyon, Bouquet Canyon, San Francisquito Canyon, Castaic Creek Canyon, Oak Spring Canyon, Sand Canyon, and Potrero Canyon. The principal tributaries of the South Fork of the Santa Clara River, which drains in a northerly direction towards its confluence with the main course of the upper Santa Clara River, include the creeks within Placerita Canyon, Newhall Canyon, and Pico Canyon.

Flow in the stream canyons near the valley floor is ephemeral and diminishes rapidly after most rainfall events. Surface flow typically occurs only during the rainy season or snowmelt season. Perennial flow may be maintained in years of extraordinary rainfall, but in normal years, the streams are dry during summer and fall months. Streams at the upper elevations flow all through the year, unless rainfall is well below normal.

Only portions of the Santa Clara River have year-round surface flow. Rising groundwater, reclaimed water from the VWRP and SWRP, agricultural runoff, and other miscellaneous flows contribute to this year-round flow. Downstream of the WRPs, approximately one mile west of the Los Angeles/ Ventura County line, a gap in perennial flow occurs where the surface water percolates through the coarse riverbed materials and into the Piru Groundwater Basin. During most years, surface flows do not occur again for more than 15 miles downstream, creating a barrier to fish migration. In very wet years, this gap in perennial flow may be reduced to nine miles. Continuous surface flow exists only under flood conditions.

Large areas of the Santa Clarita Valley are subject to flooding that results from weather conditions in the San Gabriel Mountains. Heavy winter rainfall runs off the exposed, highly fractured rocks that are overlain with a very shallow soil mantle. Vegetation normally intercepts a considerable portion of the rainfall and prevents rapid runoff. As a consequence, fires in the watershed have a pronounced effect on the level of surface-water flow and sedimentation.

Several gauging stations monitor the flow of the river and its tributaries. In addition, several sampling stations collect surface-water quality data along the river and its tributaries. Daily flow data from the county line and The Old Road bridge gauging stations indicate that the highest average monthly flows occur between January and March and the lowest between July and October.

Storage Reservoirs

Four storage reservoirs are located on the creeks that are tributary to the upper Santa Clara River. The storage reservoirs include Bouquet Canyon Reservoir, Dry Canyon Reservoir, Castaic Lake, and Castaic Lagoon.

Bouquet Canyon Reservoir

The Bouquet Canyon Reservoir, covering 628 acres, is approximately one mile west of the junction of Bouquet Canyon Road and Spunky Canyon Road. Owned and operated by the City of Los Angeles Department of Water and Power (DWP), the water storage reservoir, which was completed in March of 1934, was designed for a storage capacity of 36,500 AF.

An agreement between DWP and United Water Conservation District dictates low flow releases from Bouquet Canyon Reservoir. The original agreement, dated April 27, 1932, was amended in 1978 to provide for the following releases:

- 1 cubic foot per second (cfs) (0.6 mgd) continuously for six months during the winter.

- 5 cfs (3.2 mgd) continuously for six months during the summer.

Dry Canyon Reservoir

The Dry Canyon Reservoir is a 1,313 AF storage facility located in Dry Canyon between San Francisquito and Bouquet Canyon, five miles north of Saugus. The reservoir was originally placed in service in 1913 to provide aqueduct storage and to regulate flows in the first Los Angeles Aqueduct below the San Francisquito Power Plants. Dry Canyon Reservoir was taken out of service in January 1966 because of inability to control seepage problems. Currently, Dry Canyon Reservoir impounds water only during storms.

Castaic Lake

Castaic Lake is a 324,000 AF storage facility created by an earthfill dam across Castaic Creek. It also serves as the terminus of the West Branch of the California Aqueduct. In addition to its State Water Project functions, Castaic Lake is operated to *conserve local flood waters originating in the watershed above Castaic Dam that would otherwise waste to the Pacific Ocean because they are in excess of the flow rate below which all flows are readily percolated or otherwise beneficially used* (California Department of Water Resources, 1992). To achieve this objective, the following operational rules have been established:

- If stormwater inflow to Castaic Lake is 0 to 100 cfs (0 to 65 mgd), release approximately equals inflow (plus any releases of stored water requested by the downstream users).
- If stormwater inflow to Castaic Lake exceeds 100 cfs (65 mgd), release equals zero if storage capability exists. Water is stored until downstream users request release of the water.
- If downstream users have not requested release of stored water (from storms occurring from October 1 through May 1) by May 1, the water becomes the property of DWR.
- Flood flows occurring between May 1 and September 30 will be stored only at the option of DWR and can be requested for release by downstream users within 30 days after storage commenced.
- Downstream users can specify desired flow rate for release of stored water.

Castaic Lagoon

Castaic Lagoon is located directly south and downstream of the Castaic Dam. The lagoon, created by DWR to provide more recreational opportunities, has a surface area of 197 acres and a gross capacity of 5,701 AF of water.

Water Reclamation Plants

Treated effluent from the SWRP and VWRP comprises a majority of the total flow in the upper Santa Clara River during summer months. The SWRP and VWRP have permitted treatment capacities of 6.5 mgd and 12.6 mgd, respectively. At this time, only a very small amount of reclaimed water generated from the two WRPs is reused. Instead, nearly all effluent is discharged to the river. Table D-11 of Appendix D shows that effluent accounts for approximately 15 percent of the total stream flow in the reach of the river from the SWRP to the county line during the wet season and up to approximately 85 percent of total flow during the dry season.

Average daily flow rates at the SWRP and VWRP have generally been increasing as the population of the valley has grown. In 1996, the SWRP treated 5.7 mgd, and the VWRP treated 9.3 mgd. Therefore, the combined discharge from both the SWRP and VWRP is currently averaging 15.0 mgd. Monthly average daily flows from 1991 to 1995 for both plants are summarized in Table D-1 of Appendix D.

FUTURE PROJECTS ON THE UPPER SANTA CLARA RIVER

In addition to the expansion of the VWRP, several other proposed projects may affect the ground and surface-water resources. The most significant of these proposed projects are Newhall Ranch and CLWA's reclaimed water system.

Expansion of the Valencia WRP

To accommodate anticipated growth in the Santa Clarita Valley, the Districts are planning to further expand the VWRP. Construction would occur in two increments: Stage V (9 mgd), followed by Stage VI (6 mgd). By the year 2010, the capacity of the VWRP would increase to 27.6 mgd, bringing the total permitted capacity for the SCVJSS to 34.1 mgd.

The projected combined flows of the VWRP and SWRP through the year 2015 are depicted in Figure 16-4. Wastewater flow projections are based on SCAG 96 population projections and estimates of future industrial flows.

Newhall Ranch

The Newhall Land and Farming Company is proposing the Newhall Ranch development, a planned community of approximately 70,000 people residing in approximately 25,000 units within 12,000 acres (nearly 19 square miles). As proposed, Newhall Ranch would be bordered by the Los Angeles/ Ventura County line on the west and would be bisected by the Santa Clara River. Newhall Ranch would include shops, schools, community services, recreation, apartment homes, executive homes, estates, and a new 7.7 mgd WRP. The proposed Newhall Ranch WRP would produce high-quality tertiary treated reclaimed water, which would be used to irrigate a golf course, parks, and other landscaped areas within Newhall Ranch.

Castaic Lake Water Agency Reclaimed Water System

The *Reclaimed Water System Master Plan* was completed for the CLWA's proposed reclaimed water system in September 1993. According to the master plan, the proposed reclaimed water system would be implemented in eight phases. The phases are prioritized based on the status of the users, the anticipated construction schedule of future users, and the proximity of the users to the VWRP and SWRP.

Phase I of CLWA's reclaimed water system would distribute up to 1,700 acre-feet per year of reclaimed water from the VWRP to potential users in the Santa Clarita Valley.

The *Reclaimed Water System Master Plan* identified potential users of reclaimed water. Such potential users include the Six Flags Magic Mountain Amusement Park and golf courses. Reclaimed water at the amusement park would be used for landscape irrigation and for hosing down rides, patios, and walkways. The golf courses would use reclaimed water for irrigation purposes.

Full implementation of the master plan for the proposed reclaimed water system would deliver approximately 9,100 AFY, designated as follows:

- 3,700 AF for eight golf courses.
- 1,300 AF for parks.
- 1,000 AF for schools.
- 1,100 AF for residential landscaping.
- 500 AF for commercial/ industrial landscaping.
- 700 AF for use at a cogeneration plant.
- 500 AF for use at the Six Flags Magic Mountain Amusement Park.
- 300 AF for other uses, including cemetery landscaping, freeway landscaping, and Christmas tree farms.

IMPACTS AND MITIGATION MEASURES OF THE 2015 PLAN ALTERNATIVES

Methodology and Assumptions for Impact Analysis

The methodology used to assess potential hydrological impacts included review of published studies of the river, WRP discharge records, and stream gauge data; a reconnaissance-level survey of the Santa Clara River from the SWRP to the mouth of the river; development of water budgets to estimate mean monthly flows at a number of locations along the river that would potentially be affected by the proposed project; and estimation of depth, width, and mean channel velocity at each of these locations.

The first comprehensive study of the region, *Irrigation and Water Supply Investigations of the Upper Santa Clara Soil Conservation District, Los Angeles County, California*, was prepared by the U.S. Department of Agriculture in 1955. In 1968, DWR published a report entitled *Santa Clara River Valley Water Quality Study*. The following studies have since been commissioned by local agencies:

- *Final Environmental Impact Report for the Upper Santa Clara River Basin Facilities Plan* (County Sanitation Districts of Los Angeles County, 1980).
- *Hydrogeologic Investigation, Perennial Yield and Artificial Recharge Potential of the Alluvial Sediments in the Santa Clara River Valley of Los Angeles County, California* (Slade, 1986).
- *Hydrogeologic Assessment of the Saugus Formation of the Santa Clara Valley of Los Angeles County, California* (Slade, 1988).
- *Investigation of Water Quality and Beneficial Uses, Upper Santa Clara River Hydrologic Area* (DWR, 1993).
- *Final Report, Reclaimed Water System Master Plan* (Kennedy/Jenks Consultants, 1993).
- *Water Resources Report on the Santa Clara River* (Kennedy/Jenks Consultants, 1996).
- *Newhall Ranch Specific Plan and Water Reclamation Plant, Draft Environmental Impact Report* (Impact Sciences, Inc., 1996).

Based on literature review and field reconnaissance, it was determined that the area of potential impact was limited to the reach of the river from the SWRP to the point of percolation, approximately one mile downstream of the county line gauge.[1] This reach was subdivided for further analysis into the following four subreaches: SWRP to VWRP, VWRP to Castaic Creek, Castaic Creek to the county line gauge, and the county line gauge to the point of percolation (defined below). A summary of the existing conditions found in these four subreaches based on review of gauge records, discharge records, and our field survey is provided below:

- *SWRP to VWRP:* From June through November, approximately half the volume of the water discharged from the SWRP is lost before it reaches The Old Road bridge gauge. During the rest of the year, the river is gaining, presumably from tributary inflow and local runoff. In August 1996, the surface water from near the confluence of San Francisquito Creek to The Old Road bridge gauge was measurably cooler than temperatures measured immediately upstream (closer to the SWRP discharge), indicating an influence from rising groundwater. At The Old Road bridge gauge, the river was approximately eight feet wide and eight inches deep. The bed material was primarily sand and gravel.

1. Although a net increase or decrease of flow from the Eastern Groundwater Basin may impact downstream groundwater basins, the effects are obscured by tributary inflow and groundwater pumping. It would be highly speculative to attempt to determine groundwater levels or stream flows.

- *VWRP to Castaic Creek:* The majority of water in this reach from April through December is WRP effluent. Only during winter months (January through March) do natural flows constitute a majority of the flow in the river. In August 1996, the river was approximately 16 feet wide and 16 inches deep at the VWRP outfall. The bed material was primarily sand and gravel.

- *Castaic Creek to the County Line Gauge:* Castaic Creek provides a substantial inflow to the Santa Clara River from April through July. The river in this subreach has an appearance similar to that of the upstream subreach. In August 1996, the river was approximately 16 feet wide and 16 inches deep at the confluence with Castaic Creek.

- *County Line Gauge to the Point of Percolation:* Downstream of the county line gauge, the river passes from the Eastern Groundwater Basin into the Piru Groundwater Basin, where the surface water percolates down through the coarse bed materials. In August 1996, the river was approximately 16 feet wide and 16 inches deep at the county line gauge.

As previously mentioned, in addition to assessing the hydrological impacts of the proposed VWRP expansion project, other discharge scenarios were analyzed. This analysis was necessary since the actual level of future discharge to the Santa Clara River is unknown. Future discharge levels will be contingent on the amount of future wastewater generated (which can be estimated based on SCAG population projections) and the extent of future water reuse in the Santa Clarita Valley (which cannot be accurately estimated since the demand for reclaimed water is based on too many unknown variables). Consequently, it is conceivable that despite an increase in the amount of wastewater generation, future discharge levels to the river could decrease as a result of a relatively greater increase in water reuse. Therefore, in order to thoroughly assess the potential hydrological impacts of future changes in discharge to the Santa Clara River and the underlying aquifer system, the following six discharge scenarios were developed:

- *No Discharge Scenario*: The No Discharge Scenario assumes that discharge from both the SWRP and VWRP would completely cease (i.e., total discharge would equal 0.0 mgd). The purpose for evaluating the No Discharge Scenario is to provide a greater understanding of the overall impacts that the SCVJSS has had on the river and underlying aquifer system.

- *Reduced Discharge Scenario:* Based on interviews with various water purveyors and literature reviews, it is evident that the demand for reclaimed water will likely increase in the future. However, it is impossible to determine when and to what extent water reuse will have a significant effect on discharge levels. As an estimate, the Reduced Discharge Scenario assumes that future reuse would decrease discharges from the SWRP and VWRP to 5.0 mgd and 4.6 mgd, respectively. These discharge levels reflect the projected 2015 wastewater generation rate for the SCVJSS, less the future demand for reclaimed water as suggested by the previously mentioned water reuse studies and plans.

- *Existing Discharge Scenario*: The Existing Discharge Scenario is based on the 1996 average daily discharge levels of 5.7 mgd from the SWRP and 9.3 mgd from the VWRP. This discharge scenario was developed as part of the No Project Alternative. CEQA requires that the No Project Alternative be considered during the planning process in order to provide a baseline of environmental impacts for comparison with the other alternatives.

- *Permitted Discharge Scenario:* The current permitted capacity of the SCVJSS is 19.1 mgd (6.5 mgd at the SWRP and 12.6 mgd at the VWRP). The main rationale for evaluating the

Permitted Discharge Scenario is that 19.1 mgd is the maximum combined discharge that can be generated by the SWRP and VWRP without obtaining additional approvals from the RWQCB.

- *Recommended Project Discharge Scenario*: CEQA requires that the environmental impacts of the proposed project be assessed as part of the planning process. The Recommended Project Discharge Scenario assumes a discharge of 6.5 mgd from the SWRP and 27.6 mgd from the VWRP. These are the anticipated wastewater generation rates for the year 2015 and the resulting discharges to the river, assuming no reuse.
- *Cumulative Discharge Scenario*: CEQA requires that the cumulative impacts of similar and concurrent projects, such as the proposed Newhall Ranch development, be analyzed as part of an environment assessment. According to the latest SCAG population projections and the draft EIR for the Newhall Ranch project, the proposed 7.7 mgd Newhall Ranch WRP would be treating an estimated 5.0 mgd by the year 2015. The draft EIR for the Newhall Ranch project presumes that nearly 100 percent of the Newhall Ranch WRP's effluent would be reused. However, the Cumulative Discharge Scenario was developed to serve as a worst-case (in terms of greatest potential change to the existing discharge levels) scenario. Therefore, discharges levels were not reduced by assumed levels of reuse. Instead, this scenario assumes that 39.1 mgd (consisting of 6.5 mgd from the SWRP, 27.6 mgd from the VWRP, and 5.0 mgd from the Newhall Ranch WRP) would be discharged to the river by the year 2015.

As an assessment tool for the hydrology, water quality, and fisheries analyses, water budgets were developed for each discharge scenario. The water budgets provide an estimate of mean monthly flow in each of the subreaches under each of the six discharge scenarios. The water budgets are included in Appendix D.

To develop the budgets, the first step was to develop a seasonal adjustment factor for the Recommended Project Discharge Scenario based on the five most recent years of reporting data from SWRP and VWRP (Table D-1, Appendix D). The adjustment factors were then applied to the discharge scenarios (Table D-2, Appendix D).

The mean monthly flows from water year 1972 through water year 1995 measured at The Old Road bridge, the point of discharge from Castaic Lake, and the county line gauges are presented in Table D-3 of Appendix D. Although the period of flow records is more extensive, the development of Castaic Lake has been a major alteration to the watershed that in turn alters the flows at the county line gauge. The data set was truncated so that earlier data would not influence the water budget estimates.

Estimated gains and losses for the river reaches between the SWRP discharge point and The Old Road bridge gauge and between The Old Road bridge and the county line gauge were derived from the known discharges from the Castaic Creek and the WRPs. The various WRP discharge scenarios were then added, in order to estimate flows in the various reaches of the river. Tables D-4 through D-11 of Appendix D are the water budgets for each of the identified discharge scenarios. The tables show monthly discharges from the SWRP and VWRP, the natural gains or losses to the river based on the existing conditions, and the resultant flows in the subreaches previously identified.

Table D-12 of Appendix D lists the maximum depth, width, and mean channel velocity of the Santa Clara River at The Old Road bridge gauge, the VWRP outfall, the confluence with Castaic Creek, and the county line gauge under each discharge scenario. The following assumptions were made when estimating channel depth, width, and mean velocity in each subreach:

- The channel bed is composed of sand and gravel.
- The channel bed is mobile.
- Winter storm flows mobilize the bed materials annually, creating a new low-flow channel as they subside.
- The channel bed has a Manning's roughness coefficient of 0.035.
- The overall channel slope will remain constant at 0.0029 ft/ft.
- The channel can be represented as a simple triangular shape.
- The channel form (depth-to-width ratio) will remain constant (1:12) because sufficient space exists in the seasonal flood channel to accommodate a low-flow channel created by all discharge scenarios.
- Changes in discharge from the VWRP will occur gradually over a number of seasons.

Significance Criteria

The criteria used to evaluate the effects of the proposed project are based on federal, state, and local laws, regulations, and policies (e.g., ESA, CWA, CEQA, Cal-ESA, and California Fish and Game Code).

Alterations to the hydraulic characteristics of the watercourses are considered significant adverse impacts if the scenario would result in any the following:

- Damage or loss of property from inundation.
- Substantial reduction of flood flow capacities.
- Increased extent or severity of flooding.
- Changes in channel morphology (i.e., channel downcutting).
- Potential loss of water for groundwater recharge and for downstream water users.
- Substantial loss of aquatic habitat.

Alterations to the hydraulic characteristics of the watercourses are considered beneficial if the scenarios would result in any of the following:

- Reduction in the extent or severity of flooding of developed areas due to either existing or projected future conditions or increased groundwater recharge.
- Increase in the amount of aquatic habitat.

Analysis of Six Discharge Scenarios

To analyze the hydrologic effects of the proposed project, Manning's equation was used to estimate the maximum depth, width, and mean channel velocity. The historic record shows that the greatest natural flows occur in March above Castaic Creek and in February below Castaic Creek, and the smallest natural flows occur in August. Consequently, analysis of the flows during just two months will bracket the potential effects of the proposed project at each location to provide a worst-case low and high flow analysis.

The following sections describe the hydrologic conditions in each subreach under each discharge scenario, based on the 24-year record used in preparing the water budgets. For comparative purposes, the Existing Discharge Scenario is described first.

Existing Discharge Scenario

Under the Existing Discharge Scenario (SWRP: 5.7 mgd, VWRP: 9.3 mgd), the four subreaches are perennial. During the summer months the river is approximately eight feet wide and eight inches deep above the VWRP discharge and 15 feet wide and 16 inches deep below the discharge.

During the month of maximum flow, the river is approximately 30 feet wide and 30 inches deep above the confluence with Castaic Creek. Downstream of Castaic Creek, the river is approximately 40 feet wide and 36 inches deep.

The Existing Discharge Scenario maintains a near constant and higher groundwater level in the Alluvial Aquifer of the Eastern Groundwater Basin near the VWRP, causing surface water to extend further upstream than under recent historic conditions (1950s-1980s). The natural recharge to the Piru Groundwater Basin has also increased because much of the discharge is composed of water imported from the SWP. It is likely that as a result of effluent discharge and surface water imports, the Piru Groundwater Basin has a more constant groundwater level than under pre-SWP conditions. This discharge scenario has resulted in no detectable changes in the gap.

No Discharge Scenario

Under the No Discharge Scenario (SWRP: 0.0 mgd, VWRP: 0.0 mgd), there would be significantly less surface water than under the Existing Discharge Scenario. During the summer months, no flow would occur between the SWRP and VWRP or between the VWRP and Castaic Creek. The maximum mean monthly flow, which occurs in March, would be approximately 12 percent and 22 percent less in the SWRP to VWRP and the VWRP to Castaic Creek subreaches, respectively, compared to the Existing Discharge Scenario.

The subreaches downstream of the confluence of Castaic Creek would remain perennial, although at approximately one-third the size during the summer compared to the Existing Discharge Scenario. The resulting channel would be approximately six or seven feet wide and six inches deep compared to the current channel of 15 to 17 feet wide and 16 inches deep. Because of the large inflow from Castaic Creek and rising groundwater during the winter, only a minor reduction would occur in channel size (approximately 1 foot narrower and 2 inches shallower) compared to the Existing Discharge Scenario. The size of the gap would not change during high flow periods when compared to current levels.

Although the water budgets indicate that no flow would occur under average conditions during the summer in these subreaches, the VWRP is located near the upper limits of the historic reach of rising groundwater. It is likely that there would be surface water in some years, depending on the climatic cycle and the groundwater levels in the Alluvial Aquifer of the Eastern Groundwater Basin.

In comparison to the Existing Discharge Scenario, recharge to the Piru Groundwater Basin, where the surface water of the Santa Clara River percolates down through the coarse bed materials, would decrease by approximately 44 percent.

Reduced Discharge Scenario

Under the Reduced Discharge Scenario (SWRP: 5.0 mgd, VWRP: 4.6 mgd), the SWRP to VWRP subreach would be nearly the same as under the Existing Discharge Scenario. During summer months, the downstream subreaches would be perennial but somewhat smaller than under the Existing Discharge Scenario due to the reduced VWRP discharge. The channel width would be approximately 13 percent narrower and 15 percent shallower (approximately 3 feet and 3 inches, respectively).

During the high-flow condition, there would be essentially no change in channel size compared to the Existing Discharge Scenario, since WRP discharges are insignificant compared to flood flows. The size of the gap would not change from current levels.

Similar to the Existing Discharge Scenario, the Reduced Discharge Scenario would help to maintain a near constant groundwater level in the Alluvial Aquifer of the Eastern Groundwater Basin. However, recharge to the Piru Groundwater Basin would be decreased by approximately 13 percent.

Permitted Discharge Scenario

Under the Permitted Discharge Scenario (SWRP: 6.5 mgd, VWRP: 12.6 mgd), the SWRP to VWRP subreach would be somewhat larger than under the Existing Discharge Scenario. The channel width would increase by 10 percent and the depth by 14 percent (approximately 1 foot and 1 inch, respectively). The downstream subreaches would also increase in depth and width. The channel width would be approximately 15 percent wider and 15 percent deeper (approximately 3 feet and 3 inches, respectively) than under the Existing Discharge Scenario.

During the high-flow condition, there would be essentially no change in channel size compared to the Existing Discharge Scenario. There also would be no changes in length of the gap downstream of the county line.

Similar to the Existing Discharge Scenario, the Permitted Discharge Scenario would maintain a near constant groundwater level in the Alluvial Aquifer of the Eastern Groundwater Basin. However, recharge to the Piru Groundwater Basin would be increased by approximately eight percent.

Recommended Project Discharge Scenario

Under the Recommended Project Discharge Scenario (SWRP: 6.5 mgd, VWRP: 27.6 mgd), the SWRP to VWRP subreach would be the same as under the Permitted Discharge Scenario. The downstream subreaches would increase in depth and width compared to the Permitted Discharge Scenario. The channel width would be approximately 46 percent wider and 46 percent deeper (approximately 7 feet and 7 inches, respectively) than under the Existing Discharge Scenario.

During the high-flow condition, there would be essentially no change in channel size compared to the Existing Discharge Scenario. The size of the gap during normal and high flows would not change due to the relatively small contribution of the effluent discharge.

Similar to the Existing Discharge Scenario, the Recommended Project Discharge Scenario would maintain a near constant groundwater level in the Alluvial Aquifer of the Eastern Groundwater Basin. Because the VWRP is located in an area of rising groundwater at the downgradient end of the Eastern Groundwater Basin, additional discharge is unlikely to substantially increase the groundwater elevation in the Eastern Groundwater Basin. However, recharge to the Piru Groundwater Basin would be increased by approximately 42 percent.

Cumulative Discharge Scenario

Under the Cumulative Discharge Scenario (SWRP: 6.5 mgd, VWRP: 27.6 mgd, Newhall Ranch WRP: 5.0 mgd), the flow regime and channel size during the summer months would be similar to that of the Recommended Project Discharge Scenario in the SWRP to VWRP and VWRP to Castaic Creek subreaches. From Castaic Creek to the point of percolation, the channel width would increase by 53 percent and the channel depth would increase by 35 percent (approximately 9 feet and 7 inches, respectively) compared to the Existing Discharge Scenario dimensions. The live perennial reach would probably extend further downstream, the distance depending on the permeability of the bed materials.

During the high-flow condition, there would be essentially no change in channel size compared to the Existing Discharge Scenario. Since even the cumulative flow is small when compared to high water flows, there would be no discernable change in the size of the gap.

Similar to the Recommended Project Discharge Scenario, the Cumulative Discharge Scenario would maintain a near constant groundwater level in the Alluvial Aquifer of the Eastern Groundwater Basin and greatly increase the recharge to the Piru Groundwater Basin (approximately 54 percent).

The Recommended Project

This section discusses the impacts of the construction and operation of the recommended project. The discussion of operational impacts addresses the potential range of discharges from the Reduced Discharge Scenario to the Recommended Project Discharge Scenario. The Cumulative Discharge Scenario is also addressed as required by CEQA. However, the No Discharge Scenario has been eliminated from further analysis because of its inherent adverse impact on the hydrology and biological resources of the Santa Clara River system, downstream of the WRPs. (Additional information regarding the impact of the No Discharge Scenario is provided in Chapter 18, Biological Resources.)

VWRP Expansion Construction Impacts

Impact: *Potential for Property Damage Resulting from Inundation or Channel Modification at the VWRP.* Large areas of the Santa Clarita Valley are subject to flooding as a result of weather conditions in the San Gabriel Mountains. Although the VWRP is located above the 100-year floodplain, constrictions in the river valley near I-5 create high flow velocities during floods. Such high velocity flows have previously resulted in bed and bank erosion near the VWRP. A mechanically stabilized earth (MSE) retaining wall was constructed along the VWRP site boundary to prevent lateral scour of the upper terrace (Sapphos Environmental, 1995). This retaining wall would be extended as part of the recommended project to protect the proposed facilities at the north end of the VWRP. In addition, to prevent channel downcutting, a cellular-concrete mattress was installed immediately downstream of The Old Road bridge. Since the VWRP is not within the 100-year floodplain and is protected from excessive erosion, the impacts of flood-related inundation or channel modification would be less than significant.

Mitigation: No mitigation is required.

Impact: *Potential for Reduction in Flood Flow Capacity of the Santa Clara River.* As described previously, the expansion of the VWRP would be located on the terrace above the 100-year floodplain. Because the retaining wall would be extended to provide only erosion control (and not to expand the building parcel), it would not encroach into the floodplain.

Because the VWRP expansion would not occur within the 100-year floodplain and the retaining wall would not encroach into the 100-year floodplain, a less than significant impact to flood flow capacity would result.

Mitigation: No mitigation is required.

VWRP Expansion Operations Impacts

Impact: *Potential for Increase in Extent or Severity of Downstream Flooding.* Under the Cumulative Discharge Scenario, total WRP discharges to the river would be approximately 60 cfs (39 mgd) or less than one percent of the highest recorded daily mean flow of 7,900 cfs (5,100 mgd) (March 2, 1983) and less than one-tenth of a percent of the largest instantaneous recorded flow of 68,800 cfs (44,500 mgd) (January 25, 1969).

Because the combined VWRP and SWRP discharges would not contribute measurably to normal flood flows, a less than significant impact on the severity or extent of downstream flooding would result under all discharge scenarios.

Mitigation: No mitigation is required.

Impact: *Potential for Loss of Water for Groundwater Recharge and for Downstream Water Users.* Discharges augment the natural flow to the Piru Groundwater Basin and other downgradient groundwater basins. These discharges also help to moderate seasonal fluctuation of the groundwater levels in the Piru Groundwater Basin. In all scenarios except the Reduced Discharge Scenario there would be an increase in discharge to the river resulting in a beneficial impact to downstream water users. The Reduced Discharge Scenario would result in a decrease of recharge into the Piru Groundwater Basin by approximately 13 percent. The resulting flow would still be greater than historical flows since a portion of the effluent discharged is from imported water. Therefore, this impact is considered less than significant.

Mitigation: No mitigation is required.

Impact: *Potential for Reduction in Aquatic Habitat.* Potentially, the most significant effects of the Recommended Project Discharge Scenario are alterations to the quantity and quality of the habitat available for the unarmored threespine stickleback and Santa Ana sucker. The quantity and quality or suitability of habitat is related to flow and water quality factors. This chapter discusses only those issues relative to flow. Chapter 17, Water Quality, and Chapter 18, Biological Resources, address the water quality and biological issues, respectively.

There should not be any significant effects on the channel form because increases or slight decreases in WRP discharge would occur gradually, normal winter flood flows greatly exceed the mean monthly flows, and the channel bed is mobile. However, the active low-flow channel would become larger with increased discharge under the Recommended Project Discharge Scenario and the Cumulative Discharge Scenario.

On an annual basis, winter storm flows tend to mobilize bed materials, creating a new low-flow channel as they subside. Because the overall slope of the channel and the substrate would not change with time, the resultant low flow would take on a similar geomorphological form (similar depth to width ratio and sinuosity).

The increase in flow resulting from the Recommended Project Discharge Scenario and the Cumulative Discharge Scenario would have varying degrees of effect, depending on the month of the year. During maximum discharge months, the effect of the proposed discharge is almost non-existent. However, during low-flow months, the current discharge already overwhelms the natural flows. The proposed and cumulative discharges would further dominate the natural flows during these months.

Under all discharge scenarios, discharge would increase by only 0.8 mgd in the SWRP to VWRP subreach. It is expected that the mean channel width would increase by approximately 1 foot, the maximum channel depth would increase by 1 inch, and the mean channel velocity would increase by 0.1 foot per second (fps). Because the depth-to-width ratio would remain essentially the same, pool habitat would deepen slightly, mid-channel habitat would be slightly deeper and flow slightly faster, and the amount of edge habitat would remain similar to the existing habitat. Overall, there would be a greater absolute quantity of habitat and possibly some additional habitat variability.

Under the Recommended Project Discharge Scenario, discharge would increase by approximately 19 mgd in the VWRP to Castaic Creek subreach. The mean channel width would likely increase by 46 percent (7 feet), the maximum depth by 46 percent (7 inches), and the mean channel velocity by 29 percent (0.5 fps). Even though the flow would be substantially wider, deeper, and faster than during previous low-flow periods, a similar quantity of edge habitat would remain. Pool habitat would deepen and a much faster and deeper habitat would be created. Overall, there would be a greater absolute quantity of habitat and additional habitat variability.

Under both the Recommended Project Discharge Scenario and the Cumulative Discharge Scenario, the Castaic Creek to county line gauge subreach would be modified in the same way as described for the VWRP to Castaic Creek subreach because there is no significant flow from Castaic Creek during the summer months. Similar to the upstream subreach, there would be an overall increase in the absolute quantity of habitat and additional habitat variability.

In the county line gauge to point of percolation subreach, the increased discharge would also result in an increase in channel width, depth and velocity. However, because of rising groundwater, the proportional increase is somewhat less than in the two subreaches immediately upstream. The mean channel width would increase by 36 percent (6 feet), the depth by 36 percent (5 inches), and the mean channel velocity by 25 percent (0.4 fps) under both the Recommended Project Discharge Scenario and the Cumulative Discharge Scenario. Similar to the upstream subreaches, there would be an overall increase in the absolute quantity of habitat and additional habitat variability.

Given that edge habitat would not be lost, pool habitat would probably increase, overall quantity of habitat would increase, and the variability of habitats would increase, it appears that the proposed discharge would have a beneficial impact on the abundance of aquatic habitat. The suitability of available habitat for the aquatic species of concern is discussed in Chapter 18, Biological Resources.

Mitigation: No mitigation is required.

SWRP and VWRP Upgrade Construction Impacts

Impact: *Potential for Property Damage Resulting from Inundation or Channel Modification.* Both the SWRP and the VWRP are located above the 100-year floodplain. However, in the past, bed and bank erosion has occurred in the vicinity of the VWRP due to high velocity flows associated with winter storms and spring snowmelt. Consequently, a retaining wall was recently constructed along the VWRP site. This retaining wall would prevent damage to the facilities at the VWRP that are proposed to be upgraded. Bed and bank erosion is not a threat to the facilities at the SWRP due to its relatively distant proximity from the Santa Clara River. Therefore, the impacts of flood-related inundation or channel modification would be less than significant at both the SWRP and VWRP.

Mitigation: No mitigation is required.

Impact: *Potential for Reduction in Flood Flow Capacity at the SWRP and VWRP.* Both the SWRP and the VWRP are located above the 100-year floodplain. Facilities that would be modified or added as part of the proposed upgrades would not encroach into the 100-year floodplain at either WRP. Therefore, a less than significant impact to flood flow capacity would result.

Mitigation: No mitigation is required.

SWRP and VWRP Upgrade Operations Impacts

Impact: *Potential for Increase in the Extent or Severity of Downstream Flooding.* The proposed upgrades at the SWRP and VWRP would neither increase nor decrease the discharge levels to the Santa Clara River. Therefore, a less than significant impact on the severity or extent of downstream flooding would result from the proposed upgrades.

Mitigation: No mitigation is required.

Impact: *Potential for Loss of Water for Groundwater Recharge and for Downstream Water Users.* The proposed upgrades at the SWRP and VWRP would neither increase nor decrease the discharge levels to the Santa Clara River. Therefore, since there would be no loss of water for groundwater recharge and for downstream users, this is a less than significant impact.

Mitigation: No mitigation is required.

Impact: *Potential for Reduction in Aquatic Habitat.* The quantity and quality or suitability of habitat is related to flow and water quality factors. This chapter discusses only those issues relative to flow. Chapter 17, Water Quality, and Chapter 18, Biological Resources, address the water quality and biological issues, respectively.

Since the proposed upgrades at the SWRP and VWRP would neither increase nor decrease the discharge levels to the Santa Clara River, the proposed upgrades would not affect the river's flow. Therefore, the proposed upgrades would result in a less than significant hydrological impact to the habitat of the river in terms of flow.

Mitigation: No mitigation is required.

No Project Alternative

Under the No Project Alternative, discharge to the Santa Clara River from the WRPs of the SCVJSS could be increased to the permitted treatment capacity of 19.1 mgd. The hydrological analysis indicates that a total discharge of 19.1 mgd would increase the river's width and depth by approximately 1 foot and 1 inch, respectively. However, increased discharge could be offset by increased reuse. Regardless, hydrological impacts to the Santa Clara River and the underlying aquifer system would be minimal and are considered less than significant.