3.7 Hydrology and Geomorphology

3.7.1 Introduction

This section presents the regulatory setting, environmental setting, and potential impacts of the Proposed Project as related to hydrology and geomorphology.

Hydrology is the science (or study) of water in the natural environment, with a focus on the circulation and distribution of water as expressed in the hydrologic cycle or water balance (Goudie 1994). *Geomorphology* is the study of the earth's surface, its landforms and the processes that shape them. Within geomorphology, fluvial geomorphology is the more specific study of rivers and streams, and typically includes aspects of hydrology (the quantity and timing of watershed runoff that enters the river), hydraulics (the behavior of channelized flows in the river), and sediment dynamics (how sediment is variably eroded, transported, and deposited along the river continuum).

This section evaluates the potential for Proposed Project activities to affect the geomorphic form and function of rivers and creeks in the Project Area. Although the disciplines of fluvial geomorphology, hydrology, and hydraulics are extensive, the focus of this discussion is to consider how stream flow, stream and river features, and fluvial processes affect the physical functions that support aquatic and riparian habitats and water quality conditions. Therefore, this section supports the information presented in Section 3.3, *Biological Resources* and Section 3.13, *Water Quality*. Specifically, this section provides an overview of the existing hydrologic and geomorphic setting in the Project Area.

3.7.2 Regulatory Setting

No federal, state, regional, or local plans, policies, regulations, laws, or ordinances specifically address the geomorphology of rivers and streams in the Project Area. In practice, regulatory agencies (including the Regional Water Quality Control Board, California Department of Fish and Game, and National Marine Fisheries Service) encourage the use of geomorphic principles in the design and maintenance of stream channels and banks. Although no specific statutory requirements mandate that such measures be applied or implemented, the issuance of discretionary permits by regulatory agencies often are predicated on application of geomorphic principles in the design of instream and bank protection projects.

In recent years, state and local agencies that regulate stormwater have focused on addressing the impacts of urban hydromodification. *Hydromodification* is a process whereby surface runoff is increased because of increased impervious surfaces. The delivery time of surface runoff to creeks is reduced, and peak discharge rates in the creeks are increased. Hydromodification can lead to increased erosion in channels downstream of areas with increased peak discharges, and thus increasing sediment delivery further downstream.

Hydromodification management approaches also focus on the control of runoff, where it is generated at development parcels (source control) or considered in regards to instream erosion protection for streams subject to increased runoff. Proposed Project activities would not result in any increases in source runoff.

The Santa Clara Valley Urban Runoff Pollution Prevention Program is an association of thirteen cities and towns in Santa Clara Valley, the County of Santa Clara, and the Santa Clara Valley Water District that share a common National Pollution Discharge Elimination System (NPDES) permit to discharge stormwater to South San Francisco Bay. The NPDES permit requires co-permittees to manage increases in runoff peak flows, volumes, and durations from projects creating more than one acre of impervious surface that may cause downstream erosion, through the implementation of a Hydromodification Management Plan (HMP). The final HMP, adopted by the Water Board on July 20, 2005, delineates areas where increases in runoff are most likely to impact channel health and water quality and provides management options for maintaining pre-project runoff patterns. See Section 3.13, *Water Quality* for more information on NPDES permitting. The HMP includes several BMPs to minimize the hydrologic impacts of new development. These measures reduce the potential for development to generate damaging runoff that further destabilizes streams in the Santa Clara Basin. Although no regulatory authority is associated with the HMP that directly applies to the SMP Update, the provisions of the HMP influence stream geomorphology within the Project Area.

Other examples of hydromodification-related regulations in the Project Area include the Pajaro River Sediment Total Maximum Daily Load (TMDL) (including the San Benito River and Uvas, Llagas, and Rider Creeks, Figure 2-6) (Central Coast RWQCB 2007). As discussed in Section 3.13, *Water Quality,* the Pajaro Watershed has experienced acute erosion and sedimentation problems as a result of urban and agricultural encroachment on streams, poor and outdated drainage infrastructure (i.e., ditches, culverts, and roads), stream channelization, and other land use changes leading to increased runoff. The Pajaro River Sediment TMDL establishes sediment allocations for various land uses, targeting the greatest load reductions for agricultural activities, roads, and gravel mines. The Pajaro River Sediment TMDL also establishes a Land Disturbance Prohibition that addresses the controllable discharge of soil, silt, or earthen material from various land use activities and modifications (Central Coast RWQCB 2007).

3.7.3 Environmental Setting

Climate and Hydrology

Surface water hydrology (primarily runoff and stream flow) is largely a function of climate, land cover, and soil. In much of California, including Santa Clara County, surface hydrology also is influenced by water resources management that may capture, store, release, or transfer surface water across or between watersheds. The Project Area experiences a Mediterranean type climate, characterized by warm, dry summers and cool, wet winters. Precipitation is mainly concentrated in the winter months and falls primarily as rain, though the high elevations of the Santa Cruz Mountains and Diablo Range can receive limited snowfall. Weather in the region is subject to high annual variability as well as longer-term climatic cycles, including the Pacific-North American Oscillation, the El Niño Southern Oscillation, and the Pacific Decadal Oscillation (Andrews et al. 2004:337–348). These cycles affect temperature, precipitation, and the frequency of extreme weather events.

Rainfall, land cover, soil structure, soil moisture, slope, watershed size, reservoir operations, and other factors all influence the magnitude and duration of flows (or discharge) in rivers and streams in the Project Area. Urbanized lands with a higher proportion of impervious surfaces and reduced infiltration generally demonstrate a rapid runoff response to rainfall events. Such "flashy" hydrologic systems are noted for the short lag-times between rainfall and peak discharge and show very steep (needle-like) rising limbs of storm hydrographs[1]. Unregulated streams (i.e., those without water supply reservoirs, or located above impoundments) also may show more rapid runoff response compared to streams that have structural features that provide runoff retention or detention. Although typically unregulated, streams tend also to be surrounded by land uses that have higher rates of infiltration, reducing the amount of runoff.

Many of the streams in the Project Area are downstream of dams, and flows on these streams are regulated by these dams for water supply purposes. On regulated creek systems, peak discharges are reduced, the frequency/duration relationships are more equitable (less extreme), and base flow discharge (non-storm flow) typically extends into the later spring, summer, and fall months compared to non-regulated streams. Also, several of the reservoirs in the Project Area release flow through the summer months to recharge groundwater aquifers.

To understand Project Area hydrology, it is useful to compare representative hydrographs from various Project Area watersheds. Four representative hydrographs from the Guadalupe River, Coyote Creek, Upper Penitencia Creek, and Llagas Creek are shown in Figures 3.7-1a and 3.7-1b. All four of these creeks are regulated by upstream reservoirs. The figures show the long-term mean daily discharge for the four stations. The Guadalupe River and Coyote Creek are the largest streams in Santa Clara County, and both drain north into San Francisco Bay. Penitencia Creek is a tributary to Coyote Creek and drains into Coyote Creek in San Jose. Llagas Creek is in the Pajaro Watershed and flows south into the Pajaro River, and ultimately into Monterey Bay.

The pattern shown on each of the mean daily hydrographs in Figures 3.7-1a and 3.7-1b exemplify the Mediterranean type climate in the Project Area, with most of the stream flow in the winter and spring months and a much smaller base flow in the summer months. For example, as shown in the Coyote Creek hydrograph, for over a 10-year recorded period, the highest average mean daily flow of 191 cubic feet per second (cfs) occurred during early March, while the lowest average mean daily flow of 13 cfs (about one fifteenth as large) occurred at the end of July. The Guadalupe River, Coyote Creek, and Penitencia Creek all show a similar pattern of higher stream flow during the winter and early spring and lower flows during the summer.

[1] A hydrograph is a graph or measure of stream flow over time, typically with discharge plotted along the vertical axis and time charted along the horizontal axis.

In comparison to the mean daily flows shown in Figures 3.7-1a and 3.7-1b, Figure 3.7-2 shows peak flow discharges on the Guadalupe River for most of the years recorded between 1930 and 2002. Like the mean daily discharges, the peak discharge record also highlights the annual variability in stream flow that is characteristic of streams in the Project Area. The highest peak flow of 11,000 cfs, recorded in 1995, is over 80 times larger than the lowest peak flow 125 cfs, recorded in 1960. The distribution of peak flows over time on the Guadalupe River shows no discernable pattern, which emphasizes the unpredictability of Mediterranean type climate streams. A comparison from 2004 to 2009 of the peak flows of Coyote Creek (which drains north into San Francisco Bay) and Llagas Creek (which drains south into the Pajaro River) shows that although both creeks follow the same general pattern of higher peak flows in 2006 and 2008, and a lower peak flow in 2007, Coyote Creek shows more variability in peak flows (Figure 3.7-3). This could be caused in part by the relative locations of the stream gages, the difference in watershed size, or the degree to which flows are managed in each watershed. Coyote Creek's stream gage captures a much larger portion of a larger watershed (319 square miles out of a 320-square mile watershed) and is closer to the mouth of the creek, while Llagas Creek's stream gage is closer to the headwaters of the creek and in a smaller watershed (gaging 9.63 miles of a 104-square mile watershed).

Geomorphology

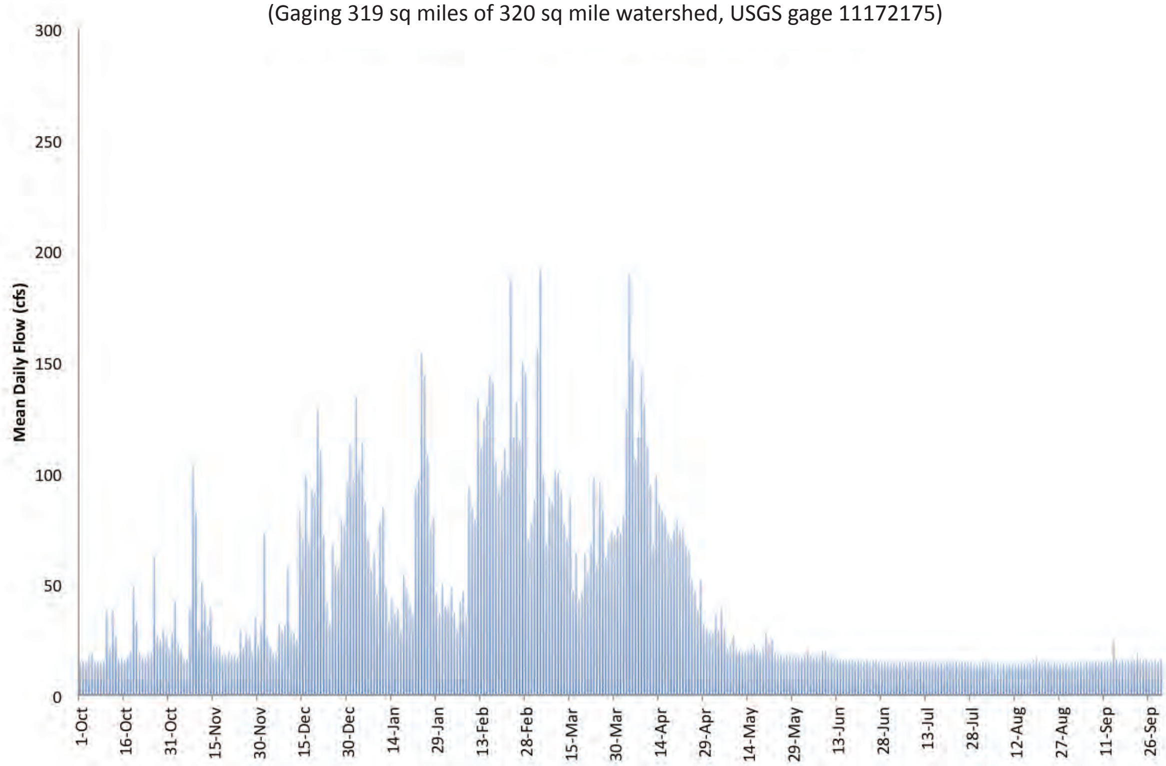
Many factors influence the geomorphology of rivers and streams, including geology, hydrology, climate, land use, and vegetation. This section describes regional geomorphic patterns in Santa Clara County, and then describes the individual watershed areas in the Project Area where stream maintenance occurs. This discussion concludes with a description of the primary channel types in the Project Area, and a summary of known changes in the Project Area since the 2002 SMP was implemented.

Regional Setting

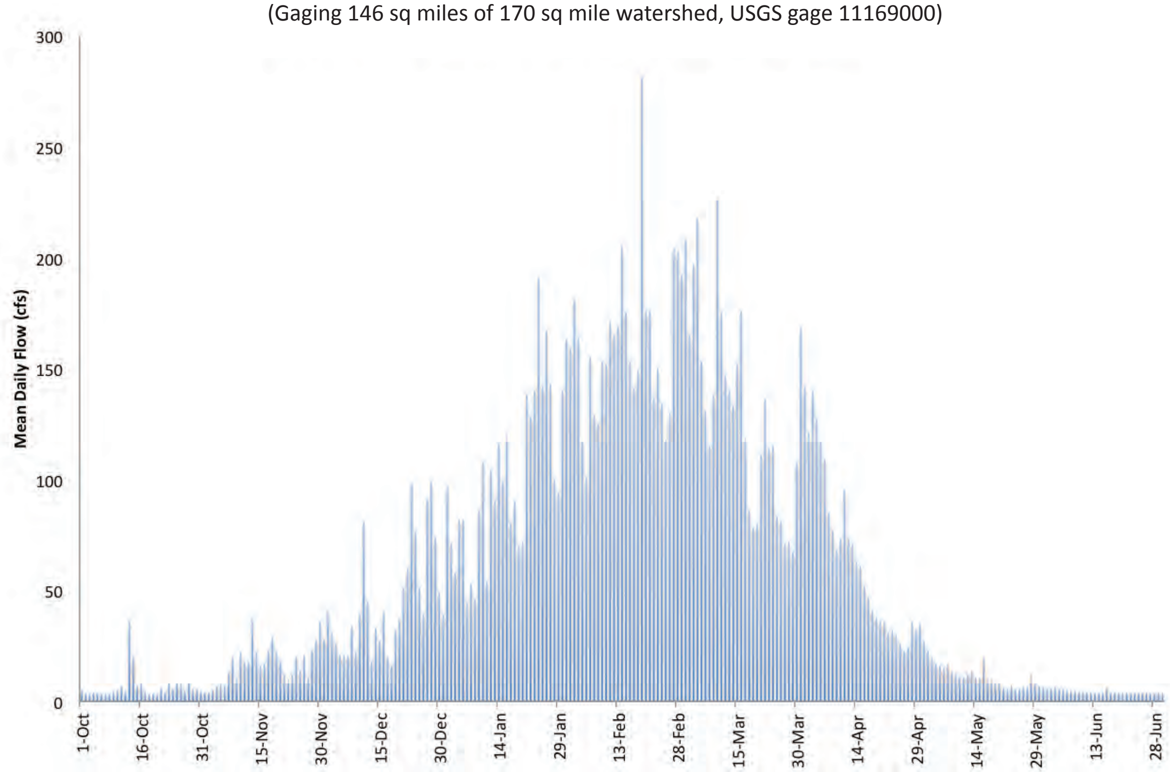
Santa Clara County is situated in the Central Coast Range province of California. The Central Coast Range is characterized by its northwest-southeast trending mountain ranges. Typically, the ranges are separated by structural depressions (valleys) that fill with alluvium (stream transported sediment) derived from the adjacent ranges. Most often, the alluvial valleys contain a primary or "trunk" stream that collects runoff and sediment from the side valley tributary streams (generally to the east and west) that ascend higher in the contributing watershed toward the ridgelines.

This general pattern holds true in Santa Clara County, with the Santa Cruz Mountains to the west and the southern Diablo Range to the east. These two ranges frame the Santa Clara Basin below (Figure 2-1), which drains to San Francisco Bay. In the southern Project Area, the Gilroy Valley of the Pajaro Watershed serves as the central alluvial valley between the Santa Cruz Mountains and Diablo Ranges. The Pajaro Watershed drains to Monterey Bay, as shown in Figure 2-1.

Mean Daily Discharge of Coyote Creek above Highway 237 at Milpitas
Based on Recorded Data, 1999-2009
(Gaging 319 sq miles of 320 sq mile watershed, USGS gage 11172175)



Mean Daily Discharge of Guadalupe River, at San Jose
Based on Recorded Data, 1930-2003
(Gaging 146 sq miles of 170 sq mile watershed, USGS gage 11169000)



Horizon WATER and ENVIRONMENT

Figure 3.7-1a
Representative Hydrographs from Project Area Watersheds

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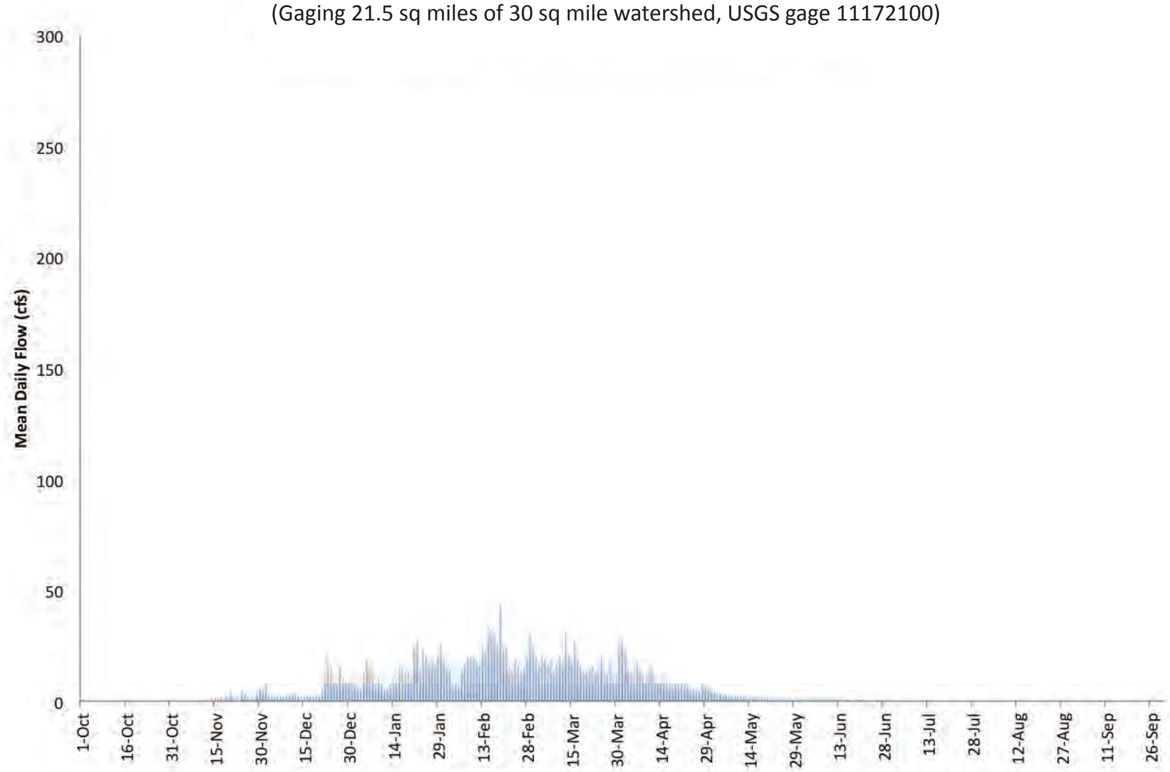
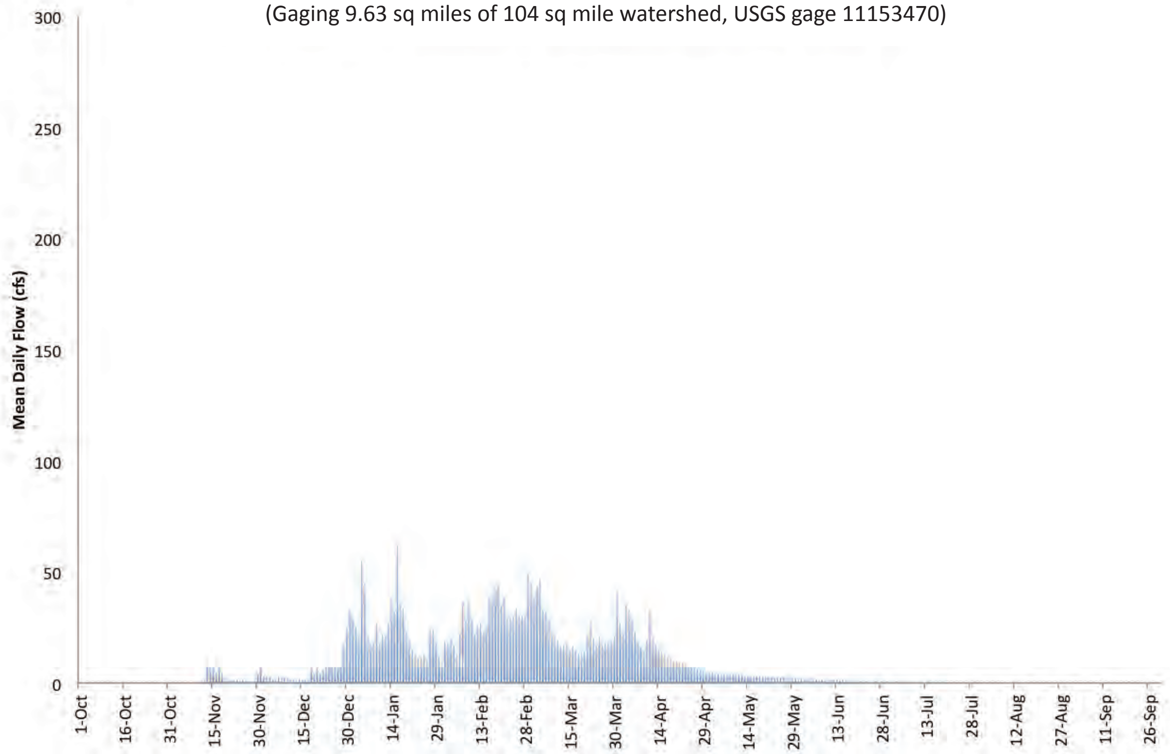
Mean Daily Discharge of Upper Penitencia Creek, San Jose
Based on Recorded Data, 1962-1987
(Gaging 21.5 sq miles of 30 sq mile watershed, USGS gage 11172100)



Mean Daily Discharge of Llagas Creek above Chesbro Reservoir Near Morgan Hill
Based on Recorded Data, 1972-2009
(Gaging 9.63 sq miles of 104 sq mile watershed, USGS gage 11153470)



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Horizon WATER and ENVIRONMENT

Figure 3.7-1b
Representative Hydrographs from Project Area Watersheds

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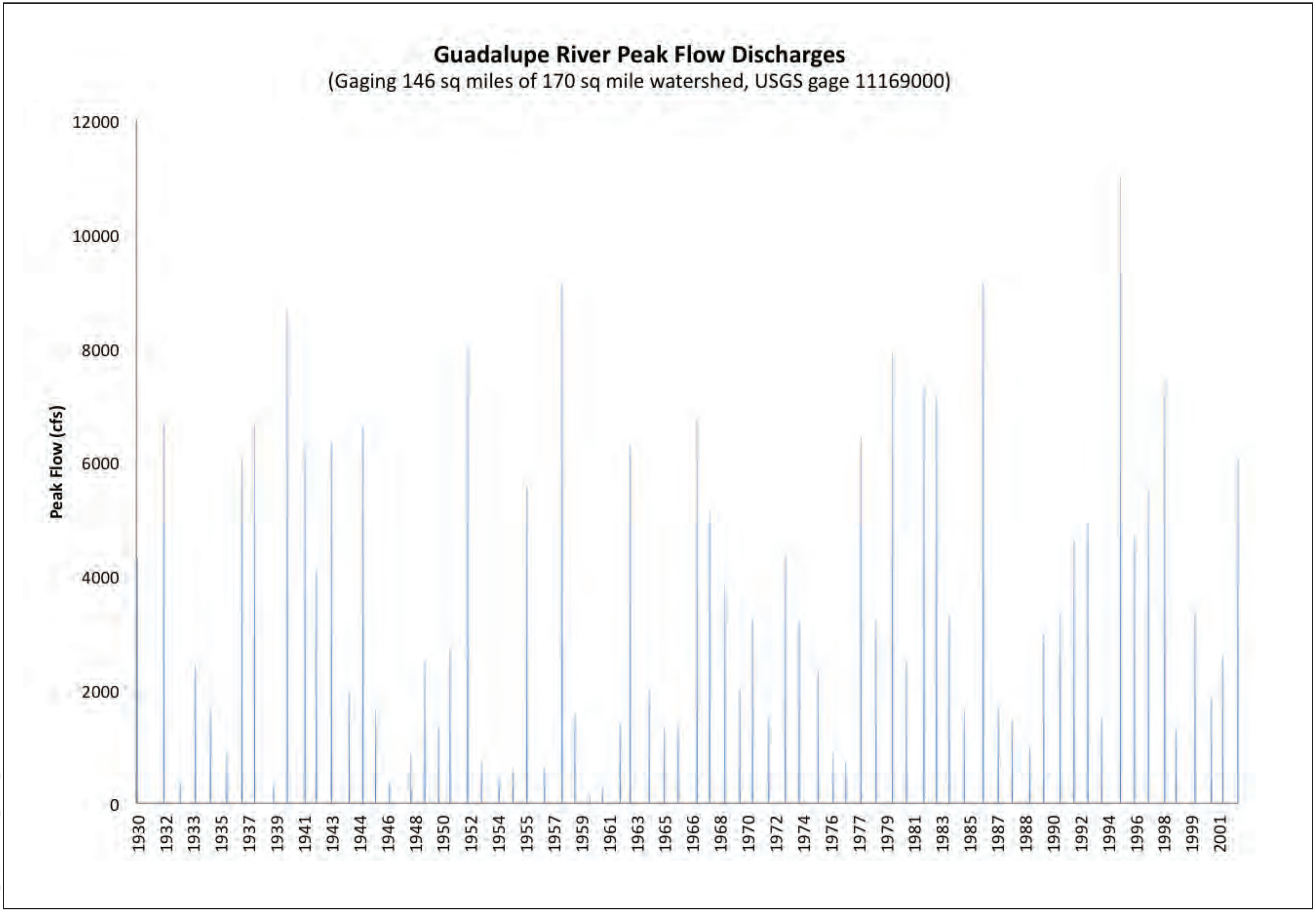

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Horizon WATER and ENVIRONMENT

Figure 3.7-2
Guadalupe River Peak Flow Discharges

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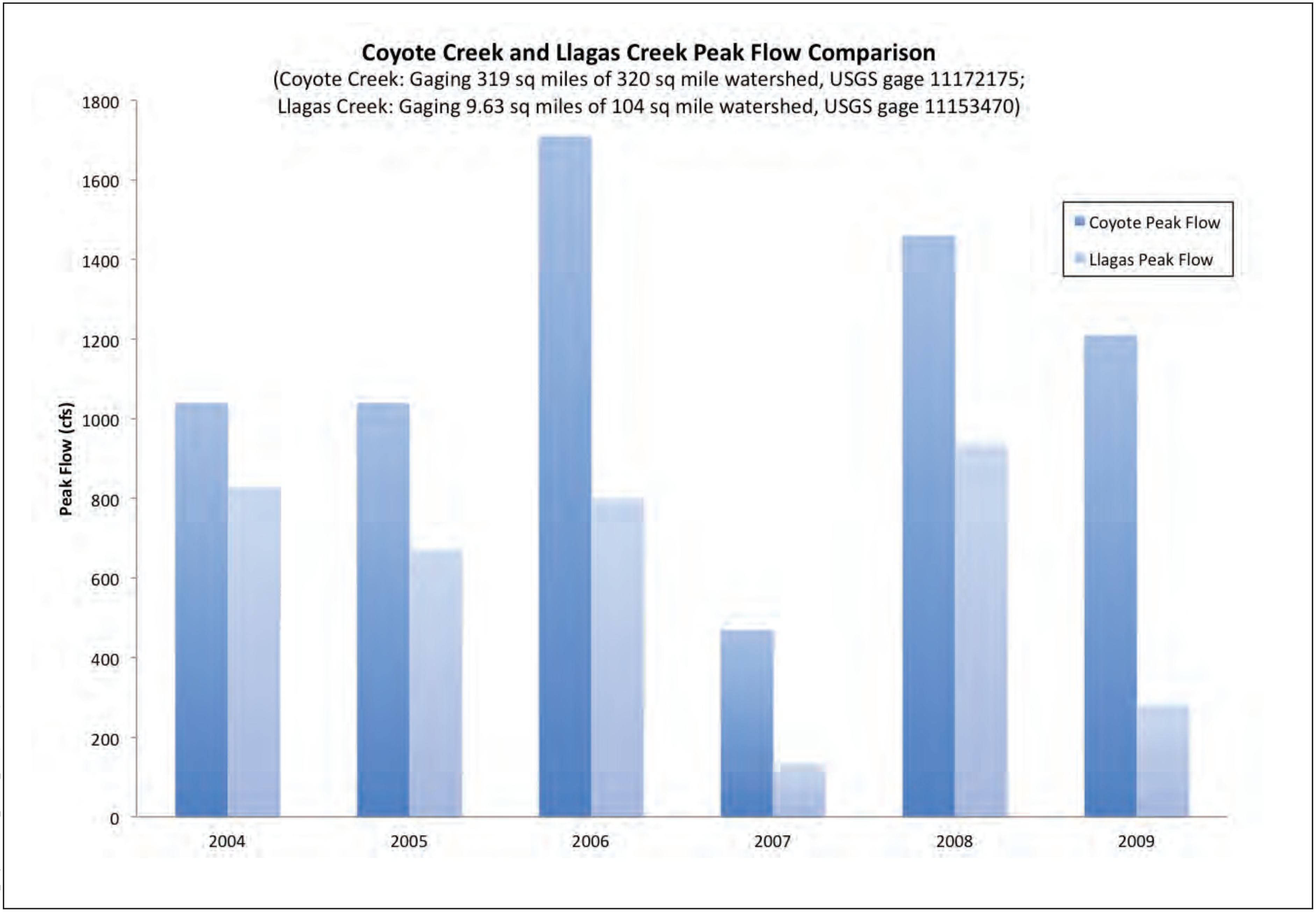

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Horizon WATER and ENVIRONMENT

Figure 3.7-3
Comparison of Peak Flows-Coyote Creek and Llagas Creek

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The ridge-valley structure of Santa Clara County presents a three-part continuum of geomorphic conditions, with crystalline or bedrock areas in the upper watersheds, transitioning to foothill alluvial fans, then to lower watershed bays and alluvial plains. These geomorphic zones are described next, following Helley et al. (1979), SCVWD (2002), and PWA (2002).

Bedrock Uplands

Bedrock uplands form the steep, mountainous headwater terrain of the principle drainages in the Project Area. In the western Project Area (Figure 2-1), the eastern slopes of the Santa Cruz Mountains form the headwaters of many Project Area waterways, including San Francisquito Creek, Adobe Creek, and the Guadalupe River. The underlying bedrock geology in this region is commonly the Franciscan Complex, a formation of compressed, uplifted, and rotated marine sedimentary materials that was deposited in the early Cretaceous Period (approximately 146 to 100 million years ago) (Norris and Webb 1990, Sullivan and Galehouse 1991). Locally, younger Mesozoic meta-sedimentary and volcanic rocks with smaller quantities of Tertiary sandstones, siltstones, and mudstones are exposed (PWA 2002). In the eastern Project Area, elevations in the Diablo Range vary from 500 to 2,800 feet above mean sea level, with slopes similar to those on the eastern Santa Cruz Mountains (SCVWD 2001). In addition to the Franciscan Complex geology, the Diablo Range includes the characteristic sandstone and mudstone depositional layers of the Great Valley Sequence. Similar to the Santa Cruz Mountains, stream channels in the Diablo Range are steep and flow through deeply incised valleys with little or no floodplain area.

In terms of climate, the steep ridgelines and relatively high elevations of the Santa Cruz Mountains generate a strong orographic effect (increased cooling and precipitation when air masses are forced up and over mountain fronts) on winter storms (cyclones) that approach from the west and southwest, laden with moisture from the Pacific Ocean. The Santa Cruz Mountains area receives the highest average rainfall totals in the county, ranging from 30 to 50 inches per year. The combination of high rainfall, steep gradients, weathered bedrock, and active landslides creates the potential for the watershed to produce high sediment yields.

The Diablo Range in the eastern Project Area receives substantially less average rainfall than the Santa Cruz Mountains, ranging from 20 to 32 inches, caused by a "rain shadow" effect as fronts move from the ocean over ranges toward the interior. Similar to the Santa Cruz Mountains, stream channels in the Diablo Range are steep and often flow through deeply incised valleys with little or no floodplain area. Active erosion in the Diablo Range includes downslope mass movement of fractured bedrock, such as debris slides and rock falls (SCVWD 2001). Fluvial geomorphic processes in this range include the headward (upstream) erosion of streambeds to form incised channels.

In several drainages (e.g., Coyote, Alamitos, Guadalupe, and Los Gatos creeks), the existence of reservoirs has effectively reduced the delivery of coarse sediment from the watershed uplands to the alluvial fans/plains below. The fine material (typically finer material and washload held in suspension) that is not trapped by reservoirs is transported downstream, and can collect and deposit in the stream channels of the Project Area (PWA 2002, SCVURPPP 2006). In addition, reservoirs can alter the geomorphology of downstream channels by changing the magnitude, frequency, duration, and timing of stream flows. Typically, reservoirs reduce the magnitude and frequency of flood events. Drainages without reservoirs in the mountain and/or foothill regions deliver higher sediment loads to the alluvial plains below.

Typically, no Proposed Project stream maintenance activities would occur in bedrock uplands, as these are above the 1000-foot elevation contour.

Foothill Alluvial Fans

The foothill alluvial fans in the Project Area are found downstream of the bedrock uplands and provide a topographic transition to the alluvial plains further downstream in the watershed. Alluvial fans collect stored sediment, much of it coarse gravel and sand. The characteristic process of alluvial fans involves distributary channels that migrate (if unconstrained) and distribute sediment across the fan surface. In the Coast Ranges, alluvial fans are typically geologically young depositional landforms from the Quaternary Period (the last 1.8 million years). Although depositional when viewed through longer geologic time scales, in the short term, present-day alluvial fans can function variably as zones of sediment erosion, sediment transport, or sediment deposition. Many of the current alluvial fan channels in the Project Area, particularly in the upper fan zones, are incising and transporting coarse sediments downstream (PWA 2002). Gullying and headward erosion through the alluvial fans in many instances have been caused or exacerbated by historic land use practices, development encroachment on stream corridors, and the channelization of streams that have essentially fixed their locations. Where streambanks have been artificially steepened, rotational slumps (the movement of a mass of soil and rock downslope and rotating) and other slope failures can occur (SCVWD 2001).

Proposed Project activities that would occur in the foothill alluvial fans typically include bank protection, sediment removal, and vegetation management.Bay Plain and Alluvial Valleys

The floodplains and alluvial valleys situated between the foothills and San Francisco Bay are formed of relatively young sedimentary deposits, dating from the Holocene epoch of the last 10,000 years. Sediment grain sizes are coarsest near the foothills and alluvial fans and become finer moving downstream toward San Francisco and Monterey bays. Whereas upper alluvial fans may slope up to a 5 percent gradient, in the lower plain regions stream slopes typically are less than 1 percent. Before large-scale human modification and flood protection activities, sediment deposition in the alluvial plains occurred primarily during moderate to large floods, with coarse material depositing over riverbanks to form natural levees and finer sediments dispersed over the broader floodplain further from the channel. The lower bay plain is composed of medium to fine grained alluvium and estuarine deposits. Many of these deposits were laid during estuarine backwater flooding conditions when winter stream flows met high tides (PWA 2002). Near the margins of San Francisco Bay, estuarine sediments intergrade with fine alluvium in the deltas of SCVWD-maintained streams; extensive areas of artificial fill and diked baylands also are found.

Although the processes that shaped the Bay plain and lower alluvial valleys have largely been disrupted through channelization and construction of artificial levees, the lower valley and Bay plain zone continues to be highly depositional. Engineered stream channelization in this lower watershed zone (and its current maintenance) has nearly eliminated past floodplain processes, such as lateral channel migration, which is now either non-existent or highly unlikely. In this lower watershed zone, some localized streambank erosion occurs as streams attempt to dissipate energy by restoring plan form sinuosity (i.e., meander patterns). These processes and their relationship to Proposed Project maintenance activities are discussed further in Section 3.7.4, *Impact Analysis*.

Project Area Watersheds

Santa Clara Basin

The Santa Clara Basin includes approximately half of Santa Clara County and small parts of San Mateo and Alameda Counties (Figure 2-1). The Santa Clara Basin consists of San Francisco Bay south of the Dumbarton Bridge and the 824 square miles that drain, generally in a northerly direction, to the Bay. The Diablo Range and the Santa Cruz Mountains form the eastern, western, and southern basin boundaries. Land uses within the Santa Clara Basin range from residential, commercial, and industrial uses in the northern portion of the basin to a primarily rural southern portion with cattle ranching, water-supply catchments, and scattered low-density residential development (SCBWMI 2000).

For the purposes of resource management, SCVWD has divided the Santa Clara Basin into five watershed management areas (WMA): Lower Peninsula, West Valley, Guadalupe, Coyote, and Pajaro WMAs (Figures 2-2 through 2-6). A general description of these watersheds is discussed next. Following this discussion, Table 3.7-1 provides a summary of the main drainages in each WMA.

Lower Peninsula WMA

The Lower Peninsula WMA (98 square miles) is located in the northwest portion of the Santa Clara Basin (Figures 2-1 and 2-2). The Lower Peninsula headwaters begin in the Santa Cruz Mountains at elevations greater than 2,500 feet. Tributary creeks fall steeply from the headwaters region to the more gently sloping alluvial fans and plains. Major streams under SCVWD's management within the Lower Peninsula WMA include San Francisquito, Stevens, Permanente, Adobe, Barron, and Matadero creeks (WMI 2007). These streams generally flow northward, conveying flows to the Palo Alto Flood Basin and, ultimately, San Francisco Bay. However, portions of Buckeye, Adobe, Permanente, and Stevens creeks flow more easterly/westerly, where their stream valleys follow the San Andreas Fault Zone, which disrupts their drainage pattern (Figure 2-2).

San Francisquito Creek marks the border between Santa Clara and San Mateo counties. SCVWD only maintains the side of the creek that is within Santa Clara County. Up to 1,500 cfs of runoff in Permanente Creek may be diverted to Stevens Creek via the Permanente Creek Diversion (Figure 2-2), built in 1959. During storm events, high flows from Barron Creek may be diverted to Matadero Creek via the Barron Creek Bypass structure. SCVWD manages Stevens Creek Reservoir (3,465 acre-feet), the largest reservoir in the Lower Peninsula Watershed, for water supply storage purposes with incidental flood protection benefits[2].

Land uses in the Lower Peninsula Watershed generally consist of open space and low-density residential development in the upper watershed, with higher density residential and commercial development on the valley floor. Municipalities that are partially or entirely with the WMA include Los Altos Hills, Palo Alto, Mountain View, Los Altos, Cupertino, and Sunnyvale. A large quarry is in the upper Permanente Watershed and mines limestone for cement production.

West Valley WMA

The West Valley WMA (85 square miles) is situated southeast of the Lower Peninsula Watershed and northwest of the Guadalupe Watershed (Figures 2-1 and 2-3). The major natural drainages in this WMA are Calabazas, San Tomas Aquino, and Saratoga creeks. These streams begin as natural channels at relatively low elevations in the Santa Cruz Mountains (less than 1,500 feet) (WMI 2007). As these streams transition from the alluvial fan regions to the Bay plain, they become highly modified channels that traverse the Bay plain and ultimately discharge to Guadalupe Slough. The Sunnyvale West and East Channels, constructed channels that provide drainage for large portions of Sunnyvale, also discharge to Guadalupe Slough. Like much of the western Santa Clara Basin, land use in the upper West Valley Watershed is primarily forest or undeveloped rangeland with low-density residential development, while the lower watershed is highly developed for residential and commercial uses. However, within the Calabazas drainage, several areas of heavy industry are in the upper watershed. Municipalities that are partially or entirely within this WMA include Sunnyvale, Santa Clara, Cupertino, San Jose, Santa Clara, Campbell, Monte Sereno, Los Gatos, and Saratoga. (SCBWMI 2000)

Guadalupe WMA

The Guadalupe WMA (Figures 2-1 and 2-4) drains approximately 170 square miles, beginning in the eastern Santa Cruz Mountains near the summit of Loma Prieta (3,790 feet above mean sea level) and eventually discharging to San Francisco Bay via Alviso Slough. The Guadalupe River, the largest drainage in the watershed, begins at the confluence of Alamitos and Guadalupe creeks and flows north through heavily urbanized portions of San Jose and Santa Clara to Alviso Slough. Alamitos Creek flows northwesterly to Almaden Reservoir (2,000 acre-feet), and then flows northerly to its confluence with Calero Creek, and eventually to its confluence with Guadalupe Creek. Three main tributaries, Ross, Canoas, and Los Gatos creeks, join the Guadalupe River on the Bay plain as it flows north towards the Bay. SCVWD operates five reservoirs in the Guadalupe Watershed for water supply storage purposes (with incidental flood protection benefits): Guadalupe, Calero, Almaden, Lexington, and Vasona Reservoirs. Municipalities that are partially or entirely with this WMA include Campbell, Santa Clara, Los Gatos, Monte Sereno, and San Jose.

[2] SCVWD does not handle maintenance activities at reservoirs or dams as part of its Stream Maintenance Program. However, stream maintenance at the reservoir outfall below the dam is included, as is any necessary stream maintenance upstream of the reservoir (below the 1,000-foot contour).

Coyote WMA

The Coyote WMA is the largest watershed in the Santa Clara Basin, encompassing over 320 square miles (Figures 2-1 and 2-5). The Coyote Watershed drains the west-facing slopes of the Diablo Range that lie within the Santa Clara Basin. The eastern and southern portions of the watershed are upland areas with elevations up to 4,000 feet above mean sea level; the northern and western portions encompass the valley floor. Coyote Creek is the principal drainage in the watershed; 29 major tributaries drain into Coyote Creek including Upper Penitencia Creek, Berryessa Creek, Lower Silver Creek, and Fisher Creek (SCVWD 2001). Streams in the watershed generally drain in a northwesterly direction to San Francisco Bay. Coyote and Anderson reservoirs (22,925 and 89,073 acre-feet, respectively) capture runoff from the upper Coyote Watershed. Anderson Reservoir's purpose is to facilitate groundwater recharge in the Santa Clara Valley groundwater basin, provide emergency water supply, and provide flood protection (PVWMA et al. 2007). Flows in the lower watershed are highly regulated by these reservoirs, which are managed largely for groundwater recharge. The Hayward and Calaveras faults are major potentially active earthquake faults that cross the watershed. The upper Coyote Watershed includes unincorporated, predominantly agricultural areas. The entire city of Milpitas and portions of San Jose and Morgan Hill lie within the watershed boundaries (SCVWD 2001).

Pajaro WMA

The Pajaro WMA is located within San Benito, Santa Clara, Santa Cruz, and Monterey counties and encompasses approximately 1,300 square miles (Figures 2-1 and 2-6) (PVWMA et al. 2007). The Pajaro Watershed is one of the Central Coast's largest watersheds and is well-known for its world-class agricultural soils and powerful flooding characteristics (DWR 2009). Most of the watershed is mountainous or hilly, with level lands confined to the floodplains of Pajaro River and its tributaries (Central Coast RWQCB 2005). Unlike streams of the Santa Clara Basin, the Pajaro River drains directly to the Pacific Ocean, near the geographic center of Monterey Bay.

Major sub-watersheds within the Pajaro River Basin include the San Benito River and Tres Pinos, Uvas, Llagas, and Corralitos creeks, the last three of which are within the Project Area. Agriculture has long been the dominant land use in the watershed and is a major source of nutrients and sediment loading to the Pajaro River. However, in recent years, substantial portions of the upper watershed area have been developed into residential subdivisions. In addition to residential and agricultural uses, historic mercury mining activities occurred in the Hernandez Lake area and gravel mining occurred along Pajaro and San Benito rivers. (Central Coast RWQCB 2005)

Major reservoirs in the Pajaro Watershed include the Chesbro and Uvas reservoirs. Chesbro Reservoir discharges to Llagas Creek, and Uvas Reservoir discharges to Uvas Creek. Anderson Reservoir discharges to Coyote Creek, outside of the Pajaro Watershed, but was historically connected to the Pajaro River Basin via a pipeline. The purpose of Chesbro and Uvas reservoirs is to facilitate groundwater recharge in the Gilroy–Hollister groundwater basin (Chesbro Reservoir also is managed for flood protection). Municipalities that are partially or entirely with this WMA include San Jose, Morgan Hill, and Gilroy.

Table 3.7-1. Principal Creeks in Project Area Watersheds

Creek or Channel	Drainage Area (square miles)	Channel Length (approx. miles)	Main Tributaries
Santa Clara Basin			
Lower Peninsula Watershed			
Adobe Creek	10	NP	Purissima Creek
Barron Creek	3	NP	N/A
Matadero Creek	14	NP	Deer Creek; Stanford Channel
Permanente Creek	17	13	Hale Creek
San Francisquito Creek	45	12.5	Los Trancos Creek
Stevens Creek	29	19	Permanente Creek Diversion; Heney Creek
West Valley Watershed			
Calabazas Creek	17	13.3	Prospect, Rodeo, and Regnart Creeks; El Camino Storm Drain
San Tomas Aquino Creek	22	16	Saratoga, Smith, Vasona, and Wildcat Creeks
Saratoga Creek	17	15	N/A
Sunnyvale West Channel	7.5	3	N/A
Sunnyvale East Channel	7.1	6	N/A
Guadalupe Watershed			
Alamitos Creek	37	8.5	Golf, Greystone, Randol, Calero and Herbert Creeks; Jacques Gulch; and Barrett Canyon
Guadalupe Creek	15.2	NP	Shannon, Pheasant, and Hicks Creeks
Los Gatos Creek	51	NP	Limekiln Canyon, Soda Spring, Aldercroft, Black, Briggs, and Hendrys Creeks; Moody Gulch
Guadalupe River	170	NP	Alamitos, Guadalupe, Ross, Canoas, and Los Gatos Creeks
Coyote Watershed			
Coyote Creek	320	42	Fisher, Upper Silver, Lower Silver, and Upper Penitencia Creeks, and other creeks tributary to the two reservoirs on Coyote Creek
Lower Penitencia Creek	30	NP	East Penitencia Channel and Berryessa Creek
Pajaro Basin			
Pajaro Watershed			
Pajaro River	1,300	NP	Pacheco, Llagas, and Uvas-Carnadero Creeks

N/A – not applicable, NP – not provided
Sources: SCBWMI 2000, PVWMA et al. 2007, WMI 2007

SMP Channel Types and Drainage Features

All Proposed Project maintenance activities would take place in channels below the 1,000-foot elevation contour. Within this zone, four primary channel types are found in which maintenance may occur: natural or mixed[3] channels on alluvial fans, mixed or concrete tributary channels on the Bay plain, mixed or concrete mainstem channels on the Bay plain, and tidally-influenced channels. An overview of each of these channel types is described next; proposed maintenance activities related to channel morphology also are discussed.

Type 1: Natural or mixed channels on alluvial fans

As streams transition from headwaters and canyons in the bedrock uplands to the foothill alluvial fans, channel slopes decrease and channel widths generally increase. As a result, sediment transport capacity decreases and bedload deposition increases. Unmanaged, sediment deposition in SCVWD-maintained channels reduces flow conveyance capacity, resulting in increased flooding risks. Consequently, under the existing SMP, the SCVWD actively maintains channel capacity by removing accumulated sediment and managing vegetation (to control hydraulic roughness), and it would continue to do so under the Proposed Project. Under the existing SMP, these maintenance activities have occured on numerous creeks throughout the foothills region, including streams such as Permanente, Calabazas, Penitencia, and Alamitos creeks, and such maintenance would continue under the Proposed Project.

Type 2: Mixed or concrete tributary channels on the Bay plain

This stream type includes the small to medium sized channels on the Bay plain that are tributary to the main streams that discharge to the Bay. Some of these channels have been engineered and straightened for flood protection and land development purposes, while others remain in a more natural state. Most of these drainages have seasonal stream flows, unless fed by artificial drainage (e.g., golf courses) or dam releases. Figures 2-11 and 2-13 show a general cross section and a photo example from Sierra Creek for this type of channel.

Channels on the Bay plain are depositional under natural conditions. Historical modifications to these channels, such as expanding cross-sectional areas for flood protection, often increase the rate of sedimentation. In-channel structures (such as weirs, bridges and culverts that control stream grade or alter hydraulics) also may influence sediment transport capacity and depositional patterns in these channels. SCVWD actively maintains channel capacity by removing accumulated sediment and managing vegetation. Streambank protection also is common in this channel type (see Section 3.7.4, *Impact Analysis*).

Type 3: Mixed or concrete mainstem channels on the Bay plain

This channel type includes the major drainages on the valley floor, such as the lower reaches of Adobe, Permanente, Stevens, Calabazas, San Tomas Aquino, and Coyote creeks, the Guadalupe River, and Sunnyvale East and West channels. Figure 2-7 provides a diagrammatical cross section and representative photographs of this channel type.

[3] See Chapter 2, *Project Description* for definitions of “natural” and “mixed” channel types.

Similar to the tributary channels, the main drainages on the Bay plain are depositional under natural conditions. Channelization and channel modification activities that have straightened, widened, and deepened these stream channels have further supported depositional processes. SCVWD has undertaken several capital improvement projects that were intended to reduce the need for ongoing sediment management by restoring the geomorphic function of these channels. This has involved construction of multistage channels and bypass features to more efficiently manage sediment discharge. Nevertheless, in many situations SCVWD must still actively maintain channel capacity by removing accumulated sediment. Bank stabilization, vegetation management, and streambank protection activities also are common in this channel type.

Type 4: Tidally-influenced channels

The delta (river to estuary interface) portions of the Type 3 channels described above are tidally influenced. Figure 2-9 provides representative photographs of this channel type. The channels in this region are typical of brackish tidal sloughs with wide and shallow cross sections and tall emergent vegetation on the channel margins. Substrate is generally poorly consolidated, fine-textured marine and alluvial sediment. Proposed Project maintenance activities in this channel type generally would include bank stabilization, sediment removal, and vegetation management.

Groundwater

The Project Area includes a number of groundwater basins and subbasins, as defined in the *California Water Plan Update* (DWR 2009). The major groundwater basins and subbasins in the project area are the Gilroy–Hollister Valley Basin (which includes the Llagas Area, Bolsa Area, Hollister Area, and San Juan Bautista Area subbasins), the Pajaro Basin, and the Santa Clara Subbasin. The Gilroy–Hollister Valley Basin and the Pajaro Basin are in the Central Coast Hydrologic Region. Within the Central Coast Hydrologic Region, groundwater is an important source of supply, accounting for 83 percent of the total supply for agricultural and urban purposes in 1995. Aquifers in the Central Coast vary, from small inland valleys and coastal terraces to extensive alluvial valleys with multiple layers of aquifers and aquitards. The four subbasins that comprise the Gilroy–Hollister Valley Basin have a combined area of 183,600 acres, most of which is in the Project Area. The Pajaro Basin is bounded to the west by Monterey Bay and to the east by the San Andreas Fault and the Santa Cruz Mountains. The Pajaro Basin has a total area of 76,800 acres, of which only a small portion is in the Project Area. Groundwater levels have been decreasing over time in the Pajaro Basin because of pumping in excess of recharge (DWR 2009).

The Santa Clara Subbasin is located in the San Francisco Bay Hydrologic Region and has an area of 153,600 acres, most of which is in the Project Area. The Santa Clara Subbasin is bounded by the Diablo Range on the west, the Santa Cruz Mountains in the east, and is in a structural trough parallel to the Coast Ranges. Land subsidence has been a problem in the Santa Clara Subbasin in the past, and an annual monitoring program has been set up to reduce land subsidence and promote groundwater recharge to ensure groundwater will continue to be a viable water supply in the future (DWR 2009).

3.7.4 Impact Analysis

Methodology

Potential impacts to hydrologic conditions and geomorphic resources were evaluated based on how the Proposed Project could affect hydrologic or geomorphic functions. Alterations to flooding conditions also were considered, under the basic assumption that stream maintenance activities would be intended to reduce flood risk. Potential short-term and long-term impacts of primary maintenance activities (sediment removal, vegetation management, and bank stabilization) were considered.

Proposed Project maintenance activities would not change runoff sources, storm drainage pathways, or outlets (outfalls) from the storm drainage network to downstream areas. Therefore, this impact analysis focuses on anticipated changes occurring within the stream channels to be maintained, and how such changes may influence other aspects of the geomorphic system. In general, the proposed sediment removal, bank stabilization, and vegetation management activities would be a continuation of SCVWD's current SMP practices. The SMP Update process would include some areas (as indicated in Figures 2-14 through 2-38) where maintenance activities did not occur during the first decade of the SMP (2002-2012) but would occur between 2012 and 2022.

Criteria for Determining Significance

For the purposes of this analysis, the Proposed Project would result in a significant impact on hydrologic or geomorphic resources if it would:

A. substantially alter existing drainage courses or patterns of the site or area, including changes to the timing or amount of runoff or alteration of the course of a stream or river in a manner which would result in substantial erosion, siltation, or stream instability;

B. contribute runoff water that would exceed the capacity of existing or planned storm water drainage systems;

C. substantially deplete surface water supplies;

D. place structures within a 100-year flood hazard area which would impede or redirect flood flows;

E. expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam;

F. substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level; or

G. expose people or structures to a significant risk of inundation by seiche, tsunami, or mudflow.

Because the intended purpose and primary objective of the current SMP is to reduce the risk of flooding, many of the criteria above are inherently counter to the objectives of the Proposed Project. Therefore, the review of potential environmental impacts that is presented next focuses on the potential for increased erosion and sedimentation caused by Proposed Project activities. The evaluation is divided into two time scales: near-term and short-term potential impacts that could occur during the immediate staging, preparation, and implementation of proposed maintenance activities; and longer-term potential effects.

Environmental Impacts

Impact HYD-1: Short-Term Instream Erosion or Sedimentation from Sediment Management Activities (Significance Criterion A; Less than Significant)

The Proposed Project would involve sediment removal and related activities, such as construction of temporary coffer dams for dewatering, culvert clearing and debris removal. During the immediate channel access, staging, and sediment removal activities, erosion from the streambanks or sediment loading into the channel and scouring may increase if the Proposed Project creates sudden vertical transitions downstream from sediment removal sites. Furthermore, sediment loads to the channel could increase if stockpiled soils or sediment-laden water at work sites enters the channel or if new areas are disturbed for staging activities. Erosion or sediment loading into the channel also could occur if the activities do not restore low-flow channels as closely as possible to their original location and form, except in areas where the original location could cause future erosion.

Applicable Best Management Practices

The following BMPs would be implemented as part of the SMP Update to minimize the potential for short-term instream erosion and sedimentation from proposed maintenance activities. Descriptions of each BMP are provided in Chapter 2, *Project Description*.

BMP GEN-4: Minimize the Area of Disturbance
BMP GEN-20: Erosion and Sediment Control Measures
BMP GEN-21: Staging and Stockpiling of Materials
BMP GEN-22: Sediment Transport
BMP GEN-23: Stream Access
BMP SED-2: Prevent Scour Downstream of Sediment Removal
BMP SED-3: Restore Channel Features
BMP SED-4: Berm Bypass

Conclusion

Implementation of the BMPs listed above would prevent sediment at work sites from entering the channel and would, following sediment removal, restore low-flow channels as closely as possible to their original location and form where the original location would not cause future erosion. Therefore, the Proposed Project would not significantly affect instream erosion or sedimentation rates. This impact would be less than significant and no mitigation would be required.

Mitigation Measures: No mitigation is required.

Impact HYD-2: Long-Term Instream Erosion or Sedimentation from Sediment Removal Activities (Significance Criterion A; Beneficial)

Although the proposed sediment removal activities are not anticipated to cause short-term adverse impacts through excessive erosion/sedimentation, the long-term potential effects of removing an average of over 45,000 cubic yards of sediment annually[4] were considered. In general, the flood protection channel network is not a system in geomorphic equilibrium, where sediment gains are balanced with sediment losses. The system is in disequilibrium because most reaches are net depositional, and sediment accumulates over time.

The cause for this net depositional condition is a result of disruption of the sediment delivery system, associated with historic land development in the region, subsidence of the Valley floor caused by historic groundwater pumping, and the construction of the flood protection channel network. Historically, before development and channelization, the streams in the Project Area periodically overtopped their banks and deposited sediment onto the adjacent floodplain. Non-channelized streams also migrated across the floodplain, seeking the most efficient pathway downstream. These pre-channelization geomorphic processes can be reviewed in standard geomorphic texts such as Dunne & Leopold (1978), Ritter (1986), or Mount (1995). Once flood protection channels were established in the Project Area to reduce overbank flooding, these channels lost their ability to spread and distribute sediments across adjacent floodplains. Upstream sediment sources, however, have not been reduced. The net result of these processes is that sediment is delivered to channels that are restricted from depositing and storing this sediment on their adjacent floodplains. The channels themselves have become the reservoirs for sediment storage. The baseline flood protection channel system is and will continue to be depositional and requires periodic sediment removal to help the streams' design flow conveyance capacities to be maintained.

Removing abundant sediment volumes from a system that is in geomorphic equilibrium may cause adverse geomorphic impacts to the overall system and, in particular, to downstream channel processes. In such a situation, the downstream channels would be "starved" of sediment transported from upstream. Such channels "starved" of sediment could respond by using the energy that would otherwise be used to transport sediment into eroding local instream sediment. This is often the origin of channel incision.

However, for the Proposed Project, the baseline condition is net depositional, whereby sediment loading far outpaces the ability for channels to transport their material downstream. The sediment removed from the Project Area's channels under the Proposed Program typically would not outpace the sediment transport capacity of downstream reaches. In other words, because the flood protection channels in the Project Area in general receive an abundant sediment supply, removing a portion of this sediment through proposed maintenance activities would not create "starved" channels downstream.

[4] SCVWD has removed an average 46,411 cubic yards of sediment annually under the current SMP.

Additionally, from an ecological viewpoint, excessive buildup of sediment in low gradient Project Area channels causes a succession of the instream habitat toward monocultural stands of cattail marsh. Removing the sediment could have a beneficial effect by providing a more varied habitat until ongoing sediment aggradation triggers the need for sediment removal again. *Conclusion*

In the long term, Proposed Project sediment management activities would provide beneficial flood protection and no impact would occur.

Mitigation Measures: No mitigation is required.

Impact HYD-3: Short-Term Erosion or Sedimentation from Vegetation Management Activities (Significance Criterion A; Less than Significant)

Instream emergent vegetation (such as cattails) develops well in non-shaded flood protection channels with shallow and low velocity flows during drier season low-flow conditions. Cattail growth results in constricting the channel bottom with thick vegetation stalks and trapping more fine sediment, resulting in further bed aggradation. Proposed vegetation management activities would remove such instream emergent vegetation that traps sediment and obstructs channel flows. The Proposed Project also would thin/prune and remove instream woody vegetation that obstructs or diverts flows, resulting in an increased flood risk. When such vegetation is removed, the opportunity for erosion caused by channel bed disturbance and exposure increases. Deposited sediment could migrate to downstream areas during subsequent flow events in the channel. This potentially eroded sediment would have the potential to travel downstream and aggrade in a downstream location. Effects of the eroded sediment on aquatic habitat are described in Section 3.3, *Biological Resources*.

Applicable Best Management Practices

The following BMPs would be implemented as part of the SMP Update to minimize the potential for short-term erosion or sedimentation from proposed vegetation management activities. Descriptions of each BMP are provided in Chapter 2, *Project Description*.

BMP VEG-1: Minimize Local Erosion Increase from In-channel Vegetation Removal
BMP REVEG-1: Seeding

Conclusion

Implementing these BMPs would help minimize the potential for any increase in local erosion or sedimentation that may result from in-channel vegetation removal. Therefore, the Proposed Project would have a less-than-significant impact on short-term erosion or sedimentation and no mitigation would be required.

Mitigation Measures: No mitigation is required.

Impact HYD-4: Short-Term Erosion or Sedimentation from Bank Stabilization Activities (Significance Criterion A; Less than Significant)

Bank stabilization activities would be implemented along stream banks where failure or severe erosion had occurred. At bank stabilization sites, SCVWD would continue to evaluate the cause of bank erosion or failure and would prepare a treatment design to provide a stable bank form while minimizing potential impacts. As described in the 2012 SMP Manual (Appendix A), SCVWD has template designs for up to 28 bank stabilization approaches. Most commonly, SCVWD would repair failing banks with earth, rock, and other natural materials, backfilled to a stable slope. Where possible, SCVWD would encourage use of biotechnical approaches, including the use of willow wattles, vegetation mattresses, and planting of native riparian trees at the top of banks and the toe of slopes to create additional bank stability and increased canopy in the channel. Once the eroded or failed bank was stabilized and new plantings became established, the active source of eroding sediment would be eliminated, providing a longer-term benefit. However, during implementation of bank stabilization projects, the banks would be exposed and vulnerable to ongoing erosion.

The use of hardscape bank treatments (such as rip rap) would be used where other alternatives would not result in a sufficiently stabilized slope. A typical condition where a hardscape solution may be used is to stabilize the bank upstream and downstream of an outfall culvert to prevent reoccurring erosion. In such cases, rock may be used adjacent to the culvert outfall to help maintain the stability of the culvert. When repairs were made, banks would be recontoured to match the adjacent bank slope, where possible (i.e., returned to pre-failure condition). If site conditions allowed, the bank slope may be stabilized at a shallower slope (reducing the likelihood of renewed failure), but only if the work is conducted within the confines of the original channel as-built condition. Stabilized banks would be flush with the existing upstream and downstream bank slope. As a result, stream flows would not be altered such that velocity would be increased or erosion would result near or downstream of the project site. It is unlikely that measurable changes to stream flow characteristics in the project reach would occur. Overall, hardscape would be minimally used in proposed bank stabilization projects, placement of hardscape would be localized to small areas, and bank stabilization sites would be contoured to match the existing bank. The amount of sediment generated by bank stabilization activities would be relatively small.

Applicable Best Management Practices

The following BMPs would be implemented as part of the SMP Update to minimize the potential for short-term erosion or sedimentation from proposed bank stabilization activities. Descriptions of each BMP are provided in Chapter 2, *Project Description*.

BMP BANK-1: Bank Stabilization Design to Prevent Erosion Downstream
BMP BANK-3: Bank Stabilization Post-Construction Maintenance

Conclusion

The Proposed Project would minimize erosion caused by bank stabilization, by ensuring that site design measures would be used to prevent potential downstream erosion impacts and by maintaining or repairing bank stabilization projects that have been damaged by winter flows. Therefore, the impact would be less than significant and no mitigation would be required.

Mitigation Measures: No mitigation is required.

Impact HYD-5: Long-Term Erosion and Sedimentation from Vegetation Management and Bank Stabilization Activities (Significance Criterion A; Beneficial)

Proposed vegetation removal, revegetation, and bank stabilization activities would have long-term beneficial effects on potential erosion and sedimentation. Pruning and selective removal of trees on streambanks that have the potential to capture debris or redirect erosive flows toward the banks would tend to reduce erosion/sedimentation processes along streambanks. Similarly, the stabilization and treatment of streambanks that are actively eroding or slumping would tend to reduce the long-term erosion and sedimentation of an actively destabilized streambank.

Conclusion

Proposed project maintenance activities would stabilize eroding streambanks such that long-term erosion and sedimentation from the banks would be reduced over time. Therefore, the proposed maintenance activities would be beneficial and no impact would occur.

Mitigation Measures: No mitigation is required.

Impact HYD-6: Harm to People, Structures, or Water Quality from Flooding (Significance Criteria D and E; Beneficial)

The Proposed Project would seek to improve flow conveyance conditions, to reduce the potential for flooding. The proposed maintenance activities would occur within the designated 100-year flood zone of channels in the Project Area.

Sediment Removal

Sediment removal activities would restore the flow conveyance capacity of Project Area channels to their design levels. Therefore, these proposed maintenance activities would reduce the potential for flooding. The Proposed Project would not involve construction of any new structures within the 100-year flood zone that could result in harm to people or structures.

Proposed sediment removal activities would include ground-disturbing activities that would occur primarily during the dry season, avoiding or minimizing the potential for flooding. However, many work sites would occur at perennial streams that carry water year-round. To conduct proposed maintenance activities such as sediment removal and bank stabilization, work sites would sometimes require dewatering, which would involve installation of a cofferdam or similar structure to prevent water from entering the work site. If the ponded water behind the temporary dewatering berm was accidently released, localized inundation of the work site and downstream area could result. However, the amount of stored water would not be substantial and would be entirely held within the flood protection channel, so no potential would exist to damage structures or harm people.

Vegetation Management

Proposed vegetation management activities would restore the flow conveyance capacity of Project Area channels to their design levels by removing instream vegetation.

Bank Stabilization

Proposed bank stabilization activities would return creek channels to their operational design. Bank stabilization activities may require the use of dewatering structures. Potential effects of the use of these structures would be similar to that described for sediment removal activities.

Other Maintenance Activities

Other proposed maintenance activities (management of animal conflicts, minor maintenance, and canal maintenance) also would generally improve the flow conveyance capacity of Project Area channels by removing trash or sediment from culverts and other crossings, and/or repairing levees that had been damaged by animals.

Applicable Best Management Practices

The following BMPs would be implemented as part of the SMP Update to minimize the potential for harm to people, structures, or water quality from flooding. Descriptions of each BMP are provided in Chapter 2, *Project Description*.

BMP GEN-33: Dewatering for Non-Tidal Sites
BMP GEN-34: Dewatering in Tidal Work Areas

Conclusion

The Proposed Project would decrease the possibility of flooding within the Project Area. The proposed maintenance activities would be beneficial and no impact would occur.

Mitigation Measures: No mitigation is required.

Impact HYD-7: Alterations to the Recharge, Quality, or Quantity of Groundwater (Significance Criterion F; Beneficial)

The Proposed Project would not utilize groundwater supplies; thus, no adverse impact on groundwater supply would occur. The majority of the creek channels (and some canals) maintained by SCVWD would be earthen, as opposed to having concrete-lined beds and banks. These creek channels (and certain canals) would provide passive avenues for groundwater recharge because water would be allowed to percolate down to shallow and deeper groundwater aquifers.

The current sediment transport conditions in the Project Area encourage accumulation of fine materials in stream channels, particularly where vegetation is overgrown and where the longitudinal slope of the channel is low. Groundwater recharge capacity is reduced in these locations as fine sediments clog pores and interstices between bed sediments. Over time, this reduces the rate at which surface water in the channels percolates down to the groundwater below.

Sediment Removal

Annual sediment removal activities and reshaping of the channel in some locations to keep sediment from depositing in the channel bed would improve infiltration and percolation to groundwater.

Bank Stabilization

Stabilizing failing stream banks would assist in reducing fine sediment inputs to the channels.

Vegetation Management

Vegetation management activities would support the growth of riparian vegetation along channel banks and would result in beneficial impacts to groundwater recharge by assisting in the reduction of fine sediment inputs to the channels.

Minor Maintenance

Minor maintenance activities would include sediment removal that would have similar beneficial impacts on groundwater quantities as those described for sediment removal activities.

Management of Animal Conflicts

Reductions in animal burrowing would assist in reducing fine sediment inputs from the levees to the channels.

Canal Maintenance

Because routine canal maintenance activities would include all general work activities, effects would be the same as described above for other routine maintenance activities.

Conclusion

The proposed sediment removal, bank stabilization, in-channel and riparian vegetation management, minor maintenance, canal maintenance, and management of animal conflicts would not deplete groundwater supplies or interfere with groundwater recharge. By reducing the amount of fine sediment in the channels/canals, these activities would improve percolation of surface water and increase groundwater levels. These proposed activities would be considered beneficial and no impact would occur.

Mitigation Measures: No mitigation is required.

Impact HYD-8: Occurrence of Seiche, Tsunami, or Mudflow (Significance Criterion G; No Impact)

The northern portion of the Project Area is located at the southern margin of San Francisco Bay. The California Emergency Management Agency has mapped areas that could be potentially inundated by tsunamis in the northern portion of the Project Area. In the Project Area, reaches of Coyote Creek and the Guadalupe River (extending approximately one-half mile inland from their mouths), the reach of Alviso Slough (extending one mile inland from its mouth), and less than one-half mile of the tidal mudflats and sloughs west of Alviso Slough are susceptible to tsunami inundation (CEMA et al. 2010).

Bank Stabilization

Proposed bank stabilization activities would not exacerbate tsunami conditions in areas that would be susceptible to tsunamis. In addition, no large bodies of water would be present in the Project Area that could create seiche hazards. Furthermore, bank stabilization activities would reduce the potential for impacts of mudflow.

Other Maintenance Activities

Similar to bank stabilization activities, other proposed maintenance activities (sediment removal, vegetation management, minor maintenance, management of animal conflicts, and canal maintenance) would not be located in tsunami-susceptible areas or near any seiche hazard areas. Management of animal conflicts may involve physical habitat alterations (such as compaction of levee faces or reconstruction of levee side slopes) that potentially could reduce any mudflow impacts. Vegetation management activities would generally remove in-channel vegetation and would not remove vegetation on levee slopes or stream banks such that the potential for mudflows would be increased. Sediment removal and minor maintenance activities generally would not affect any potential mudflows. Because routine canal maintenance activities would include all general work activities, effects would be the same as described for other routine maintenance activities.

Conclusion

No impacts related to seiche, tsunami, or mudflows would occur.

Mitigation Measures: No mitigation is required.

Impact HYD-9: Geomorphic Effects of Sediment Reuse (Significance Criterion A; Less than Significant)

Sediment reused at Pond A8 or another similar location would be placed to improve the geomorphic function in these locations. The Proposed Project would not reuse sediment in locations that could result in adverse geomorphic effects.

Conclusion

The geomorphic impact of sediment reuse would be beneficial in some cases, and in no case would have significant impacts. No mitigation would be required.

Mitigation Measures: No mitigation is required.

Impact HYD-10: Creation of Runoff Water and Depletion of Surface Water Supplies (Significance Criteria B and C; Less than Significant)

The Proposed Project could contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems if it substantially increased the quantity of existing impermeable surface areas in the Project Area. Surface water supplies could be depleted if the Proposed Project generated significant water demands that were met by surface water supplies.

Bank Stabilization

Proposed bank stabilization activities are not a projected activity and would be performed on an as-needed-basis. These activities could include the use of concrete to repair unstable lined channels or side slopes. The use of concrete as part of these activities is not anticipated to be significant and would not substantially increase impermeable surface areas in the Project Area or subsequently contribute increases in runoff such that the capacity of existing or planned stormwater drainage systems were exceeded. The performance of bank stabilization activities may require use of water supplies, including surface water supplies, as detailed under Impact PSU-3 in Section 3.10, *Public Services and Utilities*. However, as described in that impact discussion, trucked-in SCVWD water supplies would be used to meet any water demands of the Proposed Project. Demands of the Proposed Project would not be expected to substantially deplete surface water supplies.

Other Maintenance Activities

Other proposed maintenance activities (sediment removal, minor maintenance, management of animal conflicts, vegetation management, and canal maintenance) could create water demands as described under Impact PSU-3 in Section 3.10, *Public Services and Utilities*. These water demands would be met with trucked-in SCVWD water supplies and would not be anticipated to be substantial or require significant quantities of surface water supplies. These proposed activities would not increase the impermeable surface area in the Project Area and would not create substantial quantities of runoff that would exceed the capacity of existing or planned stormwater drainage systems. The removal of sediments, vegetation, and trash from channels and canals would restore the design capacity of the existing stormwater drainage systems.

Applicable Best Management Practices

The following BMPs would be implemented as part of the SMP Update to minimize the potential for creation of runoff water and depletion of surface water supplies. A description of this BMP is provided in Chapter 2, *Project Description*.

BMP GEN-4: Minimize the Area of Disturbance

Conclusion

The Proposed Project would not substantially alter the existing impermeable surface area or resulting runoff in the Project Area. In addition, the Proposed Project would not substantially deplete surface water supplies. Therefore, this impact would be less than significant and no mitigation would be required.

Mitigation Measures: No mitigation is required.

Impact HYD-11: Short-Term Erosion and Sedimentation from Minor Maintenance, Management of Animal Conflicts, and Canal Maintenance Activities (Significance Criterion A; Beneficial)

Proposed minor maintenance, management of animal conflicts, and canal maintenance activities may involve sediment removal and/or ground-disturbing activities that could affect creek channel erosion and sedimentation processes. Erosion and sedimentation-related effects of these activities would be similar to the effects described above for sediment removal activities, although on a reduced scale. During these activities, sediment loads to the channel could increase if stockpiled soils or sediment-laden water at work sites entered the channel. In addition, increased erosion and scouring could occur following these activities if the minor maintenance activities created sudden vertical transitions downstream from sediment removal sites.

Applicable Best Management Practices

The following BMPs would be implemented as part of the SMP Update to minimize the potential for short-term erosion and sedimentation from proposed maintenance activities. Descriptions of each BMP are provided in Chapter 2, *Project Description*.

BMP GEN-4: Minimize the Area of Disturbance
BMP GEN-20: Erosion and Sediment Control Measures
BMP GEN-21: Staging and Stockpiling of Materials
BMP GEN-22: Sediment Transport
BMP GEN-23: Stream Access
BMP SED-2: Prevent Scour Downstream of Sediment Removal
BMP SED-3: Restore Channel Features
BMP SED-4: Berm Bypass

Conclusion

The Proposed Project would prevent sediment at project sites from entering the channel and would, following sediment removal, restore low-flow channels as closely as possible to their original location and form where the original location would not cause future erosion. Therefore, the Proposed Project would not substantially affect instream erosion or sedimentation rates. This impact would be less than significant and no mitigation would be required.

Mitigation Measures: No mitigation is required.

Impact HYD-12: Long-Term Erosion and Sedimentation from Minor Maintenance, Management of Animal Conflicts, and Canal Maintenance Activities (Significance Criterion A; Beneficial)

Proposed minor maintenance, management of animal conflicts, and canal maintenance activities would minimize long-term erosion and sedimentation effects in creek channels if they removed sediments and/or stabilized creek banks. As described above, most channel reaches in the Project Area are net depositional and require the periodic removal of sediments to maintain channel conveyance capacities. Removal of sediments as part of the proposed minor maintenance activities would be beneficial. Animal conflict management activities, including the reconstruction of levee side slopes or surface compaction of levee faces, would reduce erosion/sedimentation processes along streambanks. Canal maintenance activities could include any of the proposed sediment removal, bank stabilization, vegetation management, or minor maintenance activities and would reduce the long-term erosion and sedimentation effects of an actively destabilized streambank.

Applicable Best Management Practices

None of the BMPs provided in Chapter 2, *Project Description,* are applicable.

Conclusion

The proposed minor maintenance, canal maintenance, and management of animal conflicts would be beneficial to prevention of erosion and sedimentation of destabilized streambanks in the Project Area. No impact would occur.

Mitigation Measures: No mitigation is required.