# 4.4 HYDROLOGY AND WATER QUALITY

## Introduction

This section addresses project impacts related to hydrology, groundwater and water quality. This discussion includes a summary of the existing hydrology in the project vicinity, an analysis of the potential impacts of the project on these features, and mitigation measures, if feasible, to reduce any significant impacts.

## Environmental Setting

The 67.7-acre Arana Gulch site is located along the eastern border of the City of Santa Cruz, north of the Upper Santa Cruz Small Craft Harbor (the former Woods Lagoon) and west of Live Oak, an unincorporated area of the County of Santa Cruz. The property is located in the lower valley region of the Arana Gulch watershed.

**Physiography.** The Arana Gulch watershed drains an approximately 3.5-square-mile area. The watershed basin is relatively long and narrow with elevations ranging from sea level at the harbor to over 600 feet at its northern boundary in the upper watershed (Balance Hydrologics, 2002).

The watershed is set in two distinct basin types: the steep stream basins in the upper watershed and the lower flat-floored alluvial channel set in the rolling marine deposits in the lower reach above the Upper Harbor basin. The subject property is located in the lower watershed area.

The upper and northern portion of the watershed consists of three steep-walled drainage systems, with surrounding slopes of up to 70 percent.[1] The three drainage systems include the eastern, central and western branch of Arana Gulch Creek. These branches have carved valleys in the Purisima sandstone in the headwaters and their confluence is upstream of the Oak Meadow Cemetery. The downstream stream of the confluence is the main branch of Arana Gulch Creek. The main stem flows through a low-gradient and narrow alluvial valley, which is confined by marine terrace deposits on the east and west side of the valley.

The 67.7-acre site varies in elevation from 10 to 70 feet above mean sea level. The eastern 34.5-acre portion of the site is the Arana Gulch Riparian area, which includes Arana Gulch Creek, a perennial stream and a tidal lagoon; a low-lying flood plain that includes emergent wetlands; and the upper flood plain that includes riparian scrub and woodland habitat (see Figure 3-3).

The central 30.2-acre portion of the site is located on the upper marine terrace and includes coastal prairie and annual grassland habitat. Small pocket wetlands formed by shallow seeps occur in several areas on the upper marine terrace (see Figure 3-3).

[1] A 70-percent slope means that for every 100 feet in horizontal distance, there is a 70-foot vertical change.

Hagemann Gulch is on the western boundary of the site (see Figure 3-2). This area is a steep 3-acre wooded canyon that features a mix of riparian trees and scrub. The canyon receives seasonal drainage from an approximately 66-acre watershed, which consists of 50 acres of urbanized area (primarily of residential, commercial and light industrial uses) and approximately 16 acres of open space or undeveloped land uses.

**Climate.** The area encompassing the project site is located in the Mediterranean-type climate zone typical of coastal central California. Summers are generally warmer and drier than winter months. Summer months (July through September) may experience high temperatures of 75 to 80 degrees Fahrenheit or higher and lower temperatures of 45 to 50 degrees Fahrenheit. Winter months (December through March) may experience high temperatures of 60 to 65 degrees Fahrenheit and low temperatures of 35 to 40 degrees Fahrenheit. Due to the proximity of Monterey Bay and the Pacific Ocean, summer temperatures are moderated by cool marine breezes and coastal fog.

Mean annual precipitation can range from approximately 26 inches per year along the coast to 34 inches per year near the headwaters of Arana Gulch. Most of the rainfall occurs between the months of November to March. Table 4.4-1 presents a summary of the monthly average precipitation rates in the Arana Gulch area.

Mean annual evapotranspiration in the Arana Gulch area is estimated to be 36.8 inches, of which less than one quarter (8.78 inches or 24 percent) occurs during the rainy season. Table 4.4-1 presents a summary of the monthly average reference evapotranspiration (ETo) in the Arana Gulch area. The ETo refers to evaporation loss of water from a vegetated land surface.

**Table 4.4-1: Mean Monthly Rainfall and Evapotranspiration for the Project Site**

| Month | Mean Monthly Precipitation[a] (Inches) | Mean Monthly Reference (ETo) Evapotranspiration[b] (Inches) | Water Surplus or Deficit (Inches) | Potential Runoff or Recharge (Inches) |
|---|---|---|---|---|
| October | 1.29 | 2.93 | -1.64 | |
| November | 3.90 | 1.65 | 2.25 | 2.25 |
| December | 5.50 | 1.22 | 4.28 | 4.28 |
| January | 6.56 | 1.46 | 5.10 | 5.10 |
| February | 5.49 | 1.76 | 3.73 | 3.73 |
| March | 4.34 | 2.69 | 1.65 | 1.65 |
| April | 2.12 | 3.54 | -1.42 | |
| May | 0.65 | 4.13 | -3.48 | |
| June | 0.19 | 4.43 | -4.24 | |
| July | 0.08 | 4.88 | -4.80 | |
| August | 0.09 | 4.27 | -4.18 | |
| September | 0.34 | 3.84 | -3.50 | |
| **Annual Total** | **30.55** | **36.8** | **-6.25** | **17.01** |

[a] Mean monthly precipitation from City of Santa Cruz (NCDC Station ID #047916).

[b] Mean monthly reference evapotranspiration (ETo) data from University of California Bulletin No. 1922, *Reference Evapotranspiration (ETo) for California,* 1987.

**Surface Hydrology.** As previously mentioned, the site includes three distinct areas that have different hydrologic characteristics and that make up the three management areas outlined in the Master Plan (see Figure 3-4). The eastern portion of the site includes the Arana Gulch Creek Riparian and Wetland Management Area, which includes Arana Gulch Creek; the central portion of the site includes coastal prairie and grasslands; and the western portion of the site includes Hagemann Gulch. These are addressed separately below.

<u>Arana Gulch Creek Riparian and Wetland Management Area.</u> The Arana Gulch Creek Riparian and Wetland Management Area encompasses the lower reach of Arana Gulch Creek, wetlands along the creek channel, dense willow stands, and riparian forest. These areas, totaling 34.5 acres, provide valuable habitat for numerous birds, small mammals, fish, amphibians, reptiles and insects. Despite the development of the Santa Cruz Harbor and sedimentation within the creek, Arana Gulch Creek provides habitat for steelhead trout.

The upper watershed of Arana Gulch Creek consists primarily of large land holdings, with low-density rural residential development and large areas covered by forests and brushlands, with some grasslands and orchards. In the vicinity of State Highway 1 and downstream to Capitola Road, the watershed is urbanized with mixed land uses including residential, commercial, and light industrial, and institutional uses such as schools, hospitals, and cemeteries.

Stream flow in Arana Gulch Creek is highly variable both seasonally and in response to rainfall events. Due to the steep topography in the upper watershed, the characteristics of the soils, and amount of impervious cover in the urbanized area, stream flow can change very rapidly in response to short, high-intensity rainfall events.

The main branch of Arana Gulch Creek meanders along the eastern boundary of this management area. The creek flows into the northern portion of the site through a culvert under Capitola Road. At the southern end, the creek flows through four large culverts into the Upper Harbor. The stream/marsh area covers the entire valley floor in the riparian area.

Historically, an on-site narrow low-flow channel was maintained by the previous landowner along the western edge of the valley below Capitola Road. The channel was maintained for irrigation purposes (Harvey and Hecht, 1982). Over the past several decades, this channel has not been maintained, becoming heavily vegetated with willow and returning to a more natural stream form. The low-flow channel is connected to the tidal channels that begin approximately 1,500 feet upstream of four 72-inch culverts connected to the Upper Harbor. The tidal channels are considered primarily tidal in both their form and in the salinity of their waters. This area also receives dispersed and some concentrated runoff from the coastal prairie/grasslands area in the central portion of the site and from urban runoff from a gully in the northern portion of Arana Gulch, located at the end of Agnes Street and the alleyway. Erosion is evident in this area.

Within the southern tidal reach, to the north of the Upper Harbor culverts, the stream banks have collapsed and there is substantial channel head cutting. Previous studies (Harvey and Hecht, 1982) identified tidal action as the primary cause of bank instability and collapse. Increasing sedimentation from the upper watershed may also be contributing to the channel widening.

<u>Coastal Prairie/Tarplant/Grasslands</u>. The Coastal Prairie/Tarplant Management Area is situated on the coastal terrace in the central portion of the site and covers approximately 30.2 acres. The topography of the area is relatively gentle on the top of the terrace with moderate to moderately steep slopes on the west, south, and east side of the terrace. The area is predominantly grass-

lands, which includes habitat for the protected Santa Cruz tarplant, with oak woodland along the sloped edges of the area. Small seasonal wetlands also occur in this area.

The hydrology of this area is dependent on climatic conditions (rainfall, evapotranspiration, and coastal fog), groundwater, soil conditions, vegetation coverage, and surface alterations, such as trails and gullies.

In areas that are well-vegetated and undisturbed, rainfall and fog are intercepted by vegetation and approximately 15 to 20 percent of precipitation infiltrates into underlying soils. Excess rainfall is shed off of these areas as dispersed sheet flow to the downslope areas. Deep infiltration of runoff recharges shallow groundwater.

Surface hydrology and drainage in a portion of this area have been altered by compacted earthen trails. Currently, there are approximately 1.2 miles of designated, maintained trails on the property. There are also several unauthorized, unmaintained pathways, totaling about 1 mile of disturbed surface. In their present condition, many of the trails (particularly those on sloped terrain) intercept sheet runoff and act as shallow channels that concentrate runoff flow, increasing the rate and volume of runoff exiting the site. Runoff in these trails and channels accelerate erosion and sedimentation on the site. These shallow channels alter and interrupt the surface hydrology by reducing the amount of water that would normally pass as sheet flow across the grasslands.

<u>Hagemann Gulch</u>. The Hagemann Gulch Riparian Woodland Management Area is a steep-sided canyon with seasonal drainage. This 3-acre area features a dense canopy of trees and scrub. The upper slope is comprised primarily of coast live oak woodland, California bay, and an understory of poison-oak and California blackberry. Riparian scrub and woodland occurs on the lower slopes.

Hagemann Gulch includes two separate drainage courses with a confluence on the Arana Gulch site. Stream flow in Hagemann Gulch is highly variable and dependent primarily on rainfall and groundwater conditions.

Both drainage courses receive intermittent flows, predominantly urban runoff, from several storm drain outlets connected to the City's storm drain system installed in the adjacent neighborhoods. Approximately 34 acres of the drainage areas are high-density urbanized land, and the remaining 16 acres are mixed park woodland and riparian corridor. A review of drainage maps provided by the City of Santa Cruz indicates that the west branch of Hagemann Gulch receives runoff from approximately 6 acres of developed lands and the east branch receives runoff from approximately 24 acres of developed lands. The main branch drains approximately 4 acres of urbanized lands and receives sheet flow from the surrounding hillsides.

**Groundwater Hydrology.** Shallow groundwater occurs in two distinct water-bearing formations: throughout the alluvial sediments beneath the valley flat in the Arana Gulch riparian area, and in the Purisima Formation on either side of the valley floor in the coastal prairie area.

Harvey and Hecht (1982) installed seven boreholes at depths ranging from 10 to 22 feet in the valley floor or riparian corridor between the Upper Harbor and Capitola Road. At the time of this investigation, shallow groundwater was encountered at depths of 2.5 to 4 feet, at an elevation of between 1 and 2 feet above the City of Santa Cruz datum (NGVD of 1929). Water levels were observed to vary with tidal stage, especially within 30 feet of the banks, where regular variations of 0.6 to 1.2 feet were observed during normal tidal cycles. The tidal channels appear to serve as groundwater drains. Between their northern limit and Capitola Road, standing water levels are generally between 0.2 to 1.0 feet below ground surface. Groundwater flow direction was observed toward Arana Gulch Creek (Harvey and Hecht, 1982).

To evaluate groundwater conditions in the Purisima formation, Weber, Hayes & Associates (WHA, 1996) installed six piezometers. The piezometers were installed into the Purisima Bedrock, which was encountered at depths ranging from 8.5 to 14 feet below ground surface. WHA reports that unconsolidated soils encountered above the bedrock contained interbedded layers of clayey sand and silty sand. First-encountered groundwater beneath the site is perched on the underlying Purisima bedrock, and groundwater flow direction is controlled by subsurface topography. Groundwater is recharged primarily by infiltration of rainfall and discharges to streams and springs. Depth to the perched groundwater fluctuates seasonally; the groundwater may be encountered at near-surface elevations following sustained rainfall, and may disappear completely during dry months (WHA, 1996). Groundwater seepage from the Purisima formation is also observed on slopes were the sandstone bedrock is exposed along the western margin of the valley floor or riparian area.

**Soil and Erosion Hazard.** Based on the Soil Survey of Santa Cruz County (USDA, 1979) there are two predominant soil types encountered at the site: Elkhorn sandy loam and Aquents soil. The Elkhorn sandy loam is found on the coastal marine terrace and slopes down to the riparian corridors of Arana Gulch Creek and Hagemann Gulch. The Elkhorn sandy loam soil is a very deep, well-drained soil. The permeability and runoff of the soil is moderately slow and the hazard of erosion low where soil is on gentle slopes, between 2 to 9 percent. On steeper slopes (over 9 percent), runoff is rapid, the hazard of erosion is high. This is observed in several of the trails that are located on steeper slopes, as described above in the "Coastal Prairie/Tarplant/ Grasslands" subsection.

Aquents soil is encountered in the marsh areas in the Arana Gulch riparian area. Aquents consist of sandy to clayey sediment and mucky and peaty material that are frequently inundated by tides and runoff water. Due to the fine particle size, these soils generally have low permeability. They are prone to erosion during high stream flow events in active channels if the soil is not well-vegetated.

**Water Quality.** Water quality monitoring in Arana Gulch has occurred in two periods. The first monitoring was undertaken in 1977 by Robert Byington, reported by Harvey and Hecht (1982). More recently, water quality was monitored between November 1996 and 1999 by the Coastal Watershed Council, summarized by Balance Hydrologics (2002).

In 1977, Robert Byington measured pH, temperature, salinity, ammonia, and dissolved oxygen at two stations in Arana Gulch from June 25 through August 1. Measurements were taken near the upstream entrance of the four 72-inch culverts connecting Arana Gulch Creek to the Upper Harbor and approximately 600 feet upstream of the culverts. The results of this testing are presented below in Table 4.4-2.

From 1996 through 1999, the Coastal Watershed Council conducted water quality measurements throughout the Arana Gulch watershed, including three sites along Arana Gulch Creek within the project site and one site on Hagemann Gulch. Measurements were made of water temperature, dissolved oxygen, turbidity, specific conductance, and pH. Weekly testing was completed throughout the year and the data have been compiled and presented to reflect seasonal changes in water quality occurring in the fall, winter, summer, and spring. The results of this monitoring program are summarized in Table 4.4-2.

In general, the results indicate that water quality in Arana Gulch Creek and Hagemann Gulch is within the water quality objectives for the aggregate parameters measured. The data indicate that at times the dissolved oxygen levels can be depressed below the water quality objective for coldwater streams. Turbidity levels varied seasonally and increased levels were measured during the winter during periods of storm runoff, indicating that sediment may directly affect spawning, egg incubation, or emergence of steelhead from the gravels. Water temperatures naturally vary seasonally and diurnally. The range of temperatures measured in Arana Gulch Creek is typically suitable for all life stages of steelhead, the critical species using the creek. The range of pH values only varied slightly from a low of 7.44 to a high or 8.15, and all values were within the water quality objectives set to protect aquatic life.

Specific conductance and salinity are indirect measurements of the amount of total dissolved solids (TDS) in the water. Higher conductivity and salinity measurements were measured in the lower reach of Arana Gulch Creek, which is influenced by tidal action and mixing of seawater. Upstream beyond the tidal regime, both the salinity and conductive levels are much lower and characteristic of the freshwater stream system. Conductivity measured in Arana Gulch Creek at the various locations is at levels that are not a limiting factor for coldwater fish using the stream, such as steelhead.

Both Arana Gulch Creek and Hagemann Gulch receive urban storm water runoff during storm events. These events most likely flush pollutants commonly found in urban runoff, such as heavy metals (zinc, copper, and lead), hydrocarbons, polyaromatic hydrocarbons, persistent pesticides, pathogens (primarily from domestic animals and wildlife), sediment, and other potential pollutants. To date, no testing has been conducted to measure these specific parameters.

**100-Year Flood Plain.** The riparian corridor and tidal estuary of Arana Gulch Creek are within the 100-year flood plain as shown in the Federal Emergency Management Agency (FEMA) National Flood Insurance Program's Flood Insurance Rate Map (FIRM) for the Arana Gulch area.

**Table 4.4-2: Water Quality Data for Arana Gulch Streams**

| Location | Parameter | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | pH | | Temperature ("C") | | Dissolved Oxygen (mg/L) | | Turbidity (JTU) | | Salinity (ppt) | | Conductivity (uhmos/cm) | |
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| **June 25-August 1, 1977[a]** | | | | | | | | | | | | |
| Upstream of Upper Harbor | 7.44 | 8.15 | 16.10 | 18.50 | 4.80 | 6.40 | – | – | 28.10 | 34.44 | – | – |
| 100 ft. above Upper Harbor | 7.52 | 7.99 | 16.20 | 20.30 | 3.70 | 5.30 | – | – | 11.85 | 31.98 | – | – |
| **Fall 1996-1999[b]** | | | | | | | | | | | | |
| Upper Harbor | – | 8.00 | – | 11.33 | – | 6.67 | – | 15.00 | – | – | – | – |
| Mid Arana Gulch Creek | – | 8.00 | – | 7.67 | – | 9.67 | – | 26.67 | – | – | – | 3.03 |
| Upper Arana Gulch Creek | – | 8.00 | – | 8.00 | – | 10.00 | – | 26.67 | – | – | – | 0.43 |
| Hagemman Gulch | 7.80 | 8.00 | 7.80 | 8.00 | – | 6.20 | 11.67 | 31.43 | – | – | – | – |
| **Winter 1996-1999[b]** | | | | | | | | | | | | |
| Upper Harbor | – | 8.00 | – | 10.37 | – | 6.70 | – | 15.00 | – | – | – | – |
| Mid Arana Gulch Creek | – | 7.83 | – | 7.27 | – | 10.93 | – | 8.33 | – | – | – | 0.43 |
| Upper Arana Gulch Creek | – | 7.83 | – | 7.35 | – | 10.67 | – | 8.33 | – | – | – | 0.47 |
| Hagemman Gulch | – | 7.92 | – | 11.00 | – | 7.83 | – | 12.27 | – | – | – | – |
| **Spring 1996-1999[b]** | | | | | | | | | | | | |
| Upper Harbor | – | 8.00 | – | 11.22 | – | – | – | 0.00 | – | – | – | – |
| Mid Arana Gulch Creek | – | 8.00 | – | 10.35 | – | 9.40 | – | 10.00 | – | – | – | 0.30 |
| Upper Arana Gulch Creek | – | 7.50 | – | 7.90 | – | – | – | 0.00 | – | – | – | 0.45 |
| Hagemman Gulch | – | 7.85 | – | 14.58 | – | 6.22 | – | 15.38 | – | – | – | – |
| **Summer 1996-1999[b]** | | | | | | | | | | | | |
| Upper Harbor | – | – | – | – | – | – | – | – | – | – | – | – |
| Mid Arana Gulch Creek | – | – | – | – | – | – | – | – | – | – | – | – |
| Upper Arana Gulch Creek | – | – | – | – | – | – | – | – | – | – | – | – |
| Hagemman Gulch | – | 7.89 | – | 10.89 | – | 5.38 | – | 28.33 | – | – | – | – |
| **Water Quality Objectives** | **6.5 – 8.5[c]** | | **Less than 24 "C"[d]** | | **Greater than 7 mg/L[c]** | | **NA** | **NA** | **NA** | **NA** | **NA** | **NA** |

[a] Harvey, H. T. and B. Hecht, 1982. *Arana Gulch Mitigation/Sedimentation Draft Final Report for Santa Cruz Port District.*
[b] Coastal Watershed Council, 2000. *Arana Gulch Watershed Monitoring Program 4-Year Trend Analysis.*
[c] Central Coast Regional Water Quality Control Board, 1994. Water Quality Control Plan (Basin Plan) for Central Coast Region.
[d] Balance Hydrologics, Inc., 2002. *Arana Gulch Watershed Enhancement Plan.*

Notes: mg/L = milligrams per liter
JTU = Jackson Turbidity Unit
ppt = parts per thousand
NA = Not applicable.

## Regulatory Setting

Several federal, state, and local laws and plans regulate activities to protect water quality and hydrology. The following sections summarize the principal regulations that pertain to these topics.

**Federal Regulations.** The Clean Water Act (CWA) regulates the discharge of pollutants to waters of the United States from any point source, enacted in 1972. In 1987, amendments to the CWA added Section 402(p), which establishes a framework for regulating non-point source storm water discharges under the National Pollutant Discharge Elimination System (NPDES). The NPDES storm water program is described below.

**State Regulations.** The California State Water Resources Control Board (State Board) and the nine Regional Water Quality Control Boards (Regional Board or RWQCB) have the authority in California to protect and enhance water quality, both through their designation as the lead agencies in implementing the Section 319 non-point source program of the federal Clean Water Act, and through the state's primary water pollution control legislation, the Porter-Cologne Act. The Central Coast (Region 3) office of the Regional Board guides and regulates water quality in streams and aquifers throughout the central coast of California and the Monterey Bay region through designation of beneficial uses, establishment of water quality objectives, and administration of the NPDES permit program for storm water and construction site runoff. The RWQCB is also responsible for Section 401 water quality certification where development results in fill of jurisdictional wetlands or waters of the U.S. under Section 404 of the CWA.

Central Coast Water Quality Control Plan (Basin Plan). The Central Coast RWQCB regulates water quality in the Monterey Bay area in accordance with the Water Quality Control Plan or "Basin Plan" (Central Coast Regional Water Quality Control Board , 1994). The Basin Plan presents the beneficial uses that the Regional Board has designated for local aquifers, streams, marshes, rivers, and bays, as well as the water quality objectives and criteria that must be met to protect these uses. Several beneficial uses have been specifically designated for Arana Gulch Creek, including the following:

- Municipal and domestic supply
- Groundwater recharge
- Contact and non-contact aquatic recreation
- Wildlife habitat
- Coldwater fisheries habitat, migration and spawning
- Freshwater replenishment
- Sport and commercial fishing

NPDES Storm Water Permit Program. The 1987 amendments to the Clean Water Act [Section 402(p)] provided for the U.S. Environmental Protection Agency (EPA) regulation of several new categories of non-point pollution sources within the existing NPDES. In Phase 1, NPDES permits were issued for urban runoff discharges from municipalities of over 100,000 people, from plants in industries recognized by the EPA as being likely sources of stormwater pollutants, and from construction activities that disturbed more than 5 acres. Phase 2 implementation, effective March 10, 2003, extended NPDES urban runoff discharge permitting to cities of 50,000 to 100,000, and to construction sites that disturb between 1 and 5 acres.

The EPA has delegated management of California's NPDES storm water permit program to the State Water Resources Board and the nine Regional Board offices. The State Board has developed several general permits for coverage under the Phase 2 NPDES storm water permit program. Based on the limited activities planned under the Arana Gulch Master Plan, the Construction General Permit is the only pertinent stormwater permits that would apply to the project.

The Small Construction General Permit covers construction activity disturbing equal to or greater than 1 acre of land. Construction activity disturbing less than 1 acre also requires a permit if it is part of a larger common plan of development or sale disturbing a total of 1 acre or greater, or is individually designated for permit coverage by the RWQCB based on threat to water quality.

Construction activity on projects that disturb one or more acres of soil, or less than 1 acre but are part of a larger common plan of development that in total disturbs one or more acres, must obtain coverage under the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ). Construction activity subject to this permit includes clearing, grading, and disturbances to the ground such as stockpiling or excavation, but does not include regular maintenance activities performed to restore the original line, grade, or capacity of a facility.

The Construction General Permit requires the development and implementation of a Storm Water Pollution Prevention Plan (SWPPP). The SWPPP should contain a site map(s) that shows the construction site perimeter, existing and proposed buildings, lots, roadways, storm water collection and discharge points, general topography (both before and after construction), and drainage patterns across the project. The SWPPP must list best management practices (BMPs) that the discharger will use to protect storm water runoff and the placement of those BMPs. Additionally, the SWPPP must contain a visual monitoring program, a chemical monitoring program for "non-visible" pollutants to be implemented if there is a failure of BMPs, and a sediment monitoring plan if the site discharges directly to a water body listed on the 303(d) list for sediment.

**Local Programs, Regulations and Policies.** The following local programs relate to water quality.

City of Santa Cruz Storm Water Program. Urban runoff and other "non-point source" discharges are regulated by the 1972 federal Clean Water Act (CWA) through the National Pollutant Discharge Elimination System (NPDES) permit program. The City of Santa Cruz has developed a comprehensive Storm Water Management Program (SWMP) in order to fulfill the requirements for the Phase II NPDES General Permit for Discharges of Storm Water from Small Municipal Separate Storm Sewer Systems (General Permit) and in order to reduce the amount of pollutants discharged in urban runoff.

The City's Ordinance 16.19.140 requires that any construction project, including those undertaken under any permit or approval granted pursuant to Titles 15, 18, and 24 of the City Code, shall implement best management practices (BMPs) including the City's mandatory BMPs as detailed in the latest BMP manual published by the City's Public Works Department. BMPs shall be maintained in full force and effect during the duration of the project.

City of Santa Cruz General Plan. The Environmental Quality Element of the City of Santa Cruz General Plan (GP) includes policies that pertain specifically to hydrologic and water quality goals of the City that are relevant to the Arana Gulch Master Plan. These are summarized in Table 4.1-1 in Section 4.1, Land Use and Planning, of the Draft EIR.

## Impacts and Mitigation Measures

**Standards of Significance.** The proposed project would result in a significant impact if it would:

- Violate any water quality standards or waste discharge requirements;
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge;
- Substantially alter the existing drainage pattern of the site or area in a manner that would result in substantial erosion or siltation on- or off-site;
- Create or contribute runoff water that would exceed the capacity of storm water drainage systems or provide substantial additional sources of polluted runoff;
- Otherwise substantially degrade water quality;
- Place within a 100-year flood hazard area structures that would impede or redirect flood flows;
- Expose people or structures to a significant risk of loss, injury, or death involving flooding; or
- Expose people or structures to inundation by seiche, tsunami, or mudflow.

**Less-Than-Significant Impacts.** The proposed project would not result in the use of groundwater. The proposed plan would result in the construction new semi-permeable and impermeable trails and the closure of several semi-impermeable, unauthorized pathways. Currently, there are approximately 2.14 miles of compacted semi-permeable trails on the property, including 1.2 miles of designated trails and several unauthorized trails. Under the Master Plan, the total length of trails would be decreased to approximately 2 miles with 1.4 miles of trails remaining as compacted semi-permeable trails constructed on slopes of less than 5 percent, and 0.6-mile of concrete paved slopes to allow for multi-use access. Computing the weighted average of impervious coverage (as discussed in a technical letter prepared by Fall Creek Engineering, Inc. as presented in Appendix C), under the proposed plan the new trails would increase the total impermeable area of the project site by 0.35 percent. The effects on recharge due to this change in land coverage would be less than significant and no mitigation would be required.

The level of improvements proposed in the Arana Gulch Master Plan would not contribute additional runoff that would exceed the capacity of stormwater drainage systems or provide substantial additional sources of polluted runoff. The long-term implementation of the Master Plan would address current and historical erosion and sedimentation problems at the site and would reduce existing sources of pollutants discharged to Arana Gulch Creek and Hagemann Gulch. The effects on downstream stormwater drainage systems and the potential discharge of polluted runoff as a result of the proposed Master Plan would be less than significant and no mitigation would be required.

Although, the new multi-use trail would be constructed near the southern end of Arana Gulch Creek in the 100-year floodway, a clear span bridge or alternative crossing would be installed that would not impede or redirect flood flows. The extent of localized flooding resulting from the 100-year flood event would not expose people and/or downstream structures to significant risk of loss, injury, or death. The potential flood-related impacts on people or downstream structures resulting from the proposed improvements would be less than significant and no mitigation would be required.

The proposed Master Plan would not expose people or structures to inundation by seiche, tsunami, or mudflow. The potential impacts on people or structures due to these events would be less than significant and no mitigation would be required.

**Potentially Significant Impacts.** The project would have the following potentially significant impacts.

**Impact HYDOLOGY-1: The project has the potential to violate water quality standards or waste discharge requirements. (PS)**

Water quality and habitat values of the wetlands and streams could be impaired by soil erosion, sedimentation, or other degradation of surface water quality during construction and post-construction activities. Runoff from areas that have been disturbed during new construction, such as the construction of a new bridge over Hagemann Gulch, the construction of the multi-use trails, and restoration of gullies and other erosion control projects, could contain sediment and other construction-related pollutants, such as paints and steel and concrete debris. Gasoline, diesel, oil, and grease could also be released from construction equipment during construction.

The project site includes both hilly and moderately erosion-prone soils that would require stabilization during construction on sloped areas, such as on the portion of the multi-use trail that is on a cross-slope connecting to the Upper Harbor. Stabilization work could result in construction-period erosion impacts. Potential construction-phase and post-construction erosion and pollutant impacts can be successfully addressed through preparation and implementation of an erosion control plan consistent with recommended design criteria and through project management and housekeeping measures as described in a Storm Water Pollution Prevention Plan (SWPPP), as required by local and state permitting agencies.

As part of the Master Plan, a new west entrance to Arana Gulch would be developed and would include the construction of a new bridge across Hagemann Gulch. The stress-ribbon bridge would be approximately 330 feet long and would be designed to avoid structural supports within the steep-sided canyon in order to minimize impacts to the steep-sided canyon and heritage trees. Due to the proposed placement of the bridge, the bridge abutments would not have the potential to confine the channel and result in channel scour and bank erosion downstream. If additional structural measures are required in the active channel area, however, scour or erosion could occur during construction, resulting in potentially significant impacts.

*Mitigation Measure HYDROLOGY-1(a): Before initiating any grading at the site, the City shall prepare an erosion control plan incorporating construction-phase measures to limit and control erosion and siltation. The erosion control plan shall incorporate components such as phasing of grading, limitations on areas of disturbance, designation of restricted entry zones, diversion of runoff away from disturbed areas, protective measures for sensitive areas, and provisions for revegetation and mulching, as required. The plan shall also prescribe treatment measures to trap sediment once it has been mobilized.*

*Mitigation Measure HYDROLOGY -1(b): The contractor for the project must comply with the City of Santa Cruz Best Management Practices (BMPs) for Construction Work. If the total area to be disturbed by the project is one or more acres, the City shall prepare a Storm Water Pollution Prevention Plan (SWPPP) for the project. The SWPPP shall include water quality control measures to reduce the potential risks of surface water and groundwater contamination during construction and post-construction stages of development. The SWPPP shall incorporate the erosion control measures outlined in Mitigation Measure HYDROLOGY-1(a) and shall be consistent with the treatment requirements contained in the City of Santa Cruz Storm Water Management Program.*

*Mitigation Measure HYDROLOGY -1(c): The City's project engineer shall complete a hydrologic and hydraulic analysis and computations to determine the appropriate location of the clear span bridge abutments and other appropriate design details for Hagemann Gulch. A scour analysis shall be completed if any structures would be located in the channel to demonstrate that the abutment or pier protection and channel scour protection design are adequate. All of these analyses and design refinements shall comply with State of California engineering standards.*

*The combination of the above mitigation measures would reduce the potential impact to a less-than-significant level. (LTS)*

**Impact HYDROLOGY-2: The project has the potential to substantially alter the existing drainage pattern of the site or area in a manner that would result in substantial erosion or siltation on- or off-site. (PS)**

Runoff from the site currently flows overland through sheet flow or is intercepted by numerous earthen trails, which concentrate runoff and convey it to either Arana Gulch Creek or Hagemann Gulch. The proposed Master Plan only identifies minimal modifications to the existing drainage patterns at the site. Several steep trails would be closed and restored to address erosion and sedimentation problems, and several new, paved multi-use trails would be constructed. The trails would traverse the coastal prairie and run down slope.

The placement of multi-use paved trails across coastal prairie/grassland habitat could potentially alter runoff patterns and lateral movement of shallow saturated flow. Currently, compacted and semi-permeable trails alter runoff patterns on the site by intercepting sheet flow and conveying runoff to downslope areas in higher volumes and rates than would occur at the site naturally.

Proper design of the trail so that the surface is outsloped to maintain sheet runoff would reduce the potential for concentrated runoff to run down the trail.

Standard paving construction techniques would involve grading, scarifying and compacting the subgrade material below the proposed concrete trailing paving. This practice could potentially alter surface hydrology in the coastal prairie/grassland areas on the site. Alternative or non-conventional construction methods are available that can be used to provide a structural sub-base for the paved trail while maintaining permeability and water movement under the trail. For example, CU Structural Soil™, developed by Cornell University, is used as a load-bearing material to support concrete and asphalt surfaces while providing subsoil conditions compatible with plantings. Structural soil is a two-part system comprised of a rigid stone "lattice" to meet engineering requirements for a load-bearing soil, and a quantity of soil required by the plantings. The lattice of load-bearing stones provides stability as well as interconnected voids for root penetration and air and water movement.

> *Mitigation Measure HYDROLOGY-2(a): To maintain natural surface runoff conditions on the site, the paved multi-use trails shall be designed to minimize concentration of discharges. Possible approaches may include, but are not limited to, out-sloping of the trail to diffuse the runoff downslope or to more frequent discharges that would minimize concentration of discharge points.*
>
> *Mitigation Measure HYDROLOGY -2(b): To maintain natural shallow subsurface flow conditions in the coastal prairie grassland area, the sub-base of the paved trail shall use a permeable type system, such as the CU Structural Soil™ or equivalent system.*
>
> *The combination of the above mitigation measures would reduce the potential impact to a less-than-significant level. (LTS)*

**Cumulative Impacts.** Other projects in the vicinity (see Chapter 6, Table 6-1) would contribute to general increased stormwater runoff due to increased impervious surface areas, and could affect the respective watersheds of both Hagemann Gulch and Arana Gulch Creek. Water quality degradation associated with urban runoff could occur. Project-related mitigation measures would eliminate the project's contribution to such impacts. No additional measures would be needed.

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