

Attachment 4-2



**Santa Clara Valley
Urban Runoff
Pollution Prevention Program**

***DRAFT
Technical Memorandum***

Campbell • Cupertino • Los Altos • Los Altos Hills • Los Gatos • Milpitas • Monte Sereno • Mountain View • Palo Alto
San Jose • Santa Clara • Saratoga • Sunnyvale • Santa Clara County • Santa Clara Valley Water District

TO: Management Committee

FROM: Program Staff

DATE: March 1, 2005

**SUBJECT: Watershed Characterization and Sampling Design Rationale -
Stevens and Permanente Creek Watersheds**

Introduction and Background

Environmental monitoring and watershed assessments are key components in the Santa Clara Valley Urban Runoff Pollution Prevention Program (Program). Environmental monitoring provides information needed to: (1) assist the Regional Water Quality Control Board (RWQCB) to characterize receiving water quality in urban watersheds consistent with the priorities of the Santa Clara Basin Watershed Management Initiative (SCBWMI) and the Program; (2) develop an understanding of baseline conditions in water bodies; (3) recognize the need for site-specific water quality investigations to address questions that might arise while conducting screening-level monitoring efforts; (4) allow for determining if control measures are having an intended effect; and, (5) conduct watershed assessments aimed at determining the condition of, and potential impacts to water bodies and Beneficial Uses (Uses).

On March 1, 2002, the SCVURPPP submitted a Multi-Year Receiving Waters Monitoring Plan (Multi-Year Plan) that was prepared in compliance with monitoring requirements of the permit. The Multi-Year Plan identifies Program monitoring activities in Santa Clara Basin Watersheds over an eight-year period. On March 1, 2004, the Program submitted the Revised Multi-Year Plan. The revisions were intended to 1) more fully integrate the monitoring activities identified in the Multi-Year Plan with watershed assessments, and 2) allow for additional follow-up monitoring activities in order to better identify sources of pollutants or causes of impairment to Beneficial Uses. Additionally, the Revised Multi-Year Plan attempts to provide the SCVURPPP a framework for conducting watershed characterization, screening-level monitoring, watershed assessment, and investigative monitoring and management action implementation.

The Program submits an Annual Monitoring Program Plan (Annual Plan) on March 1 of each year that identifies specific monitoring activities planned for the following year. The Annual Plans include information on the type of monitoring parameters and the frequency of sampling events for each watershed. To provide additional details on the

rationale for the selecting sampling site locations and parameters, the Program is supplementing the FY 05-06 Annual Plan with this technical memorandum. This memo includes a summary of existing data and information resources; descriptions of the relevant watershed attributes, and lists key issues relevant to the development of the proposed sampling design for Stevens and Permanente Creek watersheds in FY 05-06.

Information Resources

Several data and information resources from Stevens Creek and Permanente Creeks watersheds were compiled and assessed to identify baseline data for a range of environmental indicators. Existing watershed monitoring and assessment information originated from the following projects:

Monitoring Data

Surface Waters Ambient Monitoring and Assessment Program (SWAMP) (unpublished)

The San Francisco Regional Water Quality Control Board (Regional Board) collected screening level/baseline data from bioassessment studies, physical habitat assessment studies and ambient surface water quality monitoring in the Stevens and Permanente Creek watersheds as part of the SWAMP activities in 2002 and 2003. Rapid bioassessments using benthic macroinvertebrate (BMI) assemblages and visual assessments of physical habitat were conducted at eight sites in Stevens Creek watershed and seven sites in Permanente Creek watershed in April 2002.

Water grab samples were collected from three sites in Stevens Creek and two sites in Permanente Creek in April and June 2002 and January 2003. Water samples were analyzed for metals, organics (e.g., pesticides, PCBs), nutrients, anions, and suspended sediment concentrations. Water was also collected for acute and chronic toxicity testing for three aquatic species. Sediment grab samples were collected from the lowest elevation site from each watershed in June 2002 and were analyzed for metals. Field measurements of physical water quality were taken at each sampling event. In addition, continuous water quality measurements were collected over 1-2 week span during all three sampling event at three sites in Stevens Creek and one site in Permanente Creek. Rapid trash assessments were also conducted at selected sampling sites.

The RWQCB is planning to release an interpretative report documenting the monitoring results for SWAMP activities in Stevens and Permanente Creeks in early 2005.

Mercury, PCB and Organochlorine Pesticide Monitoring (KLI 2002)

The SCVURPPP analyzed PCB, mercury, and organochlorine pesticide concentrations from sediment samples collected in 2001 at two locations within the Stevens Creek watershed as part of the Joint Stormwater Agency Program (JSAP), a San Francisco Bay region wide pollutant study.

Stream Maintenance Program (SCVWD 2002)

The SCVWD conducted sediment removal activities (dredging) within Stevens Creek reaches downstream of La Avenida in 2001 and 2002 and in the Permanente Creek Diversion Channel in 2002 as part of its Stream Maintenance Program. The SCVWD characterizes the sediment material to be removed to satisfy waste discharge requirements established by the RWQCB and local sanitary landfills. Sediment characterization includes analysis for concentrations of metals (includes mercury),

organics (includes pesticides, PAHs and PCBs) and sediment grain size. Results of the sediment analysis are documented in the SCVWD's Annual Sediment Characterization Report.

Benthic Macroinvertebrate Study (USGS 2000)

The U.S. Geological Survey (USGS) sampled benthic macroinvertebrate (BMI) community assemblages at seven stream sites along Stevens Creek in the spring and fall of 1997. Preliminary results, including selected metric scores and a complete taxonomic list, were documented in the 2000 report.

Bay Area Stream Fisheries Project (Leidy 2002)

Rob Leidy of U.S. EPA conducted stream surveys for 79 streams in the San Francisco Bay Area between 1992 and 2002. Fish community assemblage information was collected at five stream locations in Stevens Creek and two stream locations in Permanente Creek between 1994 and 1996. Stream survey results were documented in a report published on the San Francisco Estuary Institute (SFEI) website and released as an Access database.

Watershed Assessment

Watershed Analysis using Limiting Factors Analysis (LFA) (Stillwater 2004)

The Stevens Creek LFA was conducted by Stillwater Sciences to fulfill the Program's NPDES permit requirements to conduct watershed analysis of creeks that are potentially impaired by sediment from anthropogenic activities. The objectives of the Stevens Creek LFA were to identify and fill information gaps related to physical and biological factors controlling population dynamics of steelhead (*Oncorhynchus mykiss*) and to identify the impacts of sediment on steelhead relative to other potential limiting factors. Based on the available existing information and reconnaissance surveys, focused studies were developed to test hypotheses regarding potential limiting factors for steelhead in Stevens Creek. The focused studies addressed the following factors: fish passage barriers, gravel permeability, pool filling, bed mobility, overwintering habitat, and water temperature.

Field data collected for the Stevens Creek LFA included: 1) permeability measurements at potential steelhead spawning sites; 2) volume of fine sediment within pools; and 3) estimated embeddedness of large substrate at potential juvenile overwintering sites. Qualitative geomorphic assessments of bed mobility were also conducted to identify potential for redd scour. The study assessed existing aquatic habitat data, fish passage impediments, and water temperature data collected in the FAHCE study (see below).

A summary of the findings of the Stevens Creek LFA included: 1) barriers, both partial and complete, limited access to a substantial amount of stream habitat; 2) seasonal low flows downstream of Fremont Avenue may severely limit steelhead outmigration success in some years; 3) gravel permeability is low but not likely limiting smolt production; 4) pool filling is low, indicating high sediment transport capacity relative to sediment supply; 5) bed mobility (and therefore potential redd scour) is relatively low in upper reaches but increases downstream; 6) overwintering habitat is likely the key limiting factor for steelhead prior to smolt outmigration; and 7) water temperature is elevated but not likely to lethal levels and is not likely limiting fish growth.

The above findings indicate that factors associated with fish passage and lack of overwintering habitat is likely to have the greatest influence on the steelhead population. Although considerable uncertainty remains regarding sediment dynamics in Stevens Creek, results of the LFA study indicated that factors related to current anthropogenic sediment inputs were not believed to substantially limit steelhead production. The study also identified important data gaps that are needed to reduce uncertainty associated with development and testing of the key hypotheses.

The Fisheries and Aquatic Habitat Collaborative Effort (FAHCE) (SCVWD 2003)

FAHCE is a multi-agency endeavor convened by the SCVWD and the Department of Fish and Game to develop an interim fisheries and aquatic habitat management plan. The goals for FAHCE include: 1) identify the contribution of SCVWD facilities and operations to existing fishery habitat conditions within the context of the variety of factors impacting salmon and steelhead populations; and 2) identify reasonable flow and non-flow measures that will improve habitat conditions for such fish populations within the context of competing water and land use demands. The FAHCE study area included Stevens Creek below the reservoir. The FAHCE project quantified the following factors: 1) diversity, abundance, and condition of existing salmon and steelhead resources; 2) habitat quantity and quality that may limit these target fish populations; 3) types and locations of non-flow measures that could change existing conditions; and 4) alternative flow regimes that could change the conditions that limit the target fish populations.

The SCVWD conducted an extensive aquatic habitat survey below the reservoir using a modified California Department of Fish and Game Level 4 Salmonid Habitat Classification. The survey identified the location and extent of critical salmonid habitat, including spawning gravels and juvenile habitat, and quantified potential impacts to these areas (e.g., substrate embeddedness). The SCVWD also conducted an inventory of fish passage impediments for the entire reach below the dam. Other data collected included continuous water temperature measurements at selected stream locations and fish population surveys.

The FAHCE Summary Report summarizes specific issues and actions for Stevens Creek watershed (SCVWD 2003). Phase I work objectives included creating a suitable spawning and rearing habitat for four miles below Stevens Creek Dam by, 1) releasing reservoir flows for fish; 2) improve passage at selected fish barriers; 3) restoring spawning and rearing areas; and, 4) stabilizing banks. Also recommended is the installation of a "gravity-fed, multi-port outlet" for releases from the cold areas in the reservoir and aeration at the outlet to restore oxygen to the water from the hypolimnion. Phase 2 and 3 include extending the steelhead habitat further upstream, downstream, and eventually into the tributaries as necessary. In addition, the study created a system of reservoir rules for which the coldwater management zone is designated and the reservoir releases are regulated.

Ongoing Projects

Relevant data sources resulting from the following projects were not available for this assessment:

Stevens and Permanente Creek Watershed Council Water (SPCWC) Quality Monitoring Program

The SPCWC is sponsoring a pilot volunteer water quality monitoring program in the Stevens and Permanente Creek watersheds. The monitoring activities to date have included collecting water quality measurements (temperature, DO, pH, conductivity and turbidity) using probes at five locations in Stevens Creek. General water quality was previously measured at three of these locations by the RWQCB in 2002 and 2003. Future monitoring activities in Permanente Creek are planned if additional funding becomes available. The SPCWC is also applying for a grant to fund BMI bioassessment study at all the stream locations previously sampled by the RWQCB's 2002-03 study.

SCVWD Stream Stewardship Program

The SCVWD is currently developing watershed stewardship plans for watersheds in the Lower Peninsula, West Valley, and Guadalupe Watershed Areas. The purpose of the plans are to provide the SCVWD with the capability to effectively and efficiently identify and implement projects and activities that will allow the District to be proactive in meeting the goals described in the Ends Policies for these watersheds areas. These stewardship plans will include two different levels of information: a planning level assessment (i.e., coarse scale) for all watershed units in each Watershed Area, using the methods described in this document, and an implementation level assessment (i.e., fine scale) for one watershed unit within each Watershed Area, using information from supplemental field data collection activities. The three pilot watersheds selected for fine scale assessment include Alamitos, Calabazas and Stevens Creek watersheds. The information on the type, methods and extent of field data collection for the three watershed areas was not available for this assessment. Geomorphic assessments at different scales of resolution were conducted at various locations in the Stevens Creek watershed.

Beneficial Use Designation

The 1995 Basin Plan (SFRWQCB 1995) designates the following beneficial uses for Stevens and Permanente Creek Watersheds:

	Beneficial Uses	Stevens Creek	Stevens Creek Reservoir	Stevens/ Permanente Creek
COLD	Cold Freshwater Habitat	E	E	E
FRSH	Freshwater Replenishment	E		
GWR	Groundwater Recharge		E	
MIGR	Fish Migration	E	E	
MUN	Municipal and Domestic Supply		E	
REC-1	Water Contact Recreation	E		E
REC-2	Non-contact Water Recreation	E	E	E
SPWN	Fish Spawning	P	E	E
WARM	Warm Freshwater Habitat	E	E	
WILD	Wildlife Habitat	E	E	E

E=Existing P=Potential

Watershed Characterization

Stevens Creek Watershed

Hydrology

Stevens Creek drains a watershed of approximately 29 mi² and discharges into South San Francisco Bay (Figure 1). Stevens Creek originates at an elevation of 2,500 feet in the Santa Cruz Mountains, flowing southeast for just over five miles along the San Andreas Fault, then bending northeast and flowing an additional three miles before reaching Stevens Creek Reservoir. From the reservoir, Stevens Creek flows northward for approximately 12.5 miles through the Santa Clara Valley Basin before emptying into the South Bay.

The Stevens Creek Reservoir was constructed in 1935 for the purpose of storing winter runoff for the recharge of the Santa Clara Groundwater Basin during the summer months (SCBWMI, 2001). Stevens Creek Reservoir is managed by the SCVWD and has a current capacity of 3,465 acre-feet of water (SCBWMI 2001). Typical summer flow into the reservoir is 0.4 cfs compared to releases of 4–5 cfs below the dam. Under current management, approximately 5.7 miles downstream of the reservoir (to Fremont Avenue) are typically wetted to allow for groundwater recharge during the summer. The typical dryback zone is about 3.25 miles (Abel 2001).

One tributary joins Stevens Creek below Stevens Creek Reservoir. Heney Creek drains an area of 0.64 mi² and enters Stevens Creek 3.7 miles below the reservoir (SCBWMI 2001). Additionally, a diversion from Permanente Creek (constructed in 1959) diverts winter storm flows (up to 1,500 cfs) into Stevens Creek approximately 6.3 miles below the reservoir (SCBWMI 2001). In the past, imported water from the Trans-Valley/West Pipeline provided water to the aquifer and instream gravel dams were installed seasonally and extended the percolation zone downstream to El Camino Road (Abel 2001).

Geologic and Geomorphic Setting

The urbanized and relatively flat Santa Clara Valley makes up roughly 40 percent of the watershed area above Highway 101, and is underlain by mostly unnamed Quaternary alluvial fan and valley fill deposits (younger and older alluvium deposits) (Stillwater 2004). Towards the hills, strata of the Pliocene and/or Quaternary Santa Clara, Livermore, or Packwood Gravels exist (Santa Clara Formation). The Mesozoic Franciscan Complex and Lower Tertiary Vaqueros Sandstone, part of the Cretaceous sedimentary formation (Great Valley Sequence), make up most of the uplands near the headwaters. Other small outcrops of Tertiary volcanic rocks, as well as primarily mudstone and shale rocks occur in the watershed (Stillwater 2004).

Geologic mapping in the Stevens Creek watershed has revealed a large landslide, the Monte Bello Ridge Landslide Complex, just west of Stevens Creek Reservoir, which provides a continuous source of sediment to the reservoir (Stillwater 2004). The landslide has overridden a smaller branch of the San Andreas Fault named the Sargent-Berrocal fault, which consists of several large bedrock masses as much as 100 meters thick with a combined area of more than 1.5 km². Numerous local shallow landslides indicate that the slide complex is still active (Sorg and McLaughlin 1980). Although the Monte Bello Ridge Landslide Complex is the only landslide within the watershed that has been analyzed and documented, this observation of deep-seated with active shallow

landsliding indicates that surface sediments and the underlying lithology are composed of erodible sediments that are likely to act as a continuous source of sediment to the channel of Stevens Creek (Stillwater 2004).

Stillwater (2004) identified four distinct geomorphically significant reaches (Upper, Transition, Middle, and Lower) from the reservoir to the Bay based on field reconnaissance observations of floodplain geometry and channel function. The highest level of natural floodplain and channel function occur in the Upper Reach, located between the dam and continuing two miles downstream, where incision and entrenchment was observed to be the lowest of all reaches. Here, the creek flows through a relatively wide, well vegetated inset valley that is relatively unconfined by urban development and is free to meander.

In the Transition Reach, located between 2.0 and 4.3 mile section below the dam, Stillwater (2004) observed “the channel and floodplain function progressively degrade as the channel narrows and residential houses encroach. Here, the channel is straight, point and lateral bars shrink or disappear altogether, and an increasing number of concrete walls and weirs act as grade control and bank stabilizing structures. Transport capacity increases as the number of roughness elements (i.e. bedforms, bar deposits, sinuosity) decrease and anthropogenic influences increase. As a result, a greater amount of scour and incision was observed.”

Floodplain entrenchment and observed incision values were greatest in the Middle Reach, located from reach mile 4.3 to reach mile 10.0 below the dam, which is primarily straight and narrow. Stillwater (2004) reports “Of the few existing bar deposits, most are perched 4–6 feet above the active channel. A number of concrete and steel structures exist in the channel and along the banks, and frequent 15–25 foot bluffs continually provide fine sediment to the channel via fluvial bank erosion. Floodplain function is somewhat restored in the Lower Reach, located from reach mile 10.0 to the Bay, as the valley widens or disappears and the creek has more room for lateral movement.”

Land Use and Potential Water Quality Impacts

Undeveloped forest and rangeland covers over 60% of the Stevens Creek watershed, most of which occurs in the upper watershed area above Stevens Creek Reservoir. Over 35% of the watershed is legally protected by agencies, easements, and land trusts (SCBWMI 2001). There is currently a minimal amount of development occurring in the drainage area above Stevens Creek reservoir, which includes low density houses, vineyards, horse stables and a rock quarry (Pamela Chu, Santa Clara County Planning Department, personal communication, 2004). The Stevens Creek Rock Quarry is located in the Swiss Creek subwatershed, which drains into the reservoir just west of the dam.

The watershed area downstream of the reservoir is primarily developed and includes the cities of Cupertino, Los Altos, Sunnyvale, and Mountain View. High-density residential neighborhoods cover most of the area below the reservoir, comprising 24% of the total watershed area. The residential areas are interspersed with commercial and industrial uses, and public institutions, collectively covering 7% of the watershed. The riparian corridor within a three mile reach below the dam is minimally development with much of the area occurring in County and City parks and two golf courses. The riparian corridor downstream of Blackberry Farm Golf Course, however, is significantly impacted from urban development and channel modifications.

Aquatic Biological Communities

The Stevens Creek watershed supports an assemblage of four native species, including federally listed steelhead (*Oncorhynchus mykiss*) and its resident form rainbow trout, as well as Sacramento sucker (*Catostomus occidentalis*), threespine stickleback (*Gasterosteus aculeatus*), and California roach (*Lavinia symmetrucus*). Steelhead is currently restricted to reaches below Stevens Creek Reservoir. Native Pacific Lamprey (*Lampetra tridentate*), hitch (*Lavinia exilicauda*), and Sacramento squawfish (*Ptychocheilus grandis*) have been collected in Stevens Creek downstream of the reservoir but records of their occurrence are rare (Stillwater 2004).

Historical steelhead run sizes are not known for Stevens Creek, but it is generally thought that construction of Stevens Creek Reservoir in the 1935 dramatically reduced the potential steelhead population by blocking access to much of the perennially flowing reaches of the stream (Stillwater 2004). A review of recent fish survey data indicates that juvenile *O. mykiss* are common to abundant from Stevens Creek Reservoir downstream to Fremont Avenue and rare to absent below Fremont Avenue (Stillwater 2004).

Introduced fish, including goldfish (*Carassius auratus*), red shiner (*Cyprinella lutrensis*) carp (*Cyprinus carpio*), mosquitofish (*Gambusia affinis*), channel catfish (*Ictalurus punctatus*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*), are occasionally found downstream of Stevens Creek Reservoir, but survey data indicate that the abundance of nonnative fish is low and their distribution appears to be restricted (Stillwater 2004).

Permanente Creek Watershed

Hydrology

Permanente Creek drains a watershed of approximately 17.5 mi² on the northeast-facing slopes of the Santa Cruz Mountains (Figure 1). Permanente Creek originates at an elevation of 2,800 feet near Black Mountain along the Montebello Ridge (SCVWD 2004). The mainstem flows east for about five miles, then bends to the north at the base of the foothills and continues another eight miles through the valley floor before emptying into the South Bay. The major tributaries to Permanente Creek are West Branch Permanente Creek and Hale Creek. The West Branch has a drainage area of about three square miles and joins the mainstem at the base of the foothills at an elevation of about 300 feet. Hale Creek has a drainage area of approximately four square miles and joins the mainstem in the valley an elevation of about 115 feet.

Stream flows are typically perennial in the upper watershed areas and ephemeral in the valley floor, with the exception of Hale Creek, which typically has minimal flow during the summer season. The hydrology of the watershed has been significantly altered to provide greater flood protection. The Permanente Creek Diversion, located about 1.5 mile upstream of Hale Creek confluence, was constructed in 1959 and currently diverts stream flows up to 1,500 cfs into Stevens Creek during the winter season (SCBWMI 2001). Permanente Creek is also diverted at the mouth from Charleston Slough eastward to Mountain View Slough (SCVWD 2004). The SCVWD does not import water to the creek during the summer season (as it does in Stevens Creek) to percolate stream flow for groundwater recharge.

Geologic and Geomorphic Setting

The underlying geology in Permanente Creek watershed is very similar to what is found in the Stevens Creek watershed. Approximately 40 percent of the watershed area occurs in the flat Santa Clara Valley that is underlain by young, unconsolidated alluvial fill washed down from the Santa Cruz Mountains. The foothill region consists of a narrow strip of northwesterly bedded tertiary shale of the Monterey Formation and gently and broadly folded claystone, sandstone, and conglomerate of the Santa Clara Formation (SCVWD 2004). The upper watershed areas are underlain by the Franciscan Group of formations that include highly deformed, contorted, faulted, sheared and weathered sections of shale, sandstone, chert, limestone, and greenstone (SCVWD 2004).

The older formations in the mountain areas are cut by numerous inactive faults. The San Andreas Fault, located to the west in the Stevens Creek watershed along the Monte Bello Ridge, is the closest active fault (SCVWD 2004). The possibly active Monte Vista Fault separates the Franciscan Group and the Monterey Formation in the foothill region of Permanente Creek watershed. This fault may be an extension of the possibly active Shannon Fault (SCVWD 2004).

Existing information was not available to classify stream channel morphology and geomorphic processes for the entire watershed. Existing channel conditions were described for ten reaches of Permanente and Hale Creek below Foothill Expressway (SCVWD 2004). The stream channel downstream of Highway 101 (Reaches 1-2) was characterized as a tidally influenced low flow channel that meandered through a wider flood plain channel. The channel bottom consisted of mud and silt substrate with banks covered in marsh vegetation (lower end) and grasses and small bushes (upper end). A short section of concrete trapezoidal channel occurred just downstream of Highway 101.

The section of creek between Highway 101 and the Hale Creek confluence (Reaches 3 – 5) was described as a combination of rectangular, trapezoidal and U-Frame constructed concrete channel. The entire section contained five drop structures and two sections of underground culvert. The channel between Hale Creek confluence and the Permanente Creek Diversion was described as a natural trapezoidal-shaped channel that contained modified sections of sacked concrete, shotcrete, or stacked concrete walls. The channel bottom consisted of mostly silt, sand, gravel with minimal cobble substrate. The bank vegetation varied from bare ground to mature trees with limited undergrowth in a very narrow riparian corridor with significant urban encroachment. The entire creek below the diversion channel was a low gradient channel (< 1% slope).

The section of creek between the diversion and Foothill Expressway (Reach 8) was primarily a natural channel, with the exception of a short section of corrugated metal pipe and another short section of trapezoidal concrete channel. This reach also contained two drop structures associated with the concrete sections. The natural section between Portland Avenue and Foothill Expressway consisted of both straightened and meandering channel alignments. The bank vegetation consisted of mature trees with limited to dense understory. The substrate consisted of primarily sand and gravel with patches of concrete fragments. The gradient slightly increased above the diversion (1 % slope).

The Permanente Diversion channel is about a 1.5 mile section of trapezoidal concrete. The lower section of Hale Creek (below Rosita Avenue) consists of U-Frame or

trapezoidal concrete channel. The remaining section up to Foothill Expressway is primarily a natural trapezoidal-shaped channel with well vegetated banks and sand and gravel substrate.

Land Use and Potential Water Quality Impacts

Undeveloped forest and rangeland covers just over 35% of the Permanente Creek watershed, most of which occurs in the drainage area above the West Branch Permanente Creek confluence. About 19% of the watershed is legally protected by agencies, easements, and land trusts (SCBWMI 2001), most of which occurs in the Rancho San Antonio Open Space Preserve. The Hanson Cement Plant and Limestone Quarry is located in the upper reaches of Permanente Creek, which accounts for almost 5% of the total watershed area. A study conducted by the USGS determined that the quarry and cement plant was a significant sediment source to the creek (USGS 1989).

The watershed area downstream of the West Branch confluence is primarily developed and includes the cities of Los Altos and Mountain View. High-density residential neighborhoods cover most of this area, comprising 43% of the total watershed area. The residential areas are interspersed with commercial and industrial uses, and public institutions, collectively covering 8% of the watershed. The riparian corridor downstream of Interstate 280 is significantly impacted from urban development and channel modifications.

Aquatic Biological Communities

Existing studies show Permanente Creek watershed supports an assemblage of four native species, including rainbow trout (*Oncorhynchus mykiss*), Sacramento sucker (*Catostomus occidentalis*), threespine stickleback (*Gasterosteus aculeatus*), and California roach (*Lavinia symmetrus*) (Leidy 2002, SCBWMI 2001). Rainbow trout are reported to be distributed in the mainstem above Interstate 280 and in the West Branch Permanente Creek. California red-legged frogs (*Rana aurora draytonii*) have also been documented in the West Branch drainage area.

Sampling Design Rationale

Several key issues relevant to the development of a sampling design for the Program's FY 05-06 Monitoring Plan were identified based on the information described above. These include:

- The monitoring data collected by the RWQCB in 2002 and 2003 as part of the SWAMP provided extensive spatial coverage of sampling locations across an urban gradient for both Stevens and Permanente Creek watersheds. The type of data collected is very similar to data collected by the Program, which will provide a useful baseline data set to potentially study status and trends over a 3-4 year time period.
- Benthic macroinvertebrate samples collected in Stevens Creek by the USGS in 1997 provide an additional data set to study long-term trends in BMI community assemblages at many of the same locations that were sampled by the RWQCB.
- Existing data show the upper 4.5 miles of Stevens Creek below the dam contain critical steelhead habitat. Sampling stations should be established to investigate

potential water quality impacts in this reach from upstream and adjacent land uses (e.g., two golf courses below the dam), as well as water operations for the Stevens Creek Dam. Existing information indicates the creek below the dam contains elevated turbidity concentrations, which appear to diminish in a downstream direction.

- Existing and planned geomorphic assessment information in Stevens Creek will be useful for interpreting results from benthic macroinvertebrate bioassessments and physical habitat assessments (i.e., assess if biological response is mostly related to habitat condition or water quality).
- Upper Permanente Creek and West Branch are similar in size, geology and land cover, but have significantly different land use impacts. The upper mainstem contains a large cement plant and quarry operation, and the West Branch is protected open space. Paired watershed monitoring design would provide useful information to study impacts of these different land uses.
- There was very limited fish information in Permanente Creek available to determine condition of native fish community. The upper watershed is reported to support rainbow trout and other native fishes. Excessive sediment production from quarry activities can have significant impacts to rainbow trout population.
- The upper watershed areas for Stevens Creek (above dam) and Permanente Creek (West Branch) are minimally disturbed and may provide suitable reference conditions for BMIs.
- Public access to creeks is primarily in Rancho San Antonio County Park and Open Space Preserve in upper Permanente Creek and in the County and City Parks and Open Space Preserves in Stevens Creek, most of which occurs above the dam and within a three mile reach below the dam.

References

Abel, J. 2001. "Barrierness": Qualitatively assessing fish passage impediments. Unpublished memo to FAHCE Consensus Committee. 17 April.

KLI, 2002. *Final Report, Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs, and Organochlorine Pesticides*. Kinnetic Laboratories, Inc. April 2002.
Leidy, R. A. 2002. Unpublished stream survey data 1992-2002.

SCBWMI (Santa Clara Basin Watershed Management Initiative). 2001. Volume One, Watershed Characteristics Report. 147 p. <http://www.scbwmi.org/PDFs/watershed-characteristic-d8.pdf> [Accessed May 2004].

SCVWD (Santa Clara Valley Water District). 2002. Sediment Removal Projects – Analytical Data for Sediment. Excel spreadsheet.

Stillwater Sciences. 2004. Stevens Creek Limiting Factors Technical Report. Prepared for the Santa Clara Valley Urban Runoff Pollution Prevention Program. September 10, 2004.

USGS (United States Geological Survey). 1989. Effects of limestone quarrying and cement-plant operations on runoff and sediment yields in the upper Permanente Creek basin, Santa Clara County, California. U.S. Geological Survey Water-Resources Investigations Report 89-4130. Prepared in cooperation with the Santa Clara Valley Water District. Sacramento, California

USGS (United States Geological Survey). 2000. The distribution and abundance of lotic macroinvertebrates during spring 1997 in seven streams of the western Santa Clara Valley area, California. U.S. Geological Survey Open-File Report 00 – 346. Prepared in cooperation with the Santa Clara Valley Urban Runoff Pollution Prevention Program.