



Santa Clara Valley Urban Runoff Pollution Prevention Program

SEDIMENT IMPACT AND MANAGEMENT PRACTICE ASSESSMENTS

Steelhead and rainbow trout were historically present in several creeks within the San Francisco Bay area. In particular, Santa Clara County had creeks well suited for steelhead populations. However, trout populations have declined over the last 100 years due to a variety of fish habitat impacts. Two of the key impacts believed to adversely affect steelhead and rainbow trout populations are excess fine sediment and a lack of larger substrate (e.g., cobble-size rocks) in creeks.



Sediment refers to the material that forms the beds of lakes, rivers and creeks. It is central to the dynamic stream system where water naturally erodes, transports and deposits sediment. Negative impacts to fish habitat result when excess fine sediment is introduced and/or the transport of larger substrate is reduced to a particular habitat unit. Excess amounts of fine, suspended sediment (silt and clay) can adversely affect water quality by diffusing light, retaining heat and increasing water temperature. In addition, negative impacts to fish habitat result when excessive amounts of sediment clog the spaces between gravel, cobble and boulders. In such cases, the following conditions may arise:

- Developing eggs may suffocate and suitable spawning gravels may be lost when fine sediment clogs the small spaces between gravel particles, preventing oxygenated water from reaching developing eggs and trapping waste products in the gravel.
- Habitat for organisms (e.g., crayfish and insects) may be destroyed. This will result in the loss of organisms that fish consume.
- Sheltered areas between boulders and gravel are filled with excess sediment which may result in the reduction or loss of protection from predation for juvenile fish.



Potential Anthropogenic Sources of Sediment in Urban Creeks

A variety of human-related (anthropogenic) activities may provide or cause excess sediment to be deposited in streams. Urban developments that increase impervious surface area will typically increase the frequency and velocity of creek flows (i.e., hydromodification) that can result in the deepening of channel beds and bank erosion. Stream erosion can also result from human activities that occur very near or directly in the stream. These activities include development in the riparian zone and straightening and hardening of channels to control flooding. Although large dams and reservoirs provide flood protection and water supply storage, they can also significantly affect sediment supply and transport by trapping larger substrate and some fine sediment within the reservoir, and releasing sediment poor “hungry water” that has a greater potential to erode the bed and banks of a creek and occasionally deepening the channel bed immediately downstream of the dam’s outlet. Other potential anthropogenic sources of sediment include landslide and surface erosion caused or exacerbated by soil disturbances associated with the construction of roads and trails.

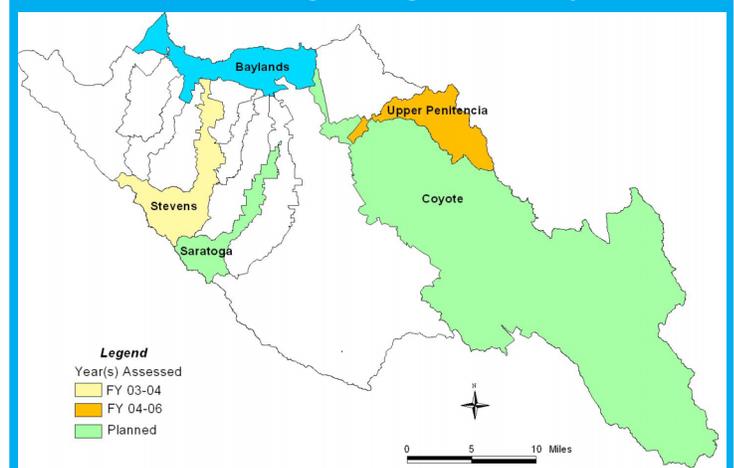
SCVURPPP Watershed Analysis Work Plan

In 2002, the Santa Clara Valley Urban Runoff Pollution Prevention Program (SCVURPPP or Program) evaluated existing data sources and used a weight-of-evidence approach to identify and prioritize watershed areas in the Santa Clara Basin that may be impacted by excessive sediment. As a result, four watershed areas were identified as high priority for further assessments (Figure 1):

- Stevens Creek (below Stevens Dam);
- Coyote Creek (below Anderson Dam);
- Upper Penitencia Creek (below Cherry Flat Dam); and
- Saratoga Creek.

Following the identification of the high priority watersheds, the Program developed a Work Plan for conducting limiting factors analyses (LFAs); and conducting assessments of sediment management practices in creeks potentially impaired by sediment from anthropogenic activities.

Figure 1. Santa Clara Basin Watersheds Assessed by SCVURPPP Using Limiting Factors Analysis



January 2006

SEDIMENT IMPACT AND MANAGEMENT PRACTICE ASSESSMENTS

Limiting Factors Analysis (LFA) Approach

To assess the factors potentially causing impacts to aquatic species in Stevens Creek and Upper Penitencia Creek, the Program adopted the Limiting Factors Analysis (LFA) approach to implement its Work Plan. LFA objectives are to:

- Collect existing data to characterize the watershed and identify issues of concern;
- Develop hypotheses to evaluate potential impacts of sediment to aquatic species;
- Conduct focused studies to test hypotheses; and
- Determine to what degree anthropogenic sediment impacts are key limiting factors for aquatic species of concern.

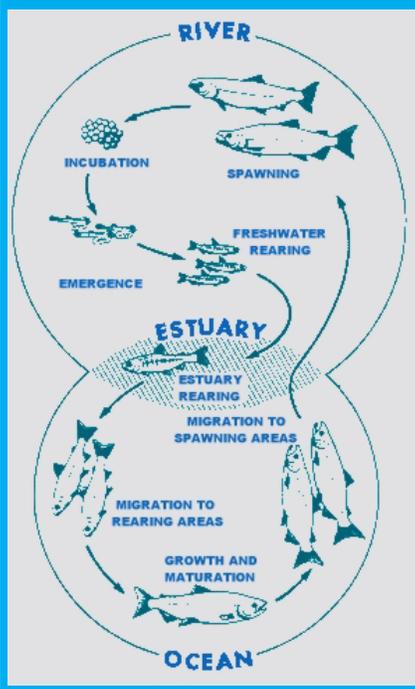
Although the LFA approach focused on sediment and its potential impacts on habitat suitability for steelhead trout (e.g., spawning gravel permeability, pool filling), additional factors (e.g., fish passage barriers and water temperature) were also investigated to provide a broader context for evaluating the effects of management actions within these watersheds. The steelhead trout lifecycle is illustrated in Figure 2.

The Program completed the LFA and Sediment Management Practice Assessment for the Stevens Creek watershed on September 10, 2004. In addition, the Program initiated an LFA in the Upper Penitencia Creek watershed in November 2004. A final report is anticipated in February 2006.

Limiting Factors Analysis

A limiting factors analysis (LFA) determines the factors that may be limiting the production of aquatic species in a water body. By identifying these factors, the Program can focus future management activities, help prioritize actions and refine our current understanding of an ecosystem.

Figure 2. Steelhead Trout Life Cycle



Stevens Creek LFA Results

Results from the focused studies indicated that factors associated with fish passage and lack of overwintering habitat for juvenile fish are likely to have the greatest influence on the existing and future steelhead trout populations. In addition, the LFA suggested that anthropogenic sediment sources are not the major impact to steelhead reproduction. Rather, it is the lack of overwintering habitat which is primarily due to a combination of the underlying lithology (i.e., clay bedrock layer) of the Stevens Creek channel and the lack of recruitment of large substrate (i.e. large rocks from watershed areas above the dam).

Stevens Creek Watershed Sediment Management Practices Assessment

The objectives of the sediment management practices assessment were to inventory and document management practices relevant to erosion processes and sediment transport and deposition within the Stevens Creek watershed, and to evaluate the effectiveness of these practices. Assessment results were based on the best available information. They include:

- Activities may affect stream erosion and may be relatively large sources of fine sediment to Stevens Creek reaches below the dam. They include: 1) dam influences on downstream bank stability near the outlet, 2) changes in flow patterns due to hydromodification and reservoir operations, 3) channel modifications, and 4) urban encroachment.
- Quarry operations may be contributing to the release of fine sediment to the creek.
- The dam likely blocks coarse sediment supply from the upper watershed drainage area and potentially may be affecting channel stability in the lower watershed.
- Existing grade control structures (e.g., road crossings, fish ladders, weirs) are likely reducing stream erosion by creating depositional areas throughout the creek through the reduction of flow. However, these structures may also be barriers to fish migration.

In response to the results of the Stevens Creek LFA and other recent studies, the Santa Clara Valley Water District (District) and the City of Cupertino have recently launched a project to reconstruct a large portion of Stevens Creek directly below the dam. The project is designed to improve overwintering habitat for steelhead and creek stability and function. This project includes removal of several fish passage obstacles and the reconstruction of a meandering fish friendly pools and riffles to the creek. In addition, the District will soon begin evaluating the appropriate flow rate and duration of reservoir releases; and investigating gravel augmentation possibilities to restore steelhead over-wintering habitat below the dam as part of the Fisheries and Aquatic Habitat Collaborative Effort (FAHCE).

References:

- Center for Ecosystem Management and Restoration 2005. *Historical Distribution and Current Status of Steelhead (Oncorhynchus mykiss) in Streams of the San Francisco Estuary, California.*
- California Association of Resource Conservation District 2001. *Sediment Fact Sheet.* in: *Guidelines for Citizen Monitors: Products of the 2000-2001 Technical Advisory Council on Citizen Monitoring.* Prepared in collaboration with the Wild On Watershed Program and the Clean Water Team for the Citizen Monitoring Program of the State Water Resources Control Board, Sacramento, CA.
- Department of Oceans and Fisheries Canada 2005. *Fish Habitat & the Effects of Silt and Sediment.* Fact Sheet. [Online] http://www.dfo-mpo.gc.ca/regions/central/pub/fact-fait/t1_e.htm. Accessed 12/6/05.
- SCVURPPP 2002. *FY 2002-2003 Draft Work Plan Volume II.* Section 3. *Identification of creeks potentially impaired by sediment from anthropogenic activities.*
- SCVURPPP 2002. *Work Plan for Conducting a Watershed Analysis and Management Practice Assessment in Other Creeks Potentially Impaired by Sediment from Anthropogenic Activities.*
- SCVURPPP 2004. *Sediment Management Practices Assessment Report for Stevens Creek Watershed.* Prepared by Eisenberg, Olivier and Associates. September 10, 2004.
- Stillwater Sciences 2004. *Final Stevens Creek Limiting Factors Analysis, Technical Report.* Prepared for the Santa Clara Valley Urban Runoff Pollution Prevention Program. September 19.



SCVURPPP is an association of the thirteen cities and towns (Campbell, Cupertino, Los Altos, Los Altos Hills, Los Gatos, Milpitas, Monte Sereno, Mountain View, Palo Alto, San Jose, Santa Clara, Saratoga, Sunnyvale) in the Santa Clara Valley, together with Santa Clara County and the Santa Clara Valley Water District. Program participants share a common permit to discharge stormwater to South San Francisco Bay.