### 6. SUMMARY AND CONCLUSIONS

## 6.1 Project Summary

### 6.1.1 Project Objectives

The San Francisquito Creek Joint Powers Authority (JPA) authorized Northwest Hydraulic Consultants, Inc. (**nhc**) and subconsultants Jones & Stokes (J&S) and EarthTech to develop conceptual designs for bank stabilization and revegetation demonstration projects at selected sites on San Francisquito Creek between Junipero Serra Boulevard and US Highway 101. The demonstration projects are intended to provide property owners and designers of bank protection works with examples of environmentally sensitive bank protection design and construction methods that utilize vegetation enhanced concepts to meet project goals.

### **6.1.2 Physical Conditions**

San Francisquito Creek flows out of the Santa Cruz Mountains and onto a coalesced alluvial fan or apron downstream of Junipero Serra Boulevard. The creek has deeply incised into the fan sediments, leaving banks that are over 25 feet high in many areas. The channel has apparently not migrated significantly since the late 1800s, probably due to a combination of resistant material near the toe of the bank and revetment of the banks by landowners. The channel has been incised at least since the late 1800s, and may continue to incise in the future, although average rates over the past 40 years appear to be fairly low. Flow conditions in the channel are highly variable, from normally dry conditions in the summer to depths over 25 feet and velocities over 8 feet per second during flood flows. Local erosion problems are widespread in the project reach, and the consequences of continued erosion frequently involve loss of developed property or threats to existing structures and public infrastructure. The creek presents challenging conditions for bank stabilization and revegetation due to the incised channel geometry, dry growing season conditions, and proximity of development to the top of bank.

#### 6.1.3 Process of Site Selection

The JPA provided a list of six potential sites for implementation of the demonstration project. The sites were screened based on a reconnaissance of erosion problems in the entire project and a review of conditions at each of the six sites. Three sites were selected by considering their potential feasibility for short to middle-term implementation, the degree to which problems and potential solutions at the sites represented erosion problems in the project reach, and budget constraints. Two of the selected sites were combined into one longer site to demonstrate the need to apply bank protection concepts on a larger scale than individual properties. The selected sites are near Station 236+00 (Sunset Publishing Site), and between Station 319+50 and 312+00 (Norton/CHC Site). A total of 11 property owners are included in the two sites.

#### 6.1.4 Meetings

During the development of the conceptual designs, several meetings were conducted with the JPA and property owners in the project reach. These included:

- Creek Reconnaissance and Assessment of Potential Demonstration Sites
- Demonstration Site Selection Presentation

- Meetings with Non-selected Site Owners to Discuss Potential Solutions
- Preliminary Design Alternative Presentations to Property Owners

# 6.2 Site Design

### 6.2.1 Design Concepts

Design concepts for the two sites were based on review of physical and biological conditions, including apparent erosion processes and the role of vegetation in bank stabilization. These considerations led to a design approach at the two demonstration sites to:

- Address erosion problems in an area (e.g., through one or two channel bends) rather than on individual properties
- Adjust channel alignment or geometry, where feasible, to reduce or distribute erosive forces
- Provide structural or semi-structural bio-technical stabilization of the toe of the slope, especially at the outsides of bends and in areas where existing erosion is occurring
- Incorporate the creation of planting sites into the toe stabilization to promote establishment of native riparian species with high stem densities and extensive root systems
- Create or utilize surfaces suitable for planting bands of riparian vegetation at elevations subject to frequent flood flows
- Utilize plantings at the created sites along the lower bank to help protect the mid-bank by slowing near bank velocities and providing an increased seed source for vegetative regeneration on the mid-bank
- Consider structural stabilization of the mid- and upper slope where erosion is particularly severe or the consequences of continued failure are high
- Utilize vegetative or bio-technical techniques to address local failures before they progress into large scale erosion sites
- Use irrigation, soil moisture control, and ongoing maintenance as a means to establish desired vegetative treatments and control non-native vegetation

It is difficult to establish vegetation on the existing middle and upper banks due to their steepness and dryness. Whe re feasible, the concepts recommend re-grading the upper slopes to improve slope stability and provide suitable planting benches. When grading is not an option due to the proximity of development at the top of bank, structural features such as retaining walls were used to stabilize this portion of the bank. However, from a geotechnical engineering perspective, other areas of the bank likely do not meet typical safety factor criteria for overall slope stability, and there is some risk of continued failures in these areas. The demonstration project assumes that some level of risk is acceptable to the JPA and the property owners, but that improvements constructed by the demonstration projects will improve creek bank stability and mitigate against potential future erosion and bank failures.

At the Norton/CHC site, two design options are included. Both options include channel modification, construction of rock toe protection features, and revegetation. One option includes a 200–foot long retaining wall to stabilize the middle and upper bank at the CHC property. A

second option is presented without this wall. This second option relies solely on toe protection and revegetation at base of the middle slope above the toe protection to stabilize the bank. This option presents a greater risk of failure for the middle and upper bank.

At the Sunset Publishing site, a relatively low cost design concept was adopted to repair a local erosion site and reduce the risk of progressive failure of the bank. This design concept relies on stabilization at the toe of the bank with rock and rootwad features and bio-technical stabilization of the middle and upper bank. This approach was adopted due to the relatively small scale of the existing failure.

The recommended concepts are shown in Figures 4.2, 4.3, and 4.4.

#### 6.2.2 Cost

Planning level cost estimates were developed for each recommended concept. At the Norton/CHC site, the cost of the design option with the retaining wall is estimated at approximately \$1,083,000. The cost of the option without the retaining wall is estimated at approximately \$781,000. At the Sunset Publishing site, the cost of the recommended concept is estimated at approximately \$166,000. These costs are based on current pricing levels, and include engineering costs (20% of construction) and a contingency (25% of construction plus engineering).

### 6.3 Next Steps

### 6.3.1 Meet with Property Owners and Acquire Funding

The first priority should be to meet with all affected property owners to review the recommended concepts. After review of the recommended concept and incorporation of comments, proceed with acquisition of necessary funds to design and complete construction. Construction of the projects in a single season, with consideration of the appropriate timing for establishment of vegetation prior to the wet season, is recommended. This approach will minimize total cost and reduce risk of erosion in the first flood season after construction.

### 6.3.2 Conduct Pre-Application Meeting with Permitting Agencies

A design review meeting is recommended to discuss preliminary design plans with staff from key regulatory agencies (e.g., RWQCB, NOAA Fisheries, CDFG, USFWS) to develop consensus early in the process. This step will help to streamline later permitting and environmental compliance processes.

#### 6.3.3 Complete Final Design & Construct Project

Detailed drawings and construction specifications should be completed that incorporate additional comments from property owners, regulatory agencies, and potential contractors. Involvement of engineering and revegetation design professionals in the construction of the project is recommended to ensure that the drawings are interpreted to fit field conditions and achieve intended functions for the bank stabilization and revegetation features. Inspection should continue beyond the construction phase to include regular annual inspection and inspection following each flood event to determine performance and identify and address maintenance issues.