
SECTION 4: VEGETATION CONDITIONS SURVEY

4.0 INTRODUCTION

The San Francisquito Creek Bank Stabilization and Revegetation project is located within a six mile reach of San Francisquito Creek that stretches from Junipero Serra Boulevard downstream to Highway 101. Within the project area, the Creek borders the City of Palo Alto and Stanford University to the southeast and the Cities of Menlo Park and East Palo Alto to the northwest. The creek forms the boundary between San Mateo and Santa Clara Counties.

This project assesses the existing channel, bank, and associated vegetation and wildlife conditions along the Creek and produced an existing conditions report and a forthcoming master plan. These documents serve as base materials to assist the Cities and the homeowners of adjacent Creek property for future bank stabilization and revegetation projects. Phase I of the project covered data collection and report preparation for the existing conditions report. Phase II of the project will result is a Master Plan report guiding future bank stabilization and revegetation efforts within the project area of San Francisquito Creek.

4.1 OBJECTIVES OF SURVEY

H.T. Harvey & Associates was hired as a member of the subconsultant team to map and analyze the existing vegetation conditions within San Francisquito Creek. These conditions were evaluated through field surveys, data collection, and data analysis. This report summarizes these results.

4.2 SURVEY METHODS

Max Busnardo and Sara Chun of H.T. Harvey & Associates conducted field surveys of the San Francisquito Creek project area in the fall and early winter of 1998 between October 16 and December 2, 1998. The San Francisquito Creek project area was assessed beginning downstream near Highway 101 and continuing towards the upstream project boundary. Existing vegetation within the riparian corridor was surveyed and the habitat types were hand-drawn onto nine, 100-scale aerial maps. The riparian corridor was defined as the top-of-bank and/or the outer dripline of riparian vegetation rooted at or below the top-of-bank. Vegetation types were differentiated as discrete, numbered polygons on the maps, and data were collected on each polygon within five vegetation categories. The five categories included: habitat type, dominant species composition, habitat quality, extent of non-native plant species, and revegetation potential. The size and extent of a polygon could vary from a single tree to a stretch of vegetation spanning both sides of the creek. Polygons were

differentiated when a single characteristic within a mapping category changed along a stretch of the creek. A more detailed description of each category and their characteristics appears at the end of this section.

Following the field surveys, the hand-delineated maps were given to Frederick T. Seher & Associates to digitize and calculate the area of each polygon. Information on each numbered polygon was then entered onto an Excel spreadsheet, and a plant list (Appendix 4-I) was generated corresponding to the dominant plant species identified within each habitat polygon during vegetation mapping. Data analyses and manipulations were also performed to determine various features of the Creek that could inform and guide bank stabilization and revegetation efforts. The maps in Appendix 4-II cover the entire project area and show the characteristics of each habitat polygon as digitally plotted in the CAD (Computer-Aided Design) program. Appendix 4-III contains the Excel spreadsheet of the raw data describing each habitat polygon.

4.2.1 HABITAT TYPES

This category characterizes the general habitat types present along the Creek as described by 1) A Guide to Wildlife Habitats of California, 2) previous habitat types identified by the Coyote Creek Riparian Station (1998), and 3) habitat types modified from these two sources in accordance with existing habitat types. Eleven habitat types were noted in the project area. The field acronyms and a description of the habitat type categories are as follows:

- BARE - Bare habitat consists of primarily earthen areas of bare soil that support little or no vegetation.
- BEW - Brackish Emergent Wetland habitat consists of areas dominated by brackish marshes with saline tolerant plants such as pickleweed (*Salicornia virginica*) or saltgrass (*Distichlis spicata*).
- COW - Coast Live Oak Woodland habitat consists of areas dominated by coast live oak trees (*Quercus agrifolia*) and can include other native trees such as California bay (*Umbellularia californica*) or California buckeye (*Aesculus californica*) and native shrubs like California blackberry (*Rubus ursinus*) or coyote brush (*Baccharis pilularis*).
- EUC - Eucalyptus habitat consists of areas dominated by one or more non-native species of eucalyptus. Common species include blue gum (*Eucalyptus globulis*) and red river gum (*Eucalyptus camaldulensis*).

- HAR - Hardscape habitat consists primarily of hardscape features such as gabion baskets or blankets, concrete retaining walls, or rock rip-rap. An overstory tree layer is not present, and little vegetation exists among the hardscape features.
- HERB - Herbaceous habitat consists of areas dominated by herbaceous, non-woody vegetation. A shrub or overstory tree layer is absent.
- NON - Non-Native habitat consists of areas dominated by non-native, woody species excluding eucalyptus stands.
- RED - Redwood habitat consists of areas dominated by California redwood (*Sequoia sempervirens*).
- SHRUB - Shrub habitat consists of areas dominated by shrubs with little or no trees present. Native and non-native shrubs are included.
- VFR - Valley Foothill Riparian consists of riparian habitat dominated by mixed, native trees and shrubs. Native tree species include red willow (*Salix laevigata*), arroyo willow (*Salix lasiolepis*), Fremont cottonwood (*Populus fremontii* ssp. *fremontii*), and others. Native shrub species include California blackberry, California rose (*Rosa californica*), mugwort (*Artemisia douglasiana*), and others.
- VOW - Valley Oak Woodland habitat consists of areas dominated by valley oak trees (*Quercus lobata*).

4.2.2 DOMINANT SPECIES COMPOSITION

The dominant 2-3 tree and/or 2-3 understory species were noted during field observations for each polygon.

4.2.3 HABITAT QUALITY

This category is based on observed vegetation characteristics that correspond to fish and wildlife habitat values such as the presence/absence and density of the overstory vegetation, the presence/absence of native species, and the complexity of vegetation structure such as the presence of tree, shrub, and herbaceous layers. The three habitat quality categories are:

- 1 - Represents high quality habitat. Native overstory with continuous understory or occurring in dense thickets; dense native overstory with sparse, non-native or no understory; native willow thicket.
- 2 - Represents medium quality habitat. Sparse overstory with

sparse, non-native or no understory; non-native overstory with native understory; dense, non-native overstory with sparse, non-native or no understory.

- 3 - Represents lower quality habitat. Sparse, non-native overstory with sparse, non-native or no understory. Any areas not included in medium or high quality categories including rock rip-rap, gabions, concrete walls, ruderal habitat, and bare ground.

4.2.4 NON-NATIVE SPECIES

This category describes the approximate percent cover of non-native, woody species within each habitat polygon. The four categories include:

- 1 - Represents a percent cover of 0 - 25 % of the polygon by non-natives.
- 2 - Represents a percent cover of 26 - 50 % of the polygon by non-natives.
- 3 - Represents a percent cover of 51 - 75 % of the polygon by non-natives.
- 4 - Represents a percent cover of 76 - 100 % of the polygon by non-natives.

4.2.5 REVEGETATION POTENTIAL

This category describes the revegetation potential of a particular habitat polygon in its existing condition. Revegetation potential could increase or decrease following implementation of bank stabilization measures.

- 1 - Represents high revegetation potential. These areas include locales with appropriate soils and hydrology that are stable and do not currently support extensive, native vegetation.
- 2 - Represents medium revegetation potential. This category covers areas that are appropriate for revegetation but have a limiting factor present (e.g. less-than-optimal soils or hydrology, presence of native vegetation) that disqualifies it as an area of high revegetation potential.
- 3 - Represents low revegetation potential. These areas include locales that support extensive native vegetation, are unstable, have a significant component of hardscape, or poor soil.

4.3 RESULTS

4.3.1 HABITAT TYPES

San Francisquito Creek traverses diverse urban and natural settings as it flows from its headwaters at Searsville Lake on Stanford University's Jasper Ridge Preserve and its broad network of tributary

creeks to San Francisco Bay. Within the project area, San Francisquito Creek borders urban, suburban, and less developed settings which influence the habitats, plant species, and habitat quality present along the Creek. In the upstream portions of the project area, the Creek abuts less developed portions of Stanford University lands to the southeast and residential homes to the northwest. In this area, the Creek assumes a more natural form with high, sloping banks, wider channels, and fewer human modifications. Where the Creek passes El Camino Real and borders the Cities of Menlo Park and Palo Alto, it enters a more pronounced suburban environment as residential homes and lots abut the Creek's banks. Due to the prevalence of adjacent houses, additional improvements such as hardscape features and bridges have been added to stabilize the channel. At the downstream end of the project area where the Creek borders the City of East Palo Alto to the north and the City of Palo Alto to the south, the Creek enters a more urbanized setting as it approaches

Table 4.1 Habitat Types of the San Francisquito Creek Project Area by Percentage

Habitat Types	Percentage within Project Area
COW (Coast Live Oak Woodland)	32.7%
VFR (Valley Foothill Riparian)	23.0%
NON (Non-Native)	18.1%
EUC (Eucalyptus)	13.3%
HERB (Herbaceous)	4.1%
HAR (Hardscape)	3.2%
SHRUB (Shrub Habitat)	2.8%
RED (Redwood)	1.5%
BARE (Bare Ground)	0.76%
VOW (Valley Oak Woodland)	0.5%
BEW (Brackish Emergent Wetland)	0.08%

Highway 101. In those reaches, it has been heavily modified with lengthy expanses of continuous concrete walls.

Due to these environmental transitions, San Francisquito Creek exhibits a diverse set of habitat types and trends within the project area. Table 4.1 breaks down the habitat types by their proportionate coverage within the project area. The Creek primarily comprises Coast Live Oak Woodland (COW) and Valley Foothill Riparian (VFR) habitats, with these two types covering more than 50% of the area (Table 4.1). Stands of eucalyptus (EUC) are prevalent along Stanford University lands near Sand Hill Road where more open and undeveloped areas border the Creek. Eucalyptus groves become increasingly scarce downstream as the Creek becomes more channelized and enters suburban and urban areas. Although non-native species, eucalyptus trees were separated from the Non-Natives (NON) category since they form such dense and prominent groves.

Table 4.2 Common native species, their bank location, and general habitat type within the San Francisquito Creek Project Area

Common Name	Scientific Name	Bank Location*				Habitat Type		
		LB	MB	UB	UP	COW	VFR	SHRUB
alder	<i>Alnus rhombifolia</i>	x					x	
arroyo willow	<i>Salix lasiolepis</i>	x					x	
big-leaf maple	<i>Acer macrophyllum</i>		x	x			x	
box elder	<i>Acer negundo</i>		x	x	x		x	
California bay	<i>Umbellularia californica</i>			x	x	x		
California blackberry	<i>Rubus ursinus</i>	x	x	x		x	x	x
California buckeye	<i>Aesculus californica</i>		x	x	x	x	x	
California rose	<i>Rosa californica</i>	x	x	x		x	x	x
California sycamore	<i>Platanus racemosa</i>	x	x				x	
coast live oak	<i>Quercus agrifolia</i>		x	x	x	x		
coyote brush	<i>Baccharis pilularis</i>		x	x	x	x		x
Fremont cottonwood	<i>Populus fremontii</i> ssp. <i>fremontii</i>	x	x				x	
Mexican elderberry	<i>Sambucus mexicana</i>			x	x		x	
mugwort	<i>Artemisia douglasiana</i>	x	x			x	x	x
Oregon ash	<i>Fraxinus latifolia</i>	x	x				x	
poison oak	<i>Toxicodendron diversilobum</i>		x	x	x	x	x	x
red willow	<i>Salix laevigata</i>	x	x				x	
sand bar willow	<i>Salix exigua</i>	x					x	
toyon	<i>Heteromeles arbutifolia</i>		x	x	x	x		

* LB=Lower Bank, MB=Mid Bank, UB=Upper Bank, UP=Upland

Patches of redwoods are scattered along the upstream end of the Creek particularly near Stanford University lands paralleling Sand Hill Road. According to Jim Johnson, Stream Keeper with the Coordinated Resource Management Planning group (CRMP), these redwoods are native to the San Francisquito Creek riparian corridor and are at the southernmost point in their range (Johnson pers. int.). Johnson notes that Spanish explorers recorded these redwoods during the 1600s. Only 1.5% of the Creek is composed of Redwood habitat.

The Brackish Emergent Wetland (BEW) habitat only exists at the extreme downstream end of the project area where the Creek flows under Highway 101 and eventually into the San Francisco Bay. Hence, it only comprises 0.08% of the project area. Tidal water enters this stretch of the Creek from the bay encouraging the growth of brackish emergent wetland plants such as pickleweed (*Salicornia virginica*), cattail (*Typha* spp.), and saltgrass (*Distichlis spicata*).

Valley Oak Woodland (VOW) is relatively scarce, covering only 0.5% of the San Francisquito Creek project area. The few areas that do exist are mostly found at the upstream end of the project area adjacent to the Stanford University golf course. Valley oak trees are

much less dominant than coast live oak trees on San Francisquito Creek.

Habitat polygons dominated by non-native species (NON) are prevalent throughout the entire reach of the Creek forming 18.1% of the project area. Due to their pervasiveness, a separate discussion is included in this report.

The other habitat types, Herbaceous (HERB), Hardscape (HAR), Shrub (SHRUB), and Bare Ground (BARE) cover 4.1%, 3.2%, 2.8%, and 0.76% of the project area respectively. Excluding the HERB, HAR, and BARE categories, more than 90% of the Creek supports an understory and overstory tree or shrub canopy.

4.3.2 SPECIES COMPOSITION

Appendix 4-I is a plant list corresponding to the dominant plants identified within each habitat polygon during vegetation mapping. Table 4.2 lists the common native tree and shrub species found within the project area, the habitat type in which they would generally fall, as well as their typical location along the creek bank or adjacent upland region. Of the eleven habitat types identified, the Valley Foothill Riparian, the Coast Live Oak Woodland, and the

Table 4.3 Habitat Quality of the San Francisquito Creek Project Area by Percentage

Habitat Quality Indicator	Percentage of Creek within Project Area
1: Higher Quality Habitat	53.8 %
2: Medium Quality Habitat	27.7%
3: Lower Quality Habitat	18.5%

Shrub types are the categories in which the bulk of the common native plants fall. If a polygon is characterized by one of the other eight habitat types, some native species may exist within it, but the VFR, COW, and SHRUB polygons generally have the highest concentration of native plants.

The project area is dominated by coast live oak trees on the mid and upper banks and the upland areas. These trees characterize the Coast Live Oak Woodland habitat type. Other native trees that fall within this assemblage and are prevalent along the Creek include California bay and California buckeye. These trees not only form a protective overstory canopy creating shaded riverine aquatic habitat, but the acorns from the oak and the buckeye flowers are a good food source for wildlife. Shrubs like California blackberry, California rose, coyote brush, mugwort, poison oak, and toyon form a native understory layer. The plants within the COW habitat type are generally drought tolerant and are adapted to upper bank locations.

Red willow, arroyo willow, and Fremont cottonwood are the three main species that characterize the Valley Foothill Riparian habitat. Adapted to moist conditions and frequent inundation, these species are primarily located on the lower creek banks and within the channel itself. Sand bar willow was observed less frequently but is a part of this assemblage. Other tree species adapted to moist conditions that are common within the project area include alder, big-leaf maple, box elder, California sycamore, and Oregon ash. Most of these species are found on the lower creek banks as opposed to within the creek channel itself. A shrub layer may also be present and includes many of the same species found within the COW habitat such as California blackberry, California rose, mugwort, and poison oak. These four species can tolerate moister conditions.

Table 4.4 Percentage of Project Area Covered by Non-Natives

Percent Cover by Non-Native Species	Percentage within Project Area
1: Percent cover of 0 - 25% by non-natives	50.8%
2: Percent cover of 25 - 50% by non-natives	10.8%
3: Percent cover or 51 - 75% by non-natives	6.0%
4: Percent cover of 76 - 100% by non-natives	32.4%

California blackberry, California rose, coyote brush, mugwort, poison oak, and Mexican elderberry are some common, native shrub species present within San Francisquito Creek. The SHRUB habitat type was used when only shrubs were present and an overstory was lacking.

4.3.3 HABITAT QUALITY

Table 4.3 breaks down the habitat quality present within the San Francisquito Creek project area. Generally, habitat quality is high within the project area with 53.8% of the habitat qualifying as higher quality. Habitat quality is a subjective indicator of native or non-native species present, overstory and understory cover, and presence of hardscape features to the associated banks. Habitat quality mostly follows the evolution of the Creek as it flows through less developed, suburban, and urban settings from upstream to downstream. The Creek is of higher quality upstream where it borders less developed Stanford University lands, open areas, and the Stanford University golf course. The creek channel is wider and less incised in these upstream areas, and fewer homes abut the Creek. Downstream, where the Creek enters residential neighborhoods, homes and lots border the Creek banks which have caused some unstable banks and erosion. This phenomenon has on occasion necessitated installation of hardscape features such as rock rip-rap, gabions, and concrete walls to bolster the banks. By itself, hardscape possesses little habitat quality. Often, these environments have encouraged pervasive, non-native species like German ivy

Table 4.5 Prevalent non-native plant species within the San Francisquito Creek project area

Common Name	Scientific Name	Type		Presence	
		Shrub	Tree	Pervasive	Clumps
acacia	<i>Acacia</i> spp.		x		x
black locust	<i>Robinia pseudoacacia</i>		x		x
broom	<i>Cytisus</i> spp.	x			x
English ivy	<i>Hedera helix</i>	x		x	
eucalyptus	<i>Eucalyptus</i> spp.		x		x
fennel	<i>Foeniculum vulgare</i>	x			x
German Ivy	<i>Senecio mikaniodes</i>	x		x	
giant reed	<i>Arundo donax</i>	x		x	
Himalayan blackberry	<i>Rubus discolor</i>	x		x	
periwinkle	<i>Vinca major</i>	x		x	
tree-of-heaven	<i>Ailanthus altissima</i>		x	x	

(*Senecio mikaniodes*), English ivy (*Hedera helix*), Himalayan blackberry (*Rubus discolor*), giant reed (*Arundo donax*), tree-of-heaven (*Ailanthus altissima*) and others to outcompete and replace the native species and lower habitat quality.

4.3.4 NON-NATIVE SPECIES

According to Table 4.4, 50.8% of the project area was classified as having less than 25% cover by non-native species. Only 10.8% of the project area was assessed as having 25-50% cover by non-native species. Six percent of the project area had a cover of non-native species between 51-75%. Finally, 32.4% of the project area had over 76% cover by non-native species. With 32.4% of the project area having a non-native cover of over 76%, non-native species form a significant component of the vegetation along San Francisquito Creek.

Table 4.5 describes the most prevalent non-native plant species within the project area, their type, and their presence within the project area. Many of these common non-native species are found on the California Exotic Pest Plant Council list of exotic pest plants of greatest concern (Cal EPPC 1996). Giant reed, broom (*Cytisus* spp.), fennel (*Foeniculum vulgare*), English ivy, Himalayan blackberry, and German ivy are located on Cal EPPC's List A1: Most Invasive Wildland Pest Plants; Widespread. Tree-of-heaven, black locust (*Robinia pseudoacacia*), and periwinkle (*Vinca major*) are found on List B: Wildland Pest Plants of Lesser Invasiveness.

English ivy, German ivy, Himalayan blackberry, and periwinkle are some of the most extensive non-native shrubs that span the entire project area. All four are low-lying species that form dense thickets that limit colonization by native species. English ivy and German ivy are also capable of growing atop hardscape features like concrete walls and gabion baskets and up tree trunks and limbs. Himalayan blackberry, a native of Eurasia, often displaces the native California blackberry. However, the fruit of Himalayan blackberry provides some value to wildlife.

Table 4.6 Revegetation potential of the San Francisquito Creek Project Area by percentage.

Revegetation Potential Category	Percentage of Creek within Project Area
1: High revegetation potential	6.4%
2 Medium revegetation potential	17.3%
3: Low revegetation potential	76.3%

Fennel, giant reed, and species of broom are also common non-native shrub species that occur along San Francisquito Creek. All three have the ability to form clonal patches that preclude colonization by native species. Giant reed can clog waterways because of its dense growth form. Fennel, giant reed, and broom are particularly noxious because of their abilities to spread rapidly and form monocultural areas.

Of the main, non-native trees present along San Francisquito Creek, species of eucalyptus are the most common, occurring in extensive groves particularly in the upstream portion of the project area. Regions particularly dense with eucalyptus stands include the stretch of the Creek paralleling Sand Hill Road where the Creek borders the City of Menlo Park and Stanford University lands. Native to Australia, eucalyptus may pose specific problems to native species due to their allelopathic properties. Because of toxins and tannins present within their leaves and bark, these substances can leach into the surrounding soil, altering the ability of native plants to colonize these areas. Eucalyptus trees do, however, provide good habitat for nesting raptors. Acacia (*Acacia* spp.), black locust, and tree-of-heaven are smaller, non-native trees that have infiltrated the San Francisquito Creek project area and can be found in isolated patches throughout.

Non-native species threaten the overall habitat quality of a creek by reducing or preventing the colonization of an area by native plants. Non-native species usually provide reduced food and habitat values for wildlife species. In addition, some non-natives may clog waterways leading to flow reduction and flood dangers to the creek. Non-natives do have some value as they stabilize banks and provide vegetation cover. Programs of non-native species removal should be a gradual effort taking into account geomorphic constraints and including a program of native species replanting and continuous maintenance efforts to control resprouting and new recruitment of non-natives.

The Coordinated Resource Management Planning groups (CRMP) have begun limited programs of non-native removal of some of the most pervasive species at targeted locations along San Francisquito Creek. According to Jim Johnson, CRMP has removed patches of giant reed, German ivy, and tamarisk (*Tamarix* spp.) along San Francisquito Creek and begun to revegetate the areas with native plants (Johnson, pers. int.) Two clumps of giant reed directly downstream of the University Avenue bridge in East Palo Alto have been cut and sprayed with an herbicide approved by the Environmental Protection Agency for use near aquatic areas. The CRMP plans to focus on smaller patches of non-natives throughout the summer and fall of 1999.

4.3.5 REVEGETATION POTENTIAL

The San Francisquito Creek project area was assessed for revegetation potential looking at the existing conditions of the creek. Assessment of the possibility of revegetation in association with future bank stabilization work was deferred until a later project phase. If a habitat polygon contained a stand of non-natives that could potentially be removed and revegetated without disturbing the stability of the banks, that polygon was assessed as having high revegetation potential. Conversely, if a habitat polygon contained a stand of non-natives whose removal might potentially destabilize the bank or cause erosion due to steep slopes, that polygon was assessed as having low revegetation potential. In the latter example, if bank stabilization work was performed in conjunction with revegetation in the future, this polygon could have a higher revegetation potential than at present depending on the nature of the stabilization work.

Table 4.6 describes the existing revegetation potential of the San Francisquito Creek project area as assessed during vegetation surveys. Based upon the existing conditions, more than three-fourths of the Creek possesses a low revegetation potential due to limiting factors such as extensive native species, unstable banks, presence of hardscape features, or poor soils. Generally, regions of high revegetation potential correspond to areas of low habitat quality, high percentage of non-natives, few hardscape features, stable banks, and appropriate soils.

Regions of high revegetation potential under current vegetation and physical conditions are located in scattered areas throughout the Creek. One area of the Creek with a concentration of polygons with high revegetation potential occurs between Seneca and Marlowe Streets in Palo Alto. This stretch occurs approximately midway within the project area. The stretch of the Creek that flows through the Stanford University Golf Course also has several areas with high revegetation potential.

Other areas of the Creek such as the stretch paralleling Sand Hill Road, possess a high percentage of non-native species and would generally be considered areas with high revegetation potential. However, due to such limiting factors as the current value of the existing cover for wildlife, the incised nature of the channel, and/or the steep banks, revegetation potential is generally considered low in the absence of a concurrent bank stabilization program.

4.4 CONCLUSIONS

The San Francisquito Creek project area comprises primarily Coast Live Oak Woodland and Valley Foothill Riparian but also exhibits a high occurrence of non-native tree and shrub species throughout. While the project area, overall, exhibits a high habitat quality, non-native species reduce the habitat quality of the Creek by precluding the colonization by native plant species and reducing the habitat values for wildlife. Due to the existing conditions of the Creek, few areas exist that have high revegetation potential. Programs that integrate bank stabilization efforts with gradual and continuous non-native species removal and native species revegetation, will be required to significantly improve the habitat values of San Francisquito Creek.

The Master Plan integrates the existing vegetation conditions with the geomorphologic work conducted by Philip Williams & Associates. Recommendations regarding a coordinated bank stabilization, native revegetation, and non-native removal program will appear in that future document for use by the Cities and the public.

4.5 REFERENCES

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