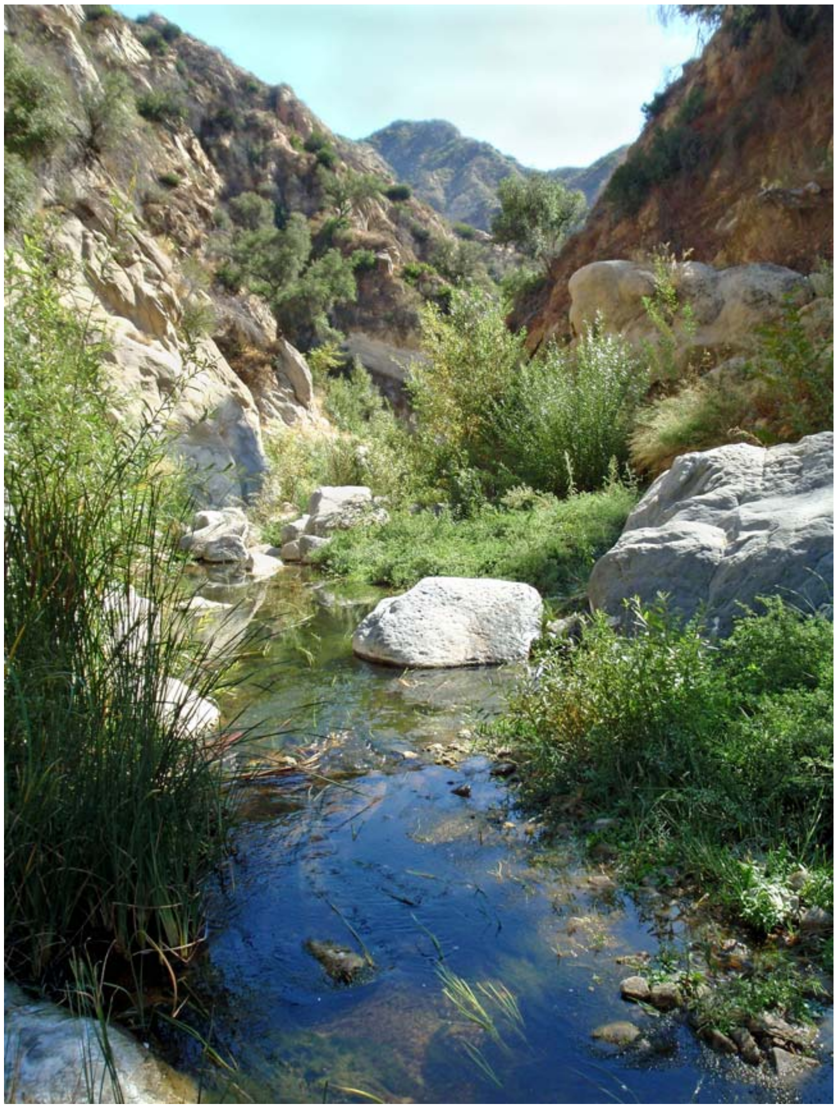
HOPPER CREEK
STREAM INVENTORY REPORT
SEPTEMBER-NOVEMBER, 2008



Prepared by:
Aaron Francis
Fisheries Biologist
Pacific States Marine Fisheries Commission, and
California Department of Fish and Game
4665 Lampson Ave, Suite C
Los Alamitos, CA 90720

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STREAM INVENTORY REPORT

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INTRODUCTION

A stream inventory of Hopper Creek was conducted by California Department of Fish and Game (CDFG) and Pacific States Marine Fisheries Commission (PSMFC) staff from September 25 to November 19, 2008 and of Tom's Creek, one of Hopper Creek's tributaries, from November 20 to November 24, 2008. The survey began approximately 1.5 miles upstream of the confluence with the Santa Clara River and extended upstream 6.43 stream miles, 7.93 miles from the confluence (Map 1). The starting location was approximately 600 feet upstream of the 126 Highway and terminated at a 40-foot waterfall, approximately 1.1 miles downstream from the Sespe Wilderness Condor Sanctuary boundary. The Tom's Creek confluence with Hopper Creek was approximately 3.46 miles upstream from the Hopper Creek/Santa Clara River confluence and 1.96 miles into the Hopper Creek survey. The survey of Tom's Creek extended approximately 1.51 stream miles upstream of its confluence with Hopper Creek and terminated at a 20-foot waterfall.

Steelhead, the anadromous form of the salmonid, *Oncorhynchus mykiss*, populate waters that extend up the Pacific coast of North America and into Asia, and whose southern range terminates in southern California. The National Marine Fisheries Service (NMFS) federally listed the Southern California Steelhead Evolutionary Significant Unit (ESU) as Endangered from Point Conception south to Malibu Creek in 1997 and expanded the range of the ESU to include all coastal creeks and rivers to the Mexican border in 2002. NMFS determined that the ESU designation of steelhead was not appropriate and reclassified the steelhead populations within the state as Distinct Population Segments in 2006. These actions did not alter the listing status of endangered for southern steelhead.

Southern steelhead are winter-run steelhead that typically enter streams to spawn from December to April in conjunction with high winter flows. Post-spawn steelhead, known as kelts, rejuvenate after spawning and, if conditions permit, return to the ocean to spawn again the following year. The offspring may remain in the freshwater stream of their birth as residents, or become anadromous and, thus, migrate to the ocean to mature. A single stream can have both resident and anadromous forms and often there may be some interbreeding between these forms (Swift 2003). The anadromous form can vary in the amount of time spent in freshwater but usually spends one to two years rearing in the freshwater stream before going to the ocean. Adult fish may return to the stream from which they originated, they may stray to other established steelhead streams, or they may re-colonize streams that have been extirpated for some years due to prolonged drought, devastating fires, or other adverse effects (Swift 2003).

Historic documentation indicates that Santa Clara River steelhead have long been associated with local human usage. Prior to European settlement in 1782, the Chumash tribe relied on steelhead as a food resource, and, after the European settlers became established throughout the Santa Clara watershed in the late 1800s and early 1900s, a recreational steelhead fishery was established. Studies have estimated the historic Santa Clara River adult steelhead run at approximately 9,000 adults; however, the construction of migration barriers during the 1900s on the main stem and its associated tributaries has limited spawning grounds and overall habitat availability, resulting in the decimation of the population (Moore, 1980a). According to a biological opinion released by NMFS in July, 2008, the Santa Clara River Freeman Diversion, located approximately 10 miles upstream of the of the mouth, is likely to jeopardize the continued existence of the endangered Southern California steelhead unless flow releases and access modifications are enacted (NMFS, 2008).

In Hopper Creek, resident *O. mykiss* populations have been observed by locals as well as CDFG field staff, with records of *O. mykiss* presence dating back to 1946. The last observation of *O. mykiss* was in 2001, when multiple year classes were identified including some *O. mykiss* that measured between 12-16 inches in length. Although steelhead have not been discovered in the Hopper Creek watershed since 2001, few focused surveys have been performed over this time period. Based on anecdotal and prior documentation, it is likely that Hopper Creek contained a historic run of steelhead.

The objective of the habitat inventory survey, and this stream inventory report, was to document the current habitat conditions, determine habitat suitability for steelhead, identify limiting factors, and recommend ways to address the factors limiting steelhead in the Hopper Creek watershed. The survey began at the end of a drought water-year for Ventura County during low stream flow conditions. However, it continued through the first rains of the new water year, which had a noticeable impact and influenced results. In addition, riverine and riparian habitats have been tremendously altered by a number of recent events including the 2003 Piru fire, the extreme flood events of the 2004/2005 water year, the extreme drought year of 2005/2006, and the 2007 Ranch fire. Observations of the natural recovery from these events were noted throughout this report. Recommendations for habitat improvement activities were based on target habitat values suitable for steelhead/*O. mykiss* in California's south coast streams.

MAP 1


L O S P A D R E S
N A T I O N A L F O R E S T
Hopper Creek Waterfall
Tom's Canyon Creek Waterfall
Tom's Canyon Creek Confluence
Start of Survey
Extent Location
within Santa Clara River Basin
Santa Clarita
Ventura
5
101
Hopper Canyon
CDFG Habitat Survey
Fall 2008
Surveyed Area
Streams
0 0.5 1 Miles
N
W E
S
CA Dept. of Fish and Game
Coastal Watershed Planning
and Assessment Program
K. Pettit 02/2009
Data Sources: CDFG, CDF,
USGS, BOR, CIWMC

WATERSHED OVERVIEW

Hopper Creek, located in Ventura County, California (Map 1), is a tributary to the Santa Clara River, which is a tributary to the Pacific Ocean. Hopper Creek's legal description at the confluence with Santa Clara River is T04N R19W S35. Its location is (34:23:03.0N) 34º23’02” north latitude and (118:50:14.0W) 118º50’08” west longitude, LLID number 1188372343842. Hopper Creek is a second order stream and has approximately 13.84 total miles of intermittent blue line stream, according to the USGS Fillmore 7.5 minute quadrangle. Hopper Creek drains a watershed of approximately 26.33 square miles and elevations range from approximately 535 feet at the mouth of the creek to 4,790 feet in the headwater areas. The headwaters of Hopper Creek are located in the Sespe Condor Sanctuary of Los Padres National Forest. The surveyed area was located below the Sanctuary boundary and consisted solely of large tracts of private land. From near its confluence with the Santa Clara River, Hopper Creek runs through citrus orchards and tree farms for approximately 2.7 miles, at which point the orchards terminate and the creek continues through open, private land with scattered abandoned residences and oil wells for the next 2.5 miles. Upstream of the citrus orchards and tree farms, and to the end of the survey, the vegetative habitat was a combination of Southern Riparian Scrub and Forest and Southern Coast Live Oak Riparian. Vehicle access was limited to Hopper Canyon Road, a partially paved private road that heads north off the 126 and crosses the river on 11 occasions using “Arizona” crossings. The road ends approximately 5.2 miles up from the confluence with Santa Clara River.

Tom’s Creek’s legal description at the confluence with Hopper Creek is T04N R19W S14. Its location is (34:25:22.0N) 34º25’13” north latitude and (118:50:07.0W) 118º50’04” west longitude, LLID number 118835434429. Tom’s Creek is a first order stream and has approximately 3.93 miles of intermittent blue line stream according to the USGS Fillmore 7.5 minute quadrangle. Tom’s Creek drains a watershed of approximately 3.27 square miles; the comparably low square mileage is a result of the physical narrowness of Tom’s Canyon. Elevations range from about 768 feet at the confluence with Hopper Creek to 3,747 feet in the headwater areas. The watershed was primarily privately owned with sections managed for rangeland while the headwaters lay within the Hopper Mountain Wildlife Refuge, which is federally managed. Vehicle access was limited to one unpaved dirt road that turns off of Hopper Canyon Road and ends shortly after the confluence, and one additional dirt road crossing that intersects the creek approximately 0.45 miles upstream of the Hopper/Tom’s Creek confluence. There were also remnants of an old road and abandoned oil equipment throughout the canyon.

METHODS

The habitat inventory conducted in Hopper Creek and Tom’s Creek followed the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The CDFG and PSMFC biologists/fisheries technicians who conducted the inventory were trained in standardized habitat inventory methods designed by the CDFG. This inventory was conducted by a two-person team who surveyed 6.44 stream miles of Hopper Creek and an additional 1.51 stream miles in Tom’s Creek. At its confluence with the Santa Clara River, Hopper Creek experienced subsurface flow that continued for 1.5 miles upstream through the channelized lower reach. This section was driven and/or walked but no inventory data was recorded due to the lack of surface water flow. The Hopper Creek survey began at the first signs of surface water and continued upstream 7.93 miles from the confluence to the limit of anadromy, which was a 40-foot waterfall. The Tom's Creek survey began at its confluence from the right bank with Hopper Creek approximately 3.5 miles upstream from the Hopper Creek confluence with the Santa Clara River. It continued upstream for approximately 1.5 miles to the limit of anadromy, which was a 20-foot waterfall.

Sampling Strategy

The inventory used a method that sampled approximately 10% of the habitat units within the survey reach. All habitat units included in the survey were classified according to habitat type, and their lengths were measured. All pool units were measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time were measured for all the parameters and characteristics required on the field form. Additionally, out of the ten habitat units demarcated on each field form, one habitat unit was randomly selected for complete measurement.

Habitat Inventory Components

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Hopper Creek to record measurements and observations. There are nine components used from the inventory form.

1. Flow:
Flow was estimated in cubic feet per second (cfs) near the end of the stream survey reach. This estimate was derived by taking the average of three measurements of surface flow, and then extrapolating an estimate based on the survey members' previous experience with stream flow measurements.

2. Channel Type:
Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics were measured using a hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures were measured and recorded at every tenth habitat unit. The time of the measurement was also recorded. Both temperatures were taken in degrees Fahrenheit in shade. The water temperature was always recorded in flowing water.

4. Habitat Type:
Habitat typing used the 24 habitat classification types defined by McCain and others (1990). Habitat units were numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Four additional habitat types that deviated from traditional classification were also included: dry units, culvert units, unsurveyed units, and unsurveyed units due to marshland. Dry units were units where flow went subsurface in the creek bed at the time of the survey. Culvert units included all units where manmade structures had been constructed inside the creek bed, diverting the stream channel. Examples of such structures include dams, debris basins, bridges, pipe culverts, concrete channels, and grade control structures among others. Unsurveyed units were sections in the watershed that were inaccessible for surveying. Examples include sections where land access had been denied by property owners, sections of extreme terrain, and marshland or lagoons that were too large to be properly surveyed among others. Hopper Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements were in feet to the nearest tenth. Habitat characteristics were measured using a hip chain, tape measure, and a stadia rod.

5. Embeddedness:
The depth of embeddedness of the cobbles in pool tail-out areas was measured by the percent of the cobble that was surrounded or buried by fine sediment. In Hopper Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate, such as bedrock, log sills, boulders, or other considerations.

6. Shelter Rating:
Instream shelter was composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. All cover was classified according to a list of nine cover types. In Hopper Creek, standard qualitative shelter values of 0 (none), 1 (low), 2 (medium), or 3 (high) were assigned according to the complexity of the cover, as follows:

Instream Shelter Complexity Value	
Value	**Instream Shelter Complexity Value Examples**
0	No shelter
1	One to five boulders; Bare undercut bank or bedrock ledge; Single piece of large wood (>12" diameter and 6' long) defined as large woody debris (LWD).
2	One or two pieces of LWD associated with any amount of small wood (<12" diameter) defined as small woody debris (SWD); Six or more boulders per 50 feet; Stable undercut bank with root mass, and less than 12" undercut; A single root wad lacking complexity; Branches in or near the water; Limited

	submersed vegetative fish cover; Bubble curtain.
3	Combinations of (must have at least two cover types): LWD/boulders/root wads; Three or more pieces of LWD combined with SWD; Three or more boulders combined with LWD/SWD; Bubble curtain combined with LWD or boulders; Stable undercut bank with greater than 12" undercut, associated with root mass or LWD; Extensive submersed vegetative fish cover.

Using an overhead view, a quantitative estimate was made of the percentage of the habitat unit covered. The shelter rating was then calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream. For example, a pool with 45% of the overhead surface area of the habitat unit covered via boulders, a bubble curtain, and large woody debris, would be given a shelter value of 3 and a total shelter rating of 135.

7. Substrate Composition:
Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs was recorded for each pool.

8. Canopy:
Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Hopper Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. Only hardwood trees were observed throughout the Hopper Creek survey.

9. Bank Composition and Vegetation:
Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand channel shaping flows. In Hopper Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percentage of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Comments and Landmarks:

In order to best describe the current conditions of the stream channel and riparian corridor, notes on landmarks, vegetation, animal species observed, erosion sites, potential migration impediments, land use, erosion sites, water diversions and influences, water quality, and any other observable characteristics of note were recorded.

Biological Inventory

Biological sampling was used during the stream inventory to determine fish species and their distribution in the stream. Fish presence/absence was primarily determined by visual observation during the instream survey. Dip nets were also used in several locations to identify fish to species. The presence/absence of macro-invertebrates was observed by examining cobbles and gravels located in the wetted portion of the streambed channel throughout the survey. Focused surveys were not performed for reptiles, amphibians, mammals, or birds but observations were noted and, if possible, identified to species.

DATA ANALYSIS

Data from the habitat inventory forms was entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, PSMFC, in conjunction with the California Department of Fish and Game. This program processed and summarized the data, producing the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics were produced from the tables using Microsoft Excel. Graphics developed for Hopper and Tom's Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

Habitat Inventory Results

The habitat inventory of Hopper Canyon and Tom's Canyon was conducted by Dave Kajtaniak (PSMFC), Aaron Francis (PSMFC), Chris Luk (PSMFC), and Jill Taylor (PSMFC) from 9/25/2008 to 11/24/2008. The total surveyed length of Hopper Creek was 38,562 feet (7.30 miles) and was comprised of 33,967 feet (6.43 miles) of main channel stream with an additional 4,595 feet (0.87 miles) of side channel. The total surveyed length of Tom's Creek was 8,096 feet (1.53 miles) and was comprised of 7,955 feet (1.51 miles) of main channel stream with an additional 141 feet of side channel.

Stream Flow

Hopper Creek stream flow was estimated to be 1.8 cfs during the survey period. Flows increased substantially following the October 31st rain; however, they quickly subsided to pre-rain conditions when the survey resumed on November 3rd. The stream displayed adequate flows, considering the fact that the survey took place towards the end of the dry season and followed two drought years.

Tom's Creek stream flow, although continuous, was very low throughout the surveyed length and was estimated to be less than 0.5 cfs.

From near its confluence with the Santa Clara River to 1.5 miles upstream, the Hopper Creek channel was confined by a man-made levee consisting of large boulders along the right and left banks. The channel consisted of a natural stream bottom dominated by sand. Due to the porosity of the streambed, this reach was dry. Surface flows then commenced and persisted for the remainder of the survey length. The habitat inventory began at the first sign of flow.

Channel Type

Through the man-made levee, the channel type was assumed to be an F4. F4 channels are entrenched meandering riffle/pool channels with low gradients, high width/depth ratio, and gravel dominant substrates. Reach 2 began where the levee ended with the channel type changing to a B4 channel. B4 channels are moderately entrenched riffle dominated channels having infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width/depth ratios, and gravel dominant substrate. Reach 3 began in the approximate vicinity of where the road ended with the channel type changing to a F2 channel. F2 channels differ from F4 channels based on dominant substrates. F2 channels have boulders as their dominant substrate type.

The resulting stream lengths for each of the channel types found in Hopper Creek were as follows: Reach 1 was 3,273 feet long, comprised of 3,131 feet of main stem and 142 feet of side channel. Reach 2 was 20,060 feet long, comprised of 17,002 feet of main stem and 3,058 feet of side channel. Reach 3 was 15,229 feet long, comprised of 13,834 feet of main stem and 1,395 feet of side channel. The survey concluded at a 40-foot waterfall, a natural barrier to all upstream migration.

Through the entire surveyed length, Tom's Creek was a B5 channel type for 7,955 feet of the main channel and an additional 141 feet of side channel. B5 channels differ from B4 channels because the dominant substrate is sand. The survey concluded at a 20-foot waterfall, a natural barrier to all upstream migration.

Water Temperatures

Water temperatures for Hopper Creek taken during the survey period ranged from 52ºF to 76ºF and air temperatures ranged from 52ºF to 93ºF. The mean water and air temperatures for Hopper Creek were 59.1ºF and 68.3ºF, respectively. For Tom's Creek, water temperatures taken during the survey period ranged from 51ºF to 64ºF and air temperatures ranged from 60ºF to 85ºF. The mean water and air temperatures for Tom's Creek were 56.8ºF and 71.3ºF, respectively. The mean water and air temperatures for the entire survey were 58.6ºF and 68.9ºF, respectively.

Summary of Habitat Types

A total of 544 discreet main channel habitat units were identified in the 33,967 feet of channel surveyed in Hopper Creek. Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 45.1% flatwater units, 41.4% riffle units, and 13.5% pool units (Graph 1). Based on total length, flatwater units made up 55.1%, riffle units made up 36.2%, and pool units made up 8.7% (Graph 3). Hopper Creek retained flow for the entire length of the survey.

A total of 154 discreet main channel habitat units were identified in the 7,955 feet of channel surveyed in Tom's Creek. Almost the entire surveyed length was comprised of Level II flatwater and riffle habitat types, 48.1% and 50.0% of all units, respectively, while remaining units comprised of 2 dry units and 1 pool unit (Graph 2). Based on total length, riffle units made up 64.4%, flatwater units made up 34.9%, and both pool and dry units combined made up less than 1% (Graph 4).

Twelve Level IV habitat types were identified during the Hopper Creek survey (Table 3). The most frequent habitat types by percent occurrence were run units at 38.6%, low gradient riffle units at 37.1%, and mid-channel pool units at 10.5% (Graph 5). Based on percent total length, the habitat types were as follows: 48.8% run units, 33.1% low gradient riffle units, 7.1% mid-channel pool units, and 6.3% step run units.

For Tom's Creek, only 6 Level IV habitat types were identified (Table 4). The most frequent habitat types by percentage of occurrence were low gradient riffle units at 47%, run units at 46%, and cascade units at 3% (Graph 6). Based on percent total length, the habitat types were as follows: 63% low gradient riffle units, 29.1% run units, and 5.8 step run units.

Summary of Pools

A total of 80 pools were identified on Hopper Creek (Table 5). Main channel pools were the most prevalent by habitat percent occurrence, at 78% (Graph 7), and comprised 82% of the total length of all pools (Table 5). Table 7 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Of the 80 pools measured, 58 had a maximum residual depth of two feet or greater, accounting for 72.5%; 22 pools measured below two feet. Fifteen of the 80 pools had a max residual depth greater than 4 feet.

The lone pool habitat unit for Tom's Creek was identified as a plunge pool that measured less than 2 feet in depth.

Embeddedness

The depth of cobble embeddedness was estimated at pool tail-outs, with ratings between 1 and 5 where the value of 1 indicates the best spawning conditions and the value of 4 indicates the worst, while a value of 5 was assigned to tail-outs deemed unsuitable for spawning due to inappropriate substrate, such as bedrock, boulders, or other considerations. Of the 80 pool tail-outs measured, 8 had a value of 1 (10%), 6 had a value of 2 (7.5%), 29 had a value of 3 (36.2%), 2 had a value of 4 (2.5%), and 35 had a value of 5 (43.8%) (Graph 11).

The pool habitat in Tom's Creek had a value of 5 since its crest substrate was composed of sand.

Shelter Rating

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300, with 0 being the lowest rating and 300 being the highest rating for habitat quality. For Hopper Creek, riffle habitats had a mean shelter rating of 47, flatwater habitats had a mean shelter rating of 45 and pool habitats had a mean shelter rating of 21 (Table 1). Of the pool types, main channel pools had a shelter rating of 18, scour pools had a mean shelter rating of 31, and backwater pools had a mean shelter rating of 15 (Table 5).

For Tom's Creek, flatwater habitats had a mean shelter rating of 5, riffle habitats had a mean shelter rating of 26, and the lone pool had a shelter rating of 40 (Table 2).

Summary of Habitat Cover and Substrate

Table 9 summarizes mean percent cover by habitat type while Table 19 summarizes the mean percent of shelter cover for Level II habitat in Hopper Creek. Aquatic vegetation was the dominant cover type for Hopper Creek, as a whole. Aquatic vegetation was also the dominant cover type for flatwater and pool habitat types, followed by boulders; whereas boulders were the dominant cover type for riffles, followed by aquatic vegetation. As seen in Graph 13, major pool cover types also include undercut banks, whitewater, and terrestrial vegetation, in successive dominance. It should be noted that a significant portion of the upstream filamentous algae that had accumulated over the summer was washed out following the October 31, 2008 rain. Much of the algae had been spread out over pool habitat and would have increased the unit percent coverage. Table 11 summarizes the dominant substrates by habitat type while Graph 15 depicts the dominant substrate observed in pool tail-outs. Gravel was the most dominant substrate type observed in 33.7% of all pools, succeeded by boulders at 26.2% and cobble at 22.5%.

Table 10 summarizes mean percent cover by habitat type in Tom's Creek while Table 20 summarizes the mean percent of shelter cover types for Level II habitat in Tom's Creek. In riffle habitats, boulders, at 39%, were the most dominant cover type, followed by terrestrial vegetation at 29%. In flatwater habitat types, aquatic vegetation was the most dominant shelter cover type at 46%, followed by terrestrial vegetation at 28%. Table 12 summarizes the dominant substrate by habitat type.

Canopy and Bank Vegetation

The riparian canopy of Hopper Canyon was comprised entirely of hardwood trees, consisting primarily of sycamore, coast live oak, cottonwood, and willows. Graph 17 depicts the mean percent canopy surveyed as 16.9%; therefore, 83.1% of the canopy was open. In addition, 10% of all units were completely open. The results were somewhat misleading due to the timing of the survey. At the time of the survey, many of the trees had begun to drop their leaves; therefore, the canopy would have been greater had the creek been surveyed earlier in the year.

For the surveyed length of Hopper Creek, the mean percent bank vegetated was 41% for the right bank and 44% for the left bank. Graph 21 depicts dominant bank vegetation by percentage, with brush vegetation dominant in 59.4% of all habitat units and hardwood tree vegetation dominant in 35.3% of all habitat units.

It should be noted that as the canyon continues to recover from the 2003 Piru Fire, the flood events of the 2004/2005 water year, the 2005/2006 drought year, and the 2007 Ranch Fire, the bank vegetation should consequently increase and may slowly change from brush dominant vegetation to tree dominant vegetation in time.

Tom's Canyon vegetation was similar to that of Hopper Canyon's; however, the stream bed was covered by considerably more terrestrial vegetation, including numerous fallen trees and thick overhanging branches and brush. This thick vegetation was especially apparent from the start of the survey at the confluence until 0.47 miles upstream and can presumably be attributed to this section being located at the southern limit of the 2007 Ranch fire, thus, this section of the tributary was not burned (see Map 2). Graph 18 depicts the mean percent canopy surveyed throughout Tom's Creek as 45.9% covered and 54.1% open. In addition, 2% of all units were found to be completely open.

Although Tom's Creek displayed considerably higher canopy density, the mean percent bank vegetated was lower with 29% for the right bank and 31% for the left bank. This could be attributed to steeper banks and a considerably narrower channel than Hopper Creek. Graph 22 depicts dominant bank vegetation by percentage with hardwood tree vegetation dominant in 53.8% of all habitat units and brush vegetation dominant in 42.3% of all habitat units.

Bank Composition

The dominant stream bank composition for Hopper Creek consisted of 39.1% boulder, 30.5% cobble/gravel, 22.2% bedrock, and 8.3% silt/clay/sand (Graph 19).

For Tom's Creek, the dominant stream bank composition consisted of 32.7% cobble/gravel, 26.9% boulder, 23.1% bedrock, and 17.3% silt/clay/sand (Graph 20).

This was consistent with the surrounding geologic features found elsewhere in the Santa Clara Watershed, which is uplifted marine terrace composed of late Miocene sedimentary formation.

Biological Inventory Results

Fish were observed in Hopper Creek from approximately 400 feet upstream of the start of the survey, until approximately 5.8 miles into the survey (7.3 miles up from the confluence with the Santa Clara River). Dip nets were used in random pools in reaches 2 and 3 to capture and identify fish to species. Fish species captured were identified as three-spine stickleback (*Gasterosteus aculeatus*) and arroyo chub (*Gila orcuttii*). Stickleback were only observed in the lower reaches, both in this survey and historically, whereas arroyo chub have previously been observed throughout the watershed. Pools with groups of fish numbering 100+ were common and abundant populations were observed in run habitat as well. These large groups were assumed to be comprised mostly of arroyo chub. Exotic species, such as the fathead minnow (*Pimephales promelas*), have historically been observed in the Santa Clara watershed but were not observed during this survey.

Two large pools located directly downstream of the waterfall were snorkeled on October 29, 2008. No fish species were observed in these pools; however, these pools were very deep with bedrock ledges providing cover. The divers could not sufficiently survey the pools to ascertain the presence/absence of fish. No *O. mykiss* were observed in the surveyed area even though the presence of *O. mykiss* was noted as recent as 2001. It is also possible that additional fish, including *O. mykiss*, could have gone undetected due to habitat cover throughout the entire length of the survey. Electrofishing and snorkeling of riffle, runs, and deeper pools in the spring/summer should be performed to verify the presence or absence of fish, particularly *O. mykiss*, as they are generally more difficult to detect through bankside observations or to capture through the use of dipnets.

No fish of any species were observed in Tom's Creek and it was assumed that fish did not populate this tributary during the survey due to extreme low water conditions.

Various reptiles and amphibians were observed throughout Hopper Canyon. California tree frogs (*Pseudacris cadaverina*) and pacific tree frogs (*Pseudacris regilla*) were observed approximately 2,000 feet from the start of the survey and were locally abundant throughout the canyon. Other species include numerous sightings of southwestern pond turtles (*Clemmys marmorata pallida*), two-striped garters (*Thamnophis hammondii*), and western fence lizards (*Sceloporus occidentalis*). Three coast horned lizards (*Phrynosoma coronatum*) were observed as well as one California toad (*Bufo boreas halophilus*) and one possible whiptail lizard (*Aspidoscelis tigris*). Reptiles and amphibians were less abundant in Tom's Creek; however, pacific and California tree frogs were observed along with two southwestern pond turtles and one coast horned lizard.

Throughout Hopper Creek, there was a fairly diverse and prolific population of macroinvertebrates. Macroinvertebrates observed included caddis flies, mayflies, katydids, giant water bugs, dragonflies, damselflies, grasshoppers, water striders, water boatman, and various aquatic larvae. The macroinvertebrate population observed in Tom's Creek was significantly smaller and less diverse. This could be attributed to extreme low water conditions and the lack of suitable substrate.

Numerous mammals, mammal tracks, and scat were also observed throughout the watershed. One California bobcat (*Lynx rufus californicus*) was seen in Hopper Canyon as well as a bobcat carcass; California ground squirrel (*Spermophilus beecheyi*) sightings were common. The numerous tracks, markings, and scat identified include those for black bear (*Ursus americanus*), coyote (*Canis latrans*), raccoon (*Procyon lotor*), Botta's pocket gopher (*Thomomys bottae*), and mule deer (*Odocoileus hemionus*). Through Tom's Canyon, numerous bear tracks were observed as well as many tracks that were presumably mountain lion (*Puma concolor*).

Bird species of note include, but were not limited to, ferruginous hawks (*Buteo regalis*), northern flickers (*Colaptes auratus*), canyon wrens (*Catherpes mexicanus*), house finch (*Carpodacus mexicanus*), mockingbirds (*Mimus polyglottos*), Anna's hummingbirds (*Calypte anna*), bushtits (*Psaltriparus minimus*), and American kestrels (*Falco sparverius*). One California condor (*Gymnogyps californianus*), a Federal and State endangered species, was also observed soaring above Hopper Canyon on the afternoon of November 25th.

Vegetation consisted primarily of native tree species throughout the riparian canopy of Hopper Canyon and Tom's Canyon; overall, invasive plant species were generally limited. Tree vegetation consisted primarily of willow (*Salix sp.*), western sycamore (*Platanus racemosa*), cottonwood (*Populus sp.*), and coast live oak (*Quercas agrifolia*), with occasional white alder (*Alnus rhombifolia*) and California black walnut (*Juglans californica*).

The most prolific invasive vegetation observed was tree tobacco (*Nicotiana glauca*), found most often in areas of disturbance throughout the canyon. In the lower reaches, castor bean (*Ricinus communis*) was observed around the levee and Peruvian peppertrees (*Schinus molle*) and eucalyptus (*Eucalyptus sp.*) were planted on the banks. Tamarisk (*Tamarix sp.*) was spotted on occasion in both the upper and lower reaches but their presence was limited. Tamarisk, however, is highly invasive and has caused extensive damage to a number of southern California streams and rivers. Efforts to monitor and/or deter the spread of its population should be considered. In the stream itself, watercress was also observed although the populations didn't appear to be overly abundant.

It should be noted that following the October 31st rain, increased river flow resulted in downstream flushing of pooled, standing oil from the various upstream oil seeps. The transported oil covered aquatic and terrestrial plant life and bank substrate up to the stream's bankfull height. The observed presence of wildlife, most notably fish and amphibians, was considerably diminished until the survey extended upstream beyond the oil seepages. Wildlife observations markedly increased upstream of the oil seepages. Prior to the rains, however, amphibians and fish were observed in numerous pools with oil seeps and appeared unaffected. It is unknown if the transported oil disturbance caused a decrease in wildlife or if significantly less wildlife observations were merely the result of the storm event.

The following species were either seen or noted via tracks, scat, or some other sign:

Fish	Arroyo chub	Three-spine stickleback	
Reptiles	Two-striped garter	Coastal whiptail	Coast horned lizard
	Western fence lizard	Southwestern pond turtle	
Amphibians	Pacific treefrog	California treefrog	Western toad
Birds	California condor	Ferruginous hawk	Northern flicker
	Canyon wren	House finch	Kestrel
	Anna's hummingbird	Bushtit	Mockingbird
Mammals	Mountain lion (tracks)	Black bear (tracks/scat)	Bobcat
	Coyote (tracks/scat)	Raccoon (tracks)	Mule deer (tracks/scat)
	Ground squirrel	Botta's pocket gopher	

PAST SURVEYS

Several previous studies and habitat surveys have been conducted in Hopper Creek from 1942 to 2008. These reports describe fish presence/absence and habitat suitability for *O. mykiss*. While these surveys varied in their level of detail, the majority included observations of resident *O. mykiss* populations and concluded that Hopper Creek could support steelhead runs based on the presence of suitable spawning and rearing habitat.

Location	Date	Notes	Source
Hopper Creek & Tom's Creek	1942-1947	"The following are other minor tributaries to the main stem Santa Clara River that have been stocked with hatchery rainbow trout, but whose CDFG files lack any mention or record of an historical steelhead run: Hopper Canyon Creek, for which there are rainbow trout stocking records dating back to 1942, 1944, and 1946 and its tributary, Tom's Creek, which was planted with fingerling rainbow trout in 1946 and contained 10-15cm trout in 1947…."	Titus 2000
Hopper Creek	1946-1947	A 1947 CDFG fishing report described the fishing as "poor this year since no fingerling plant was (made) in 1946".	Becker, G.S. and I.J. Reining 2008
Hopper Creek	1980	A 1980 report indicates the author's opinion that Hopper Canyon Creek "probably…served as spawning and rearing habitat for the historic steelhead run" (Moore 1980b). The opinion is based on the results of a 1979 survey.	Becker, G.S. and I.J. Reining 2008
Hopper Creek	1984	Rod Thompson, retired Ventura County Police Chief, reported that a close friend of his observed several trout in the 16" range and some bigger in the large pool below the waterfall identified in this report as the upstream natural limit to anadromy.	Stoecker and Kelley 2005
Hopper Creek, above anadromy	1985-1989	Rod Thompson reported that he fished Hopper Creek several times in this time period upstream of the large impassable waterfall and limit to anadromy. He reported excellent year-round flows in Hopper Creek and abundant rainbow trout upstream of the waterfall. He did not know how they got upstream of the waterfall	Stoecker and Kelley 2005

Hopper Creek & Tom's Creek	1992	Hopper Creek was surveyed on June 7 and 8, 1992 using an electrofisher. Arroyo chub were observed approximately 1km up from the Highway 126 and became increasingly abundant further upstream. Habitat was said to become increasingly better with increased water velocity, canopy and decreased water temperatures further upstream, with fair to good spawning areas in the upper reaches. First rainbow trout (RT) was observed 2.5 to 3 km (1.55 to 1.86 mi) upstream of the road end and additional RT (1-4 per pool) were observed as the survey commenced until the end of the survey at the first natural barrier, a 10-15 meter (33-50 feet) waterfall, 1.5km (0.93mi) from the first RT sighting. Toms Creek contained very low flows with no fish and, according to locals, went dry over the last five summers. Other species observed: southwestern pond turtles, numerous water snakes, fresh scat and prints of black bear, deer, and raccoon.	Parmenter, S. and D. McEwan 1999
Hopper Creek	2001	Trautwein reported seeing up to 10 rainbow trout approximately 12-16 inches on Hopper Creek upstream of Highway 126 to the large pool at the base of the impassable waterfall identified as the upstream limit to anadromy in this report. Trautwein also reported that Maurice Cardenas of the CDFG had surveyed Hopper Creek and observed rainbow trout presence.	Stoecker and Kelley 2005
Hopper Creek	2004	An electrofish survey was conducted on November 9, 2004 starting at the end of Hopper Canyon Road and ending approximately 2 miles upstream, 500-600 meters downstream from the waterfall (1648 seconds total time). No fish of any species were observed, however, many pools were deemed too deep to e-fish. A number of pools were also found to be heavily silted, possibly resulting from fires.	NMFS 2004
Hopper Creek	2005	A 2005 assessment of the Santa Clara system that included an analysis of steelhead recovery opportunities noted Hopper Creek as one of nine streams in the watershed most likely "…to support significant *O. mykiss* stocks during critical low water years....Hopper Creek contains a limited amount of high quality salmonid habitat and an existing *O. mykiss* population that may contribute to the anadromous steelhead population." (It should be noted that Hopper Creek was not physically surveyed for the report and relied on historic and personal accounts and visual observations by helicopter.)	Stoecker and Kelley 2005
Hopper Creek & Tom's Creek	2008	2008 survey of sensitive species in Hopper Canyon by DFG concluded with no sightings of steelhead; however, this survey did not focus on fish species and a more concentrated effort was reserved for amphibians and reptiles. Also, the survey did not extend up to the anadromy barrier and stopped short of where previous historical accounts of observed steelhead are located. Sensitive species observed: California condor, southwestern pond turtle, coast patch-nosed snake, two-striped garter snake, coast horned lizard, silvery legless lizard.	Semenson 2008

DISCUSSION

The lower reach of Hopper Creek was distinguished by a channelized levee that began at the confluence with Santa Clara River and continued for approximately 2.2 miles. At the time of the survey, subsurface flow was observed during the first 1.5 miles. From the levee, the surveyed portion of Hopper Creek then continued upstream through natural, unspoiled southern coast live oak riparian and southern riparian scrub habitat that supported a wide diversity of native flora and fauna. Although recent storm and fire events have altered the landscape and density of the vegetative habitat, the watershed appeared to be recovering with many native populations remaining intact. Even though the presence of steelhead went unnoted during the survey, the quality of the riparian and riverine habitat looked suitable for supporting a small *O. mykiss* population, as observed in the past.

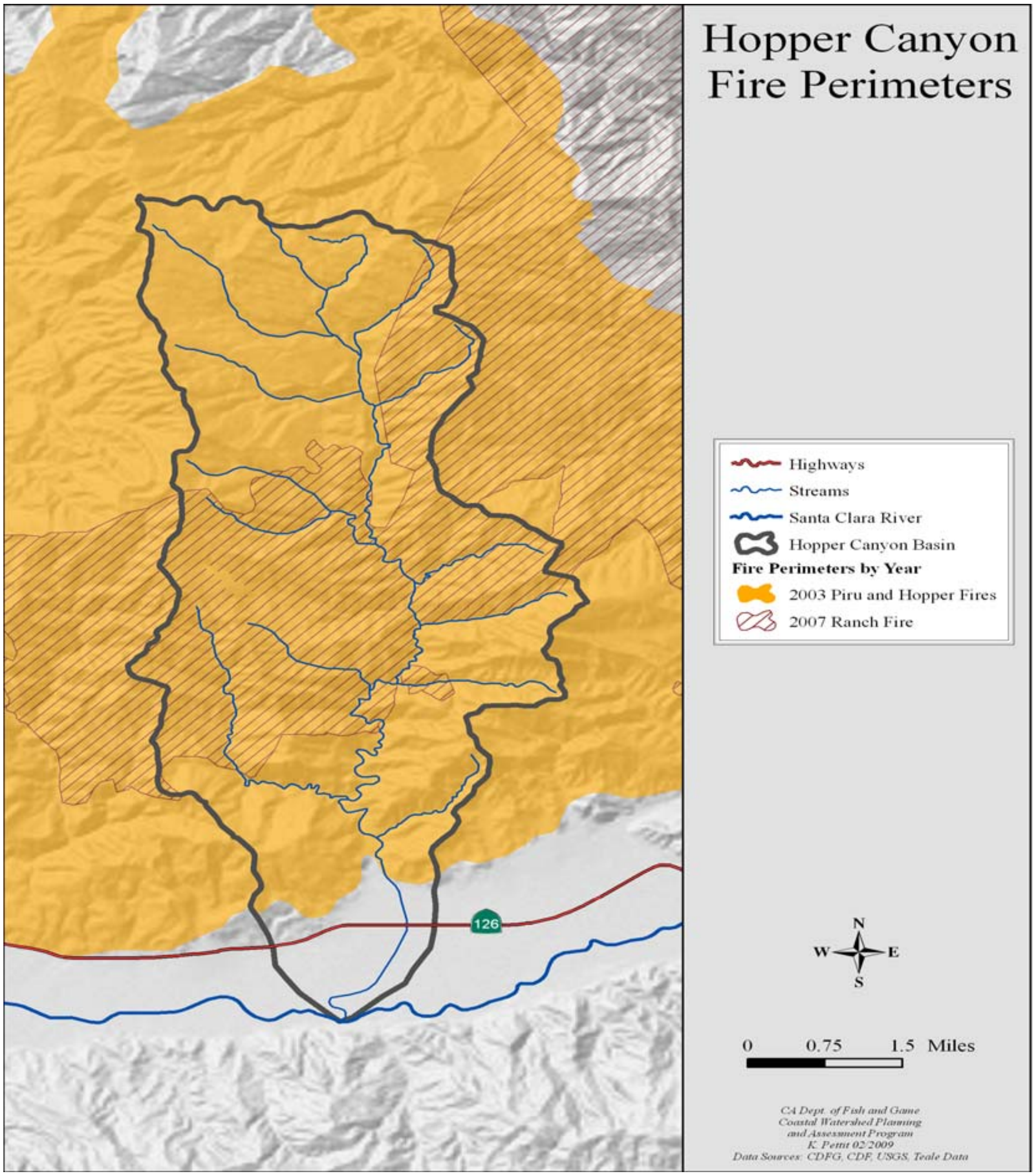
Although there is limited historical information on the presence of steelhead in Hopper Creek, it seems likely that steelhead historically used Hopper Creek as a spawning and rearing stream. A 1947 report described the fishing as "poor this year since no fingerling plant was (made) in 1946" indicating both historical planting and a population sufficient enough to support a recreational fishery. Personal accounts in 1984 and in 2001 described a reproducing *O. mykiss* population in Hopper Creek before the anadromy barrier. Reports from 1985-1989 indicated a reproducing resident *O. mykiss* population above the waterfall as well. In 1992, electrofishing and snorkel surveys detected multiple *O. mykiss* year classes from 2.5km to 3km (1.55 to 1.86 miles) above the end of the road, until the final pool beneath the waterfall. Even though historical accounts indicate an existing *O. mykiss* population both below and above the waterfall, no *O. mykiss* were observed during this survey.

It should be noted that a number of recent events have altered Hopper Canyon in a variety of ways. In October of 2003, the Piru fire burned down through Hopper Canyon consuming a majority of the systems vegetation and fuel litter, removing flow obstructions, and creating water-repellant soils that resulted in decreased water infiltration and storage throughout the watershed (Cannon, 2007). Following the fire was the 2004/2005 water year, the third wettest water year in recorded history for the towns of Fillmore and Piru, which border the Hopper Creek watershed to the west and east, respectively. The decrease in water infiltration and storage led to a dramatic increase in runoff, exacerbating the effects of the January 6-11, 2005 storm events that produced flood waters estimated around 19,000 cfs, well above the flood stage of 5,000 cfs (Cannon, 2007, see Figure 1). The 2004/2005 water year was followed by the driest water year in recorded history during the 2005/2006 season and the Ranch fire of 2007. Although not as extensive as the 2003 Piru fire, the Ranch fire burned much of the Canyon as well (see Map 2).

It is possible that the combination of these events led to a decline in Hopper Creek's resident *O. mykiss* population, although further presence-absence studies should be conducted to provide a more conclusive evaluation.

Figure 1: Hopper Creek at the 126 bridge, 1-19-2005

MAP 2



The habitat typing survey of Hopper Creek designated that flatwater habitat types comprised 55% of the total length of this survey, riffles 36%, and pools 9%. The pools were relatively deep, with 58 of the 80 (72.5%) pools having a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. However, the percent of pools by stream length increased progressively in the 2nd and 3rd reaches. No pools were found in the 1st reach, due in part to the man-made levee. In reach 2, the percent of pools by stream length was 4%, and, in reach 3, the percent of pools by stream length increased to 17%. In reach 3, the percent of pools with a residual pool depth greater than 2 feet increased to 92%. In 2nd order streams, a primary pool is defined to have a maximum residual depth of at least 2 feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy.

Fourteen of the 80 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-one of the pool tail-outs had embeddedness ratings of 3 or 4. Thirty-five of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning and mostly the result of the location of the pool tail-out residing in sections where the substrate was bedrock, boulder, or sand. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Although only 14 pool tail-outs measured had a rating of 1 or 2, there were also riffle and run sections throughout the survey that had potential to be used as spawning gravel beds. Forty-five of the 80 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids. The other determining factor involves the sampling method, which only measures potential spawning areas in pool-tails. Southern California steelhead also utilize riffles as potential spawning grounds. This survey methodology did not take this into account and thus did not record/evaluate these areas. Sediment sources in Hopper Canyon should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was 21, which was lower than the shelter rating of 45 in flatwater habitats. A pool shelter rating of approximately 100 is desirable. In Hopper Creek, aquatic vegetation was the dominant cover type in pools, followed by boulders; although, after the October 31, 2008 rain event, much of the filamentous algae that had yet to be surveyed was washed out. Filamentous algae provide pool cover during the hot summer months and are known to be consumed by *O. mykiss*, presumably for the invertebrates ensnared inside, thus providing not only cover but a vital food source (Merz, 2002). Log and root wad cover structures in pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 17%. Reach 1 had a canopy density of 6.72%, Reach 2 had a canopy density of 14.11%, and Reach 3 had a canopy density of 21.51%. The percentage of right and left bank covered with vegetation was moderate at 41% and 44%, respectively. Adequate canopy density consists of thick overhead riparian brush and tree vegetation that provides streambed shading to maintain cool water temperatures and cover to protect fish species from predators. In general, revegetation projects are considered when canopy density is less than 80%; however, since Hopper Canyon is still recovering from the 2003 Piru fire, the 2004/2005 storm events, and the 2007 Hopper fire, canopy is likely to increase as vegetation returns in the near future. During the survey, there were a number of young willow, mulefat, and sycamore sprouts observed throughout Hopper Canyon. The growth and development of this vegetation, along with additional recruitment, will further improve overall canopy, stabilize stream banks, moderate water temperatures, and potentially increase macro-invertebrate populations as well. Through the levee in Reach 1, however, vegetation was deterred by bank maintenance. There were also a number of exotic tree species such as eucalyptus, Peruvian pepper, castor bean and tobacco tree. Planting endemic hardwood tree species in the levee would deter bank erosion, promote bank stabilization, and possibly increase the water table.

Reach 1 began inside the man-made levee at the first signs of surface water and continued until the end of the levee. It contained 26 main channel units in 3,131 feet. The reach contained one stream crossing consisting of an unpaved road using a natural bottom Arizona crossing. This crossing would not pose any fish passage issues. Reach 1 was marked by long runs with aquatic vegetation being the dominant cover type. The aquatic vegetation consisted primarily of cattails and filamentous algae. There were no pools. Installing structures that will increase pool habitat could enhance overall stream habitat conditions and provide resting pools and cover for migrating fish. In addition, streambed-sediment in the levee should be mapped to determine if actions can be taken to increase streambed complexity, thus increasing continuous surface flow. According to the California Salmonid Stream Habitat Restoration Manual, the suitability of Reach 1, a F4 channel type, for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs; single and opposing wing-deflectors; channel constrictors; and log cover. It would, however, be poor for boulder clusters because there is a tendency for the clusters to become covered in sediment due to the decreased energy of flat water areas with slopes less than 1%.

Reach 2 began immediately upstream from the levee and contained 265 main channel units in 17,002 feet. It continued through Hopper Canyon and was crossed on ten occasions by the unpaved Hopper Canyon road. All road crossings were Arizona crossings, most with natural bottoms, although three were paved with concrete. Regular maintenance of this road is required following the winter rains. There were also man-made alterations to the streambed, such as boulder embankments, to decrease stream energy and divert flow of floodwaters in numerous sections. The natural streambed was clearly altered approximately 2.79 miles into the survey where a boulder levee was constructed for the road and the direction of flow was diverted away from the levee. This development appears to have been recently constructed and eliminated the presence of two road crossings mentioned in previous reports and observed in the Google Earth aerial shot as (see Figure 2). In this section, the substrate changed from gravel to sand and flow noticeably depreciated although it never went completely subsurface. In addition, a man-made gravel and boulder embankment was erected between the creek and the levee to prevent floodwaters from altering Hopper Canyon Road (see Figure 3). Reach 2 terminated near the end of the road and the last set of operating oil wells approximately 3.81 miles into the survey. According to the California Salmonid Stream Habitat Restoration Manual, the suitability of Reach 2, a B4 channel type, for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs; boulder clusters; bank placed boulders; single and opposing wing-deflectors; and log cover.

Figure 2: Streambed and Hopper Canyon Road Alterations, Aerial View

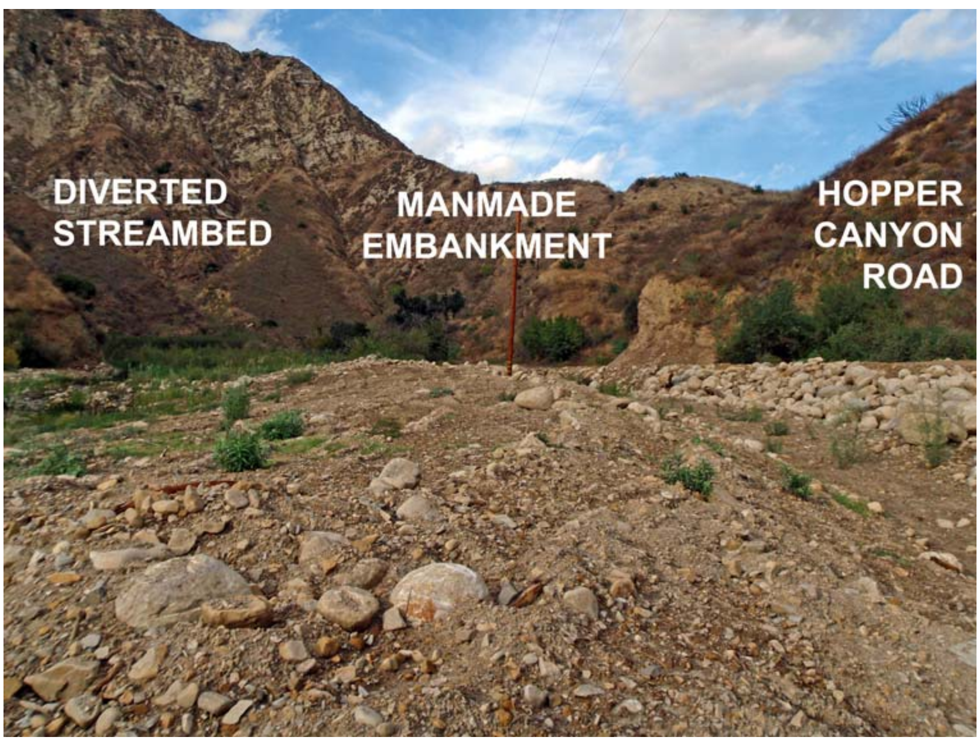


Figure 3: Streambed and Hopper Canyon Road Alterations

The only Arizona road crossing that created a potential migration barrier occurred approximately 4.86 miles upstream from the Hopper Creek confluence with the Santa Clara River (3.36 miles upstream from the start of the survey). The concrete Arizona crossing was 27 feet through the stream channel with a wetted width of 33 feet and a total width of 69.5 feet for the entire concrete crossing. This structure dammed the entire streambed creating a pool upstream of the road with a max depth of 3.0 feet. The crossing structure also created a downstream plunge of approximately 3.8 feet from the road to the pool surface with a maximum depth of 3.1ft at the time of the survey (see Figure 4). Like most hardened crossings in Southern California, this structure introduces a partial barrier for adult steelhead as a result of the 3.8 ft jump height from the plunge pool to the road surface and increased velocities over the road due to the lack of velocity breaks. With sufficient flow, this structure would be passable for adult steelhead; however, it would be a complete barrier for juvenile steelhead at all flows. A feasibility study should be conducted to develop alternatives to the Arizona crossing that would allow a greater window of opportunity for adult and juvenile steelhead.

Figure 4: Hopper Creek at Hopper Canyon Road Crossing Structure

Reach 3 continued upstream through Hopper Canyon until the waterfall through an F2 channel type. It contained 253 main channel units in 13,834 feet. Aside from occasional remnants of past oil drilling equipment scattered throughout the canyon, the creek flowed through undisturbed, natural habitat. Reach 3 contained the best *O. mykiss* habitat of the entire survey. In addition, all previous accounts of resident *O. mykiss* were located in this section of Hopper Creek. According to the California Salmonid Stream Habitat Restoration Manual, the suitability of Reach 3, a F2 channel type, for fish habitat improvement structures is as follows: fair for plunge weirs; single and opposing wing-deflectors; and log cover.

The surveyed length of Tom's Creek was a B5 channel type with 154 main channel units in

7,955 feet. It concluded at a 20-foot waterfall, which appeared to be the limit of anadromy. The lack of flow, inadequate pool habitat, and inadequate substrate, however, limit Tom's Creek as a viable tributary for an *O. mykiss* or steelhead population. Historic accounts indicate that the creek has gone dry a number of years and past surveys do not indicate the presence of fish of any species except for one CDFG account of *O. mykiss* in 1947; however, this was most likely a result of an *O. mykiss* plant the previous year in 1946.

Water temperatures can be a significant limiting factor for steelhead survival and reproduction. Juvenile steelhead oversummering in coastal streams of southern California can experience a continual warm-water environment. Recent work indicates that previously held notions concerning thermal limits and tolerance of southern California steelhead need to be reconsidered (Spina 2006; 2007). According to the *Guide to the reference values used in south-central/southern California coast steelhead conservation action planning (CAP) workbooks*, maximum weekly average temperatures (MWATS) associated with California steelhead growth and development are as follows (Kier Associates and NMFS 2008):

MWAT Range	Description
< 62.6ºF (17ºC)	Very Good
62.6-72.6ºF (17-22.5ºC)	Good
72.5-77.0ºF (22.5-25ºC)	Fair
≥ 77ºF	Poor

In Hopper Creek, water temperatures recorded on survey days ranged from 52ºF to 76ºF with the mean being 58.8ºF, well within the non-lethal range for *O. mykiss* survival. The upper limit temperature of 76ºF can be attributed to the initial survey start day of September 25. This day was abnormally hot with air temperatures exceeding 90ºF and resulted in the highest recorded water temperatures of the survey. Additionally, these temperatures were taken in the lowest reach of Hopper Creek within the levee boundaries where there was minimal stream flow and riparian canopy compared to the rest of the surveyed reaches further upstream. In late October, cooler weather prevailed with occasional rains in November. This resulted in lower water temperatures beneficial to steelhead growth and development.

Even though temperatures observed in Hopper Creek were within the non-lethal range for *O. mykiss* survival, it is possible that during the warmer months they may approach unsuitable levels. Therefore, water temperatures should be monitored throughout the summer months in the upper section of Hopper Creek where *O. mykiss* have historically been observed and more extensive water quality and temperature sampling would need to be conducted to develop further insight. In addition, there may be subsurface flow or cold seeps that are providing thermal refugia pools within Hopper Creek, as is seen in a number of southern California streams.

Temperatures studies were conducted in Topanga Creek from 2001-2005. These studies could serve as a basis for comparison for conditions that were observed in Hopper Creek during the warm summer months. Between June and September, maximum summer water temperatures throughout Topanga Creek ranged between 70ºF and 90ºF; however, high temperatures such as these did not last for significant periods of time and it should be noted that the average temperatures in all locations for all years typically fell within the range of 59ºF and 68ºF (Dagit, 2006). From the survey and the observed presence of *O. mykiss* throughout the year in the Topanga watershed, it was clear that *O. mykiss* were able to tolerate the warm temperatures. This is probably due to the presence of cold seeps and stratification within the pools. It's likely that the Hopper watershed experiences similar conditions to that of Topanga watershed; and, therefore, it can be assumed that an *O. mykiss* population in Hopper Creek should be able to persist.

Although designated an intermittent stream on the USGS 7.5 Fillmore Quadrangle, flows in Hopper Creek appeared sufficient to support a small population of *O. mykiss*. Especially considering the 2006/2007 and 2007/2008 water years were both drought years. Flows on Tom's Creek, however, appeared insufficient to support a population of *O. mykiss* and no fish of any species were observed throughout the creek, even though, numerous fish were observed above and below its confluence with Hopper. According to the 1992 survey, Tom's Creek has gone dry on a number of occasions. Two other tributaries entered Hopper with observable flow. Both, however, were deemed inaccessible or inhospitable for *O. mykiss* due to natural instream barriers.

A number of natural oil seeps were observed throughout the surveyed length of Hopper Creek and to a lesser degree in Tom's Canyon. According to local DCOR employee, George Reid, the seeps fill up throughout the dry summer months, resulting in downstream oil flow after the first significant rain event. The most significant seeps observed during the survey were located approximately 4.85 miles upstream from the Hopper Creek confluence at the Santa Clara river (approximately 3.35 miles upstream from the start of the survey) in a right bank side channel that stems from the plunge pool created by the concrete Arizona crossing structure barrier previously mentioned, with additional smaller seeps directly above the road crossing (see Figure 5 and Figure 6).

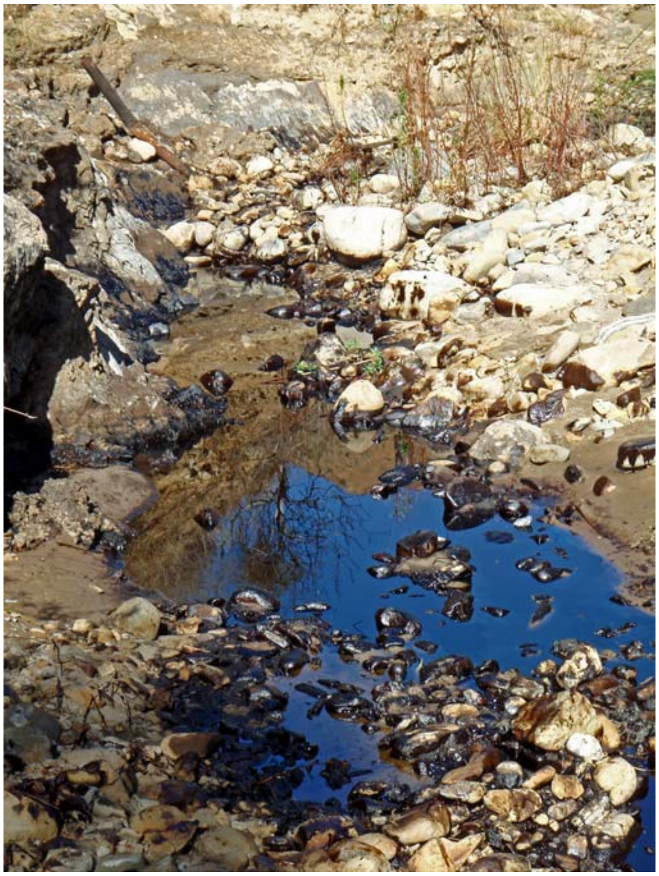


Figure 5: Hopper Creek Oil Seep beneath Hopper Creek Road Crossing

Figure 6: Hopper Creek Oil Downstream of Oil Seep

Following the October 31st rain, the first major precipitation event of the 2008/2009 water year, oil was observed covering short sections of the bank and terrestrial and aquatic vegetation approximately 0.63 miles downstream from the first major seeps, increasing in quantity as the survey continued upstream (see Figure 7). Approximately 0.19 miles downstream from the seeps, a thick layer of oil was observed covering all vegetation and bank substrate up to bankfull width while pooling in areas with eddies and low flow. There was also a noticeable decline in observable wildlife in the areas associated with the presence of oil after the rains. Once the survey moved past these seeps and the presence of oil became negligible, observable wildlife numbers appeared to return to normal.

Figure 7: Hopper Creek Oil Covered Vegetation

It should be noted that, before the rains, fish and amphibians were readily observed in and around pools where seeps were located and appeared unaffected. There were also sections where aquatic algae had become discolored, in some cases turning white (see Figure 8). This discoloring indicated a decline in photosynthesis, although whether this was the result of toxic elements being leached into the system or due to some other agent was not determined.

Figure 8: Hopper Creek Aquatic Vegetation near Oil Seep

Water quality sampling should be conducted in Hopper Creek to determine if water quality measurements for pH, dissolved oxygen, salinity, electrical conductivity, and nutrient loads are suitable for southern California steelhead throughout the year. Areas of specific concern should be in and around stream units where oil seeps have been observed. Although these seeps were observed historically when *O. mykiss* populations were present, it is possible the activity of these seeps have recently been altered in some manner, thus affecting the water chemistry of the stream and potentially negatively impacting water quality conditions and *O. mykiss* populations. However, based on the seemingly abundant populations of other fish species and numerous observations of reptile and amphibian species, it appears the presence of oil in the stream has little impact on their populations or survival.

Throughout most of the surveyed area in Hopper Creek, a large and diverse population of macroinvertebrates was present, providing a viable food source for rearing juvenile *O. mykiss* and steelhead. Macroinvertebrates include: caddis flies, mayflies, katydids, giant water bugs, dragonflies, damselflies, grasshoppers, water striders, water boatman, and various aquatic larvae. A more focused survey could provide greater insight into the abundance of macroinvertebrates and water quality conditions. The observed presence of macroinvertebrates in Tom's Creek was considerably less, most likely due to the lack of flow and adequate substrate.

CONCLUSION

Habitat surveys were conducted in Hopper Creek and in one of its associated tributaries, Tom's Creek, from September to November, 2008. The objective of the habitat surveys and this stream inventory report was to document the current habitat conditions, determine habitat suitability for steelhead, and recommend options for the potential enhancement of habitat in the Hopper Creek watershed for steelhead. While the surveys focused on habitat parameters associated with steelhead, additional observations in relation to past surveys of flora, fauna, and habitat alterations of note were also included.

Based on overall observed habitat conditions and the results of the habitat typing survey, Hopper Creek could support a small population of steelhead/*O. mykiss* and has historically supported populations as recently as 2002. Adequate flow regimes appear to exist in the middle and upper portions of the surveyed area, and Hopper Creek offered moderate to good instream habitat conditions for spawning and rearing *O. mykiss* and other native fish species. Spawning gravels, although limited in pool tail-outs, do appear in other habitat types throughout the stream, particularly in the upper reaches. Overall, pools were somewhat infrequent and lack cover; however, they did increase in frequency and displayed excellent mean residual pool depth as the creek proceeded upstream. Although current riparian vegetation was somewhat sparse, Hopper Canyon is still recovering from the 2003 Piru fire, the 2004/2005 flood events, and the 2007 Ranch fire. Evidence of recovery was observed along much of the stream survey as willow saplings, sycamores and, to a lesser extent, cottonwoods and alders were repopulating the stream banks. It is possible that a resident *O. mykiss* population still exists beneath and above the waterfall; however, a more thorough survey should be conducted to determine the presence of *O. mykiss* in both locations. Additional studies to provide further insight into the viability of Hopper Creek as a steelhead stream include water temperature monitoring during the summer months to determine if temperatures remain suitable for *O. mykiss*, a bioassessment to determine relative health of Hopper Creek in relation to macroinvertebrate population numbers and diversity, and water quality sampling for measurements such as pH, dissolved oxygen, salinity and nutrient levels to determine if conditions are suitable for the needs of steelhead/*O. mykiss*.

RECOMMENDATIONS

1) Hopper Canyon has supported a resident *O. mykiss* population and most likely supported a steelhead population in the past; therefore, it should be managed as an anadromous, natural production stream. Designing and implementing fish passage improvement projects in the lower channelized streambed and at the Arizona road crossing along Hopper Creek road at river mile 4.86, which has created a complete barrier for juvenile steelhead and a low flow barrier for adult steelhead, would facilitate adult migration to more suitable habitat upstream and allow juvenile *O. mykiss* to migrate up and downstream.

2) Although historically present, steelhead/*O. mykiss* were not observed during this survey; however, the survey did not include all means of determining *O. mykiss* presence/absence, such as seining, snorkeling, and electrofishing. In order to ascertain the presence/absence of *O. mykiss* as well as other native fish species in Hopper Creek, it would be advisable to conduct more forward surveys throughout sections of creek with suitable habitat, including known locations where *O. mykiss* have historically been observed, i.e. the pools below the waterfall barrier.

3) The limited water temperature data available suggests that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring should be performed for a 3- to 5-year period during the temperature extreme months of summer and early fall.

4) Perform a survey through the channelized subsurface section of Hopper Creek from the Santa Clara confluence to the starting point of this survey during flow conditions to determine passability for steelhead of this section and the duration of the passage window.

5) Increase the canopy on Hopper Creek throughout the levee in Reach 1 by planting appropriate native species like willow and sycamore trees along the banks will increase riparian cover; providing shade and cooler water temperatures. In many cases, planting will need to be coordinated with bank stabilization or upslope erosion control projects. Coordinated planting efforts along the top of levees have been shown to assist bank stabilization and draw the water table closer to the streambed, thus promoting surface flow.

6) Perform macroinvertebrate sampling to determine the community assemblage, species richness, and relative abundance on a quarterly basis for 3 years.

7) Perform water quality studies to determine whether water quality measurements in Hopper Creek are within the suitable range to support southern California steelhead.

8) Where feasible, design and install roughness elements to increase instream complexity in Reach 1. This must be done where the banks are stable or in conjunction with stream

bank armor to prevent erosion.

9) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream. Planting of native hardwoods in the lower reaches and throughout the levee would assist in stream bank erosion control.

10) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

11) Suitable size spawning substrate on Hopper Canyon is limited and relegated only to the upper reach. Projects should be designed at suitable sites to trap and sort spawning gravel.

12) Evaluate Hopper Creek spawning habitat by taking a closer look at the riffles to quantify the amount of additional spawning habitat and determine spawning habitat quality as well.

13) Install a stream gage in Hopper Creek in order to take daily records of stream flow.

14) Inventory invasive species, such as Tamarisk and tree tobacco, in the watershed. Develop a plan to remove these non-native species from the watershed.

REFERENCES

Becker, G.S. and I.J. Reining. 2008. Steelhead/rainbow trout (Oncorhynchus mykiss) resources south of the Golden Gate, California. Cartography by D.A. Asbury. Center for Ecosystem Management and Restoration. Oakland, CA.

Cannon, Dr. Susan. Post Fire Debris Flow Hazards in So Cal. US Geological Survey, Landslides Hazards Program.

Dagit, Rosi, K. Reagan. 2006. Southern Steelhead Trout Topanga Creek Monitoring Summary, June 2001-September 2005. Topanga, CA.

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins. 1998. California Salmonid Stream Habitat Restoration Manual, 3rd edition. California Department of Fish and Game, Sacramento, California.

Kier Associates and National Marine Fisheries Service. 2008. Guide to reference values used in the South-Central/Southern California Steelhead Conservation Action Planning (CAP) Workbooks. Arcata, CA and NOAA Fisheries, National Marine Fisheries Service, Southwest Region, Long Beach, CA.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

McInnis, Rodney R. 2008. Final Biological Opinion – Approve United Water Conservation District’s Proposal to Operate the Vern Freeman Diversion and Fish-Passage Facility. National Marine Fisheries Service, Southwest Region.

Merz, Joseph E., 2002. Seasonal Feeding Habits, Growth, and Movement of Steelhead Trout in the Lower Mokelumne River. California Fish and Game 88(3):95-111 2002.

Moore, M. R. 1980a. An assessment of the impacts of the proposed improvements to the Vern Freeman Diversion on anadromous fishes of the Santa Clara River system, Ventura County, California. Contract Report 670 to the Ventura County Environmental Resources Agency.

[NMFS] National Marine Fisheries Service. 2004. Field Notes for NMFS survey on Hopper Canyon, 9 November 2004. Report by Heidi Fish.

[NMFS] National Marine Fisheries Service. 2008. Final Biological Opinion – Approve United Water Conservation District’s Proposal to Operate the Vern Freeman Diversion and Fish-Passage Facility. National Marine Fisheries Service, Southwest Region.

Parmenter, S. and D. McEwan. 1999. 1992 Stream Surveys of Several Ventura and Los Angeles County Streams. California Department of Fish and Game.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam

Semonson, Vince. 2008. Senstive Species Survey Report, Hopper Canyon. Prepared for DCOR by VJS Biological Consulting.

Spina, A.P. 2007. Thermal ecology of juvenile steelhead in a warm-water environment. Environmental Biology of Fishes.

Stoecker, M. and E. Kelley, Ph.D. 2005. Santa Clara River Steelhead Trout Assessment and Recovery Opportunities. Prepared for the Nature Conservancy and the Santa Clara Trustee Council. pp.107, 127-130.

Swift, C.C. 2003. Survey for Native Fishes in the Santa Clara River, vicinity of Fillmore, Ventura County, with special reference to the federally endanger south coast steelhead. Prepared for Envicom corporation.

Titus et. a. 2003. History and Status of Steelhead in California Coastal Drainages South of San Francisco Bay – Draft. California Department of Fish and Game.

APPENDIX 1: COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

HOPPER CREEK Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Start of Survey:
0	0001.00	Bio Sample: (Bank Observation) Fish observed 400 feet after start. (unidentified, most likely arroyo chub, fathead minnow, and/or stickleback)
0	0001.00	Access Points / Location: (Road) waterflow observed 300 feet above 126; from this point to mouth the creek is channelized and subsurface
2094	0010.00	General Comment: Vegetation observed: heavy algae growth throughout, cattails throughout, willows & mulefat dominant bank veg, some cottonwood, tobacco tree (non-native), entirely channelized, runs through a citrus grove. Animals observed: fish (arroyo chub, fathead minnow, and/or stickleback); lizard
2124	0011.00	General Comment: Fauna observed: first California tree frog seen; possible whiptail lizard; salt residue observed on banks (possible pesticide or mineral runoff)
2310	0014.00	General Comment: tree lined (willow)
2481	0016.00	Access Points / Location: (Road) GPSHOPCKRX01 (GPS), instream cobble road crossing
2568	0018.00	General Comment: pacific tree frog
2607	0019.00	General Comment: NON-NATIVE: tamarisk observed; fauna: pac & cal treefrog
3131	0027.00	General Comment: New channel type; levee ends
3170	0028.00	General Comment: levee ends
3228	0032.00	General Comment: clay bank
3241	0033.00	General Comment: clay bank

HOPPER CREEK Position (ft.)	Habitat Unit #	Comments:
3568	0039.00	General Comment: cattails cover unit, very thick
3738	0041.00	General Comment: Large fish observed, 5" (assumed to be arroyo chub), backwater pool really bedrock formed, not boulder
5547	0078.00	General Comment: Overgrown cattails in channel
5547	0078.00	Tributaries: Left Bank Trib observed
5927	0080.00	General Comment: Channel Type Taken
5945	0081.00	Bio Sample: (Other) dipnet: stickleback and arroyo chub observed
6537	0098.00	Access Points / Location: (Road) Assumed road crossing in this unit or neighboring units
6869	0100.01	General Comment: Length missing: assumed length to be 30 feet
6869	0100.01	Erosion Site: (Bank) side channel created by landslide
6869	0101.00	General Comment: (ext. erosion site comment) Rock some sort of sandstone. Stream will most likely clear out sediment and downcut through material. Upstream of landslide a large pool has formed. Update: Landslide occurred during the summer of 2008 according to local George Reid, after one day of rain, the obstructing talus field was cleared and the pool emptied to become a long, deep, wide run. Piru precipitation indicated approx. 1.2 inches of rain. Assuming 1-3 inches of rainfall for Hopper Canyon.
6869	0101.00	Erosion Site: (Bank) Right bank landslide; 192 feet in length, extends approximately150 feet up the hillside. Landslide has created a talus or scree that extends into the creek. This has created a low flow barrier. Landslide material is very erosive and easily breaks apart
6940	0102.00	General Comment: 1st rain cleared the obstructed area emptying the dammed pool and creating a long, wide, deep run.
7837	0108.00	General Comment: missing 100% for % unit covered; adjusted boulders from 40% to 45%
7931	0110.00	General Comment: looked up embeddedness; began rechecking embeddedness

HOPPER CREEK Position (ft.)	Habitat Unit #	Comments:
8478	0123.00	General Comment: sycamores observed; bedrock channel
9581	0147.00	General Comment: added 1.2 unit, divided long 1.1 unit into new 1.2 unit and smaller 1.1 unit
10303	0160.00	Tributaries: Tom's Creek confluence from right bank. Difficult to observe due to heavy aquatic and terrestrial vegetation.
10371	0161.00	General Comment: overrun with cattails
10371	0161.00	Access Points / Location: (Road) HOPCKRDX03 (GPS road crossing point)
10789	0165.00	General Comment: lots of veg
11643	0177.00	Structures: HOPCKRDX04 (GPS) road crossing
11829	0181.00	General Comment: cattails overgrown
12915	0195.00	General Comment: 4 pond turtles
13413	0201.00	Structures: road crossing
13507	0201.01	Structures: side channel created by channel diversion, piles of rocks deflecting stream energy
13708	0208.00	General Comment: aquatic plant growth over tail crest gravel
14309	0215.00	General Comment: after rain, oil on a lot of veg; fewer fish, fewer frogs observed
14733	0220.00	Structures: man-made road diversion at the end, very soft sand, rock piles and boulders
15560	0226.00	General Comment: three overlapping channels; two side channels and one main channel through the middle
16065	0233.00	Structures: HOPCKRDX07 (GPS) instream road crossing
16533	0239.00	General Comment: pipe inside pool
16595	0239.01	General Comment: bear scat

HOPPER CREEK Position (ft.)	Habitat Unit #	Comments:
16595	0239.01	Tributaries: HOPCKTRB02 (GPS) trib pics
16595	0240.00	General Comment: oil everywhere
17231	0248.00	General Comment: oil on all gravel, oil everywhere, some pac treefrogs, few fish
17530	0251.00	General Comment: oil slick cattails
17574	0252.00	Structures: in stream road crossing
17617	0253.00	General Comment: oil seep
17702	0253.01	General Comment: entire side channel is an oil seep
17757	0255.00	Structures: Road crossing; 4 ft drop, oil everywhere
17829	0257.00	Structures: pool created by road
17852	0258.00	General Comment: fish, pac frogs
17949	0259.00	General Comment: oil everywhere
18082	0261.00	General Comment: 3 overlapping channels, pipes going through main channel; rockslide broke 1 pipe that's now leaking
18269	0266.00	Structures: road crossing 10, no point
18957	0277.00	General Comment: road crossing 11, no point
19414	0284.00	Tributaries: HOPCKTRB03 (GPS)
19835	0287.00	General Comment: cottonwoods
20067	0291.00	Structures: road ends
20133	0292.00	General Comment: Channel Type Change: F2
20277	0292.01	General Comment: channel type change
20786	0303.00	Structures: man-made pool, dammed with stacked boulders
21433	0312.00	General Comment: pool tail substrate could be gravel or small/large

HOPPER CREEK Position (ft.)	Habitat Unit #	Comments:
		cobble
21608	0315.00	General Comment: two boulders form a weird midchannel pool
21769	0321.00	Tributaries: trib
22508	0334.00	General Comment: 50/50gravel cobble
22895	0342.00	Tributaries: trib coming in
25089	0378.00	General Comment: sand covered gravel
26161	0397.00	Tributaries: trib
26510	0403.00	General Comment: ash trees observed, cotton, sycamore, willow
27288	0413.00	General Comment: oil seep, water seep
28498	0438.00	General Comment: very wide and shallow, dense, high veg, cattails and willows
28806	0442.00	Structures: water tank observed
28855	0443.00	Tributaries: left bank trib; HOPCKTRB07 (GPS), has water trickle and thick oil seepage
28951	0445.00	General Comment: beer raccoon track
30403	0472.00	General Comment: turtle
30454	0473.00	General Comment: bobcat
30528	0475.00	General Comment: no fish
30689	0479.00	General Comment: no fish
32273	0515.00	Tributaries: trib
32958	0525.00	General Comment: great spawning gravel
33424	0533.00	General Comment: good gravel
33565	0534.01	General Comment: impassable side channel

HOPPER CREEK Position (ft.)	Habitat Unit #	Comments:
33565	0534.01	Tributaries: right bank trib, impassable
33747	0542.00	General Comment: snorkel survey revealed no fish, estimated measurement
33867	0544.00	General Comment: estimated
33967	0544.00	End of Survey: 40ft waterfall to pool, snorkel survey revealed no fish

TOM'S CREEK Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Start of Survey: Confluence with Hopper Creek, very dense cattails at confluence, heavy veg throughout the creek, low flow but continuous until anadromous barrier at a 20ft waterfall
0	0001.00	General Comment: No fish seen throughout. Observed Fauna: Pac & Cal treefrogs, Western Pond Turtle, coast horned lizard, numerous mountain lion and bear tracks throughout; Flora: willow, mulefat, oak, sycamore; Heavy vegetation throughout including large fallen trees at numerous spots
101	0003.00	General Comment: Dense veg
236	0006.00	General Comment: dense veg
399	0008.00	General Comment: through bedrock
2458	0042.00	General Comment: Fence and dirt road
2549	0043.00	Tributaries: right bank trib enters next to dirt road, pics
2891	0049.00	General Comment: pac tree frogs
3320	0059.00	General Comment: missed air temp; assuming 60
3664	0069.00	General Comment: unknown track ~4in, claws showing, pic
3754	0072.00	Tributaries: TOMCKTRB03 (GPS point)
4386	0087.00	General Comment: No sub, assuming 1)B, 2)C

TOM'S CREEK		
Position (ft.)	**Habitat Unit #**	**Comments:**
4699	0097.00	General Comment: Missing 10% shelter rating (10 to terrestrial added, remembered unit); pool measurements missing (added measurements 0.2, 5 and B; had to guess measurements but remembered unit)
4794	0100.00	General Comment: missing % covered, assuming 5
5841	0120.00	General Comment: turtles observed; mountain lion tracks, bear tracks
6188	0127.00	General Comment: missing measurements
6580	0135.00	Tributaries: trib, no GPS point
6735	0139.00	General Comment: mountain lion and bear tracks
7955	0154.00	End of Survey: impassable waterfall approximately 20 ft high

APPENDIX 2: LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

APPENDIX 3: TABLES

Table 1: Hopper Creek - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
270	54	FLATWATER	45.1	79	21245	55.1	13.2	0.8	1.3	1271	343213	1084	292651		45
81	79	POOL	13.5	41	3342	8.7	13.5	1.8	3.0	602	48737	1641	131270	1400	21
248	45	RIFFLE	41.4	56	13975	36.2	10.0	0.5	1.0	430	106567	248	61455		47

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
599	178	38562	498517	485375

Table 2: Tom's Creek - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Tom's Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
2	2	DRY	1.3	21	42	0.5	3.5								0
76	10	FLATWATER	48.1	37	2826	34.9	4.9	0.3	0.7	131	9974	46	3491		5
1	1	POOL	0.6	13	13	0.2	12.0	0.3	1.5	148	148	74	74	44	40
79	13	RIFFLE	50.0	66	5215	64.4	4.6	0.2	0.6	186	14732	41	3200		26

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
158	26	8096	24854	6765

Table 3: Hopper Creek - Summary of Habitat Types and Measured Parameters

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
222	36	LGR	37.1	58	12765	33.1	10.0	0.5	1.9	460	102065	248	55043		35	15
25	8	HGR	4.2	46	1156	3.0	11.0	0.8	2.2	305	7625	252	6306		103	19
1	1	CAS	0.2	54	54	0.1	8.0	0.6	2.0	346	346	207	207		5	24
231	41	RUN	38.6	81	18801	48.8	14.0	0.8	4.5	1529	353202	1308	302082		39	18
39	13	SRN	6.5	63	2444	6.3	10.0	0.7	2.0	458	17859	378	14742		62	18
63	62	MCP	10.5	43	2740	7.1	13.0	1.9	14.6	629	39632	1822	112934	1576	18	19
5	5	LSBk	0.8	46	232	0.6	16.0	1.4	3.8	694	3469	1224	6119	969	19	14
2	2	LSBo	0.3	21	42	0.1	10.0	0.8	1.4	208	416	253	506	170	35	7
7	7	PLP	1.2	30	210	0.5	12.0	1.2	3.9	345	2417	686	4804	484	48	5
1	1	SCP	0.2	42	42	0.1	6.0	2.1	3.0	239	239	599	599	503	10	43
2	1	BPB	0.3	15	30	0.1	16.0	1.5	1.9	288	576	605	1210	432	30	42
1	1	DPL	0.2	46	46	0.1	37.0	2.1	4.5	1702	1702	4255	4255	3574	5	11

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
599	178	38562	529548	508805

Table 4: Tom’s Creek - Summary of Habitat Types and Measured Parameters

Stream Name: Tom’s Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
74	12	LGR	46.8	69	5072	62.6	4.0	0.2	1.2	184	13617	38	2848		28	50
5	1	CAS	3.2	29	143	1.8	6.0	0.3	0.7	216	1080	65	324		5	47
73	9	RUN	46.2	32	2353	29.1	5.0	0.3	1.1	122	8872	41	3017		4	46
3	1	SRN	1.9	158	473	5.8	5.0	0.4	1.3	219	656	87	262		5	14
1	1	PLP	0.6	13	13	0.2	12.0	0.3	1.5	148	148	74	74	44	40	40
2	2	DRY	1.3	21	42	0.5	4.0			0	0				150	9

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
158	26	8096	24373	6525

Table 5: Hopper Creek - Summary of Pools

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid. Vol (cu.ft.)	Mean Shelter Rating
63	62	MAIN	78	43	2740	82	13.3	1.9	629	39632	1576	97688	18
14	14	SCOUR	17	35	484	14	12.9	1.2	450	6302	612	8568	31
4	3	BACKWATER	5	30	118	4	19.7	1.9	743	2973	1503	6012	15

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
81	79	3342	48906	112268

Table 6: Tom's Creek - Summary of Pools

Stream Name: Tom's Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid. Vol (cu.ft.)	Mean Shelter Rating
1	1	SCOUR	100	13	13	100	12.0	0.3	148	148	44	44	40

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
1	1	13	148	44

Table 7: Hopper Creek - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
62	MCP	78	1	2	12	19	18	29	17	27	14	23
2	BPB	3	0	0	2	100	0	0	0	0	0	0
2	LSBo	3	0	0	2	100	0	0	0	0	0	0
7	PLP	9	0	0	3	43	3	43	1	14	0	0
5	LSBk	6	0	0	2	40	2	40	1	20	0	0
1	DPL	1	0	0	0	0	0	0	0	0	1	100
1	SCP	1	0	0	0	0	0	0	1	100	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Feet Max Resid. Depth	Total 1< 2 Feet % Occurrence	Total 2< 3 Feet Max Resid. Depth	Total 2< 3 Feet % Occurrence	Total 3< 4 Feet Max Resid. Depth	Total 3< 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
80	1	1	21	26	23	29	20	25	15	19

Mean Maximum Residual Pool Depth (ft.): 3

Table 8: Tom's Creek - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Tom's Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
1	PLP	100	0	0	1	100	0	0	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Feet Max Resid. Depth	Total 1< 2 Feet % Occurrence	Total 2< 3 Feet Max Resid. Depth	Total 2< 3 Feet % Occurrence	Total 3< 4 Feet Max Resid. Depth	Total 3< 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
1	0	0	1	100	0	0	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 2

Table 9: Hopper Creek - Summary of Mean Percent Cover By Habitat Type

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
222	36	LGR	0	0	0	0	17	32	13	38	0
25	8	HGR	0	0	0	0	3	4	43	50	0
1	1	CAS	0	0	0	0	0	0	100	0	0
231	42	RUN	0	0	0	0	17	51	4	29	0
39	13	SRN	0	0	0	0	15	24	24	36	0
63	21	MCP	12	0	0	0	9	44	9	25	0
5	5	LSBk	34	0	0	0	4	39	10	13	0
2	2	LSBo	0	0	0	0	23	48	15	15	0
7	3	PLP	18	0	0	0	3	0	52	27	0
1	1	SCP	30	0	0	0	50	20	0	0	0
2	1	BPB	50	0	0	0	15	35	0	0	0
1	1	DPL	0	0	0	0	0	100	0	0	0

Table 10: Tom’s Creek - Summary of Mean Percent Cover By Habitat Type

Stream Name: Tom’s Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
74	12	LGR	0	0	0	0	27	20	11	42	0
5	1	CAS	0	0	0	0	50	0	50	0	0
73	9	RUN	0	0	0	0	31	48	4	17	0
3	1	SRN	0	0	0	0	0	20	40	40	0
1	1	PLP	0	0	0	0	10	20	50	20	0

Table 11: Hopper Creek - Summary of Dominant Substrates By Habitat

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
222	36	LGR	0	0	36	14	11	33	6
25	8	HGR	0	0	0	0	0	100	0
1	1	CAS	0	0	0	0	0	0	100
231	42	RUN	5	24	21	17	5	21	7
39	13	SRN	0	8	23	0	0	62	8
63	21	MCP	10	38	33	5	5	0	10
5	5	LSBk	0	80	20	0	0	0	0
2	2	LSBo	50	50	0	0	0	0	0
7	3	PLP	0	0	33	0	33	0	33
1	1	SCP	100	0	0	0	0	0	0
2	1	BPB	0	100	0	0	0	0	0
1	1	DPL	0	100	0	0	0	0	0

Table 12: Tom's Creek - Summary of Dominant Substrates By Habitat

Stream Name: Tom's Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
74	12	LGR	0	92	0	0	0	8	0
5	1	CAS	0	0	0	0	0	0	100
73	9	RUN	11	89	0	0	0	0	0
3	1	SRN	0	100	0	0	0	0	0
1	1	PLP	0	100	0	0	0	0	0

Table 13: Hopper Creek - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
17	0	100	10	41	44

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 14: Tom's Creek - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Tom's Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
46	0	100	2	29	31

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 15: Hopper Creek - Fish Habitat Inventory Data

Stream Name: Hopper Canyon   LLID: 1188372343842   Drainage: Piru
Survey Dates: 9/25/2008 to 11/19/2008   Survey Length (ft.): 38562   Main Channel (ft.): 33967   Side Channel (ft.): 4595
Confluence Location: Quad: COBBLESTONE   Legal T04NR19WS35   Latitude 34:23:03.0N   Longitude: 118:50:14.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4
Reach Length (ft.): 3131
Riffle/Flatwater Mean Width (ft.): 9.0
BFW:
Range (ft.): 37 to 37
Mean (ft.): 37
Std. Dev.: 0
Base Flow (cfs): 1.8
Water (F): 63 - 76 Air (F): 77 - 93
Dry Channel (ft.): 0

Canopy Density (%): 6.7
Coniferous Component (%): 0.0
Hardwood Component (%): 100.0
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 47.1
Dominant Shelter: Aquatic Vegetation
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 0.0
Pool Frequency (%): 0.0
Residual Pool Depth (%):
< 2 Feet Deep:
2 to 2.9 Feet Deep:
3 to 3.9 Feet Deep:
>= 4 Feet Deep:
Mean Max Residual Pool Depth (ft.):
Mean Pool Shelter Rating:

Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0

STREAM REACH: 2

Channel Type: B4
Reach Length (ft.): 17002
Riffle/Flatwater Mean Width (ft.): 13.0
BFW:
Range (ft.): 43 to 43
Mean (ft.): 43
Std. Dev.: 0
Base Flow (cfs): 1.8
Water (F): 52 - 69 Air (F): 57 - 87
Dry Channel (ft.): 0

Canopy Density (%): 14.1
Coniferous Component (%): 0.0
Hardwood Component (%): 100.0
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 51.8
Dominant Shelter: Aquatic Vegetation
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 3.9
Pool Frequency (%): 9.4
Residual Pool Depth (%):
< 2 Feet Deep: 64.3
2 to 2.9 Feet Deep: 28.6
3 to 3.9 Feet Deep: 7.1
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 1.86
Mean Pool Shelter Rating: 30

Pool Tail Substrate (%): Silt/Clay: 3.6 Sand: 25.0 Gravel: 50.0 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 7.1 Bedrock: 14.3
Embeddedness Values (%): 1. 25.0 2. 10.7 3. 14.3 4. 0.0 5. 50.0

Table 15: Hopper Creek - Fish Habitat Inventory Data (continued)

Stream Name: Hopper Canyon LLID: 1188372343842 Drainage: Piru
Survey Dates: 9/25/2008 to 11/19/2008 Survey Length (ft.): 38562 Main Channel (ft.): 33967 Side Channel (ft.): 4595
Confluence Location: Quad: COBBLESTONE Legal T04NR19WS35 Latitude 34:23:03.0N Longitude: 118:50:14.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: F2
Reach Length (ft.): 13834
Riffle/Flatwater Mean Width (ft.): 11.2
BFW:
Range (ft.): 36 to 36
Mean (ft.): 36
Std. Dev.: 0
Base Flow (cfs): 1.8
Water (F): 52 - 59 Air (F): 52 - 80
Dry Channel (ft.): 0

Canopy Density (%): 21.5
Coniferous Component (%): 0.0
Hardwood Component (%): 100.0
Dominant Bank Vegetation: Brush
Vegetative Cover (%): 29.2
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 16.8
Pool Frequency (%): 19.4
Residual Pool Depth (%):
< 2 Feet Deep: 7.7
2 to 2.9 Feet Deep: 28.8
3 to 3.9 Feet Deep: 34.6
>= 4 Feet Deep: 28.8
Mean Max Residual Pool Depth (ft.): 3.63
Mean Pool Shelter Rating: 12

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 3.8 Gravel: 25.0 Sm Cobble: 34.6 Lg Cobble: 0.0 Boulder: 36.5 Bedrock: 0.0
Embeddedness Values (%): 1. 1.9 2. 5.8 3. 48.1 4. 3.8 5. 40.4

Table 16: Tom's Creek - Fish Habitat Inventory Data

Stream Name: Tom's Creek   LLID: 1188354344229   Drainage: Piru
Survey Dates: 11/20/2008 to 11/24/2008   Survey Length (ft.): 8096   Main Channel (ft.): 7955   Side Channel (ft.): 141
Confluence Location: Quad: PIRU   Legal T04NR19WS14   Latitude 34:25:22.0N   Longitude: 118:50:07.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B5
Reach Length (ft.): 7955
Riffle/Flatwater Mean Width (ft.): 4.7
BFW:
Range (ft.): 17.29 to 17.299
Mean (ft.): 17.3
Std. Dev.: 2.00117700188684
Base Flow (cfs): 0.4
Water (F): 51 - 64   Air (F): 60 - 85
Dry Channel (ft.): 42

Canopy Density (%): 45.9
Coniferous Component (%): 0.0
Hardwood Component (%): 100.0
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 29.6
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 0.2
Pool Frequency (%): 0.6
Residual Pool Depth (%):
< 2 Feet Deep: 100.0
2 to 2.9 Feet Deep: 0.0
3 to 3.9 Feet Deep: 0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 1.5
Mean Pool Shelter Rating: 40

Pool Tail Substrate (%): Silt/Clay: 0.0   Sand: 100.   Gravel: 0.0   Sm Cobble: 0.0   Lg Cobble: 0.0   Boulder: 0.0   Bedrock: 0.0
Embeddedness Values (%): 1. 0.0   2. 0.0   3. 0.0   4. 0.0   5. 100.0

Table 17: Hopper Creek - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

Mean Percentage of Dominant Stream Bank

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	29	30	22.2
Boulder	50	54	39.1
Cobble/Gravel	39	42	30.5
Sand/Silt/Cla	15	7	8.3

Mean Percentage of Dominant Stream Bank

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage
Grass	8	3	4.1
Brush	80	78	59.4
Hardwood Trees	45	49	35.3
Coniferous	0	0	0.0
No	0	3	1.1

Total Stream Cobble Embeddedness 4

Table 18: Tom's Creek - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Tom's Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

Mean Percentage of Dominant Stream Bank

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	5	7	23.1
Boulder	8	6	26.9
Cobble/Gravel	9	8	32.7
Sand/Silt/Cla	4	5	17.3

Mean Percentage of Dominant Stream Bank

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage
Grass	2	0	3.8
Brush	10	12	42.3
Hardwood Trees	14	14	53.8
Coniferous	0	0	0.0
No	0	0	0.0

Total Stream Cobble Embeddedness 5

Table 19: Hopper Creek - Mean Percent of Shelter Cover Types For Entire Stream

Stream Name: Hopper Canyon **LLID:** 1188372343842 **Drainage:** Piru

Survey Dates: 9/25/2008 to 11/19/2008

Confluence **Quad:** COBBLESTONE MTN. **Legal** T04NR19WS35 **Latitude:** 34:23:03.0N **Longitude:** 118:50:14.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	17
SMALL WOODY DEBRIS (%)	0	0	0
LARGE WOODY DEBRIS (%)	0	0	0
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	14	16	10
AQUATIC VEGETATION (%)	27	44	40
WHITEWATER (%)	20	8	13
BOULDERS (%)	39	31	20
BEDROCK LEDGES (%)	0	0	0

Table 20: Tom’s Creek - Mean Percent of Shelter Cover Types For Entire Stream

Stream Name: Tom’s Creek **LLID:** 1188354344229 **Drainage:** Piru

Survey Dates: 11/20/2008 to 11/24/2008

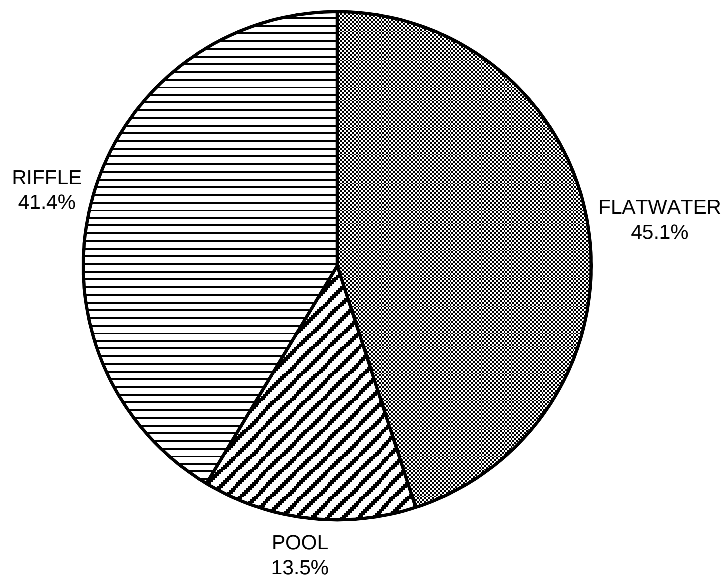
Confluence **Quad:** PIRU **Legal** T04NR19WS14 **Latitude:** 34:25:22.0N **Longitude:** 118:50:07.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	0
SMALL WOODY DEBRIS (%)	0	0	0
LARGE WOODY DEBRIS (%)	0	0	0
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	29	28	10
AQUATIC VEGETATION (%)	18	46	20
WHITEWATER (%)	14	8	50
BOULDERS (%)	39	20	20
BEDROCK LEDGES (%)	0	0	0

APPENDIX 4: GRAPHS

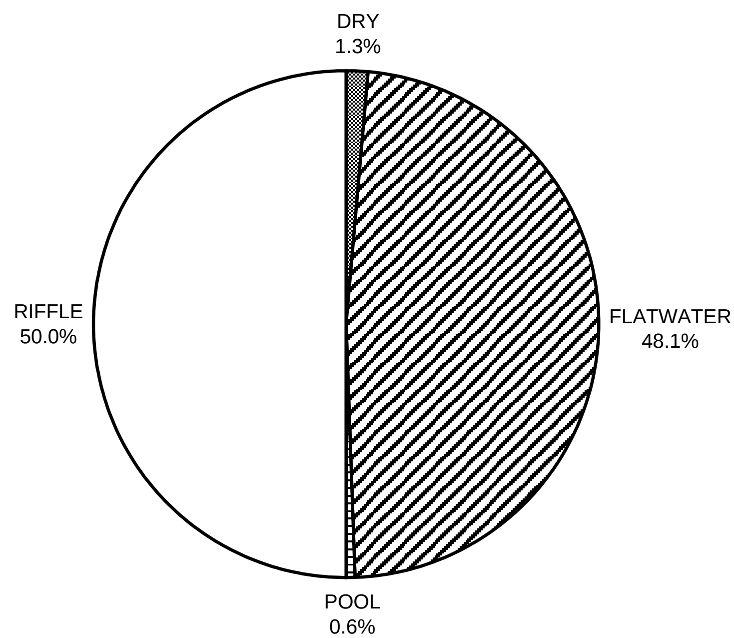
Graph 1: Hopper Creek - Habitat types by percent occurrence

HOPPER CANYON 2008
HABITAT TYPES BY PERCENT OCCURRENCE

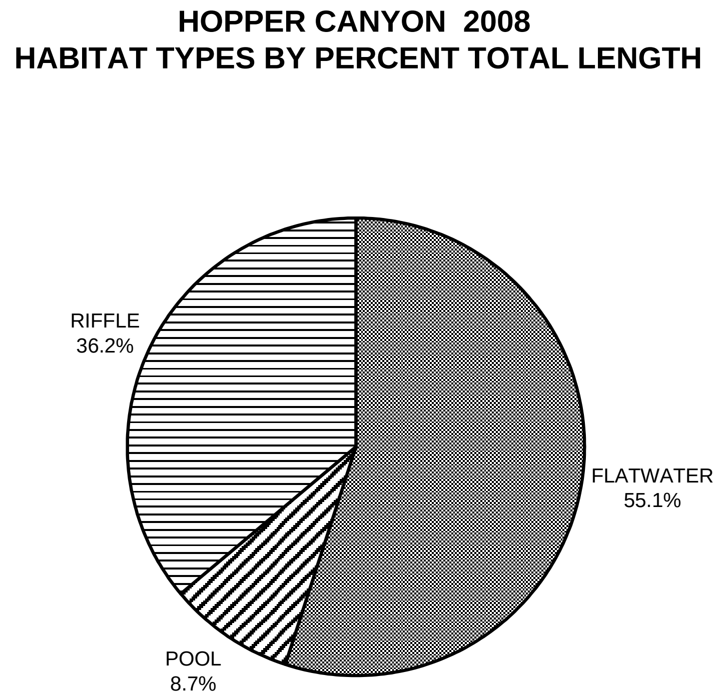


Graph 2: Tom's Creek - Habitat types by percent occurrence

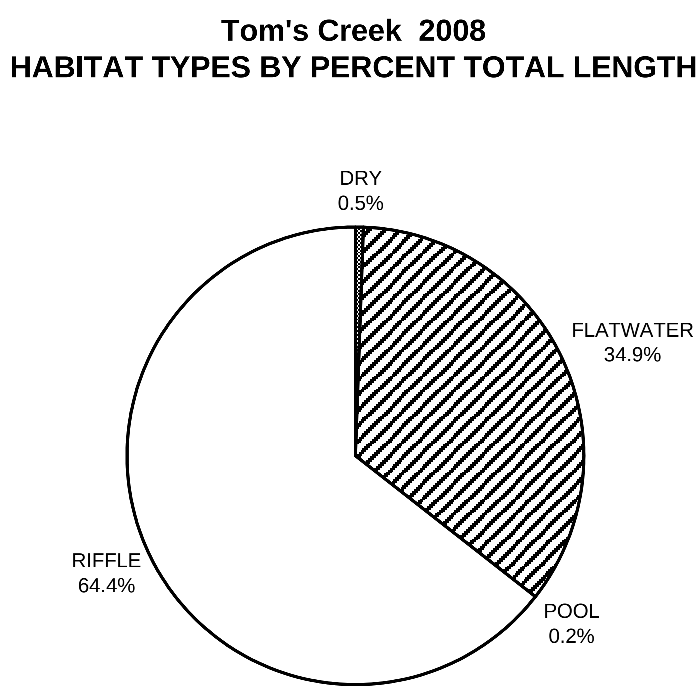
Tom's Creek 2008
HABITAT TYPES BY PERCENT OCCURRENCE



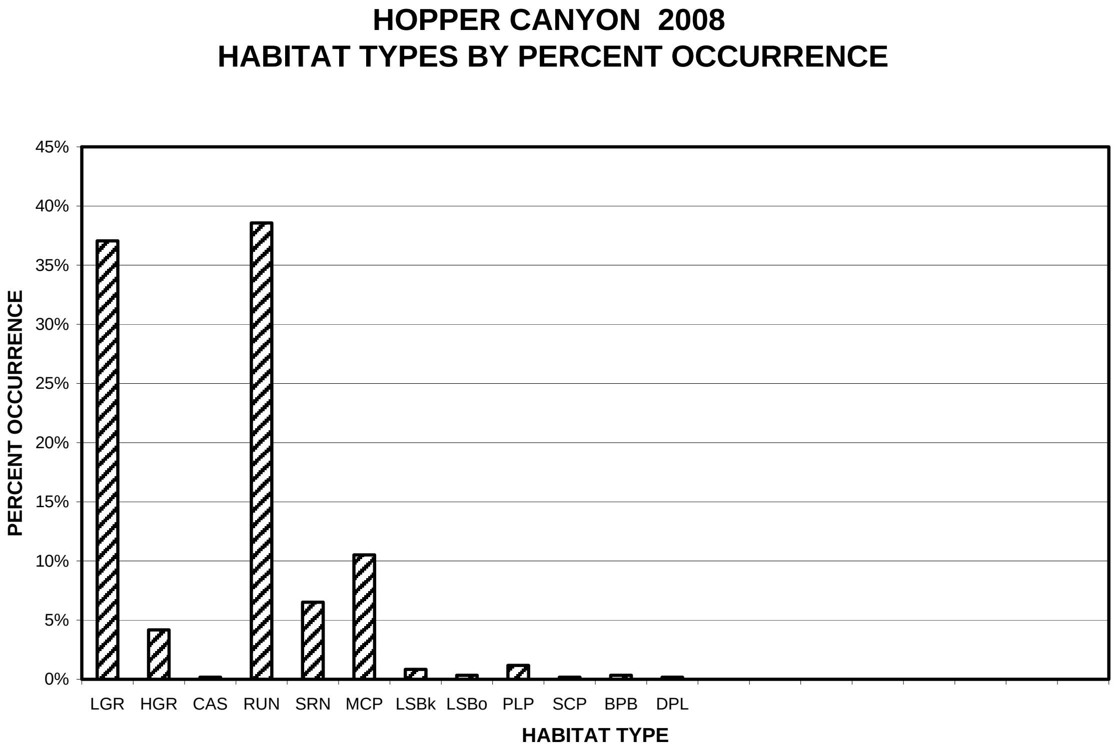
Graph 3: Hopper Creek - Habitat types by percent total length



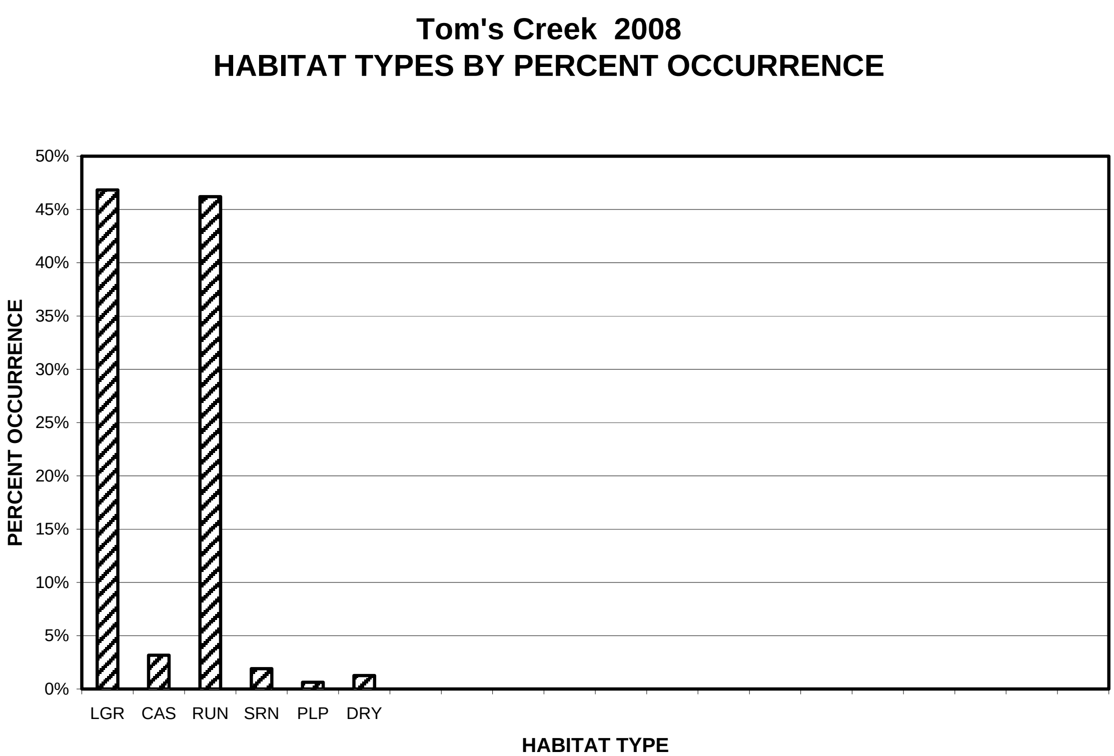
Graph 4: Tom's Creek - Habitat types by percent total length



Graph 5: Hopper Creek - Habitat types by percent occurrence

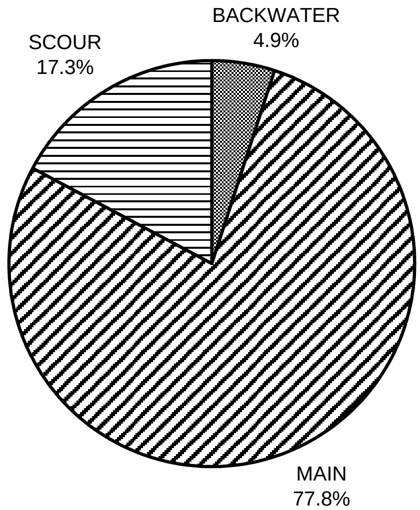


Graph 6: Tom's Creek - Habitat types by percent occurrence



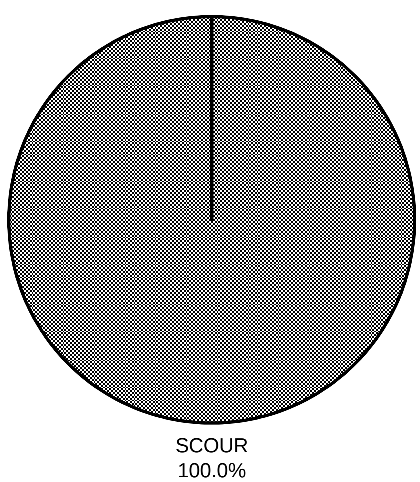
Graph 7: Hopper Creek - Pool types by percent occurrence

HOPPER CANYON 2008
POOL TYPES BY PERCENT OCCURRENCE

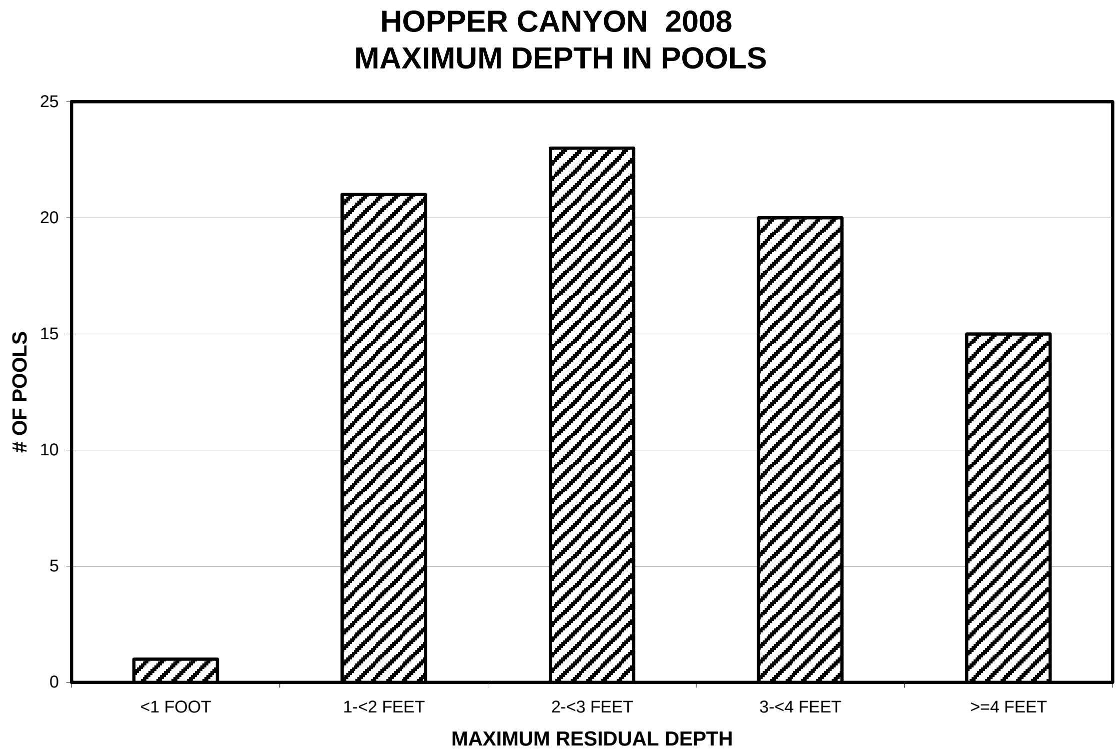


Graph 8: Tom's Creek - Pool types by percent occurrence

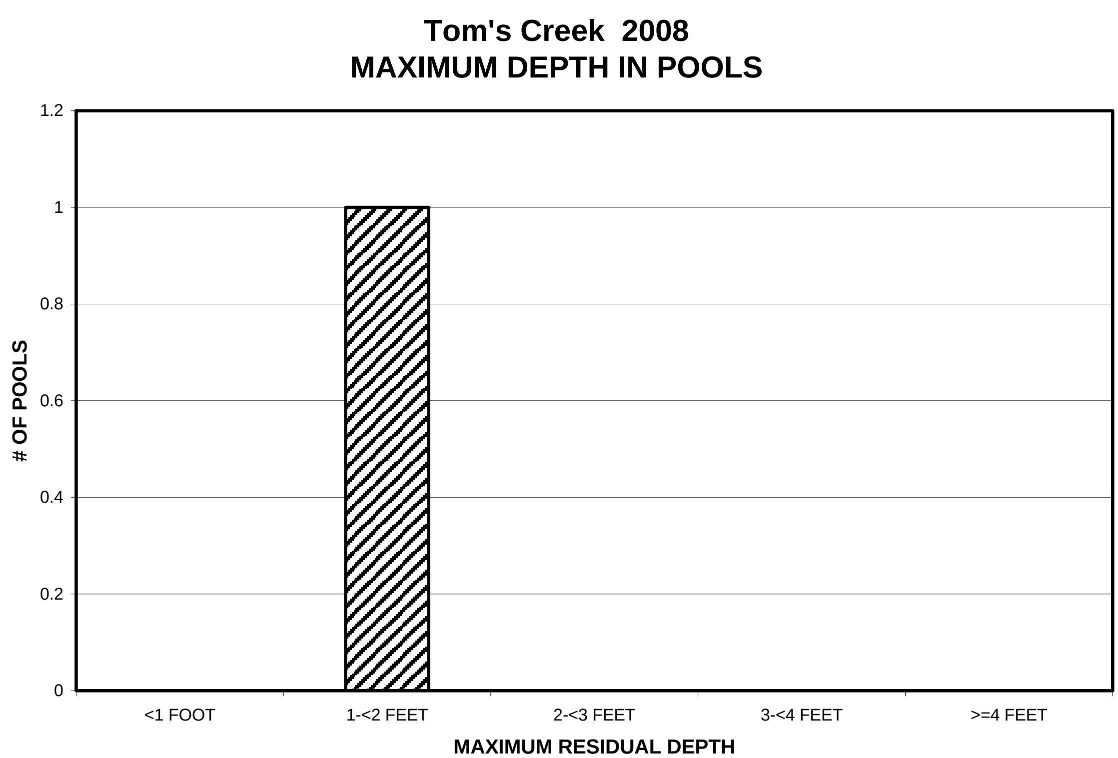
Tom's Creek 2008
POOL TYPES BY PERCENT OCCURRENCE



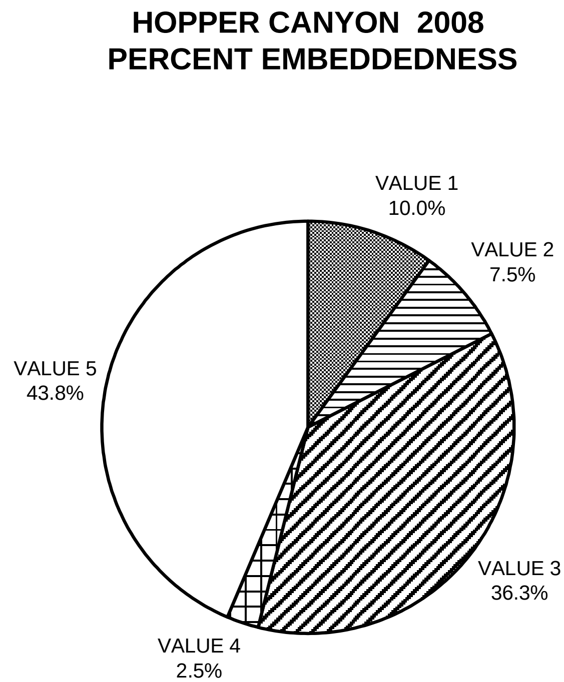
Graph 9: Hopper Creek - Maximum depth in pools



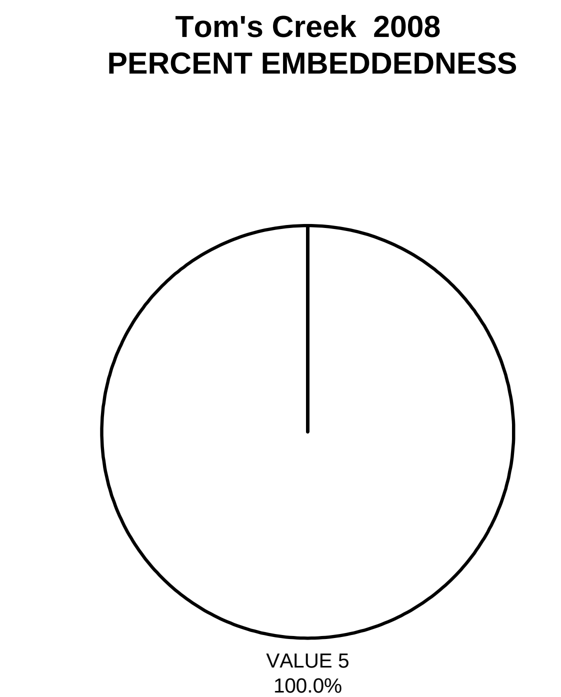
Graph 10: Tom's Creek - Maximum depth in pools



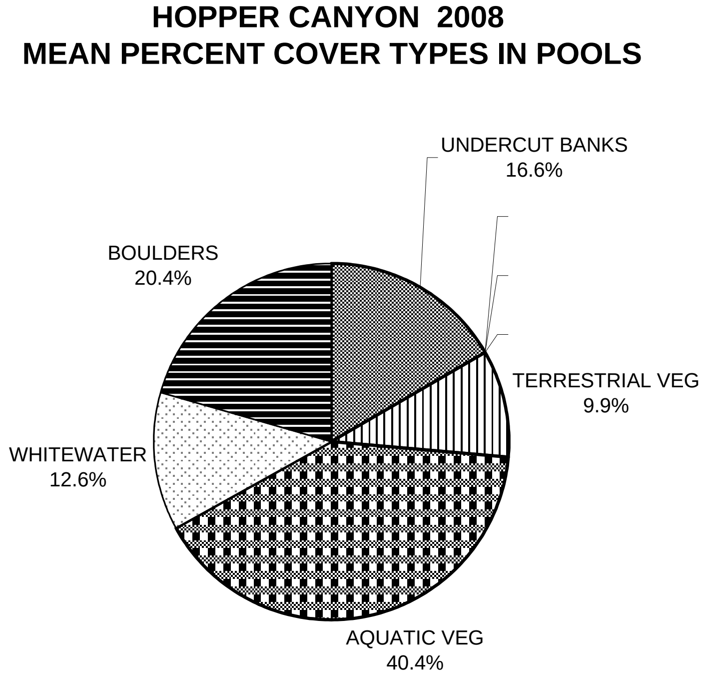
Graph 11: Hopper Creek - Percent Embeddedness



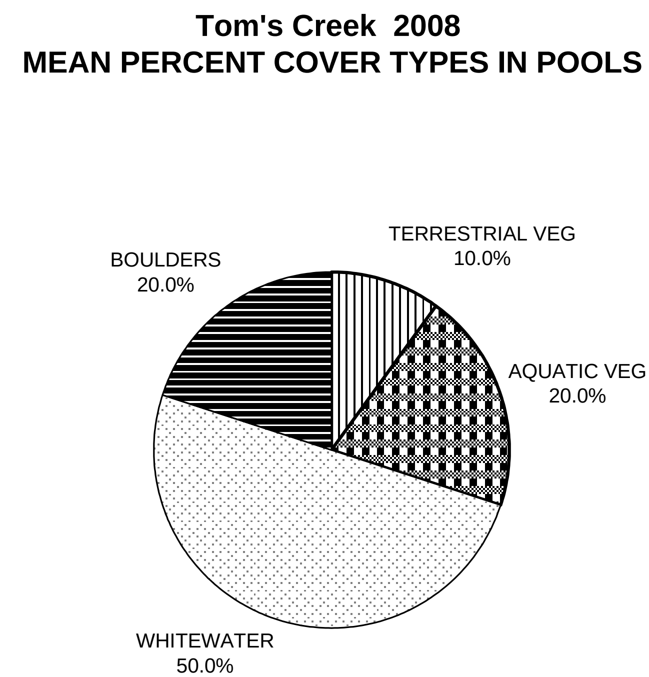
Graph 12: Tom's Creek - Percent Embeddedness



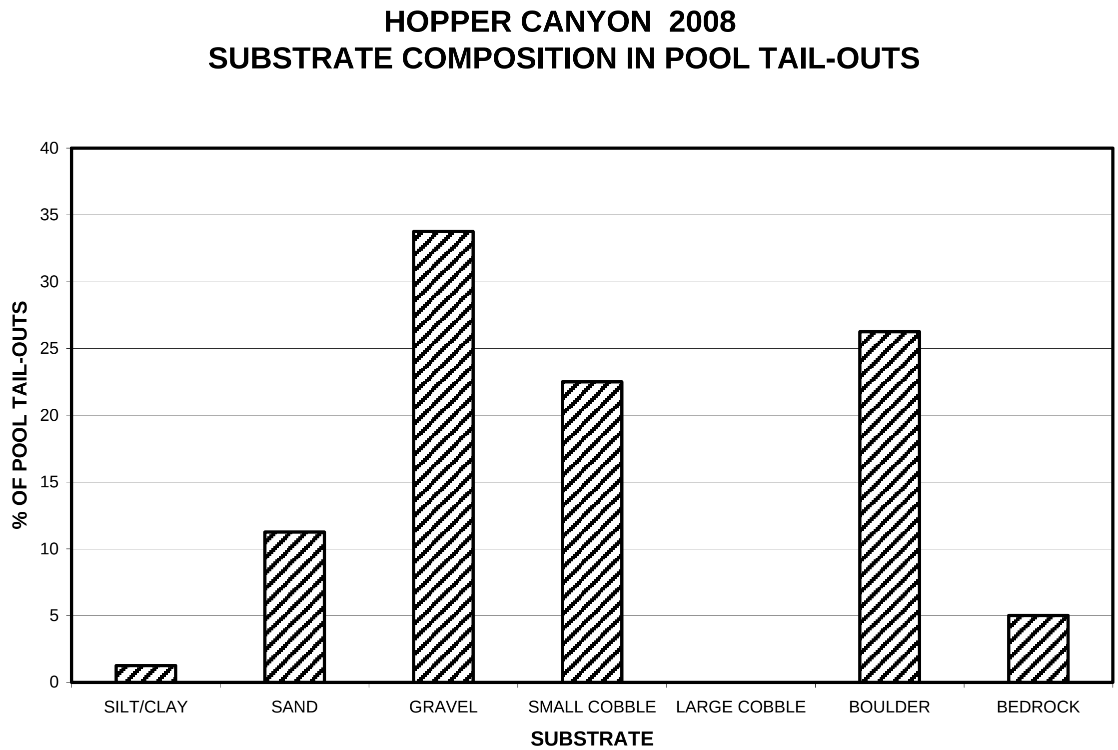
Graph 13: Hopper Creek - Mean percent cover types in pools



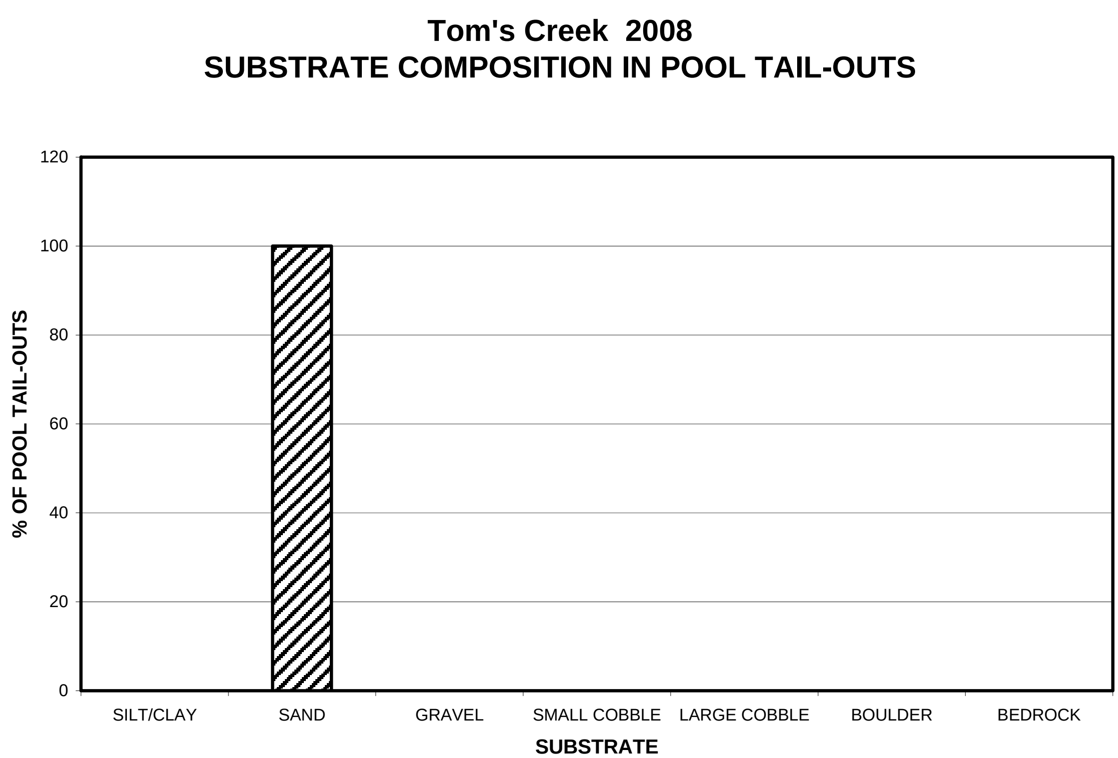
Graph 14: Tom's Creek - Mean percent cover types in pools



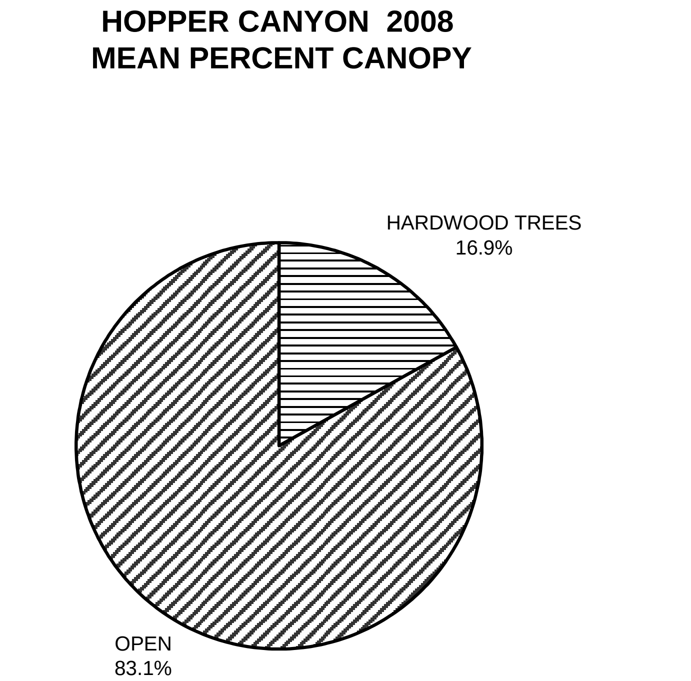
Graph 15: Hopper Creek - Substrate composition in pool tail-outs



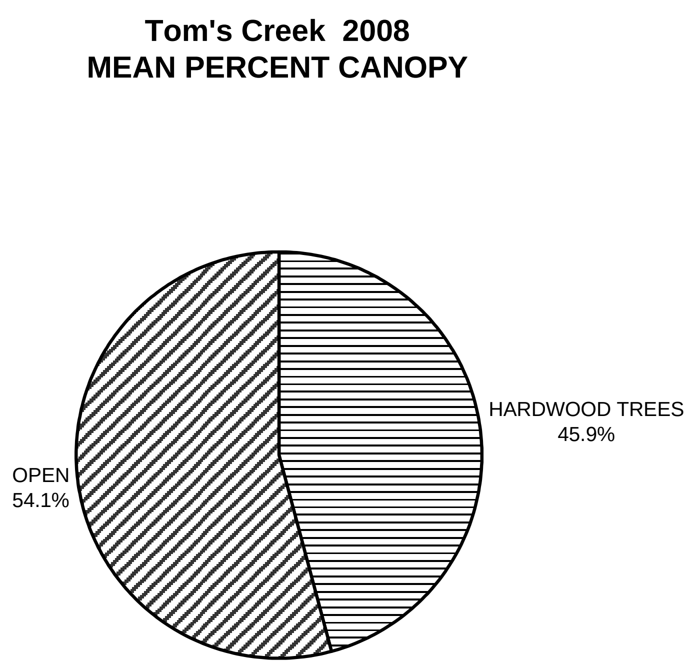
Graph 16: Tom's Creek - Substrate composition in pool tail-outs



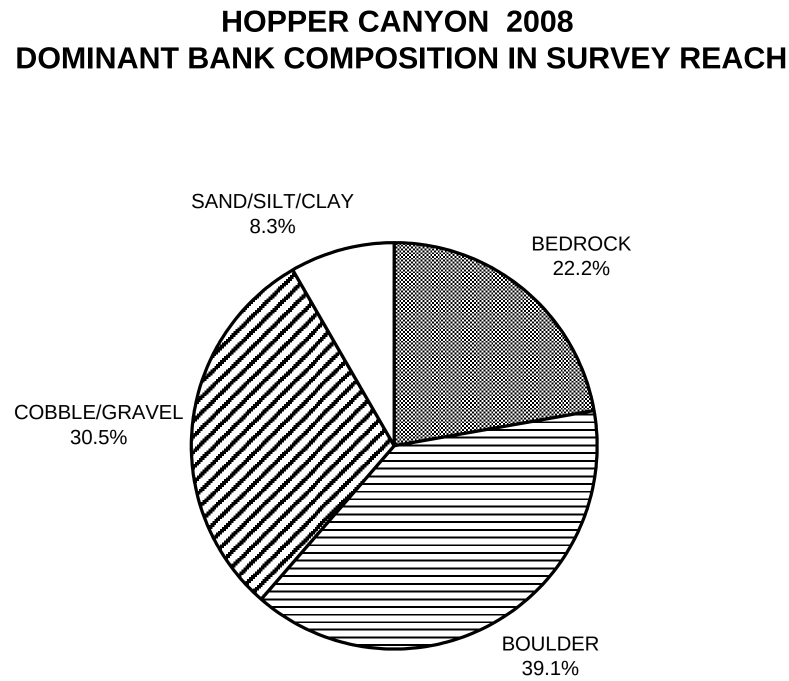
Graph 17: Hopper Creek - Mean percent canopy



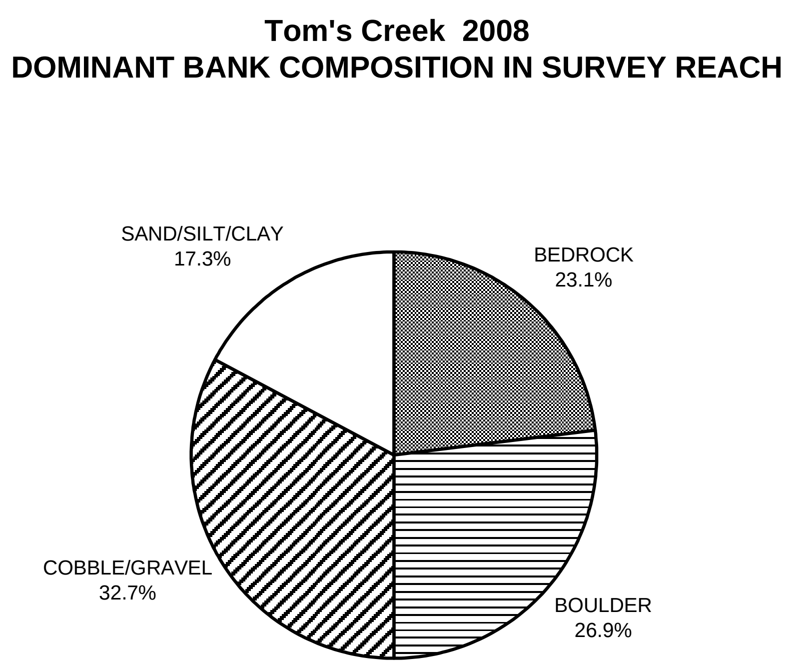
Graph 18: Tom's Creek - Mean percent canopy



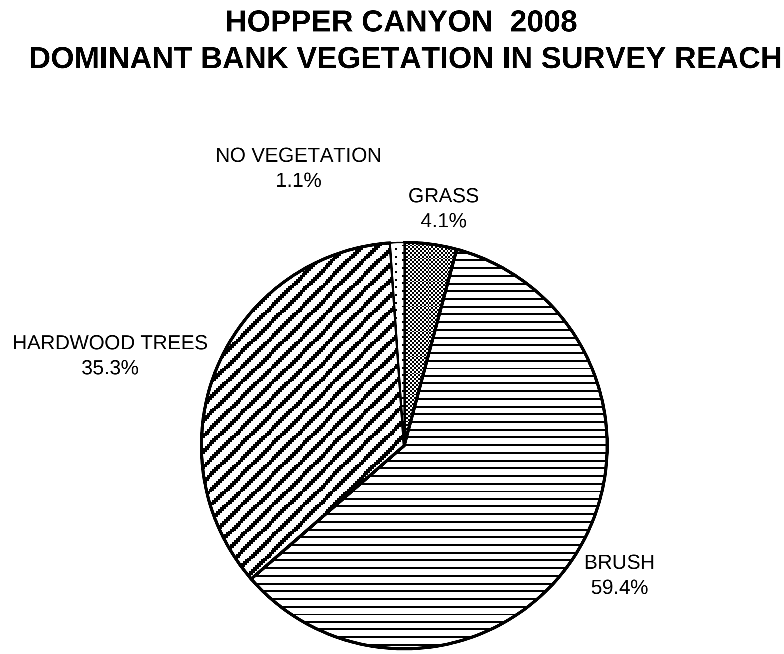
Graph 19: Hopper Creek - Dominant bank composition in survey reach



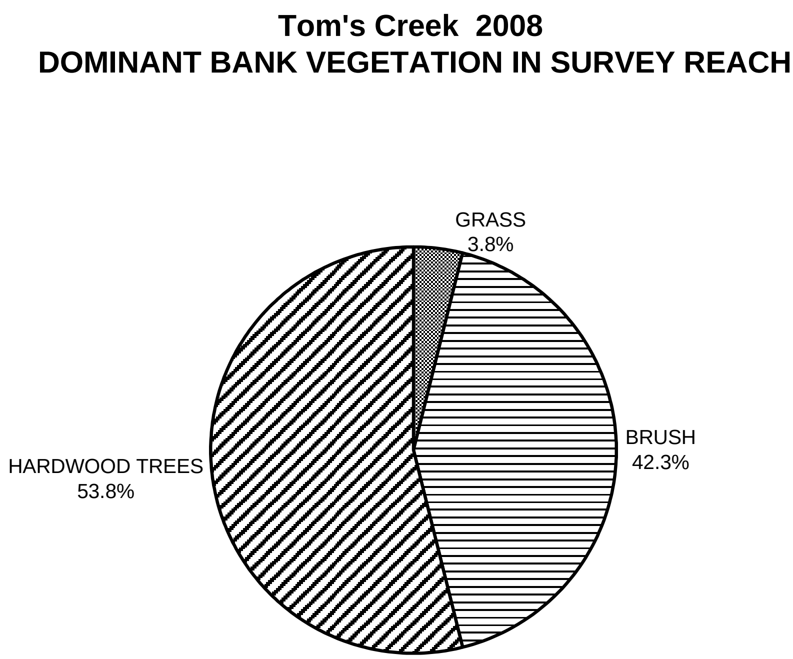
Graph 20: Tom's Creek - Dominant bank composition in survey reach



Graph 21: Hopper Creek - Dominant bank vegetation in survey reach



Graph 22: Tom's Creek - Dominant bank vegetation in survey reach



APPENDIX 5: SURVEY PHOTOGRAPHS

Hopper Creek Photos

Hopper Confluence w/ Santa Clara

Hopper Creek Inside the Levee

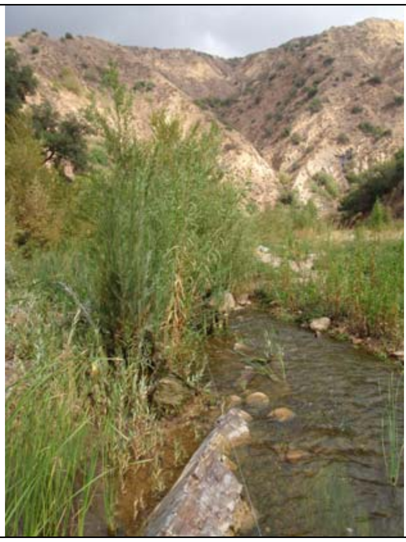
Beneath the 126, Upstream

HAB0001, Upstream

HAB0001, Downstream

Reach 1, Upstream

	
Reach 1, Seep	Reach 1, Plant Leeching from Seep
	
Reach 1, Western Toad	Around HAB0059, Upstream
	
HAB0065, Downstream	Reach 1, Arroyo Chub

	
Reach 1, 3-Spine Stickleback	HAB0100, Landslide, Right bank
	
HAB0102, Upstream above landslide	Landslide from the Road
	
HAB0136, Upstream	HAB0136, Downstream

Between HAB0140-150, Upstream

HAB0161, On Road from Right Bank

HAB0161, Right bank Concrete

Around HAB0165, Upstream

Between HAB0167-0176

HAB0177, Road Crossin

	
HAB0181, Overgrown cattails	Between HAB0194-0201
	
HAB0201, Before Road Crossing from Right Bank	Between HAB0203-0212
	
HAB0219, Dowstream	HAB220, Left Bank, Man-made stream alteration

	
HAB220, Upstream	HAB 220, LB w/ Road
	
HAB0220, Oil on plants	HAB0233, Road Crossing
	
HAB0239, Oil in pool	HAB0239.1, LB Trib

HAB0239.1, LB Trib

HAB0240, Oil on plants

HAB0240, Oil on plants

HAB0240, RB Hillside

HAB0243, from RB

HAB0252, Road Crossing from RB

	
HAB0252, Downstream	HAB0252, Upstream
	
HAB0253, Oil Seep	HAB0255, Plunge from Road Crossing
	
HAB0255, Plunge from Road Crossing	HAB0256, Road Crossing from RB

	
HAB0261, Pipes in unit	HAB0264, Upstream
	
HAB0277, Road Crossing RB	HAB0342, RB Trib
	
HAB0389, Step Run, Upstream	HAB0443, Oil and water seep (LB seep)

	
HAB0443, Oil Seep	HAB0445, Bear and raccoon tracks
	
Between HAB0519-0528	HAB0529
	
HAB0535, RB Trib	HAB0544, Waterfall Anadromy barrier

Western Fence Lizard

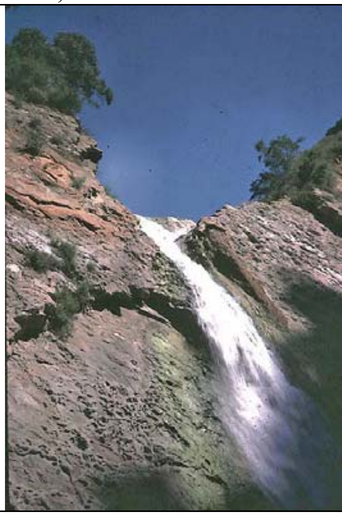
Two-striped garter

California Treefrogs

Coast Horned Lizards

Western Pond Turtles

Hopper Creek Fall Pool June 1978



Hopper Creek Falls, June 1978

Hopper Creek Above the Falls, 1978

After Flooding Below Railroad bridge, Jan. 19, 2005

After Flooding at Railroad Bridge, Jan 19, 2005

Tom's Creek Photos

Between HAB0001 to 0006

Between HAB0001 to 0006

	
RB Road, HAB0042	RB Trib, HAB0043
	
HAB0072, Trib	Between HAB0107 and 0116
	
HAB0135, RB Trib	Between HAB0137 to 0146, RB Trib

HAB0154, Anadromy Barrier Waterfall

HAB0154, Anadromy Barrier Waterfall

Possible Moutain Lion print

Western Pond Turtle

Bear Print

Cow Skull