STREAM INVENTORY REPORT

Singley Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Singley Creek. Stream inventories and reports were also completed for two tributaries to Singley Creek. One of the reports is a subsection to this report.

The Singley Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Singley Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for chinook salmon, coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Singley Creek is a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Singley Creek's legal description at the confluence with the Pacific Ocean is T01N R03W S34. Its location is 40°25′52″ north latitude and 124°24′10″ west longitude. Singley Creek is a 3rd order stream and has approximately 4.1 miles of blue line stream according to the USGS Cape Mendocino and Capetown 7.5 minute quadrangles. Singley Creek drains a watershed of approximately 7.9 square miles. Elevations range from 0 feet at the ocean to 2,654 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via Old Mattole Rd near "Ocean House" at mouth. Access farther up the creek is available only with landowner permission, via a private road paralleling the creek.

METHODS

The habitat inventory conducted in Singley Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

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SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are 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 are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is 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 Singley Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 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. Channel dimensions are measured using hip chains, hand levels, tape measures, and stadia rods. 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.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

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Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Singley 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 are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Singley 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 particle size, having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide 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. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Singley Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

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 is recorded for each pool.

8. Canopy:

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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 Singley Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the top of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

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 winter flows. In Singley 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 percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Singley Creek. In addition, seventeen sites were electrofished for fish species distribution and composition; and two sites were multiple pass depletion electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- **Riffle, flatwater, and pool habitat types**
- **Habitat types and measured parameters**
- **Pool types**
- **Maximum pool depths by habitat types**
- **Dominant substrates by habitat types**
- **Mean percent shelter by habitat types**

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Graphics are produced from the tables using Quattro Pro. Graphics developed for Singley Creek include:

- **Riffle, flatwater, pool habitats by percent occurrence**
- **Riffle, flatwater, pool habitats by total length**
- **Total habitat types by percent occurrence**
- **Pool types by percent occurrence**
- **Total pools by maximum depths**
- **Embeddedness**
- **Pool cover by cover type**
- **Dominant substrate in the pool tail outs**
- **Mean percent canopy**
- **Bank composition by composition type**
- **Bank vegetation by vegetation type**

HABITAT INVENTORY RESULTS

*** ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT ***

The habitat inventory of June 1, 2, 3, 10, 15, 17, and 18, 1999, was conducted by Andrea Kudrez and Chris Ramsey (WSP\AmeriCorps). The total length of the stream surveyed was 22,319 feet with an additional 275 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 4.0 cfs on June 8, 1999.

Singley Creek is an F4 channel type for the first 10,002 feet, a B3 channel type for the next 11,788 feet, and a B2 channel type for the remaining 529 feet. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B channels have moderate entrenchment and moderate gradients. Pools are spaced infrequently, plan and profile are very stable and banks are stable. B3 channels have cobble-dominant substrates while B2 channels have boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 59 degrees Fahrenheit. Air temperatures ranged from 54 to 80 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% riffle units, 33% flatwater units, and 28% pool units (Graph 1). Based on total length of Level II habitat types there were 53% riffle units, 33% flatwater units, and 14% pool units (Graph 2).

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Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 34%; runs, 26%; and mid-channel pools, 9% (Graph 3). Based on percent total length, low gradient riffles made up 50%, runs 23%, and mid-channel pools 5%.

A total of 120 pools were identified (Table 3). Scour pools were the most frequently encountered, at 58%, and comprised 59% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Ten of the 120 pools (8.3%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 120 pool tail-outs measured, 0 had a value of 1 (0.0%); twenty-nine had a value of 2 (24.2%); twenty-six had a value of 3 (21.7); two had a value of 4 (3.3%) and sixty-three had a value of 5 (52.5%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning. The breakdown of dominant substrate composition for the sixty-three pool tail-outs that had a value of 5 were as follows: 48% large cobble, 37% boulder, 13% silt/clay/sand or small gravel , and 2% bedrock.

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. Riffle habitat types had a mean shelter rating of 26, flatwater habitat types had a mean shelter rating of 18, and pool habitats had a mean shelter rating of 50 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 62. Main channel pools had a mean shelter rating of 35 (Table 3).

Table 5 summarizes mean percent cover by habitat type. White water and boulders are the dominant cover types in Singley Creek. Graph 7 describes the pool cover in Singley Creek. White water is the dominant pool cover type. Boulders and large woody debris are the next most common pool cover types.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate in pool tail-outs. Gravel was the dominant substrate observed in 32% of pool tail-outs while large cobble was the next most frequently observed substrate type, at 28%. The mean percent canopy density for the surveyed length of Singley Creek was 83%. The mean percentages of deciduous and coniferous trees were 88% and 12%, respectively. Graph 9 describes the mean percent canopy in Singley Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 80%. The

mean percent left bank vegetated was 81%. The dominant elements composing the structure of the stream banks consisted of 4.9% bedrock, 10.4% boulder, 81.7% cobble/gravel, and 3.0% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 81.1% of the units surveyed. Additionally, 8.5% of the units surveyed had grass as the dominant vegetation type, and 7.3% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Seventeen sites were electrofished for species composition and distribution in Singley Creek on August 24 and 25, 1999. Water temperatures taken during the electrofishing periods of 11:00am to 3:45pm ranged from 54 to 63 degrees Fahrenheit. Air temperatures ranged from 64 to 74 degrees Fahrenheit. The sites were sampled by Michelle Gilroy and Glen Yoshioka (DFG), and Chris Ramsey (WSP).

The first site sampled was habitat unit 15, a channel confluence pool approximately 2,238 feet from the confluence with the Pacific Ocean, at the confluence with the first right bank tributary. The site yielded 10 young-of-the-year, 4 one-plus and 2 two-plus age class steelhead. Two sculpin and 2 three-spined stickleback were also observed.

The second site was habitat unit 20, a lateral scour pool - boulder formed, located approximately 2,543 feet above the creek mouth. The site yielded 1 young-of-the-year, 11 one-plus and 2 two-plus age class steelhead.

The third site sampled was habitat unit 23, a lateral scour pool - root wad enhanced, located approximately 2,733 feet above the creek mouth. The site yielded 5 young-of-the-year, 11 one-plus, 2 two-plus age class steelhead and 2 sculpin.

The fourth site sampled was habitat unit 30, a lateral scour pool - root wad enhanced, located approximately 3,132 feet above the creek mouth. The site yielded 1 young-of-the-year and 6 one-plus age class steelhead. Eight sculpin and 1 three-spined stickleback were also observed.

The fifth site sampled included habitat unit 34, a lateral scour pool - log enhanced, located approximately 3,381 feet above the creek mouth. The site yielded 4 young-of-the-year and 16 one-plus age class steelhead.
The sixth site sampled was habitat unit 37, a lateral scour pool - root wad enhanced, located approximately 3,739 feet above the creek mouth. The site yielded 11 young-of-the-year, 7 one-plus and 1 two-plus age class steelhead.

The seventh site sampled was habitat unit 39, a lateral scour pool - root wad enhanced, located approximately 3,801 feet above the creek mouth. The site yielded 3 young-of-the-

year steelhead and 1 sculpin.

The eighth site sampled was habitat unit 41, a lateral scour pool - log enhanced, located approximately 3,860 feet above the creek mouth. The site yielded 4 young-of-the-year, 16 one-plus, 3 two-plus age class steelhead and 1 sculpin.

The ninth site sampled was habitat unit 43, a mid-channel pool, with root cover, located approximately 3,985 feet above the creek mouth. The site yielded 1 young-of-the-year and 3 one-plus year class steelhead. One sculpin was also observed.

The tenth site sampled was habitat unit 46, a mid-channel pool with log scour and small woody debris cover, located approximately 4,082 feet above the creek mouth. The site yielded 6 one-plus and 1 two-plus age class steelhead.

The eleventh site sampled was habitat unit 211, a mid-channel pool with log scour, located approximately 13, 903 feet above the creek mouth. The site yielded 2 young-of-the year, 6 one-plus age class steelhead, and 1 two-plus age class steelhead.

The twelfth site sampled was habitat unit 243, a lateral scour pool - log enhanced, located approximately 15,430 feet above the creek mouth. The site yielded 6 young-of-the-year and 6 one-plus age class steelhead.

The thirteenth site sampled was habitat unit 256, a mid-channel pool, located approximately 15,953 feet above the creek mouth. The site yielded 4 young-of-the-year and 3 one-plus age class steelhead.

The fourteenth site sampled was habitat unit 272, a lateral scour pool - log enhanced, located approximately 16,645 feet above the creek mouth. The site yielded 5 young-of-the-year and 4 one-plus age class steelhead.

The fifteenth site sampled was habitat unit 334, a plunge pool located approximately 19,681 feet above the creek mouth. The site yielded 2 young-of-the-year age class steelhead and 2 one-plus age class steelhead.

The sixteenth site sampled was habitat unit 409, a plunge pool, located approximately 21,975 feet above the creek mouth. The site yielded 4 young-of-the-year steelhead.

The seventeenth site sampled was habitat unit 414, a mid-channel pool with boulder cover, located 22,132 feet above the creek mouth. The site yielded 2 young-of-the-year steelhead.

The following chart displays the information yielded from these sites:

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Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead YOY	1+	2+
08/24/99	1	2, 238	15	CCP	1	F4	10	4	2
08/24/99	2	2,543	20	LSBo	1	F4	1	11	2
08/24/99	3	2,733	23	LSR	1	F4	5	11	2
08/24/99	4	3,132	30	LSR	1	F4	1	6	0
08/24/99	5	3,381	34	LSL	1	F4	4	16	0
08/24/99	6	3,739	37	LSR	1	F4	11	7	1
08/24/99	7	3,801	39	LSR	1	F4	3	0	0
08/24/99	8	3,860	41	LSL	1	F4	4	16	3
08/24/99	9	3,985	43	MCP	1	F4	1	3	0
08/24/99	10	4,082	46	MCP	1	F4	0	6	1
08/25/99	11	13,903	211	MCP	2	B3	2	6	1
08/25/99	12	15,430	243	LSL	2	B3	6	6	0
08/25/99	13	15,953	256	MCP	2	B3	4	3	0
08/25/99	14	16,645	272	LSL	2	B3	5	4	0
08/25/99	15	19,681	334	PLP	2	B3	2	2	0
08/25/99	16	21,975	409	PLP	3	B2	4	0	0
08/25/99	17	22,132	414	MCP	3	B2	2	0	0

In addition to the seventeen sites sampled, two index sites were designated for multiple pass depletion electrofishing in cooperation with the DFG "Steelhead Monitoring and Research Program". The electrofishing was completed by Michelle Gilroy, Rod McLeod, Scott Silloway, Holly Taylor, and Susan Taylor (DFG).

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Index site #1 was sampled on October 12, 1999 and included habitat units 28-32, a run, low gradient riffle, lateral scour pool - root wad enhanced, low gradient riffle, and lateral scour pool - root wad enhanced series located approximately 3,050 feet above the creek mouth. The stream flow was 0.38 cfs. The air and water temperatures at 11:55 were 76°F and 55°F, respectively. Two passes with a combined effort of 36 minutes and 53 seconds yielded 44 young-of-the-year and 37 one and two-plus age class steelhead. The site also yielded 31 sculpin and 1 three-spined stickleback. The following amphibians were identified at this site: Pacific giant salamanders, one red-legged frog, one tree frog, and one yellow-legged frog.

Index site #2 was sampled on October 4, 1999 and included habitat units 203-205, a low gradient riffle, run, lateral scour pool - root wad enhanced series located approximately 13,622 feet above the creek mouth. The stream flow was 0.2 cfs. The air and water temperatures at 11:10 were 64°F and 54°F, respectively. Three passes with a combined effort of 43 minutes and 48 seconds yielded 65 young-of-the-year and 13 one and two-plus age class steelhead. Juvenile and adult Pacific giant salamanders were also identified.

DISCUSSION

Singley Creek is a F4 channel type for 10,002 feet, a B3 channel type for 11,788 feet and a B2 channel type for the remaining 529 feet. The suitability of F4 channel types 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; and poor for boulder clusters. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. The suitability of B2 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days of June 1, 2, 3, 10, 15, 17, and 18, 1999, ranged from 51 to 59 degrees Fahrenheit. This is a favorable water temperature range for salmonids. Air temperatures ranged from 54 to 80 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 33% of the total length of this survey, riffles 53%, and pools 14%. The pools are relatively shallow, with only 10 of the 120 pools (8.3%) having a maximum depth of three feet or greater. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as

long as the low flow channel width.

None of the 120 pool tail-outs measured had an embeddedness rating of 1. Twenty-eight of the pool tail-outs had embeddedness ratings of 3 or 4. Sixty-three of the pool tail-outs had a rating of 5 which is considered unsuitable for spawning. Eight of the 63 were unsuitable for spawning due to the dominant substrate being silt/sand/clay or small gravel. The remainder of pool tails valued at 5 were dominated by large cobble, boulder, or bedrock. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

The mean shelter rating for pools was 50. The shelter rating in the flatwater habitats was 18. A pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by boulders and white water in all habitat types. Log and root wad structure in the 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 83%. Reach 1 had a canopy density of 70% while Reaches 2 and 3 had canopy densities of 90% and 92%, respectively. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 80% and 81%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Singley Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Increase the large wood component in the pools and flatwater habitat units. Most of the existing cover is from boulders and whitewater. Adding additional high quality complexity with woody cover is desirable.

4) 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.

5) 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.

6) Identify potential riparian planting sites in Reach 1 and other individual sites lacking vegetation.

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.

0' Begin survey at confluence with Pacific Ocean. Channel type is an F4.

947' Bridge, 25' long x 30' high x 100'wide.

1,055' Fence, 3' tall and 0.3' above the water.

1,058' Bridge, 9.7' high x 45' wide.

1,757' Left bank 1.5" diameter pipe.

2,200' Unnamed tributary enters from the right bank. The tributary was inventoried in 1999 and a separate habitat inventory report was completed.

2,238' First electrofishing site.

2,253' Fence, 4.3' high, in water holding small woody debris.

2,310' Dirt road stream crossing.

2,519' Bank failure, 84' long x 30' high, contributing sediment.

2,543' Second electrofishing site.

2,733' Third electrofishing site.

2,848' Left bank failure, 25' high x 40' long, contributing sediment.

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3,050' Electrofishing Index Site #1.

3,132' Fourth electrofishing site.

3,381' Fifth electrofishing site.

3,407' Left bank failure, 30' high x 40' long.

3,739' Sixth electrofishing site.

3,801' Seventh electrofishing site.

3,860' Eighth electrofishing site.

3,985' Ninth electrofishing site.
Dry left bank tributary enters.

4,037' Spring enters left bank.

4,082' Tenth electrofishing site.

4,160' Left bank failure and plunge pool holding sediment and backing up channel upstream.

6,419' Left bank failure, 111' long x 30' high associated with a log debris accumulation, 58' long x 8' high x 25' wide, retaining sediment.

6,639' Log debris accumulation, 46' long x 10' high x 100' wide, retaining sediment.

6,682' Small left bank tributary enters, 50 degrees F.

8,045' Left bank failure, 30' long x 40' high.
8,103' Left bank tributary enters, 51 degrees F.

9,051' Flagging for "Timber Harvest Boundary". Left bank tributary enters, 52 degrees F.

10,002' Channel type changes to a B3.

10,158' Left bank side channel created by log debris accumulation, 70' wide x 10' high x 10' long, retaining sediment.

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10,358'	**Bank failure, 100' long x 150' high.**
10,372'	**Right bank side channel. Left bank failure, 30' long x 35' high.**
10,602'	**Left bank tributary enters, 52 degrees F.**
10,722'	**Right bank log debris accumulation, 8' high x 10' wide x 10' long.**
11,927'	**Log debris accumulation, 3' long x 26' wide, retaining sediment and forming 1.4' high plunge.**
12,102'	**Log debris accumulation, 15' long x 50' wide x 10' high; with associated left bank failure, 30' long x 50' high.**
12,366'	**Left bank spring enters.**
12,433'	**Log debris accumulation, 15' long x 20' wide x 10' high, retaining 2.5' of sediment.**
13,053'	**Log debris accumulation, 10' long x 50' wide x 4' high, retaining sediment.**
13,315'	**Stream crossing.**
13,370'	**Left bank tributary enters.**
13,452'	**Hobo temperature gage.**
13,622'	**Electrofishing Index Site #2.**
13,722'	**Right bank failure, 40' high x 75' long.**
13,800'	**Log debris accumulation, 15' long x 50' wide x 15' high, retaining sediment.**
13,903'	**Eleventh electrofishing site.**
14,832'	**Left bank tributary enters, 59 degrees F.**
15,324'	**Left bank failure, 50' high.**
15,430'	**Twelfth electrofishing site.**

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15,508'	**Flagging for "Timber harvest boundary". Right bank tributary, 55 degrees F.**
15,670'	**Flagging for "Timber harvest boundary".**
15,953'	**Thirteenth electrofishing site.**
16,187'	**Flagging for "Timber harvest boundary".**
16,324'	**Flagging for "Contract boundary".**
16,645'	**Fourteenth electrofishing site.**
16,827'	**Right bank failure, 30' long x 35' high.**
17,466'	**Left bank tributary enters, 53 degrees F.**
17,952'	**Plunge retaining gravel 2.2' high.**
18,271'	**Left bank failure, 90' long x 90' high, with associated log debris accumulation, 8' long x 30' wide x 10' high, retaining approximately 5' of sediment.**
18,788'	**Right bank failure, 103' long.**
18,803'	**Log debris accumulation, 60' long x 60' wide x 20' high, retaining 5' of sediment.**
19,137'	**Flagging for "Contract boundary".**
19,276'	**Log debris accumulation, 99' long x 75' wide x 20' high, retaining sediment.**
19,669'	**Left bank tributary enters, 52 degrees F.**
19,681'	**Fifteenth electrofishing site.**
19,694'	**Log debris accumulation, 20' long x 30' wide x 15' high, with a 2' plunge, retaining sediment.**
19,767'	**Two foot high plunge retaining large woody debris and sediment.**
19,800'	**Log debris accumulation, 20' long x 30' wide x 15' high, retaining sediment.**

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19,845'	**Log debris accumulation, 10' long x 30' wide x 10' high, with 3' plunge.**
20,059'	**Log debris accumulation, 5' long x 30' wide x 10' high, retaining 4' of sediment, with water going subsurface.**
20,469'	**Two foot high plunge retaining 2' of sediment.**
21,142'	**Three foot plunge retaining sediment.**
21,790'	**Channel type changes to a B2.**
21,877'	**Right bank tributary, 53 degrees F (see subsection report).**
21,922'	**Log debris accumulation, 6' long x 30' wide x 15' high, with 3' plunge, holding sediment.**
21,975'	**Sixteenth electrofishing site. Two foot plunge.**
22,080'	**Two foot plunge.**
22,107'	**Log debris accumulation, 31' long x 30' wide x 20' high, retaining sediment, with associated left bank failure, 100' long x 70' high. Probable barrier to anadromous salmonids.**
22,132'	**Seventeenth electrofishing site.**
22,319'	**End of Survey. No fish observed for the last 700' feet surveyed.**

REFERENCES

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

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]**		