STREAM INVENTORY REPORT

Bond Creek

INTRODUCTION

A stream inventory was conducted in the summer of 2003 on Bond Creek. The survey began at the confluence with Hollow Tree Creek and extended upstream approximately 2.6 miles.

The Bond 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 Bond 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 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

Bond Creek is a tributary to Hollow Tree Creek, a tributary to South Fork Eel River, a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map1). Bond Creek's legal description at the confluence with Hollow Tree Creek is T22N R17W S15. Its location is 39.7666 degrees north latitude and 123.7372 degrees west longitude. Bond Creek is a second order stream and has approximately 4.1 miles of blue line stream according to the USGS Leggett 7.5 minute quadrangle. Bond Creek drains a watershed of approximately 6.5 square miles. Elevations range from about 600 feet at the mouth of the creek to 1,800 feet in the headwater areas. Redwood forest, Douglas fir forest, and mixed hardwood forest dominate the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 1 to Westside Road at Hales Grove.

METHODS

The habitat inventory conducted in Bond Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and 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.

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. All pools except step-pools are fully sampled.

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 Bond Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

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 are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

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:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). 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". Bond 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 Bond 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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is 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. 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 Bond 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:

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 Bond 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. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood 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 Bond 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.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

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 Bond Creek. In addition, fourteen sites were 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 Stream Habitat 1.0.36, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces 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 (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for Bond 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

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

The habitat inventory of June 24 to July 10, 2003 was conducted by Shaunna Bradshaw (WSP), Janelle Breton and Dan Resnik (CCC). The total length of the stream surveyed was 13,887 feet with an additional 10 feet of side channel.

Stream flow was measured 227 feet from the confluence with Hollow Tree at the start of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.24cfs on June 25, 2003.

Bond Creek is an F4 channel type for the first 4,652 feet of the stream surveyed (Reach 1), an A2 channel type for the next 811 feet of the stream surveyed (Reach 2), a B4 channel type for the next 2,347 feet of the stream surveyed (Reach 3), an A3 channel type for the next 1,181 feet of the stream surveyed (Reach 4), and an F4 channel type for the remaining 4,906 feet of the stream surveyed (Reach 5). F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A2 channels are steep, narrow, cascading, step-pool streams with high energy and debris transport associated with depositional soils in very stable bedrock channels. B4 channels are moderately entrenched riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width /depth ratios and gravel dominant substrates. A3 channel types are steep, narrow, cascading, step-pools streams with high energy and debris transport associated with depositional soils and cobble dominated substrate.

Water temperatures taken during the survey period ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 60 to 81 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% pool units, 36% riffle units, 26% flatwater units and 1% dry units, (Graph 1). Based on total length of Level II habitat types there were 37% riffle units, 31%

flatwater units, 28% pool units, and 4% dry units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 32% mid-channel pool units, 30% low gradient riffle units and 21% run units (Graph 3). Based on percent total length, 31% low gradient riffle units, 25% mid-channel pool units and 21% run units.

A total of 114 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 90%, and comprised 93% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fifty-seven of the 114 pools (50%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 114 pool tail-outs measured, 27 had a value of 1 (24%); 48 had a value of 2 (42%); 29 had a value of 3 (25%); 10 had a value of 5 (9%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate, including bedrock, log sills, boulders, etc.

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 and flatwater habitat types each had a mean shelter rating of 26, and pool habitats had a mean shelter rating of 61 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 62, backwater pools had a mean shelter rating of 20 and scour pools had a mean shelter rating of 50 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris and small woody debris are the dominant cover types in Bond Creek. Graph 7 describes the pool cover in Bond Creek. Large woody debris is the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 62% of pool tail-outs and small cobble was observed in 25% of pool tail-outs.

The mean percent canopy density for the surveyed length of Bond Creek was 93%. The mean percentages of hardwood and coniferous trees were 62% and 38%, respectively. Seven percent of the canopy was open. Graph 9 describes the mean percent canopy in Bond Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 67%. The mean percent left bank vegetated was 64%. The dominant elements composing the structure of the stream banks consisted of 52% sand/silt/clay and 21% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 52% of the units surveyed. Additionally, 44% of the units surveyed had hardwood trees as the dominant vegetation type (Graph 11).

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BIOLOGICAL INVENTORY RESULTS

Fourteen sites were surveyed for species composition and distribution in Bond Creek on August 27, 2003. Thirteen sites were electrofished and one site was surveyed via underwater observation. Water temperatures taken during the biological survey ranged from 58 to 59 degrees Fahrenheit. Air temperatures ranged from 63 to 71 degrees Fahrenheit. The sites were sampled by Shaunna Bradshaw (WSP) and Paul Divine (DFG).

In Reach 1, two sites were sampled between Habitat Units #001 and #121. Habitat Unit #121 is approximately 4,652' feet from the confluence with Hollow Tree Creek. The reach yielded four young-of-year steelhead/rainbow trout (SH/RT), one SH/RT age 1+ and three young-of-year coho.

In Reach 2, three sites were sampled between Habitat Units #122 and #132. Habitat Unit 132 is approximately 5,463' from the confluence with Hollow Tree Creek. The reach yielded one young-of year SH/RT, four SH/RT age 1+ and one SH/RT age 2+.

In Reach 3, eight sites were sampled between Habitat Units #133 and #181. Habitat Unit #181 is approximately 7,810' from the confluence with Hollow Tree Creek. The reach yielded three young-of-year SH/RT, six SH/RT age 1+ and two SH/RT age 2+.

In Reach 4, one site was sampled between Habitat Units #182 and #212. Habitat Unit #212 is approximately 8,991' from the confluence with Hollow Tree Creek. The reach yielded one SH/RT age 1+ and one SH/RT age 2+.

The following chart displays the information yielded from these sites:

2003 BOND CREEK biological observations.

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		Steelhead		
					YOY	1+	YOY	1+	2+
Reach 1 F4 Channel Type									
08/27/03	1	005	4.2	175	1	0	2	0	0
08/27/03	2	119	4.2	5,021	2	0	2	1	0
Reach 2 A2 Channel Type									
08/27/03	1	127	5.6	5,268	0	0	1	2	1
08/27/03	2	129	4.2	5,308	0	0	0	1	0

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2003 BOND CREEK biological observations.

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		Steelhead		
					YOY	1+	YOY	1+	2+
08/28/03	3	131	4.2	5,399	0	0	0	1	0
Reach 3 B4 Channel Type									
08/27/03	1	139	4.2	5,927	0	0	0	0	0
08/27/03	2	143	3.3	6,034	0	0	0	0	0
08/27/03	3	144	4.2	6,111	0	0	1	0	1
08/27/03	4	149	4.2	6,310	0	0	1	0	0
08/27/03	5	153	4.2	6,516	0	0	1	1	1
08/27/03	6	161	4.2	6,899	0	0	0	1	0
08/27/03	7	171*	4.2	7,309	0	0	0	1	0
08/27/03	8	174	4.2	7,450	0	0	0	3	0
Reach 4 A3 Channel Type									
08/27/03	1	190	5.6	8,140	0	0	0	1	1

*Habitat Unit #171 was sampled via underwater observation and all other units were sampled via electrofishing. Both sampling techniques are described in *California Salmonid Stream Habitat Restoration Manual*, 3rd edition, Flosi et al. 1998.

DISCUSSION

Bond Creek is an F4 channel type for the first 4,652 feet of the stream surveyed, an A2 channel type for the next 811 feet of the stream surveyed, a B4 channel type for the next 2,347 feet of the stream surveyed, an A3 channel type for the next 1,181 feet of the stream surveyed, and an F4 channel type for the remaining 4,906 feet of the stream surveyed. The suitability of F4, A2, B4, A3 and F4 channel types for fish habitat improvement structures are as follows. F4 channel types are good for bank-placed boulders, fair for plunge weirs, single and opposing wing-deflectors, channel constrictors and log cover and poor for boulder clusters. A2 channel types are generally not suitable for fish habitat improvement structures due to high energy and stable stream banks with poor gravel retention capabilities. B4 channel types are excellent for low-stage plunge weirs, boulder cluster, bank placed boulders, single and opposing wing-deflectors and log cover.

The water temperatures recorded on the survey days June 24 to July 10, 2003 ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 60 to 81 degrees Fahrenheit.

Flatwater habitat types comprised 31% of the total length of this survey, riffles 37%, and pools 28%. The pools are relatively shallow, with only 57 of the 114 (50%) pools having a maximum residual depth greater than two feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two 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.

Seventy-four of the 111 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-seven of the pool tail-outs had embeddedness ratings of 3 or 4. Ten of the pool tail-outs had a rating of 5, which is considered not suitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Ninety-seven of the 111 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 61. The shelter rating in the flatwater habitats was 26. A pool shelter rating of approximately 80 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Bond Creek. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 93%. Reach 1 had a canopy density of 94%, Reach 2 had a canopy density of 97%, Reach 3 had a canopy density of 95%, Reach 4 had a canopy density of 94% and Reach 5 had a canopy density of 89%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 67% and 64%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Bond 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) 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.

4) 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.

5) Where feasible, design and engineer pool enhancement structures to increase the number of pools or deepen existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

6) Increase woody cover in the pools and flatwater habitat units. Adding high quality complexity with woody cover is desirable.

COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with Hollow Tree Creek. CCC rock structure.
79	0002.00	CCC structure, site dated May 4, 1999.
110	0003.00	Right bank failure measures 20' long x 5' wide x 10' high.
175	0005.00	CCC structure
203	0005.00	Electrofishing site Thermograph placement site. CCC site 404'.
343	0012.00	CCC structure, site dated May, 1999. Left bank erosion site measures 20' long x 1' wide x 6' high.
439	0014.00	Left bank failure measures 87' long x 5' wide x 20' high and extends into Habitat Units #015 and #016.
622	0018.00	CCC structure, site dated July, 1999.

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732	0020.00	Log debris accumulation (LDA) measures 22' long x 35' wide x 5' high and is composed of 16 pieces of large woody debris. It is retaining a volume of sediment measuring 20' long x 10' wide x 4' deep.
756	0021.00	Left bank failure measures 30' long x 7' wide x 10' high.
875	0024.00	CCC structure, site dated April 14, 2003.
997	0026.00	CCC structure.
1104	0028.00	Willow planting, site dated April 14, 2003.
1178	0030.00	CCC structure.
1214	0031.00	CCC structure.
1336	0034.00	CCC structure, site 1400’ April 6, 2003.
1370	0035.00	CCC structure.
1405	0036.00	CCC structure, site 1500' April 6, 2003.
1431	0037.00	CCC structure.
1445	0038.00	CCC structure.
1597	0043.00	CCC structure, site 1700' May 7, 1997.
1637	0044.00	Left bank failure measures 15' long x 6' wide x 20' high.
1659	0045.00	CCC structure.
1669	0046.00	CCC structure.
1760	0048.00	CCC structure. Left bank failure measures 30' long x 6' wide x 15' high.
1832	0050.00	CCC structures.
1903	0051.00	CCC structure. LDA measures 10’ long x 25’ wide x 6' high and is composed of nine pieces of large wood debris. It is retaining a volume of sediment measuring 10' long x 6' wide x 1' deep.
1949	0052.00	YOY salmonid observed.
2106	0055.00	CCC structure
2174	0057.00	CCC structure

2254	0059.00	CCC structure.
2312	0061.00	CCC structure, site 2490'
2392	0063.00	CCC structure
2799	0072.00	CCC structure, site 2980'
2851	0073.00	CCC structure, site 3050'
3078	0077.00	CCC structure
3142	0078.00	Left bank erosion site measures 10' long x 10' deep x 90' high and is beginning to revegetate.
3161	0079.00	Old road crossing. CCC structure, site 2425' April 6, 2003
3230	0080.00	CCC structure, site 3425'
3325	0082.00	CCC structure, site 3600' April 16, 2003
3430	0084.00	CCC structure
3475	0085.00	Good access trail
3517	0086.00	CCC structure
3544	0087.00	CCC structure
3641	0089.00	CCC structure. Dry tributary enters from left bank with 5% slope. Channel is entrenched 4’.
3954	0096.00	CCC structure, site 4160' May 12, 1999
4088	0098.00	CCC structure
4197	0101.00	CCC structure, site 4500' April 17, 2003. Left bank erosion site measures 20’ long x 5' wide x15' high.
4266	0102.00	CCC structure
4354	0105.00	CCC structure. Tributary enters from left bank, not accessible to fish.
4547	0109.00	CCC structure
4649	0112.00	CCC structures

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4717	0113.00	Tributary enters from left bank; the water temperature was 54 degrees Fahrenheit. It is not accessible to fish.
4738	0114.00	CCC structure
4875	0116.00	CCC structure
5021	0119.00	CCC structure
5099	0122.00	Electrofishing site. Channel type changes from F4 to A2. CCC structure.
5148	0123.00	CCC rock weir structure.
5424	0132.00	Electrofishing site. Erosion site on the left bank measures 20' long x 30' deep x 40' high.
5453	0133.00	Channel type changes from A2 to B4. LDA measures 40' long x 20' wide x 7' high and is composed of six pieces of large wood. It is not retaining sediment.
5751	0135.00	Dry tributary entering from right bank.
5822	0136.00	CCC structure, site 6250' June 17, 1999.
5904	0138.00	LDA measures 25' long x 25' wide x 6' high and is retaining a volume of sediment measuring 20' long x 10' wide x 3' deep.
5985	0141.00	Electrofishing site. CCC structure.
6034	0143.00	CCC structure on the right bank. Electrofishing site
6166	0145.00	Electrofishing site. LDA measures 25' long x 20' wide x 10' high and is composed of seven pieces of large wood.
6219	0147.00	CCC site 6330'
6281	0148.00	Dry side channel parallels unit.
6310	0149.00	CCC structure creating an LDA measuring 20' long x 20' wide x 7' high and is composed of six pieces of large wood. It is retaining a volume of sediment measuring 10’ long x 20’ wide x 1’ deep. Electrofishing site.
6351	0150.00	Channel type changes from A2 to B4.
6516	0153.00	CCC structure. Left bank erosion site measures 20' long x 50' high and is contributing gravel to the stream. Electrofishing site

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6550	0154.00	CCC digger log structure
6899	0161.00	CCC structures. Electrofishing site.
6986	0163.00	Channel is narrow and bedrock dominated for 90’.
7044	0165.00	Rip rap on right bank measures 20' long x 10' deep x 20' high.
7126	0169.00	CCC structure
7309	0171.00	Right bank erosion site measures 5' long x 5' wide x 10' high.
7450	0174.00	LDA measures 20' long x 30' wide x 10' high and is composed of six pieces large wood. It is retaining a volume of sediment measuring 20' long x 10' wide x 7' deep. Underwater observation site. Electrofishing site
7654	0178.00	CCC structure
7702	0180.00	CCC structure
7722	0181.00	Channel type change B4 to A3.
7800	0182.00	CCC structure
7987	0186.00	CCC structure
8140	0190.00	Three foot high plunge. Electrofishing site
8206	0192.00	LDA is composed of four pieces large wood and packed with small woody debris. It measures 7' long x 3' wide x 8' high.
8242	0193.00	Flagged road "start PWA survey."
8312	0195.00	CCC structure.
8397	0198.00	Left bank erosion site measures 5' long x 5' wide x 1' high.
8421	0199.00	Log spanning creek and retaining sediment measuring 10' long x 10' wide x 4' deep.
8560	0203.00	Log spanning channel and retaining sediment measuring 50’ long x10' wide x 4' deep and creating a 2' high plunge.
8605	0204.00	Two foot high plunge.

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8682	0205.00	Tributary enters from left bank at a 25% gradient.
8712	0206.00	CCC structure
8881	0211.00	CCC structure
8920	0212.00	Channel type change from A3 to F4. Left bank erosion site measures 90' long x 40' wide x 80' high and is contributing fine sediment and gravel to the stream.
9004	0214.00	CCC structure.
9067	0216.00	LDA measures 50' wide x 7' high.
9093	0217.00	LDA measures 25' long x 50' wide x 7' high. There are no visible gaps in it. High flow side channel with over 14 pieces large wood. It is retaining sediment measuring 60' long x 9' wide x 3' deep.
9367	0226.00	LDA is composed of over 11 pieces of large wood and is retaining sediment measuring 15' long x 5' wide x 2' deep.
9603	0233.00	Road crossing.
11914	0269.00	Left bank erosion site measures 30' wide x 5' high.
11943	0270.00	LDA measures 20' long x 10' wide x 5' high and is composed of five pieces of large wood. It is retaining sediment measuring 20' long x 10' wide x 3' deep.
12264	0277.00	LDA measures 30' long x 50' wide x 12' high and is retaining sediment measuring 30' long x 30' wide x 3' deep.
13107	0294.00	LDA measures 20' long x 40' wide x 7’ high and is composed of eight pieces of large wood. It is retaining sediment measuring 20' long x 10' wide x 3' deep.
13304	0298.00	Dry left bank tributary with 20% gradient.
13576	0302.00	Right bank erosion site measures 36' long x 1' wide x10' high.
13623	0303.00	Left bank erosion site measures 20' long x 8' high.
13662	0305.00	LDA measures 15' long x 20' wide x 12' high and is composed of 11 pieces of large wood. It is retaining sediment measuring 5' wide x 3' deep.

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13727	0307.00	Six foot diameter root wad blocking the channel and retaining sediment measuring 20' long x 10' wide x 5' deep.
13882	0309.00	End of survey due to access constraints. Not the end of anadromy.

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.

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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]	