STREAM INVENTORY REPORT

Michaels Creek

INTRODUCTION

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

Michaels Creek is a tributary to Hollow Tree Creek, a tributary to South Fork Eel River, a tributary to Eel River, a tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Michaels Creek's legal description at the confluence with Hollow Tree Creek is T22N R17W S14. Its location is 39°45'45.0" north latitude and 123°43'17.0" west longitude. Michaels Creek is a second order stream and has approximately 4.73 miles of blue line stream (including tributaries) according to the USGS Leggett 7.5 minute quadrangle. Michaels Creek drains a watershed of approximately 3.65 square miles. Elevations range from about 1,220 feet at the mouth of the creek to 1,600 feet in the headwater areas. Redwood/Douglas fir and mixed hardwood dominate the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via State Highway 1 to Westside Road at Hales Grove.

METHODS

The habitat inventory conducted in Michaels Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps Technical Advisor 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 pool units 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 Michaels 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) at 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 (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. 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". Michaels 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 Michaels 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 like bedrock, log sills, boulders 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 Michaels 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 Michaels 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 Michaels 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 Michaels Creek. In addition, nine sites were snorkel surveyed. 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 1.0.34, 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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Michaels 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 6/24/2003 to 7/23/2003 was conducted by Lindsay Selvaggio and Corby Hines (WSP/AmeriCorps), and Dan Resnik (CCC). The total length of the stream surveyed was 13,749 feet with an additional 112 feet of side channel.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.27 cfs on 06/26/03.

Michaels Creek is a B4 channel type for the first 5,890 feet of the stream surveyed (Reach 1) and an F4 channel type for remaining 7,859 feet of the stream surveyed (Reach 2). 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. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 47 to 66 degrees Fahrenheit. Air temperatures ranged from 59 to 84 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 35% riffle units, 33% pool units, 31% flatwater units, and 0.2% dry units (Graph 1). Based on total length of Level II habitat types there were 40% flatwater units, 32% riffle units, 27% pool units, and 0.3% dry units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 25% mid-channel pool units, 21% run units, and 21% low gradient riffle units (Graph 3). Based on percent total length, 23% were run units, 22% mid-channel pool units,

and 20% low gradient riffle units.
A total of 137 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 76%, and comprised 81% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depth by pool habitat types. Pool quality for salmonids increases with depth. Fifty-three of the 137 pools (39%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 137 pool tail-outs measured, 102 had a value of 1 (74.5%); 23 had a value of 2 (16.8%); 4 had a value of 3 (2.9%); 1 had a value of 4 (0.7%); and 7 had a value of 5 (5.1%); (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 unsuited for spawning due to inappropriate substrate like bedrock, log sills or boulders.

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. Pool habitats had a mean shelter rating of 58, riffle habitat types had a mean shelter rating of 22, and flatwater habitat types had a mean shelter rating of 11 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 62, scour pools had a mean shelter rating of 46, and backwater pools had a mean shelter rating of 40 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris and small woody debris are the dominant cover types in Michaels Creek. Graph 7 describes the pool cover in Michaels 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 observed in 29% of pool tail-outs.

The mean percent canopy density for the surveyed length of Michaels Creek was 93%. The mean percentages of hardwood and coniferous trees were 80% and 20%, respectively. Graph 9 describes the mean percent canopy in Michaels Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 54%. The mean percent left bank vegetated was 57%. The dominant elements composing the structure of the stream banks consisted of 54% cobble/gravel and 26% sand/silt/clay, (Graph 10). Hardwood trees were the dominant vegetation type observed in 57% of the units surveyed. Additionally, 18% of the units surveyed had grass as the dominant vegetation type, and 17% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Nine sites were snorkel surveyed for species composition and distribution in Michaels Creek on November 04, 2003. Water temperatures taken during the snorkel survey period (0940 to 1430) ranged from 39 to 40 degrees Fahrenheit. The sites were sampled by Trevor Tollefson (DFG)

and Sarah Ganas (WSP).

In reach one, three sites were sampled between habitat units 001 and 152, a distance of 5,869 feet. The reach yielded 11 steelhead young-of-year and 24 coho young-of-year.

In reach two, six sites were sampled between habitat units 152 and 405, a distance of 7,880 feet. The reach yielded 21 steelhead young-of-year, four steelhead 1+, 63 coho young-of-year, and five coho 1+.

Additionally, one site was sampled upstream of the habitat inventory survey, 14,849 feet from the confluence with Hollow Tree Creek. This site yielded two coho young-of-year.

The following chart displays the information yielded from these sites:

Figure 1. 2003 Michaels Creek snorkel survey observations.

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		Steelhead Trout/ Rainbow Trout		
					YOY	1+	YOY	1+	2+
Reach 1 B4 Channel Type									
11/04/03	1	022	4.2	946’	8	0	4	0	0
11/04/03	2	039	4.2	1635’	7	0	3	0	0
11/04/03	3	078	4.2	3333’	9	0	4	0	0
Reach 2 F4 Channel Type									
11/04/03	4	167	4.2	6372’	1	0	2	0	0
11/04/03	5	200	4.3	7400’	10	0	3	0	0
11/04/03	6	267	4.2	9490’	23	3	11	4	0
11/04/03	7	322	4.2	11,493’	10	0	2	0	0
11/04/03	8	395	3.4	13,338’	19	2	3	0	0
11/04/03	9		3.3	14,849’	2	0	0	0	0

DISCUSSION

Michaels Creek is a B4 channel type for the first 5,890 feet of the stream surveyed (Reach 1) and

an F4 channel type for the next 7,859 feet of the stream surveyed (Reach 2). The suitability of B4 channel types 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. 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 water temperatures recorded on the survey days 6/24/2003 to 7/23/2003, ranged from 47 to 66 degrees Fahrenheit. Air temperatures ranged from 59 to 84 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 40% of the total length of this survey, riffles 32%, and pools 27%. The pools are relatively shallow, with 53 of the 137 (39%) 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. 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.

One-hundred-twenty-five of the 137 pool tail-outs measured had embeddedness ratings of 1 or 2. Five of the pool tail-outs had embeddedness ratings of 3 or 4. Seven of the pool tail-outs had a rating of 5, which is considered unsuitable 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.

One-hundred-twenty-five of the 137 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 58. The shelter rating in the flatwater habitats was 11. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Michaels Creek. Large woody debris is also 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 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 93%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was at 54% and 57%, 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) Manage Michaels Creek 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) 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.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from large woody debris. Adding high quality complexity with woody cover is desirable.

5) Evaluate the fish habitat improvement structures for effectiveness. If necessary, modify or maintain the structures following the evaluation recommendations.

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.

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Start of survey at the confluence with Hollow Tree Creek.
46	0003.00	Fish habitat improvement structure
114	0005.00	Fish habitat improvement structure
516	0013.00	Fish habitat improvement structure
590	0014.00	Channel type taken. Channel type is a B4
680	0015.00	Stream flow taken
680	0015.00	Fish habitat improvement structure
946	0022.00	Fish habitat improvement structure First snorkel survey site

Position (ft.)	Habitat Unit #	Comments:
1048	0025.00	Fish habitat improvement structure
1087	0027.00	Fish habitat improvement structure
1263	0032.00	Fish habitat improvement structure
1326	0034.00	Fish habitat improvement structure
1473	0036.00	Fish habitat improvement structure
1635	0039.00	Fish habitat improvement structure Second snorkel survey site
1765	0042.00	Fish habitat improvement structure
1765	0042.00	Left bank tributary #1 (Doctors Creek). Flow estimated to be 0.7cfs. Slope measured at 4%. Water temperature of tributary was 55°F. Temperatures of Michaels Creek above and below the tributary were 54°F and 58°F, respectively. Coho and steelhead observed.
2105	0050.00	Fish habitat improvement structure, some debris accumulating.
2269	0052.00	Old bridge contributing wood and sediment.
2306	0053.00	Access Points / Location: (Road)
2387	0055.00	Fish habitat improvement structure
2421	0056.00	Fish habitat improvement structure
2891	0066.00	Fish habitat improvement structure
2959	0068.00	Left bank unnamed tributary #2 enters 9' into unit. Flow estimated to be <0.1cfs. Slope measured at 50%. Water temperature of tributary 52°F. The temperature of Michaels Creek both above and below was 60°F. Not accessible to fish.
3064	0072.00	Log debris accumulation (LDA) 10'H x 25'W x 25'L, containing 10 pieces of large wood. LDA is retaining gravel and cobble, 15'W x 20'L x 4'D. Gaps visible in LDA, allowing water to flow through. Not a barrier to salmonids, as fish were observed upstream.
3333	0078.00	Third snorkel survey site
3411	0081.00	Right bank unnamed tributary #3. Flowing intermittently, but dry at mouth. Water temperature for tributary was 51°F. Water temperatures both above and

Position (ft.)	Habitat Unit #	Comments:
		below Michaels Creek were 56°F. Tributary not accessible to fish.
3513	0083.00	Fish habitat improvement structure
3762	0088.00	Fish habitat improvement structure
3809	0089.00	Right bank unnamed tributary #4. Flow estimated to be <0.1cfs. Slope measured at 50%. Water temperature of tributary 56°F. Temperatures of Michaels Creek both above and below tributary were 58°F. Not accessible to fish.
3944	0092.00	Right bank erosion contributing sediment and large woody debris, 35'L x 55'H x 20'W.
3968	0093.00	Fish habitat improvement structure
3982	0094.00	Fish habitat improvement structure
4030	0096.00	Fish habitat improvement structure
4322	0104.00	Fish habitat improvement structure
4391	0106.00	Fish habitat improvement structure
4477	0110.00	LDA, 10'H x 25'W x 40'L, containing 12 pieces of large wood. Gaps visible, allowing water to flow through. Retaining sediment ranging from sand to small cobble. LDA not a barrier to salmonids, as fish were observed upstream of LDA.
5192	0128.00	Fish habitat improvement structure. Large woody debris accumulating on structure.
5404	0135.00	Fish habitat improvement structure. Small woody debris accumulating on structure.
5533	0139.00	Fish habitat improvement structure
5577	0141.00	Fish habitat improvement structure, with 2 pieces of large woody debris.
5824	0150.00	Fish habitat improvement structures
5844	0151.00	Fish habitat improvement structure
5869	0152.00	Channel type taken, change from B4 to F4.

Position (ft.)	Habitat Unit #	Comments:
5869	0152.00	Right bank tributary #5. Intermittent flow estimated to be 0.1cfs, dry at mouth. Slope measured to be 50%. Water temperature 53°F. Temperatures of Michaels Creek both above and below the tributary were 57° F. Not accessible to fish.
6039	0159.00	Two springs enter from left bank.
6156	0162.00	Spring enters from left bank 10' into habitat unit.
6372	0167.00	Fish habitat improvement structure Fourth snorkel sample site
6449	0170.00	Right bank unnamed tributary #6. Not flowing. Slope measured at 22%. Accessible to fish.
6529	0173.00	Fish habitat improvement structure
6936	0186.00	Left bank unnamed tributary #7 enters 17' into unit. Flow estimated to be <0.1cfs. Slope measured at 30%. Water temperature 52°F. Temperatures of Michaels Creek both above and below tributary were 57° F. Not accessible to fish.
7400	0200.04	LDA, 8'H x 35'W x 35'L, containing 20 pieces of large wood. LDA retaining sediment ranging from sand to small cobble,15'W x 30'L x 6'D. Fish observed upstream. Fifth snorkel survey site.
7677	0211.00	Right bank unnamed tributary #8 enters at top of unit. Not flowing. Slope measured at 35%. Not accessible to fish.
8258	0229.00	Right bank erosion, 60'L x 25'H x 7'W.
8834	0242.00	Right bank erosion, 60'L x 15'H x 4'W.
8834	0242.00	LDA, 8'H x 25'W x 37'L, containing 17 pieces of large wood. Gaps visible in LDA, causing water to flow through. LDA retaining sediment ranging from gravel to cobble, 7'W x 8'L x 3'D. LDA not a barrier to salmonids, as fish were observed above LDA.
8925	0245.00	Left bank unnamed tributary #9 not flowing. Slope measured at 30%. Not accessible to fish.
9159	0252.00	Fish habitat improvement structure

Position (ft.)	Habitat Unit #	Comments:
9184	0253.00	Fish habitat improvement structure
9196	0254.00	Fish habitat improvement structure
9334	0260.00	Fish habitat improvement structures, accumulating large woody debris
9490	0265.00	Sixth snorkel survey site
9610	0271.00	LDA, 10'H x 18'W x 15'L, containing 11 pieces of large wood. Gaps visible in LDA, allowing water to flow through. LDA retaining sediment ranging from sand to gravel, 10'W x 8'L x 3'D. LDA not a barrier to salmonids, as fish were observed upstream of the LDA.
9964	0280.00	Left bank unnamed tributary, not flowing. Slope measured at approximately 30%. Not accessible to fish.
10574	0295.00	LDA, 10'H x 10'W x 15'L, containing 6 pieces of large wood. Gaps visible in LDA, allowing water to flow through. LDA retaining sediment ranging from gravel to cobble, 5'W x 5'L x 1'D. LDA not a barrier to salmonids, as fish were observed above LDA.
10737	0300.00	LDA, 9'H x 20'W x 35'L, containing 18 pieces of large wood. Gaps visible in LDA, allowing water to flow through. LDA retaining sediment ranging from gravel to cobble, 5'W x 10'L x 1'D. LDA not a barrier to salmonids, as fish were observed above LDA.
10795	0302.00	Right bank unnamed tributary #11, not flowing. Slope measured at approximately 35%. Not accessible to fish.
10871	0304.00	LDA, 7'H x 15'W x 20'L, containing 9 pieces of large wood. Gaps visible in LDA, allowing water to flow through. LDA retaining sediment ranging from gravel to cobble, 10'W x 4'L x1'D. LDA not a barrier to salmonids, as fish were observed above LDA.
11493	0322.00	Left bank tributary #12, not flowing. Slope measured to be approximately 17%. Not accessible to fish. Seventh snorkel survey site
11843	0333.00	Left bank erosion, 28'L x 18'H x 4'W.
12190	0347.00	LDA, 5'H x 16'W x 16'L, containing 7 pieces of large wood. Gaps visible in LDA, allowing water to flow through. LDA retaining sediment ranging from gravel to cobble, 12'W x 5'L x 2'D. LDA not a barrier to salmonids, as fish were observed above LDA.

Position (ft.)	Habitat Unit #	Comments:
12241	0349.00	Two pieces of large woody debris collecting small woody debris.
12547	0359.00	Left bank tributary #13 enters at top of unit. Flow estimated at <1cfs. Slope measured at 4%. Water temperature at 63°F. Temperatures of Michaels Creek both above and below were measured to be 64°F. Accessible to fish, coho observed.
12605	0362.00	Three pieces of large woody debris collecting small woody debris.
13086	0385.00	Large woody debris collecting small woody debris.
13335	0395.00	Eighth snorkel survey site
13653	0405.00	The probable end of anadromy was determined to be at 16,514', 2,765' upstream of the habitat inventory survey. No channel type was completed for the upper reach, although it was believed to change from an F4 to an A3, as the channel narrowed to a bankfull width of 6', and the slope increased to 20% approximately 300' past the confluence of what would be Tributary #14. The substrate of the main channel was small cobble, though extremely silty, and the stream was high-gradient riffle/plunge pool dominated. Tributary #14 enters the stream from the left bank at approximately 14,849', contributes 35-40% to the flow, and is accessible to salmonids. One salmonid was observed 300' upstream of the confluence with the main channel. One 1+ salmonid was observed at approximately 15,549'. The survey continued roughly 1000' beyond this point; no further salmonids were observed. The channel was filled with large woody debris and contained numerous plunge pools, or waterfalls, with little or no pool below. The probable end of anadromy was determined to be at 16,514' where the channel became so constricted that access was no longer viable, and a 4.5' diameter log spanned the channel.
13749	0405.00	End of habitat inventory due to access constraints. Remaining 2,765' of stream in which anadromous fish were observed was measured using a hip chain, and a narrative of the channel was completed (see above).

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]	