SALMON AND STEELHEAD RESTORATION AND ENHANCEMENT PROGRAM

NORTH COAST

WATERSHED PLANNING and COORDINATION PROJECT

STREAM INVENTORY REPORT

Larabee Creek, Mainstem Eel River, 2000

CALIFORNIA DEPARTMENT OF FISH AND GAME

SPORT FISH RESTORATION ACT

2000

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Larabee Creek

NORTH COAST WATERSHED PLANNING and COORDINATION PROJECT

The North Coast Watershed Planning and Coordination Project (NCWPCP), formerly the Basin Planning Project (BPP), was begun in 1991 to develop salmon and steelhead restoration and enhancement programs in North Coast watersheds for the Department of Fish and Game (DFG). The objectives of the project conform with the goals of California's Salmon and Steelhead Restoration and Enhancement Program of 1988. The Restoration Program strives to enhance the status of anadromous salmonid populations and improve the fishing experience for Californians. The program intends to achieve a doubling of the population of salmon and steelhead by the year 2000. The project is supported by the Sport Fish Restoration Act, which uses sport fishermen's funds to improve sport fisheries.

The NCWPCP conducts stream and habitat inventories according to the standard methodologies discussed in the *California Salmonid Stream Habitat Restoration Manual*, (Flosi et.al., 1998). Biological sampling is conducted using electrofishing and direct observation to determine species presence and distribution; selected streams are electrofished for population estimates. Some streams are also sampled for sediment composition. Collected information is used for base-line data, public cooperation development, restoration program planning, specific project design and implementation, and for project evaluation.

The Eel River system was identified as the initial basin for project planning activities. Most anadromous tributaries to the Van Duzen, South Fork Eel, Mainstem Eel, Middle Fork Eel, and the North Fork Eel rivers have been inventoried since 1991. Initial field inventory of the Eel River system should be essentially complete in 1996. NCWPCP personnel have also worked in cooperation with the DFG Salmon Restoration Project's staff to inventory streams on the Mattole River, Mendocino Coast, and Humboldt Bay.

STREAM INVENTORY REPORT

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INTRODUCTION

A stream inventory was conducted during the summer of 2000 on Larabee Creek. The 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 Larabee 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

Larabee Creek is tributary to the mainstem Eel River, located in Humboldt County, California (Map 1). Larabee Creek's legal description at the confluence with the mainstem Eel River is T1S R2E S2. Its location is 40°24′33″ North latitude and 123°55′54″ West longitude. Larabee Creek is a fourth order stream and has approximately 24 miles of blue line stream according to the USGS Redcrest, Myers Flat, Bridgeville, Blocksburg, Larabee Valley, Dinsmore 7.5 minute quadrangles. Larabee Creek drains a watershed of approximately 81.5 square miles, and the system has a total of 75.5 miles of blue line stream. Elevations range from about 100 feet at the mouth of the creek to 2,400 feet in the headwater areas. Redwood, Douglas fir, mixed hardwood forests, and grasslands dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access to the mouth of Larabee Creek exists from U.S. Highway 101 via the Shively Road. To get to the upper watershed vehicle access exists via U.S. Highway 101 to Highway 36, proceeding east to Bridgeville. At Bridgeville turn right onto Alderpoint Road. Follow Alderpoint Road over the ridge to the Larabee watershed.

METHODS

The habitat inventory conducted in Larabee Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et. al.,1998). The AmeriCorps Watershed Stewards Project (WSP) 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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<u>SAMPLING STRATEGY</u>

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1995). 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, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further 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.

<u>HABITAT INVENTORY COMPONENTS</u>

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 Larabee 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, if available. In some cases flows are estimated.

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.

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. Additionally, a recording thermograph was deployed in Larabee Creek to record temperatures on a 24 hour basis during warm summer months.

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4. Habitat Type:

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". Larabee 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. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Larabee 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 Larabee 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.

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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 Larabee 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 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 Larabee 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 was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Larabee Creek fish presence was observed from the stream banks, and four sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85 mm)(Valentine, 1995).

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:

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- 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

Graphics are produced from the tables using Quattro Pro. Graphics developed for Larabee 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
- 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 19, to August 31, 2000, was conducted by Dan Kintz, Daria Libel, Johanna Schussler, Gordon Johnson (WSP), Courtney Danely, and Jennifer Jenkins (CCC). The total length of the stream surveyed was 124,337 feet with an additional 2,427 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 15.9 cfs on July 3, 2000

Larabee Creek is a F4 channel type for the first 27,905 feet, a B2 channel type for the next 1,206 feet, a F2 channel type for the next 16,814 feet, a B3 channel type for the next 7,692 feet, and a B4 channel for the remaining 66,720 feet of the stream reach surveyed.

Water temperatures taken during the survey period ranged from 61°-78° F. Air temperatures ranged from 58°-92° F.

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Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 29% riffle units, 29% flatwater units, and 38% pool units (Graph 1). Based on total **length** of Level II habitat types there were 30% riffle units, 31% flatwater units, and 30% pool units (Graph 2).

Seventeen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 29%; mid-channel pools, 29%; and runs, 27% (Graph 3). Based on percent total **length**, low gradient riffles made up 29%; runs, 29%; and mid-channel pools, 22%.

A total of 435 pools were identified (Table 3). Main channel pools were most frequently encountered at 77% and comprised 78% 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. Three hundred sixty of the 435 pools (82%) had a depth of two feet or greater, while 236 of 435 (54%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 363 pool tail-outs measured, seventy-eight had a value of 1 (21%); 138 had a value of 2 (38%); eighty-three had a value of 3 (22%); nineteen had a value of 4 (5%) and forty-five had a value of 5 (12%) (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.

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 18, flatwater habitat types had a mean shelter rating of 15, and pool habitats had a mean shelter rating of 22 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 23. Scour pools had a mean shelter rating of 22 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Larabee Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Larabee Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Gravel was the dominant substrate observed in 229 of the 363 pool tail-outs measured (63%). Small cobble was the next most frequently observed dominant substrate type and occurred in 23% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 30%. The mean percentages of conifer and deciduous trees were 24% and 76%, respectively. Graph 9 describes the canopy in Larabee Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 58.3%. The mean percent left bank vegetated was 61.1%. The dominant elements composing the structure of the stream banks consisted of 10% bedrock, 26.9% boulder, 52.9% cobble/gravel, and 10.2% sand/silt/clay (Graph 10). Deciduous trees were the dominant bank vegetation type observed in 46.4% of the units surveyed. Additionally, 45.6% had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads, and 8% was not vegetated (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Four sites were electrofished on August 30, October 11, 12, 2000 in Larabee Creek. The sites were sampled by Glenn Yoshioka (CDFG), Gordon Johnson, and Dan Kintz (WSP).

The first site was sampled on August 30, 2000. The sampling site began at a stream ford located 68,223 feet upstream of the mouth of Larabee Creek and extended upstream 55 feet. The site included a low gradient riffle and a lateral scour pool (bedrock formed). The site yielded 43 juvenile steelhead rainbow trout and 4 California roach. Based upon visually estimated lengths, the probable distribution of steelhead age classes was 40 age 0+, 1 age 1+, 1 age 2+, and age 3+ individuals.

The second site was sampled on October 11, 2000 at the confluence with Mill Creek, approximately 75,299 feet from the mouth of Larabee Creek. The site included a lateral scour pool (bedrock formed), a run, and a low gradient riffle. The site yielded 33 juvenile steelhead rainbow trout and 1 California roach. Based upon visually estimated lengths, the probable distribution of steelhead age classes was 29 age 0+ and 4 age 1+ individuals.

The third site was sampled on October 12, 2000 at the confluence with Martin Creek, approximately 84,407 feet from the mouth of Larabee creek. The site included a low gradient riffle, a run, a secondary channel pool, and two mid-channel pools. The site yielded 93 juvenile steelhead rainbow trout and 26 California roach. Based upon visually estimated lengths, the probable distribution of steelhead age classes was 85 age 0+, 4 age 1+, and 4 age 2+ individuals.

The fourth site was sampled on August 30, 2000 and began at the confluence with Cooper Creek, 124,337 feet above the mouth of Larabee Creek and extended downstream. Flows had gone subsurface, with scattered, isolated mid-channel pools. The site included three of these isolated mid-channel pools. The site yielded 74 juvenile steelhead rainbow trout, 76 California roach, and one lamprey ammocoete. Based upon visually estimated lengths, the probable distribution of steelhead age classes was 66 age 0+, 6 age 1+, and 2 age 2+ individuals.

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Four size classes of juvenile steelhead rainbow trout were found in Larabee Creek. These size classes probably represent the following four age classes (0+, 1+, 2+, 3+) based on the size categories listed in the Restoration Manual. These data can be summarized as follows:

	SHRT Age 0+	SHRT Age 1+	SHRT Age 2+	SHRT Age 3+
Site 1	40	1	1	1
Site 2	29	4	0	0
Site 3	85	4	4	0
Site 4	66	6	2	0

<u>GRAVEL SAMPLING RESULTS</u>

No gravel samples were taken on Larabee Creek.

<u>DISCUSSION</u>

Larabee Creek is a F4 channel type for the first 27,905 feet of stream surveyed, a B2 channel type for the next 1,206 feet, a F2 channel type for the next 16,814 feet, a B3 channel type for the next 7,692 feet, and a B4 for the remaining 66,720 feet. The suitability of F4 channel types for fish habitat improvement structures is: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, log cover; and poor for boulder clusters. The suitability of B2 channel types for fish habitat improvement structures is excellent for plunge weirs, single and opposing wing-deflectors, and log cover. The suitability of F2 channel types for fish habitat improvement structures is fair for plunge weirs, single and opposing wing-deflectors, and log cover. The suitability of B3 channel types for fish habitat improvement structures is excellent for plunge weirs, boulder clusters and bank placed boulder, single and opposing wing-deflectors, and log cover. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days between June 19 to August 31, 2000, ranged from 61°-78 °F. Air temperatures ranged from 58°-92 °F. The upper end of this water temperature range is unacceptable for salmonids. The maximum temperature observed, 78° F, is probably lethal to juvenile salmon. Much of Larabee Creek seems to have maximum summer temperatures that are marginal for salmonids. However, to obtain a more complete temperature profile, temperature monitoring should be performed for several additional years. Also additional data was collected from recording thermographs at 3 sites deployed during the summer of 1999 and 2000 by the Humboldt County RCD and the Pacific Lumber Company.

Flatwater habitat types comprised 31% of the total length of this survey, riffles 30%, and pools 30%. The pools are relatively deep, with 236 of the 435 (54%) pools having a maximum depth greater than 3 feet. 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. Primary pools comprise 16% of the total length of the habitat surveyed. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat.

Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with any needed modification of log debris accumulations (LDA) in the stream. The LDAs in the system may be retaining gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Seventy-eight of the 363 (21%) pool tail-outs measured had an embeddedness rating of 1, 38% had a rating of 2, 27% had ratings of 3 or 4, and 12% had a rating of 5 and were considered unsuitable for spawning. Twenty-six of the forty-five (57%) with a rating of 5 were unsuitable for spawning due to the dominant substrate being silt/sand/clay or gravel being too small. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Larabee Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was low with a rating of 22. The shelter rating in the flatwater habitats was slightly lower at 15. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in nearly all habitat types. Additionally root masses contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Instream cover created by small and large woody debris provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Three hundred eleven of the 363 (86%) pool-tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 30%. This is a low percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 58.3% and 61.1%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting native species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) The limited water temperature data available suggest that maximum temperatures are above 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 canopy and bank vegetation on Larabee Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy or bank vegetation is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

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) Primary pools comprise 16% of the total length of the habitat surveyed. Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

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

8) There are several log debris accumulations present on Larabee Creek. The modification of these debris accumulations may be desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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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 the confluence with the mainstem Eel River.
135'	Side channel dries up 30' before entering the Eel River
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320'	Hundreds of young-of-the-year (YOY) fish, species unknown.
3474'	Chris Creek enters from the right bank (RB) at the top of the unit.
3695'	Out of the hydrologic influence of the Eel River and its flood prone zone, begin 100% survey of habitat types by first occurrence.
11094'	Left bank (LB) slope failure, 50' L x 100' H.
11815'	Balcom Creek enters on LB.
14486'	Carson Creek enters on RB.
22685'	Tributary enters LB at bottom of unit.
28152'	RB tributary enters.
29791'	LB tributary trickles into Larabee Creek.
29991'	Begin unsurveyed (9.0) section through the Gorge. Unit is estimated to be 4000' long.
33991'	Continue survey 115' past RB Unnamed Tributary 1 at boulder enhanced lateral scour pool.
36381'	RB tributary enters 150' into unit.
39128'	Minor LB tributary enters at the top of the unit.
39896'	LB tributary enters 25' into unit.
41181'	LB tributary enters Larabee Creek. Tributary does not appear accessible for anadromous species.

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43144'	LB tributary enters at top of unit.
44741'	RB tributary enters Larabee Creek.
48022'	LB tributary enters 50' into unit.
51719'	Larabee Creek is very confined with numerous large boulders.
56976'	LB tributary enters 20' into unit.
57502'	Burr Creek enters from RB at top of unit.
61708'	LB tributary enter 35' into unit.
65559'	Large pond formed by 1603 permitted man-made dam. Dam is made of a heavy plastic weave tube filled with water. Dam has provision for fish passage. The down stream side of the dam is rocked in to help keep in place.
66214'	LB tributary enters 120' into unit.
68107'	LB tributary enters at top of unit.
68223'	Road crosses creek. Bioinventory Site #1.
70217'	LB tributary enters at top of unit.
71502'	RB tributary enters at top of unit.
72036'	RB tributary enters Larabee Creek.
75024'	Unnamed Tributary 4 enters from LB. Salmonids present.
75299'	RB tributary enters at top of unit, salmonids present.
77942'	Knack Creek enters from RB.
77994'	Large canyon/ gorge with large boulders throughout unit.
80048'	Boulder field.
80608'	RB tributary enters at top of unit.
80705'	LB tributary enters at top of unit.
82366'	Log Debris Accumulation (LDA), 40' L x 20' W

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82903'	RB failure contributing fine sediment which is in evidence in 3-4 downstream units.
84407'	RB tributary enters at bottom of unit.
85470'	LB tributary enters Larabee Creek.
87608'	Bridge passes over unit. LB tributary enters at top of unit.
87652'	Road fords the creek.
87736'	Gorge with large boulders.
91700'	Bosworth Creek enters at top of unit, salmonids present.
94168'	Very narrow channel/ gorge with large boulders. 6' plunge at top unit.
96758'	Unit flows through 4 2' diameter culverts.
96798'	Bridge passes over unit.
100488'	Road fords stream.
101688'	Fence crosses top of unit.
107996'	RB tributary enters at top of unit.
108876'	Bridge crosses over unit (Alderpoint Road).
115127'	Salmonids present, water temperature 64° F.
123614'	Cable over top of unit.
123915'	LDA, 60' L x 40' W
124337'	Cooper Creek enters RB at top unit. End of survey due to end of work season. Bioinventory Site #4.

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Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, California.`

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5