STREAM INVENTORY REPORT

West Chamberlain Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on West Chamberlain 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 West Chamberlain 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

West Chamberlain Creek is tributary to Chamberlain Creek, tributary to the North Fork Big River, tributary to Big River, tributary to the Pacific Ocean, and is located in Mendocino County, California (Map 1). West Chamberlain Creek's legal description at the confluence with Chamberlain Creek is T17N R15W S05. Its location is 39°21′56″ north latitude and 123°33′33″ west longitude. West Chamberlain Creek is a second order stream and has approximately 3.7 miles of blue line stream according to USGS Comptche and Northspur 7.5 minute quadrangles. West Chamberlain Creek drains a watershed of approximately 4 square miles. Elevations range from about 350 feet at the mouth of the creek to 1400 feet in the headwater areas. The watershed is dominantly mixed conifer. The watershed is primarily within Jackson Demonstration State Forest and is managed for timber production. Vehicle access exists via State Route 20.

METHODS

The habitat inventory conducted in West Chamberlain Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). 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 (Hopelain, 1994). 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.

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 West Chamberlain 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.

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". West Chamberlain 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 West Chamberlain 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 West Chamberlain 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 West Chamberlain 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 West Chamberlain 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 West Chamberlain Creek fish presence was observed from the stream banks, and two 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 Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

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

Graphics are produced from the tables using Quattro Pro. Graphics developed for West Chamberlain 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 27, July 1-3, 8-11, and 15-16, 1997, was conducted by Tara Cooper and Shelly Dunn (CCC), and Lisa Campbell (WSP\AmeriCorps). The total length of the stream surveyed was 18,363 feet with an additional 89 feet of side channel.

Flow was measured 150' from the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.2 cfs on June 19, 1997. A second flow was taken 7,865' from the confluence, also on June 19, 1997 at 0.58 cfs.

West Chamberlain Creek is an F4 channel type for 17,568 feet of stream reach surveyed. F4 channels are entrenched, meandering riffle/pool channels on a low gradient with high width/depth ratio. F4 channel types have gravel dominant substrates. The remaining 765 feet of stream reach surveyed is an A4 channel type. A4 channels are steep, narrow, cascading step pool streams with high energy/debris transport associated with depositional soils. A4 channels also have gravel dominant substrates.

Water temperatures taken during the survey period ranged from 53 to 64 degrees Fahrenheit. Air temperatures ranged from 57 to 79 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 25% riffle units, 33% flatwater units, 41% pool units, and 1% dry units (Graph 1). Based on total **length** of Level II habitat types there were 16% riffle units, 54% flatwater units, and 30% pool units (Graph 2).

Nineteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low gradient riffles, 24%; mid-channel pools, 23%; and step runs, 21% (Graph 3). Based on percent total **length**, step runs made up 44%, mid-channel pools 18%, and low gradient riffles 16%.

A total of 238 pools were identified (Table 3). Main channel pools were most frequently encountered at 60% and comprised 66% 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. Sixty-four of the 238 pools (25%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 238 pool tail-outs measured, 6 had a value of 1 (2.5%); 108 had a value of 2 (45.3%); 85 had a value of 3 (35.7%); 7 had a value of 4 (2.8%) and 35 had a value of 5 (14.6%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates that the tail-out is not suitable for spawning. Of the 35 pool tail-outs valued at 5, 26 (75%) were unsuitable for spawning due to the tail-outs being comprised of large cobble, boulder, bedrock or wood.

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 10, flatwater habitat types had a mean shelter rating of 27, and pool habitats had a mean shelter rating of 63 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 70. Main channel pools had a mean shelter rating of 61 and backwater pools had a rating of 54 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in West Chamberlain Creek. Graph 7 describes the pool cover in West Chamberlain Creek.

Table 6 summarizes the dominant substrate by habitat type. Of the nineteen low gradient riffles fully measured the dominant substrate in 18 was gravel or small cobble. Gravel was the dominant substrate observed in 156 of the 238 pool tail-outs measured (65.5%). Small cobble was the next most frequently observed dominant substrate type and occurred in 18.5% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 87%. The mean percentages of deciduous and coniferous trees were 18% and 82%, respectively. Graph 9 describes the canopy in West Chamberlain Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 85%. The mean percent left bank vegetated was 83%. The dominant elements composing the structure of the stream banks consisted of 10.6% bedrock, 6.5% boulder, 36.5% cobble/gravel, and 46.5% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 76.4% of the units surveyed, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on September 10, 1997, in West Chamberlain Creek. The sites were sampled by Tara Cooper and Craig Mesman (CCC).

The first site sampled included habitat units 192 through 195, a low gradient riffle/pool combination approximately 7,527 feet from the confluence with Chamberlain Creek. The site yielded 7 steelhead, 3 salamanders, and 1 sculpin.

The second site included habitat units 451 through 461, a pool/riffle/run combination located approximately 15,601 feet above the creek mouth. This site yielded 27 salamanders.

DISCUSSION

West Chamberlain Creek is an F4 channel type for the first 17,568 feet of stream surveyed and an A4 channel type for the remaining 765 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for weirs, single and opposing wing deflectors, channel constrictors, and log cover; and poor for boulder clusters. The suitability of A4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for weirs, opposing wing deflectors, and log cover; poor for boulder clusters, and single wing deflectors.

The water temperatures recorded on the survey days between June 27 and July 16, 1997, ranged from 53 to 64 degrees Fahrenheit. Air temperatures ranged from 57 to 79 degrees Fahrenheit.

This is an acceptable water temperature range for salmonids. 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 54% of the total **length** of this survey, riffles 16%, and pools 30%. The pools are relatively shallow, with only 64 of the 238 (25%) pools having a maximum 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 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.

Ninety-two of the 238 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 4 had a 1 rating. 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 West Chamberlain 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 63. The shelter rating in the flatwater habitats was 27. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by large woody debris and undercut banks in all habitat types. Additionally, small woody debris contributes a small amount. Log and root wad cover structure in the pool and flatwater habitats are needed to improve 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.

Two-hundred of the 238 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 87%. This is a relatively high 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 high at 85% and 83%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) West Chamberlain 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) 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.

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

5) 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.

6) 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.

COMMENTS AND LANDMARKS

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

0'	Begin survey at confluence with Chamberlain Creek. Channel type is an F4.
84'	Bridge, 15' long x 30' wide x 15' high.
705'	Right bank erosion, 18' long x 15' high.
2,587'	Right bank tributary with trickling water, dominant substrate is silt, no fish observed.
2,806'	Left bank erosion from the road above the creek, 58' long x 15' high.
3,245'	Right bank tributary with trickling water, the channel is very entrenched, cobble is the dominant substrate, no fish observed.
4,230'	Log Debris Accumulation (LDA), 7' long x 20' wide x 6' high.
4,248'	Right bank erosion, 20' long x 25' high.
4,490'	Left bank tributary not accessible to anadromous fish.

West Chamberlain Creek

4,761'	LDA, 5' long x 50' wide x 5' high, not a barrier.
5,500'	LDA, 7' long x 20' wide x 4' high, not a barrier.
5,755'	Culvert.
6,033'	Road 15' above the left bank.
6,063'	Left bank erosion, 30' long.
6,198'	Water diversion on left bank.
6,220'	Right bank tributary, dry. Accessible to anadromous fish, substrate is gravel/cobble dominant.
7,238'	Right bank erosion, 90' long x 100' high.
7,527'	Electrofishing site #1.
7,725'	Confluence with Gulch 16.
7,842'	Non-operative bridge, 20' long x 15' wide x 10' high.
7,961'	Road visible from the right bank.
9,184'	Right bank landslide forming a gully, 37' long x 100' high.
9,640'	Left bank erosion, 17' long x 18' wide.
10,310'	Left bank erosion.
10,723'	Left bank tributary.
10,823'	Culvert, 2' x 2', running under the road; extremely rusty bottom but still passable. Substrate is highly embedded, no fish observed.
11,739'	LDA, 16' long x 20' wide x 5' high, not a barrier.
11,773'	Right bank erosion, 11' long.
11,824'	Left bank erosion, 50' long.
12,011'	LDA, 10' long x 15' wide x 3', with associated right bank erosion, 15' high.
12,232'	Left bank culvert.

12,698'	Left bank tributary, with a culvert, 11' long x 4' wide x 4' high culvert, no fish observed.
12,898'	Right bank tributary 4' wide. Substrate is large cobble, channel is steep, no fish observed.
13,768'	Left bank culvert.
14,152'	Right bank erosion, 9' long.
14,244'	Right bank tributary, dry. Substrate is large cobble, channel is steep, no fish observed.
14,256'	Left bank erosion, 19' long.
14,553'	Left bank erosion, 13' long.
15,323'	Left bank tributary with a culvert 35' long x 4' wide x 4' high with an 8' high jump into the culvert.
15,337'	Left bank erosion, 56' long x 40' high.
15,511'	Right bank tributary, 150' up the channel becomes dry.
15,554'	Left bank erosion, 36' long x 60' high, contributing debris to the stream.
15,601'	Electrofishing site #2.
15,801'	Left bank culvert.
16,010'	Left bank erosion, 20' long x 6' high.
16,163'	LDA, 9' long x 5' wide x 3' high, not a barrier.
16,180'	LDA, 30' long with 2.5' high log in the channel, possible barrier.
16,226'	Right bank tributary, dry with cobble dominant substrate. Very steep and overgrown.
16,242'	Right bank erosion, 5' high.
16,315'	LDA, 20' long x 15' wide, not a barrier.
16,811'	Left bank erosion, 23' long x 6' high.

16,848'	Right bank erosion.
16,870'	Left bank tributary, little flow, substrate is small cobble dominant, no fish observed.
16,876'	Left bank erosion, 15' high.
17,012'	Left bank erosion ends.
17,209'	Right bank tributary, mostly dry with a LDA 236' from confluence that is a probable barrier. Substrate is bedrock dominant.
17,547'	Left bank erosion. Channel type changes to an A4.
17,868'	LDA, 3' long x 8' wide x 3' high, not a barrier.
17,994'	Right bank tributary, dry.
18,039'	LDA, 2' long x 4' wide x 2' high, not a barrier.
18,363'	Bedrock waterfall, 50' high. End of survey.

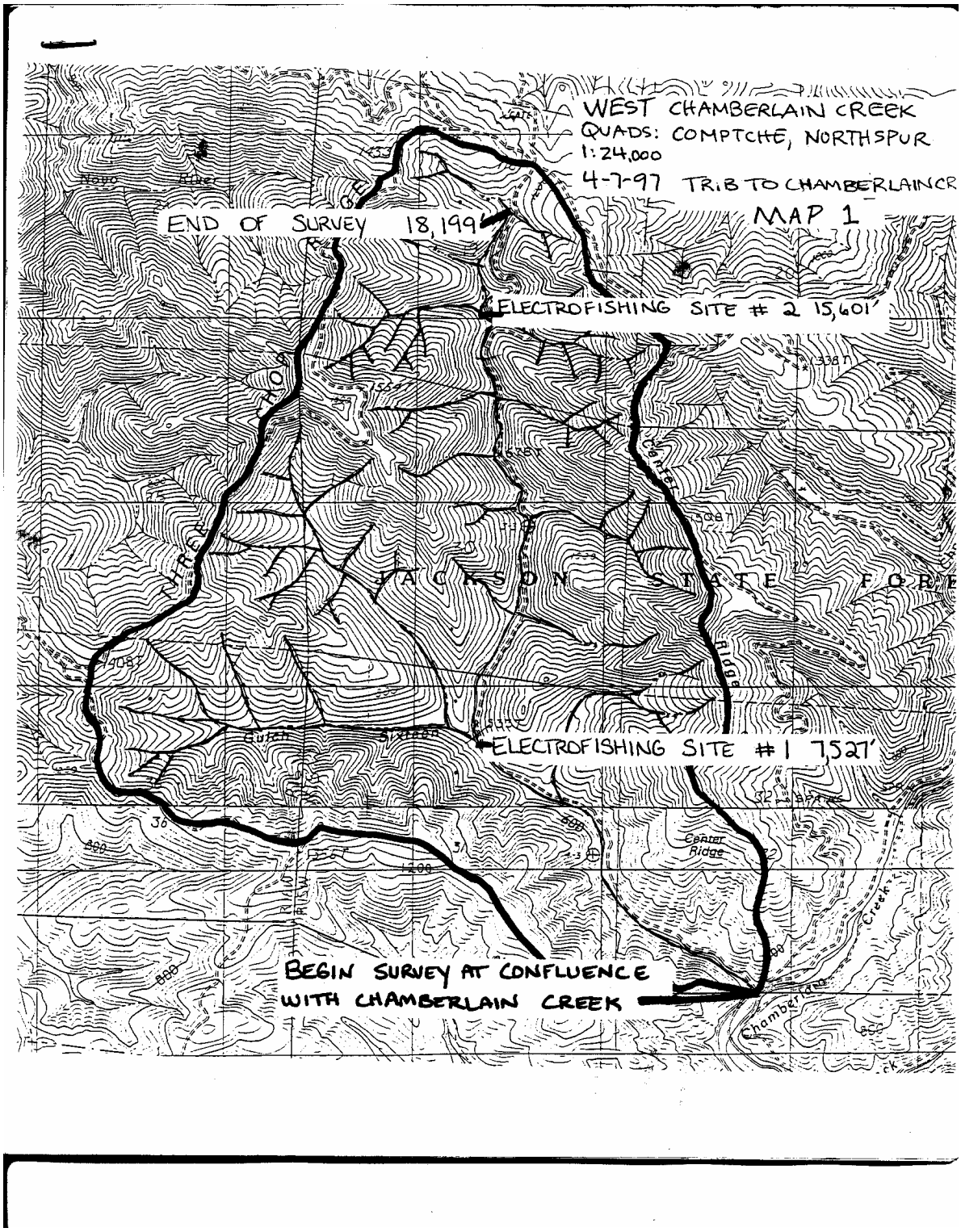
REFERENCES

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.

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


WEST CHAMBERLAIN CREEK
QUADS: COMPTCHE, NORTHSPUR
1:24,000
4-7-97 TRIB TO CHAMBERLAIN CR
MAP 1
END OF SURVEY 18,199'
ELECTROFISHING SITE # 2 15,601'
JACKSON STATE FOR
ELECTROFISHING SITE #1 7,527'
BEGIN SURVEY AT CONFLUENCE
WITH CHAMBERLAIN CREEK
Center Ridge
Chamberlain Creek