STREAM INVENTORY REPORT

Big Canyon Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Big Canyon Creek. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Big Canyon Creek.

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

Big Canyon Creek is a tributary to Little Creek, a tributary to Tomki Creek, a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Big Canyon Creek's legal description at the confluence with Little Creek is T18N R13W S01. Its location is 39.4386 degrees north latitude and 123.2572 degrees west longitude. Big Canyon Creek is an intermittent stream according to the USGS Willits 7.5 minute quadrangle. Big Canyon Creek drains a watershed of approximately 0.5 square miles. Elevations range from about 1,760 feet at the mouth of the creek to 2,600 feet in the headwater areas. 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 101 from Willits, California via the Hearst Willits Road to East Side Road to Berry Canyon Road to the confluence of Little Creek and Big Canyon Creek.

METHODS

The habitat inventory conducted in Big Canyon 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.

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 Big Canyon 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 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 (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". Big Canyon 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 Big Canyon 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 particle size, bedrock, 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 Big Canyon 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 Big Canyon 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 Big Canyon 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.

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 Big Canyon 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 low gradient riffles
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

The habitat inventory of June 11 to June 12, 1997 was conducted by April Richards and Andrew Shea (WSP). The total length of the stream surveyed was 2,893 feet.

Flow was not measured on Big Canyon Creek.

Big Canyon Creek is a B3 channel type for the first 895 feet of stream surveyed (Reach 1), an A3 channel type for the next 717 feet (Reach 2), and a B4 channel type for the next 1,281 feet of the stream reach surveyed (Reach 3). B3 channel types are moderately entrenched, moderate gradient, riffle dominated cobble channel with infrequently spaced pools; very stable plan and profile; and stable banks. A3 channel types are steep, narrow, cascading, step-pool streams; high energy/debris transport associated with depositional soils; cobble channel. B4 channel types are moderately entrenched, moderate gradient, riffle dominated gravel channel with infrequently spaced pools; very stable plan and profile; and stable banks.

Water temperatures taken during the survey period ranged from 55 to 58 degrees Fahrenheit. Air temperatures ranged from 59 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 47% riffle units, 33% pool units, 17% flatwater units, and 3% dry units (Graph 1). Based on total length of Level II habitat types there were 65% riffle units, 20% flatwater units, 14% pool units, and 1% dry units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were high gradient riffles, 33%; mid-channel pools, 13%; and low gradient riffles, 10% (Graph 3). Based on percent total length, high gradient riffles made up 45%, low gradient riffles 20%, and step runs 13%.

A total of ten pools were identified (Table 3). Main channel pools were most frequently encountered at 70% and comprised 91% 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. Two of the ten pools (20%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the six pool tail-outs measured, three had a value of 2 (50%); and three had a value of 5 (50%); (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. In Big Canyon Creek, two of the three pool tail-outs with embeddedness values of 5 were not suitable for spawning due to the tail-outs being comprised of large cobble or boulder.

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 0, flatwater habitat types had a mean shelter rating of 2, and pool habitats had a mean shelter rating of 39 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 75. Main channel pools had a mean shelter rating of 24 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Big Canyon Creek. Graph 7 describes the pool cover in Big Canyon Creek.

Table 6 summarizes the dominant substrate in pool habitat types. Small cobble was the dominant substrate observed in two of the five pool tail outs measured (40%). Gravel, large cobble, and boulders were the next most frequently observed dominant substrate type and each occurred in 20% of the pool tail-outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 85%. The mean percentages of conifer and deciduous trees were 37% and 63%, respectively. Graph 9 describes the canopy in Big Canyon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 26%. The mean percent left bank vegetated was 18%. The dominant elements composing the structure of the stream banks consisted of 40% cobble/gravel, 30% sand/silt/clay, 20% bedrock, and 10% boulders (Graph 10). Grass was the dominant bank vegetation type observed in 30% of the units surveyed. Additionally, 20% of the units surveyed had deciduous trees as the dominant bank vegetation, and 20% had coniferous trees as the dominant bank vegetation, including down trees, logs, and root wads (Graph 11).

DISCUSSION

Big Canyon Creek is a B3 channel type for the first 895 feet of stream surveyed, an A3 channel type for the next 717 feet, and a B4 channel for the remaining 1,281 feet. The suitability of B3, A3, and B4 channel types for fish habitat improvement structures is as follows: B3 are excellent for plunge weirs, boulder clusters and bank placed boulder, single and opposing wing-deflectors, and log cover. A3 channels are generally not suitable for fish habitat improvement projects. B4 channels are 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 June 11 to June 12, 1997 ranged from 55 to 58 degrees Fahrenheit. Air temperatures ranged from 59 to 68 degrees Fahrenheit. This is a good water temperature range for salmonids. Big Canyon Creek seems to have temperatures favorable to salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 20% of the total length of this survey, riffles 65%, and pools 14%. The pools are relatively shallow, with only two of the ten (20%) pools having a maximum depth greater than two feet. 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. Primary pools comprised less than 3% of the total length of the habitat surveyed in Big Canyon Creek. 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.

Three of the six pool tail-outs measured had embeddedness ratings of 1 or 2, none had ratings of 3 or 4, and three 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. In Big Canyon 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 39. The shelter rating in the flatwater habitats was 2. A pool shelter rating of approximately 80 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in most habitat types. Additionally, root mass

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 of the six (50%) pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered suitable for spawning salmonids.

The mean percent canopy density for the stream was 85%. 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 25.9% and 18.3%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting native species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Big Canyon 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) In the "B" channel types, 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. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) There are several log debris accumulations present on Big Canyon Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations may be desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

Big Canyon Creek

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):	Comments:
0'	Start of survey at confluence with Little Creek.
149'	Channel type is a B3.
185'	Log debris accumulation (LDA) measures approximately 6' long x 21' wide x and 8' high and is retaining gravel.
499'	Log debris accumulation measures approximately 15' long, 11' wide, and 5' high.
593'	Log debris accumulation measures approximately 9' long, 14' wide, and 6' high.
895'	Tributary enters on right bank with a water temperature of 55 degrees Fahrenheit.
1,324'	Channel type changes to an A3.
2,025'	Channel type changes to a B4.
2,893'	End of survey. Flow above this point is very low. No salmonids or other fish were observed during this survey.

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 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