STREAM INVENTORY REPORT

Bud Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Bud 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 Bud 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

Bud Creek is 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). Bud Creek's legal description at the confluence with Tomki Creek is T19N R13W S05. Its location is 39.5342 degrees north latitude and 123.2750 degrees west longitude. Bud Creek is a first order stream and has approximately 2.4 miles of blue line stream according to the USGS Willis Ridge 7.5 minute quadrangle. Bud Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 1,960 feet at the mouth of the creek to 3,000 feet in the headwater areas. Douglas fir forest and mixed hardwood forest dominate the watershed. The watershed is entirely privately owned.

METHODS

The habitat inventory conducted in Bud 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 Bud 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". Bud 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 Bud 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 Bud 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 Bud 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 Bud 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.

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 Bud Creek, one site was 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 Bud 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 July 15, 1997 was conducted by Jessie Robertson, April Richards (WSP), and Allan Renger (CCC). The total length of the stream surveyed was 4,368 feet.

Flow was not measured on Bud Creek.

Bud Creek is a B3 channel type for the entire 4,368 feet surveyed. B3 channel types are moderately entrenched, moderate gradient, riffle dominated cobble channels with infrequently

spaced pools; very stable plan and profile; and stable banks.

Water temperatures taken during the survey period ranged from 62 to 66 degrees Fahrenheit. Air temperatures ranged from 81 to 86 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 55% pool units and 45% dry units (Graph 1). Based on total length of Level II habitat types there were 88% dry units and 12% pool units (Graph 2).

Two Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were main channel pools, 55% and dry units, 45% (Graph 3). Based on percent total length, dry units made up 88% and main channel pools 12%.

A total of 23 pools were identified (Table 3). All of the pools encountered were main channel pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Four of the twenty-three pools (17%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 23 pool tail-outs measured, one had a value of 2 (4%); and 22 had a value of 5 (96%); (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 Bud Creek, 14 of the 22 pool tail-outs which had embeddedness values of 5 were not suitable for spawning due to the tail-outs being comprised of large cobble, boulders, or bedrock.

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 16 and dry units had a mean shelter rating of 0 (Table 1). The main channel pools had the highest mean shelter rating at 16 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Bud Creek. Small woody debris, large woody debris, terrestrial vegetation, aquatic vegetation, and white water are absent in all habitat types. Graph 7 describes the pool cover in Bud Creek.

Table 6 summarizes the dominant substrate by habitat type. Small and large cobble were the dominant substrate observed in 52% the pool tail outs measured. Gravel was the dominant substrate in 17% of the pool tail outs. Boulders were also the dominant substrate type in an additional 17% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 78%. The mean percentages of deciduous and coniferous trees were 80% and 20%, respectively. Graph 9 describes the canopy in Bud Creek.

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For the stream reach surveyed, the mean percent right bank vegetated was 31%. The mean percent left bank vegetated was 38%. The dominant elements composing the structure of the stream banks consisted of 38% boulders, 38% cobble/gravel, and 25% bedrock (Graph 10). Deciduous trees were the dominant vegetation type observed in 75% of the units surveyed. Additionally, 25% of the units surveyed had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

One site was electrofished on July 15, 1997 in Bud Creek. The sites were sampled by Jessie Robertson, Allan Renger, and Richards (WSP).

The first site sampled included a habitat unit just upstream of the CCP above road access. This site had an area of 364 square feet and a volume of 328 cubic feet. The site yielded one rough skin newt.

DISCUSSION

Bud Creek is a B3 channel type for the entire 4,368 feet of stream surveyed. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs; boulder clusters and bank placed boulder; single and opposing wing-deflectors; log cover.

The water temperatures recorded on the survey days July 15, 1997 ranged from 62 to 66 degrees Fahrenheit. Air temperatures ranged from 81 to 86 degrees Fahrenheit. This is a suitable water temperature range for 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 0% of the total length of this survey, riffles 0%, pools 12%, and dry units 88%. The pools are relatively shallow, with only four of the 23 (17%) pools having a maximum depth greater than two feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum 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.

None of the 23 pool tail-outs measured had an embeddedness rating of 1. None of the pool tail-outs had embeddedness ratings of 3 or 4. One had an embeddedness rating of 2. 96% of the pool tail-outs had a rating of 5, which is considered not suitable for spawning. The pool tail-outs were not suitable for spawning due to the dominant substrate being too large to be 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 Bud Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

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The mean shelter rating for pools was 16. 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 all habitat types. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

All of the pool tail outs had silt and sand or large cobble and boulders as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean percent canopy density for the stream was 78%. 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 31% and 38%, respectively.

RECOMMENDATIONS

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

2) The limited water temperature data available suggest that maximum temperatures are within/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) Where feasible, design and engineer pool enhancement structures to increase the number of pools. These structures, if designed properly, should also sort suitable spawning substrate. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

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 Tomki Creek. Channel type is B3.
3,697'	Steep gradient, sub-surface tributary enters right bank.
4,368'	Survey ended due to lack of fish observed during the last 1,898 feet surveyed.

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