STREAM INVENTORY REPORT

Cashmere Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Cashmere Creek. The survey began at the confluence with Redwood Creek and extended upstream 500 feet.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Cashmere 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

Cashmere Creek is a tributary to the Redwood Creek, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Cashmere Creek's legal description at the confluence with Redwood Creek is T07N R03E S06. Its location is 41.0206 degrees north latitude and 123.8822 degrees west longitude. Cashmere Creek is a first order stream and has approximately 1.5 miles of blue line stream according to the USGS Panther Creek 7.5 minute quadrangle. Cashmere Creek drains a watershed of approximately1.2 square miles. Elevations range from about 660 feet at the mouth of the creek to 1,980 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via highway 299 to Redwood Valley Road.

METHODS

The habitat inventory conducted in Cashmere 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

Cashmere Creek

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 Cashmere 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". Cashmere 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.

Cashmere Creek

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 Cashmere 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 Cashmere 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 Cashmere 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 Cashmere 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.

Cashmere Creek

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 Cashmere 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 27, 2001 was conducted by M. Wallar and E. Gill. The total length of the stream surveyed was 500 feet.

Stream flow was not measured on Cashmere Creek.

Cashmere Creek is an A2 channel type for the entire 500 feet of the stream surveyed. A2 channels are boulder dominated steep, narrow, cascading, step-pool streams with high energy transport.

The water temperature taken during the survey period was 55 degrees Fahrenheit. The air temperature was 64 degrees Fahrenheit.

Cashmere Creek

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% pool units, 30% riffle units, and 30% flatwater units (Graph 1). Based on total length of Level II habitat types there were 47% flatwater units, 40% riffle units, and 13% pool units (Graph 2).

Five level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were high-gradient riffles, 30%; step runs, 30%; and plunge pools, 20% (Graph 3). Based on percent total length, step runs made up 47%, high gradient riffles 40%, and step pools 8%.

A total of four pools were identified (Table 3). Scour pools were the most frequently encountered at 50%, and comprised 71% 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. All four of the pools (100%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the four pool tail-outs measured, one had a value of 1 (25%); two had a value of 2 (50%); one had a value of 5 (25%); (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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 30, and pool habitats had a mean shelter rating of 15 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 20. Main pools had a mean shelter rating of 13(Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Cashmere Creek. Large and small woody are lacking in nearly all habitat types. Graph 7 describes the pool cover in Cashmere Creek. Whitewater is the dominant pool cover type followed by boulders.

The mean percent canopy density for the surveyed length of Cashmere Creek was 96%. The mean percentages of deciduous and coniferous trees were 93% and 3%, respectively. Graph 9 describes the mean percent canopy in Cashmere Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 94%. The mean percent left bank vegetated was 97%. The dominant elements composing the structure of the stream banks consisted of 50% cobble/gravel, 40% boulders, and 10% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 90% of the units surveyed. Additionally, 90% of the units surveyed had deciduous trees as the dominant vegetation type, and 10% had coniferous trees as the dominant vegetation (Graph 11).

Cashmere Creek

DISCUSSION

Cashmere Creek is an A2 channel type for the entire length of the survey. A2 channels are generally not suitable for fish habitat improvement projects.

The water temperature recorded on the survey day June 27, 2001, was 55 degrees Fahrenheit. The air temperatures was 64 degrees Fahrenheit. This is a suitable water temperature 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 47% of the total length of this survey, riffles 40%, and pools 13%. The pools are relatively deep; all four of the pools had 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.

Three of the four pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. One of the pool tail-outs 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.

The mean shelter rating for pools was low with a rating of 15. The shelter rating in the flatwater habitats was slightly better at 30. 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. Additionally, whitewater contributes a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 96%. 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 94% and 97%, respectively. In areas of stream bank erosion or where bank vegetation is at unacceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

Cashmere Creek

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)   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.

4)   Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

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 Redwood Creek. The channel type is an A2.
110'	Embeddedness value 5 due to large wood.
136'	Out of influence of Redwood Creek.
174'	Log debris accumulation (LDA) measures 15' wide x 5.5' high x 10' long and contains two pieces of large woody debris (LWD). The LDA is retaining sand and gravel. Water is flowing over LDA; there is a 5.5' high plunge over it.
396'	LDA measures 5.5' high x 17' wide x 15' long and contains three pieces of LWD. The LDA is retaining gravel and large cobble. Water is flowing over the LDA.
479'	Landslide on right bank. End of survey at base of landslide; water still flowing under small woody debris that lines the creek for more than 200 feet; slope in steep (>10 degrees), flow is rapid white water; possible fish barrier; no fish observed throughout reach.

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.

Cashmere Creek

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}

CASCADE
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS
Trench Pool	(TRP)	[4.1]	{ 8}
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9}

BACKWATER POOLS
Secondary Channel Pool	(SCP)	[6.1]	{ 4}
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5}
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6}
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7}
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS
Dry	(DRY)	[7.0]
Culvert	(CUL)	[8.0]
Not Surveyed	(NS)	[9.0]
Not Surveyed due to a marsh	(MAR)	[9.1]