STREAM INVENTORY REPORT

Williams Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Williams 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 Williams Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

An adult carcass survey was conducted in Williams Creek on January 26, 1989. One chinook skeleton was found during the three mile survey. No other adults or redds were found, although steelhead fry were sampled during 1996 summer electrofishing (DFG file data). The objective of this report is to document the current habitat conditions and to recommend options for the potential enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Williams Creek is tributary to the Middle Fork of the Eel River, tributary to the Eel River, located in Mendocino County, California. Williams Creek's legal description at the confluence with the Middle Fork Eel River is T23N R11W S31. Its location is 39°48'52" N. latitude and 123°07'56" W. longitude. Williams Creek is a third order stream and has approximately 17.8 miles of blue line stream according to the USGS Covelo East, Bluenose Ridge, Newhouse Ridge and Leech Lake 7.5 minute quadrangles. Williams Creek drains a watershed of approximately 31 square miles. Summer base runoff is approximately 0.4 cubic feet per second (cfs) at the mouth, but over 15 cfs is not unusual during winter storms. Elevations range from about 1400 feet at the mouth of the creek to 5000 feet in the headwater areas. Grass and mixed hardwood forest dominate the watershed. The watershed is primarily in private ownership and is managed for timber production, cattle rangeland and private residence. Vehicle access exists from Highway 162 near Covelo via County Road 338.

METHODS

The habitat inventory conducted in Williams 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). Williams Creek personnel were trained in May, 1996, by Ruth Goodfield and Scott Downie. 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. 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 Williams 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". Williams 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 Williams 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), 76 - 100% (value 4). Additionally, a rating of "not suitable" (value 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 Williams 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.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers

as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Williams 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 Williams Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) 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 Williams Creek fish presence was observed from the stream banks, and three sites were electrofished using one 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, DFG. 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 and include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length

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- 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
- 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 August 12-15, September 24-26 and October 16, 1996, was conducted by Dale Melton and Todd Schaible (WSP/AmeriCorps). The total length of the stream surveyed was 34,313 feet with an additional 439 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.4 cfs on August 20, 1996.

Williams Creek is a C3 channel type for the first 18,703 feet, an F4 for the next 994 feet, and a B3 for the final 14,616 feet of stream reach surveyed. C3 channels are low gradient, meandering, point-bar, riffle/pool, alluvial channels with well a defined floodplain and cobble-dominant substrates. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, stable banks and cobble-dominated substrates.

Water temperatures taken during the survey period ranged from 50 to 82 degrees Fahrenheit. Air temperatures ranged from 53 to 101 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, pool, and dry habitat types. Based on frequency of **occurrence** there were 40% riffle units, 38% flatwater units, 21% pool units, and 1% dry units (Graph 1). Flatwater units comprised 40% of the total **length**, 38% riffle units, 17% pool units, and 5% dry units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were high gradient riffles, 27%; runs, 20%; and mid-channel pools, 16% (Graph 3). Based on percent total **length**, high gradient riffles made up 24%, runs, 17%, and step runs, 17%.

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A total of 116 pools were identified (Table 3). Mid-channel pools were most frequently encountered at 87% and comprised 88% 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. One hundred thirteen of the 116 pools (97%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 116 pool tail-outs measured, seven had a value of 1 (6%); 43 had a value of 2 (36%); 16 had a value of 3 (14%); three had a value of 4 (3%); and 47 had a value of 4 (41%) (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 35, and flatwater habitats had a mean shelter rating of 27 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 35. Scour pools had a mean shelter rating of 32 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in two of the five low gradient riffles measured (40%). Small cobble also occurred in 40% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 39%. The mean percentages of deciduous and coniferous trees were 97% and 3%, respectively (Graph 9).

For the stream reach surveyed, the mean percent right bank vegetated was 67%. The mean percent left bank vegetated was 73%. The dominant elements composing the structure of the stream banks consisted of 22% bedrock, 26% boulder, 45% cobble/gravel, and 7% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 71% of the units surveyed. Additionally, 18% of the units surveyed had grass as the dominant vegetation type, and 7% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on August 20, 1996, in Williams Creek. The sites were

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sampled by Ruth Goodfield (DFG) and Dale Melton (WSP/AmeriCorps).

The first site sampled was habitat unit 005, a mid-channel pool approximately 300 feet from the confluence with the Middle Fork Eel River. This site had an area of 420 sq ft and a volume of 546 cu ft. The site yielded ten young-of-the-year (YOY) steelhead rainbow trout.

The second site included habitat units 116-118, a step run, a high gradient riffle, and a dam pool located approximately 7,589 feet above the creek mouth. This site had an area of 3,262 sq ft and a volume of 2,936 cu ft. The site yielded 13 YOY steelhead rainbow trout and one 1+.

The third site sampled included habitat units 148-150, a high gradient riffle, a step run, and a low gradient riffle located approximately 9,801 feet above the creek mouth. The site had an area of 2400 sq ft and a volume of 1920 cu ft. The site yielded two YOY steelhead rainbow trout.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Williams Creek.

DISCUSSION

Williams Creek is a C3 channel type for the first 18,703 feet, an F4 for the next 994 feet, and a B3 for the final 14,616 feet of stream reach surveyed. The suitability of C3 channel types for fish habitat improvement structures is excellent for bank placed boulders; good for low-stage weir, boulder clusters, single and opposing wing deflectors, and log cover; and fair for medium-stage weir. F4 channels are good for bank placed boulders; fair for low-stage weir, single and opposing wing-deflectors, general constrictors, and log cover; and poor for medium-stage weir and boulder clusters. Finally, B3 channels are excellent for low-stage plunge weir, boulder clusters and bank placed boulders, single and opposing wing-deflectors, and log cover; and good for medium-stage plunge weir.

The water temperatures recorded on the survey days August 12-15, July 24-26 and October 16, 1996, ranged from 50 to 82 degrees Fahrenheit. Air temperatures ranged from 53 to 101 degrees Fahrenheit. This is a marginal water temperature range for salmonids. Water temperatures above 68° F, if sustained, are near the threshold stress level 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.

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Flatwater habitat types comprised 40% of the total **length** of this survey, riffles 38%, pools 17%, and dry units 5%. The pools are relatively deep, with 71 of the 116 (61%) pools having a maximum depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. 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. 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 the modification of the numerous log debris accumulations (LDA's) in the stream.

The LDA's in the system are retaining needed 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.

Nineteen of the 116 pool tail-outs measured had embeddedness ratings of 3 or 4. Only seven 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 Williams 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 34. The shelter rating in the flatwater habitats was slightly lower at 27. 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, undercut banks contribute a small amount. Log and root wad cover structures 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.

Four of the five low gradient riffles 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 39%. This is a relatively low percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 66.8% and 73.3%, 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.

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RECOMMENDATIONS

1) Williams 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 on Williams Creek by planting willow, alder, and Douglas fir along the stream where shade canopy 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, like the site at 25,018', 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) 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 and in some areas the material is locally available.

8) Spawning gravel on Williams Creek are limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel in order to expand redd site distribution in the stream.

9) There are several log debris accumulations present on Williams Creek that are retaining large quantities of fine sediment. The modification of these debris

accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

PROBLEM SITES 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 the M.F. Eel River. Channel type is C3.
681'	Bioinventory site #1.
1458'	Bridge spans stream; rip-rap on right bank.
6659'	Bridge spans stream; rip-rap on stream banks.
7589'	Bioinventory site #2.
9569'	Dry tributary enters on right bank (RB).
9801'	Bioinventory site #3.
11348'	Road fords stream.
11868'	Wooden bridge spans stream.
15630'	Dry tributary enters on RB.
16451'	Road fords stream.
17161'	Dry tributary enters on RB.
18675'	Channel type changes from C3 to F4.
19625'	Channel type changes from F4 to B3.
20270'	Tributary enters on left bank (LB).
23061'	Land slide on LB 150 feet long x 100 feet high.
23208'	Large debris accumulation (LDA) 10 feet long x 20 feet wide x 10 feet high

trapping small woody debris.

25018' Slide on RB 40 feet long x 90 feet high contributing fines, gravel and large woody debris.

25355' Slide on LB 30 feet long x 100 feet high contributing gravel and large woody debris 20% revegetated.

25527' Tributary enters on LB.

26506' Tributary enters on LB. Two 1+ and five young-of-the-year (YOY) observed from the streambanks by observers.

27038' Slide on LB 90 feet long x 70 feet high 50% revegetated. Five YOY.

29678' Tributary enters on RB. One 2+, two 1+ and 15 YOY observed from the stream banks by observers.

29971' Slide on LB 80 feet long x 150 feet high contributing fines, gravels and boulders.

30294' Right bank erosion 300 feet long x 60 feet high contributing fines, gravels and cobbles.

30667' Dry tributary enters on LB.

32790' Slide on RB 50 feet long x 75 feet high contributing fines to boulders.

34313' Stream channel is dry for last 1500 feet. Large boulders block channel for 300' which seem to be a barrier to migrating salmonids. **End of Survey.**

References

Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Depart

ment 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.

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