STREAM INVENTORY REPORT

McCarvey Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on McCarvey 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 McCarvey Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species. There is no known record of adult spawning surveys having been conducted on McCarvey Creek.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for chinook salmon, 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

McCarvey Creek is tributary to the South Branch North Fork Navarro River, tributary to the North Fork Navarro River, located in Mendocino County, California (Figure 1). McCarvey Creek's legal description at the confluence with South Branch North Fork Navarro River is T15N R14W S16. Its location is 39°09′12″ north latitude and 123°24′57″ west longitude. McCarvey Creek is a first order stream and has approximately 1.4 miles of blue line stream according to the USGS Bailey Ridge 7.5 minute quadrangle. McCarvey Creek drains a watershed of approximately 1.9 square miles. Summer base runoff is approximately 0.1 cubic feet per second (cfs) at the mouth. Elevations range from about 630 feet at the mouth of the creek to 1,700 feet in the headwater areas. Redwood and Douglas fir forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via private road.

METHODS

The habitat inventory conducted in McCarvey 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). McCarvey Creek personnel were trained in May, 1995, by Gary Flosi. 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 McCarvey 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". McCarvey 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 (*Sampling Levels for Fish Habitat Inventory*, 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 McCarvey 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" (NS) 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 McCarvey 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 McCarvey 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 McCarvey 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 McCarvey Creek fish presence was observed from the stream banks, and two 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, 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 Lotus 1,2,3. Graphics developed for McCarvey 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
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

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HABITAT INVENTORY RESULTS

The habitat inventory of June 6 and 7, 1995, was conducted by Jason MacDonnell (CCC) and Shelley Dunn (WSP/AmeriCorps). The total length of the stream surveyed was 4,036 feet.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.09 cfs on July 18, 1995.
McCarvey Creek is a B4 channel type for the entire 4,036 feet of stream reach surveyed. B4 channels are moderately entrenched, moderate gradient, riffle-dominant channels with infrequently spaced pools, stable banks, and gravel-dominant substrates.

Water temperatures ranged from 54 to 59 degrees Fahrenheit. Air temperatures ranged from 59 to 74 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 37% flatwater units, 34% pool units, and 29% riffle units (Graph 1). Based on total **length** of Level II habitat types there were 55% flatwater units, 25% riffle units, and 20% pool units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were low-gradient riffles, 26%; step runs, 21%; and runs, 14% (Graph 3). Based on percent total **length**, step runs made up 43%, low-gradient riffles 24%, and runs 11%.

A total of 36 pools were identified (Table 3). Scour pools were most frequently encountered at 61% and comprised 63% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Eighteen of the 36 pools (50%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 35 pool tail-outs measured, 1 had a value of 1 (2.8%); 24 had a value of 2 (68.6%); 7 had a value of 3 (20.0%); and 3 had a value of 4 (8.6%) (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. Pool habitat types had a mean shelter rating of 96, and flatwater habitats had a mean shelter rating of 33 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 110. Scour pools had a mean shelter rating of 99 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in McCarvey Creek. Graph 7 describes the pool cover in McCarvey Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 3 of the 4 low gradient riffles measured (75%). Sand was the next most frequently

observed dominant substrate type and occurred in 25% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 74%. The mean percentages of deciduous and coniferous trees were 55% and 45%, respectively. Graph 9 describes the canopy in McCarvey Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 80%. The mean percent left bank vegetated was 90%. The dominant elements composing the structure of the stream banks consisted of 6.3% bedrock, 4.2% boulder, 22.9% cobble/gravel, and 66.7% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 58% of the units surveyed. Additionally, 19% of the units surveyed had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on July 18, 1995, in McCarvey Creek. The sites were sampled by Chris Coyle (CCC) and Bettina Chimarios and Shelly Dunn (WSP/AmeriCorps).

The first site sampled included habitat units 65-67, two scour pools and a run located approximately 2,106 feet above the creek mouth. This site had an area of 260 sq ft and a volume of 65 cu ft. The site yielded one 1+ steelhead. An additional 1+ steelhead and an unidentified 0+ salmonid were observed but not caught.

The second site sampled included habitat units 71-73, a mid-channel pool, scour pool, and step run located approximately 2,345 feet above the creek mouth. This site is above a suspected barrier. The site had an area of 200 sq ft and a volume of 120 cu ft. Three Pacific giant salamanders and three frogs were sampled. No fish were sampled, and no fish were observed during the survey above this site.

DISCUSSION

McCarvey Creek is a B4 channel type for the entire 4,036 feet of stream surveyed. The suitability of B4 channel types for fish habitat improvement structures is as follows: excellent for low-stage plunge weirs, boulder clusters, bank-placed boulders, single and opposing wing deflectors, and log cover; and good for medium-stage plunge weirs.

The water temperatures recorded on the survey days June 6 and 7, 1995, ranged from 54 to 59 degrees Fahrenheit. Air temperatures ranged from 59 to 74 degrees Fahrenheit. This is a good water temperature range for salmonids. However, temperatures recorded during biological inventory on July 18, 1995, ranged from 65 to 71° Fahrenheit. These temperatures, if sustained, are above the threshold stress limit for juvenile 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 55% of the total **length** of this survey, riffles 25%, and pools 20%. The pools are relatively deep, with 18 of the 36 (50%) 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 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.

Ten of the 35 pool tail-outs measured had embeddedness ratings of 3 or 4. Only one 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 McCarvey 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 high with a rating of 96. The shelter rating in the flatwater habitats was lower at 33. A pool shelter rating of approximately 100 is desirable. The relatively large amount of cover that now exists is being provided primarily by large woody debris in all habitat types. Additionally, terrestrial vegetation contributes a small amount.
Three of the four low gradient riffles measured had gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 74%. 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 80% and 90%, respectively.

RECOMMENDATIONS

1) McCarvey 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) There are several log debris accumulations present on McCarvey 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.

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) Increase the canopy on McCarvey Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. Planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

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.

Position (ft):	Comments:
0'	Begin survey at confluence with South Branch North Fork Navarro River. Channel type is B4.
247'	LDA 3' high x 7' wide x 10' long. Not a barrier.
393'	LDA 4' high x 8' wide x 15' long. Not a barrier.
499'	LDA 5' high x 7' wide x 10' long. Not a barrier.
699'	LDA 10' high x 15' wide x 25' long. Possible barrier.
1269'	Right bank slump 8' high x 20' long contributing fines.
1481'	Embedded log spans channel. Passable at high flows.
1927'	Bridge 25' long x 30' wide x 11' clearance.
2033'	LDA 4' high x 10' wide x 4' long.
2286'	LDA 5' high x 13' wide x 11' long imposed on steep bedrock sheet with gravel retained 100' upstream. Possible barrier.
2570'	LDA 5' high x 11' wide x 5' long. Not a barrier.

2603' Right bank tributary. First 500' accessible to fish.

3045' LDA 5' high x 10' wide x 10' long. Possible barrier.

3824' Right bank tributary.

4011' LDA 14' high x 12' wide x 20' long. Possible barrier.

4036' End of survey due to diminished habitat and lack of observed fish.

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