STREAM INVENTORY REPORT

Unnamed Tributary to Price Creek (Muddy Creek)

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on an unnamed tributary to Price Creek locally known as, and from this point referred to as, Muddy Creek. The survey began at the confluence with Price Creek and extended upstream 0.8 miles.

A habitat inventory was conducted at Muddy Creek. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Muddy 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

Muddy Creek is a tributary to Price Creek, a tributary to the Eel River, located in Humboldt County, California (Map 1). Muddy Creek's legal description at the confluence with Price Creek is T 01N R 01W S 05. Its location is 40E30N6.6O north latitude and 124E12N39O west longitude. Muddy Creek is a first order stream and has approximately 1.2 miles of blue line stream according to the USGS Fortuna 7.5 minute quadrangle. Muddy Creek drains a watershed of approximately 1.1 square miles. Elevations range from about 600 feet at the mouth of the creek to 2,200 feet in the headwater areas. Mixed conifer/hardwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via Blue Slide Road to Price Creek Road.

METHODS

The habitat inventory conducted in Muddy Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The 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 Muddy 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". Muddy 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 Muddy 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 unsuited 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 Muddy 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 Muddy 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 Muddy 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 root wads) 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 Muddy 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

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of May 20, 2002 was conducted by Ryan Wells and Hillary Kleeb (WSP). The total length of the stream surveyed was 4,281 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.4 cfs on May 20, 2002.

Muddy Creek is a F4 channel type for 3,401 feet and a G4 channel type for 879 feet of the stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. G4 channel types are entrenched "gully" step-pool and low width/depth ratio on moderate gradient and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 49° to 56° Fahrenheit. Air temperatures ranged from 52° to 67° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44% riffle units, 25% flatwater units, and 31% pool units (Graph 1). Based on total length of Level II habitat types there were 47% riffle units, 34% flatwater units, and 19% pool units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were high gradient riffle, 29%; mid-channel pool, 21%; and run, 15% (Graph 3). Based on percent total length, high gradient riffles made up 38%, step runs, 18%, and runs made up 16%.

A total of sixty pools were identified (Table 3). Main pools were the most frequently encountered at 75%, and comprised 81% 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. Nine of the 60 pools (15%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 56 pool tail-outs measured, seven had a value of 1 (13%); fourteen had a value of 2 (25%); nineteen had a value of 3 (34%); four had a value of 4 (7%); and twelve had a value of 5 (21%) (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 17, flatwater habitat types had a mean shelter rating of 25, and pool habitats had a mean shelter rating of 32 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 70. Scour pools had a mean shelter rating of 50 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Muddy Creek. Graph 7 describes the pool cover in Muddy Creek. Boulders are the dominant pool cover type followed by bedrock ledges.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 77% of pool tail-outs while large cobble was the next most frequently observed substrate type, at 10%.

The mean percent canopy density for the surveyed length of Muddy Creek was 82%. The mean percentages of deciduous and coniferous trees were 88% and 12%, respectively. Graph 9 describes the mean percent canopy in Muddy Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 83.8%. The mean percent left bank vegetated was 82.3%. The dominant elements composing the structure of the stream banks consisted of 36.8% boulder, 35.9% cobble/gravel, and 23.6% silt/clay, 3.8% bedrock (Graph 10). Deciduous trees were the dominant vegetation type observed in 78.3% of the units surveyed (Graph 11).

DISCUSSION

Muddy Creek is a F4 channel type for the first 3,401 feet of stream surveyed and a G4 channel type for the remaining 879 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank placed boulders, fair for plunge weirs: single and opposing wing deflectors; channel constrictors; log cover, poor for boulder clusters. The suitability of G4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders, fair for plunge weirs; opposing wing deflectors; log cover, poor for boulder clusters; single wing deflectors.

The water temperatures recorded on the survey days May 20, 2002 ranged from 49° to 56° Fahrenheit. Air temperatures ranged from 52° to 67° Fahrenheit.

Flatwater habitat types comprised 34% of the total length of this survey, riffles 47%, and pools 19%. The pools are relatively shallow, with only 9 of the 60 (15%) 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.

Twenty-one of the 56 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-three of the pool tail-outs had embeddedness ratings of 3 or 4. Twelve of the 56 pool tail-outs had a rating of 5, which is considered unsuitable 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. Sediment sources in Muddy Creek should be mapped and rated according to their

potential sediment yields, and control measures should be taken.

Forty-five of the 56 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 32. The shelter rating in the flatwater habitats was 25. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all habitat types. Large woody debris contributes only 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 82%. Reach 1 had a canopy density of 82% while Reach 2 had canopy density of 83%. In general, revegetation projects are considered when canopy density is less than 80%. The percentage of right and left bank covered with vegetation was 83.8% and 82.3%, respectively.

RECOMMENDATIONS

1) Muddy 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) 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) 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.

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.

0' Begin survey at confluence with Price Creek. Channel type is F4.

1,780' Log debris accumulation (LDA).

1,915' Small waterfall with a three-foot drop, possible low-flow barrier for salmonids.

2,500' Humboldt Crossing, 16' wide x 4' high x 16.5' long, not a barrier to salmonids.

3,401' Channel type changes from a F4 to a G4.

3,522' Muddy Creek forks; survey continued up the left fork; the right fork was dry.

3,793' Tributary enters on right bank; dry at the time of survey.

3,840' LDA of six large pieces, 7' wide x 11' long x 4' high.

3,898' LDA of six large pieces, 16' wide x 15' long x 7' high, with a large pool at the base. The seven-foot plunge presents a possible fish barrier.

4,056' LDA of six large pieces, 22' wide x 20' long x 5' high.

4,080' Tributary enters on right bank.

4,280' End of survey due to possible end of anadromy.

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 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]		