STREAM INVENTORY REPORT

Dairy Creek

INTRODUCTION

A stream inventory was conducted during the summer of 2003 on Dairy Creek. The survey began at the confluence with North Fork Yager Creek and extended upstream 0.75 miles.

A habitat inventory was conducted on Dairy Creek. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Dairy Creek. A biological inventory was not conducted.

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

Dairy Creek is a tributary to North Fork Yager Creek, a tributary to the Van Duzen River, a tributary to the Eel River, located in Humboldt County, California (Map 1). Dairy Creek's legal description at the confluence with North Fork Yager is T 03N, R 03E, S 28. Its location is 40°36′45″ north latitude and 123°50′45″ west longitude. Dairy Creek is a second order stream and has approximately 7.1 miles of blue line stream according to the Yager Junction 7.5 minute USGS Quadrangle. Dairy Creek drains a watershed of approximately 7.1 square miles. Elevations range from about 1,300 feet at the mouth of the creek to 3,000 feet in the headwaters area. Grass and mixed hardwood forests dominate the watershed. The watershed is entirely privately owned and is managed for timber production and rangeland. Vehicle access exists via Kneeland-Bridgeville Road.

METHODS

The habitat inventory conducted in Dairy Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) 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 and all pools 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. All pools except step pools are fully sampled.

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 Dairy Creek to record measurements and observations. There are eleven 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 (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.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). 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". Dairy 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 Dairy 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, such as bedrock, log sills, boulders, etc.

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 Dairy 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 Dairy 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 Dairy 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.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 1.30, a Visual Basic data entry program developed by Karen Wilson, Coastal Watershed Assessment Program, California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Dairy Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant 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 11, and 12th, 2003, was conducted by Sarah Ganas and Lesley Merrick (WSP). The total length of the stream surveyed was 3,960 feet. Stream flow was not measured on Dairy Creek.

Dairy Creek is a B4 channel type for 1,531 feet and A2 channel type for the remainder of the stream survey. B4 channels are moderately entrenched, moderate gradient, riffle dominated gravel channels with infrequently spaced pools, a very stable plan and profiles, and stable banks. A2 channels are steep, narrow, cascading, step-pool streams, with high energy/ debris transport associated with a boulder channel.

Water temperatures taken during the survey period ranged from 59 to 62 degrees Fahrenheit. Air temperatures ranged from 65 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% riffle units, 32% flatwater units, and 32% pool units (Graph 1). Based on total length of Level II habitat types there were 51% riffle units, 29% flatwater units, and 20% pool units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 20%; runs, 17%; and step runs, 15% (Graph 3). Based on percent total length, cascades made up 25%, high grade riffles, 16%, and runs, 14%.

A total of 19 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 79%, and comprised 81% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Eight of the 19 pools (42%) had a residual depth of two feet or

greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 19 pool tail-outs measured, 1 had a value of 1 (5.3%); 5 had a value of 2 (26.3%); 9 had a value of 3 (47.4%); 3 had a value of 4 (15.8%); and 1 had a value of 5 (5.3%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4, the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuitable for spawning, due to inappropriate substrate, such as bedrock, log sills, boulders, etc.

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 18, flatwater habitat types had a mean shelter rating of 17, and pool habitats had a mean shelter rating of 32 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 34. Main pools had a mean shelter rating of 31 (Table 3).

Table 5 summarizes mean percent escape/ambush cover by habitat type. Graph 7 describes the pool cover in Dairy Creek. Boulders are the dominant pool cover type followed by whitewater.

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 61.5% of pool tail-outs while small cobble was the next most frequently observed substrate type, at 21.5%.

The mean percent canopy density for the surveyed length of Dairy Creek was 86%. The mean percentages of deciduous and coniferous trees were 94% and 6%, respectively. Table 7 describes the mean percent canopy in Dairy Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 88.3%. The mean percent left bank vegetated was 87.5%. The dominant elements composing the structure of the stream banks consisted of 21.7% bedrock, 25% boulder, 50% cobble/gravel, and 3.3% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 98.3% of the units surveyed with coniferous trees being the second most dominant vegetation type observed in 1.7 % of the units surveyed (Graph 11).

A biological inventory was not conducted, however, a bank observation of one undetermined fish species was made at 3,759 feet above the confluence with North Fork Yager Creek.

DISCUSSION

Dairy Creek is a B4 channel type for the first 1,531 feet of stream surveyed and an A2 channel type for the remaining 2,429 feet. The suitability of B4 channel types for fish habitat improvement structures is excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing deflectors and log cover. A2 channel types are generally not suitable for fish habitat improvement structures.

The water temperatures recorded on the survey days of August 11 and 12th, 2003, ranged from

59 to 62 degrees Fahrenheit. Air temperatures ranged from 65 to 76 degrees Fahrenheit. 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.

Flatwater habitat types comprised 28.7% of the total length of this survey, riffles 51.2%, and pools 20%. The pools are relatively deep, with 10 of the 19 (52.6%) 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 residual 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.

Six of the 19 pool tail-outs measured had embeddedness ratings of 1 or 2. Eleven of the 19 pool tail-outs had embeddedness ratings of 3 or 4. One of the 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 Dairy Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Sixteen of the 19 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 17. 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. 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 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 86%. Reach 1 had a canopy density of 94% while Reach 2 had canopy densities of 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 adequate at 88.3% and 87.5%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Dairy 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) 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) 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.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) 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.

7) 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.

0' Begin survey at confluence with North Fork Yager.

1,429’ General Comment: Channel type changes from a B4 to an A2.

1,665’ General Comment: Waterfall with a 6 ft. plunge.

1,800’ General Comment: Six plunges of 7 ft. with an approximate 30% channel gradient.

2,101’ General Comment: Waterfall, 5 ft. drop

2,221’ Erosion Site: Left bank erosion (50 ft. long, 30 ft. tall, 10 ft. deep)

2,544’ Fish Passage: Estimated 20 ft drop over 70 ft. length, possible end of anadromy.

3,759’ Bio Sample: one 8 to 10 inch fish sighted from bank, species undetermined.

3,960’ End of Survey (access not granted by landowner upstream of this point)

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.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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]	