STREAM INVENTORY REPORT

"Belleview Creek'

INTRODUCTION

A stream inventory was conducted May 18, 2004 on an unnamed tributary to the Eel River locally known as, and hereafter referred to as, Belleview Creek. The survey began at the confluence with the Eel River and extended upstream 0.4 miles.

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

Belleview Creek is a tributary to the Eel River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Belleview Creek's legal description at the confluence with the Eel River is T02N R01W S36. Its location is 40.5089 degrees north latitude and 124.1244 degrees west longitude. Its LLID number is 1241244405089. Belleview Creek is an intermittent stream according to the USGS Hydesville 7.5 minute quadrangle. Belleview Creek drains a watershed of approximately 1.7 square miles. Elevations range from about 30 feet at the mouth of the creek to 470 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Blue Slide Road.

METHODS

The habitat inventory conducted in Belleview Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors 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. All 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 Belleview 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) near 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 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 (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". Belleview 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 Belleview 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 like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile 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 for prey. 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 Belleview 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 Belleview 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 hardwood 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 Belleview 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 1.0.39, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the 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 Residual 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 Belleview 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 Residual 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 May 18, 2004 was conducted by Janelle Breton (DFG) and Dan Resnik, (CCC). The total length of the stream surveyed was 2,237 feet.

Stream flow was estimated to be 0.3 cfs during the survey period.

Belleview Creek is a G1 channel type for 451 feet of the stream surveyed (Reach 1), and a B4 channel type for the remaining 1,786 feet of the stream surveyed (Reach 2). G1 channels are entrenched "gully" step-pool channels on moderate gradients with low width /depth ratios and bedrock dominant substrates. B4 channels are moderately entrenched riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width /depth ratios and gravel dominant substrates.

Water temperatures taken during the survey period ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 51 to 63 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% riffle units, 30% pool units, 26% flatwater units, and 4% culvert units (Graph 1). Based on total length of Level II habitat types there were 49% riffle units, 21% pool units, 23% flatwater units, and 7% culvert units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 32% low gradient riffle units, 22% mid-channel pool units, and 26% run units (Graph 3). Based on percent total length, there was 40% low gradient riffle units, 23% run units and 14% mid-channel pool units.

A total of 15 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 87%, and comprised 88% 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. Three of the 15 pools (20%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 15 pool tail-outs measured, one had a value of 2 (7%); eight had a value of 3 (53%); five had a value of 4 (33%); one had a value of 5 (7%); (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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, and boulders.

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 6, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 35 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 70. Main channel pools had a mean shelter rating of 30.

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

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 67% of pool tail-outs, and small cobble was observed in 33% of pool tail-outs.

The mean percent canopy density for the surveyed length of Belleview Creek was 94%. The mean percentages of hardwood and coniferous trees were 56% and 44%, respectively. Six percent of the canopy was open. Graph 9 describes the mean percent canopy in Belleview Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 60%. The mean percent left bank vegetated was 61%. The dominant elements composing the structure of the stream banks consisted of 55% sand/silt/clay, 23% bedrock, and 23% cobble/gravel. Hardwood trees were the dominant vegetation type observed in 46% of the units surveyed. Additionally, 23% of the units surveyed had coniferous trees as the dominant vegetation type, and 23% had grass as the dominant vegetation (Graph 11).

DISCUSSION

Belleview Creek is a G1 channel type for the first 451 feet of stream surveyed and a B4 channel type for the remaining 1,786 feet. The suitability of G1 channel types for fish habitat improvement structures is as follows: fair for log cover and poor for boulder clusters. 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.

The water temperatures recorded on the survey day May 18, 2004 ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 51 to 63 degrees Fahrenheit.

Flatwater habitat types comprised 23% of the total length of this survey, riffles 49%, and pools 21%. The pools are relatively shallow, with only three of the 15 (20%) pools having a maximum residual 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 residual 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.

One of the 15 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirteen 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. Sediment sources in Belleview Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

All of the 15 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 35. The shelter rating in the flatwater habitats was 5. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Belleview Creek. Large woody debris is the dominant cover type in pools followed by small woody debris. 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 94%. Reach 1 had a canopy density of 96% and Reach 2 had a canopy density of 93%. 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 84% and 85%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Belleview 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) The stream crossing at 758’ (culvert under Blue Slide Road) is a complete fish passage barrier. Explore options to replace that structure with one that meets the NOAA Fisheries and DFG criteria for fish passage.

Belleview Creek

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):	Habitat unit #:	Comments:
0	0001.00	Start of survey at confluence with the Eel River.
288	0007.00	Out of influence of the Eel River, begin 10% sampling. Right bank slumping; the erosion site measures 25' high x 25' long and is contributing sediment to the channel. Right bank spring.
384	0009.00	Right bank erosion site measures 30' high x 30' long.
451	0011.00	Channel type change from G1 to B4.
473	0012.00	Right bank erosion site measures 20' high x 20' long.
655	0016.00	Log debris accumulation (LDA) measures 20' high x 20' wide x 50' long and is retaining sediment measuring 20' wide x 20 long x 5' high.
758	0018.00	Steel culvert with 3.2’ diameter at the inlet to 5.2’diameter at the outlet, 117’ long, with an overall slope of 3.2 percent and a 5.7’ drop to the outlet pool. The culvert has three breaks in slope, a 20 degree turn and is in very poor condition.
1,221	0026.00	Steel footbridge.
1,409	0031.00	Unnamed tributary enters from left bank; it is contributing less than 1% to Belleview Creek’s total discharge. The water temperature was 53 degrees Fahrenheit.
1,928	0041.00	Property boundary: Green Diamond Resource Company.
2,157	0045.00	Culvert measures 4’ diameter x 30’ long with a 4.5’ plunge at outlet. LDA is composed of approximately 26 pieces of large woody debris (LWD) and is retaining sediment measuring 20' long x 5' wide x 4' high.
2,172	0050.00	LDA measures 20' high x 30' long and is associated with bank erosion. End of survey. Steep gradient estimated 30%, series of LDAs retaining fine sediment.

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]	