STREAM INVENTORY REPORT

"Cooper Gulch"

INTRODUCTION

A stream inventory was conducted on August 22, 2007 on an unnamed tributary to Humboldt Bay commonly know as, and hereinafter referred to as, Cooper Gulch. The survey began at the confluence with Eureka Slough and extended upstream 1.3 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Cooper Gulch.

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

Copper Gulch is a tributary to Eureka Slough, a tributary to North Bay Channel, which drains into the Pacific Ocean. It is located in Humboldt County, California (Map 1). Cooper Gulch's legal description at the confluence with Eureka Slough is T5N R1W S23. Its location is 40.8055 degrees north latitude and 124.1407 degrees west longitude, LLID number 1241395408056. Cooper Gulch is a first order stream and has approximately 1.3 miles of blue line stream according to the USGS Eureka 7.5 minute quadrangle. Cooper Gulch drains a watershed of approximately 0.7 square miles. Elevations range from about sea level at the mouth of the creek to 120 feet in the headwater areas. Mixed hardwood dominates the watershed. The watershed is primarily residential. Vehicle access exists via Highway 101 to V Street in Eureka.

METHODS

The habitat inventory conducted in Cooper Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and 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 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 Cooper Gulch 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". Cooper Gulch 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 Cooper Gulch, 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 Cooper Gulch, 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 Cooper Gulch, 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 Cooper Gulch, 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 2.0.19, 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 Cooper Gulch 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 Cooper Gulch on August 22, 2007 was conducted by S. Truett and J. Pixley (WSP). The total length of the stream surveyed was 4,772 feet with an additional 35 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.41 cfs on August 22, 2007.

Cooper Gulch is an E6 channel type for the entire 4,772 feet of the stream surveyed. E6 channels are low gradient, meandering riffle/pool streams with low width/depth ratio and little deposition. They are very efficient and stable, have high meander width ratio, and a silt/clay-dominant substrates.

The water temperature during the survey period was 56 degrees Fahrenheit. The air temperature was 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 47% flatwater units, 29% riffle units, 12% pool units, 6% culvert units, and 6% dry units (Graph 1). Based on total length of Level II habitat types there were 85% flatwater units, 8% dry units, 3% riffle units, 3% culvert units, and 1% pool units (Graph 2).

Five Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 35% run units, 29% low gradient riffle units, 12% glide units and 12% mid-channel pool units (Graph 3). Based on percent total length, glide units made up 49%, run units 36%, and dry units 8%.

A total of two pools were identified (Table 3). All of the pools encountered were main channel pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. One of the two pools (50%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the two pool tail-outs measured, one had a value of two (50%); one had a value of 5 (50%); (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 such as bedrock, log sills, boulders, or other considerations.

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 2, flatwater habitat types had a mean shelter rating of 3, and pool habitats had a mean shelter rating of 38 (Table 1).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover types in Cooper Gulch. Graph 7 describes the pool cover in Cooper Gulch. Undercut banks are the dominant pool cover type followed by aquatic vegetation.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. A silt/clay substrate type was observed in 50% of pool tail-outs and sand substrate was observed in 50% of pool tail-outs.

The mean percent canopy density for the surveyed length of Cooper Gulch was 48%. Fifty-two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 100% and 0%, respectively. Graph 9 describes the mean percent canopy in Cooper Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 94%. The dominant elements composing the structure of the stream banks consisted of 100% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 71% of the units surveyed. Additionally, 14% of the units surveyed had deciduous trees as the dominant vegetation type and 14% had brush as the dominant vegetation (Graph 11).

DISCUSSION

Cooper Gulch is an E6 channel type for the entire 4,772 feet of stream surveyed. The suitability of E6 channel types for fish habitat improvement structures is as follows: E6 channel types are good for bank-placed boulders, and fair for opposing wing-deflectors.

The water temperature recorded on August 28, 2007 was 56 degrees Fahrenheit. The air temperature was 62 degrees Fahrenheit. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 85% of the total length of this survey, riffles 3%, and pools 1%. One of the two (50%) pools had 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 two pool tail-outs measured had an embeddedness rating of 1 or 2. None of the pool tail-outs had an embeddedness rating 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 Cooper Gulch should be mapped and rated according to their potential

sediment yields, and control measures should be taken.

Both pool tail-outs had silt, sand, large cobble, boulders or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 38. The shelter rating in the flatwater habitats was 3. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Cooper Gulch. Undercut banks are the dominant cover type in pools followed by aquatic vegetation. 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 48%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 100% and 94%, 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) Cooper Gulch 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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from undercut banks. Adding high quality complexity with woody cover in the pools is desirable.

4) Increase the canopy on Cooper Gulch by planting appropriate native vegetation like willow, alder, redwood, 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 affected from upstream.

5) Culvert #04 is located under Myrtle Avenue near the intersection with 8th Street at 3006 feet from the confluence. The outlet is subsurface with no visible opening. The culvert inlet can be found approximately 425’ upstream of the intersection of Myrtle Avenue and 8th Street near the 8th Street and R Street sign post. It is a single 4’ diameter culvert made of concrete. Cooper Gulch has good flow into the culvert inlet but does not flow from the outlet side. It is assumed that Cooper Gulch seeps through the fill slope and forms at a low point which drains toward Eureka Slough. A small overflow culvert was found on the left bank of the outlet fill-slope just below the Myrtle Avenue sidewalk.

Cooper Gulch

Water was flowing from this rusted culvert into a channel which flows to the Cooper Gulch outlet pool. This is a barrier to salmonids and should be replaced with a culvert that provides unimpeded fish passage.

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	The survey began at the confluence with Eureka Slough. This first habitat unit of the survey became shallower as it was surveyed upstream; it also went from a silt/clay/sand substrate to a gravel substrate as the survey moved upstream. There was a right bank drainage pipe and a right bank drainage ditch.
0	0001.00	Culvert #01 is located under the 'Circle K' off ramp on Highway 101 just north of Eureka. It is made of concrete and measured 6' in diameter and is 56' long. Not a barrier; the bottom is covered in depositional bay mud. There was no plunge and the maximum depth within 5' of the outlet was 3.7'. The culvert slope was 0%. Its condition was good. Culvert #02 is located under V Street is a 90' long concrete culvert that is 5' in diameter. There was no plunge, and the maximum depth within 5' of the outlet was 1.5'. The culvert slope was 0%; it was in good condition and not a barrier. Cooper Gulch narrows significantly after the culvert.
2355	0003.00	Culvert #03 passed under 6th Street. It is a single culvert, made of corrugated metal. The length is 151' with a 5' diameter. The maximum depth within 5' of outlet is 0.7' and there was no plunge. It was in good condition. The slope is 0.5%. There was asphalt in the culvert. This culvert was not a fish barrier.
3006	0009.00	The creek went subsurface under Myrtle Ave.
3006	0009.00	Culvert #04 is located under Myrtle Avenue near the intersection with 8th Street. The outlet is subsurface with no visible opening. The culvert inlet can be found approximately 425' upstream of the intersection of Myrtle Avenue and 8th Street near the 8th Street and R Street sign post. It is a single 4' diameter culvert made of concrete. Cooper Gulch has good flow into the culvert inlet but does not flow from the outlet side. It is assumed that Cooper Gulch seeps through the fill slope and forms at a low point which drains toward Eureka Slough. A small overflow culvert

		was found on the left bank of the outlet fill-slope just below the Myrtle Avenue sidewalk. Water was flowing from this rusted culvert into a channel which flows to the Cooper Gulch outlet pool. This is a barrier to salmonids and should be replaced with a culvert that provides unimpeded fish passage.
3477	0012.00	Bridge #01 is a wooden footbridge that measured 5' wide x 5' high and 34.5' long.
4512	0015.00	Bridge #02 is a wooden footbridge that measured 8' wide x 3' high and 13' long.
4772	0016.00	End of survey due to an unsurveyable marsh with very little flowing water.

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]	