STREAM INVENTORY REPORT

Cloney Gulch

INTRODUCTION

A stream inventory was conducted during June 2004 on Cloney Gulch. The survey began at the confluence with Freshwater Creek and extended upstream 2.3 miles.

The Cloney Gulch 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 Cloney Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

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

Cloney Gulch is a tributary to Freshwater Creek, a tributary to Freshwater Slough, a tributary to Eureka Slough, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Cloney Gulch's legal description at the confluence with Freshwater Creek is T04N R01E S03. Its location is 40.7578 degrees north latitude and 124.0483 degrees west longitude, LLID number 1240483407577. Cloney Gulch is a second order stream and has approximately 5.2 miles of blue line stream according to the USGS Arcata South 7.5 minute quadrangle. Cloney Gulch drains a watershed of approximately 4.7 square miles. Elevations range from about 35 feet at the mouth of the creek to 1,600 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists via Old Arcata Road to Freshwater-Kneeland Road.

METHODS

The habitat inventory conducted in Cloney 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.

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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 Cloney 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". Cloney 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 Cloney 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 Cloney 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 Cloney 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 Cloney 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.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Cloney Gulch. In addition, selected sites were sampled using a Smith-Root Model 12 electrofisher and underwater observations, as discussed in unpublished data from the Juvenile Salmonid Abundance Summer Survey Report, 2004 (Richer, S., McCanne, D. 2004).

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.9, 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 Cloney 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 June 22 to June 30, 2004 was conducted by Lindsey Selvaggio, Corby Hines and Leslie Merrick (CCC). The total length of the stream surveyed was 12,295 feet with an additional 176 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.27 cfs on July 6, 2004.

Cloney Gulch is an F4 channel type for 10,624 feet of the stream surveyed (Reach 1), an F2 channel type for 1,202 feet of the stream surveyed (Reach 2), and an A2 channel type for 469 feet of the stream surveyed (Reach 3). F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. F2 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and boulder-dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder dominant substrates.

Water temperatures taken during the survey period ranged from 57 to 62 degrees Fahrenheit. Air temperatures ranged from 58 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44% flatwater units, 31% pool units, 19% riffle units, and 6% dry units (Graph 1). Based on total length of Level II habitat types there were 58% flatwater units, 24% pool units, 15% riffle units, and 3% dry units (Graph 2).

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Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 29% run units, 25% mid-channel pool units, and 15% low gradient riffle units (Graph 3). Based on percent total length there were 30% run units, 28% step run units and 18% mid-channel pool units.

A total of 96 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 80%, and comprised 76% 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. Forty of the 96 pools (42%) had a residual depth of two feet or greater (Graph 5). Twelve of the 96 pools (12%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 93 pool tail-outs measured, 12 had a value of 1 (13%); 63 had a value of 2 (68%); 10 had a value of 3 (11%); four had a value of 4 (4%); and four had a value of 5 (4%); (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 31, flatwater habitat types had a mean shelter rating of 43, and pool habitats had a mean shelter rating of 70 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 74, scour pools had a mean shelter rating of 54, backwater pools had a mean shelter rating of 40 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Cloney Gulch. Graph 7 describes the pool cover in Cloney Gulch. 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. A gravel substrate type was observed in 67% of pool tail-outs, and small cobble was observed in 21% of pool tail-outs.

The mean percent canopy density for the surveyed length of Cloney Gulch was 91%. The mean percentages of hardwood and coniferous trees were 36% and 64%, respectively (Table 7). Nine percent of the canopy was open. Graph 9 describes the mean percent canopy in Cloney Gulch.

For the stream reach surveyed, the mean percent right and left bank vegetated was 87% each (Table 7). The dominant elements composing the structure of the stream banks consisted of 75% sand/silt/clay, 18% cobble/gravel, 5% bedrock, and 2% boulders (Graph 10). Hardwood trees were the dominant vegetation type observed in 37% of the units surveyed. Additionally, 34% of the units surveyed had brush as the dominant vegetation type, and 30% had coniferous tress as the dominant vegetation (Graph 11).

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BIOLOGICAL INVENTORY RESULTS

A biological survey was conducted by the Institute for River Ecosystems (IRE) in cooperation with the Department of Fish and Game. The sample reach included 11,367 feet. Coho were observed throughout Reach 1 and approximately 67 feet into Reach 2, a total distance of 10,765 feet. In this survey trout species were not distinguished and include cutthroat and rainbow, both resident and anadromous forms. Trout were sampled throughout Reach 1 and approximately 340 feet into Reach 2, a total distance of 10,964 (Ricker, S., McCanne, D. Unpublished Data, 2004). Juvenile salmonids were also observed from the stream banks up to a distance of 11,943 feet in Cloney Gulch.

DISCUSSION

Cloney Gulch is an F4 channel type for the first 10,624 feet of stream surveyed, an F2 channel type for the next 1,202 feet, and an A2 channel type for the remaining 469 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; and log cover, but poor for boulder clusters. The suitability of F2 channel types for fish habitat improvement structures is as follows: fair for plunge weirs; single and opposing wing deflectors; and log cover. The A2 channel types generally not suitable for fish habitat improvement structures. A2 channels are high energy streams with poor gravel retention capabilities.

The water temperatures recorded on the survey days June 22 to June 30, 2004 ranged from 57 to 62 degrees Fahrenheit. Air temperatures ranged from 58 to 70 degrees Fahrenheit. This is a good temperature range for juvenile salmonids. 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 58% of the total length of this survey, riffles 15% and pools 24%. The pools are relatively shallow, with 40 of the 96 (42%) 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. 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.

Seventy-five of the 93 pool tail-outs measured had embeddedness ratings of 1 or 2. Fourteen of the pool tail-outs had embeddedness ratings of 3 or 4. Four 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 Cloney Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

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Eighty-four of the 96 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 70. The shelter rating in the flatwater habitats was 43. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Cloney Gulch. 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 91%. Reach 1 had a canopy density of 90%, Reach 2 had a canopy density of 93%, and Reach 3 had a canopy density of 95%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 87% each. 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) Cloney 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) 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 in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

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) There are several log debris accumulations present on Cloney Gulch that are retaining large quantities of fine sediment. Since no electrofishing was conducted as part of this survey it is uncertain if these LDA's are barriers to anadromous salmonids, specifically coho salmon. The modification of these debris accumulations may be desirable, if the wood can be used to increase cover in the pool and flatwater habitats. Any modification of the LDA's must be done carefully, over time, to avoid excessive sediment loading in

downstream reaches.

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 Freshwater Creek. Channel type is an F4.
43	0003.00	Culvert measures 16' wide x 18' high.
286	0007.00	Humboldt Fish Action Council (HFAC) 100 meter mark 69' into unit on right bank.
366	0008.00	Trail access to F-K road and PALCO road.
419	0010.00	Salmonids observed last 10 units.
750	0017.00	Fish habitat improvement structure.
938	0021.00	PALCO monitoring station. Foot bridge 22' into habitat unit measures 30' long x 3' wide x 8' high.
1306	0029.00	Right bank erosion site measures 65' long x 12' high x 2' deep.
1373	0030.00	HFAC 400 meter mark 16' into unit. Log debris accumulation (LDA) measures 7' high x 28' wide x 25' long and is composed of 16 pieces of large wood.
1648	0035.00	Salmonids observed last 10 units.
1698	0036.00	HFAC 500 meter mark 254' into unit.
2063	0045.00	HFAC 600 meter mark 20' into unit.
2362	0053.00	Trail access to road on right bank.
2517	0055.00	Log pilings in channel.
2726	0056.00	HFAC 800 meter mark 60' into unit.
3099	0063.00	HFAC 900 meter mark 5' into unit.

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3154	0065.00	Log pilings in channel.
3241	0066.00	Access to quad trail on right bank.
3331	0068.00	Old car in pool.
3331	0068.00	Old road on left bank.
3598	0074.00	LDA measures 7' high x 30' wide x 20' long and is composed of eight pieces of large wood and large amount of small woody debris.
3653	0075.00	HFAC 1,100 meter mark 139' into unit.
3823	0076.00	LDA measures 7' high x 25' wide x 23' long and is composed of 14 pieces of large wood. Stored sediment measures 2’ deep. Fish observed above.
4052	0085.00	HFAC 1,200 meter mark 55' into unit. Falls Gulch enters from the left bank. Contributes approximately 45% to flow. Water temperatures for the tributary and Cloney Gulch was 57 degrees Fahrenheit.
4283	0090.00	HFAC 1,300 meter mark 7' into unit on fallen tree on left bank. LDA measures 4' high x 13' wide x 12' long and is composed of five pieces of large wood. Fish observed above.
4574	0095.00	HFAC 1,400 meter mark 7' into unit.
4620	0096.00	LDA measures 5' high x 15' wide x 7' long and is composed of five pieces of large wood. Stored sediment measures 2' deep. Fish observed above.
4687	0099.00	Small landslide causing flow to go subsurface for a short distance.
4810	0104.00	Left bank tributary #2 enters at top of unit, dry.
4906	0106.00	HFAC 1,500 meter mark 11' into unit.
5015	0110.00	LDA measures 5' high x 20' wide x 20' long and is composed of 11 pieces of large wood. Fish observed above.
5261	0117.00	HFAC 1,600 meter mark 9' into unit on right bank.
5398	0122.00	Lamprey observed.
5601	0126.00	HFAC 1,700 meter mark at top of unit on left bank.

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5656	0129.00	LDA measures 9' high x 22' wide x 20' long and is composed of 20 pieces of large wood. Stored sediment measures 3' deep. Salmonids observed above.
5679	0130.00	Access to quad trail, very overgrown.
5876	0134.00	Railroad rails in creek. 1800 meter mark 54' into unit on right bank.
5938	0135.00	Left bank erosion site measures 45' into unit 18' long x 25' high x 10' deep. LDA measures 11' high x 23' wide x 32' long and is composed of 15 pieces of large wood. Stored sediment measures 2' deep. Fish observed above.
6099	0138.00	LDA measures 7' high x 17' wide x 28' long and is composed of 15 pieces of large wood.
6174	0142.00	LDA measures 6' high x 15' wide x 5' long and is composed of six pieces of large wood.
6192	0143.00	HFAC 1,900 meter mark 65' into unit.
6551	0150.00	HFAC 2,000 meter mark at top of unit.
6853	0158.00	HFAC 2,100 meter mark at top of unit.
6918	0161.00	Few salmonids observed last 10 units.
7074	0166.00	Right bank erosion site measures 18' long x 12' high x 4' deep. LDA measures 10' high x 35' wide x 30' long and is composed of 16 pieces of large wood. Stored sediment measures 4' deep. Fish observed above even though the channel is extremely silted in.
7114	0167.00	Creek is subsurface.
7145	0168.00	Small amount of water between two subsurface units.
7243	0171.00	HFAC 2,200 meter mark at top of unit.
7303	0173.00	LDA measures 5' high x 10' wide x 6' long and is composed of 11 pieces of large wood. Stored sediment measures 3' deep. Fish observed above.
7586	0182.00	HFAC 2,300 meter mark 13' into unit on left bank.
7728	0187.00	Right bank erosion site measures 17' high x 24' long x 6' deep. LDA measures 7' high x 18' wide x 38' long and is composed of 10 pieces of large wood. Stored sediment measures 2' deep. Fish observed above.

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7842	0190.00	HFAC 2,400 meter mark 138' into unit.
8000	0192.00	Old railroad remnants, log pilings in channel.
8155	0197.00	LDA measures 8' high x 18' wide x 20' long and is composed of 16 pieces of large wood. Stored sediment measures 3' deep. Fish observed above.
8238	0199.00	HFAC 2,500 meter mark 15' into unit on left bank.
8535	0206.00	HFAC 2,600 meter mark 26' into unit.
8872	0213.00	HFAC 2,700 meter mark 10' into unit on left bank.
8906	0214.00	Right bank erosion site measures 10' long x 12' high x 6' deep. LDA measures 11' high x 30' wide x 45' long and is composed of 15 pieces of large wood. Stored sediment measures 5' deep. Fish observed above.
9038	0218.00	LDA measures 4' high x 12' wide x 12' long and is composed of 10 pieces of large wood. Stored sediment measures 2' deep. Fish observed above.
9056	0219.00	Left bank tributary #3, dry. It is not accessible to fish.
9155	0222.00	HFAC 2,800 meter mark at top of unit.
9193	0224.00	Log pilings and old railroad pieces in creek.
9235	0225.00	Railroad logs spanning the channel forming a terraced stream bed.
9390	0230.00	Railroad tracks in creek.
9450	0231.00	LDA measures 11' high x 15' wide x 15' long and is composed of 11 pieces of large wood. Stored sediment measures 5' deep. Fish observed above.
10153	0245.00	Right bank erosion site measures 10' long x 16' high x 5' deep. LDA measures 15' high x 30' wide x 10' long and is composed of eight pieces of large wood. Stored sediment measures 2' deep.
10624	0261.00	Channel type F2. Scattered salmonids observed last 10 units.
10699	0262.00	LDA measures 10' high x 15' wide x 18' long and is composed of seven pieces of large wood. Stored sediment measures 2' deep.
11146	0271.00	LDA measures 16' high x 35' wide x 25' long and is composed of 15 pieces of large wood. Stored sediment measures 3' deep.

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11278	0276.00	Right bank tributary enters 30' into unit. The water temperature in Cloney Gulch was 59 degrees Fahrenheit above and below the tributary. The temperature of the tributary was 57 degrees Fahrenheit. It is not accessible to fish.
11659	0286.00	Log pilings in creek. Tributary enters from the right bank 50' into unit. Temperature of Cloney Gulch was 60 degrees Fahrenheit above and below. The temperature of the tributary was 58 degrees Fahrenheit. Not accessible to fish.
12243	0301.00	Channel type an A2. End of survey due to boulder and large cobble substrate, high gradient and no fish observed since Habitat Unit #296 at 11,944'.

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.

Richer, S., McCanne, D., 2004. Unpublished data from the *Juvenile Salmonid Abundance Summer Survey Report 2004.* Anadromous Fisheries Research and Monitoring Program (AFRAMP), California Department of Fish and Game and Institute for River Ecosystems (IRE), Humboldt State University, Arcata, 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]	

Appendix A

California Department of Fish & Game

Large Woody Debris (LWD) Riparian Inventory

Freshwater Basin, Humboldt County

BACKGROUND

The importance of large woody debris (LWD) in the development of a stream's morphological and biological productivity has been well documented. It strongly influences stream habitat characteristics and biotic composition. Large woody debris is often the structural element associated with pool formation and is considered one of the major elements that create complex fish habitat vital for juvenile salmonid survival. Habitat complexity is particularly important for coho salmon and steelhead trout juveniles because these salmonids remain in the stream for at least one year before migrating to the ocean.

Large woody debris inventories describe the present relative abundance of LWD elements providing, or with the potential to provide, fish habitat within the stream channel. Large woody debris inventories also describe the relative abundance of "recruitable" LWD. Recruitable LWD is the large wood existing out of the stream channel that has a high potential of entering the stream channel in the future.

METHODS

Prior to conducting the LWD inventory, the stream was habitat-typed employing the methods described by Flosi, et al (1998). The Cloney Gulch habitat-typing survey delineated three stream reaches. The start and end points for the LWD inventory reaches correspond to stream reach start and end points of the habitat survey.

Large woody debris inventory methods, data recording forms, and database structure are described in Flosi, et al (1998). Large woody debris minimum size criteria was 12-inches in diameter and 6 feet in length. Root wads had the 12-inch minimum diameter criteria but had no minimum length requirement. Diameter and length categories consisted of the following:

Diameter Category	Length Category
1. 1-2 feet 2. 2-3 feet 3. 3-4 feet 4. Over 4 feet	1. 6-20 feet 2. Over 20 feet

Cloney Gulch

Condition or status categories included:

a) dead and down
b) dead and standing
c) perched for imminent delivery to the stream channel
d) live coniferous trees
e) live broadleaf trees (a.k.a. deciduous/hardwood)

The sampling strategy consisted of selecting a random starting point near the beginning of the LWD survey reach, and then systematically sampling 200 foot sections out of every 1,000 feet of stream length surveyed. The first 1,200 feet of the LWD survey reach was segmented into 200 foot sections and consecutively numbered 1 through 6. One of these six 200 foot sections was randomly selected as the beginning of the *first* sample section. After conducting the inventory survey in the initial 200 foot section, surveyors proceeded upstream 800 feet and surveyed the next 200 feet as the *second* sample section. The *third* sample section began 800 feet upstream of the end of the second sample section and the next 200 feet were surveyed, and so on. Systematic sampling continued upstream until the end of the LWD survey reach. This method produced a sampling level of approximately 20 percent. For channel type reaches that were less than 1000 feet, the entire reach was surveyed.

RESULTS

The Cloney Gulch LWD inventory consisted of three inventory reaches.
Reach 1, a F4 channel type extended upstream approximately 10624 feet from the mouth. This reach contained 13.2 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 63.6% live coniferous, 17.4% dead and down, 9.8% live broadleaf, 6.8% dead and standing, and 2.3% perched (Table 3). Within the bankfull channel, reach 1 contained 6.9 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 100% dead and down and 0% live coniferous, 0% live broadleaf, 0% dead and standing, and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 20.1, of which 45.8% were dead and down, 41.8% were live coniferous, 6.5% live broadleaf, 4.5% dead and standing, and 1.5% perched. Of the pieces in reach 1, 62.3% were in LWD size category of 1-2 feet in diameter, 26.6% were in the 2-3 foot category, 6.3% were in the 3-4 foot category, and 4.8% were in the >4 foot category (Figure 1).

Reach 2, a F2 channel type started at 10624 feet from the mouth and extended upstream approximately 11826 feet from the mouth. This reach contained 13 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 73.1% live coniferous, 11.5% dead and standing, 7.7% dead and down, 7.7% perched, and 0% live broadleaf (Table 3). Within the bankfull channel, reach 2 contained 3 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 100% dead and down, 0% live coniferous, 0% dead and standing, 0% perched, and 0% live broadleaf. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 16, of which 59.4% were live coniferous, 25% dead and down, 9.4% dead and standing, 6.3% perched, and 0% live broadleaf. Of the pieces in reach 2, 71.9% were in the LWD size category of the 1-2

feet in diameter, 18.8% were in the 2-3 foot category, 6.3% were in the 3-4 foot category, and 3.1% were in the >4 foot category (Figure 1).

Reach 3, an A2 channel type started at 11826 feet from the mouth and extended upstream approximately 12295 feet from the mouth. This reach contained 35.5 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 80.3% live coniferous, 9.9% dead and standing, 5.6% dead and down, 4.2% perched, and 0% live broadleaf (Table 3). Within the bankfull channel, reach 3 contained 10 pieces of LWD per linear feet of stream. The conditions of the pieces were 100% dead and down, 0% coniferous, 0% dead and standing, 0% perched, and 0% live broadleaf. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 45.5, of which 62.6% were coniferous, 26.4% dead and down, 7.7% dead and standing, 3.3% perched, and 0% live broadleaf. Of the pieces in reach 3, 64.8% were in the LWD size category of the 1-2 feet in diameter, 25.3% were in the 2-3 foot category, 7.7% were in the 3-4 foot category, and 2.2% were in the >4% foot category (Figure 1).

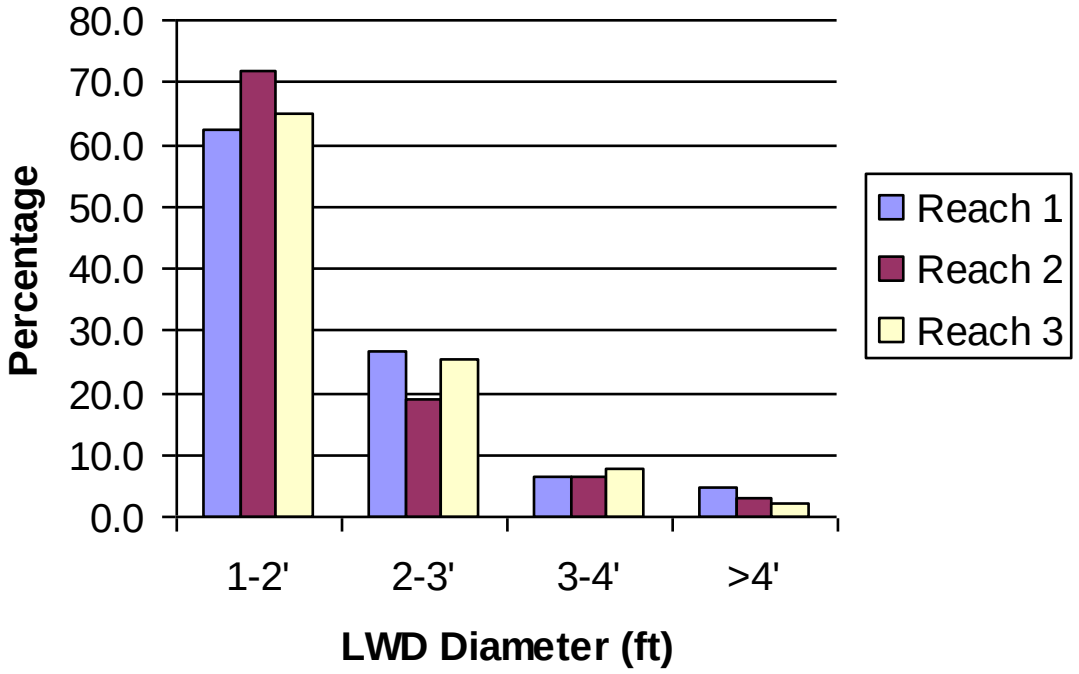

Figure 1. Percent of LWD according to diameter size class and reach

DISCUSSION

Reach 1, a F4 channel type had a bankfull width of 18. LWD on the banks was dominated by live, 1-2 feet diameter, greater than 20 feet tall coniferous trees. While 1-2 feet diameter, less than 20 feet tall dead and down LWD dominated the stream channel. The 1-2 feet diameter size class was the most common for all LWD pieces in both the stream channel and the bank zones

(Table 1). In the stream channel, there were 6.9 pieces of dead and down LWD per 100 linear feet of stream observed (Table 2).

Reach 2, a F2 channel type had a bankfull width of 16. In reach 2 LWD on the banks was dominated by live, 1-2 feet diameter, greater than 20 feet tall coniferous trees. There was an equal number of 1-2 feet diameter, less than 20 feet tall dead and down LWD and 1-2 feet diameter, more than 20 feet tall dead and down LWD that dominated the stream channel. The 1-2 feet diameter size class was the most common for all LWD pieces in both the stream channel and the bank zones (Table 1). In the stream channel, there were 3.0 pieces of dead and down LWD per 100 linear feet of stream observed (Table 2).

Reach 3, a A2 channel type had a bankfull width of 14. LWD on the banks was dominated by live, 1-2 feet diameter, greater than 20 feet tall coniferous trees. While 1-2 feet diameter, less than 20 feet tall dead and down LWD dominated the stream channel. The 1-2 feet diameter size class was the most common for all LWD pieces in both the stream channel and the bank zones (Table 1). In the stream channel, there were 10.0 pieces of dead and down LWD per 100 linear feet of stream observed (Table 2).

One goal of conducting LWD inventories is to provide data that, along with fish population and habitat type data, will enable resource managers to characterize the quality of available and potential fish habitat. Although, the relationship between the number, size, and type of LWD pieces per 100 feet, and quality of fish habitat has not been fully established, it is generally accepted that LWD in the stream channel plays a vital role in contributing to the quality of fish habitat. Large woody debris within the bank zone is the source for future instream LWD and addresses the issue of LWD recruitment to the stream channel. Information in this report will enable resource managers to identify areas lacking in LWD, subsequently leading to planning and prioritizing prescriptions for improvement. This information will also be useful in detecting changes in LWD relative abundance with relation to land use practices or riparian zone restoration projects.