

# STREAM INVENTORY REPORT

## Dunlap Gulch

### INTRODUCTION

A stream inventory was conducted from June 14 to June 28, 2005 on Dunlap Gulch. The survey began at the confluence with North Fork Elk River and extended upstream 0.5 miles.

The Dunlap 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 Dunlap 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

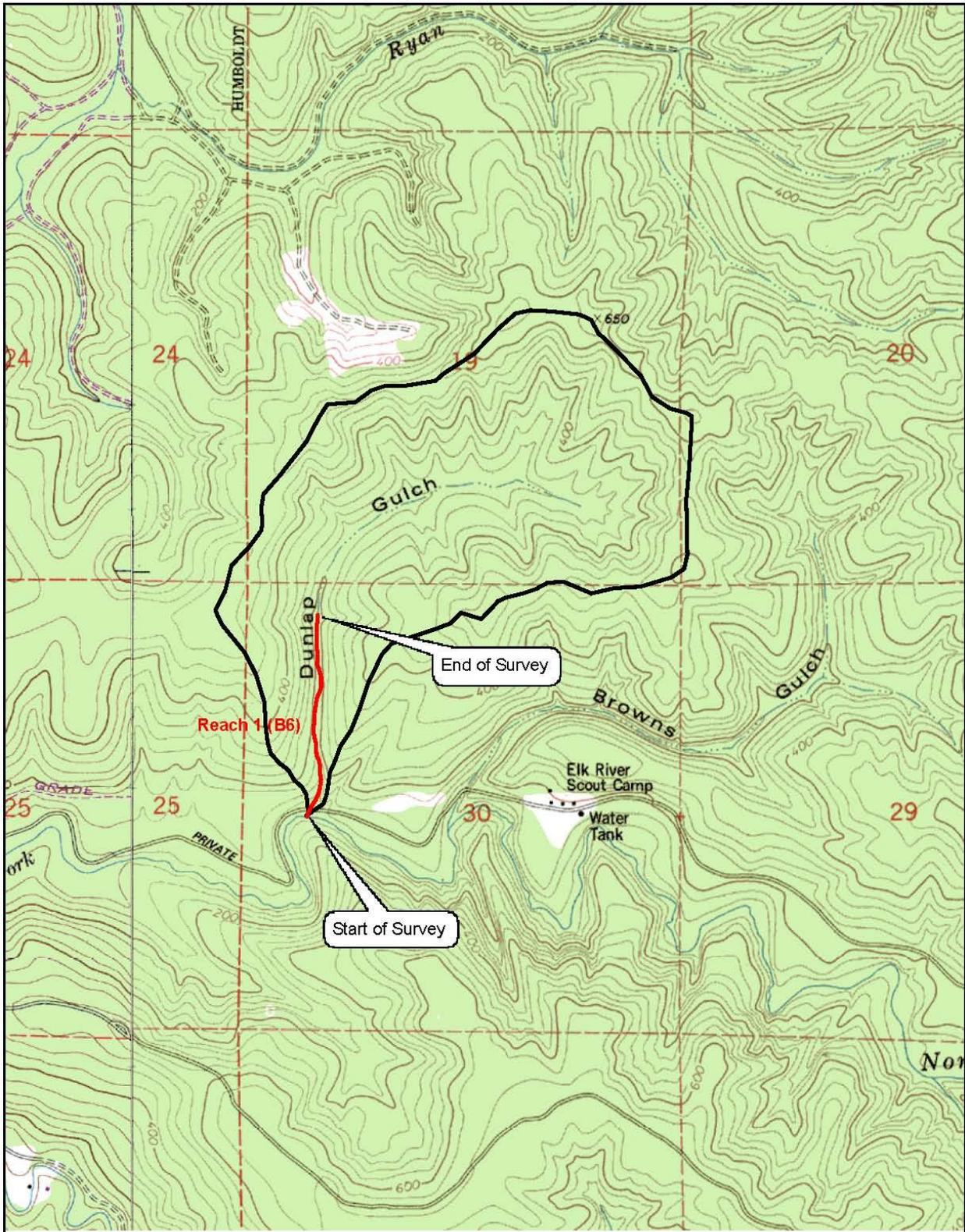
Dunlap Gulch is a tributary to North Fork Elk River, a tributary to Elk River, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). Dunlap Gulch's legal description at the confluence with North Fork Elk River is T04N R01E S30. Its location is 40.7003 degrees north latitude and 124.1175 degrees west longitude, LLID number 1241176407003. Dunlap Gulch is a first order stream and has approximately 1.2 miles of blue line stream according to the USGS McWhinney Creek 7.5 minute quadrangle. Dunlap Gulch drains a watershed of approximately 0.6 square miles. Elevations range from about 75 feet at the mouth of the creek to 300 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 Highway 101 to Elk River Road through a locked gate.

### METHODS

The habitat inventory conducted in Dunlap 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 three-person team.

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Map 1



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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. 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 Dunlap 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". Dunlap 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

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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 Dunlap 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 Dunlap 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 Dunlap 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 Dunlap 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

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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 Dunlap Gulch. In addition, seven sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.17, 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

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- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Dunlap 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

The habitat inventory of June 14 to June 27, 2005 was conducted by M. Liggett, M. Erkel, J. Freewoman, and A. Nelson (WSP). The total length of the stream surveyed was 2,448 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.07 cfs on June 16, 2005.

Dunlap Gulch is a B6 channel type for 2,448 feet of the stream surveyed. B6 channels are moderately entrenched, with a moderate gradient, riffle dominated channels and infrequently spaced pools. They have a very stable plan and profile, stable banks, and a silt/clay channel.

Water temperatures taken during the survey period ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 55 to 60 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 42% pool units, 32% flatwater units, 19% riffle units, 6% unsurveyed units, and 1% culvert units (Graph 1). Based on total length of Level II habitat types there were 41% flatwater units, 40% pool units, 15% riffle units, 3% unsurveyed units, and 2% culvert units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 37%; run units, 32%; and low gradient riffle units, 19% (Graph 3). Based on percent total length, run units made up 41%, mid-channel pool units 35%, and low gradient riffle units 15%.

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A total of 45 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 93%, and comprised 95% 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. Nine of the 43 pools (21%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 44 pool tail-outs measured, five had a value of 2 (11%); 11 had a value of 3 (25%); 21 had a value of 4 (48%); and seven had a value of 5 (16%); (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 6, flatwater habitat types had a mean shelter rating of 25, and pool habitats had a mean shelter rating of 50 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 53, and scour pools had a mean shelter rating of 8 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Dunlap Gulch. Graph 7 describes the pool cover in Dunlap 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 45% of pool tail-outs and silt/clay was observed in 32% of pool tail-outs.

The mean percent canopy density for the surveyed length of Dunlap Gulch was 95%. Five percent of the canopy was open. Of the mean percent canopy density, the mean percentages of hardwood and coniferous trees were 27% and 73%, respectively. Graph 9 describes the mean percent canopy in Dunlap Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 98%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 90% sand/silt/clay and 10% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 48% of the units surveyed. Additionally, 26% of the units surveyed had grass as the dominant vegetation type, and 17% had brush as the dominant vegetation (Graph 11).

## **BIOLOGICAL INVENTORY RESULTS**

Seven sites were electrofished for species composition and distribution in Dunlap Gulch on August 1, 2005. The water temperature taken during the electrofishing period was 57 degrees Fahrenheit. Air temperatures ranged from 61 to 63 degrees Fahrenheit. The sites were sampled by A. Nelson (WSP) and P. Divine (DFG).

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Seven sites were sampled. The sample sites yielded eight young-of-the-year coho salmon.

The following chart displays the information yielded from these sites:

2003 Dunlap Gulch e-fish observations.

Date	Site #	Hab. Unit #	Hab. Type	Approx . Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
Reach 1 B6 Channel Type									
8/01/05	1	11	8.0	164	2	0	0	0	0
8/01/05	2	16	4.1	208	3	0	0	0	0
8/01/05	3	23	1.1	357	1	0	0	0	0
8/01/05	4	29	5.1	466	0	0	0	0	0
8/01/05	5	31	4.2	501	2	0	0	0	0
8/01/05	6	40	4.2	674	0	0	0	0	0
8/01/05	7	59	3.3	1216	0	0	0	0	0

## DISCUSSION

Dunlap Gulch is a B6 channel type for the entire 2,448 feet of stream surveyed. The suitability of B6 channel types for fish habitat improvement structures is as follows: excellent for bank-placed boulders and log cover; it is good for plunge weirs, single and opposing wing-deflectors, and channel constrictors; and it is fair for boulder clusters.

The water temperatures recorded on the survey days June 14 to June 27, 2005 ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 55 to 60 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 41% of the total length of this survey, pools 40%, and riffles 15%. The pools are relatively shallow with only nine of the 43 (21%) 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. Adding log structure that will increase or deepen pool habitat is recommended.

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Five of the 44 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-two of the pool tail-outs had embeddedness ratings of 3 or 4. Seven 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 Dunlap Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-three of the 44 pool tail-outs had silt, sand, or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 50. The shelter rating in the flatwater habitats was 25. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Dunlap 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 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 high at 98% and 99%, respectively.

### RECOMMENDATIONS

- 1) Dunlap 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 pool 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.
- 4) 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.
- 5) There are numerous log debris accumulations (LDA) present on Dunlap Gulch that are retaining large quantities of sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches. Any large wood moved from these LDA's must remain within the bankfull channel.

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### 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	Start of survey at the confluence of North Fork Elk River. Dunlap Gulch parallels the North Fork Elk River channel separated only by a gravel bar until Habitat Unit #003.
35	0002	Young-of-the-year (YOY) salmonids observed in this unit.
89	0007	Out of the influence of North Fork Elk River in this unit.
124	0011	Metal culvert, 7' diameter x 40' long, in fair condition. The bottom of the culvert is covered with silt/gravel/cobble. First electrofishing site, two coho YOY captured.
176	0014	Log debris accumulation (LDA) measures 4' high x 15' wide x 10' long, with six pieces of large wood. Water flows through and there are visible gaps. The LDA is retaining a volume of silt, sand, and gravel measuring 2' wide x 4' long x 1' deep. Fish were observed above.
208	0016	Second electrofishing site. Three coho YOY captured.
291	0020	LDA measures 6' high x 20' wide x 57' long, with nine pieces of large wood. A volume of silt, sand, and gravel is being retained measuring 15' wide x 30' long x 4' deep. Fish were observed above.
357	0023	Third electrofishing site. One coho YOY captured.
379	0025	Access point at an old railroad trestle bridge falling down into the creek.
466	0029	Fourth electrofishing site; no fish captured.
501	0031	Fifth electrofishing site. Two coho YOY captured.
569	0035	LDA measures 10' high x 15' wide x 20' long, with 13 pieces of large wood. A volume of silt and gravel is being retained measuring 10' wide x 15' long x 5' deep. The few fish observed upstream of the LDA during the habitat survey were likely resident trout. During the e-fish survey no fish were captured upstream of this unit.

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674	0040	LDA measuring 2.5' high x 15' wide x 2.5' long, with three pieces of large wood. A volume of silt, sand, and gravel is being retained measuring 20' wide x 20' long x 3' deep. Sixth electrofishing site, no fish captured.
707	0042	LDA measures 7' high x 15' wide x 10' long, with six pieces of large wood. Water doesn't flow through it and there are no visible gaps. A volume of silt, sand, and gravel is being retained measuring 15' wide x 10' long x 5' deep. Water goes subsurface under this LDA.
716	0043	Possible old railroad remnants in the channel for 180' of this unit. Cut logs span the channel from bank to bank.
716	0043	A dry right bank tributary enters 234' into unit.
970	0044	The large woody debris in this unit is possibly due to an historic bridge. LDA measures 6' high x 10' wide x 3' long, with three pieces of large wood. Water flows over the LDA. A volume of silt, sand, and gravel is being retained measuring 7' wide x 20' long x 6' deep.
1015	0047	LDA measures 10' high x 10' wide x 10' long, with 10 pieces of large wood. A volume of silt, sand, and gravel is being retained measuring 10' wide x 15' long x 5' deep.
1086	0051	LDA measures 5' high x 25' wide x 3' deep, with seven pieces of large wood. A volume of silt, sand, and gravel is being retained measuring 15' wide x 20' long x 3' deep.
1216	0059	A dry side channel enters at the top of the unit. Seventh electrofishing site, no fish captured, furthest upstream electrofishing site.
1296	0062	An old growth redwood log spanning the channel creating a 6.5' high plunge.
1674	0079	LDA measures 5' high x 15' wide x 5' long, with six pieces of large wood. A volume of silt, sand, and gravel is being retained measuring 8' wide x 15' long x 3' deep. The water goes subsurface under this LDA.
1933	0088	1.5' plunge at the top of this unit due to an old growth redwood spanning the channel.
2009	0090	LDA measures 3' high x 7' wide x 15' long, with nine pieces of large wood. A volume of silt, sand, and gravel is being retained measuring 10' wide x 15' long x 3' deep.

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2020	0091	Three foot high plunge between two logs at the top of this unit. The logs span the channel and the water flows under the downstream log. The logs have sediment and vegetation on top of them.
2053	0092	LDA measures 5' high x 10' wide x 20' long, with six pieces of large wood. A volume of silt is being retained measuring 15' wide x 15' long x 4' deep.
2248	0101	LDA measures 3' high x 15' wide x 15' long, with 10 pieces of large wood. A volume of silt and sand is being retained measuring 10' wide x 10' long x 2' deep.
2292	0103	LDA measures 8' high x 25' wide x 30' long, with 12 pieces of large wood. A volume of silt, sand, gravel, and cobble is being retained measuring 20' wide x 15' long x 4' deep.
2448	0108	End of survey due to numerous LDA's and the water going subsurface for at least the next 250'.

## **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.

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### 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]	

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## Appendix A

California Department of Fish & Game

Large Woody Debris (LWD) Riparian Inventory

### **Dunlap Gulch Humboldt County June 2005**

#### 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 Dunlap Gulch habitat typing survey delineated 1 stream reach. 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:

<b>Diameter Category</b>	<b>Length Category</b>
1. 1-2 feet	1. 6-20 feet
2. 2-3 feet	2. Over 20 feet
3. 3-4 feet	
4. Over 4 feet	

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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

\*Tables 1 and 2 are located at the end of this report.

Figure 1. Large Woody Debris Inventory for Dunlap Gulch, Humboldt County, California 2005.

Expressed in Number of Pieces Per 100 linear Feet of Stream Channel.

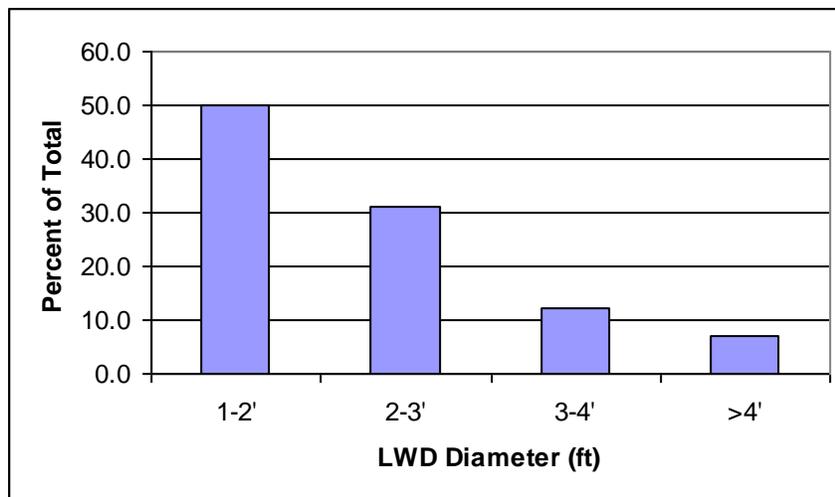
STREAM	REACH	CHANNEL TYPE	TOTAL LENGTH	DEAD		--LIVE TREES--			TOTAL
				DOWN	STANDING	PERCHED	CONIFER	BROADLEAF	
Number of pieces per 100 linear feet of stream out of channel on right and left banks									
Dunlap Gulch	1	B6	2448	0.3	0.5	1.5	14	0.3	16.6
Number of pieces per 100 linear feet of stream within the bankfull channel									
Dunlap Gulch	1	B6	2448	12.5	0		0	0	12.5
Number of pieces per 100 linear feet of stream out of channel on right and left banks and within the bankfull channel									
Dunlap Gulch	1	B6	2448	12.8	0.5	1.5	14	0.3	29.1
Percentage of LWD pieces found out of channel on right and left banks									
Dunlap Gulch	1	B6	2448	1.80722892	3.012048193	9.036144578	84.337349	1.807228916	100
Percentage of LWD pieces found within the bankfull channel									
Dunlap Gulch	1	B6	2448	100.0	0.0	0.0	0.0	0.0	100
Percentage of LWD pieces found out of channel on right and left banks and within the bankfull channel									
Dunlap Gulch	1	B6	2448	44.0	1.7	5.2	48.1	1.0	100

## Dunlap Gulch

The Dunlap Gulch LWD inventory consisted of 1 inventory reach.

Reach 1, a B6 channel type extended upstream approximately 0 feet from the mouth. This reach contained 16.6 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 84.3% live coniferous, 12.8% dead and standing, 9.0% perched, 1.8% dead and down and 1.8% live broadleaf (Figure 1). Within the bankfull channel, Reach 1 contained 12.5 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 29.1, of which 48.1% were live coniferous, 44.0% were dead and down, 5.2% perched, 1.7% dead and standing and 1.0% live broadleaf. Of the pieces in Reach 1, 50.0% were in LWD size category of 1-2 foot in diameter, 31.0% were in the 2-3 foot category, 12.1% were in the 3-4 foot category and, 6.9% were in the >4 foot category (Figure 2).

Figure 2: Percent of LWD according to diameter size class and stream reach



## DISCUSSION

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.