

STREAM INVENTORY REPORT

Cahto Creek

INTRODUCTION

A stream inventory was conducted from July 14, 2009 to July 27, 2009 on Cahto Creek. The survey began at the confluence with Tenmile Creek and extended upstream 3.1 miles.

The Cahto Creek 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 Cahto Creek. 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 Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Cahto Creek is a tributary to Tenmile Creek, tributary to South Fork Eel River, tributary to Eel River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Cahto Creek's legal description at the confluence with Tenmile Creek is T21N R15W S13. Its location is 39.6801 north latitude and 123.4869 west longitude, LLID number 1234857396802. Cahto Creek is a second order stream and has approximately 6.9 miles of blue line stream according to the USGS Cahto Peak 7.5 minute quadrangle. Cahto Creek drains a watershed of approximately 5.6 square miles. Elevations range from about 1,600 feet at the mouth of the creek to 2,500 feet in the headwater areas. Mixed hardwood forest dominates the watershed. The watershed is primarily privately owned and is managed for rangeland and recreation. Vehicle access exists via Branscomb Road.

METHODS

The habitat inventory conducted in Cahto Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail

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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 Cahto Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Cahto Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

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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 Cahto Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate 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 Cahto Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Cahto Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Cahto Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

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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 Cahto Creek. In addition, underwater observations were made at 19 sites. 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 2.0.19, 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

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

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of July 14, 2009 to July 27, 2009, was conducted by R. Okey and T. Fleming (WSP). The total length of the stream surveyed was 16,138 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.18 cfs on July 15, 2009.

Cahto Creek is an F4 channel type for 11,855 feet of the stream surveyed (Reach 1), and an F3 channel type for 4,283 feet of the stream surveyed (Reach 2). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios, very stable with gravel-dominant substrates. F3 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios, very stable with cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 56 to 74 degrees Fahrenheit. Air temperatures ranged from 58 to 92 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% flatwater units, 34% pool units, and 28% riffle units (Graph 1). Based on total length of Level II habitat types there were 40% pool units, and 37% flatwater units, 21% riffle units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 30%; low gradient riffle units, 27%; and run units, 22% (Graph 3). Based on percent total length, mid-channel pool units made up 34%, low gradient riffle units 21%, and run units 20%.

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A total of 127 pools were identified (Table 3). Main channel pools were the most frequently encountered at 91% (Graph 4), and comprised 87% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty-nine of the 127 pools (39%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 127 pool tail-outs measured, 23 had a value of 1 (18.1%); 43 had a value of 2 (33.9%); 36 had a value of 3 (28.3%); 14 had a value of 4 (11%); 11 had a value of 5 (8.7%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited 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 16, and pool habitats had a mean shelter rating of 29 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating of 35. Main channel pools had a mean shelter rating of 28 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Root mass is the dominant cover type in Cahto Creek. Graph 7 describes the pool cover in Cahto Creek. Root mass is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was the dominant substrate observed in 43% of the pool tail-outs. Gravel was the next most frequently observed dominant substrate type and occurred in 41% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Cahto Creek was 76%. Twenty-four percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 97% and 3%, respectively. Graph 9 describes the mean percent canopy in Cahto Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 84%. The mean percent left bank vegetated was 86%. The dominant elements composing the structure of the stream banks consisted of 80% sand/silt/clay, 8% bedrock, 8% cobble/gravel, and 4% boulder (Graph 10). Hardwood trees were the dominant vegetation type observed in 87.9% of the units surveyed. Additionally, 9.2% of the units surveyed had brush as the dominant vegetation type, and 2.2% had grass as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Nineteen sites were snorkel surveyed for species composition and distribution in Cahto Creek on July 28, 2009. Water temperatures taken during the sampling period of 0900 to 1300 were 66

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degrees Fahrenheit. Air temperatures ranged from 66 to 84 degrees Fahrenheit. The sites were sampled by I. Mikus (DFG), and R. Okey and T. Fleming (WSP).

In reach 1, which comprised the first 11,855 feet of stream, 10 sites were sampled. The reach sites yielded 109 young-of-the-year steelhead/rainbow trout (SH/RT), 3 age 1+ SH/RT, 98 three-spine stickleback, approximately 150 California roach, 2 largemouth bass and 5 green sunfish.

In reach 2, 9 sites were sampled starting approximately 12,131 feet from the confluence with Tenmile Creek and continuing upstream 1,338 feet. The reach sites yielded 132 young-of-the-year SH/RT, 3 age 1+ SH/RT, 53 California roach, and 4 green sunfish.

The following chart displays the information yielded from these sites:

2009 Cahto Creek underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: F4 Channel Type									
07/28/09	1	30	pool	1,688	14	0	0	0	0
07/28/09	2	46	pool	2,618	1	0	0	0	0
07/28/09	3	51	pool	2,807	5	0	0	0	0
07/28/09	4	105	pool	5,713	11	0	0	0	0
07/28/09	5	110	pool	5,994	5	0	0	0	0
07/28/09	6	129	pool	7,273	5	0	0	0	0
07/28/09	7	135	pool	7,553	7	0	0	0	0
07/28/09	8	198	pool	10,877	38	3	0	0	0
07/28/09	9	213	pool	11,522	14	0	0	0	0
07/28/09	10	225	pool	11,764	9	0	0	0	0
Reach 2: F3 Channel Type									
07/28/09	11	238	pool	12,276	16	0	0	0	0
07/28/09	12	247	run	12,578	17	0	0	0	0
07/28/09	13	249	pool	12,626	29	3	0	0	0
07/28/09	14	254	pool	12,831	24	0	0	0	0
07/28/09	15	256	pool	12,900	13	0	0	0	0
07/28/09	16	257	pool	12,957	9	0	0	0	0
07/28/09	17	262	pool	13,059	11	0	0	0	0
07/28/09	18	264	pool	13,119	10	0	0	0	0
07/28/09	19	267	pool	13,328	3	0	0	0	0

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DISCUSSION

Cahto Creek is an F4 channel type for 11,855 feet of the stream surveyed (Reach 1) and an F3 channel type for the remaining 4,283 feet of the stream surveyed (Reach 2). The suitability of F4 and F3 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. F3 channel types are good for bank-placed boulders, single and opposing wing-deflectors and fair for plunge weirs, boulder clusters, channel constrictors and log cover.

The water temperatures recorded on the survey days July 14, 2009 to July 27, 2009, ranged from 56 to 74 degrees Fahrenheit. Air temperatures ranged from 58 to 92 degrees Fahrenheit. The upper range of these water temperatures is unsuitable for rearing juvenile coho salmon. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 36.7% of the total length of this survey, riffles 21.4%, and pools 40.1%. Forty-nine of the 127 (39%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a 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 large wood structures that will increase or deepen pool habitat is recommended.

Sixty-six of the 127 pool tail-outs measured had embeddedness ratings of 1 or 2. Fifty of the pool tail-outs had embeddedness ratings of 3 or 4. Eleven of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Cahto Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One hundred seven of the 127 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 is 29. The shelter rating in the flatwater habitats is 16. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by root mass in Cahto Creek. Root mass is the dominant cover type in pools followed by boulders. 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 76%. Reach 1 had a canopy density of 70%, Reach 2 had a canopy density of 91%. In general, revegetation projects are considered when canopy density is less than 80%.

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The percentage of right and left bank covered with vegetation was 84% and 86%, 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) Cahto Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are above the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from root mass. Adding high quality complexity with woody cover in the pools is desirable.
- 4) 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.
- 5) 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.
- 6) Increase the canopy in Reach 1 on Cahto Creek 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. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

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:
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0	0001.00	Survey begins at the confluence with Ten Mile Creek.
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113	0004.00	Log debris accumulation (LDA) #01 is 5' high x 41' wide x 6' long and consists of 4 pieces of large wood as well as an accumulation of small woody debris. It is retaining fine sediment to cobble 11' wide x 5' long x 1' deep. It has visible gaps and water is flowing through. Fish are present above LDA.
141	0005.00	Cahto Creek is now out of the influence of Tenmile Creek.
248	0008.00	Right bank is eroding for 80' and contributing fine sediment and bringing in trees.
384	0011.00	Dry tributary enters left bank. Left bank erosion is 70' long and contributing fine sediment.
804	0016.00	One-plus size fish present in unit.
1511	0026.00	Aquatic vegetation consists of masses of algae approximately 2-5' in diameter.
1816	0033.00	Mulligan Road Bridge #01 spans creek. It is a concrete, wood and metal flatcar bridge 14' wide x 8.4' high and 62' long. It is not a barrier to fish.
1975	0036.00	The bank is reinforced with metal gabions covering approximately 60% of the bank in this unit.
2104	0038.00	Right bank erosion is approximately 70' long and contributing fine sediment.
2435	0043.00	Right bank failure approximately 80' long and 20' high is contributing fine sediment to cobble. Sediment accumulation and fallen trees are acting as barrier between 2 pools. Water is flowing between pools, but straining through dense downed trees and roots. Over 100 young-of-the-year (YOY) size fish are trapped in an isolated pool.
2445	0044.00	Lower 7' of unit is flowing underground into habitat unit #043.
2483	0046.00	Private road/ATV trail fords creek.
2818	0054.00	Left bank erosion is contributing fine sediment.
2875	0055.00	Right bank erosion is approximately 50' long and is contributing fine sediment to cobble and bringing in trees.
3395	0064.00	Left bank erosion is approximately 20' long and is contributing fine sediment.

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3438	0065.00	Left bank erosion is approximately 40' long and is contributing fine sediment to cobble and bringing in trees.
3739	0073.00	Right bank slump is approximately 80' long forming island of clay/silt and contributing fine sediment to cobble.
4102	0081.00	LDA #02 is 6' high x 34' wide x 21' long, consisting of 4 pieces of large wood, with visible gaps and water flowing through. It is retaining fine sediment to cobble 13' wide x 12' long x 2.5' deep. Fish are present above LDA.
4732	0090.00	Left bank is eroding along 10' of unit contributing fine sediment to large cobble. YOY observed.
4911	0093.00	Private dirt road is approximately 14' wide and fords creek.
5248	0102.00	End of access at bottom of habitat unit.
5395	0103.00	Access resumes at upstream end of property.
5578	0105.00	Gabion approximately 120' long and 4' high reinforcing left bank.
5774	0108.00	Cahto Road Bridge is 28' wide x 12' high x 60' long. Gabions approximately 25' long x 10' high support right and left banks beneath bridge.
6009	0113.00	Three old cars on right bank, two appear to be providing bank stabilization.
6079	0114.00	Cars providing left bank armor.
6329	0117.00	Cars providing right bank armor.
6492	0119.00	Dry tributary enters creek on right bank.
8615	0168.00	Left bank tributary #01 enters creek at top of unit. Tributary is dry from mouth to 38'. Blown out culvert/dirt road crosses creek at approximately 120'. Tributary is accessible to fish, however no fish were observed.
8836	0171.00	Top of unit is dry, isolating it from unit above. Private dirt road fords creek at top of pool.
8924	0172.00	Riffle is dry at top and only a trickle for entire length.
8944	0173.00	Begin no access at top of unit. Wire ranch fencing spans creek from bank to bank at property line.

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9820	0175.00	Access resumes at upstream end of property line. Cattle fence spans creek at bottom of habitat unit. Private dirt road fords creek.
10559	0190.00	Right bank erosion approximately 150' long is contributing fine sediment to large cobble.
10940	0205.00	Right bank erosion approximately 130' long is contributing fine sediment to large cobble and bringing in trees.
11423	0215.00	Right bank erosion approximately 75' long is contributing fine sediment to large cobble.
11461	0217.00	LDA is 21' wide x 13' long x 7' high, consisting of 11 pieces of large wood has water flowing through and has visible gaps. It is not retaining sediments and it is not a barrier. Fish are present above LDA. LDA is possibly caused by barbed wire fence crossing stream. The right bank side of fence is blown out and buried under woody debris.
11635	0226.00	Left bank erosion is approximately 200' long is contributing fine sediment to large cobble. One plus size fish present in habitat unit.
11855	0231.00	Channel type changes to F3.
11988	0235.00	Private road flatcar bridge spans creek. Bridge consists of metal and wood and is 61' wide x 14' high x 39' long. It is falling apart in some places and pieces of it are in the creek. It is not a barrier.
12686	0254.00	Water is opaque due to suspended silt and greasy film from unknown source.
12718	0255.00	Tributary #02 enters on right bank. The tributary is accessible to fish, but none are observed. It is not flowing, but the channel is wet. There is an isolated shallow pool approximately 150' upstream at the base of an LDA. The slope is estimated to be 2%.
12862	0259.00	Dry tributary enters right bank. Alders are growing in channel.
12886	0261.00	LDA is 1.8' high x 14' wide x 3' long, and consists of 3 pieces of large wood, has visible gaps and water is flowing through. It is retaining fine sediment to small cobble 5' wide x 9' long x 1.2' deep. Fish present above LDA.
12928	0263.00	Overgrown road fords creek.

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12974	0264.00	LDA is 3' high x 26' wide x 20' long, consists of 4 pieces of large wood spans creek, has water flowing through and has visible gaps. It is retaining fine sediment to small cobble 13' wide x 14' long x 1' deep. It is not a barrier to adults or juveniles. Fish seen above LDA.
13267	0270.00	Wooden fence panels suspended from steel cable spans creek.
13310	0271.00	Brandscomb Road concrete box culvert is 9' high x 30' wide x 58' long and spans creek. Concrete wall parallel to flow bisects length of culvert creating 2 channels - one channel is flowing, one channel is dry. The slope of the culvert is less than 1%. The maximum depth within 5' of culvert outlet is 0.4' and the plunge height is 0. The culvert is not a barrier to fish.
13452	0274.00	Right bank erosion approximately 120' long is contributing fine sediment and large cobble.
13746	0282.00	Right bank erosion approximately 120' long is contributing fine sediment to boulders and bringing in trees.
13786	0283.00	Dry tributary enters right bank.
13941	0289.00	Concrete, metal and wood bridge for private road that is 25' wide x 14' high x 24' long. Bridge is not a barrier.
13979	0290.00	Dry tributary enters right bank.
14012	0291.00	Dry tributary/drainage enters right bank.
14101	0293.00	Plunge pool with a plunge height of 3'. Suspended sediment in water limits visibility to 1.5'.
14128	0295.00	Accumulated iron oxidizing bacteria forms 1' layer of sludge in channel with clear water flowing on top of sludge layer. Orange sludge is visible in units below tributary. Tributary enters right bank, flowing at approximately 0.01 cfs and contributing approximately 5% to the downstream flow of receiving stream. The slope is estimated to be approximately 1%. It is accessible to fish, but no fish present.
14151	0296.00	Erosion on right bank is approximately 50' high x 75' long and is contributing fine sediment to cobble.
14188	0298.00	One-plus sized fish observed.
14391	0304.00	Dry tributary enters left bank.

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14438	0307.00	Erosion on the left bank is approximately 20' high x 35' long and is contributing fine sediment to cobble.
14666	0316.00	Riffle has 2.5 ft plunge.
15287	0342.00	Banks beyond tree buffer are mostly crumbling sandstone and grass. Erosion on right and left bank approximately 20' high x 75' long and contributing fine sediment to boulders and causing trees to fall and cave in over channel. Narrow strip of young alders and willow are stabilizing the banks.
15709	0357.00	Riffle has 2' plunge.
15766	0359.00	Step pool with 3' and 1' plunge.
15806	0360.00	Orange bacteria coating substrate present from this habitat unit forward in increasing volume progressing upstream. In still water, bacteria makes it difficult to see substrate and fish.
15990	0368.00	Riffle has 2.5 ft plunge.
16017	0369.00	Pool is filled with clouds of orange bacteria up to 2' in diameter. One hundred percent of substrate is obscured. One YOY observed.
16033	0370.00	Right bank erosion approximately 60' high x 10' long and is contributing fine sediment to boulders. Debris covers approximately 90% of channel.
16053	0372.00	Four foot plunge to 1' deep pool, then a 3' plunge.
16113	0374.00	Dry tributary enters right bank at top of unit and is accessible to fish.
16138	0374.00	End of survey due to creek being completely full of orange bacteria from bank to bank as far upstream as could be seen.

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.

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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]	

Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
6	0	DRY	1.6	45	271	1.8									
134	12	FLATWATER	35.8	42	5581	36.7	9.4	0.4	0.6	539	72281	274	36760		16
3	0	NOSURVEY	0.8	304	912										
127	127	POOL	34.0	48	6113	40.1	12.4	1.0	2.0	623	79113	803	102007	679	29
104	18	RIFFLE	27.8	31	3261	21.4	6.0	0.3	0.6	127	13184	39	4007		6
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
374	157				16138					164578			142774		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
100	15	LGR	26.7	32	3203	21.0	6	0.2	0.8	138	13834	35	3528		7	84
1	1	CAS	0.3	21	21	0.1	8	1.0	1.9	143	143	143	143		0	91
3	2	BRS	0.8	12	37	0.2	3	0.4	0.8	32	96	11	32		0	95
2	2	GLD	0.5	72	143	0.9	18	0.5	0.7	1374	2748	646	1292		15	96
82	8	RUN	21.9	36	2977	19.6	8	0.4	1.2	401	32884	214	17511		17	80
50	2	SRN	13.4	49	2461	16.2	6	0.6	0.8	258	12919	146	7279		10	78
113	113	MCP	30.2	46	5222	34.3	12	1.0	5.4	592	66876	743	83963	628	29	72
1	1	CCP	0.3	37	37	0.2	15	0.7	1.1	555	555	555	555	389	10	97
1	1	STP	0.3	40	40	0.3	12	1.6	2.7	480	480	864	864	768	40	94
9	9	CRP	2.4	77	690	4.5	13	1.2	4	1066	9593	1585	14265	1347	42	70
2	2	LSR	0.5	54	109	0.7	11	0.8	2.1	617	1234	617	1234	494	18	66
1	1	PLP	0.3	15	15	0.1	25	2.7	4.2	375	375	1125	1125	1013	15	96
6	0	DRY	1.6	45	271	1.8										
3	0	NS	0.8	304	912											

Total Units
374

Total Units Fully Measured
157

Total Length (ft.)
16138

Total Area (sq.ft.)
141736

Total Volume (cu.ft.)
131791

Table 3 - Summary of Pool Types

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating
115	115	MAIN	91	46	5299	87	12.3	1.0	591	67911	627	72161	28
12	12	SCOUR	9	68	814	13	13.8	1.3	934	11202	1177	14122	35
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
127	127				6113					79113		86283	

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
113	MCP	89	1	1	73	65	25	22	10	9	4	4
1	CCP	1	0	0	1	100	0	0	0	0	0	0
1	STP	1	0	0	0	0	1	100	0	0	0	0
9	CRP	7	0	0	2	22	4	44	2	22	1	11
2	LSR	2	0	0	1	50	1	50	0	0	0	0
1	PLP	1	0	0	0	0	0	0	0	0	1	100

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
127	1	1	77	61	31	24	12	9	6	5

Mean Maximum Residual Pool Depth (ft.): 2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Dry Units: 6

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
100	15	LGR	0	20	0	0	32	10	0	38	0
1	1	CAS	0	0	0	0	0	0	0	0	0
3	2	BRS	0	0	0	0	0	0	0	0	0
104	18	TOTAL RIFFLE	0	20	0	0	32	10	0	38	0
2	2	GLD	15	10	0	65	10	0	0	0	0
82	9	RUN	2	12	0	25	38	0	0	23	0
50	2	SRN	0	0	0	0	0	0	0	100	0
134	13	TOTAL FLAT	4	10	0	31	28	0	0	27	0
113	113	MCP	18	20	5	24	7	3	0	21	2
1	1	CCP	0	0	0	40	0	0	0	60	0
1	1	STP	0	10	0	10	0	0	20	60	0
9	9	CRP	27	18	8	27	8	1	0	12	0
2	2	LSR	40	50	0	8	0	3	0	0	0
1	1	PLP	0	50	0	50	0	0	0	0	0
127	127	TOTAL POOL	19	20	5	24	7	2	1	21	2
3	0	NS									
374	158	TOTAL	17	19	5	24	9	3	0	22	2

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Dry Units: 6

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
100	15	LGR	0	0	13	40	33	7	7
1	1	CAS	0	0	0	0	0	0	100
3	2	BRS	0	0	0	0	0	0	100
2	2	GLD	0	50	50	0	0	0	0
82	8	RUN	0	13	38	25	25	0	0
50	2	SRN	0	0	50	0	50	0	0
113	113	MCP	1	30	32	27	6	2	2
1	1	CCP	0	0	0	0	100	0	0
1	1	STP	0	0	0	0	0	0	100
9	9	CRP	0	44	22	33	0	0	0
2	2	LSR	0	0	50	50	0	0	0
1	1	PLP	0	0	0	0	0	0	100

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Cahto Creek LLID: 1234857396802 Drainage: Eel River - South Fork
Survey Dates: 7/14/2009 to 7/27/2009
Confluence Location: Quad: CAHTO PEAK Legal Description: T21NR15WS13 Latitude: 39:40:49.0N Longitude: 123:29:09.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
76	3	97	0	84	86

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Survey Length (ft.): 16138

Main Channel (ft.): 16138

Side Channel (ft.): 0

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4

Reach Length (ft.): 11855

Riffle/Flatwater Mean Width (ft.): 7.9

BFW:

Range (ft.): 19 to 59

Mean (ft.): 29

Std. Dev.: 11

Base Flow (cfs.): 0.2

Water (F): 58 - 74

Air (F): 58 - 90

Dry Channel (ft): 271

Canopy Density (%): 69.0

Coniferous Component (%): 2.3

Hardwood Component (%): 97.7

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 83.9

Dominant Shelter: Root masses

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 5

LWD per 100 ft.:

Riffles: 1

Pools: 1

Flat: 1

Pools by Stream Length (%): 43.0

Pool Frequency (%): 40.4

Residual Pool Depth (%):

< 2 Feet Deep: 55

2 to 2.9 Feet Deep: 28

3 to 3.9 Feet Deep: 12

>= 4 Feet Deep: 5

Mean Max Residual Pool Depth (ft.): 2.1

Mean Pool Shelter Rating: 31

Pool Tail Substrate (%): Silt/Clay: 1

Sand: 2

Gravel: 46

Sm Cobble: 46

Lg Cobble: 2

Boulder: 2

Bedrock: 0

Embeddedness Values (%): 1. 21.5

2. 32.3

3. 31.2

4. 11.8

5. 3.2

STREAM REACH: 2

Channel Type: F3

Reach Length (ft.): 4283

Riffle/Flatwater Mean Width (ft.): 6.8

BFW:

Range (ft.): 13 to 25

Mean (ft.): 18

Std. Dev.: 4

Base Flow (cfs.): 0.2

Water (F): 56 - 64

Air (F): 58 - 92

Dry Channel (ft): 0

Canopy Density (%): 90.5

Coniferous Component (%): 4.0

Hardwood Component (%): 96.0

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 87.0

Dominant Shelter: Boulders

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 2

LWD per 100 ft.:

Riffles: 1

Pools: 1

Flat: 0

Pools by Stream Length (%): 23.7

Pool Frequency (%): 23.6

Residual Pool Depth (%):

< 2 Feet Deep: 79

2 to 2.9 Feet Deep: 15

3 to 3.9 Feet Deep: 3

>= 4 Feet Deep: 3

Mean Max Residual Pool Depth (ft.): 1.6

Mean Pool Shelter Rating: 24

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 0

Gravel: 26

Sm Cobble: 35

Lg Cobble: 18

Boulder: 9

Bedrock: 12

Embeddedness Values (%): 1. 8.8

2. 38.2

3. 20.6

4. 8.8

5. 23.5

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Confluence Location: Quad: CAHTO PEAK

Legal Description: T21NR15WS13

Latitude: 39:40:49.0N

Longitude: 123:29:09.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	14	10	7.6
Boulder	6	7	4.1
Cobble / Gravel	13	13	8.3
Sand / Silt / Clay	124	127	79.9

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	4	3	2.2
Brush	15	14	9.2
Hardwood Trees	136	140	87.9
Coniferous Trees	2	0	0.6
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

StreamName: Cahto Creek

LLID: 1234857396802

Drainage: Eel River - South Fork

Survey Dates: 7/14/2009 to 7/27/2009

Confluence Location: Quad: CAHTO PEAK

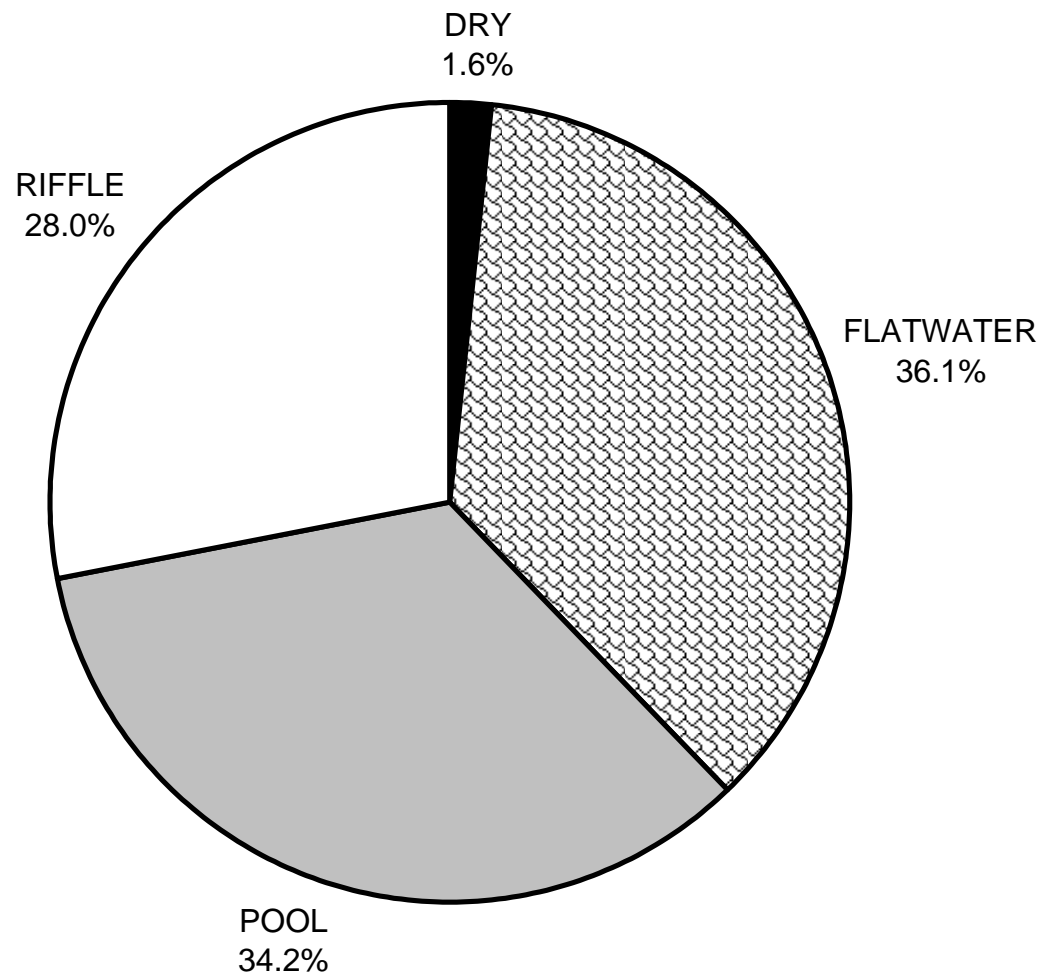
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Longitude: 123:29:09.0W

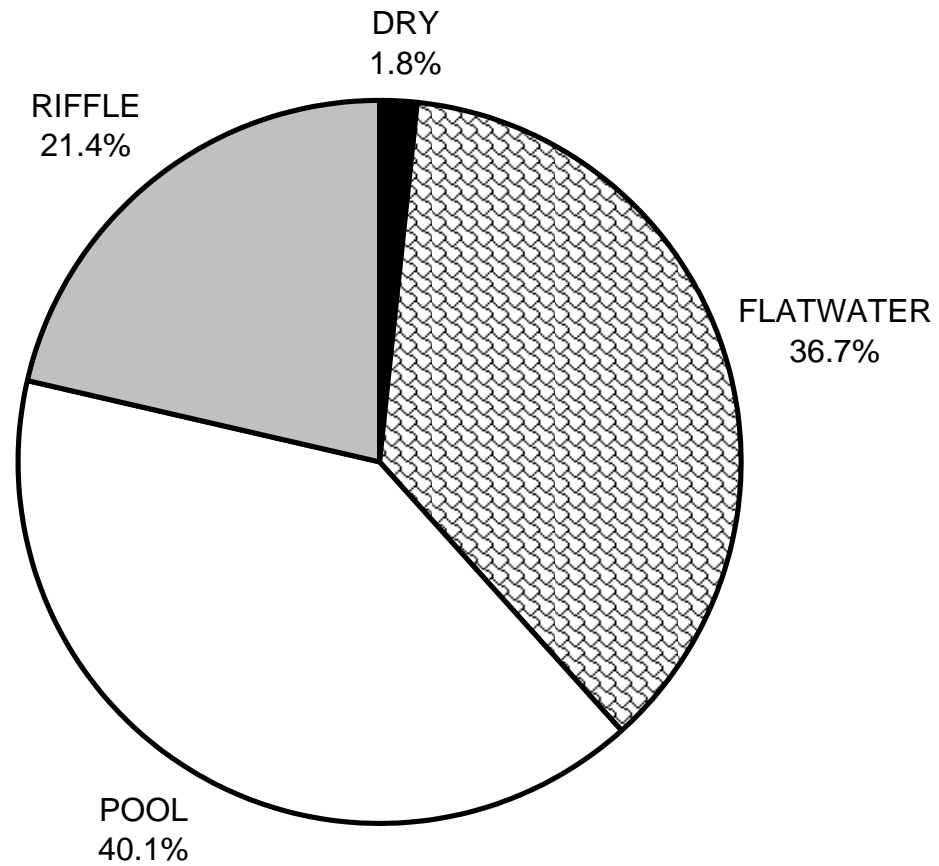
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	4	19
SMALL WOODY DEBRIS (%)	20	10	20
LARGE WOODY DEBRIS (%)	0	0	5
ROOT MASS (%)	0	31	24
TERRESTRIAL VEGETATION (%)	32	28	7
AQUATIC VEGETATION (%)	10	0	2
WHITEWATER (%)	0	0	1
BOULDERS (%)	38	27	21
BEDROCK LEDGES (%)	0	0	2

CAHTO CREEK 2009
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

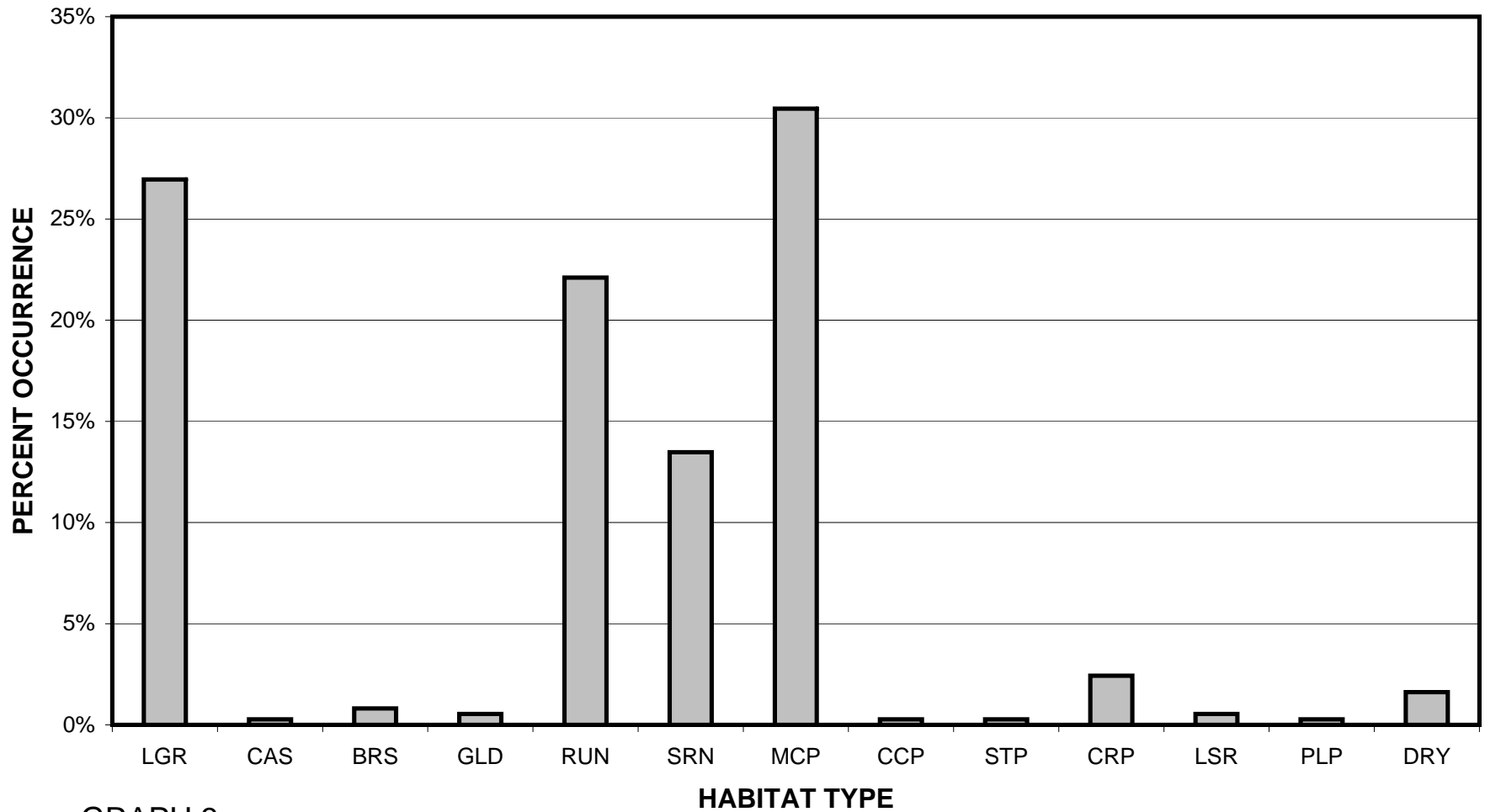
CAHTO CREEK 2009
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

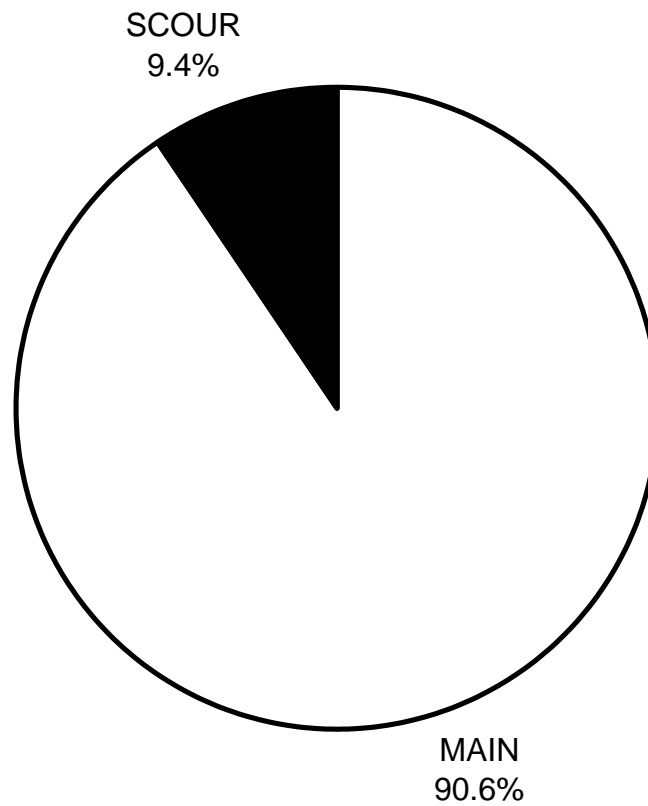
CAHTO CREEK 2009

HABITAT TYPES BY PERCENT OCCURRENCE



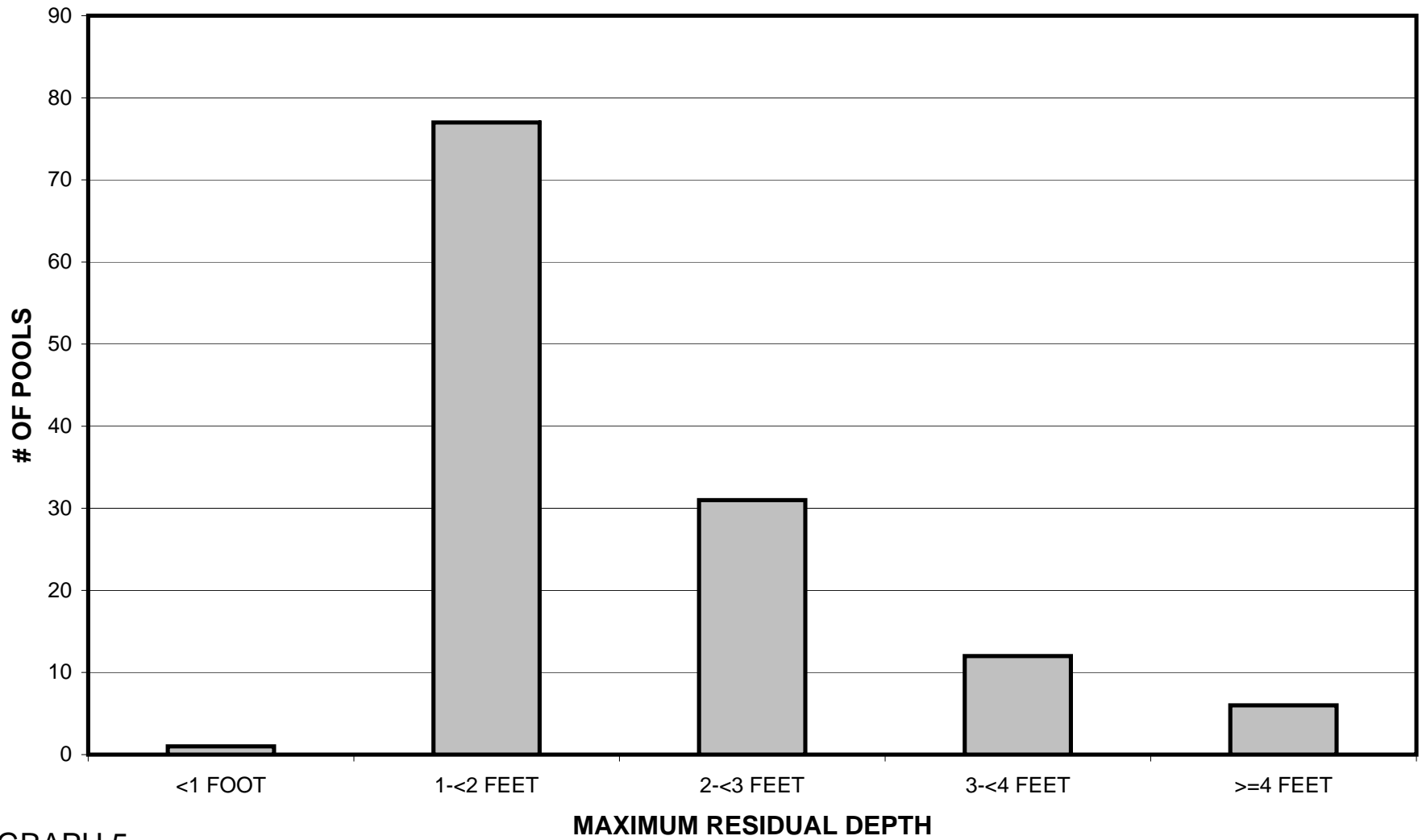
GRAPH 3

**CAHTO CREEK 2009
POOL TYPES BY PERCENT OCCURRENCE**



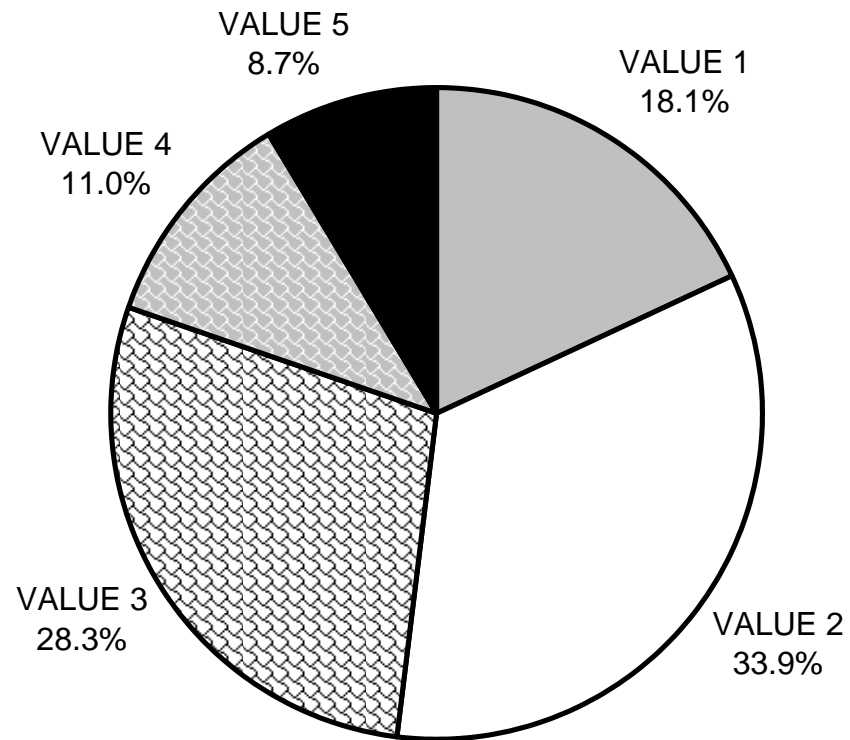
GRAPH 4

CAHTO CREEK 2009 MAXIMUM DEPTH IN POOLS



GRAPH 5

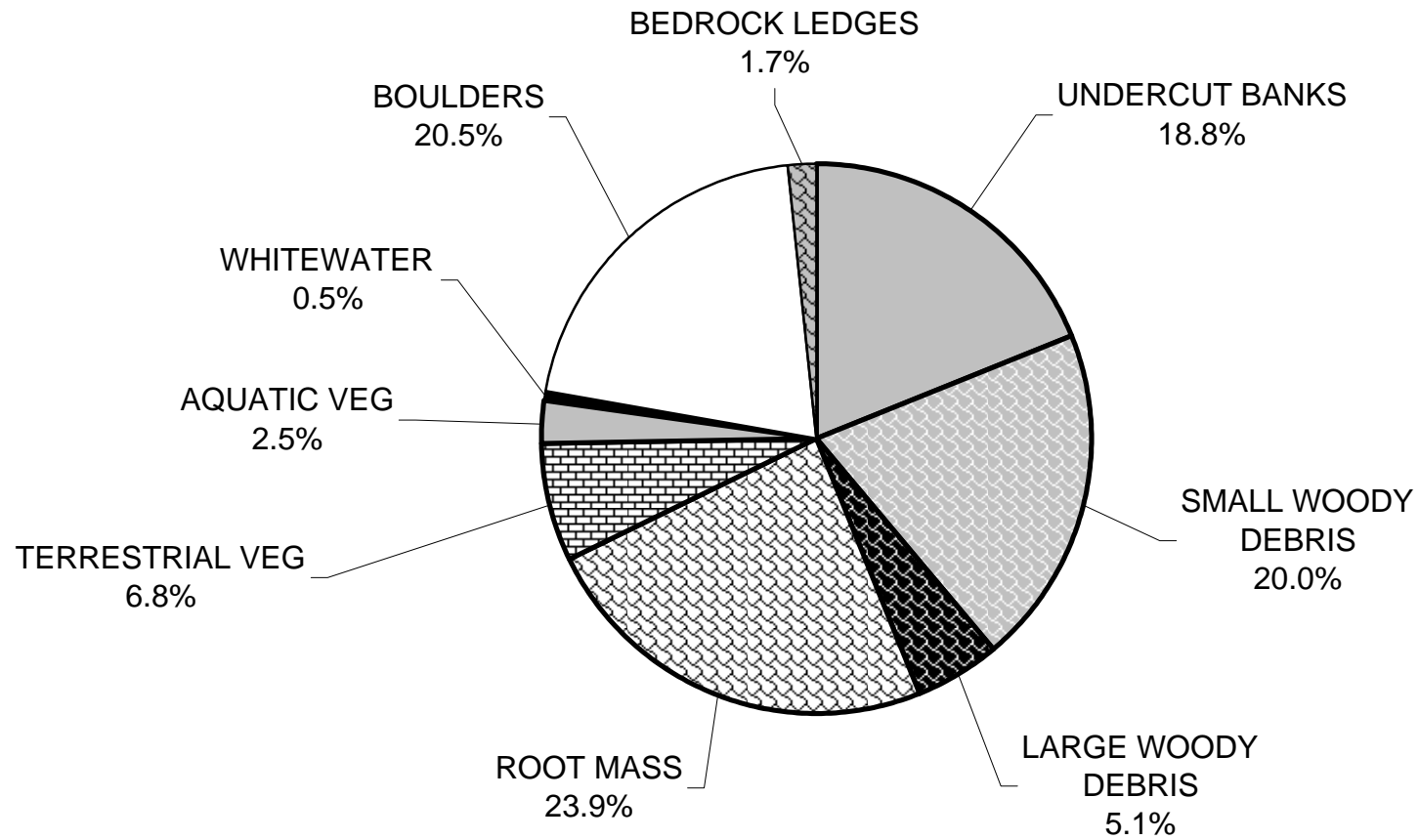
CAHTO CREEK 2009 PERCENT EMBEDDEDNESS



GRAPH 6

CAHTO CREEK 2009

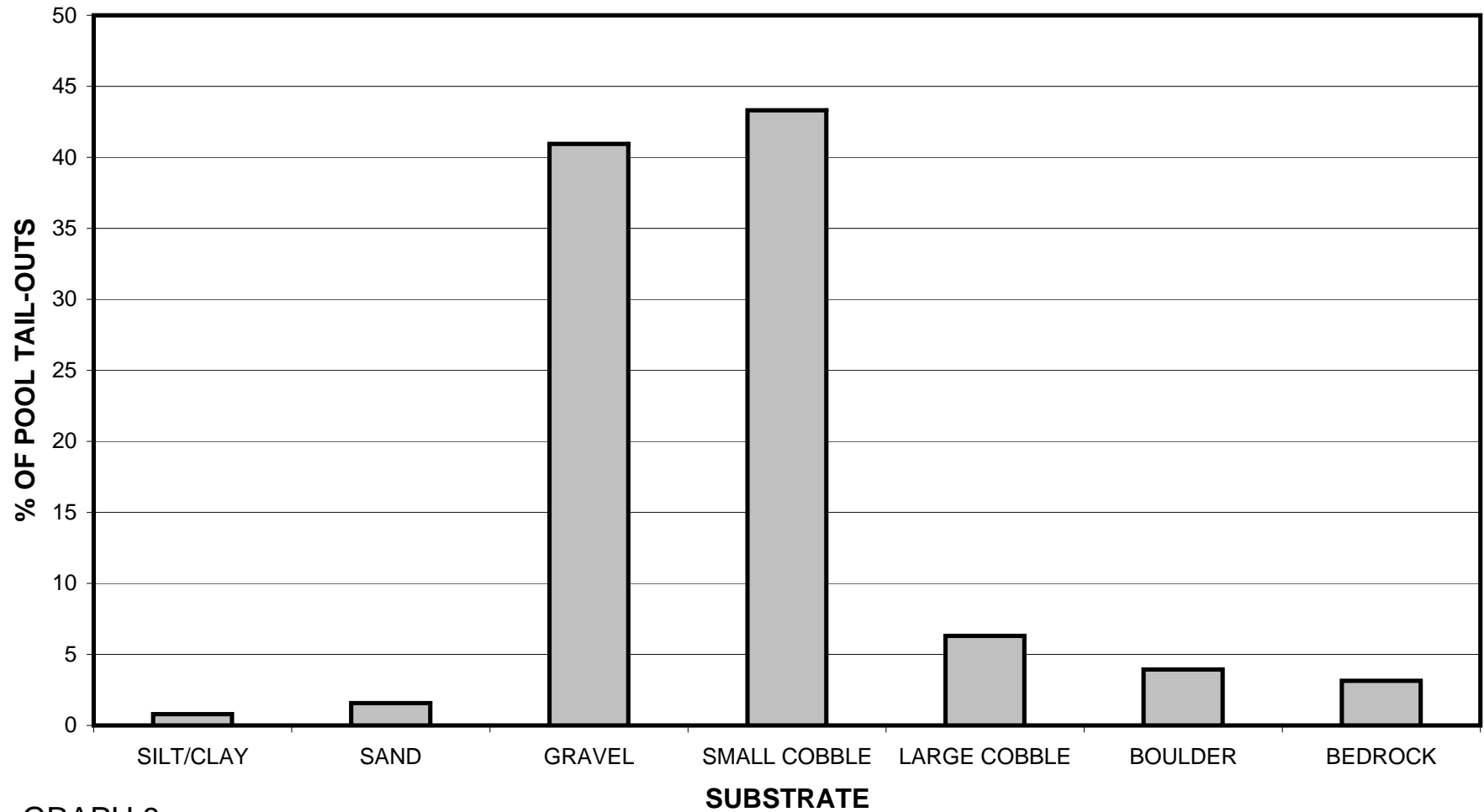
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

CAHTO CREEK 2009

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



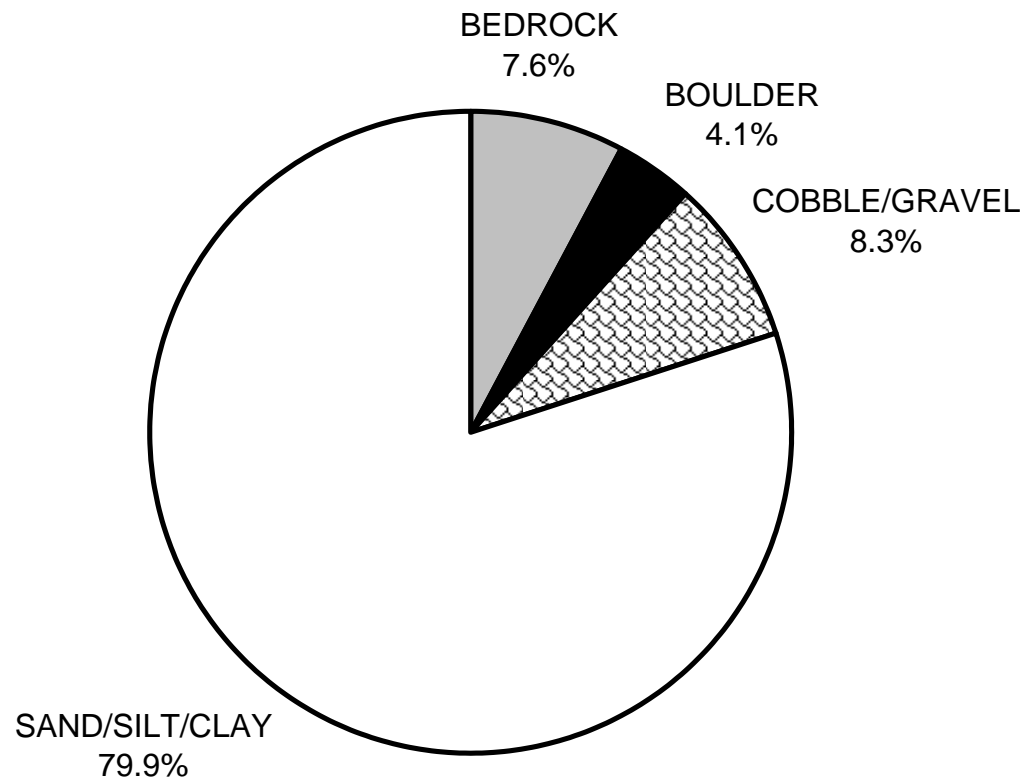
GRAPH 8

**CAHTO CREEK 2009
MEAN PERCENT CANOPY**



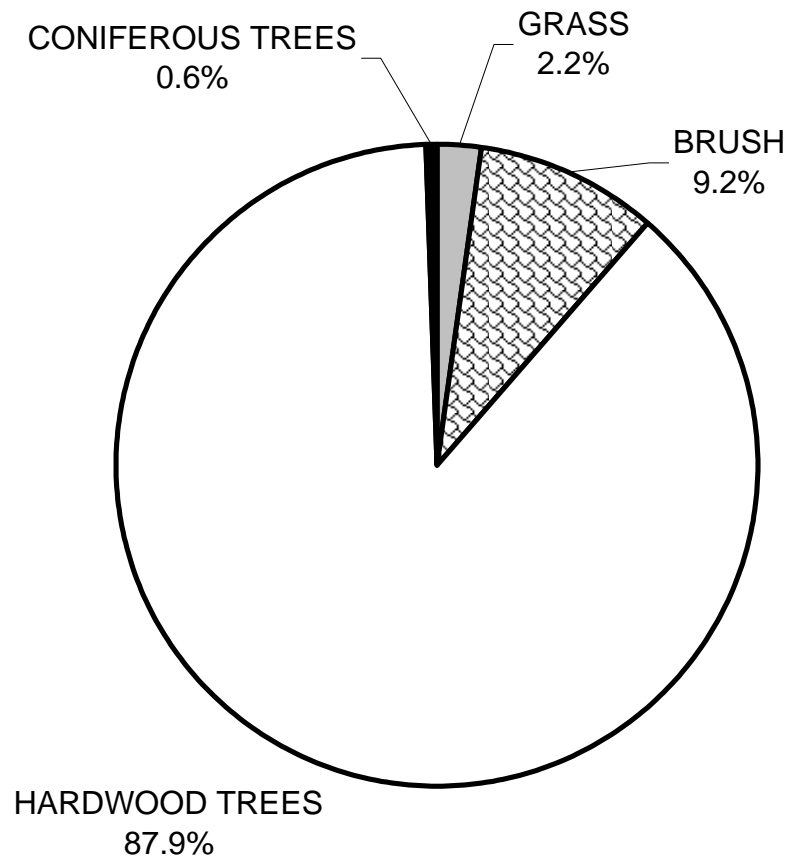
GRAPH 9

CAHTO CREEK 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH

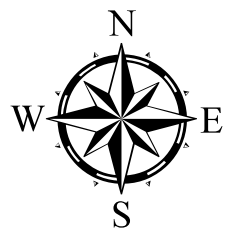
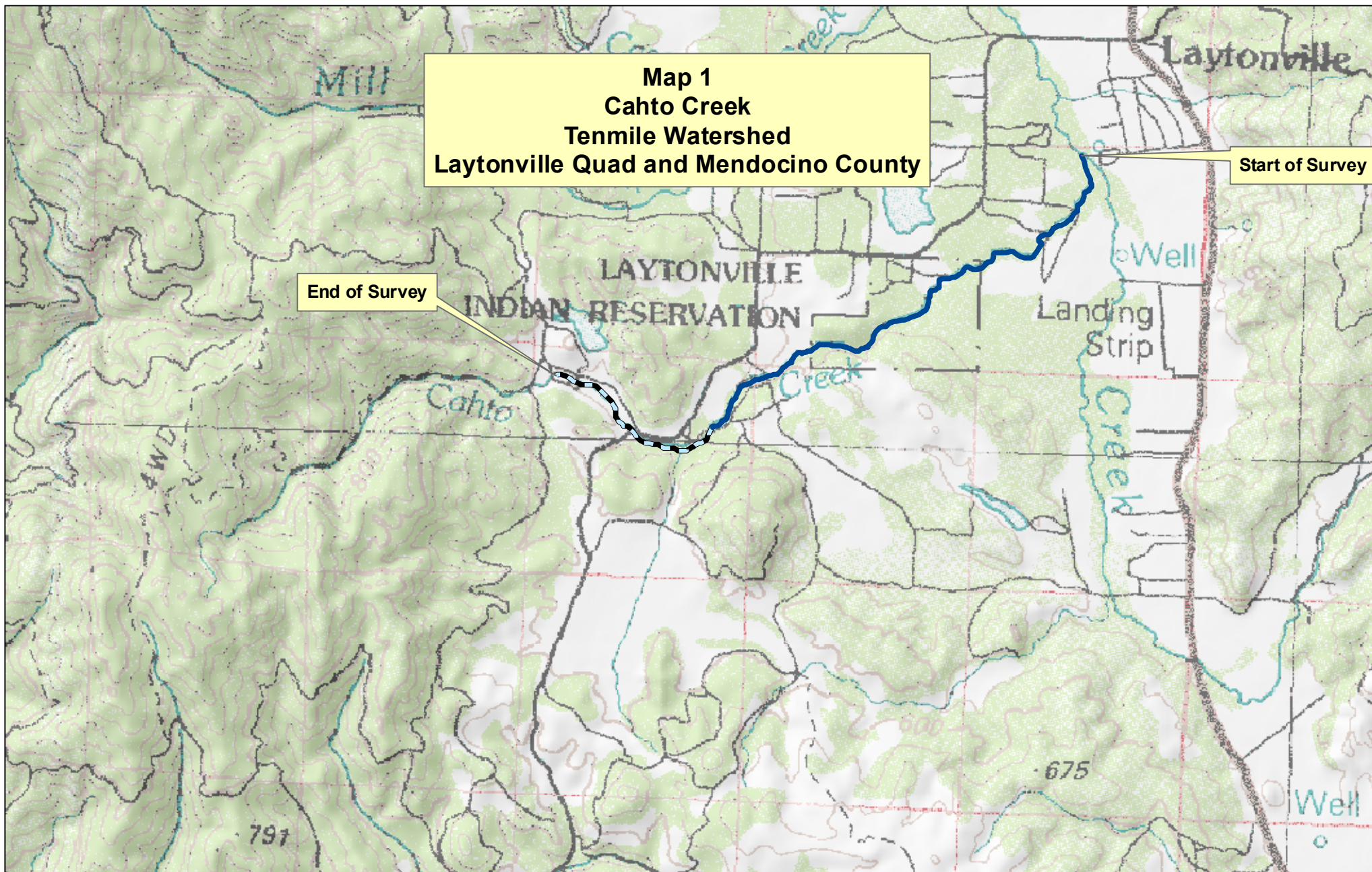


GRAPH 10

CAHTO CREEK 2009
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11



Legend

- Reach 1, F4 Channel Type
- - - Reach 2, F3 Channel Type

0 2,400 4,800 Feet

