

STREAM INVENTORY REPORT

Canoe Creek

INTRODUCTION

A stream inventory was conducted during June 4, 2007 to June 19, 2007 on Canoe Creek. The survey began at the confluence with South Fork Eel River and extended upstream 1.9 miles.

The Canoe 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 Canoe 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

Canoe Creek is a tributary to South Fork Eel River, tributary to Eel River which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Canoe Creek's legal description at the confluence with South Fork Eel River is T2S R2E S13. Its location is 40.2955 north latitude and 123.9000 west longitude, LLID number 1238988402956. Canoe Creek is a second order stream and has approximately 10.7 miles of blue line stream according to the USGS Weott 7.5 minute quadrangle. Canoe Creek drains a watershed of approximately 10.6 square miles. Elevations range from about 140 feet at the mouth of the creek to 1,800 feet in the headwater area. The watershed is dominated by old growth redwoods and mixed conifers. The watershed is entirely owned by the California State Parks Department and is managed as a park. Vehicle access exists from State Highway 101, to the Avenue of the Giants then via foot bridge across the Eel River to the mouth.

METHODS

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

SAMPLING STRATEGY

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

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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 Canoe 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". Canoe Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Canoe 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

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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 Canoe 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 Canoe 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 Canoe Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

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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 Canoe Creek. In addition, underwater observations were made at 29 sites using techniques 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

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

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- 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 4, 2007 to June 19, 2007, was conducted by J. Pixley and B. Rahn, (WSP). The total length of the stream surveyed was 9,842 feet with an additional 502 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 6.53 cfs on June 14, 2007.

Canoe Creek is an F4 channel type for 4,553 feet of the stream surveyed (Reach 1), an F2 channel type for 2,347 feet of the stream surveyed (Reach 2), and a B2 channel type for remaining 3,444 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 channel types are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and boulder-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle-dominated channels with infrequently spaced pools, a very stable plan and profile, and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 54 to 58 degrees Fahrenheit. Air temperatures ranged from 50 to 74 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 41% riffle units, 36% pool units and 23% flatwater units (Graph 1). Based on total length of Level II habitat types there were 40% riffle units, 32% flatwater units and 28% pool units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 29% mid-channel pool units, 24% low gradient riffle units, and 16% run units (Graph 3). Based on percent total length low gradient riffle unit made up 25%, mid-channel pool units 22%, and run units 19%.

A total of 61 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 90% (Graph 4), and comprised 93% 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-eight of the 59 pools (81%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 59 pool tail-outs

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measured, 2 had a value of 1 (3.4%); 36 had a value of 2 (61%); 10 had a value of 3 (16.9%); 4 had a value of 4 (6.8%); and 7 had a value of 5 (11.9%) (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 74, flatwater habitat types had a mean shelter rating of 33, and pool habitats had a mean shelter rating of 75 (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 113, backwater pools had a mean shelter rating of 38 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Canoe Creek. Graph 7 describes the pool cover in Canoe Creek. Boulders are the dominant pool cover type followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was observed in 32% of pool tail-outs while boulders were observed in 31% of pool tail-outs.

The mean percent canopy density for the surveyed length of Canoe Creek was 81%. Nineteen percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 11% and 89%, respectively. Graph 9 describes the mean percent canopy in Canoe Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 86%. The mean percent left bank vegetated was 83%. The dominant elements composing the structure of the stream banks consisted of 97% sand/silt/clay and 3% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 67% of the units surveyed. Additionally, 16% of the units surveyed had brush as the dominant vegetation type, and 7 % had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Twenty-nine sites were surveyed by a snorkel survey for species composition and distribution in Canoe Creek on September 24th and 26th of 2007. Water temperatures taken during the electrofishing period 1000 to 1545 ranged from 50 to 56 degrees Fahrenheit. The sites were sampled by B. Rahn (WSP), T. Chapple (WSP) and A. Renger (DFG).

In reach one, which comprised the first 4,449 feet of stream, 10 sites were sampled. The reach sites yielded 30 young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), 1 age 1+ SH/RT, 1 coho salmon and 150 Sacramento pikeminnow.

In reach two, nine sites were sampled starting approximately 4,450 feet from the confluence with South Fork Eel River and continuing upstream to 6,549 feet. The reach sites yielded 101 YOY SH/RT, 11 age 1+ SH/RT and 4 Sacramento pikeminnow.

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In reach three, 10 sites were sampled starting approximately 6,549 feet from the confluence with South Fork Eel River and continuing upstream to 9,843 feet. The reach sites yielded 125 YOY SH/RT and one age 1+ SH/RT.

The following chart displays the information yielded from these sites:

2007 Canoe Creek Underwater Observations.

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
Reach 1: F4 Channel Type									
09/24/07	1	004	4.2	349	0	0	1	0	0
07/24/07	2	010	4.2	696	0	0	3	1	0
09/24/07	3	016	4.2	943	0	0	3	0	0
09/24/07	4	025	4.2	1477	0	0	6	0	0
09/24/07	5	033	4.2	1851	0	0	3	0	0
09/24/07	6	037	4.2	2025	1	0	6	0	0
09/24/07	7	051	4.2	2643	0	0	0	0	0
09/24/07	8	055	4.2	2896	0	0	0	0	0
09/24/07	9	070	4.2	4000	0	0	8	0	0
09/24/07	10	074	4.2	4163	0	0	0	0	0
Reach 2: F2 Channel Type									
09/24/07	11	082	5.6	4603	0	0	15	2	0
09/24/07	12	085	4.2	4696	0	0	19	2	0
09/24/07	13	088	5.6	4820	0	0	0	0	0
09/24/07	14	090	4.2	4954	0	0	16	4	0
09/26/07	15	095	4.2	5307	0	0	14	1	0
09/26/07	16	101	4.2	5849	0	0	17	1	0
09/26/07	17	103	6.5	5983	0	0	7	0	0
09/26/07	18	108	4.4	6304	0	0	1	0	0
09/26/07	19	110	4.2	6431	0	0	12	1	0

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Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
Reach 3: B2 Channel Type									
09/26/07	20	112	6.5	6548	0	0	19	0	0
09/26/07	21	116	4.2	6943	0	0	13	0	0
09/26/07	22	118	4.2	7352	0	0	15	1	0
09/26/07	23	125	4.2	7631	0	0	10	0	0
09/26/07	24	128	4.4	7699	0	0	21	0	0
09/26/07	25	130	4.2	7837	0	0	3	0	0
09/26/07	26	135	4.2	7977	0	0	11	0	0
09/26/07	27	137	4.4	8059	0	0	8	0	0
09/26/07	28	139	4.2	8190	0	0	12	0	0
09/26/07	29	142	5.6	8290	0	0	13	0	0

DISCUSSION

Canoe Creek is a F4 channel type for the first 4,553 feet of stream surveyed, an F2 channel type for the next 2,347 feet and a B2 channel type for the remaining 3,444 feet. The suitability of F4, F2 and B2 channel types for fish habitat improvement structures is as follows: F4 channels are good for bank-placed boulders, fair for plunge weirs, single and opposing wing-deflectors, channel constrictors and log cover. F2 channel types are fair for plunge weirs, single and opposing wing-deflectors, and log cover. B2 channel types are excellent for plunge weirs, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days June 4, 2007 to June 19, 2007, ranged from 54 to 58 degrees Fahrenheit. Air temperatures ranged from 50 to 74 degrees Fahrenheit. 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 32% of the total length of this survey, riffles 40%, and pools 28%. Forty-eight of the 59 (81%) 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.

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Thirty-eight of the 59 pool tail-outs measured had embeddedness ratings of 1 or 2. Fourteen 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 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.

Thirty of the 59 pool tail-outs had silt, sand, large cobble, boulders or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 75. The shelter rating in the flatwater habitats was 33. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Canoe Creek. Boulders are the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 81%. Reach 1 had a canopy density of 82.2%, reach 2 had a canopy density of 65.4%, and reach 3 had a canopy density of 90.1%. 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 86% and 83%, respectively.

RECOMMENDATIONS

- 1) Canoe Creek should be managed as an anadromous, natural production stream.
- 2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from boulders. Adding high quality complexity with woody cover in the pools is desirable.
- 3) 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.

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	Survey started at the confluence with the South Fork Eel River. This begins reach 1 which is a F4 channel type.

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501	0008.00	Out of influence of South Fork Eel River.
696	0010.00	Young-of-the-year (YOY) salmonids were observed.
696	0010.00	Log debris accumulation (LDA) #01 was 8' high x 113' wide x 15' long with 15 pieces of large woody debris (LWD). Water flowed through and there are visible gaps. Gravel was retained measuring 100' wide x 100' long x 4' deep. Fish were seen above the accumulation, it is not a barrier.
2064	0038.00	Log debris accumulation (LDA) #02 was 15' high x 45' wide x 70' long with 25 pieces of large woody debris. Water flowed through and there are visible gaps. Sand and gravel was being retained measuring 40' wide x 100' long x 3' deep. Fish were seen above the accumulation, it is not a fish barrier.
2643	0051.00	There was erosion observed on the right bank hillside throughout habitat unit #052.
2731	0052.00	Log debris accumulation (LDA) #3 was 12' high x 42' wide x 30' long with 4 pieces of large woody debris. The accumulation was caused by a 40" diameter tree that had fallen from the right bank. It collected smaller woody debris from a slide on the same bank. Water flowed through and there were visible gaps. Retained sand and gravel measured 6' wide x 60' long x 2' high. The sediment was primarily stored at edges of LDA. The accumulation was not a barrier to fish; juveniles were seen above.
3150	0059.00	There was a dry side channel approximately 200 feet long with erosion off right bank spanning it.
4191	0075.00	There was left bank erosion observed that had dropped logs into the creek. The logs formed a log debris accumulation (LDA) #4 that was 15' high x 58' wide x 35' long with 18 pieces of large woody debris. Water flowed through and there were visible gaps. Sediment was retained; it ranged from sand to cobble and measured 30' wide x 100' long x 5' high. Fish were seen above accumulation, it was not a fish barrier.
4603	0083.00	There was erosion occurring on the right bank throughout habitat unit #086.
4603	0083.00	The plunge height at the top of this unit was 1.6' high.
4725	0086.00	Log debris accumulation (LDA) #05 was 15' high x 90' wide x 25' long with 23 pieces of large woody debris (LWD). Water flowed through and there were visible gaps. Sediment ranging from sand to boulders was

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retained. It measured 80' wide x 90' long x 4' deep. Fish were seen above the accumulation. It is not a barrier.

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| 4912 | 0089.00 | Log debris accumulation (LDA) #06 was 15' high x 85' wide x 90' long with over 100 pieces of large woody debris (LWD). Sediment ranging in size from sand to boulders was being retained. It measured 20' wide x 120' long x 5' deep. Fish were seen above the accumulation. It is not a barrier. The accumulation had two distinct sections, one of which had no visible gaps. It extended through habitat unit #92. |
| 5204 | 0092.02 | There was a tributary (trib#001) on the right bank flowing at less than 0.1 cfs and contributing a negligible amount of water to Canoe's flow. Canoe's downstream temperature was 57 degrees Fahrenheit and upstream was 52 degrees Fahrenheit. It was not accessible to fish and its slope was 20%. No fish were observed. |
| 5204 | 0092.02 | Log debris accumulations (LDA) #07 was 15' high x 70' wide x 33' long, and it contained 30 pieces of large woody debris (LWD). Water appeared to be flowing through, even though there were no visible gaps. The retained sediment ranged in size from sand to cobble and it measured 15' wide x 175' long x 7' deep. There were two plunges in this unit, one was 1.7' high and the other was 0.8' high. Fish were seen upstream. It appears that this channel used to be the main channel, until the accumulation formed. |
| 5204 | 0093.00 | There was a plunge at the top of this unit measuring 4.6' high. |
| 5307 | 0095.00 | There was a tributary (trib#002) entered this unit from the left bank. It was flowing at less than 0.5 cfs and contributing to ~1% of Canoe Creek's flow. The tributary's temperature was 54 degrees Fahrenheit, and the temperature of Canoe Creek upstream and downstream of Canoe Creek was 54 degrees. The tributary was accessible to fish during high flows, its slope was 3%. No fish were observed in the tributary. |
| 5499 | 0096.00 | There was a right bank tributary entering this unit, it was filled with sediment and it was not flowing. No young-of-the-year salmonids were observed in the tributary. |
| 5742 | 0100.00 | A massive left bank landslide extends from this unit to habitat unit #108. |
| 5983 | 0103.00 | There was a 5' plunge at the top of this unit. |
| 6015 | 0104.00 | Log debris accumulation (LDA) #08 was on this unit. It measured 25' high x 130' wide x 200' long and it contained 35 pieces of large woody debris (LWD). Water was flowing through, there were no visible gaps and sediment was being retained. The sediment measured 45' wide x 735' long x 5' deep and ranged in size from sand to large cobble. Fish were observed upstream. The creek's slope increases above this unit. The accumulation extended through habitat unit #111. |

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6034	0105.00	The log debris accumulation that began at habitat unit #104 continues through habitat unit #111.
6360	0109.00	A tributary (trib#003) entered at this unit from the left bank. It was flowing at ~0.5 cfs and contributed to <1% of Canoe Creeks flow. The tributary's temperature was 56 degrees, while Canoe Creek was 59 degrees upstream as well as downstream of the tributary. The tributary was not accessible to fish and had a 40% slope. No fish were observed in the tributary.
6491	0111.00	This unit marks the end of the log debris accumulation that began at habitat unit #104.
6548	0112.00	This unit was steep (> 10% gradient) and had high velocity. The substrate was predominantly large boulders.
6875	0115.00	There was an active slide on the right bank that was ~20' wide.
6875	0115.00	Log debris accumulation (LDA) #09 It measured 5' high x 60' wide x 40' long and contained 7 pieces of large woody debris. Water was flowing through, though there were no visible gaps. The sediment that was being retained measured 60' wide x 400' long x 3' deep and it ranged in size from sand to gravel. Fish were seen above the accumulation, but appeared to be a possible barrier to adults and juveniles due to the lack of gaps.
6943	0116.00	There was a seep on the right bank as well as active erosion.
7149	0117.00	The gradient of the stream increased above this unit.
8113	0138.00	There was a tributary (trib#004) entering from the right bank at this unit. It was flowing at ~0.5 cfs and was contributing to ~5% of Canoe Creek's flow. The temperature of the tributary was 55 degrees. The temperature of Canoe Creek downstream of the tributary was 57 degrees and upstream it was 59 degrees. The tributary was accessible to fish and had a slope of 10%. Fish were observed in the tributary it probably flowing year-round.
8190	0139.00	There was a tributary (trib#005) entering this unit from the right bank. It was flowing at 0.5 cfs and was contributing to ~5% of Canoe Creeks flow. The temperature of the tributary was 55 degrees. The temperature of Canoe Creek was 57 degrees downstream of the confluence and 59 degrees upstream. The slope of tributary was 10% and no fish were seen. The tributary probably flows year round.
8214	0140.00	There was a left bank seep and left bank erosion.
8334	0143.00	The plunge at the top of this unit measured 4.9' high.

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8359	0144.00	The top of this unit had a 6' high plunge.
9105	0153.00	The top of this unit had a plunge of 6' high with a cascade.
9273	0156.00	There was a tributary (trib#006) on the right bank entering at this unit. It was flowing at <1 cfs and contributing to ~5% of Canoe Creeks flow. The temperature of the tributary was 54 degrees. The temperature of Canoe Creek downstream of the confluence as well as upstream was 56 degrees. The slope was 5% and was accessible to fish. Salmonids were observed in the tributary. It looks like the tributary flows year round.
9418	0158.00	The runs in this step-run unit were separated by 2' - 3' high cascades.
9674	0160.00	The runs in this step-run unit were separated by 2' - 5' high cascades.
9674	0160.00	There were young-of-the-year salmonids observed in this unit as well as most units throughout the entire survey.
9842	0163.00	This unit marked the end of the survey. This survey ended due lack of access to the survey crew. The hike into the creek had become too long to survey the creek. This unit had a plunge height of 4.5'.

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 }

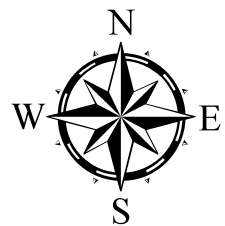
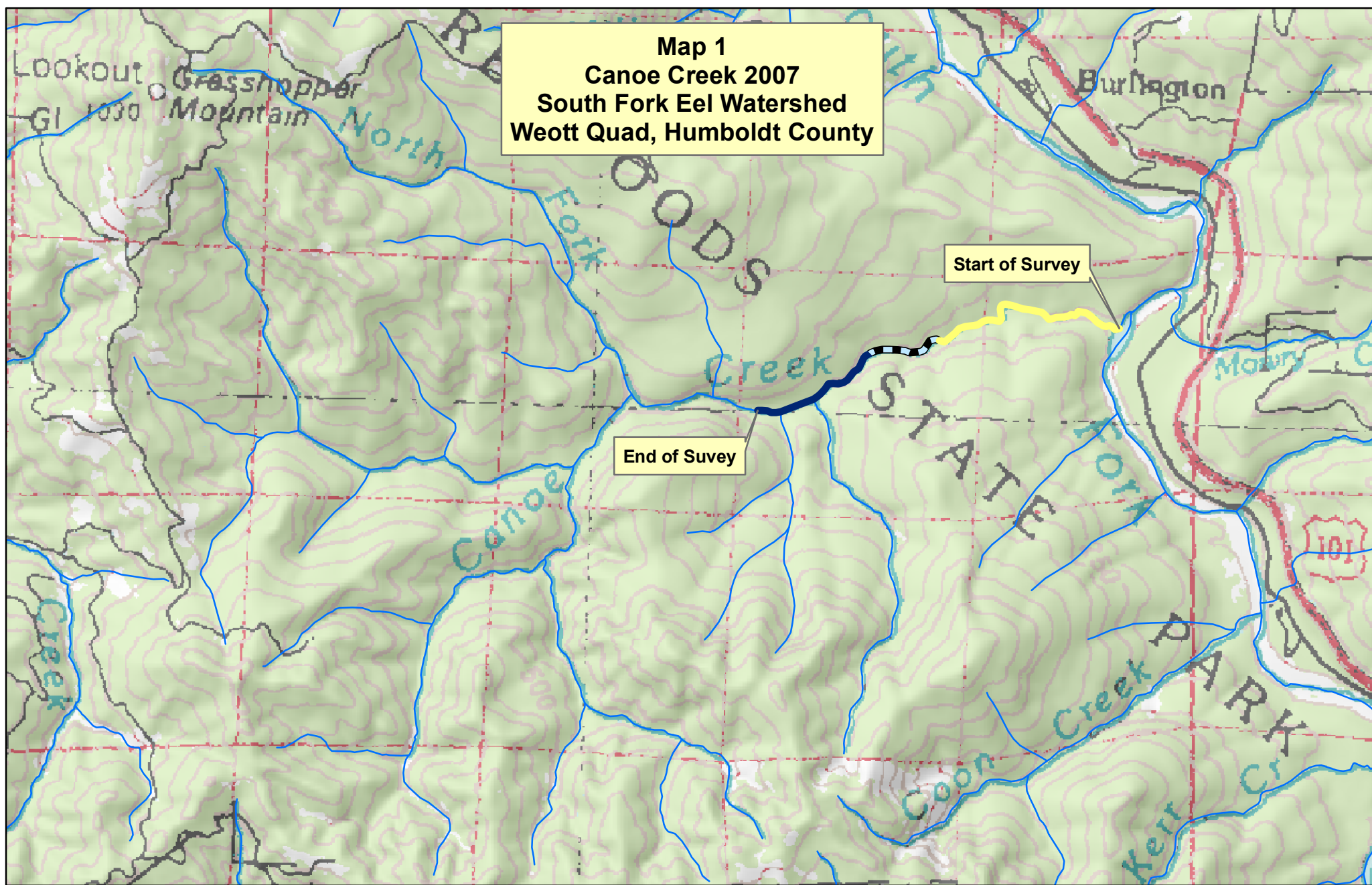
BACKWATER POOLS

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]	

Map 1
Canoe Creek 2007
South Fork Eel Watershed
Weott Quad, Humboldt County



Legend

- Reach 1, F4 Channel Type
- Reach 2, F2 Channel Type
- Reach 3, B2 Channel Type

0 1,600 3,200 6,400 Feet



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

Stream Name: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Confluence Location: Quad: WEOTT

Legal Description: T02SR02ES13

Latitude: 40:17:44.0N

Longitude: 123:53:56.0W

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
39	6	FLATWATER	22.9	85	3302	31.9	16.7	1.1	2.1	1220	47562	1263	49248		33
61	59	POOL	35.9	47	2891	27.9	20.9	1.1	2.8	838	51104	1550	94528	987	75
70	8	RIFFLE	41.2	59	4151	40.1	23.5	1.1	2.3	1484	103897	1524	106705		74
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
170	73				10344					202563			250480		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Confluence Location: Quad: WEOTT

Legal Description: T02SR02ES13

Latitude: 40:17:44.0N

Longitude: 123:53:56.0W

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 (%)
40	4	LGR	23.5	63	2535	24.5	24	0.9	2.7	2048	81930	1532	61276		48	82
26	1	HGR	15.3	51	1326	12.8	19	0.8	1.6	228	5928	182	4742		75	75
4	3	CAS	2.4	72	290	2.8	24	1.5	5.1	1151	4604	1962	7846		110	70
28	6	RUN	16.5	68	1917	18.5	17	1.1	2.8	1220	34147	1263	35357		33	86
11	0	SRN	6.5	126	1385	13.4										83
49	47	MCP	28.8	46	2271	22.0	20	1.0	5.4	795	38941	1391	68155	885	72	83
1	1	CCP	0.6	19	19	0.2	51	1.1	1.9	921	921	1749	1749	1013	30	79
5	5	STP	2.9	83	413	4.0	21	1.3	4.1	1303	6513	2869	14343	1788	97	83
1	1	LSR	0.6	33	33	0.3	21	0.4	1.3	658	658	658	658	263	45	85
3	3	PLP	1.8	32	95	0.9	36	1.8	5	1065	3196	2534	7602	1788	135	81
2	2	DPL	1.2	30	60	0.6	14	1.4	3.8	394	789	852	1703	529	38	50

Total Units
170

Total Units Fully Measured
73

Total Length (ft.)
10344

Total Area (sq.ft.)
177627

Total Volume (cu.ft.)
203432

Table 3 - Summary of Pool Types

Stream Name: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Confluence Location: Quad: WEOTT

Legal Description: T02SR02ES13

Latitude: 40:17:44.0N

Longitude: 123:53:56.0W

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
55	53	MAIN	90	49	2703	93	20.3	1.1	845	46475	973	53492	74
4	4	SCOUR	7	32	128	4	32.3	1.5	964	3854	1407	5627	113
2	2	BACKWATER	3	30	60	2	13.5	1.4	394	789	529	1058	38
Total Units	Total Units Fully Measured				Total Length (ft.)				Total Area (sq.ft.)			Total Volume (cu.ft.)	
61	59				2891				51118			60177	

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

Stream Name: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Confluence Location: Quad: WEOTT

Legal Description: T02SR02ES13

Latitude: 40:17:44.0N

Longitude: 123:53:56.0W

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
47	MCP	80	0	0	8	17	21	45	10	21	8	17
1	CCP	2	0	0	1	100	0	0	0	0	0	0
5	STP	8	0	0	1	20	3	60	0	0	1	20
1	LSR	2	0	0	1	100	0	0	0	0	0	0
3	PLP	5	0	0	0	0	0	0	2	67	1	33
2	DPL	3	0	0	0	0	1	50	1	50	0	0

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
59	0	0	11	19	25	42	13	22	10	17

Mean Maximum Residual Pool Depth (ft.): 2.8

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Dry Units: 0

Confluence Location: Quad: WEOTT

Legal Description: T02SR02ES13

Latitude: 40:17:44.0N

Longitude: 123:53:56.0W

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
40	4	LGR	11	6	29	3	0	0	25	26	0
26	1	HGR	0	0	0	0	0	0	50	50	0
4	3	CAS	8	7	17	7	2	0	28	27	5
70	8	TOTAL RIFFLE	9	6	21	4	1	0	29	29	2
28	6	RUN	12	14	10	8	0	4	14	38	0
11	0	SRN									
39	6	TOTAL FLAT	12	14	10	8	0	4	14	38	0
49	47	MCP	5	11	25	7	2	0	12	36	1
1	1	CCP	50	0	0	40	0	0	5	5	0
5	5	STP	6	4	15	0	0	0	16	59	0
1	1	LSR	40	10	0	45	5	0	0	0	0
3	3	PLP	5	0	38	0	0	0	25	32	0
2	2	DPL	0	15	43	0	0	0	0	15	28
61	59	TOTAL POOL	7	10	24	7	2	0	12	36	2
170	73	TOTAL	7	10	23	7	2	0	14	36	2

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Dry Units: 0

Confluence Location: Quad: WEOTT

Legal Description: T02SR02ES13

Latitude: 40:17:44.0N

Longitude: 123:53:56.0W

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
40	4	LGR	0	0	100	0	0	0	0
26	1	HGR	0	0	0	0	0	100	0
4	3	CAS	0	33	0	0	33	33	0
28	6	RUN	0	33	50	17	0	0	0
11	0	SRN	0	0	0	0	0	0	0
49	47	MCP	0	49	43	2	6	0	0
1	1	CCP	0	100	0	0	0	0	0
5	5	STP	0	60	40	0	0	0	0
1	1	LSR	0	0	100	0	0	0	0
3	3	PLP	0	67	33	0	0	0	0
2	2	DPL	0	100	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Canoe Creek LLID: 1238988402956 Drainage: Eel River - South Fork
Survey Dates: 6/4/2007 to 6/19/2007
Confluence Location: Quad: WEOTT Legal Description: T02SR02ES13 Latitude: 40:17:44.0N Longitude: 123:53:56.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
81	89	11	0	86	83

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: Canoe Creek	LLID: 1238988402956	Drainage: Eel River - South Fork
Survey Dates: 6/4/2007 to 6/19/2007	Survey Length (ft.): 10344	Main Channel (ft.): 9842
		Side Channel (ft.): 502
Confluence Location: Quad: WEOTT	Legal Description: T02SR02ES13	Latitude: 40:17:44.0N
		Longitude: 123:53:56.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 82.2	Pools by Stream Length (%): 28.9
Reach Length (ft.): 4449	Coniferous Component (%): 92.9	Pool Frequency (%): 36.6
Riffle/Flatwater Mean Width (ft.): 20.7	Hardwood Component (%): 7.1	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 25
Range (ft.): 19 to 36	Vegetative Cover (%): 85.3	2 to 2.9 Feet Deep: 46
Mean (ft.): 28	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 18
Std. Dev.: 5	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 11
Base Flow (cfs.): 6.5	Occurrence of LWD (%): 23	Mean Max Residual Pool Depth (ft.): 2.5
Water (F): 54 - 58	Air (F): 50 - 64	LWD per 100 ft.:
Dry Channel (ft): 0	Riffles: 2	Mean Pool Shelter Rating: 56
	Pools: 8	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0	Sand: 0	Gravel: 21
	Sm Cobble: 50	Lg Cobble: 7
	Boulder: 21	Bedrock: 0
Embeddedness Values (%): 1. 0.0	2. 96.4	3. 0.0
	4. 0.0	5. 3.6

STREAM REACH: 2

Channel Type: F2	Canopy Density (%): 65.5	Pools by Stream Length (%): 18.6
Reach Length (ft.): 2099	Coniferous Component (%): 94.3	Pool Frequency (%): 28.6
Riffle/Flatwater Mean Width (ft.): 18.4	Hardwood Component (%): 5.7	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 10
Range (ft.): 28 to 44	Vegetative Cover (%): 70.2	2 to 2.9 Feet Deep: 30
Mean (ft.): 38	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 30
Std. Dev.: 6	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 30
Base Flow (cfs.): 6.5	Occurrence of LWD (%): 38	Mean Max Residual Pool Depth (ft.): 3.2
Water (F): 54 - 56	Air (F): 56 - 68	LWD per 100 ft.:
Dry Channel (ft): 0	Riffles: 5	Mean Pool Shelter Rating: 135
	Pools: 28	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 0	Sand: 0	Gravel: 0
	Sm Cobble: 40	Lg Cobble: 30
	Boulder: 30	Bedrock: 0
Embeddedness Values (%): 1. 10.0	2. 50.0	3. 40.0
	4. 0.0	5. 0.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B2	Canopy Density (%): 90.1	Pools by Stream Length (%): 33.1
Reach Length (ft.): 3294	Coniferous Component (%): 81.7	Pool Frequency (%): 39.6
Riffle/Flatwater Mean Width (ft.): 24.0	Hardwood Component (%): 18.3	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 14
Range (ft.): 31 to 44	Vegetative Cover (%): 92.4	2 to 2.9 Feet Deep: 43
Mean (ft.): 37	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 24
Std. Dev.: 5	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 19
Base Flow (cfs.): 6.5	Occurrence of LWD (%): 13	Mean Max Residual Pool Depth (ft.): 3.0
Water (F): 54 - 57 Air (F): 63 - 74	LWD per 100 ft.:	Mean Pool Shelter Rating: 72
Dry Channel (ft): 0	Riffles: 5	
	Pools: 3	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 19 Sm Cobble: 5 Lg Cobble: 14 Boulder: 43 Bedrock: 19		
Embeddedness Values (%): 1. 4.8 2. 19.0 3. 28.6 4. 19.0 5. 28.6		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Confluence Location: Quad: WEOTT

Legal Description: T02SR02ES13

Latitude: 40:17:44.0N

Longitude: 123:53:56.0W

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	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	3	2	3.4
Sand / Silt / Clay	70	71	96.6

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	5	5	6.8
Brush	14	10	16.4
Hardwood Trees	3	6	6.2
Coniferous Trees	50	48	67.1
No Vegetation	1	4	3.4

Total Stream Cobble Embeddedness Values: 3

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

StreamName: Canoe Creek

LLID: 1238988402956

Drainage: Eel River - South Fork

Survey Dates: 6/4/2007 to 6/19/2007

Confluence Location: Quad: WEOTT

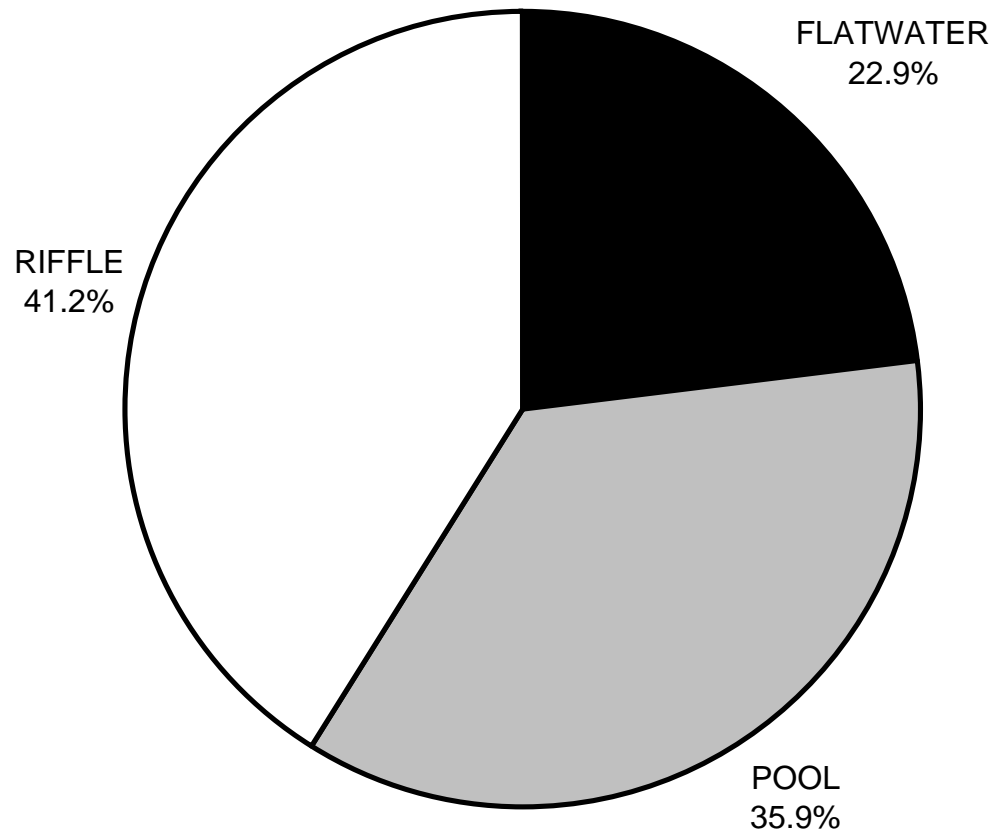
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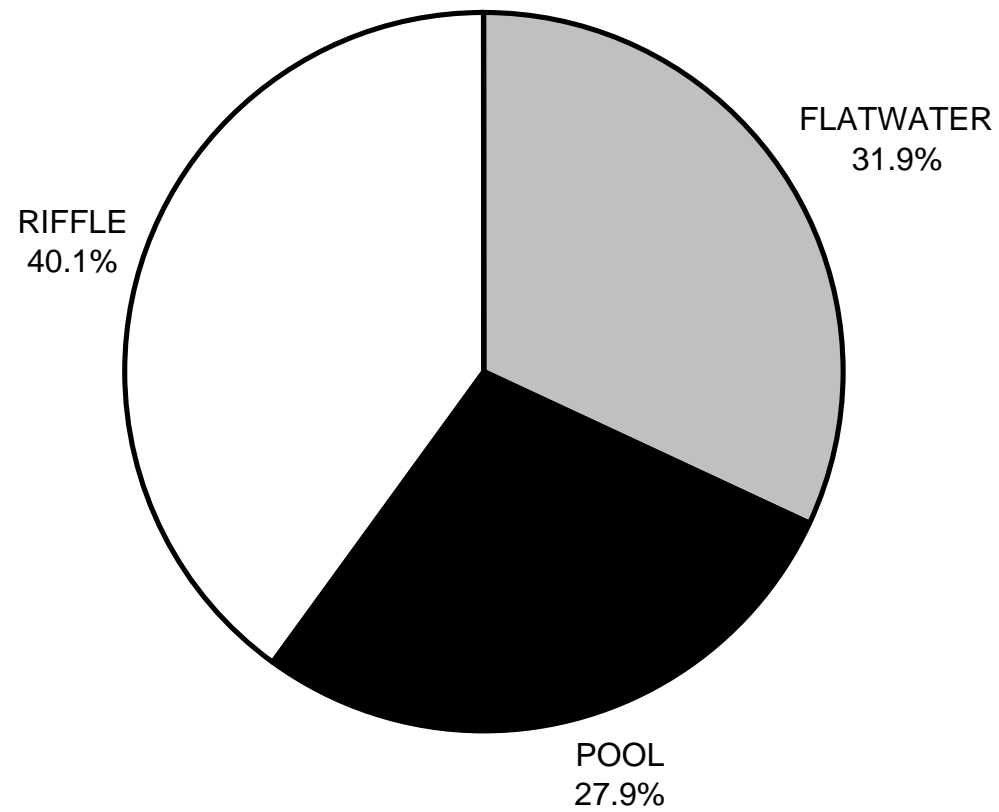
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	9	12	7
SMALL WOODY DEBRIS (%)	6	14	10
LARGE WOODY DEBRIS (%)	21	10	24
ROOT MASS (%)	4	8	7
TERRESTRIAL VEGETATION (%)	1	0	2
AQUATIC VEGETATION (%)	0	4	0
WHITEWATER (%)	29	14	12
BOULDERS (%)	29	38	36
BEDROCK LEDGES (%)	2	0	2

CANOE CREEK 2007
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

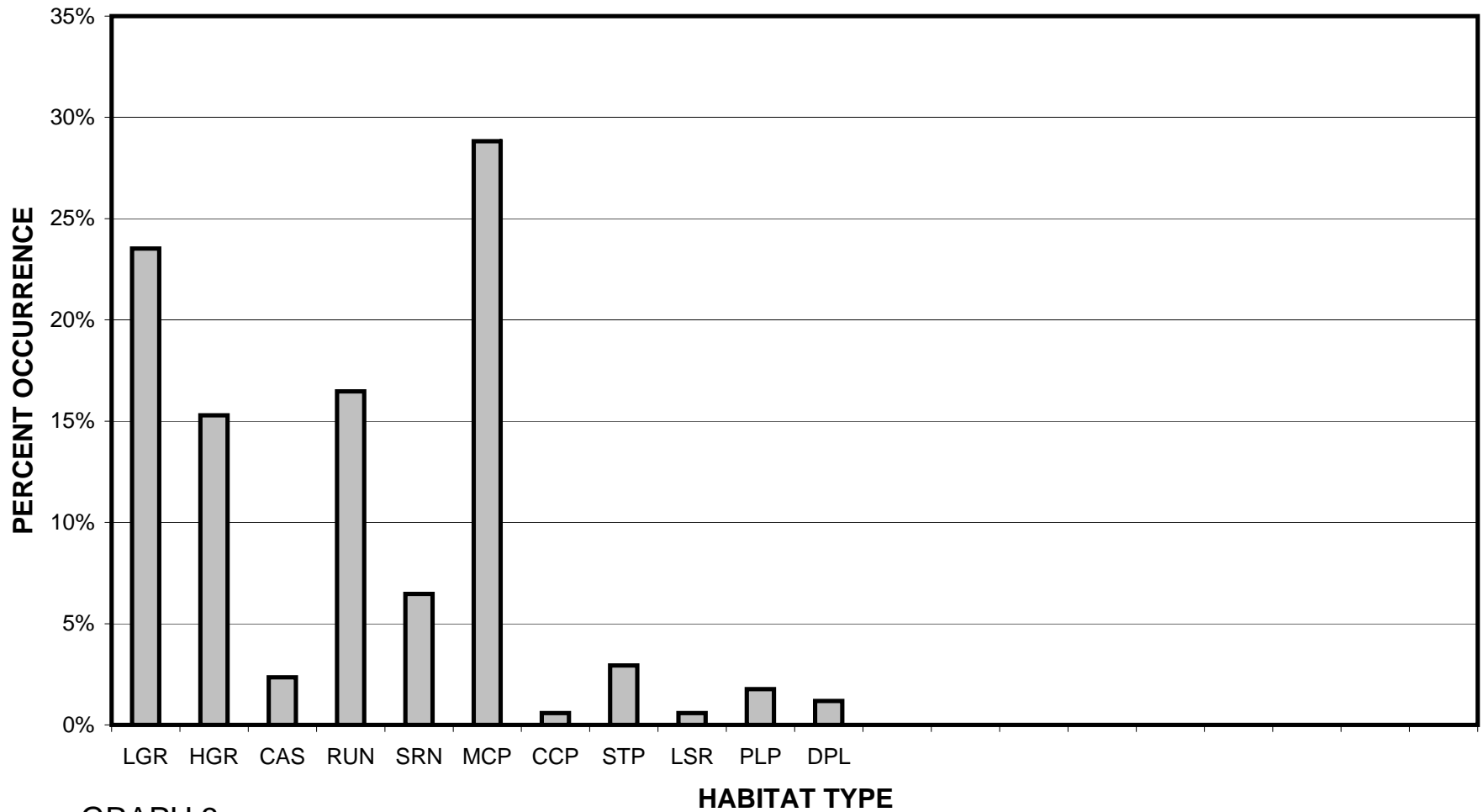
CANOE CREEK 2007
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

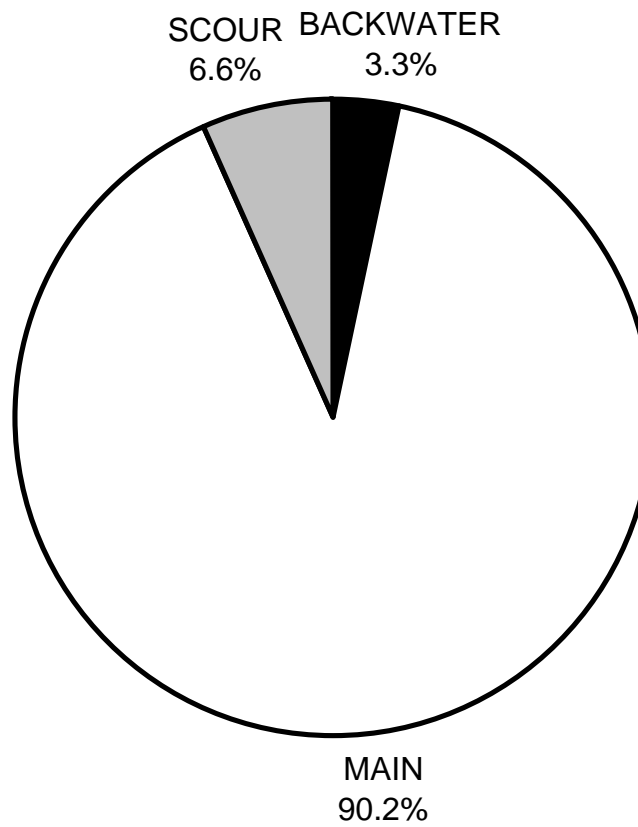
CANOE CREEK 2007

HABITAT TYPES BY PERCENT OCCURRENCE



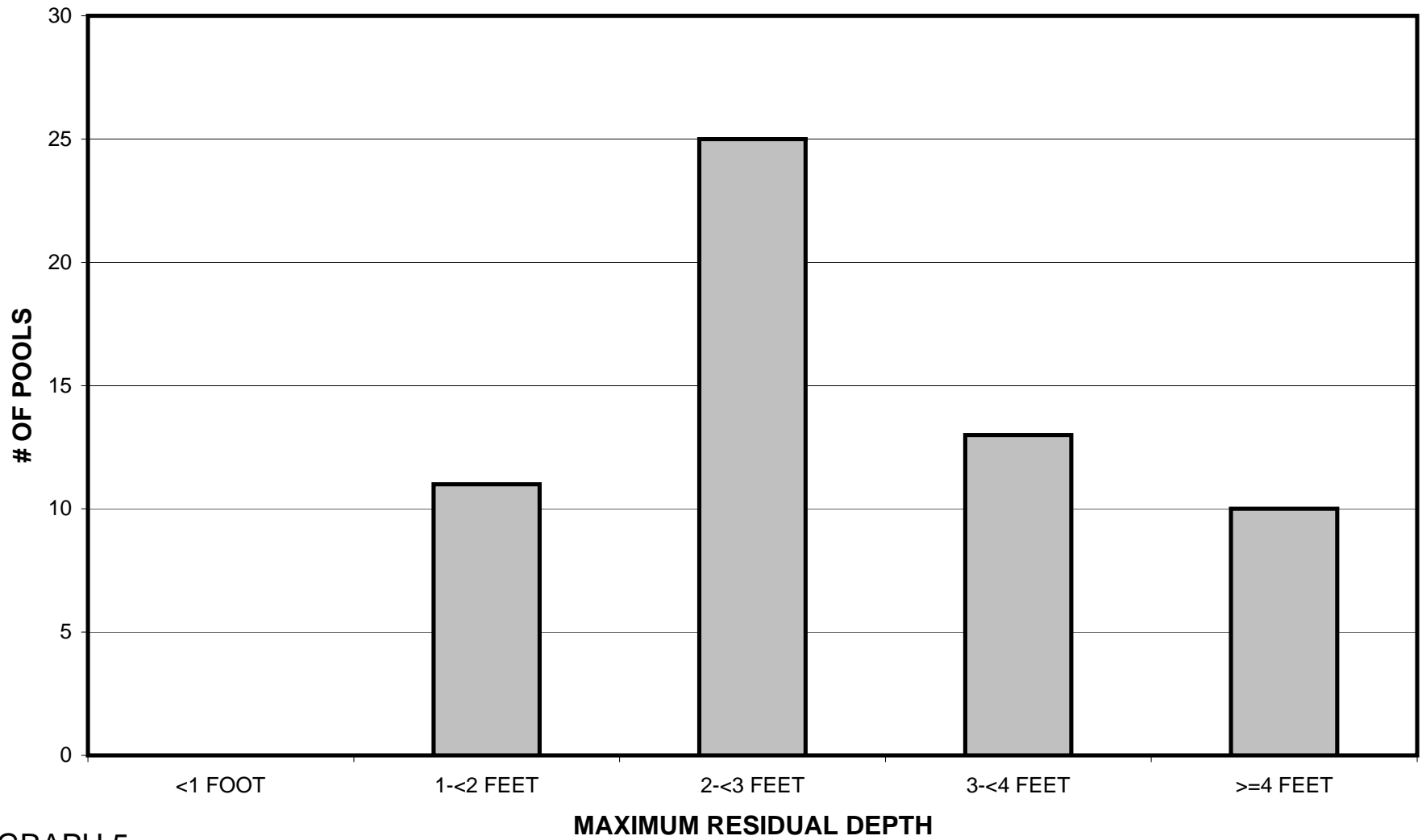
GRAPH 3

CANOE CREEK 2007
POOL TYPES BY PERCENT OCCURRENCE



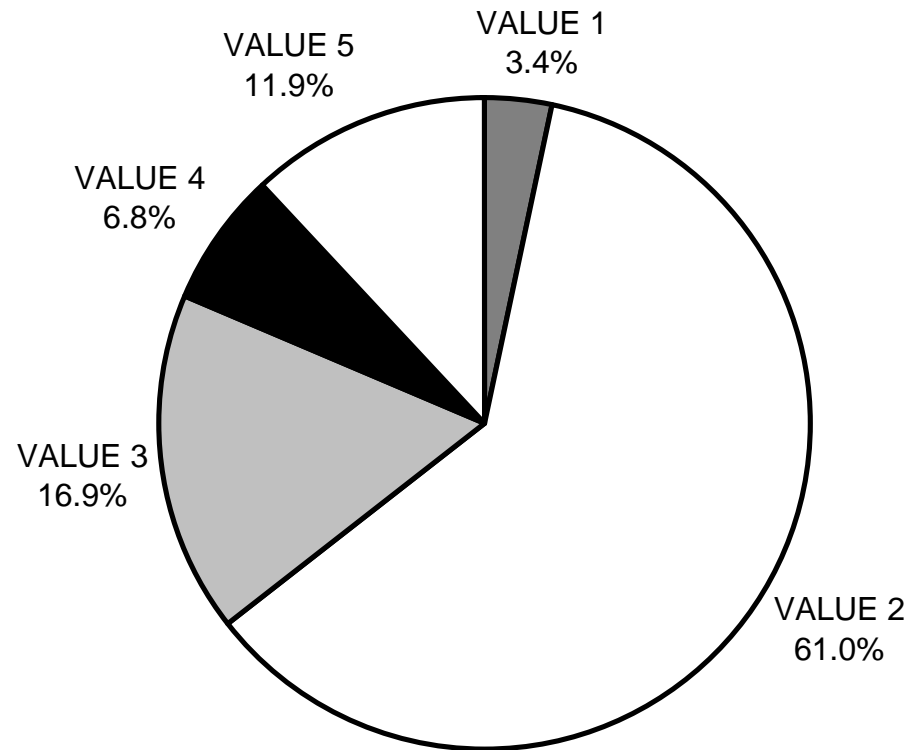
GRAPH 4

CANOE CREEK 2007 MAXIMUM DEPTH IN POOLS



GRAPH 5

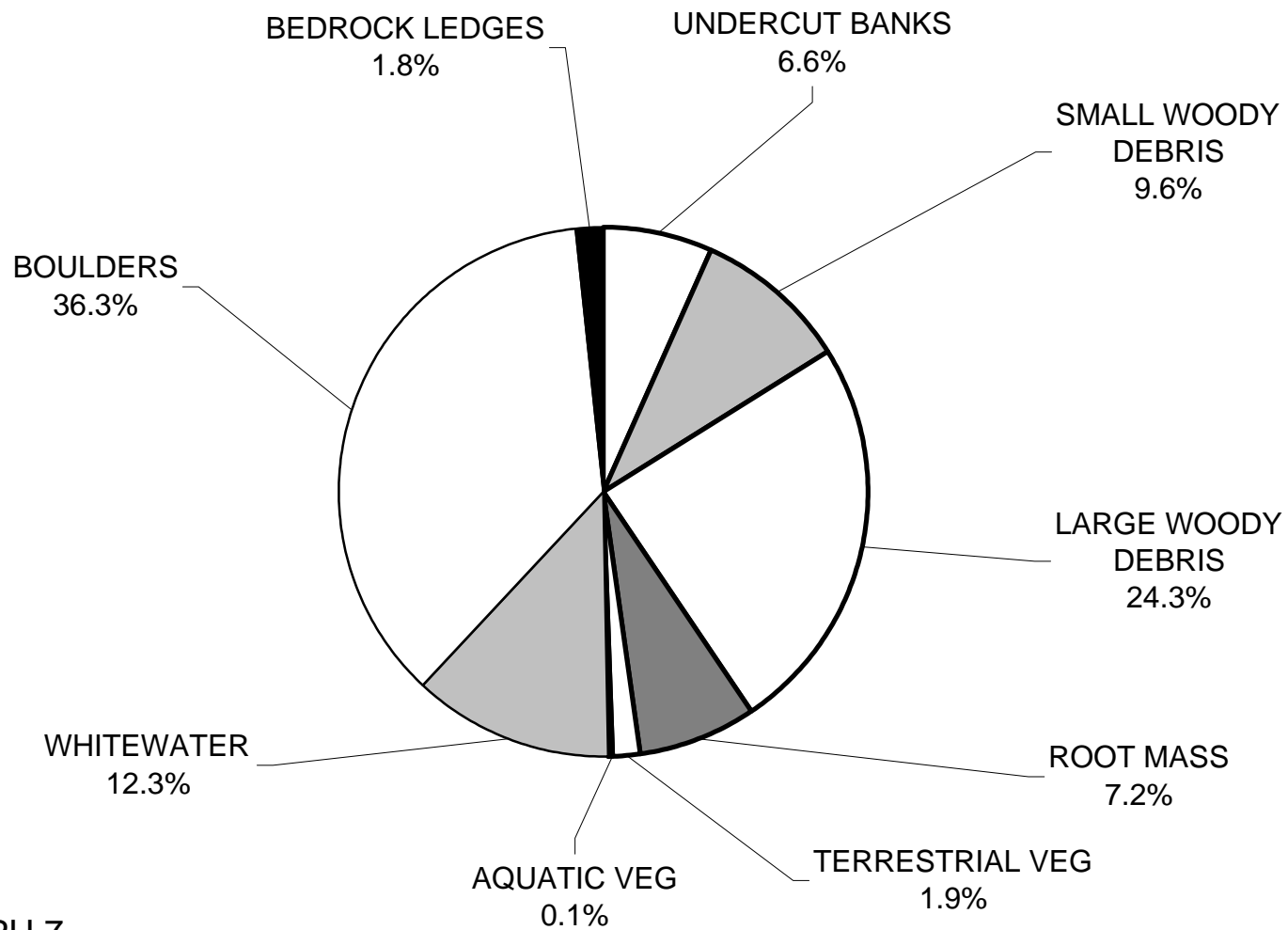
CANOE CREEK 2007 PERCENT EMBEDDEDNESS



GRAPH 6

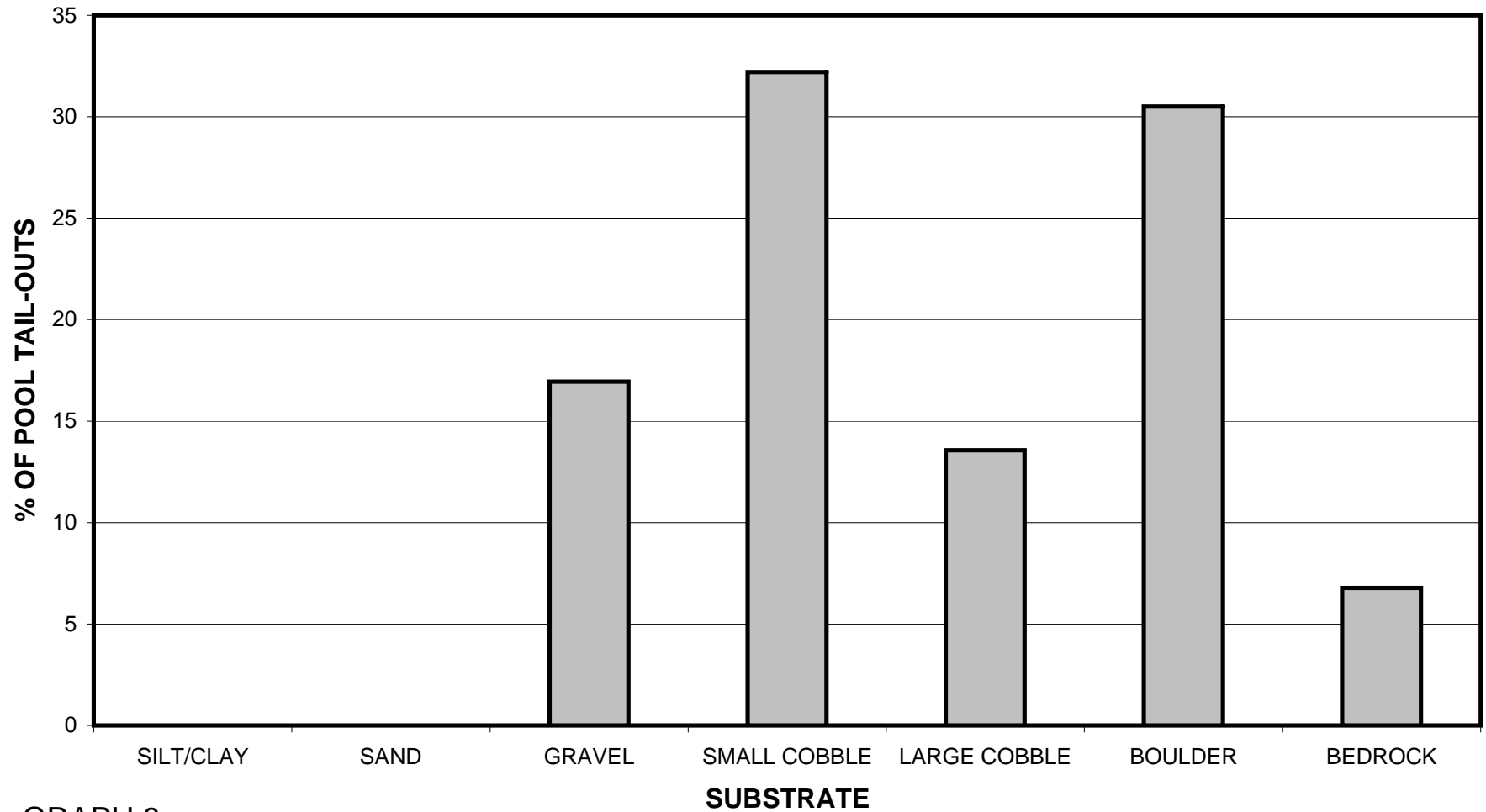
CANOE CREEK 2007

MEAN PERCENT COVER TYPES IN POOLS



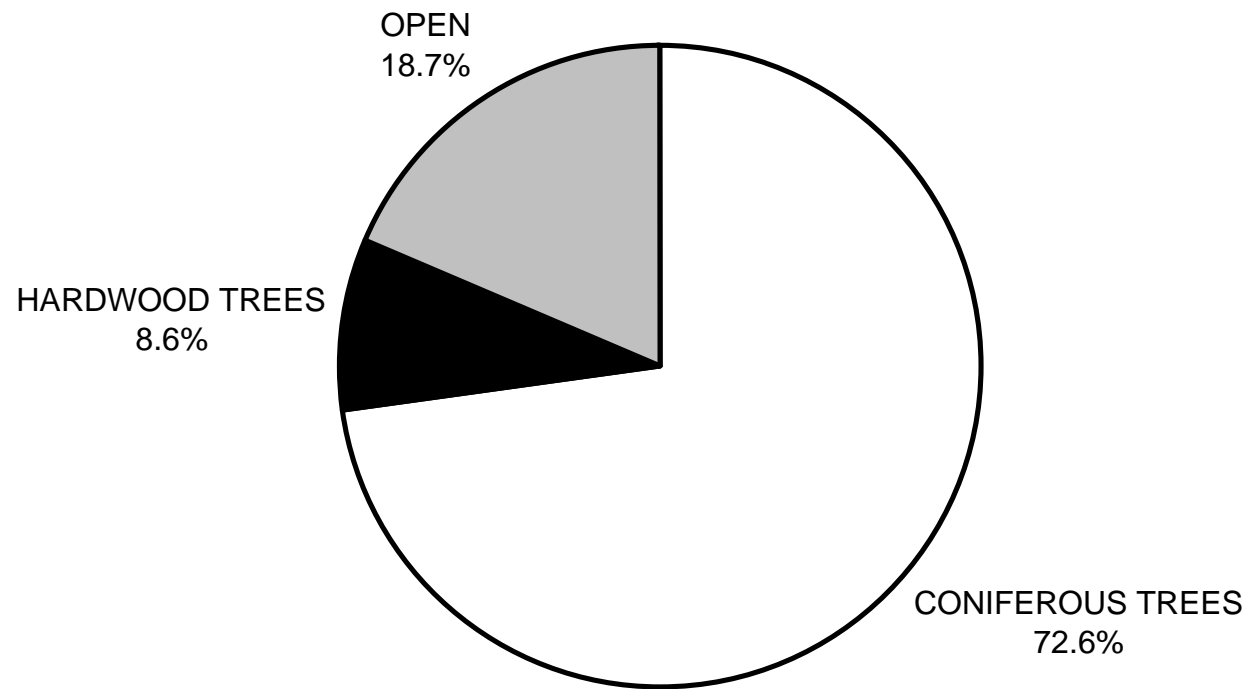
GRAPH 7

CANOE CREEK 2007
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



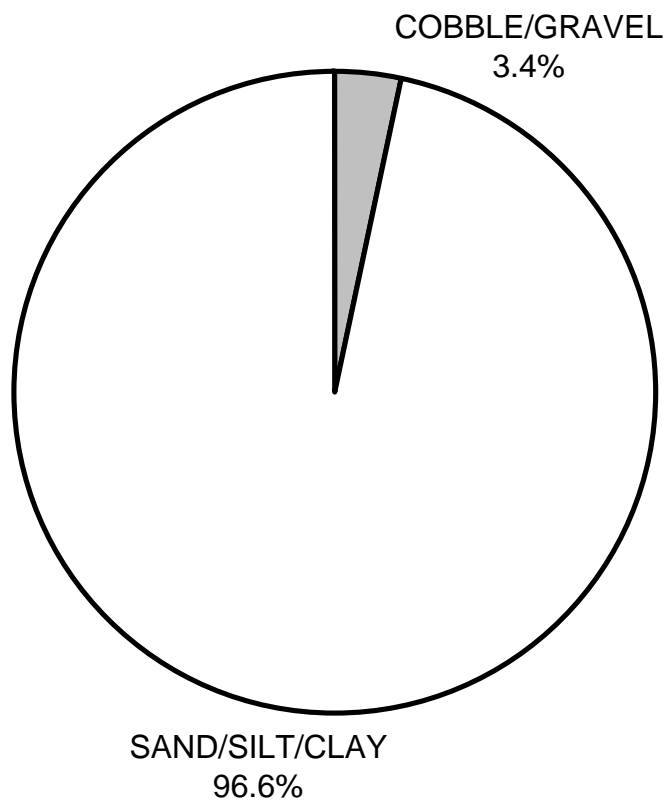
GRAPH 8

**CANOE CREEK 2007
MEAN PERCENT CANOPY**



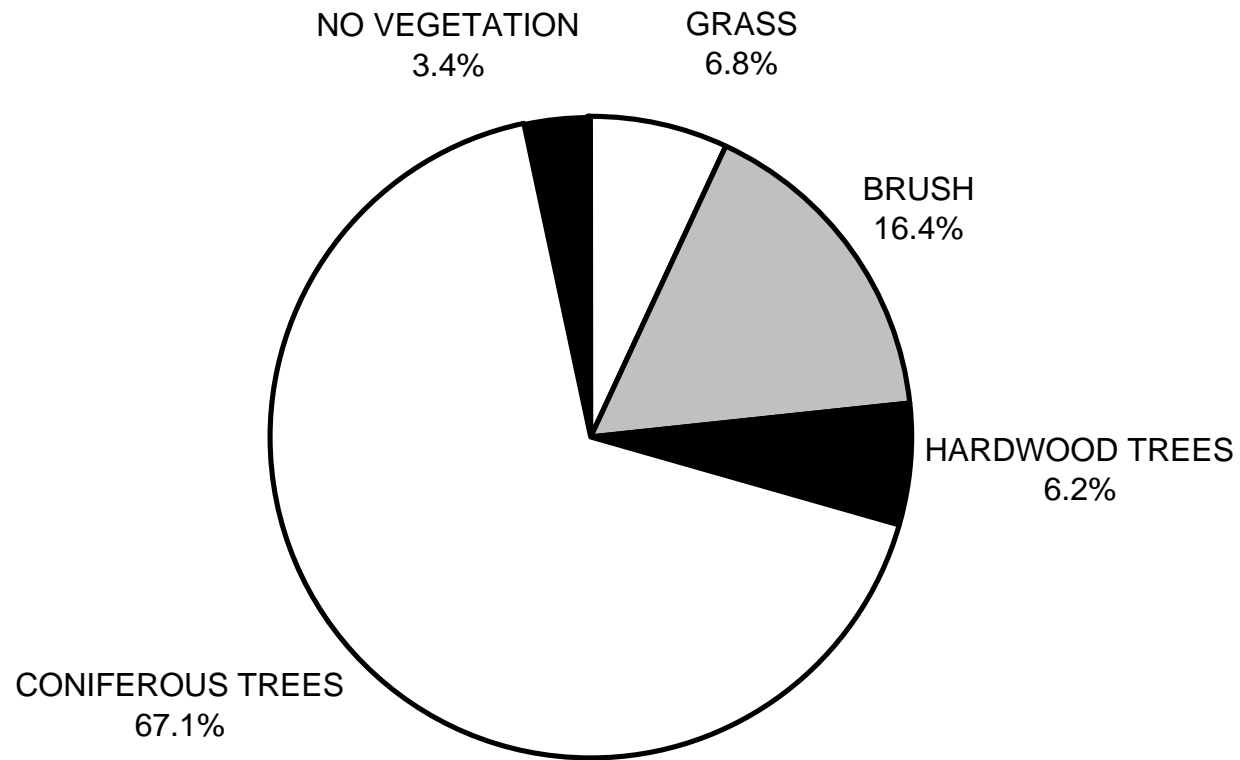
GRAPH 9

**CANOE CREEK 2007
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

CANOE CREEK 2007
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11