STREAM INVENTORY REPORT

Sproul Creek

INTRODUCTION

A stream inventory was conducted during August 2004 on Sproul Creek. The survey began at the confluence with South Fork Eel River and extended upstream 6.1 miles. Stream inventories and reports were also completed for five tributaries to Sproul Creek including: Warden, Little Sproul, West Fork Sproul and Cox creeks and unnamed tributary #5.

The Sproul 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 Sproul 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

Sproul Creek is a tributary to the South Fork Eel River, a tributary to the Eel River, a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Sproul Creek's legal description at the confluence with South Fork Eel River is T04S R03E S34. Its location is 40°04'10.0" north latitude and 123°49'34.0" west longitude, LLID number 1238261400695. Sproul Creek is a 3rd order stream and has approximately 25.9 miles of blue line stream according to the USGS Garberville 7.5 minute quadrangle. Sproul Creek drains a watershed of approximately 23.98 square miles. Elevations range from about 310 feet at the mouth of the creek to 1,000 feet in the headwater areas. Redwood and mixed hardwood forests dominate the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Sprowl Creek Road from Highway 101 in Garberville.

METHODS

The habitat inventory conducted in Sproul 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 embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement. All pools except step-pools are fully sampled.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Sproul 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". Sproul 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 Sproul 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 Sproul 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 Sproul 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 Sproul 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.

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 Sproul Creek. In addition, 9 sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.9, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type

- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Sproul 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 8/2/2004 to 8/25/2004 was conducted by E. Pope and L. Merrick, (CCC). The total length of the stream surveyed was 32,465 feet with an additional 1,653 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.41 cfs on 08/05/04.

Sproul Creek is a F3 channel type for 9,155 feet of the stream surveyed (Reach 1), a B2 channel type for 2,056 feet of the stream surveyed (Reach 2), a F3 channel type for 22,076 feet of the stream surveyed (Reach 3) and a B2 channel type for the remaining 831 feet of the stream surveyed (Reach 4).

F3 channels are entrenched, meandering riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates. B2 channels have a moderate gradient and are moderately entrenched, with a very stable plan and profile, stable banks, and a riffle and boulder dominated channel with infrequently spaced pools.

Water temperatures taken during the survey period ranged from 60 to 74 degrees Fahrenheit. Air temperatures ranged from 61 to 86 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 31% riffle units, 38% flatwater units, 30% pool units and 1% dry units (Graph 1). Based on total length of Level II habitat types there were 20% riffle units, 43% flatwater units, 37% pool units and 0.5% dry units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 31% run units, 27% low gradient riffle units, 27% mid-channel pool units (Graph 3). Based on percent total length there were 33% run units, 33% mid-channel pool units, and 17% low gradient riffle units.

A total of 149 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 93%, and comprised 92% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fifty-three of the 145 pools (37%) measured had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 146 pool tail-outs measured, 14 had a value of 1 (9.6%); 78 had a value of 2 (53.4%); 32 had a value of 3 (21.9%); 12 had a value of 4 (8.2%) and 10 had a value of 5 (6.8%) (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 8, flatwater habitat types had a mean shelter rating of 15 and pool habitats had a mean shelter rating of 33 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 34, scour pools had a mean shelter rating of 33, backwater pools had a mean shelter rating of 30 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 19% of pool tail-outs and small cobble was observed in 64% of pool tail-outs.

The mean percent canopy density for the surveyed length of Sproul Creek was 84%. The mean percentages of hardwood and coniferous trees were 91% and 9%, respectively. Sixteen percent of the canopy was open. Graph 9 describes the mean percent canopy in Sproul Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 79%. The mean percent left bank vegetated was 78%. The dominant elements composing the structure of the stream banks consisted of 17% bedrock, 6% boulder, 43% cobble/gravel and 34% sand/silt/clay

(Graph 10). Hardwood trees were the dominant vegetation type observed in 78% of the units surveyed. Additionally, 16% of the units surveyed had coniferous trees as the dominant vegetation type, and 4% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Nine sites were electrofished for species composition and distribution in Sproul Creek on October 5 and 6, 2004. Water temperatures taken October 5, 2004 during the electrofishing period 0945 to 1445 ranged from 57 to 61 degrees Fahrenheit. Air temperatures ranged from 57 to 73 degrees Fahrenheit. Water temperatures taken October 6, 2004 during the electrofishing period 0940 to 1600 ranged from 54 to 59 degrees Fahrenheit. Air temperatures ranged from 56 to 69 degrees Fahrenheit. The sites were sampled by C. Hines (CCC), and P. Divine, A. Renger and T. Tollefson (DFG).

In reach 1, which comprised the first 8,417 feet of stream, 2 sites were sampled. The reach sites yielded 11 young-of-the-year steelhead/rainbow trout (SH/RT), 6 age 1+ SH/RT, 4 coho, 1 Sacramento pikeminnow, 3 three-spine stickleback, 1 sculpin and 11 roach.

In reach 2, 2 sites were sampled starting approximately 8,760 feet from the confluence with the South Fork Eel River and continuing upstream 920 feet. The reach sites yielded 25 young-of-the-year SH/RT, 24 age 1+ SH/RT, 1 age 2+ SH/RT and 5 coho.

In reach 3, 4 sites were sampled starting approximately 11,598 feet from the confluence with the South Fork Eel River and continuing upstream 20,652 feet. The reach sites yielded 29 young-of-the-year SH/RT, 23 age 1+ SH/RT, 34 coho and 2 three-spine stickleback.

In reach 4, 1 site was sampled starting approximately 32,982 feet from the confluence with the South Fork Eel River. The reach sites yielded 1 young-of-the-year SH/RT and 3 coho.

The following chart displays the information yielded from these sites:

2004 Sproul Creek E-fish Observations

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
Reach 1 F3 Channel Type									
10/05/04	1	82	4.2	6417	3	0	4	3	0

2004 Sproul Creek E-fish Observations

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
10/06/04	2	34	4.2	2475	1	0	7	3	0
Reach 2 B2 Channel Type									
10/05/04	1	99	4.2	8740	4	1	16	11	0
10/05/04	2	103	4.2	8986	0	0	9	11	1
Reach 3 F3 Channel Type									
10/05/04	1	126	4.2	10883	2	1	10	1	0
10/06/04	2	254	4.2	20731	1	4	4	12	0
10/06/04	3	264	3.3	21414	1	0	10	6	0
10/06/04	4	451	4.3	31664	25	0	5	5	0
Reach 4 B2 Channel Type									
10/06/04	1	467	5.6	32260	1	2	1	0	0

DISCUSSION

Sproul Creek is a F3 channel type for the first 9,155 feet of stream surveyed (Reach 1), a B2 channel type for the next 2,056 feet (Reach 2), a F3 channel type for the next 22,076 feet (Reach 3), and a B2 channel type for the remaining 831 feet (Reach 4). The suitability of B2 and F4 channel types for fish habitat improvement structures is as follows: A B2 channel type is excellent for plunge weirs, single and opposing wing deflectors, and log cover. A F4 channel type is good for bank-placed boulders, poor for boulder clusters and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperatures recorded on the survey days 8/2/2004 to 8/25/2004, ranged from 60 to 74 degrees Fahrenheit. Air temperatures ranged from 61 to 86 degrees Fahrenheit. The upper range of the water temperatures recorded during the survey is above threshold stress level for juvenile coho. 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 43% of the total length of this survey, riffles 20%, pools 37%, and dry 0.5%. The pools are relatively shallow, with 53 of the 145 (37%) pools having a maximum residual depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum residual depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

Ninety-two of the 146 pool tail-outs measured had embeddedness ratings of 1 or 2. Forty-four of the pool tail-outs had embeddedness ratings of 3 or 4. Ten 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, indicates good quality spawning substrate for salmon and steelhead. Sediment sources in Sproul Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One-hundred-twenty-two of the 146 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 33. The shelter rating in the flatwater habitats was 15. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Sproul Creek. Boulders are the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover 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 84%. Reach 1 had a canopy density of 65.8%, Reach 2 had a canopy density of 70.2%, Reach 3 had a canopy density of 90.2% and Reach 4 had a canopy density of 98.6%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 79% and 78%, 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) Sproul Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are near the threshold stress level 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 boulders. 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) Increase the canopy on Reaches 1 and 2 of Sproul 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 (feet)	**Habitat unit #**	**Comments:**
0	0001.00	Start survey at confluence with South Fork Eel River. Channel type is an F3.
293	0006.00	Trail from country road enters left bank, good access.
432	0008.00	Sproul Creek Road Bridge 86’ into unit
1027	0015.00	Human made mini boulder dam at top of unit (water flows through).
2477	0034.00	Electrofishing Site 2, Reach 1
2477	0034.00	Little Sproul Creek enters left bank at top of unit. Contributes approximately 10% of the flow to Sproul Creek. Water temperature is 73° F.
2477	0034.00	Bridge 18’ high x 15’ wide x 90’ long.
3284	0043.00	Left bank erosion 50’ long x 20’ high x 1’ deep.
4679	0058.00	Channel type taken, F3
5603	0071.00	Dry tributary enters right bank.
5883	0074.00	Right bank erosion, 30’ long x 25’ high x 1’ deep.
6224	0078.00	Three inch cable spans the unit mid-channel creating the start of a side channel type area with a build up of large and small cobble.
6417	0082.00	Electrofishing Site 1, Reach 1.
8280	0095.00	Road access to first landing area with old tanks and culverts past Barnum Gate. Old road goes directly into unit ("Garage" sign post from Barnum Timber Rd).
8563	0098.00	Channel type change to B2.

Position (feet)	Habitat unit #	Comments:
8740	0099.00	Electrofishing Site 1, Reach 2.
8986	0103.00	Electrofishing Site 2, Reach 2.
9293	0108.00	Ford.
9787	0114.00	Right bank erosion, 63’ long x 50’ high x 2’ deep.
10055	0117.00	Dry tributary enters 105’ into unit
10512	0121.00	Road enters from right bank.
10600	0123.00	Channel type change to F3.
10643	0124.00	Right bank erosion, 100’ long x 65’ high x 4’ deep.
10883	0126.00	Electrofishing Site 1, Reach 3.
11123	0133.00	Road access.
12059	0143.05	Right bank erosion, 50’ long x 40’ high x 2’ deep.
12083	0145.00	Log debris accumulation (LDA) composed of 3 pieces of large woody debris
12114	0146.00	LDA 20’ high x 35’ wide x 40’ long. Not a barrier.
12773	0154.00	Warden Creek enters 21’ into unit. Contributes <1% to flow of Sproul Creek. Temperature of Sproul Creek stream upstream of tributary is 64° F.
12773	0154.00	Good parking and access at Warden Creek.
13071	0161.00	Road visible on left bank.
13741	0168.00	Road visible on left bank.
14245	0174.00	Small woody debris accumulation.
15060	0184.00	Road visible along side of creek.
15312	0187.00	Two trees spanning channel 5’ high with a stump in between, retaining small woody debris and large woody debris on right bank.
15697	0192.00	Rusted old equipment on left bank.
15697	0192.00	Road no longer visible.
16278	0202.00	Tributary #3 enters and is flowing contributing < 1% to the flow of Sproul Creek. Temperature is 60° F. This tributary is not accessible to fish.
16803	0208.00	Channel type taken, still F3.
16892	0209.00	Dry tributary enters right bank.
17309	0215.00	Left bank erosion 100’ long x 10’ high x 1’ deep, contributing trees, root mass and silt.
18961	0235.00	Unit has a root wad island and is retaining small woody debris and 6 pieces of large woody debris. Island and large woody debris is not spanning the channel.
19174	0238.00	Good access and parking just off main road.
19496	0243.00	Fallen tree is storing cobble and has created this riffle and is making two distinct pools.
20731	0254.00	Electrofishing Site 2, Reach 3.

Position (feet)	Habitat unit #	Comments:
21056	0260.00	Confluence with West Fork Sproul Creek.
21056	0260.00	Parking site access at the bridge.
21170	0262.00	One piece of large wood is retaining small woody debris, 5’ high x 15’ wide x 6’ long.
21414	0264.00	Electrofishing Site 3, Reach 3.
21670	0271.00	Left bank erosion, 25’ long x 15’ high x 1’ deep.
21805	0274.00	Channel becomes braided until habitat unit 277.
21915	0278.00	Fallen alders.
21963	0279.00	Dry right bank tributary.
21963	0279.00	Fish trap on left bank, and tubing still in creek.
23111	0302.00	Dry right bank tributary.
23476	0308.00	Large root wad accumulating small woody debris at the bend in the creek.
23743	0315.00	Left bank erosion
24100	0322.00	Left bank erosion, 30’ long x 12’ high x 1’ deep.
24586	0328.00	Dry tributary enters right bank.
24665	0330.00	Trail to gorge pool.
24974	0335.00	Parking for upper spawner survey drop off point. Walk downstream for access to habitat unit 335 and higher.
25582	0346.00	Old structure retaining 2 pieces of large and small woody debris, spanning the channel.
25730	0349.00	Boulder weir at top of unit. Right bank rip rapped.
25789	0350.00	Rip rap continues half way into unit.
25789	0350.00	Right bank erosion after rip rap ends, 6’ wide x 2’ deep x 10’ high, contributing boulders and large cobble.
25970	0353.00	Left bank erosion, 40’ long x 18’ high x 1’ deep.
26033	0354.00	Dry tributary enters left bank at top of unit.
26187	0357.00	Right bank erosion, 40’ long x 2’ deep x 15’ high.
26218	0358.00	Cable around root mass on right bank.
26318	0360.00	Left bank erosion, 30’ long x 8’ high x 1’ deep.
26993	0369.00	Dry left bank tributary at top of unit.
27199	0373.00	Dry left bank tributary.
27865	0386.00	Right bank erosion, 25’ long x 10’ high x 1’ deep. Re-vegetation in progress.
28025	0391.00	Right bank erosion, 50’ long x 40’ high x 4’ deep, contributing large and small woody debris.
28538	0398.00	Left bank erosion, 50’ long x 12’ high x 2’ deep.
28604	0400.00	Old boulder and log structure needs maintenance.

Position (feet)	Habitat unit #	Comments:
29102	0408.00	Dry right bank side channel.
29102	0408.00	Left bank erosion, 50’ long x 20’ high x 2’ deep.
29543	0416.00	Upper reach spawner survey drop-off road enters at top of unit.
29598	0417.00	Left bank unnamed tributary #5 enters at top of unit, flowing and contributes approximately 5% flow to the receiving stream. Accessible to fish.
29765	0419.00	Left bank scour erosion of silt/clay over bedrock, 35’ long x 4’ high x 1’ deep.
30373	0428.00	Old notched log structure at bottom of unit.
30447	0429.00	Right bank erosion, 12’ long x 3’ high x 1’ deep.
30707	0435.00	Left bank erosion, 20’ long x 3’ high x 1’ deep.
30830	0437.00	Fallen left bank redwood spanning channel and causing small woody debris pile up on left bank.
31128	0442.00	Right bank erosion, cobble and sand over bedrock, 80’ long x 8’ high x 2’ deep.
31374	0446.00	Left bank erosion, cobble and sand over bedrock, 70’ long x 3’ high x 1’ deep.
31457	0448.00	Right bank erosion, 20’ long x 3’ high x 1’ deep.
31582	0451.00	Begin upper reach of spawner survey.
31582	0451.00	Boulder weir at bottom of unit.
31582	0451.00	Cox Creek enters right bank at top of unit, contributing approx. 0.1% to the flow of Sproul Creek. Temperature of Sproul Creek downstream of tributary is 66°F. Temperature of tributary is 64° F. Accessible to fish.
31634	0452.00	Electrofishing Site 4, Reach 3.
31634	0452.00	Channel type change to B2.
31791	0454.00	Right bank road.
32195	0464.00	Right bank erosion, 35’ long x 10’ high x 2’ deep.
32260	0467.00	Electrofishing Site 1, Reach 4.
32360	0468.00	Bedrock sheet with 22% slope.
32365	0468.00	End of survey due to lack of access.

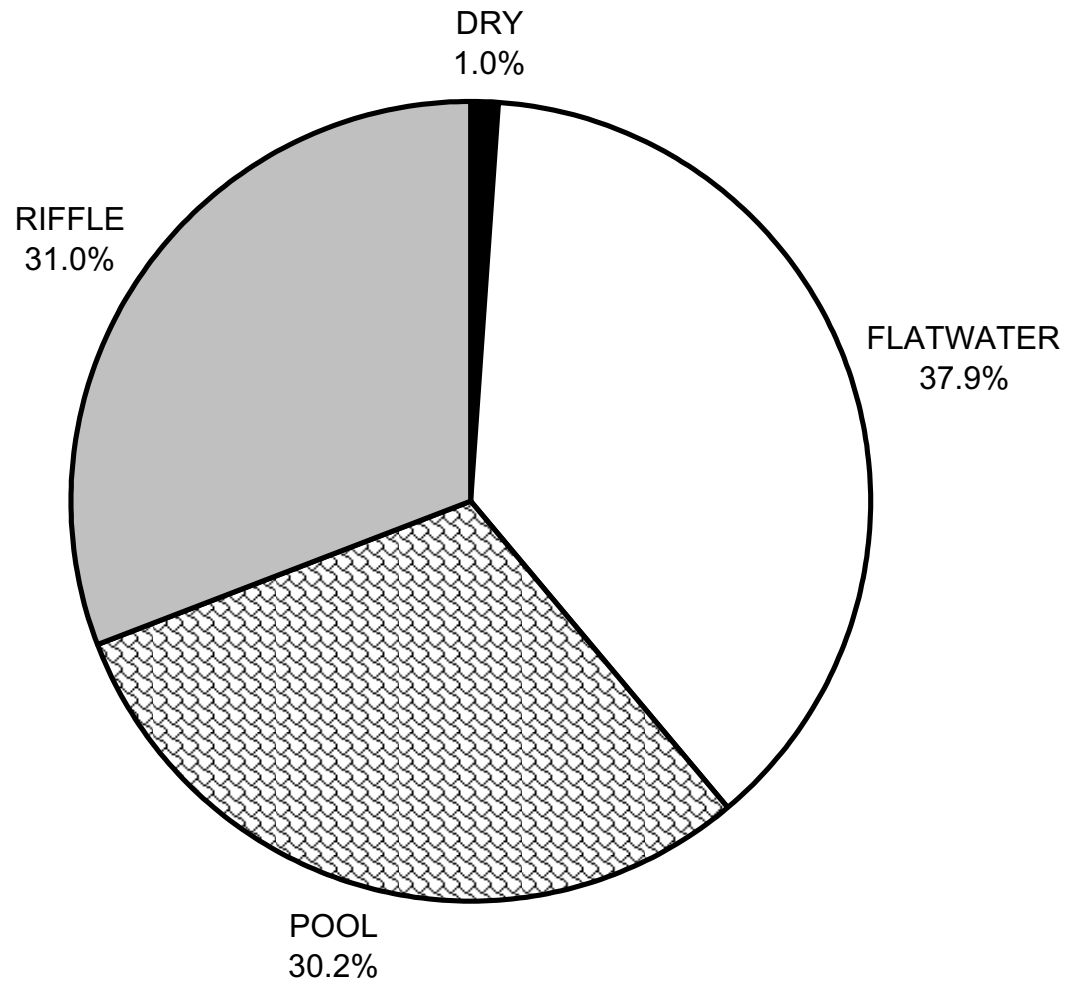
REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

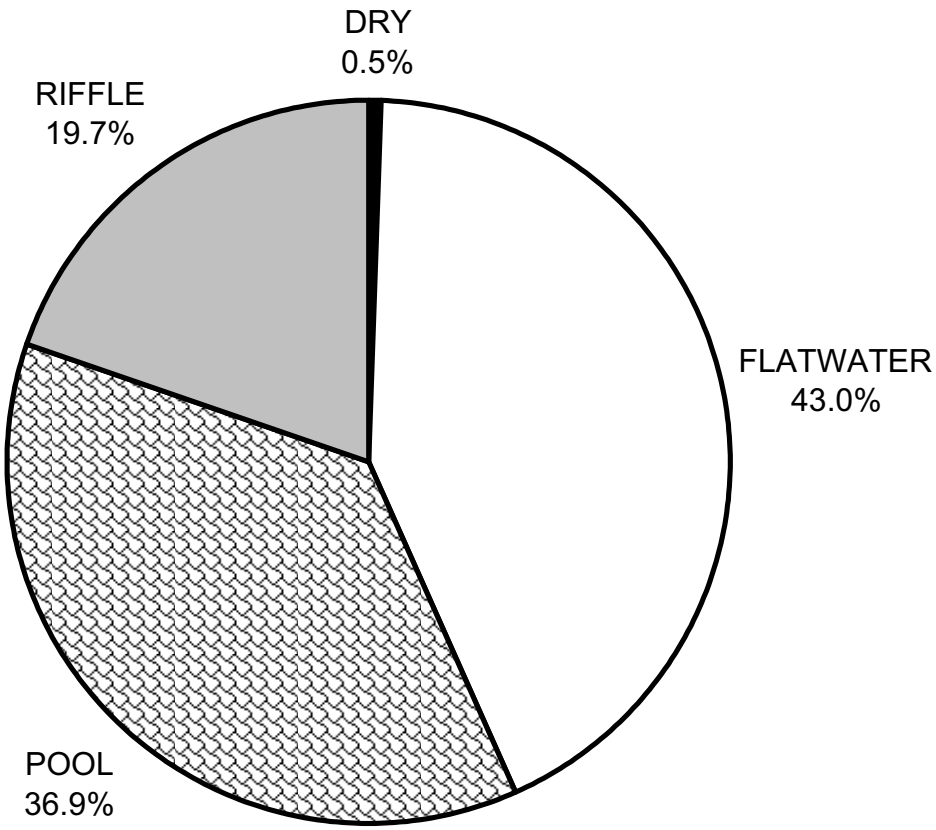
RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

SPROUL CREEK 2004
HABITAT TYPES BY PERCENT OCCURRENCE



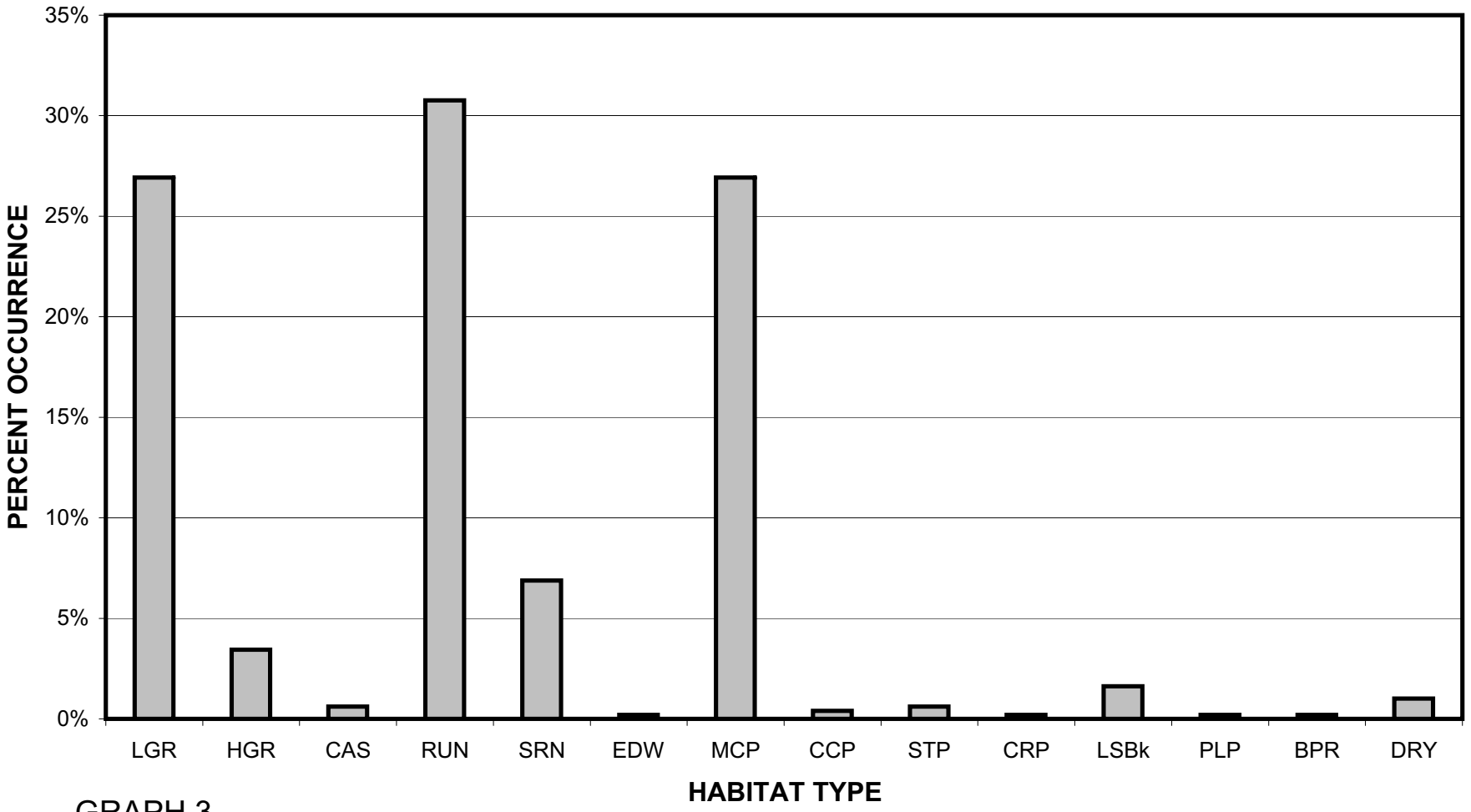
GRAPH 1

SPROUL CREEK 2004
HABITAT TYPES BY PERCENT TOTAL LENGTH



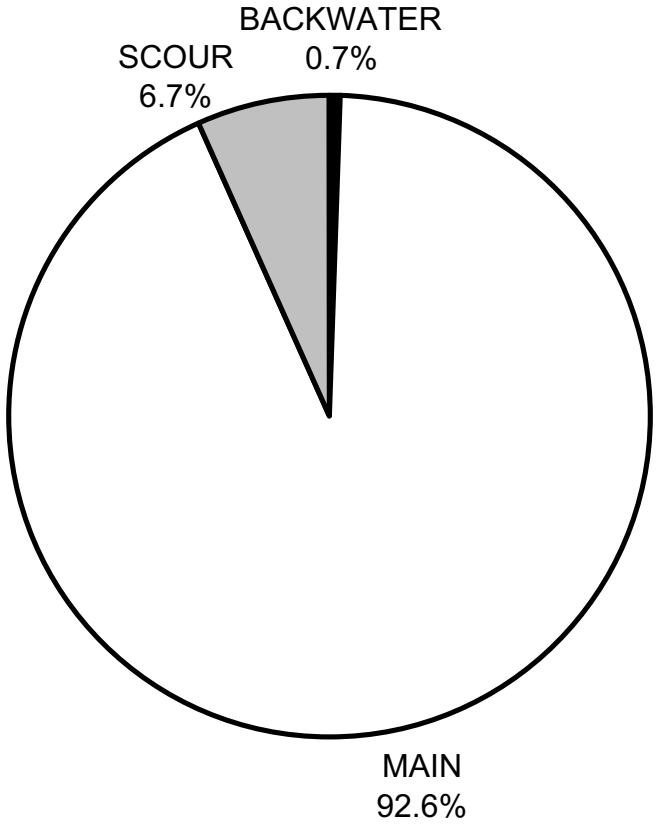
GRAPH 2

SPROUL CREEK 2004
HABITAT TYPES BY PERCENT OCCURRENCE



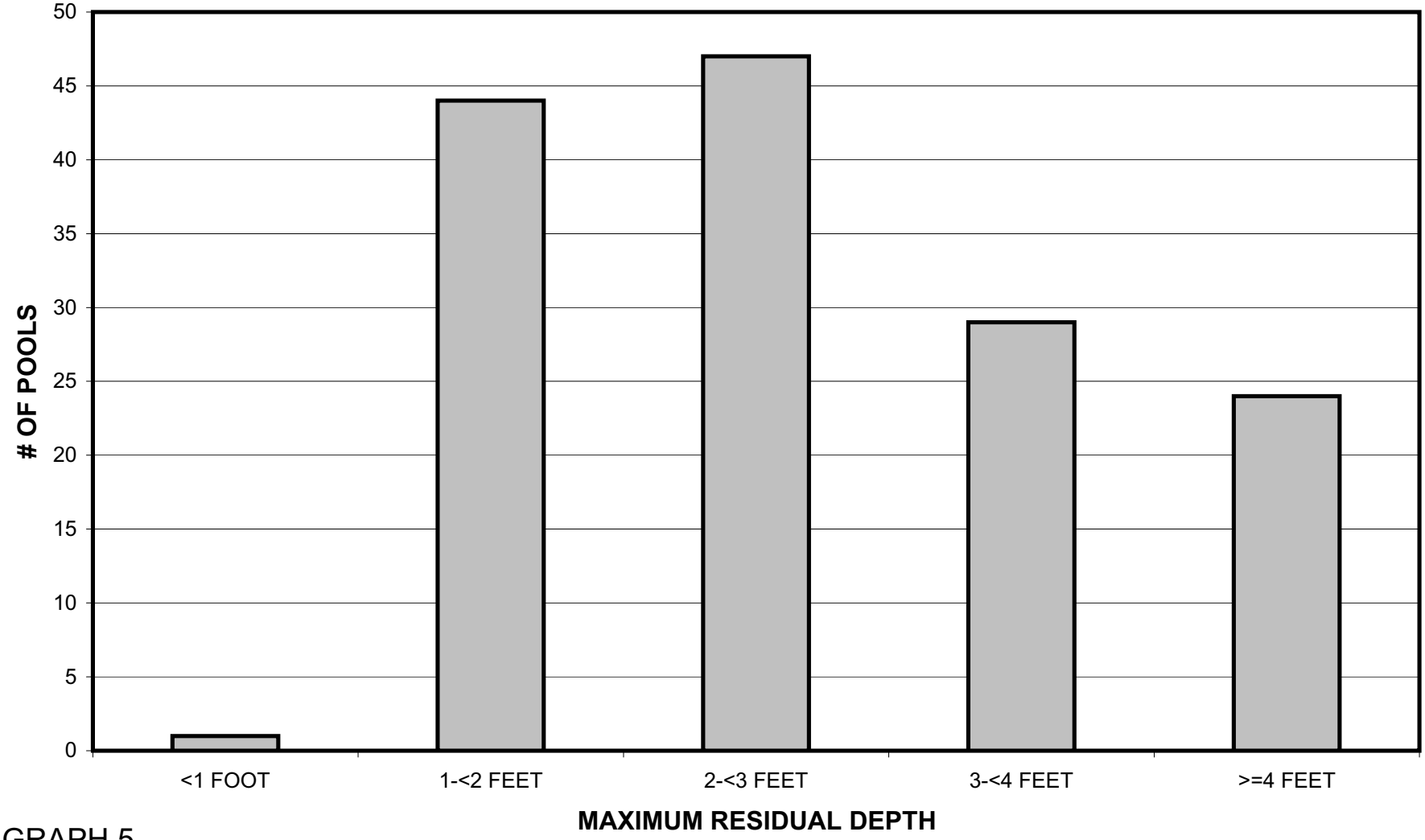
GRAPH 3

SPROUL CREEK 2004
POOL TYPES BY PERCENT OCCURRENCE



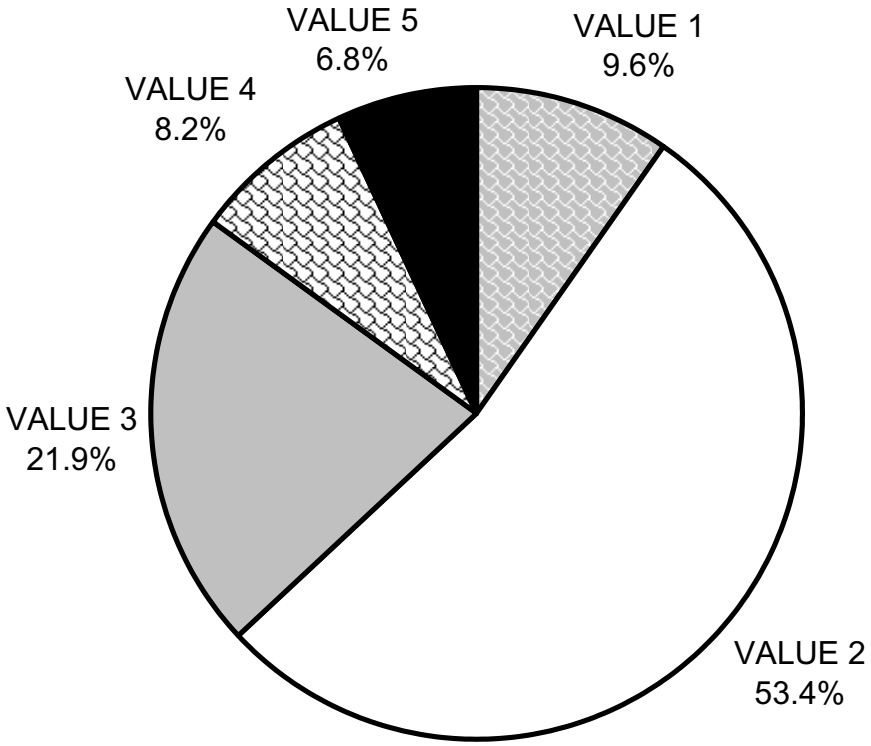
GRAPH 4

SPROUL CREEK 2004
MAXIMUM DEPTH IN POOLS



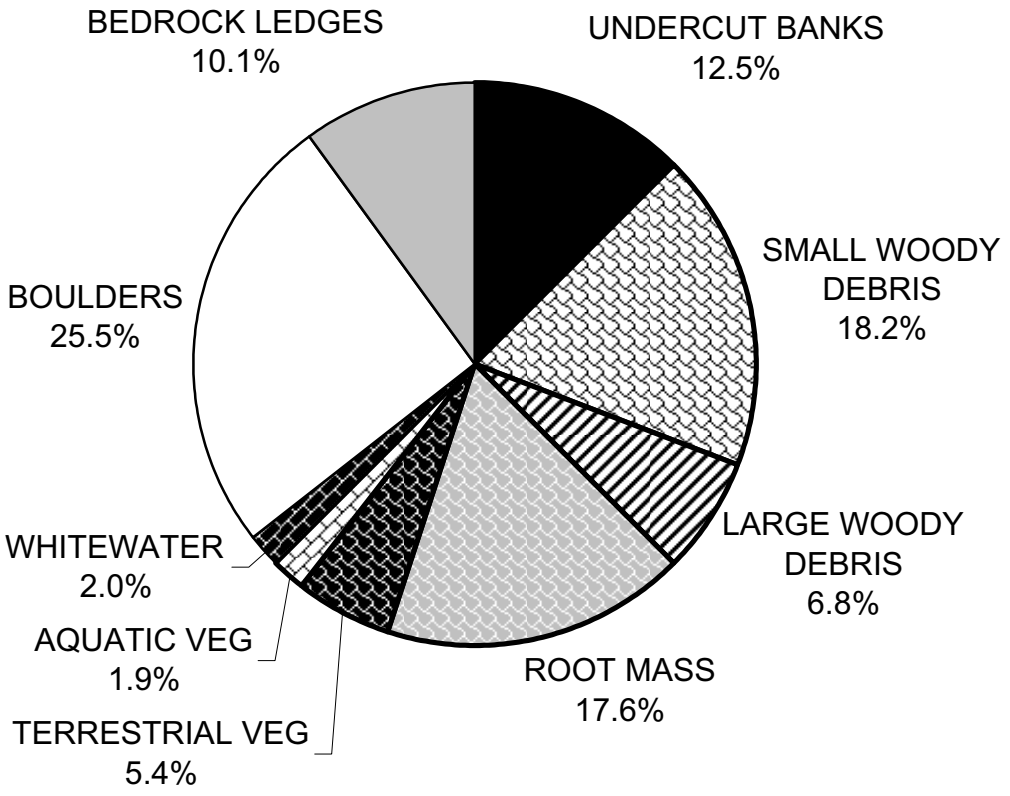
GRAPH 5

SPROUL CREEK 2004
PERCENT EMBEDDEDNESS



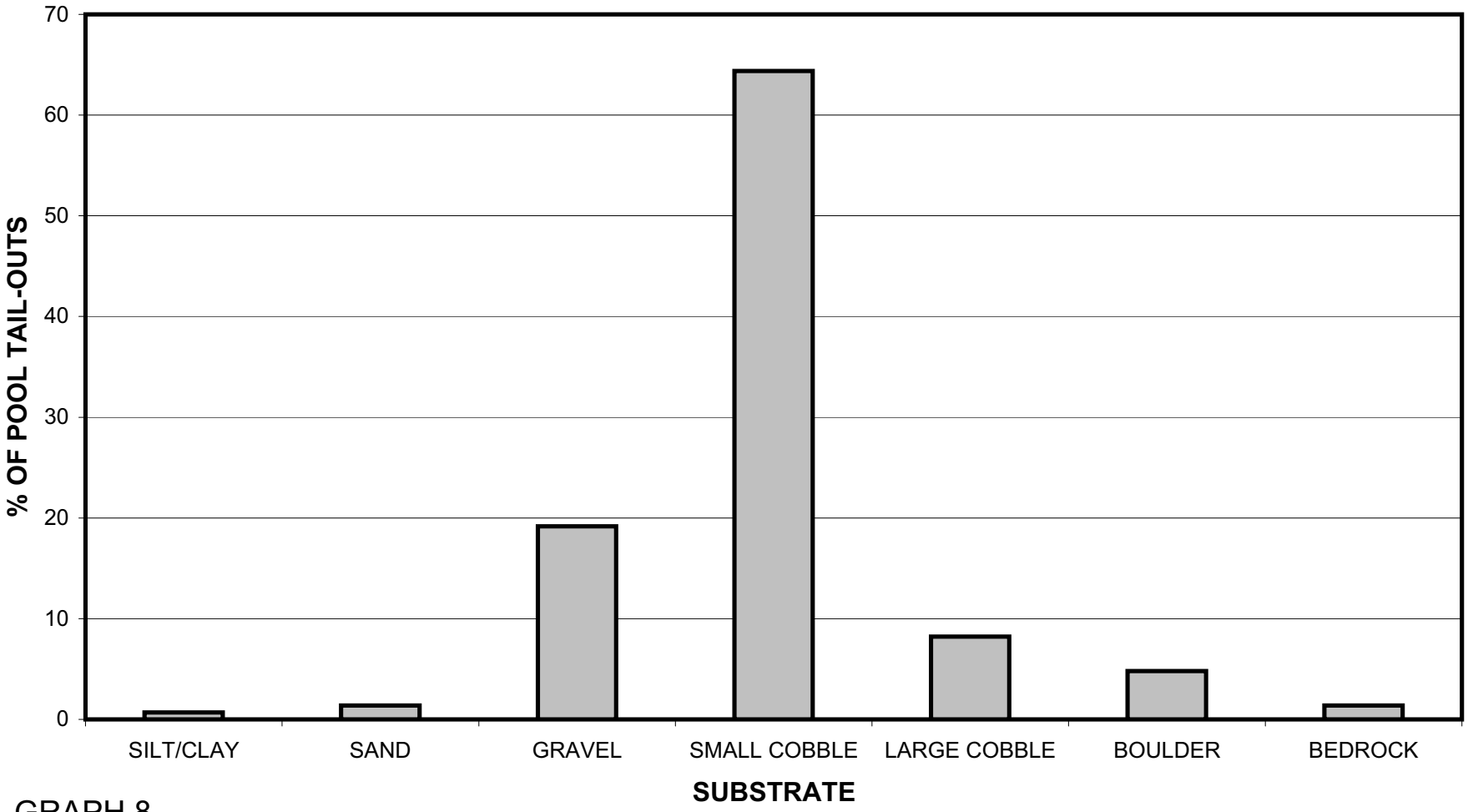
GRAPH 6

SPROUL CREEK 2004
MEAN PERCENT COVER TYPES IN POOLS



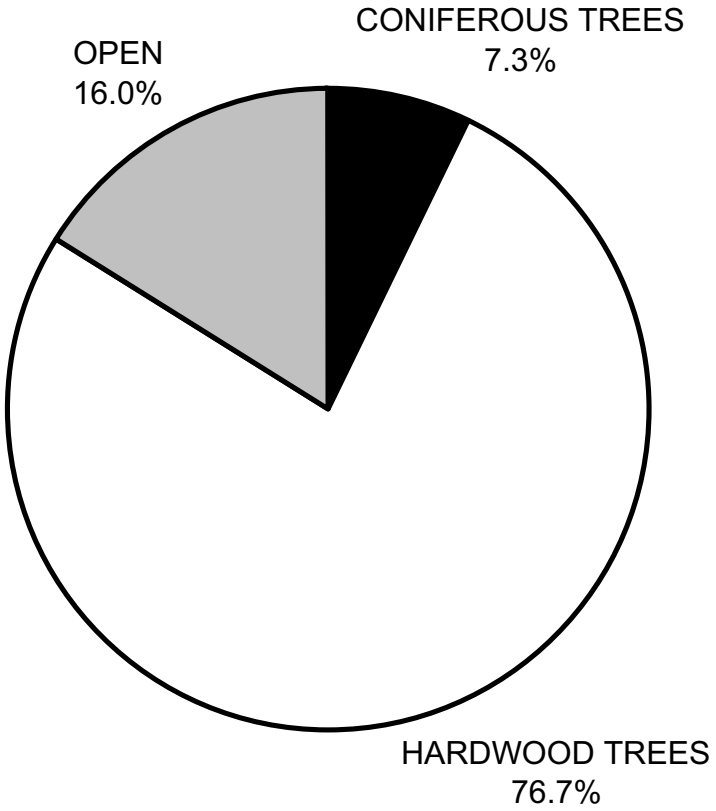
GRAPH 7

SPROUL CREEK 2004
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



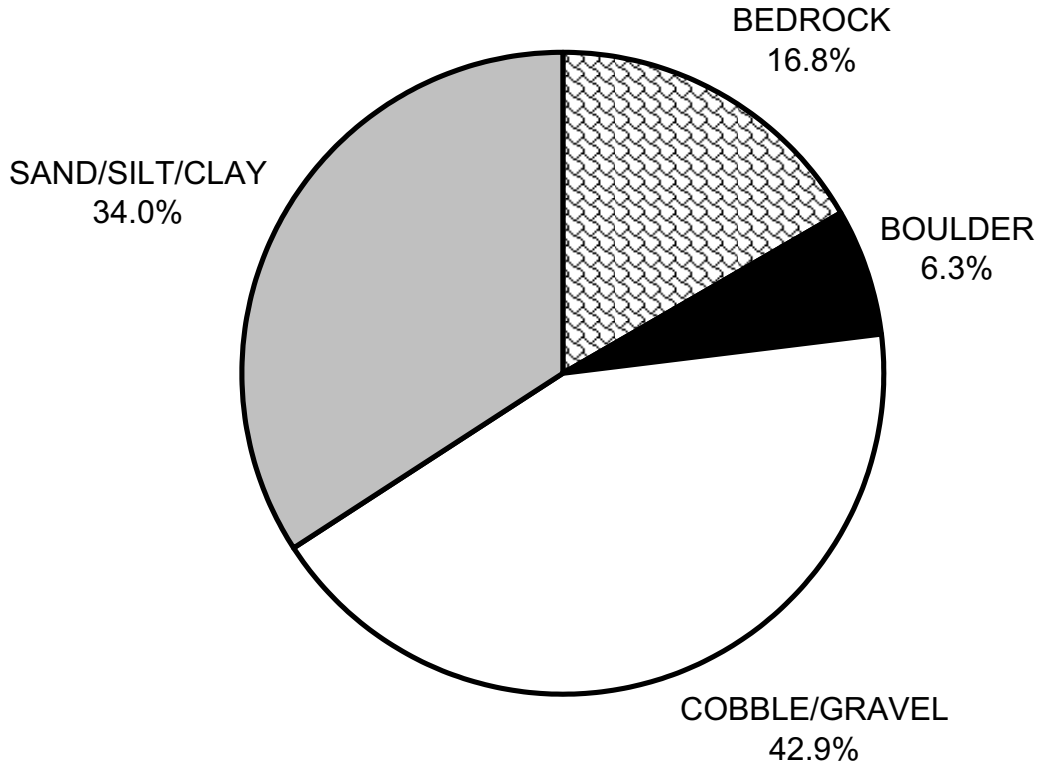
GRAPH 8

SPROUL CREEK 2004
MEAN PERCENT CANOPY



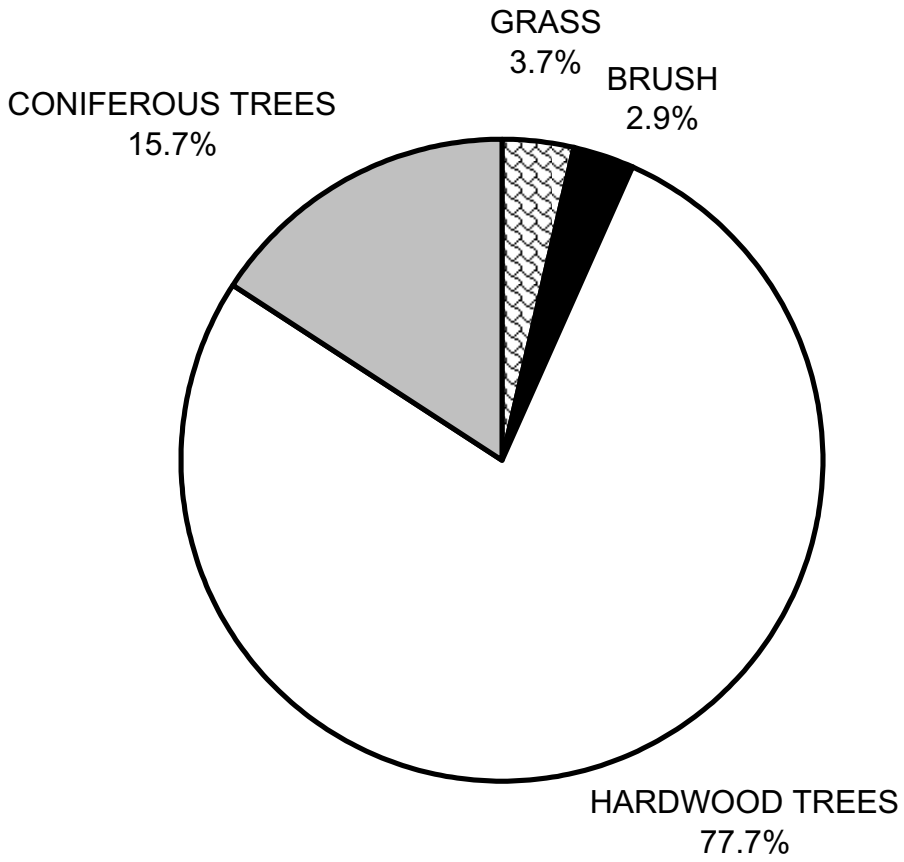
GRAPH 9

SPROUL CREEK 2004
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

SPROUL CREEK 2004
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11