STREAM INVENTORY REPORT

Harper Creek

INTRODUCTION

A stream inventory was conducted during June 5, 2007 to July 11, 2007 on Harper Creek. The survey began at the confluence with Bull Creek and extended upstream 0.9 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Harper Creek.

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

Harper Creek is a tributary to Bull Creek, tributary to South Fork Eel River, tributary to Eel River which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Harper Creek's legal description at the confluence with Bull Creek is T1S R2E S29. Its location is 40.3505 north latitude and 123.9868 west longitude, LLID number 1239857403506. Harper Creek is a first order stream and has approximately 1.8 miles of blue line stream according to the USGS Weott 7.5 minute quadrangle. Harper Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 274 feet at the mouth of the creek to 1,300 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily owned by California State Parks and is managed for recreation. Vehicle access exists via Highway 101 near Honeydew; take the Mattole Road west approximately 4.5 miles until you get to a bridge over Harper Creek.

METHODS

The habitat inventory conducted in Harper 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.

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 Harper 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". Harper 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 Harper 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 Harper 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 Harper 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 Harper 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 Harper Creek. Detailed biological sampling was not conducted on Harper Creek during the 2007 survey. Stream bank observation 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

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

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- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of June 5, 2007 to July 11, 2007, was conducted by I. Mikus and S. McSmith (DFG). The total length of the stream surveyed was 4,680 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.47 cfs on June 19, 2007.

Harper Creek is a G3 channel type for 1,494 feet of the stream surveyed (Reach 1) and an A2 channel type for 3,186 feet of the stream surveyed (Reach 2).

G3 channels are entrenched "gully" step-pool channels on moderate gradients with low width to depth ratios and cobble-dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 56 degrees Fahrenheit. Air temperatures ranged from 54 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% riffle units, 38% pool units, 22% flatwater units, 1% culvert units, and 1% no survey units (Graph 1). Based on total length of Level II habitat types there were 50% riffle units, 29% flatwater units, 20% pool units, and 1% culvert units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 28% high gradient riffle units, 18% mid-channel pool units, and 15% plunge pool units (Graph 3). Based on percent total length high gradient riffle units made up 39%, step run units 20%, mid-channel pool units 11%, and low gradient riffle units 11%.

A total of 67 pools were identified (Table 3). Main channel pools were the most frequently encountered at 52% and comprised 58% 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. Seven of the 67 pools (10%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 67 pool tail-outs measured, 13 had a value of 1 (19.4%); 13 had a value of 2 (19.4%); 11 had a value of 3 (16.4%); 14 had a value of 4 (20.9%); 16 had a value of 5 (23.9%) (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 9, flatwater habitat types had a mean shelter rating of 9, and pool habitats had a mean shelter rating of 34 (Table 1). Of the pool types, the scour pools had a mean shelter rating of 45 and main channel pools had a mean shelter rating of 25 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Harper Creek. Graph 7 describes the pool cover in Harper Creek. Boulders are the dominant pool cover type followed by undercut banks.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Boulders were observed in 33% of pool tail-outs and gravel was observed in 31% of pool tail-outs.

The mean percent canopy density for the surveyed length of Harper Creek was 90%. Ten percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 32% and 68% respectively. Graph 9 describes the mean percent canopy in Harper Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 97%. The mean percent left bank vegetated was 97%. The dominant elements composing the structure of the stream banks consisted of 67% sand/silt/clay, 23% cobble/gravel, 10% boulder, and 1% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 36% of the units surveyed. Additionally, 32% of the units surveyed had deciduous trees as the dominant vegetation type, 28% had brush as the dominant vegetation, and 5% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Salmonids were observed from stream banks up to 4,017 from the confluence with Bull Creek during the 2007 stream survey on Harper Creek.

DISCUSSION

Harper Creek is a G3 channel type for the first 1,494 feet of stream surveyed and an A2 channel type for the remaining 3,186 feet. The suitability of G3 and A2 channel types for fish habitat improvement structures is as follows: G3 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover. A2 channel types are generally not suitable for improvement structures due to their high stream energy and stable stream banks which have poor gravel retention capabilities.

The water temperatures recorded on the survey days June 5, 2007 to July 11, 2007, ranged from 52 to 56 degrees Fahrenheit. Air temperatures ranged from 54 to 64 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 29% of the total length of this survey, riffles 50%, and pools 20%. The pools are relatively shallow, with only 7 of the 67 (10%) pools having 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.

Twenty-six of the 67 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-five of the pool tail-outs had embeddedness ratings of 3 or 4. Sixteen 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-five of the 67 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 34. The shelter rating in the flatwater habitats was 9. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Harper Creek. Boulders are the dominant cover type in pools followed by undercut banks. 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 90%. Reach 1 had a canopy density of 87.0% and Reach 2 had a canopy density of 91.4%. 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 97% and 97%, 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) Harper Creek should be managed as an anadromous, natural production stream.

2) Culvert #1 is the Mattole Road crossing. It was a twin box, concrete culvert, each box had the same dimensions of 10' high, 10' wide and 25' long. The plunge height was 1.7' and the max depth within 5' of the outlet was 1.2'. Its slope was 0.5% and it was in good condition. It is a possible barrier to juvenile salmonids. The right bank culvert was partially clogged with boulders and cobbles. A fish passage assessment should be conducted on this culvert.

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) 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 Bull Creek. Reach 1 of this survey was a G3. The first 75' of this stream had a 9% slope. Log debris accumulation (LDA) #01 is at the bottom of this unit. It was 7' high x 52' wide x 11' long, and it had 10 pieces of large woody debris (LWD). Water was flowing through it and there were visible gaps. No sediment was being retained.
93	0003.00	Bridge #01 crossed this unit. It was a wood footbridge measuring 5.5' wide, 13' high and 37' long.
333	0010.00	Culvert #01 is the Mattole Road crossing. It was a twin box, concrete culvert, each box had the same dimensions of 10' high, 10' wide and 25' long. The plunge height was 1.7' and the max depth within 5' of the outlet was 1.2'. Its slope was 0.5% and it was in good condition. It is a possible barrier to juvenile salmonids. The right bank culvert was partially clogged with boulders and cobbles. A fish passage assessment should be conducted on this culvert.
358	0011.00	The right bank was made up of concrete. There was a boulder plunge of 1.3'.
377	0013.00	This unit is roughly the end of Bull Creek's influence. There was a 1.8' boulder plunge.
422	0015.00	Young-of-the-year (YOY) salmonids were observed in this unit.
583	0020.00	There was a horse/hiking trail crossing the creek at the top of this unit.
623	0021.00	The right bank was steep and bare and the left bank had a hiking trail.

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758	0026.00	A left bank tributary entered at this unit. The tributary was not flowing but there was water which had a temperature of 52 degrees Fahrenheit. The temperature of Harper Creek downstream and upstream of the tributary was 53 degrees Fahrenheit. The tributary was accessible to fish, but it had a high slope of 10% and no fish were observed in the first 100'.
808	0028.00	There was a 1.6' log plunge.
1300	0044.00	YOY were observed in this unit.
1479	0050.00	There was a boulder plunge of 1.6'.
1533	0052.00	There was a boulder plunge of 1.9'.
1569	0054.00	There was a plunge a height of 0.4'.
1594	0056.00	There was a 1.6' plunge off of boulders.
1626	0058.00	There was a slide on the left bank that was ~ 40' long, and 30' high and was contributing fine sediment.
1818	0065.00	There was a left bank slide, it extended through habitat unit #68. The slide was ~ 60' long and 35' high, gravel and silt being contributed, a seep was at the upstream end of the slide. There was also a 3.6' boulder plunge.
1856	0068.00	There was a boulder plunge of 1.7'.
1971	0074.00	There was a 1.6' boulder plunge.
2118	0080.00	There was a 1.0' boulder plunge.
2242	0085.00	LDA #02 was 5.2' high x 17' wide x 7' long. The LDA contained 6 pieces of LWD, water was flowing through, and there were visible gaps. Sediment was being retained in the dimensions of ~ 5' wide, 10' long and 1.5' deep. The size of the sediment ranged from silt to small cobble. There were fish seen above the LDA.
2368	0090.00	There was a 1.4' boulder plunge.
2389	0092.00	There was a 5" salmonid observed.
2552	0097.00	There was a 1.6' boulder plunge.
2608	0100.00	There was a bare bank on the left bank that was 20' high x 75' long, it extended into the next habitat unit (#101).

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2761	0104.00	LDA #03 was 7.5' high x 29' wide x 4' long; the LDA was composed of one log. Water was flowing through, but there were no visible gaps. Sediment was being retained in the dimensions of 20' wide x 100' long x 4' deep, and it ranged in size from silt to large cobble. There were fish seen above the LDA. The water hits the LDA log and goes subsurface under the log. There were ~ 35 year old redwoods growing out of the LDA log. There was a 6' plunge due to the LDA.
3121	0119.00	There was a slide on the left bank that measured ~ 50' long x 35' high. Approximately 15' of the length was completely bare and actively sliding.
3151	0121.00	LDA #04 was 6' high x 22' wide x 6' long and included 5 pieces of LWD. Water was flowing through, but there were no visible gaps. There was sediment retained measuring ~ 10' wide x 25' long x 3' deep, the sediment ranged in size from silt to boulders. Fish were seen above the LDA. The tail-out consisted of large cobble on top of redwood burl.
3204	0123.00	There was a 1' log plunge.
3432	0132.00	A YOY salmonid was observed.
3515	0135.00	There was a 5’ log plunge at the top of this unit.
3557	0138.00	There was a dry, steep intermittent tributary entering at this unit. It was causing erosion of sediment ranging in size from fines to gravel.
3708	0139.00	There was a log pile-up on this unit that did not quite qualify as an LDA. Old growth redwoods were spanning ~50' of dry channel, but the wetted channel finds a wood free gap of ~6' on the right bank, water plunges ~3' into a small pool.
3941	0147.00	Tributary #02 entered at this unit. It was flowing at an estimated 0.2 cfs, it was contributing to ~35% of Harper Creek's flow. The tributary's temperature was 55 degrees Fahrenheit which was the same as Harper Creek’s temperature downstream and upstream of the tributary. It was accessible to fish but there was a possible adult and juvenile barrier ~250’ upstream from the mouth. The slope of the tributary was 8%, and no fish were observed in it.
4017	0148.00	There was a 2.2' log plunge.
4346	0158.00	There was a boulder plunge of 1.9'.
4385	0162.00	There was a 2.2' boulder plunge.
4430	0164.00	There was a right bank slide measuring approximately 40' long x 30' wide.

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4487	0167.00	There was a log plunge of 2.8' at the top of this unit.
4504	0169.00	There was a 4.2' boulder plunge.
4547	0171.00	There was a 3.8' log plunge at the top of this unit.
4561	0172.00	There was a right bank slide that was approximately 25' high x 15' long.
4660	0175.00	There was a 6' plunge at the top of this unit.
4680	0176.00	The survey ended due to a high likelihood of the end of anadromy. The possible end of anadromy was a boulder and log LDA with a 6' waterfall causing a blockage of fish passage. Above the LDA the creek's slope was >35% for >200', with many >3' waterfalls with no jump pools. No fish were seen for last 20 units.

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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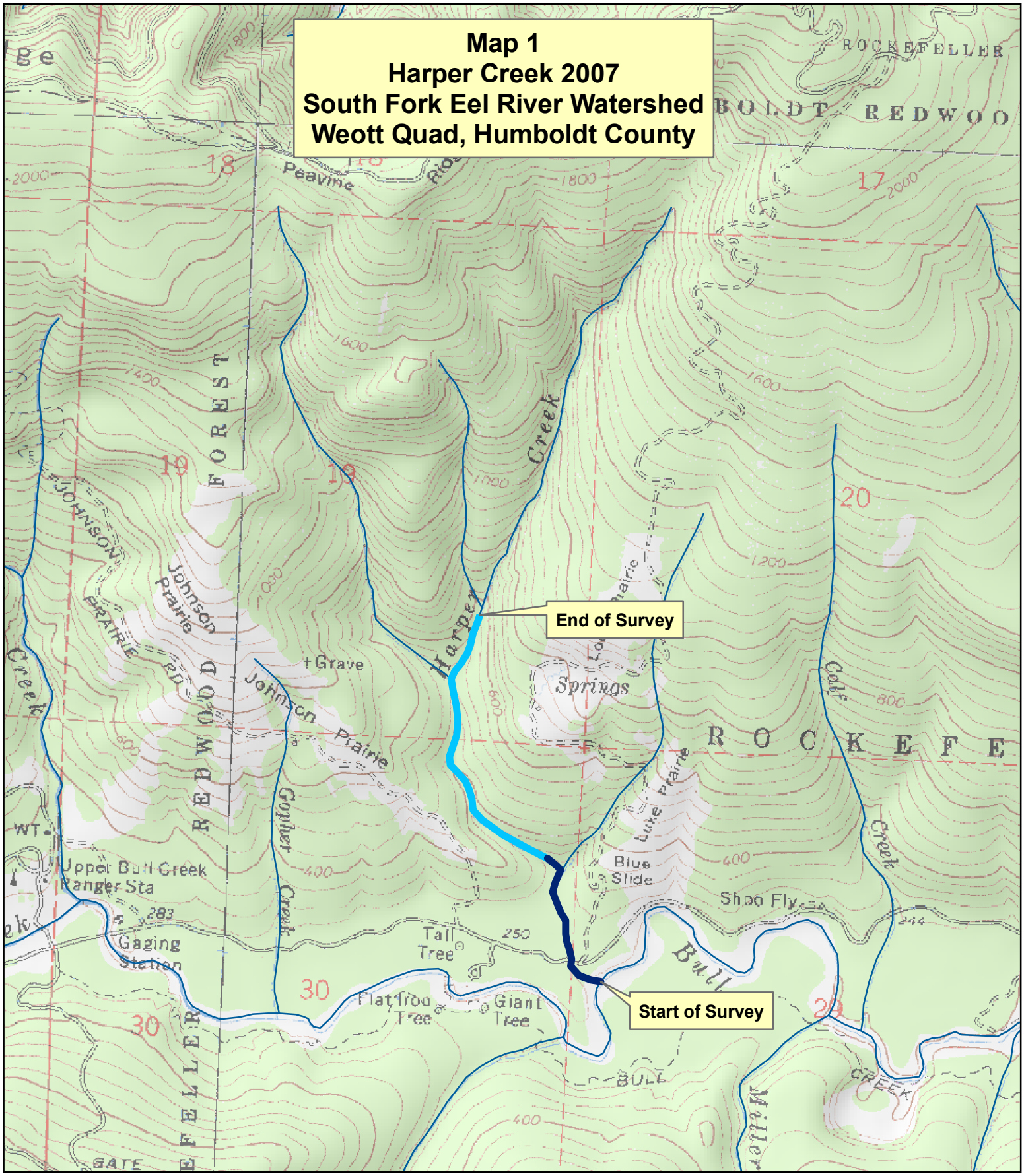
LEVEL III and LEVEL IV HABITAT TYPES

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
Harper Creek 2007
South Fork Eel River Watershed
Weott Quad, Humboldt County
End of Survey
Start of Survey
Harper Creek
Johnson Prairie
Upper Bull Creek Ranger Sta
Gaging Station
Tall Tree
Flat Iron Tree
Giant Tree
Blue Slide
Shoo Fly
Bull Creek
Rockefeller Forest
Redwood
Legend
Reach 1, G3 Channel Type
Reach 2, A2 Channel Type
0
750
1,500
3,000 Feet
N
S
E
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RESOURCES AGENCY
CALIFORNIA
DEPARTMENT FISH & GAME

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

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0

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
1	0	CULVERT	0.6	25	25	0.5									
38	7	FLATWATER	21.6	36	1366	29.2	7.0	0.5	0.8	208	7895	108	4105		9
1	0	NOSURVEY	0.6	12	12	0.3									
67	67	POOL	38.1	14	945	20.2	10.0	0.6	1.3	136	9108	126	8431	83	34
69	9	RIFFLE	39.2	34	2332	49.8	8.2	0.4	0.8	206	14180	84	5801		9

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
176	83	4680	31182	18337

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

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 (%)
20	3	LGR	11.4	25	498	10.6	10	0.3	1	221	4427	72	1446		5	92
49	6	HGR	27.8	37	1834	39.2	7	0.4	1.2	198	9682	90	4408		11	89
18	5	RUN	10.2	24	423	9.0	7	0.5	0.9	172	3098	88	1591		5	89
20	2	SRN	11.4	47	943	20.1	8	0.6	0.9	297	5938	157	3144		18	85
32	32	MCP	18.2	16	507	10.8	9	0.5	2	136	4360	118	3773	72	25	91
3	3	STP	1.7	14	43	0.9	8	0.4	1.2	115	346	88	264	51	17	93
1	1	CRP	0.6	13	13	0.3	7	0.2	0.9	91	91	73	73	18	20	98
4	4	LSBo	2.3	12	48	1.0	9	0.1	1.1	96	383	58	231	17	30	91
27	27	PLP	15.3	12	334	7.1	12	0.7	3.1	145	3928	151	4090	110	48	89
1	0	CUL	0.6	25	25	0.5										
1	0	NS	0.6	12	12	0.3										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
176	83	4680	32252	19019

Table 3 - Summary of Pool Types

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

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
35	35	MAIN	52	16	550	58	8.6	0.5	134	4706	70	2457	25
32	32	SCOUR	48	12	395	42	11.5	0.7	138	4402	98	3033	45

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
67	67	945	9108	5490

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

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

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
32	MCP	48	11	34	19	59	2	6	0	0	0	0
3	STP	4	2	67	1	33	0	0	0	0	0	0
1	CRP	1	1	100	0	0	0	0	0	0	0	0
4	LSBo	6	3	75	1	25	0	0	0	0	0	0
27	PLP	40	3	11	19	70	4	15	1	4	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
67	20	30	40	60	6	9	1	1	0	0

Mean Maximum Residual Pool Depth (ft.): 1.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007 Dry Units: 0

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

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
20	3	LGR	0	0	0	0	0	0	50	50	0
49	6	HGR	6	0	16	7	0	0	9	62	0
69	9	TOTAL RIFFLE	4	0	11	5	0	0	21	59	0
18	5	RUN	50	0	24	0	0	0	0	26	0
20	2	SRN	43	45	0	0	0	0	0	13	0
38	7	TOTAL FLAT	48	15	16	0	0	0	0	22	0
32	32	MCP	19	14	11	3	0	0	4	49	0
3	3	STP	0	0	0	0	0	0	7	93	0
1	1	CRP	95	0	0	0	0	0	0	5	0
4	4	LSBo	44	0	0	1	0	0	0	55	0
27	27	PLP	19	2	14	2	0	0	26	37	0
67	67	TOTAL POOL	21	7	11	2	0	0	13	46	0
1	0	CUL									
1	0	NS									
176	83	TOTAL	21	7	11	2	0	0	13	45	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007 Dry Units: 0

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

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
20	3	LGR	0	0	33	33	33	0	0
49	6	HGR	0	0	0	0	83	17	0
18	5	RUN	0	0	20	40	40	0	0
20	2	SRN	0	0	50	0	50	0	0
32	32	MCP	6	0	47	3	19	25	0
3	3	STP	0	0	33	0	33	33	0
1	1	CRP	0	0	0	0	0	100	0
4	4	LSBo	0	0	25	0	50	25	0
27	27	PLP	0	4	41	0	11	44	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
90	68	32	0	97	97

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: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007 Survey Length (ft.): 4680 Main Channel (ft.): 4680 Side Channel (ft.): 0

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: G3
Reach Length (ft.): 1494
Riffle/Flatwater Mean Width (ft.): 8.2
BFW:
Range (ft.): 11 to 16
Mean (ft.): 14
Std. Dev.: 2
Base Flow (cfs.): 0.5
Water (F): 53 - 53 Air (F): 56 - 60
Dry Channel (ft): 0

Canopy Density (%): 87.0
Coniferous Component (%): 60.2
Hardwood Component (%): 39.8
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 94.2
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 5
LWD per 100 ft.:
Riffles: 1
Pools: 5
Flat: 1

Pools by Stream Length (%): 16.4
Pool Frequency (%): 32.0
Residual Pool Depth (%):
< 2 Feet Deep: 100
2 to 2.9 Feet Deep: 0
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.0
Mean Pool Shelter Rating: 22

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 0 Sm Cobble: 38 Lg Cobble: 25 Boulder: 38 Bedrock: 0
Embeddedness Values (%): 1. 18.8 2. 31.3 3. 31.3 4. 6.3 5. 12.5

STREAM REACH: 2

Channel Type: A2
Reach Length (ft.): 3186
Riffle/Flatwater Mean Width (ft.): 7.5
BFW:
Range (ft.): 11 to 17
Mean (ft.): 15
Std. Dev.: 2
Base Flow (cfs.): 0.5
Water (F): 52 - 56 Air (F): 54 - 64
Dry Channel (ft): 0

Canopy Density (%): 91.4
Coniferous Component (%): 70.2
Hardwood Component (%): 29.8
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 97.8
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 12
LWD per 100 ft.:
Riffles: 5
Pools: 9
Flat: 2

Pools by Stream Length (%): 22.0
Pool Frequency (%): 40.5
Residual Pool Depth (%):
< 2 Feet Deep: 86
2 to 2.9 Feet Deep: 12
3 to 3.9 Feet Deep: 2
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.4
Mean Pool Shelter Rating: 38

Pool Tail Substrate (%): Silt/Clay: 2 Sand: 0 Gravel: 41 Sm Cobble: 10 Lg Cobble: 16 Boulder: 31 Bedrock: 0
Embeddedness Values (%): 1. 19.6 2. 15.7 3. 11.8 4. 25.5 5. 27.5

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

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	1	0	0.6
Boulder	7	9	9.8
Cobble / Gravel	18	20	23.2
Sand / Silt / Clay	56	54	67.1

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	4	4.9
Brush	19	27	28.0
Hardwood Trees	29	23	31.7
Coniferous Trees	30	29	36.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

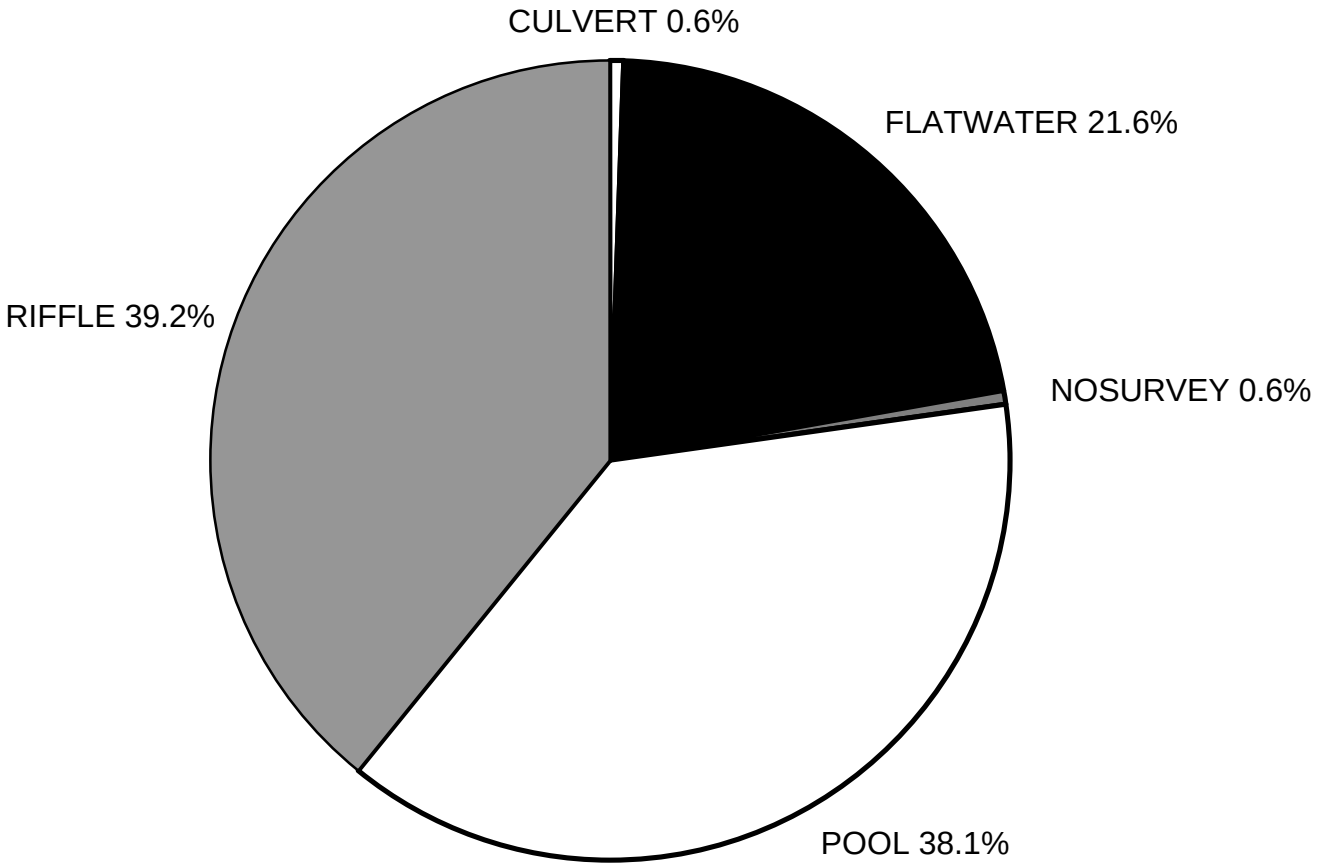
StreamName: Harper Creek LLID: 1239857403506 Drainage: Eel River - South Fork

Survey Dates: 6/5/2007 to 7/11/2007

Confluence Location: Quad: WEOTT Legal Description: T01SR02ES29 Latitude: 40:21:02.0N Longitude: 123:59:09.0W

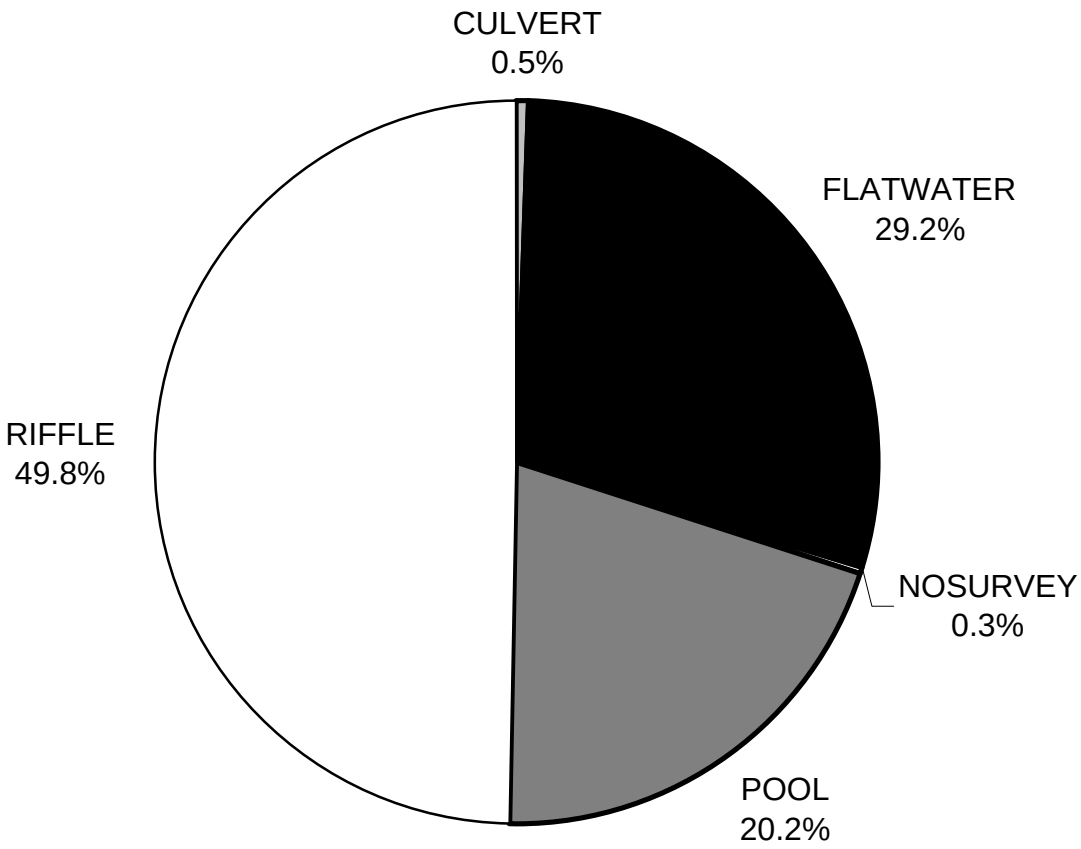
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	4	48	21
SMALL WOODY DEBRIS (%)	0	15	7
LARGE WOODY DEBRIS (%)	11	16	11
ROOT MASS (%)	5	0	2
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	21	0	13
BOULDERS (%)	59	22	46
BEDROCK LEDGES (%)	0	0	0

HARPER CREEK 2007
HABITAT TYPES BY PERCENT OCCURRENCE



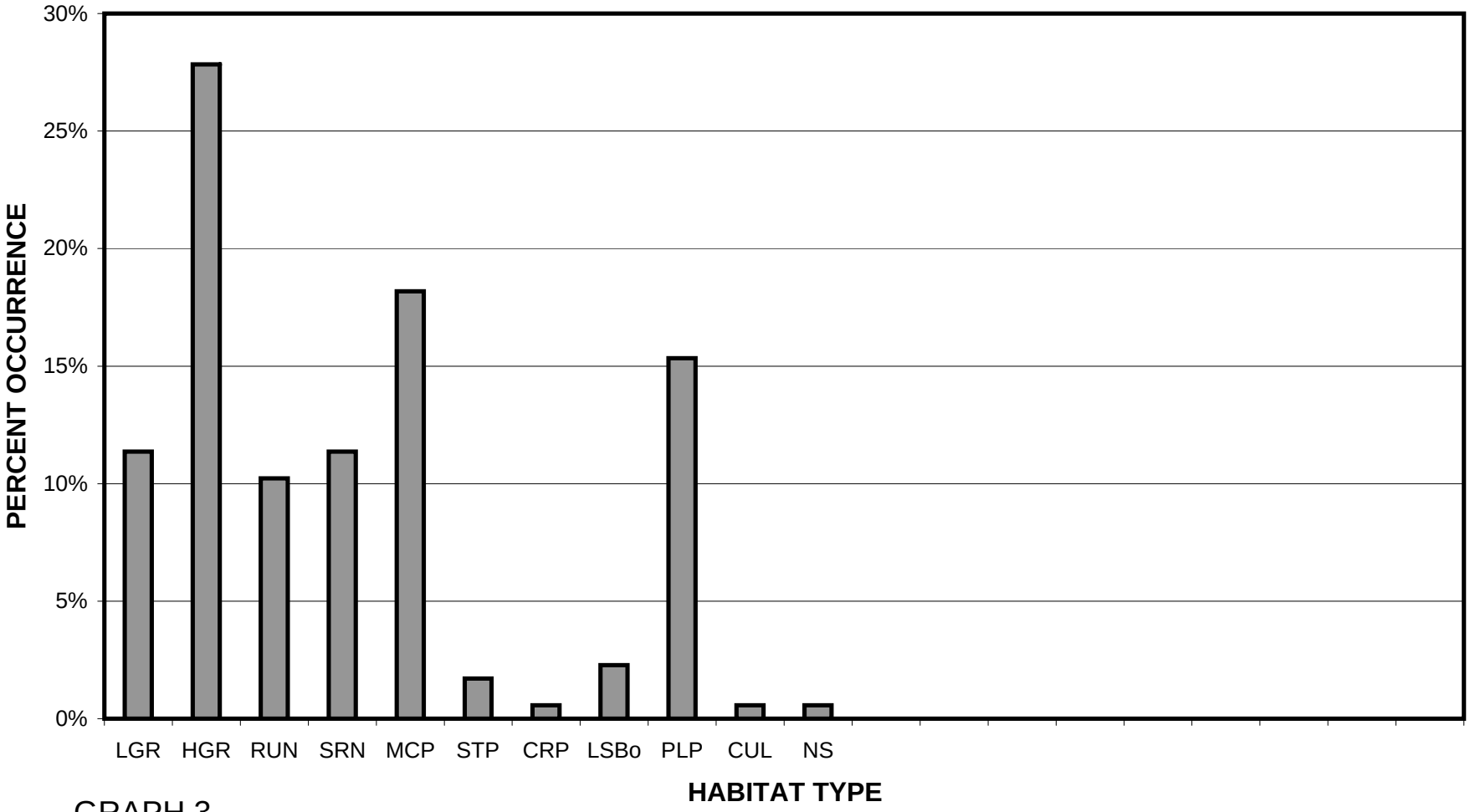
GRAPH 1

HARPER CREEK 2007
HABITAT TYPES BY PERCENT TOTAL LENGTH



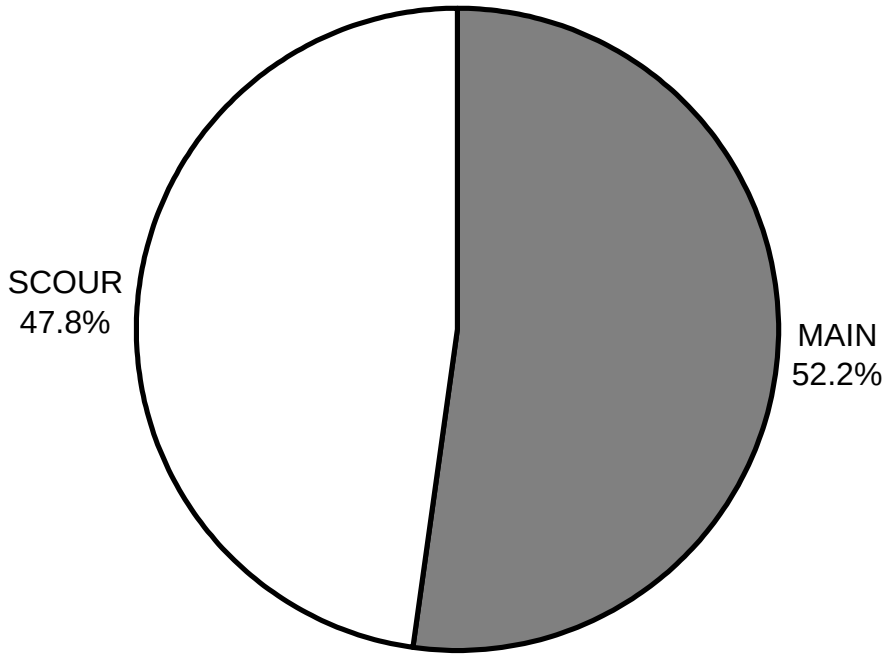
GRAPH 2

HARPER CREEK 2007
HABITAT TYPES BY PERCENT OCCURRENCE



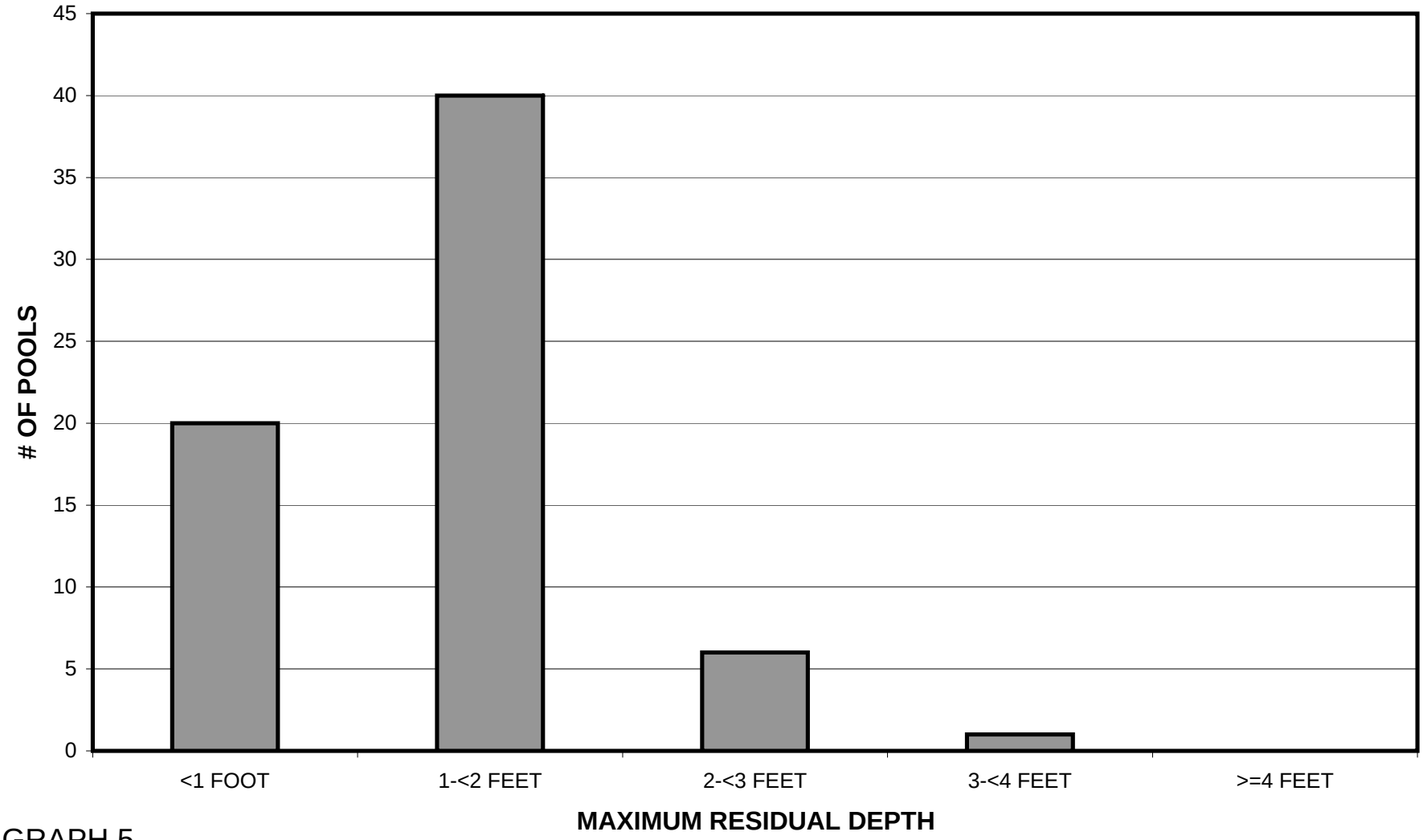
GRAPH 3

HARPER CREEK 2007
POOL TYPES BY PERCENT OCCURRENCE



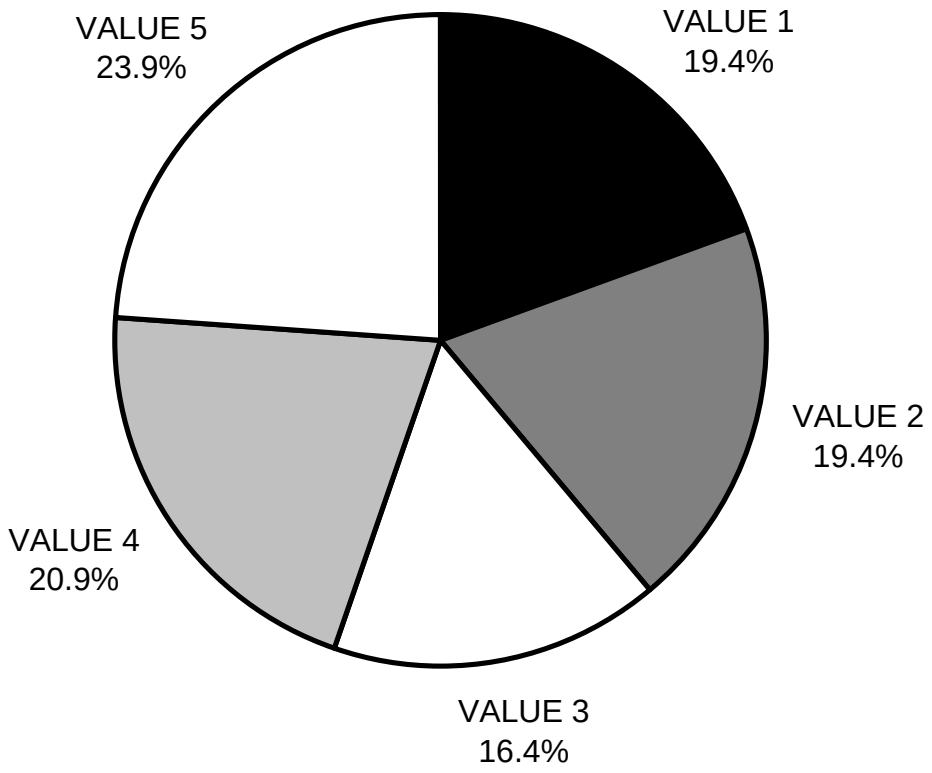
GRAPH 4

HARPER CREEK 2007
MAXIMUM DEPTH IN POOLS



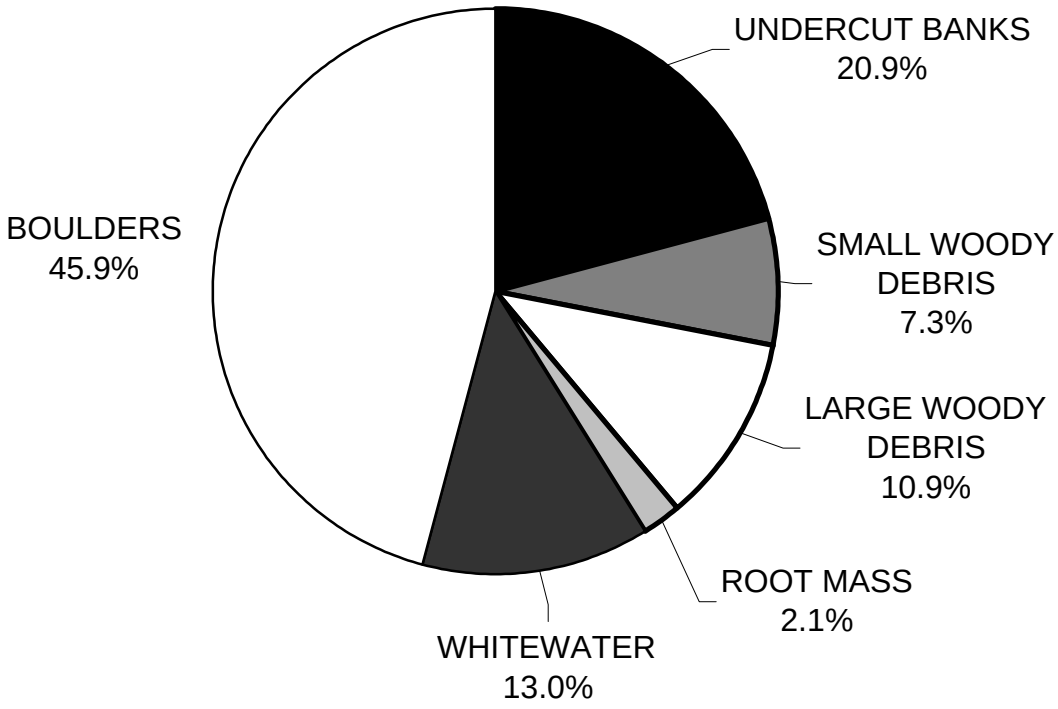
GRAPH 5

HARPER CREEK 2007
PERCENT EMBEDDEDNESS



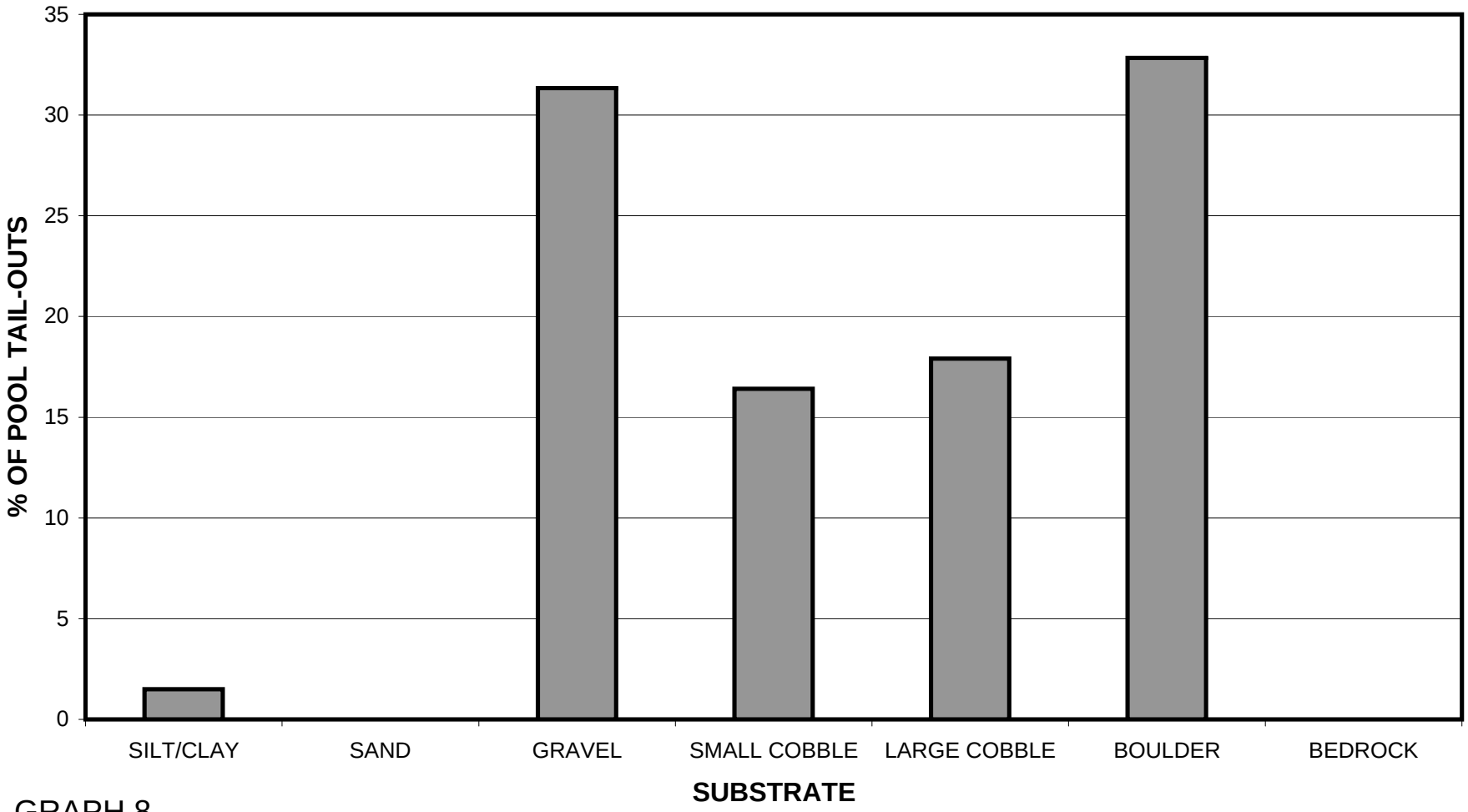
GRAPH 6

HARPER CREEK 2007
MEAN PERCENT COVER TYPES IN POOLS



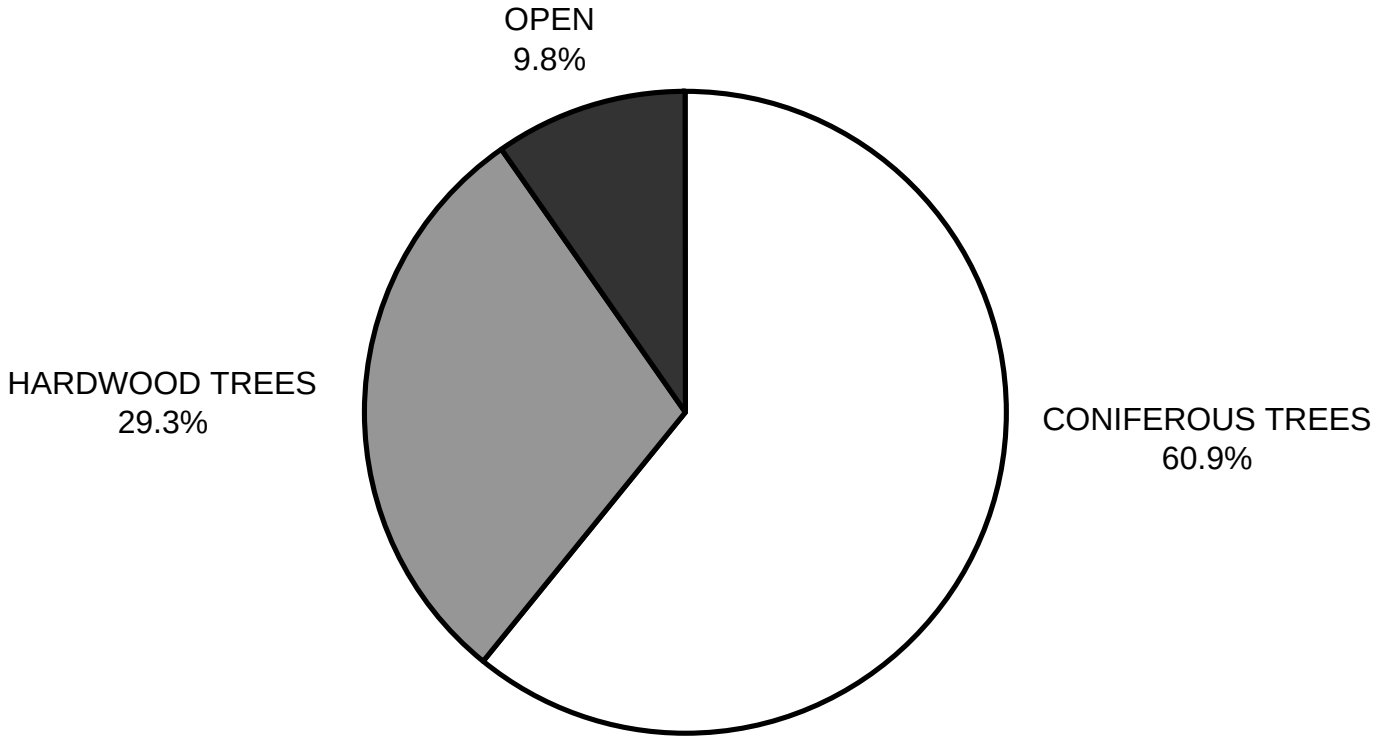
GRAPH 7

HARPER CREEK 2007
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



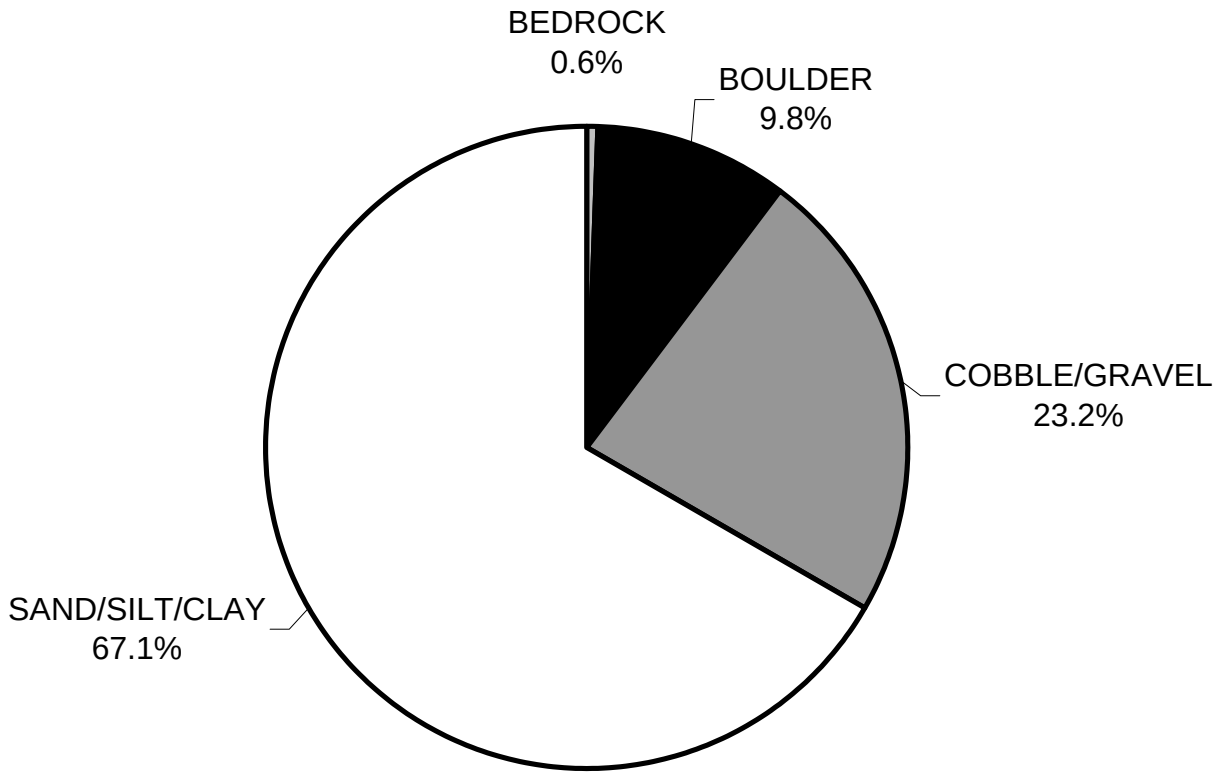
GRAPH 8

HARPER CREEK 2007
MEAN PERCENT CANOPY



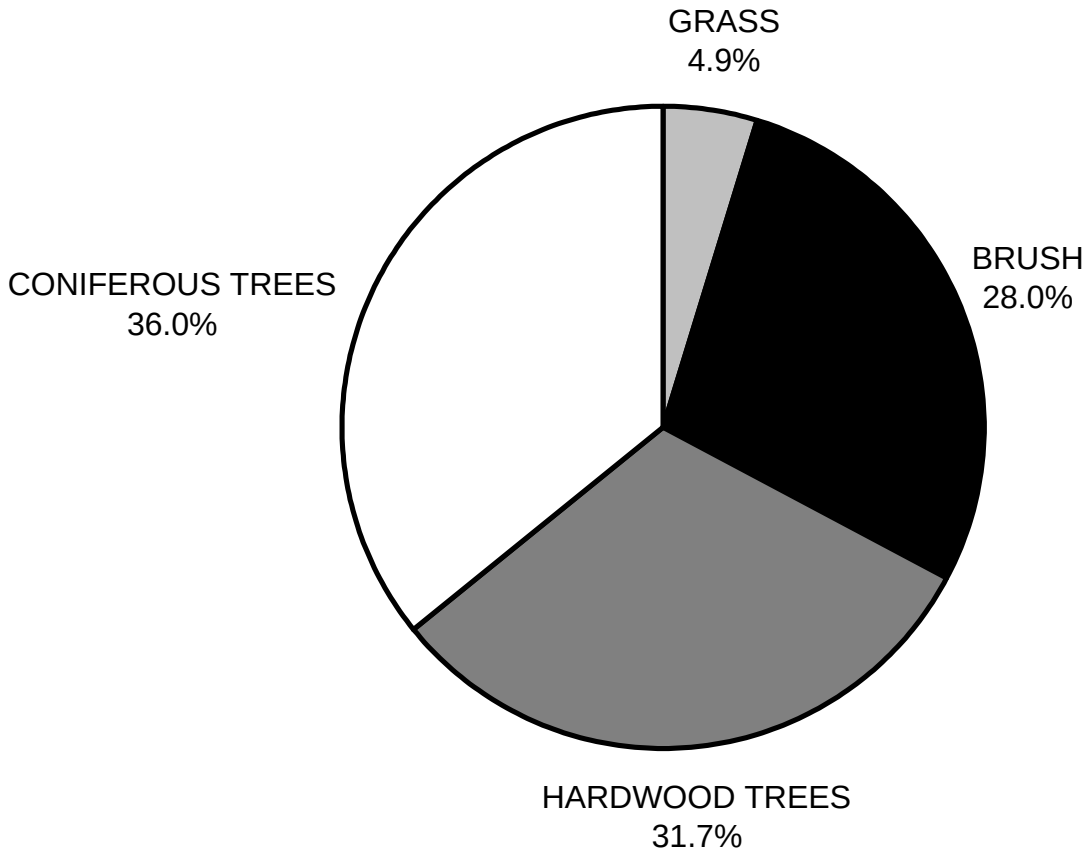
GRAPH 9

HARPER CREEK 2007
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

HARPER CREEK 2007
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11