

STREAM INVENTORY REPORT

Bear Haven Creek

INTRODUCTION

A stream inventory was conducted from September 10 to October 2, 2012 on Bear Haven Creek. The survey began at the confluence with Middle Fork Ten Mile River and extended upstream 5.5 miles. A stream inventory and report was also completed for one tributary to Bear Haven Creek.

The Bear Haven 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 Bear Haven 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 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

Bear Haven Creek is a tributary to Middle Fork Ten Mile River, tributary to Ten Mile River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Bear Haven Creek's legal description at the confluence with Middle Fork Ten Mile River is T20N R16W S31. Its location is 39.5563 degrees north latitude and 123.6808 degrees west longitude, LLID number 1236794395562. Bear Haven Creek is a second order stream and has approximately 3.8 miles of blue line stream according to the USGS Dutchmans Knoll 7.5 minute quadrangle. Bear Haven Creek drains a watershed of approximately 6.6 square miles. Elevations range from about 110 feet at the mouth of the creek to 900 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Georgia-Pacific Industrial Road north of Fort Bragg.

METHODS

The habitat inventory conducted in Bear Haven Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by the CDFW. 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

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

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5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Bear Haven 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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is classified according to a list of nine cover types. In Bear Haven 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. The shelter rating is then calculated for each fully-described habitat unit by multiplying shelter value and percent 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Bear Haven 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 Bear Haven Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

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10. Large Woody Debris Count:

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

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Bear Haven Creek. In addition, underwater observations were made at 12 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 Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for Bear Haven 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 September 10 to October 2, 2012 was conducted by R. Spencer, A. Garcia, and B. Leonard (CDFW). The total length of the stream surveyed was 28,996 feet with an additional 183 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 1.44 cfs on September 27, 2012.

Bear Haven Creek is an F4 channel type for 8,177 feet of the stream surveyed (Reach 1), a C4 channel type for 2,270 feet of the stream surveyed (Reach 2), a B2 channel type for 943 feet of the stream surveyed (Reach 3), an F4 channel type for 13,732 feet of the stream surveyed (Reach 4), and a G4 channel type for 4,057 feet of the stream surveyed (Reach 5). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. C4 channels are meandering point-bar, riffle/pool, alluvial channels with broad well defined floodplain on low gradients and gravel-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and boulder-dominant substrates. G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 55 degrees Fahrenheit. Air temperatures ranged from 51 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 41% pool units, 34% flatwater units, 23% riffle units, 2% dry units, and 1% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 45%

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flatwater units, 38% pool units, 14% riffle units, 2% dry units, and 1% unsurveyed units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 38%; step run units, 23%; and low gradient riffle units, 19% (Graph 3). Based on percent total length, step run units made up 38%, mid-channel pool units 36%, and low gradient riffle units 11%.

A total of 256 pools were identified (Table 3). Main channel pools were the most frequently encountered at 98% (Graph 4), and comprised 99% 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. Ninety-seven of the 256 pools (38%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 256 pool tail-outs measured, 97 had a value of 1 (37.9%); 113 had a value of 2 (44.1%); 39 had a value of 3 (15.2%); five had a value of 4 (2%); two had a value of 5 (0.8%) (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 not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 1, flatwater habitat types had a mean shelter rating of 10, and pool habitats had a mean shelter rating of 50 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 52. Main channel pools had a mean shelter rating of 50 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Bear Haven Creek. Graph 7 describes the pool cover in Bear Haven Creek. Large woody debris is the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 73% of the pool tail-outs. Silt/clay was the next most frequently observed dominant substrate type and occurred in 18% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Bear Haven Creek was 97%. Three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 44% and 56%, respectively. Graph 9 describes the mean percent canopy in Bear Haven Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 51% sand/silt/clay, 41% cobble/gravel, 6% bedrock, and 2% boulders (Graph 10). Coniferous trees were the dominant vegetation type observed in 82% of the units

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surveyed. Additionally, 15% of the units surveyed had deciduous trees as the dominant vegetation type, and 3% had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 12 sites for species composition and distribution in Bear Haven Creek on October 15, 2012. The sites were sampled by I. Mikus and B. Leonard (CDFW).

In Reach 1, which comprised the first 8,177 feet of stream, two sites were sampled. The reach sites yielded three young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), and 23 YOY coho salmon.

In Reach 2, three sites were sampled starting approximately 8,775 from the confluence with Middle Fork Ten Mile River and continuing upstream 1,480 feet. The reach sites yielded 20 YOY SH/RT, two age 1+ SH/RT, 33 YOY coho salmon, and two 1+ coho salmon.

In Reach 3, three sites were sampled starting approximately 10,487 from the confluence with Middle Fork Ten Mile River and continuing upstream 787 feet. The reach sites yielded one YOY SH/RT, one age 1+ SH/RT, and 10 YOY coho salmon.

In Reach 4, four sites were sampled starting approximately 11,325 from the confluence with Middle Fork Ten Mile River and continuing upstream 827 feet. The reach sites yielded one age 1+ SH/RT.

The following chart displays the information yielded from these sites:

2012 Bear Haven Creek underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: F4 Channel Type									
10/15/12	1	005	Pool	140	0	0	0	9	0
	2	069	Pool	3,833	3	0	0	14	0
Reach 2: C4 Channel Type									
10/15/12	3	162	Pool	8,822	10	1	0	12	0
	4	179	Pool	10,084	6	0	0	10	0
	5	183	Pool	10,255	4	1	0	11	2
Reach 3: B2 Channel Type									
10/15/12	6	189	Pool	10,529	1	0	0	10	0

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	7	198	Pool	11,134	0	1	0	0	0
	8	204	Pool	11,274	0	0	0	0	0
Reach 4: F4 Channel Type									
10/15/12	9	206	Pool	11,363	0	0	0	0	0
	10	208	Pool	11,545	0	0	0	0	0
	11	212	Pool	11,745	0	0	0	0	0
	12	218	Pool	12,152	0	1	0	0	0

DISCUSSION

Bear Haven Creek is an F4 channel type for the first 8,177 feet of stream surveyed, a C4 channel type for the next 2,270 feet, a B2 channel type for the next 943 feet, an F4 channel type for the next 13,732 feet, and a G4 channel type for the remaining 4,057 feet. The suitability of F4, C4, B2, and G4 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. C4 channel types are good for bank placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. B2 channel types excellent for plunge weirs, single and opposing wing-deflectors, and log cover. G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days September 10 to October 2, 2012 ranged from 52 to 55 degrees Fahrenheit. Air temperatures ranged from 51 to 68 degrees Fahrenheit. This is a good water temperature range for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 45% of the total length of this survey, riffles 14%, and pools 38%. Ninety-seven of the 256 (38%) 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.

Two hundred ten of the 256 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. Two 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.

One hundred ninety-four of the 256 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

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The mean shelter rating for pools is 50. The shelter rating in the flatwater habitats is 10. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Bear Haven Creek. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 97%. Reach 1 had a canopy density of 98%, Reach 2 had a canopy density of 95%, Reach 3 had a canopy density of 98%, Reach 4 had a canopy density of 97%, and Reach 5 had a canopy density of 96%. The percentage of right and left bank covered with vegetation was 99% and 99%, respectively.

RECOMMENDATIONS

- 1) Bear Haven Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.
- 3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

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	Start of survey at the confluence with Middle Fork Ten Mile River. The channel is an F4.
48	0003.00	Road 10000 crosses the channel. The crossing is a 20' wide x 64' long x 16.2' high railcar bridge.
3763	0069.00	South Fork Bear Haven Creek (Tributary #01) enters on the left bank. It contributes approximately 25% to Bear Haven Creek's flow. The water temperature of the tributary is 53 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 52 degrees

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Fahrenheit. The slope of the tributary is 2-4%. Fish were observed in the tributary.

7749	0146.00	Right bank seep. More than 40 pieces of large woody debris (LWD) have accumulated in the channel. The bank is eroding around the LWD.
7894	0151.00	Dry right bank tributary. Log debris accumulation (LDA) #01 contains 30 pieces of large woody debris (LWD) and measures 6' high x 50' wide x 35' long. Water does not flow through the LDA; the flow is subsurface above it. There are no visible gaps in the LDA. Retained sediment ranges from sand to gravel and measures 40' wide x 80' long x 4' deep. Fish were observed above the LDA.
8177	0154.00	The channel changes from an F4 to a C4.
9645	0175.00	Right bank seep.
10382	0187.00	The channel changes from a C4 to a B2.
11325	0206.00	The channel changes from a B2 to an F4. LDA #02 contains over 10 pieces of LWD and measures 8' high x 28' wide x 13' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 30' wide x 300' long x 6' deep. There are two 4' high plunges over the LDA. Fish were observed above the LDA.
12240	0221.00	Right bank seep.
12562	0226.01	There is a 1.5' high plunge over a log. Dry left bank tributary.
12562	0227.00	There is a 41' long step pool with a 16% slope. One step measures 4' high, another step measures 3' high.
13266	0238.00	LDA #03 contains 14 pieces of LWD and measures 9' high x 32' wide x 14' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 20' wide x 50' long x 3' deep. There is a 3' high plunge over the LDA. Fish were observed above the LDA.
21807	0416.00	Tributary #02 enters on the right bank. It contributes approximately 15% to Bear Haven Creek's flow. The water temperature of the tributary is 53 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 52 degrees Fahrenheit. The slope of the tributary is 1-2%. An LDA with a 4.5' high plunge 450' upstream

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from the mouth may impede fish passage. No fish were observed in the tributary.

22376	0426.00	A landslide on the left bank measures 20' high x 50' wide. It is contributing fine sediment to the channel.
22961	0440.00	Tributary #03 enters on the left bank. It contributes approximately 10% to Bear Haven Creek's flow. The water temperature of the tributary is 53 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 52 degrees Fahrenheit. The slope of the tributary is 4-10%. The tributary is not accessible to salmonids due to a large LDA 20' upstream from the mouth.
23717	0462.00	Age 2+ fish observed.
24939	0492.00	The channel changes from an F4 to a G4.
25173	0501.00	A landslide on the left bank measures 40' high x 10' wide.
25626	0513.00	There is a 2' high plunge over logs.
25983	0524.00	Right bank spring.
26101	0526.00	YOY observed.
26203	0527.00	Dry right bank tributary.
26386	0535.00	Tributary #04 enters on the left bank. It contributes approximately 5% to Bear Haven Creek's flow. The water temperature of the tributary is 53 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 52 degrees Fahrenheit. The slope of the tributary is approximately 4%. The tributary may be accessible to salmonids, but no fish were observed.
26582	0543.00	Left bank spring.
26602	0544.00	There is a 3.5' high plunge over logs.
26611	0545.00	There is a 4' high plunge over log.
27403	0572.00	A 5" fish observed.
28078	0594.00	LDA #04 contains six pieces of LWD and measures 5' high x 10' wide x 13' long. Water does not flow through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 15' wide x 50' long x 3' deep. Fish were not observed above the LDA.

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28446	0610.00	Failed culvert on right bank.
28470	0611.00	Dry right bank tributary. There is a 4' high plunge over log.
28526	0613.00	There is a 3' high plunge over small woody debris and root mass.
28991	0623.00	End of survey due to diminished habitat. The last several hundred feet of the survey consisted of multiple dry units and a series of 3'-4' high plunges over woody debris. The gradient has increased to 10-15% and spawning habitat is limited. No fish were observed in the last 1,500' of the survey.

REFERENCES

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

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

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

Stream Name: Bear Haven Creek

LLID: 1236794395562 Drainage: Rockport

Survey Dates: 9/10/2012 to 10/2/2012

Confluence Location: Quad: DUTCHMANS Legal Description: T20NR16WS31 Latitude: 39:33:22.0N Longitude: 123:40:46.0

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
14	0	DRY	2.2	39	549	1.9									
210	34	FLATWATER	33.5	63	13243	45.4	8.3	0.4	1.0	416	87414	180	37830		10
5	0	NOSURVEY	0.8	41	205	0.7									
256	256	POOL	40.8	44	11183	38.3	11.1	0.6	1.9	498	127387	413	105715	306	50
142	19	RIFFLE	22.6	28	3999	13.7	6.4	0.2	0.4	99	14008	22	3135		1
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
627	309				29179					228809			146680		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Bear Haven Creek

LLID: 1236794395562

Drainage: Rockport

Survey Dates: 9/10/2012 to 10/2/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS31

Latitude: 39:33:22.0N

Longitude: 123:40:46.0W

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 (%)
117	13	LGR	18.7	28	3266	11.2	7	0.2	0.6	116	13540	25	2952		0	97
25	6	HGR	4.0	29	733	2.5	6	0.2	1.4	62	1541	15	381		3	99
63	16	RUN	10.0	32	2047	7.0	9	0.4	1.5	336	21143	134	8432		10	96
147	18	SRN	23.4	76	11196	38.4	8	0.4	1.6	488	71729	221	32530		9	96
239	239	MCP	38.1	43	10346	35.5	11	0.6	5.3	498	119050	414	98963	307	50	97
12	12	STP	1.9	60	715	2.5	11	0.6	2.6	598	7181	481	5769	342	43	94
3	3	LSL	0.5	25	74	0.3	9	0.5	1.4	183	548	123	370	87	70	98
2	2	PLP	0.3	24	48	0.2	12	0.7	1.8	304	608	306	612	250	25	96
14	0	DRY	2.2	39	549	1.9										
5	0	NS	0.8	41	205	0.7										

Total Units
627

Total Units Fully Measured
309

Total Length (ft.)
29179

Total Area (sq.ft.)
235340

Total Volume (cu.ft.)
150010

Table 3 - Summary of Pool Types

Stream Name: Bear Haven Creek

LLID: 1236794395562

Drainage: Rockport

Survey Dates: 9/10/2012 to 10/2/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS31

Latitude: 39:33:22.0N

Longitude: 123:40:46.0W

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
251	251	MAIN	98	44	11061	99	11.1	0.6	503	126231	309	77254	50
5	5	SCOUR	2	24	122	1	10.4	0.5	231	1156	152	762	52

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
256	256	11183	127387	78016

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

Stream Name: Bear Haven Creek LLID: 1236794395562 Drainage: Rockport
 Survey Dates: 9/10/2012 to 10/2/2012
 Confluence Location: Quad: DUTCHMANS Legal Description: T20NR16WS31 Latitude: 39:33:22.0N Longitude: 123:40:46.0W

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
239	MCP	93	11	5	134	56	74	31	19	8	1	0
12	STP	5	1	8	8	67	3	25	0	0	0	0
3	LSL	1	0	0	3	100	0	0	0	0	0	0
2	PLP	1	0	0	2	100	0	0	0	0	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
256	12	5	147	57	77	30	19	7	1	0

Mean Maximum Residual Pool Depth (ft.): 1.9

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Bear Haven Creek

LLID: 1236794395562

Drainage: Rockport

Survey Dates: 9/10/2012 to 10/2/2012

Dry Units: 14

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS31

Latitude: 39:33:22.0N

Longitude: 123:40:46.0W

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
117	13	LGR	0	0	0	0	0	0	0	0	0
25	6	HGR	0	45	5	0	0	0	0	50	0
142	19	TOTAL RIFFLE	0	45	5	0	0	0	0	50	0
63	16	RUN	4	60	15	1	0	0	0	20	0
147	18	SRN	0	54	30	8	7	0	0	0	0
210	34	TOTAL FLAT	2	57	23	5	3	0	0	10	0
239	239	MCP	4	37	44	10	1	1	0	2	0
12	12	STP	0	31	39	7	1	0	11	3	8
3	3	LSL	0	25	70	5	0	0	0	0	0
2	2	PLP	0	5	43	0	0	0	3	0	50
256	256	TOTAL POOL	4	37	44	9	1	1	1	2	1
5	0	NS									
627	309	TOTAL	4	39	42	9	1	0	1	3	1

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Bear Haven Creek LLID: 1236794395562 Drainage: Rockport
 Survey Dates: 9/10/2012 to 10/2/2012 Dry Units: 14
 Confluence Location: Quad: DUTCHMANS Legal Description: T20NR16WS31 Latitude: 39:33:22.0N Longitude: 123:40:46.0W

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
117	13	LGR	0	8	77	8	8	0	0
25	6	HGR	0	0	67	17	17	0	0
63	16	RUN	6	6	69	6	13	0	0
147	18	SRN	0	0	72	22	6	0	0
239	239	MCP	26	22	44	7	1	0	0
12	12	STP	25	25	25	8	0	0	17
3	3	LSL	33	33	33	0	0	0	0
2	2	PLP	50	0	50	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Bear Haven Creek

LLID: 1236794395562

Drainage: Rockport

Survey Dates: 9/10/2012 to 10/2/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS31

Latitude: 39:33:22.0N

Longitude: 123:40:46.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	56	44	0	99	99

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: Bear Haven Creek LLID: 1236794395562 Drainage: Rockport
 Survey Dates: 9/10/2012 to 10/2/2012 Survey Length (ft.): 29179 Main Channel (ft.): 28996 Side Channel (ft.): 183
 Confluence Location: Quad: DUTCHMANS Legal Description: T20NR16WS31 Latitude: 39:33:22.0N Longitude: 123:40:46.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 98.3	Pools by Stream Length (%): 50.9
Reach Length (ft.): 8177	Coniferous Component (%): 38.1	Pool Frequency (%): 45.1
Riffle/Flatwater Mean Width (ft.): 9.5	Hardwood Component (%): 61.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 55
Range (ft.): 18 to 35	Vegetative Cover (%): 98.9	2 to 2.9 Feet Deep: 29
Mean (ft.): 25	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 14
Std. Dev.: 5	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 1
Base Flow (cfs.): 1.4	Occurrence of LWD (%): 35	Mean Max Residual Pool Depth (ft.): 2.1
Water (F): 52 - 53 Air (F): 51 - 65	LWD per 100 ft.:	Mean Pool Shelter Rating: 45
Dry Channel (ft): 0	Riffles: 2	
	Pools: 5	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 96 Sm Cobble: 4 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 37.7 2. 50.7 3. 11.6 4. 0.0 5. 0.0		

STREAM REACH: 2

Channel Type: C4	Canopy Density (%): 94.5	Pools by Stream Length (%): 40.3
Reach Length (ft.): 2205	Coniferous Component (%): 43.7	Pool Frequency (%): 45.7
Riffle/Flatwater Mean Width (ft.): 13.3	Hardwood Component (%): 56.3	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 56
Range (ft.): 20 to 27	Vegetative Cover (%): 99.7	2 to 2.9 Feet Deep: 38
Mean (ft.): 24	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 6
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.4	Occurrence of LWD (%): 43	Mean Max Residual Pool Depth (ft.): 2.1
Water (F): 53 - 54 Air (F): 63 - 68	LWD per 100 ft.:	Mean Pool Shelter Rating: 43
Dry Channel (ft): 0	Riffles: 1	
	Pools: 7	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 100 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 31.3 2. 50.0 3. 18.8 4. 0.0 5. 0.0		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B2	Canopy Density (%): 98.2	Pools by Stream Length (%): 26.7
Reach Length (ft.): 943	Coniferous Component (%): 33.3	Pool Frequency (%): 31.6
Riffle/Flatwater Mean Width (ft.): 9.0	Hardwood Component (%): 66.7	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 50
Range (ft.): 22 to 25	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep: 50
Mean (ft.): 22	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.4	Occurrence of LWD (%): 41	Mean Max Residual Pool Depth (ft.): 2.0
Water (F): 52 - 54 Air (F): 53 - 68	LWD per 100 ft.:	Mean Pool Shelter Rating: 25
Dry Channel (ft): 0	Riffles: 1	
	Pools: 8	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 100 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 16.7 2. 83.3 3. 0.0 4. 0.0 5. 0.0		

STREAM REACH: 4

Channel Type: F4	Canopy Density (%): 97.0	Pools by Stream Length (%): 37.3
Reach Length (ft.): 13614	Coniferous Component (%): 61.4	Pool Frequency (%): 41.3
Riffle/Flatwater Mean Width (ft.): 6.1	Hardwood Component (%): 38.6	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 55
Range (ft.): 17 to 30	Vegetative Cover (%): 99.1	2 to 2.9 Feet Deep: 39
Mean (ft.): 22	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 7
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.4	Occurrence of LWD (%): 43	Mean Max Residual Pool Depth (ft.): 2.0
Water (F): 52 - 53 Air (F): 53 - 64	LWD per 100 ft.:	Mean Pool Shelter Rating: 58
Dry Channel (ft): 174	Riffles: 3	
	Pools: 12	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 31 Sand: 12 Gravel: 56 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 1		
Embeddedness Values (%): 1. 47.1 2. 38.7 3. 13.4 4. 0.8 5. 0.0		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 5

Channel Type: G4	Canopy Density (%): 96.2	Pools by Stream Length (%): 18.3
Reach Length (ft.): 4057	Coniferous Component (%): 78.9	Pool Frequency (%): 34.8
Riffle/Flatwater Mean Width (ft.): 5.0	Hardwood Component (%): 21.1	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 96
Range (ft.): 7 to 24	Vegetative Cover (%): 98.3	2 to 2.9 Feet Deep: 4
Mean (ft.): 11	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 5	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.4	Occurrence of LWD (%): 31	Mean Max Residual Pool Depth (ft.): 1.2
Water (F): 52 - 55 Air (F): 52 - 66	LWD per 100 ft.:	Mean Pool Shelter Rating: 41
Dry Channel (ft): 375	Riffles: 2	
	Pools: 13	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 17 Sand: 4 Gravel: 72 Sm Cobble: 7 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 19.6 2. 41.3 3. 26.1 4. 8.7 5. 4.3		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Bear Haven Creek

LLID: 1236794395562

Drainage: Rockport

Survey Dates: 9/10/2012 to 10/2/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS31

Latitude: 39:33:22.0N

Longitude: 123:40:46.0W

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	20	17	6.0
Boulder	5	4	1.5
Cobble / Gravel	127	129	41.4
Sand / Silt / Clay	157	159	51.1

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	0	1	0.2
Brush	7	10	2.8
Hardwood Trees	48	43	14.7
Coniferous Trees	254	255	82.4
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Bear Haven Creek

LLID: 1236794395562

Drainage: Rockport

Survey Dates: 9/10/2012 to 10/2/2012

Confluence Location: Quad: DUTCHMANS

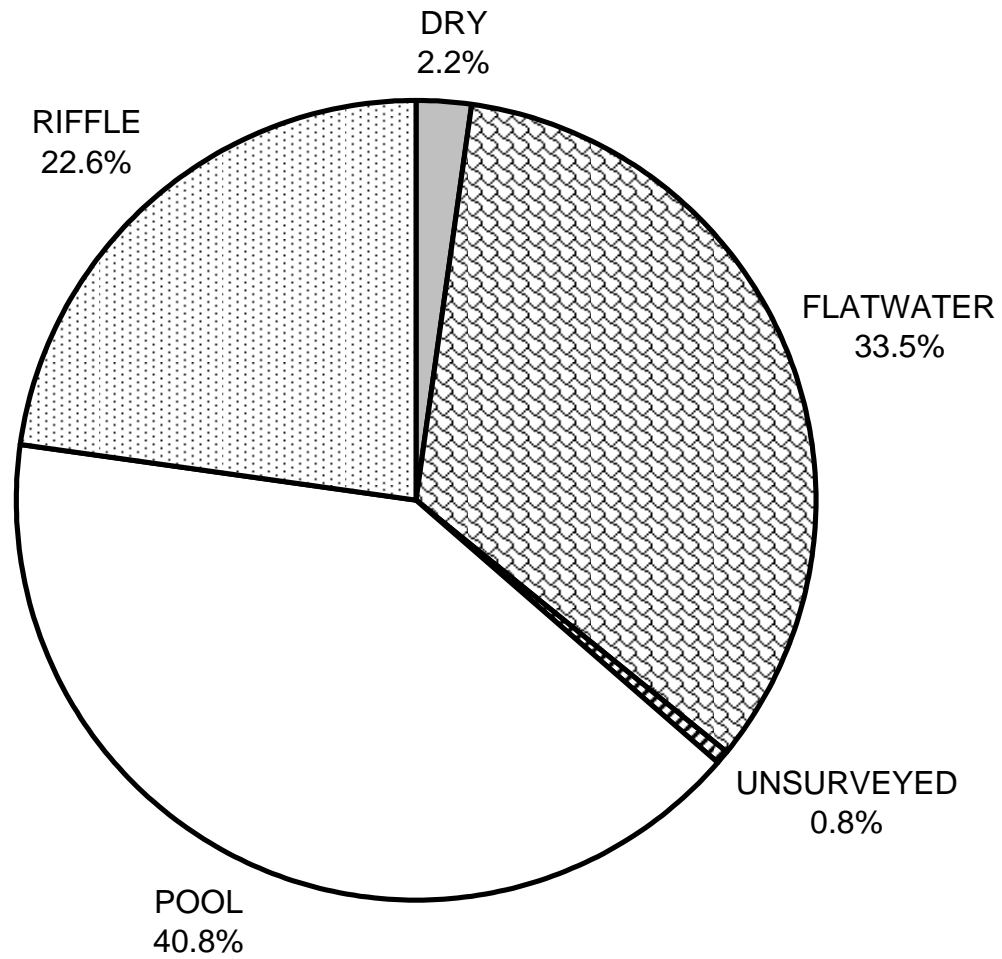
Legal Description: T20NR16WS31

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Longitude: 123:40:46.0W

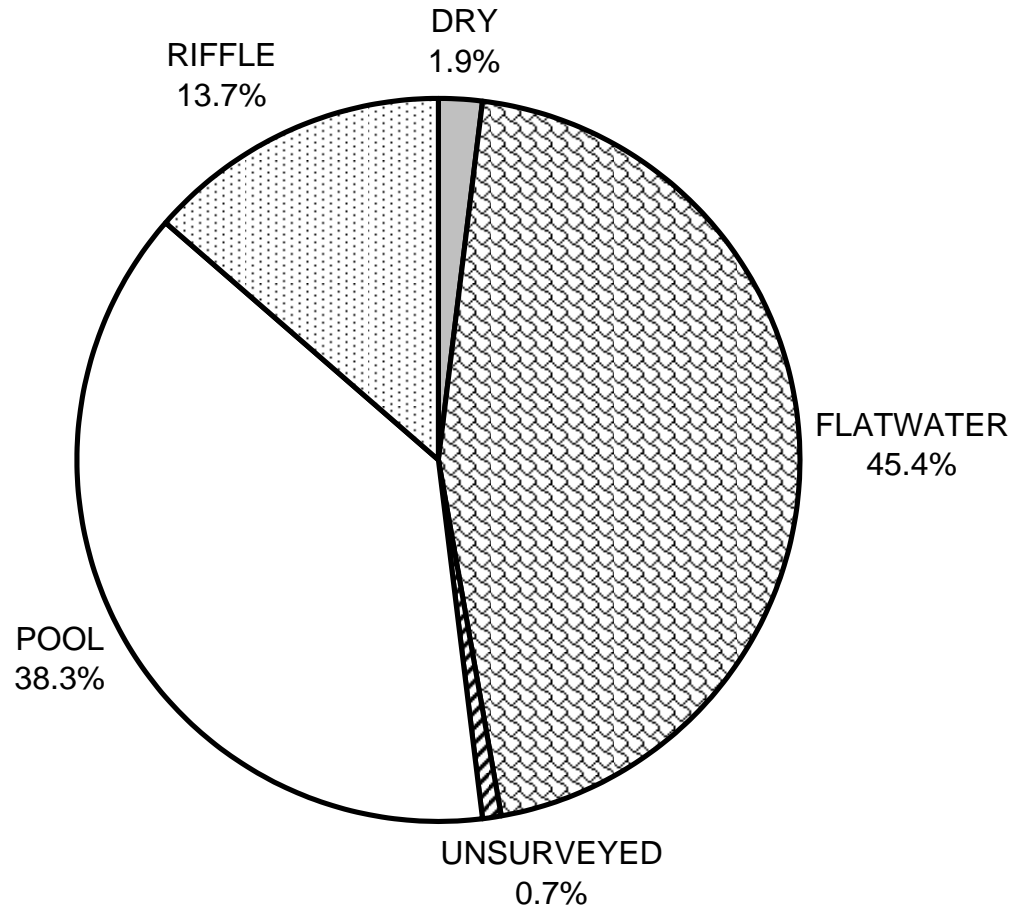
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	2	4
SMALL WOODY DEBRIS (%)	45	57	37
LARGE WOODY DEBRIS (%)	5	23	44
ROOT MASS (%)	0	5	9
TERRESTRIAL VEGETATION (%)	0	3	1
AQUATIC VEGETATION (%)	0	0	1
WHITEWATER (%)	0	0	1
BOULDERS (%)	50	10	2
BEDROCK LEDGES (%)	0	0	1

BEAR HAVEN CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



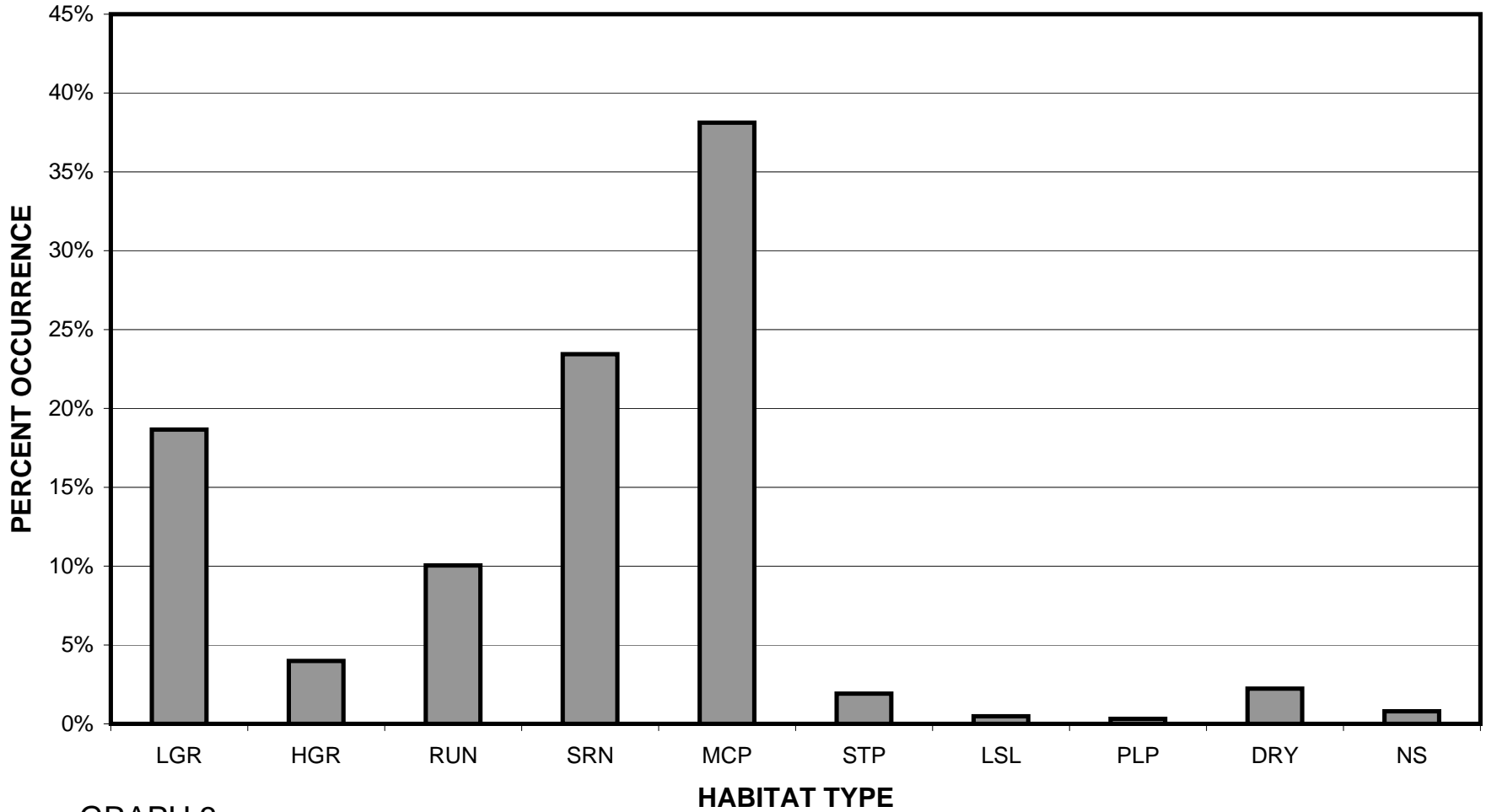
GRAPH 1

BEAR HAVEN CREEK 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



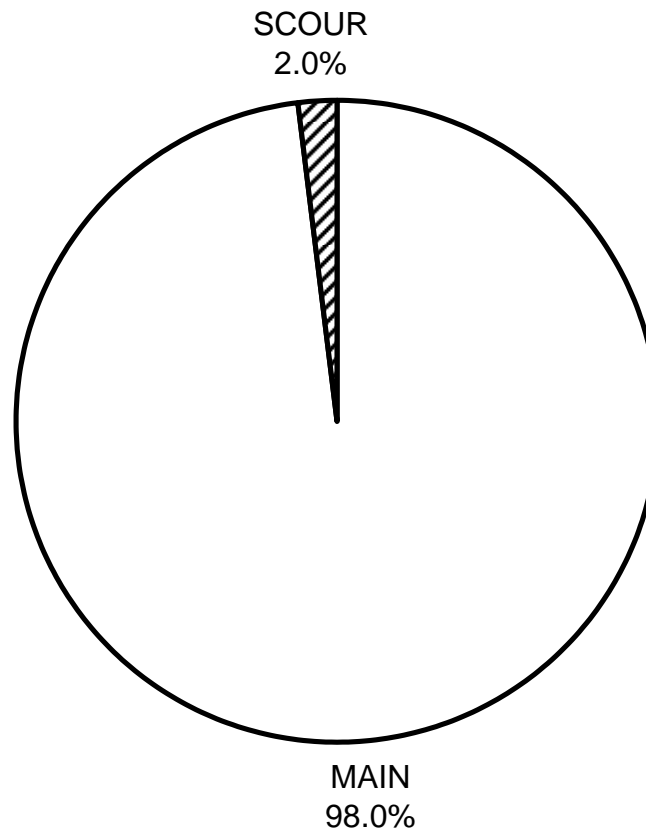
GRAPH 2

BEAR HAVEN CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



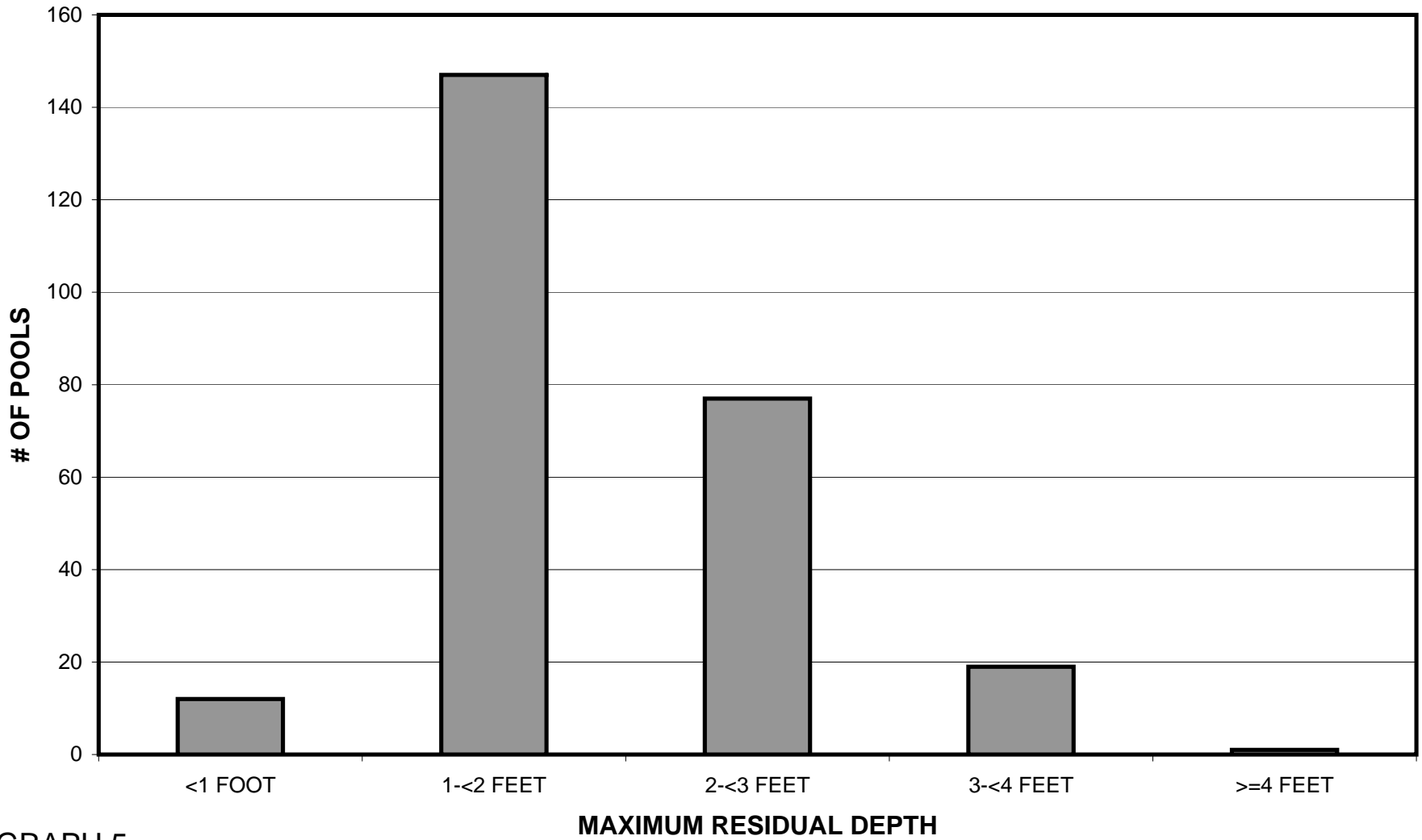
GRAPH 3

**BEAR HAVEN CREEK 2012
POOL TYPES BY PERCENT OCCURRENCE**



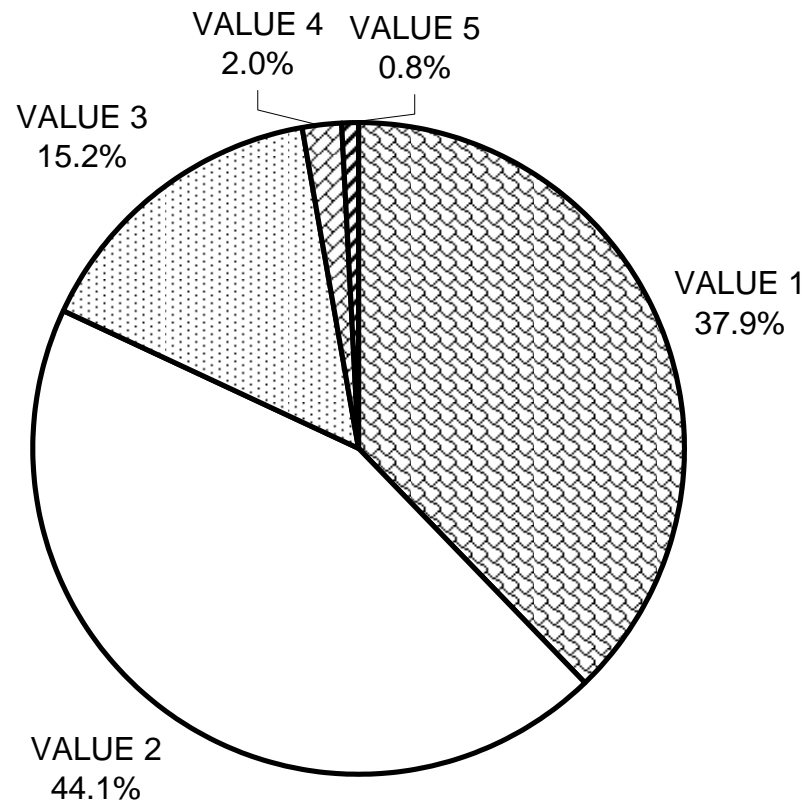
GRAPH 4

BEAR HAVEN CREEK 2012 MAXIMUM DEPTH IN POOLS



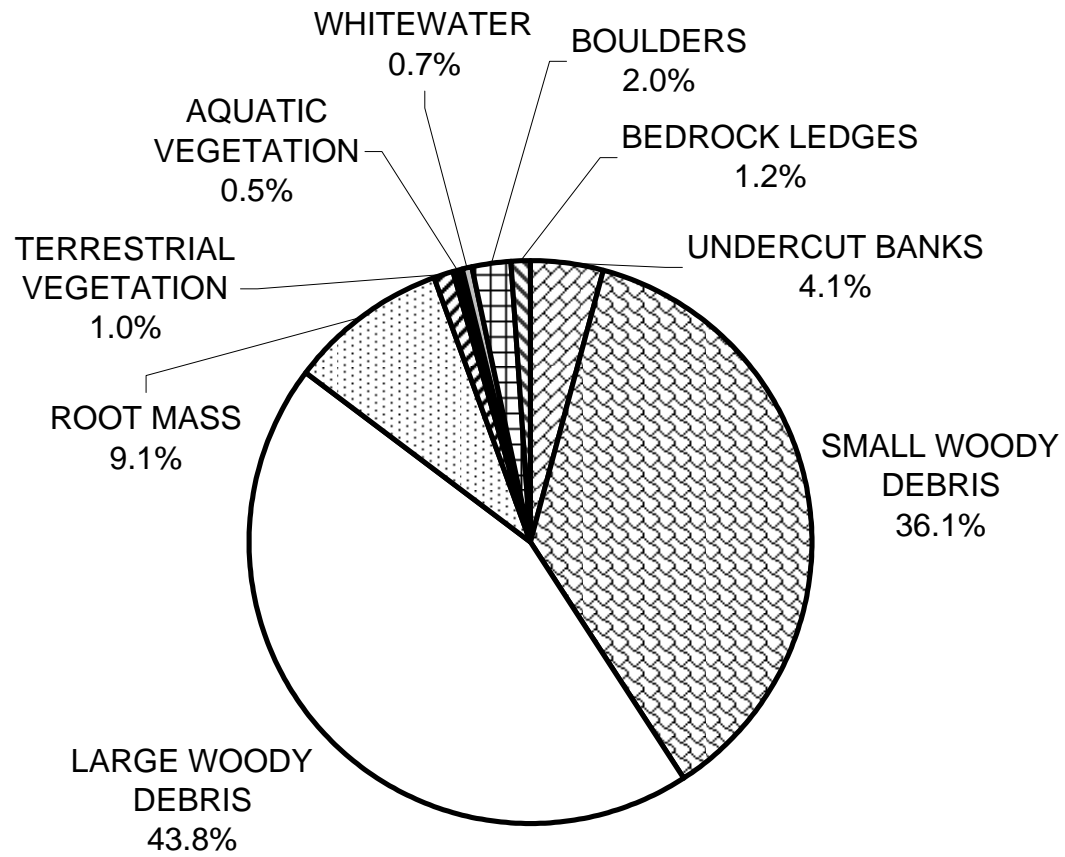
GRAPH 5

BEAR HAVEN CREEK 2012 PERCENT EMBEDDEDNESS



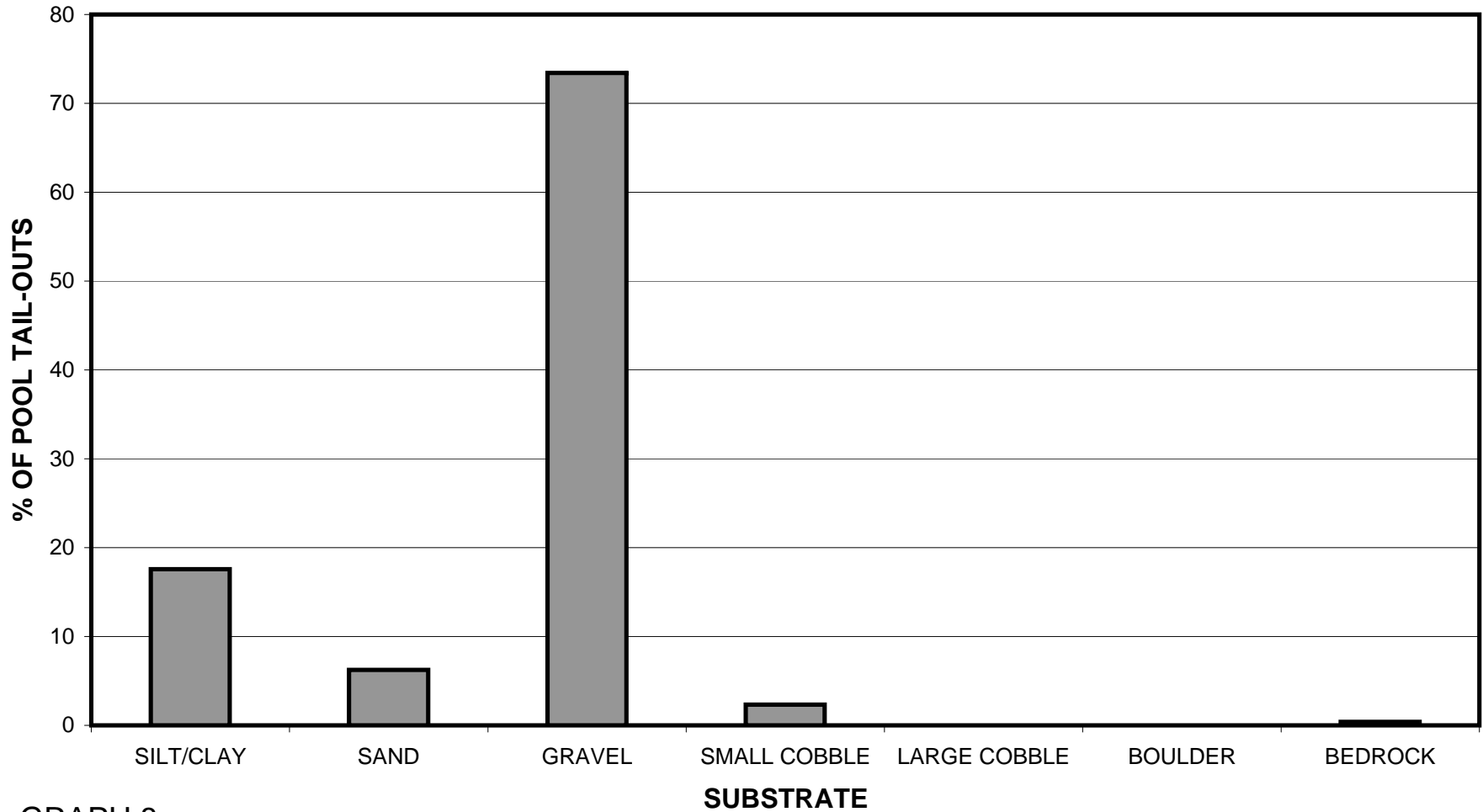
GRAPH 6

BEAR HAVEN CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



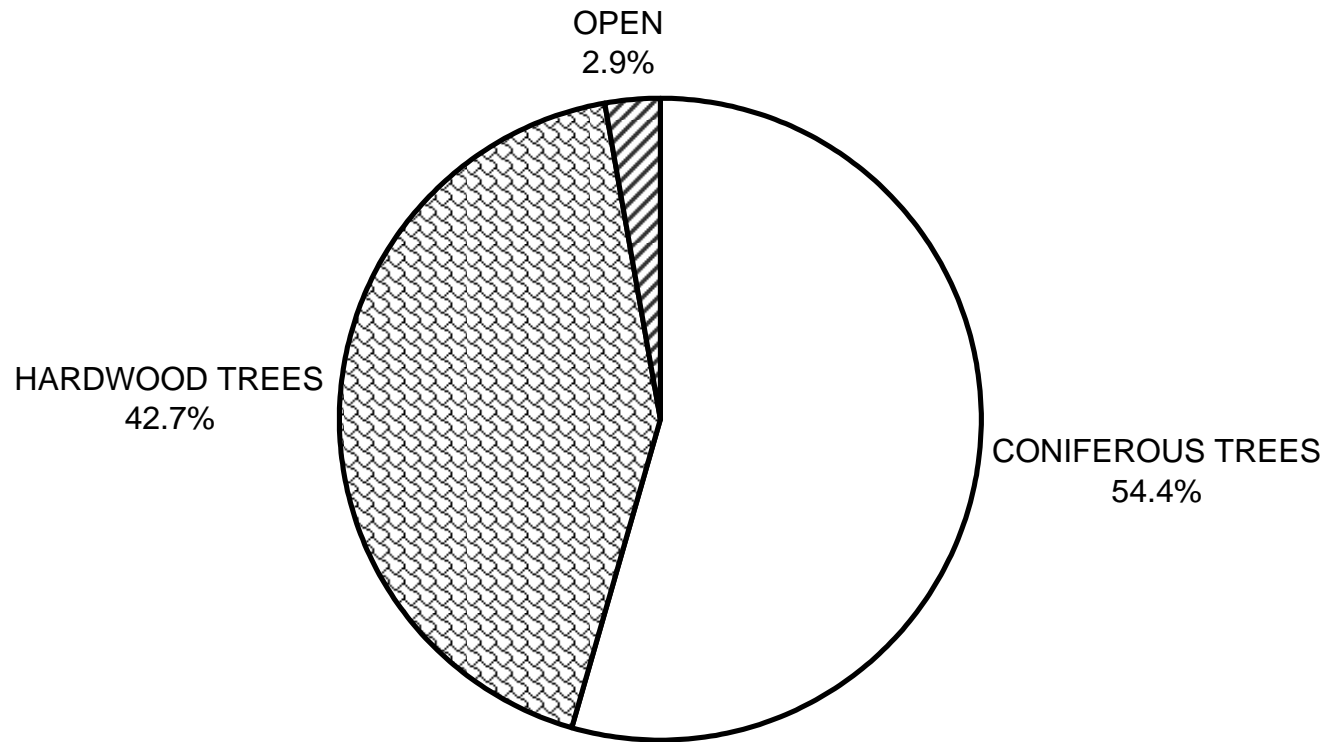
GRAPH 7

BEAR HAVEN CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



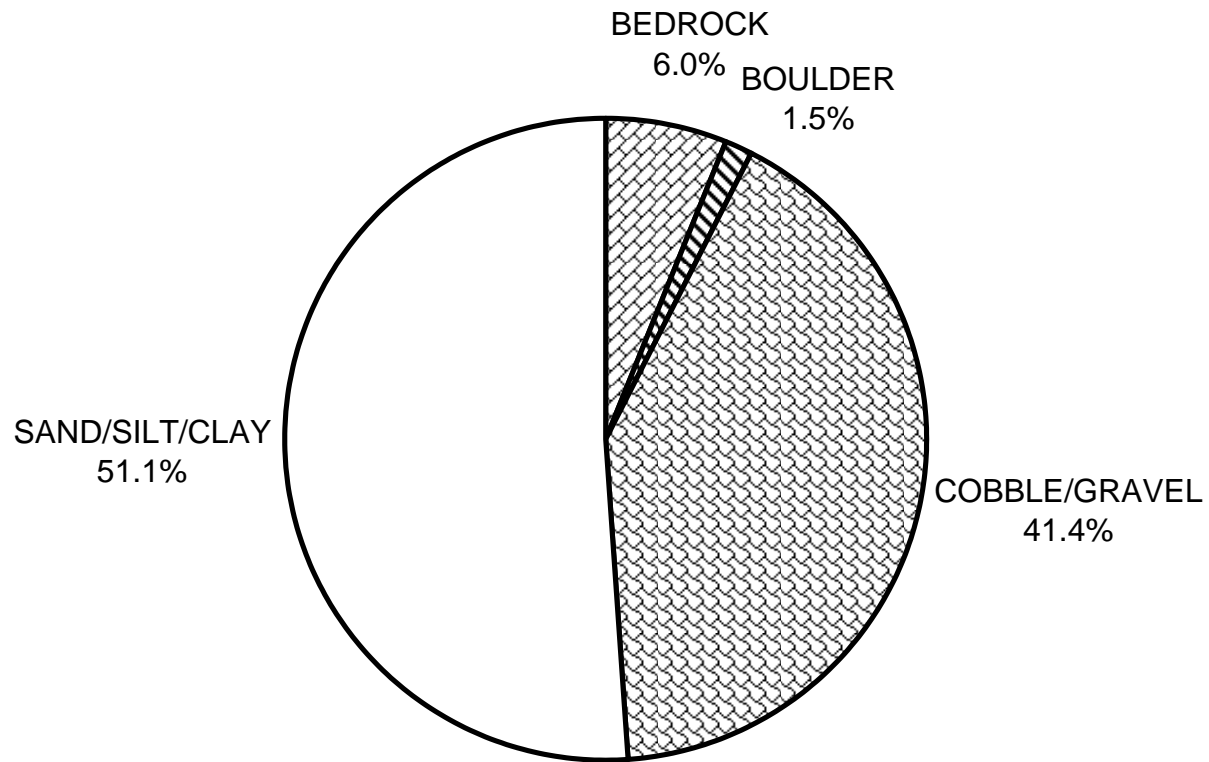
GRAPH 8

BEAR HAVEN CREEK 2012 MEAN PERCENT CANOPY



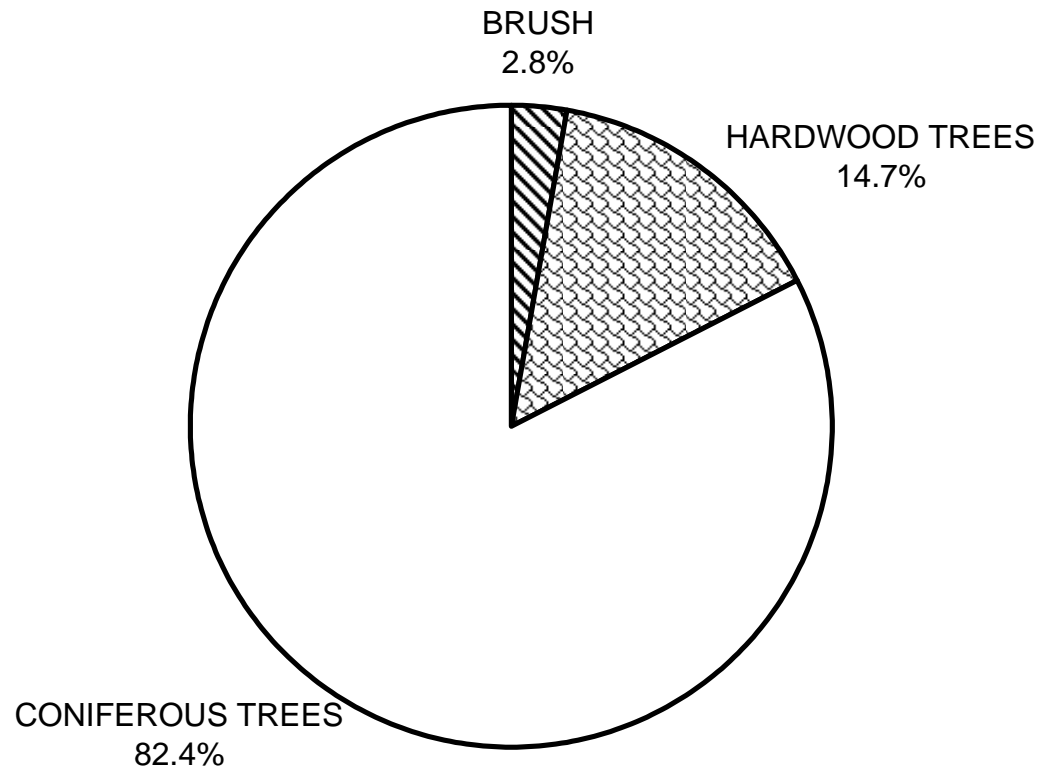
GRAPH 9

**BEAR HAVEN CREEK 2012
DOMINANT BANK COMPOSITION IN SURVEY REACH**



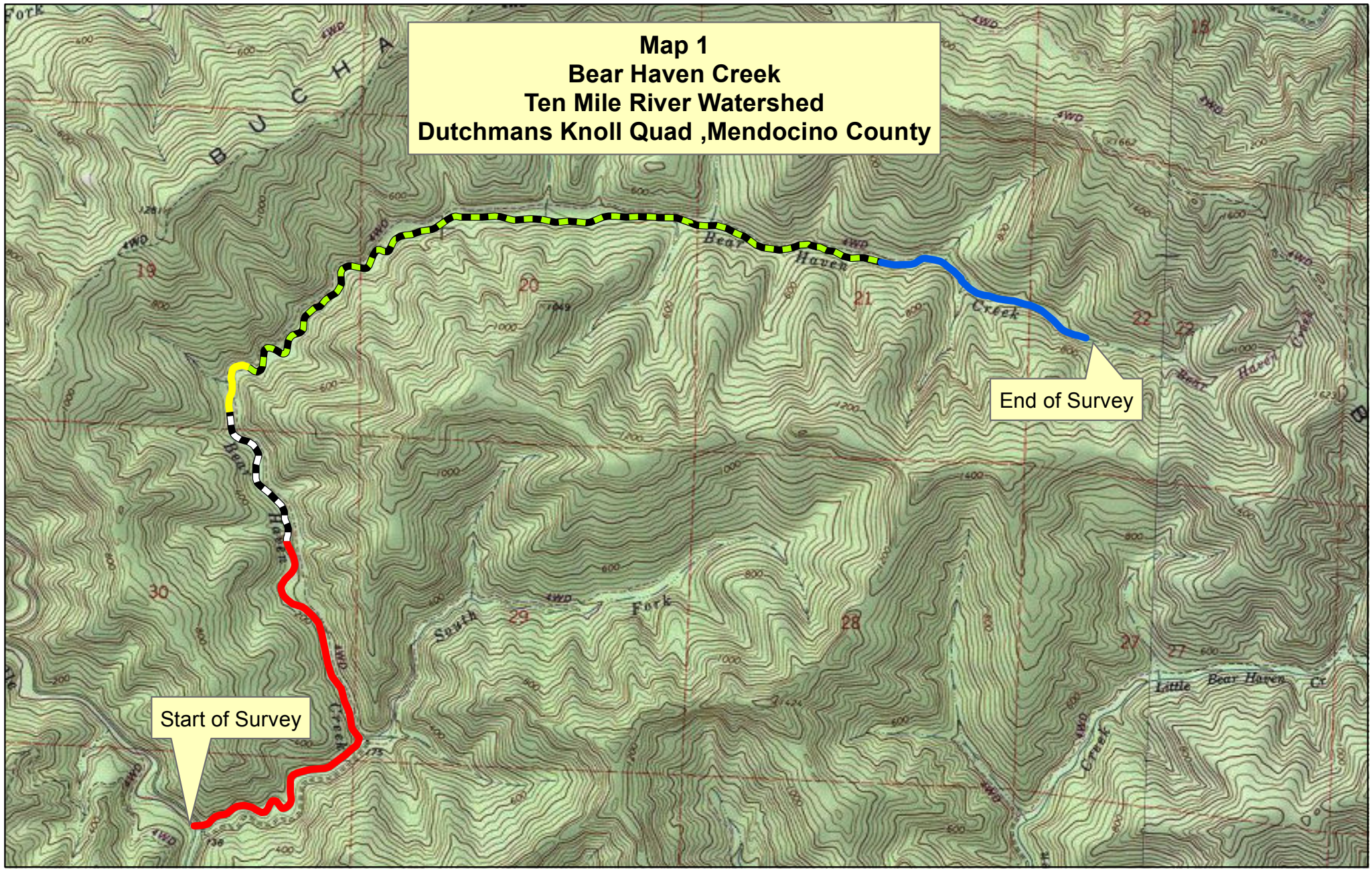
GRAPH 10

**BEAR HAVEN CREEK 2012
DOMINANT BANK VEGETATION IN SURVEY REACH**



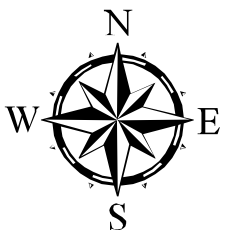
GRAPH 11

Map 1
Bear Haven Creek
Ten Mile River Watershed
Dutchmans Knoll Quad ,Mendocino County



Start of Survey

End of Survey



-  Reach 1, Channel Type F4
-  Reach 2, Channel Type C4
-  Reach 3, Channel Type B2
-  Reach 4, Channel Type F4
-  Reach 5, Channel Type G4

