

# STREAM INVENTORY REPORT

## Buckhorn Creek

### INTRODUCTION

A stream inventory was conducted from October 23 to October 30, 2012 on Buckhorn Creek. The survey began at the confluence with Little North Fork Ten Mile River and extended upstream 1.8 miles.

The Buckhorn 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 Buckhorn 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

Buckhorn Creek is a tributary to Little North Fork Ten Mile River, a tributary to North Fork Ten Mile River, a tributary to Ten Mile River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Buckhorn Creek's legal description at the confluence with Little North Fork Ten Mile River is T20N R17W S13. Its location is 39.5943 degrees north latitude and 123.7133 degrees west longitude, LLID number 1237119395942. Buckhorn Creek is a first order stream and has approximately 1.6 miles of blue line stream according to the USGS Dutchmans Knoll 7.5 minute quadrangle. Buckhorn Creek drains a watershed of approximately 1.8 square miles. Elevations range from about 100 feet at the mouth of the creek to 800 feet in the headwater areas. Mixed hardwood 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, CA.

### METHODS

The habitat inventory conducted in Buckhorn 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 and Watershed Stewards Project/AmeriCorps (WSP) members that conducted the inventory were trained in standardized habitat inventory methods by the CDFW. This inventory was conducted by a two-person team.

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### 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 Buckhorn 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". Buckhorn 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

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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 Buckhorn 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 Buckhorn 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 densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Buckhorn 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 Buckhorn Creek, the dominant composition type and the dominant

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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 Buckhorn Creek. In addition, underwater observations were made at fifteen 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)

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- 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 Buckhorn 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 October 23 to October 30, 2012 was conducted by R. Spencer and C. Tiffany (CDFW), and E. Augustyn and N. Massa (WSP). The total length of the stream surveyed was 9,266 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.54 cfs on October 25, 2012.

Buckhorn Creek is a G4 channel type for the entire length of the survey, 9,266 feet. 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 50 to 55 degrees Fahrenheit. Air temperatures ranged from 48 to 63 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 38% pool units, 29% riffle units, 28% flatwater units, and 5% dry units (Graph 1). Based on total length of Level II habitat types there were 44% flatwater units, 28% riffle units, 21% pool units, and 7% dry units (Graph 2).

Twelve Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 31%; low gradient riffle units, 23%; and step run units, 22% (Graph 3). Based on percent total length, step run units made up 38%, low gradient riffle units 22%, and mid-channel pool units 16%.

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A total of 95 pools were identified (Table 3). Main channel pools were the most frequently encountered at 98% (Graph 4), and comprised 98% 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. Ten of the 93 pools measured (11%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 95 pool tail-outs measured, 34 had a value of 1 (35.8%); 44 had a value of 2 (46.3%); 13 had a value of 3 (13.7%); two had a value of 4 (2.1%); two had a value of 5 (2.1%) (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 4, flatwater habitat types had a mean shelter rating of 8, and pool habitats had a mean shelter rating of 44 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 45. Scour pools had a mean shelter rating of 28 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Buckhorn Creek. Graph 7 describes the pool cover in Buckhorn 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 78% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 19% of the pool tail-outs

The mean percent canopy density for the surveyed length of Buckhorn Creek was 96%. Four percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 23% and 77%, respectively. Graph 9 describes the mean percent canopy in Buckhorn 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 71% cobble/gravel, 19% sand/silt/clay, 9% bedrock, and 1% boulders (Graph 10). Coniferous trees were the dominant vegetation type observed in 91% of the units surveyed. Additionally, 8% of the units surveyed had deciduous trees as the dominant vegetation type, and 2% had brush as the dominant vegetation type (Graph 11).

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### BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 15 sites for species composition and distribution in Buckhorn Creek on October 28, 2012. The sites were sampled by I. Mikus and T. Anderson (CDFW).

Fifteen sites were sampled within the first 3,924 feet of Buckhorn Creek. The reach sites yielded 38 young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), five age 1+ SH/RT, and 79 YOY coho salmon.

The following chart displays the information yielded from these sites:

2012 Buckhorn Creek underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
G4 Channel Type									
10/28/12	1	003	Pool	62	3	0	0	0	0
	2	004	Pool	73	4	0	0	2	0
	3	006	Pool	142	4	0	0	5	0
	4	019	Pool	647	3	0	0	8	0
	5	041	Pool	1,709	4	0	0	8	0
	6	047	Pool	1,879	4	1	0	9	0
	7	064	Pool	2,497	3	0	0	27	0
	8	067	Pool	2,583	0	1	0	7	0
	9	072	Pool	2,790	5	0	0	13	0
	10	075	Pool	2,964	2	1	0	0	0
	11	081	Pool	3,344	2	1	0	0	0
	12	089	Pool	3,689	2	1	0	0	0
	13	093	Pool	3,837	2	0	0	0	0
	14	095	Pool	3,902	0	0	0	0	0
	15	096	Pool	3,924	0	0	0	0	0

### DISCUSSION

Buckhorn Creek is a G4 channel type. The suitability of G4 channel types for fish habitat improvement structures is as follows: G4 channel types are good for bank-placed boulders and

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fair for plunge weirs, opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days October 23 to October 30, 2012 ranged from 50 to 55 degrees Fahrenheit. Air temperatures ranged from 48 to 63 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 44% of the total length of this survey, riffles 28%, and pools 21%. Ten of the 93 (11%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing large wood structures that will increase or deepen pool habitat is recommended.

Seventy-eight of the 95 pool tail-outs measured had embeddedness ratings of 1 or 2. Fifteen 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.

Ninety-two of the 95 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 44. The shelter rating in the flatwater habitats is 8. 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 Buckhorn 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 96%. The percentage of right and left bank covered with vegetation was 97% and 97%, respectively.

## **RECOMMENDATIONS**

- 1) Buckhorn 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.



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- 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 Little North Fork Ten Mile River. The channel is a G4 for the entire length of the survey.
62	0004.00	Log debris accumulation (LDA) #01 contains nine pieces of large woody debris (LWD) and measures 4' high x 25' wide x 4' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 25' wide x 50' long x 3' deep. There is a 3' high plunge over the LDA. Fish were observed above the LDA.
487	0016.00	An erosion site on the left bank measures 36' long x 10' high. It is contributing fine sediment to the channel.
598	0019.00	LDA #02 contains 11 pieces of LWD and measures 7' high x 19' wide x 7' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 15' wide x 100' long x 6' deep. Fish were observed above the LDA.
1076	0031.00	There is a 4' high plunge over boulders.
2458	0064.00	LDA #03 contains 18 pieces of LWD and measures 12' high x 16' wide x 34' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to small cobble and measures 10' wide x 80' long x 4' deep. Fish were observed above the LDA.
3801	0093.00	There is a 3.5' high plunge over LWD.
3902	0096.00	There is a 3' high plunge over LWD.
4090	0098.00	There is a 1.5' high plunge over LWD.
4389	0105.00	LDA #04 contains 17 pieces of LWD and measures 8' high x 44' wide x 21' long. Water flows through the LDA and there are visible gaps in it.

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		Retained sediment ranges from silt to gravel and measures 10' wide x 60' long x 4' deep. Fish were observed above the LDA.
4491	0109.00	LDA #05 contains four pieces of LWD and measures 5' high x 20' wide x 11' long. Water does not flow through the LDA; the channel is dry for 30' above it. There are visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 28' wide x 80' long x 5' deep. Fish were observed above the LDA.
4751	0113.00	There is a 2' high plunge over SWD.
5508	0139.00	Two exposed culverts in the channel. They are not obstructing flow.
6355	0162.00	Tributary #01 enters on the right bank. It contributes approximately 40% to Buckhorn Creek's flow. The water temperature of the tributary was 51 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 51 degrees Fahrenheit. The slope of the tributary is 2-4%. Fish were observed in the tributary.
6593	0167.00	LDA #06 contains five pieces of LWD and measures 4' high x 13' wide x 5' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 10' wide x 50' long x 3' deep. There are two 2' high plunges over the LDA. Fish were observed above the LDA.
6600	0168.00	LDA #07 contains six pieces of LWD and measures 7' high x 14' wide x 9' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 10' wide x 80' long x 6' deep. There is a 2' high plunge followed by a 3' high plunge over the LDA. Fish were observed above the LDA.
6872	0175.00	Tributary #02 enters on the left bank. It contributes less than 1% to Buckhorn Creek's flow. The water temperature of the tributary was 51 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 51 degrees Fahrenheit. The tributary is not accessible to salmonids due to a cascade with 15-25% slope near the mouth.
6961	0178.00	There is a 2' high plunge and a 2.5' high plunge over LWD and root mass.
7069	0181.00	LDA #08 contains three pieces of LWD and measures 5' high x 14' wide x 10' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to large cobble and measures 12' wide x 60' long x 5' deep. There is a 5' high plunge over the LDA. Fish were observed above the LDA.

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7224	0187.00	Multiple 1'-2' high plunges over woody debris.
7865	0210.00	YOY observed.
8781	0243.00	There is a 250' long dry section.
9129	0247.00	LDA #09 contains four pieces of LWD and measures 6.5' high x 12' wide x 15' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to boulders and measures 10' wide x 50' long x 6' deep. There is a 6' high plunge over the LDA. Fish were not observed above the LDA.
9255	0250.00	End of survey at 12' high x 25' wide x 20' long LDA with a long dry section above it. The dry section ends at a 15' high cascade with 90% slope. The channel is braided and there are trees growing within it. The slope of the channel has increased to 10-20%.

## 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: Buckhorn Creek

LLID: 1237119395942 Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Confluence Location: Quad: DUTCHMANS KNOLL Legal Description: T20NR17WS13 Latitude: 39:35:39.0N Longitude: 123:42:43.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
13	0	DRY	5.2	53	691	7.5									
70	9	FLATWATER	28.0	58	4033	43.5	6.4	0.4	0.7	319	22321	111	7781		8
95	93	POOL	38.0	21	1972	21.3	8.7	0.6	1.3	172	16297	152	14394	114	44
72	13	RIFFLE	28.8	36	2570	27.7	4.8	0.2	0.4	94	6766	21	1496		4
<b>Total Units</b>	<b>Total Units Fully Measured</b>				<b>Total Length (ft.)</b>					<b>Total Area (sq.ft.)</b>			<b>Total Volume (cu.ft.)</b>		
250	115				9266					45384			23671		

**Table 2 - Summary of Habitat Types and Measured Parameters**

Stream Name: Buckhorn Creek

LLID: 1237119395942

Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR17WS13

Latitude: 39:35:39.0N

Longitude: 123:42:43.0W

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 (%)
58	8	LGR	23.2	36	2061	22.2	4	0.2	0.6	83	4803	19	1074		6	96
13	4	HGR	5.2	38	497	5.4	6	0.2	0.6	135	1758	30	390		3	96
1	1	CAS	0.4	12	12	0.1	3	0.1	0.4	18	18	2	2		0	100
1	0	GLD	0.4	14	14	0.2										
13	3	RUN	5.2	25	329	3.6	6	0.4	0.8	162	2100	69	898		7	97
55	6	SRN	22.0	65	3552	38.3	6	0.3	1.1	398	21865	132	7271		8	91
1	0	EDW	0.4	138	138	1.5										
78	77	MCP	31.2	19	1493	16.1	8	0.6	3.1	158	12351	141	10992	107	44	96
15	14	STP	6.0	29	438	4.7	10	0.6	2.2	251	3770	219	3282	165	50	97
1	1	LSL	0.4	29	29	0.3	6	0.4	1	174	174	122	122	70	10	100
1	1	PLP	0.4	12	12	0.1	6	0.4	1	68	68	55	55	27	45	98
13	0	DRY	5.2	53	691	7.5										

Total Units  
250

Total Units Fully Measured  
115

Total Length (ft.)  
9266

Total Area (sq.ft.)  
46908

Total Volume (cu.ft.)  
24086

**Table 3 - Summary of Pool Types**

Stream Name: Buckhorn Creek

LLID: 1237119395942

Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR17WS13

Latitude: 39:35:39.0N

Longitude: 123:42:43.0W

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
93	91	MAIN	98	21	1931	98	8.8	0.6	173	16056	115	10739	45
2	2	SCOUR	2	21	41	2	6.0	0.4	121	242	48	97	28

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
95	93	1972	16299	10836

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

Stream Name: Buckhorn Creek

LLID: 1237119395942

Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR17WS13

Latitude: 39:35:39.0N

Longitude: 123:42:43.0W

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
77	MCP	83	23	30	45	58	8	10	1	1	0	0
14	STP	15	5	36	8	57	1	7	0	0	0	0
1	LSL	1	0	0	1	100	0	0	0	0	0	0
1	PLP	1	0	0	1	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
93	28	30	55	59	9	10	1	1	0	0

Mean Maximum Residual Pool Depth (ft.): 1.3



**Table 5 - Summary of Mean Percent Cover By Habitat Type**

Stream Name: Buckhorn Creek

LLID: 1237119395942

Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Dry Units: 13

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR17WS13

Latitude: 39:35:39.0N

Longitude: 123:42:43.0W

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
58	8	LGR	0	50	40	0	0	0	0	10	0
13	4	HGR	0	50	50	0	0	0	0	0	0
1	1	CAS	0	0	0	0	0	0	0	0	0
72	13	TOTAL RIFFLE	0	50	42	0	0	0	0	8	0
1	0	GLD	0	0	0	0	0	0	0	0	0
13	3	RUN	0	63	22	10	0	0	0	5	0
55	6	SRN	0	63	14	5	0	0	1	17	0
1	0	EDW	0	0	0	0	0	0	0	0	0
70	9	TOTAL FLAT	0	63	17	7	0	0	1	13	0
78	78	MCP	2	29	41	14	0	0	1	9	4
15	15	STP	1	23	42	22	0	0	2	8	2
1	1	LSL	75	25	0	0	0	0	0	0	0
1	1	PLP	0	30	0	60	0	0	10	0	0
95	95	TOTAL POOL	3	28	40	15	0	0	1	8	4
250	117	TOTAL	2	32	39	14	0	0	1	9	3

**Table 6 - Summary of Dominant Substrates By Habitat Type**

Stream Name: Buckhorn Creek

LLID: 1237119395942

Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Dry Units: 13

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR17WS13

Latitude: 39:35:39.0N

Longitude: 123:42:43.0W

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
58	8	LGR	0	0	75	25	0	0	0
13	4	HGR	0	0	50	50	0	0	0
1	1	CAS	0	0	0	0	0	0	100
1	0	GLD	0	0	0	0	0	0	0
13	3	RUN	0	0	67	33	0	0	0
55	6	SRN	0	0	67	33	0	0	0
1	0	EDW	0	0	0	0	0	0	0
78	78	MCP	12	3	53	23	9	0	1
15	15	STP	7	0	33	33	20	0	7
1	1	LSL	0	0	100	0	0	0	0
1	1	PLP	0	0	0	100	0	0	0

**Table 7 - Summary of Mean Percent Canopy for Entire Stream**

Stream Name: Buckhorn Creek

LLID: 1237119395942 Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Confluence Location: Quad: DUTCHMANS Legal Description: T20NR17WS13 Latitude: 39:35:39.0N Longitude: 123:42:43.0W

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Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
96	77	23	0	97	97

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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 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: Buckhorn Creek

LLID: 1237119395942

Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR17WS13

Latitude: 39:35:39.0N

Longitude: 123:42:43.0W

**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	7	14	9.0
Boulder	1	2	1.3
Cobble / Gravel	84	81	70.5
Sand / Silt / Clay	25	20	19.2

**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	0	0.0
Brush	3	1	1.7
Hardwood Trees	13	5	7.7
Coniferous Trees	101	111	90.6
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:** 2

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

StreamName: Buckhorn Creek

LLID: 1237119395942

Drainage: Rockport

Survey Dates: 10/23/2012 to 10/30/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR17WS13

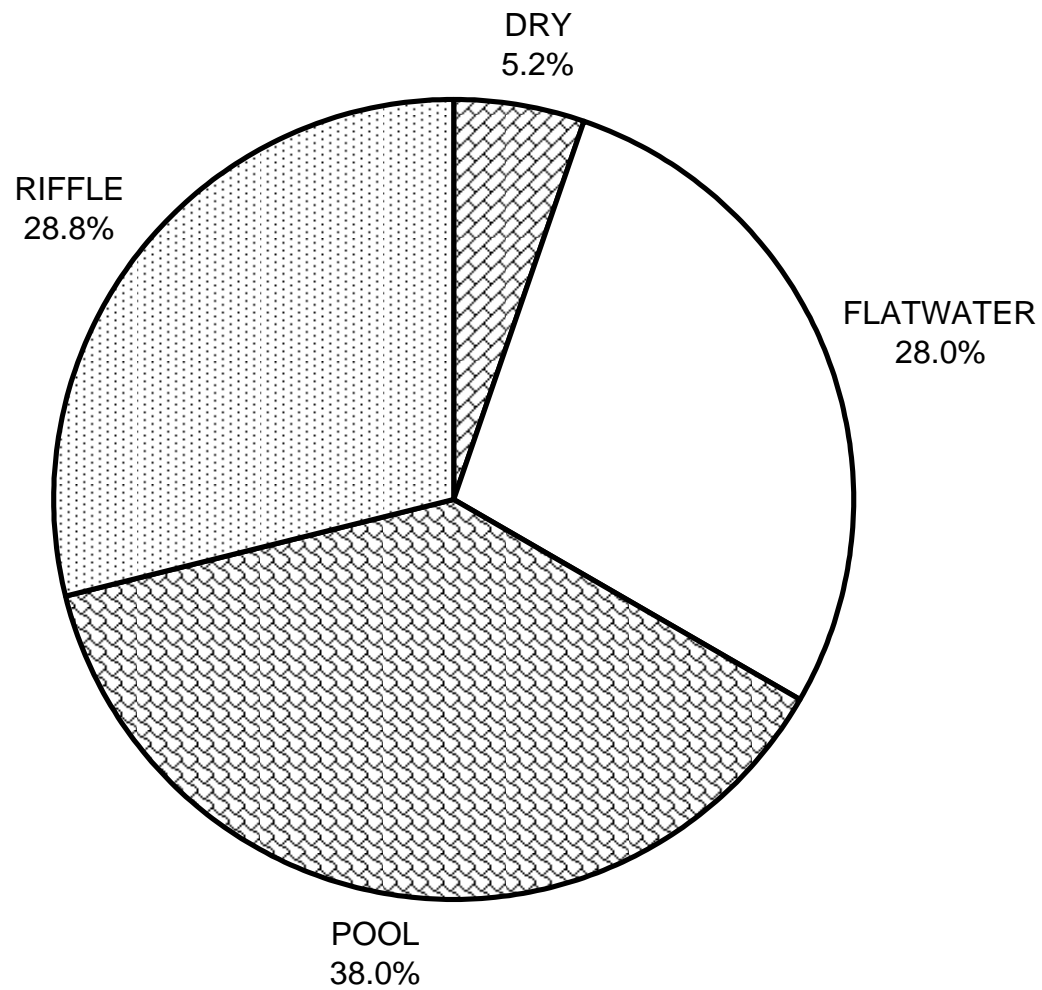
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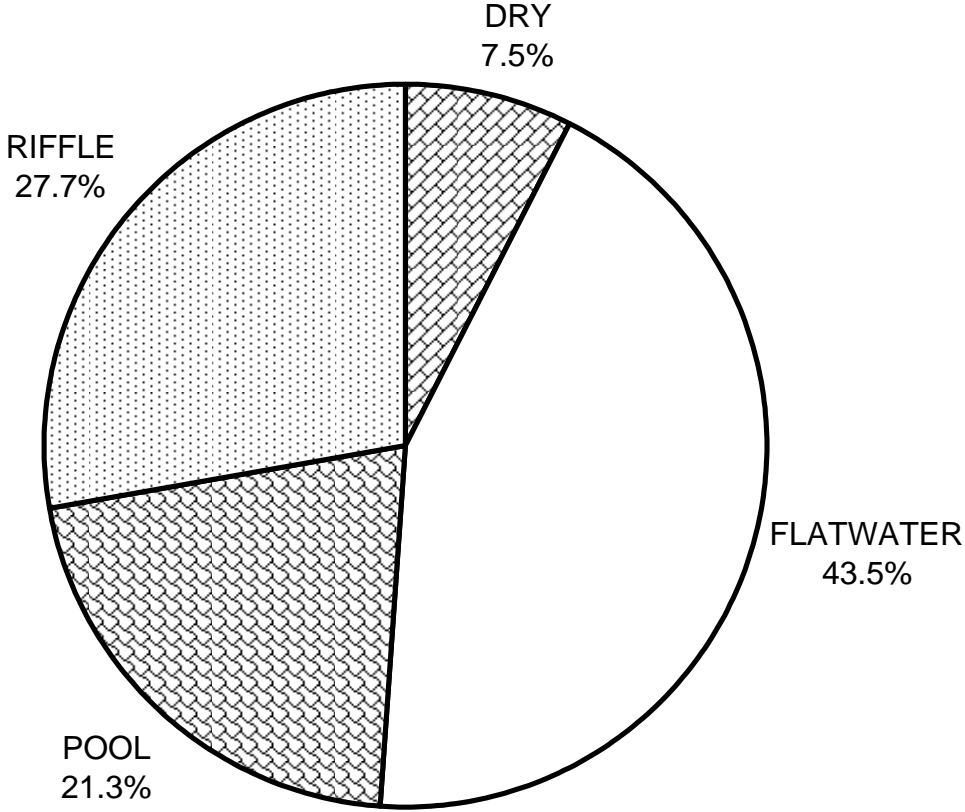
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	0	3
SMALL WOODY DEBRIS (%)	50	63	28
LARGE WOODY DEBRIS (%)	42	17	40
ROOT MASS (%)	0	7	15
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	1	1
BOULDERS (%)	8	13	8
BEDROCK LEDGES (%)	0	0	4

# BUCKHORN CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

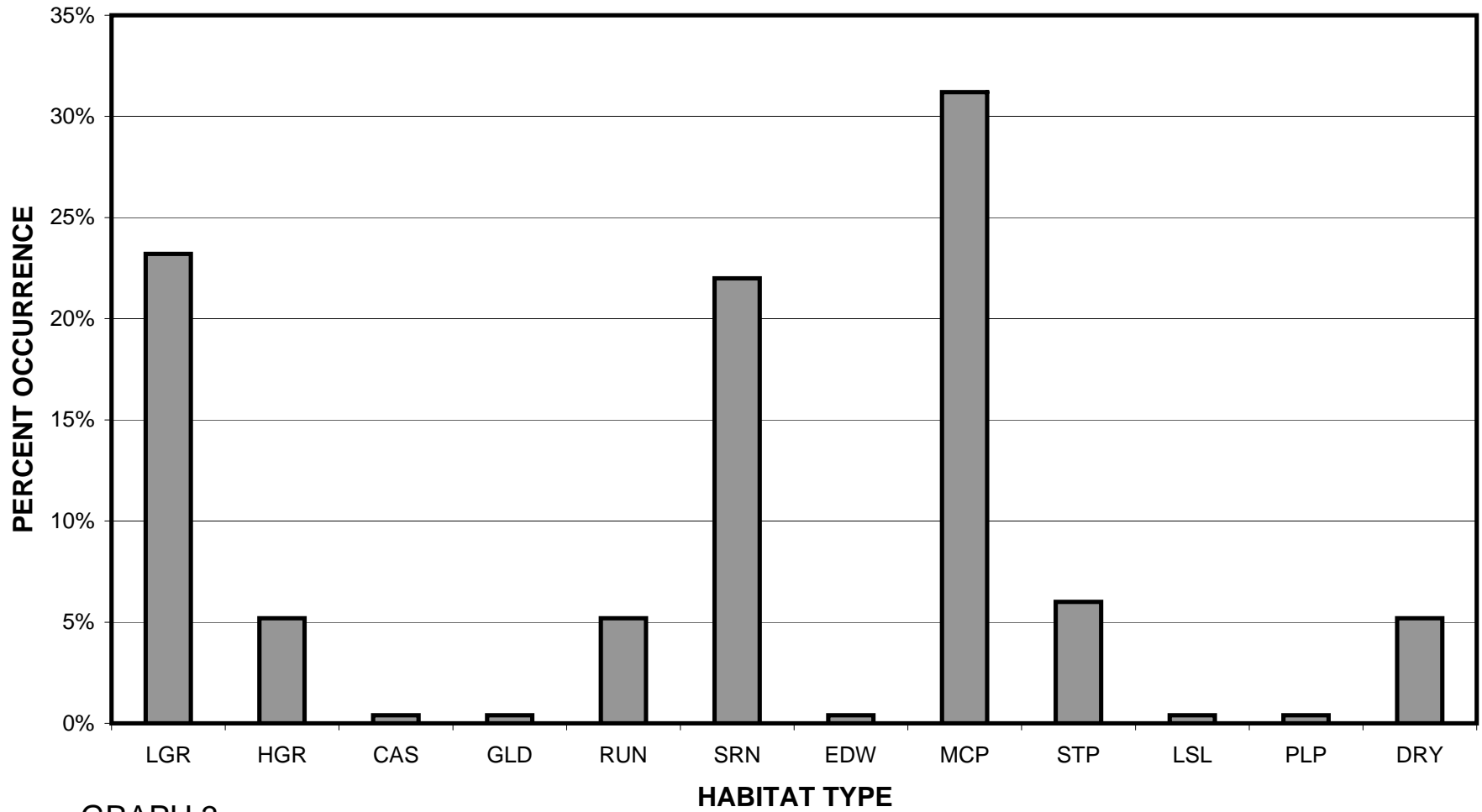
**BUCKHORN CREEK 2012  
HABITAT TYPES BY PERCENT TOTAL LENGTH**



GRAPH 2

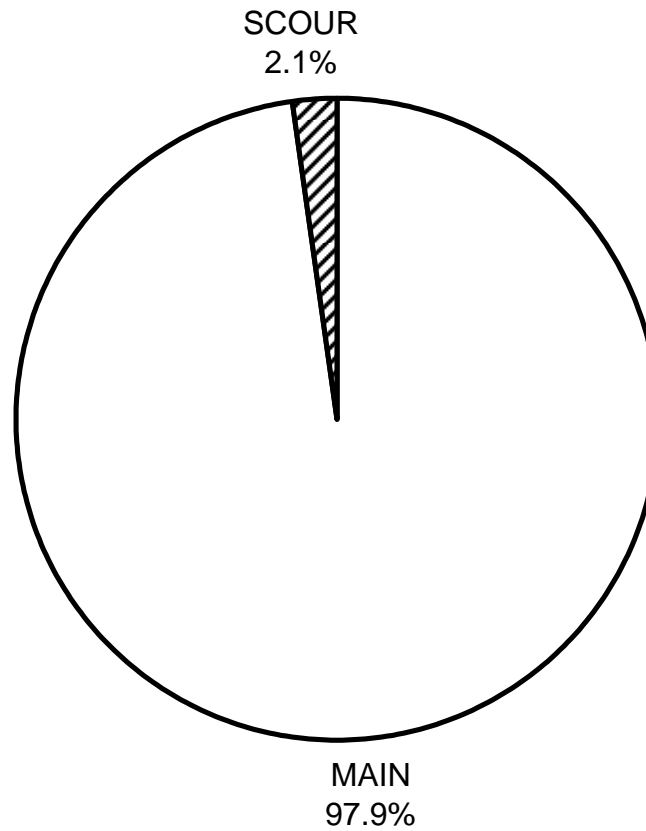


# BUCKHORN CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



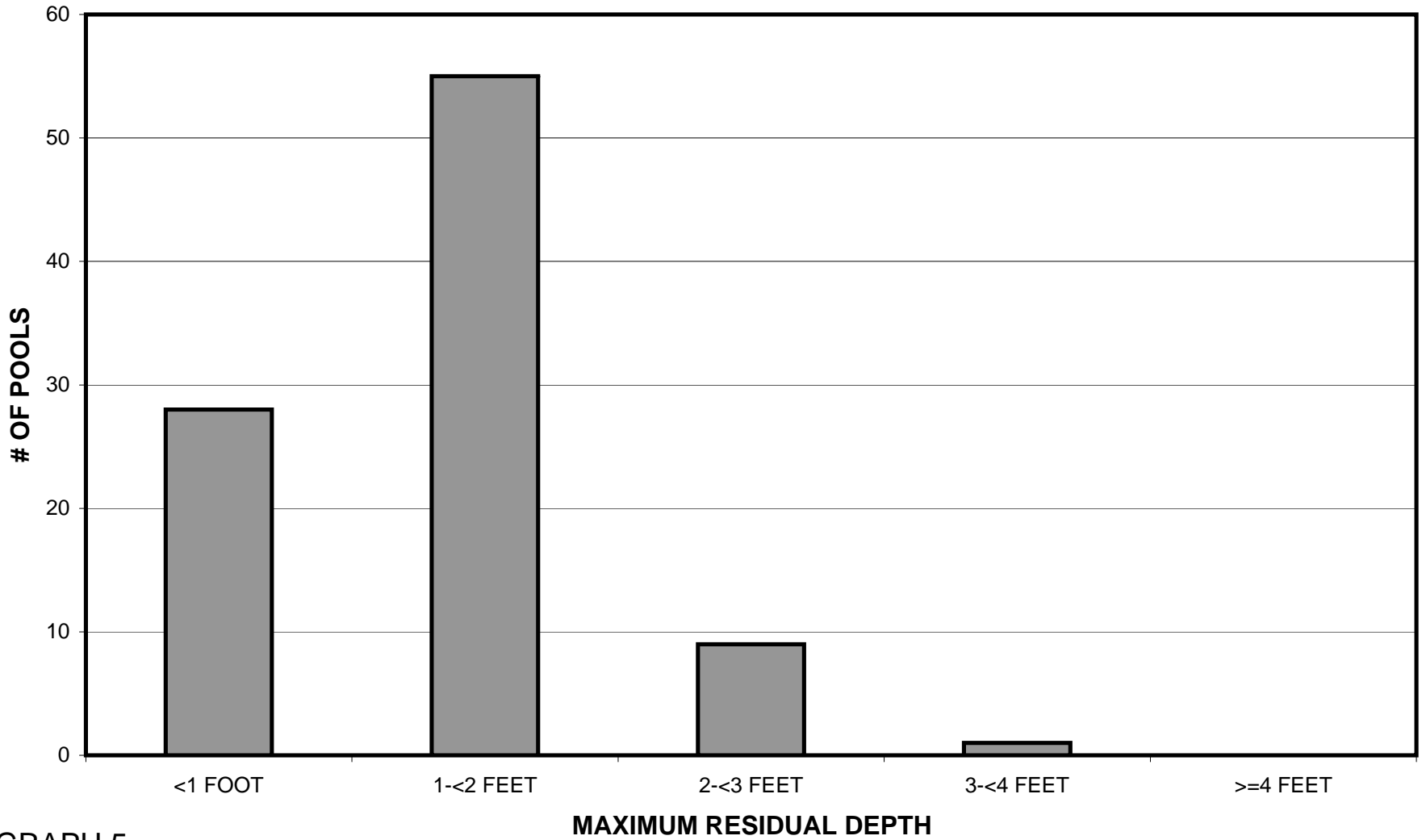
GRAPH 3

**BUCKHORN CREEK 2012  
POOL TYPES BY PERCENT OCCURRENCE**



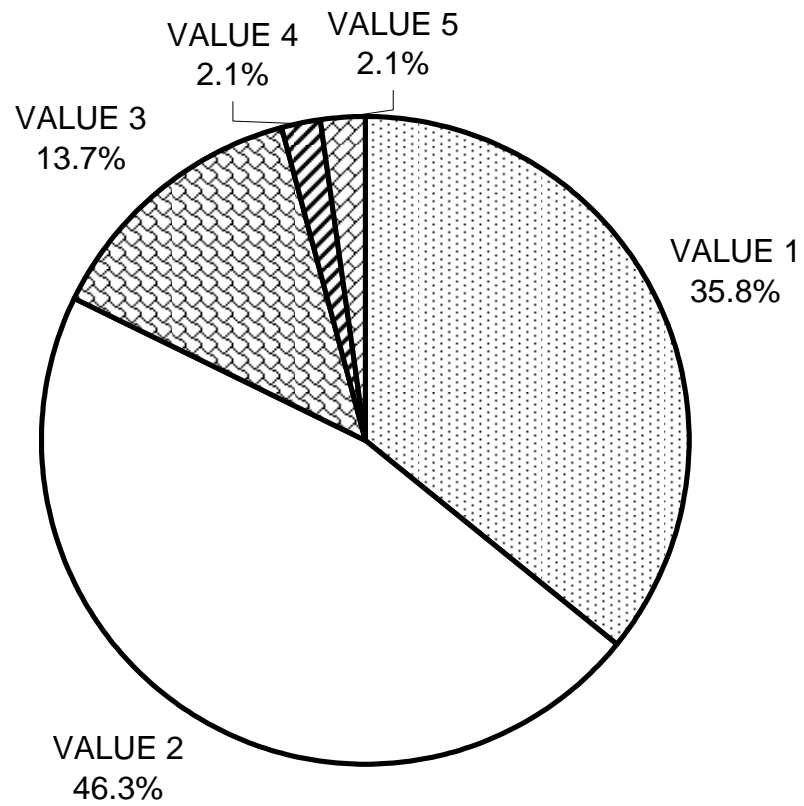
GRAPH 4

# BUCKHORN CREEK 2012 MAXIMUM DEPTH IN POOLS



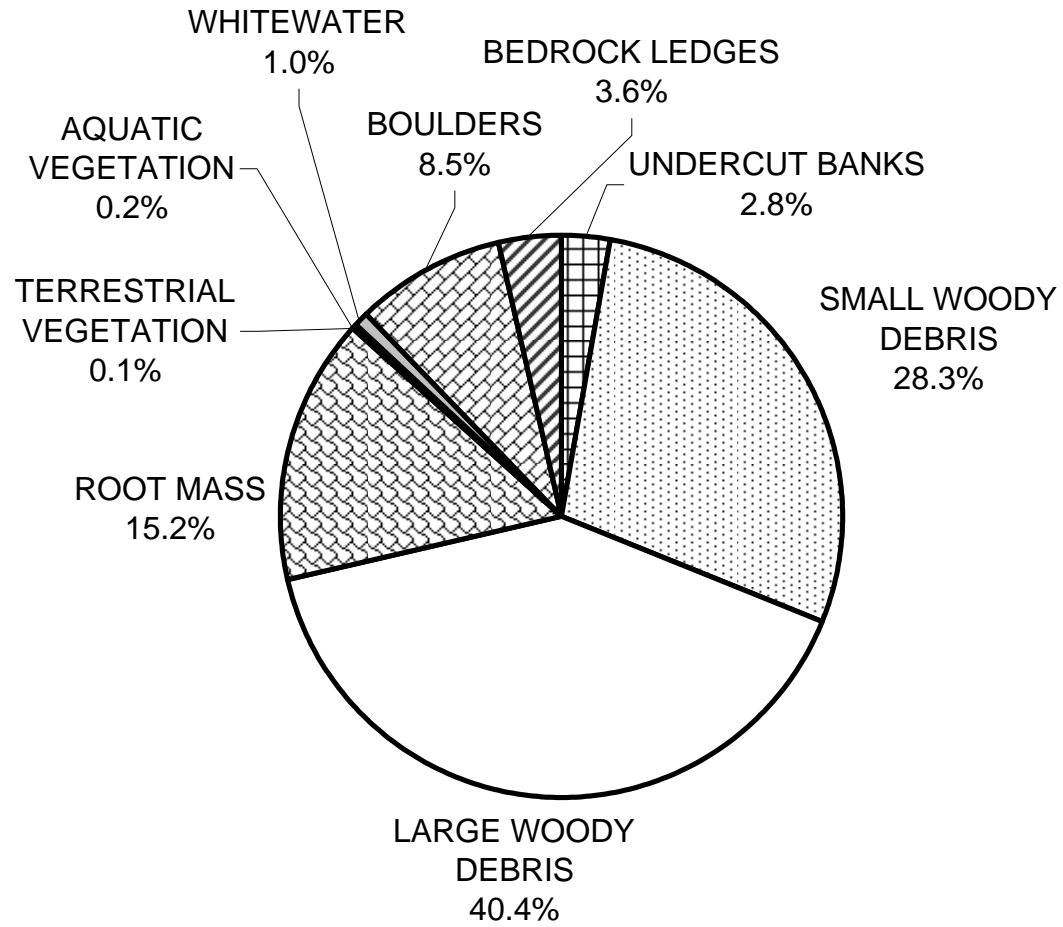
GRAPH 5

# BUCKHORN CREEK 2012 PERCENT EMBEDDEDNESS



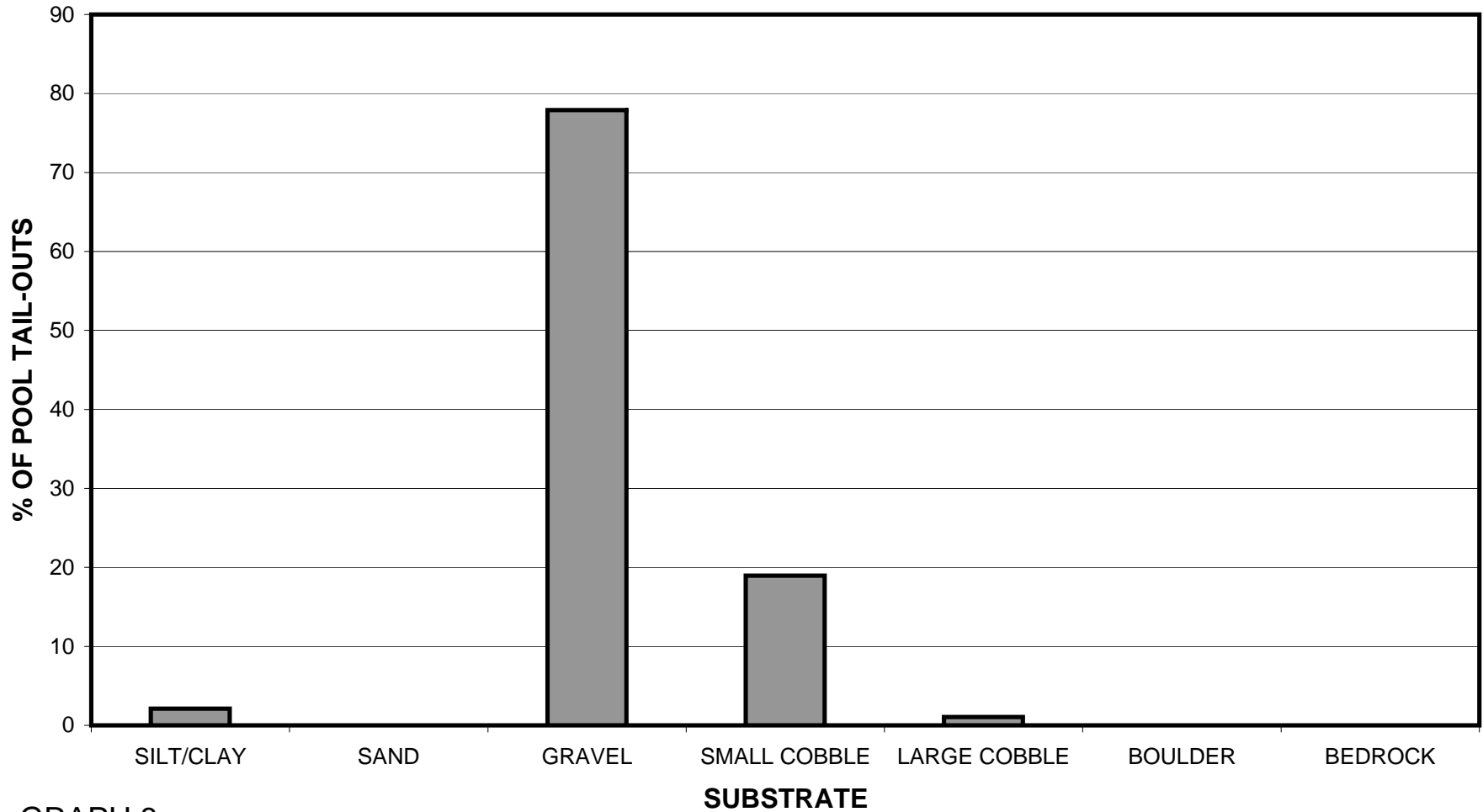
GRAPH 6

# BUCKHORN CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



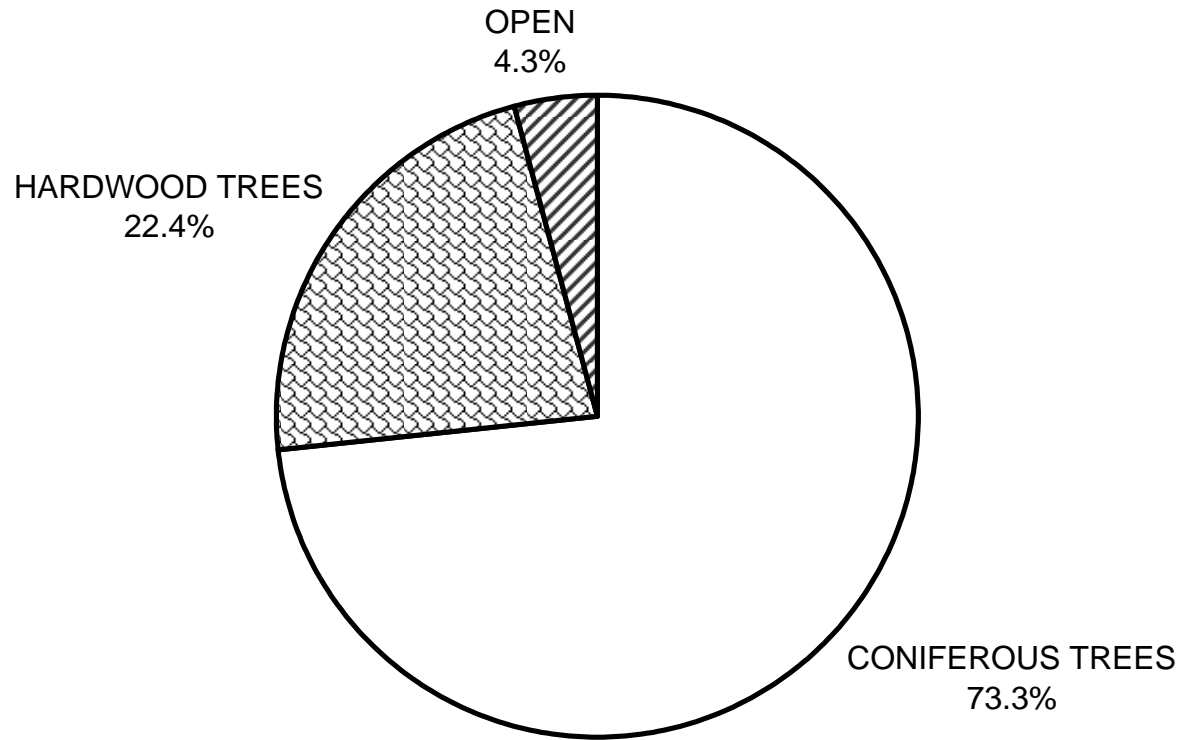
GRAPH 7

# BUCKHORN CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



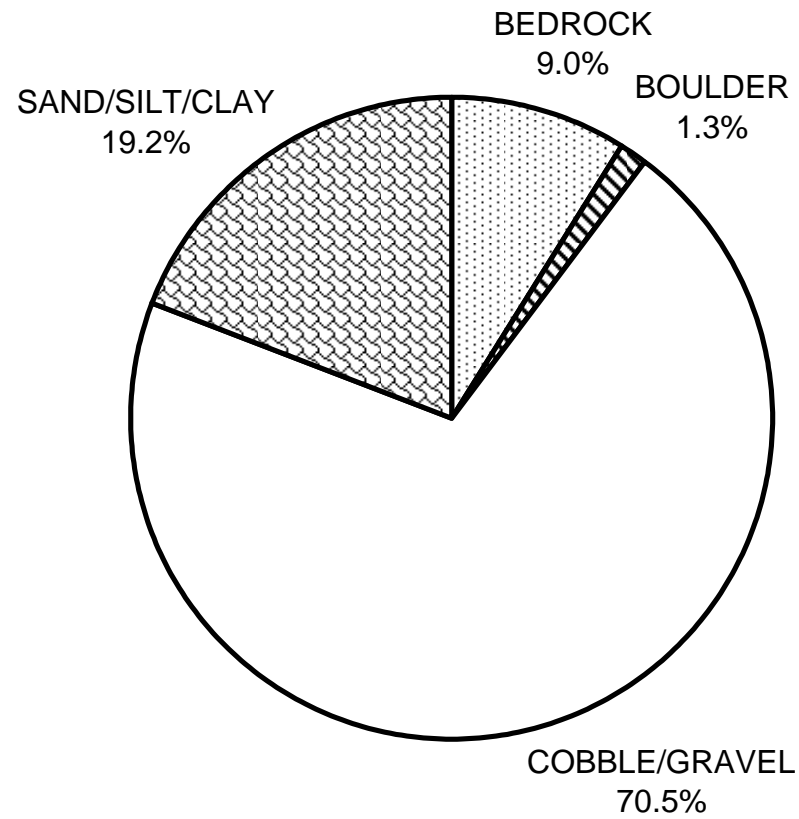
GRAPH 8

# BUCKHORN CREEK 2012 MEAN PERCENT CANOPY



GRAPH 9

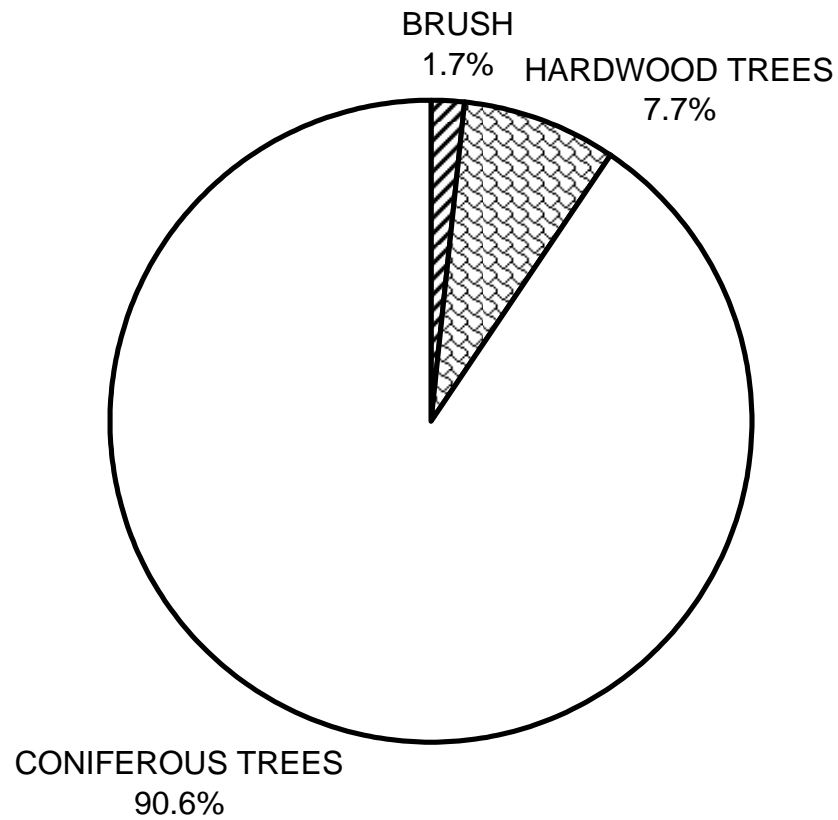
# BUCKHORN CREEK 2012 DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10




**BUCKHORN CREEK 2012  
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

**Map 1**  
**Buckhorn Creek**  
**Ten Mile River Watershed**  
**Dutchmans Knoll Quad, Mendocino County**



 Channel Type G4

