

# STREAM INVENTORY REPORT

## Beartrap Creek

### INTRODUCTION

A stream inventory was conducted from September 28 to September 29, 2010 on Beartrap Creek. The survey began at the confluence with Rancheria Creek and extended upstream 0.8 miles.

The Beartrap 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 Beartrap 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

Beartrap Creek is a tributary to Rancheria Creek, tributary to Navarro River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Beartrap Creek's legal description at the confluence with Rancheria Creek is T13N R14W S07. Its location is 38.9995 north latitude and 123.4482 west longitude, LLID number 1234471389996. Beartrap Creek is a first order stream and has approximately 1.9 miles of blue line stream according to the USGS Zeni Ridge 7.5 minute quadrangle. Beartrap Creek drains a watershed of approximately 2.1 square miles. Elevations range from about 500 feet at the mouth of the creek to 2,100 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production. Vehicle access exists via Highway 128 to Mountain View Road near Philo.

### METHODS

The habitat inventory conducted in Beartrap Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The 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

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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 Beartrap 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". Beartrap 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 Beartrap 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 Beartrap 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Beartrap 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 Beartrap 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 Beartrap Creek. In addition, underwater observations were made at 10 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

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

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for Beartrap 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 28 to September 29, 2010, was conducted by I. Mikus (DFG) and P. Scott (WSP). The total length of the stream surveyed was 4,090 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.07 cfs on October 4, 2010.

Beartrap Creek is a G4 channel type for 3,652 feet of the stream surveyed (Reach 1), and an A3 channel type for 438 feet of the stream surveyed (Reach 2). G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios and gravel-dominant substrates. A3 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 54 to 58 degrees Fahrenheit. Air temperatures ranged from 48 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% riffle units, 32% pool units, 27% flatwater units, 1% dry units, and 1% no survey units (Graph 1). Based on total length of Level II habitat types there were 37% riffle units, 34% flatwater units, 26% pool units, and 3% dry 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, 29%; low gradient riffle units, 27%; and run units, 15% (Graph 3). Based on percent total length, mid-channel pool units made up 24%, low gradient riffle units 24%, and step run units 22%.

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A total of 41 pools were identified (Table 3). Main channel pools were the most frequently encountered at 93% (Graph 4), and comprised 95% 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 41 pools (17%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 41 pool tail-outs measured, 16 had a value of 1 (39%); 14 had a value of 2 (34.1%); 8 had a value of 3 (19.5%); 1 had a value of 4 (2.4%); 2 had a value of 5 (4.9%) (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 5, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 11 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 12. Scour pools had a mean shelter rating of 7 (Table 3).

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

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 46% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 32% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Beartrap Creek was 80%. Twenty percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 53% and 47%, respectively. Graph 9 describes the mean percent canopy in Beartrap Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 94%. The mean percent left bank vegetated was 89%. The dominant elements composing the structure of the stream banks consisted of 37% cobble/gravel, 25% bedrock, 20% sand/silt/clay, and 17% boulder (Graph 10). Coniferous trees were the dominant vegetation type observed in 41% of the units surveyed. Additionally, 40% of the units surveyed had hardwood trees as the dominant vegetation type, and 12% had grass as the dominant vegetation type (Graph 11).

## **BIOLOGICAL INVENTORY RESULTS**

Survey teams conducted a snorkel survey at 10 sites for species composition and distribution in Beartrap Creek on October 6, 2010. Water temperatures taken during the survey period of 1425

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to 1500 ranged from 57 to 58 degrees Fahrenheit. Air temperatures ranged from 73 to 76 degrees Fahrenheit. The sites were sampled by I. Mikus (DFG), and A. Glasgow (WSP).

In reach 1, which comprised the first 3,652 feet of stream, 10 sites were sampled. The reach sites yielded 36 young-of-the-year steelhead/rainbow trout (SH/RT) and one sculpin.

2010 Beartrap 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: G4 Channel Type									
10/06/10	1	002	Pool	36	1	0	0	0	0
	2	006	Pool	139	2	0	0	0	0
	3	010	Pool	218	2	0	0	0	0
	4	012	Pool	248	2	0	0	0	0
	5	018	Pool	489	14	0	0	0	0
	6	021	Pool	604	10	0	0	0	0
	7	026	Pool	759	5	0	0	0	0
	8	036	Pool	1082	0	0	0	0	0
	9	043	Pool	1278	0	0	0	0	0
	10	052	Pool	1650	0	0	0	0	0

## DISCUSSION

Beartrap Creek is a G4 channel type for the first 3,652 feet of stream surveyed (Reach 1), and an A3 channel type for the remaining 438 feet of the stream surveyed (Reach 2). The suitability of G4 and A3 channel types for fish habitat improvement structures is as follows: A3 channel types are generally not suitable for fish habitat improvement structures. 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 28 to September 29, 2010, ranged from 54 to 58 degrees Fahrenheit. Air temperatures ranged from 48 to 70 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any 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 34% of the total length of this survey, riffles 37%, and pools 26%. Seven of the 41 (17%) 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

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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 structures that will increase or deepen pool habitat is recommended.

Thirty of the 41 pool tail-outs measured had embeddedness ratings of 1 or 2. Nine 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.

Thirty-two of the 41 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 11. The shelter rating in the flatwater habitats is 5. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Beartrap Creek. Boulders are the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 80%. Reach 1 had a canopy density of 76%, and Reach 2 had a canopy density of 90%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 94% and 89%, 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) Beartrap 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 boulders. Adding high quality complexity with woody cover in the pools is desirable.
- 4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.



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### 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 the confluence with Rancheria Creek. The channel type is a G4. There is a 4' high plunge into a pool on Rancheria Creek at the mouth of Beartrap Creek.
352	0017.00	Log debris accumulation (LDA) #01 contains approximately 75 pieces of large woody debris (LWD) and measures 9' high x 60' wide x 48' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to cobble and measures 30' wide x 120' long x 5' deep. Fish are present above the LDA.
604	0022.00	Fish habitat structure with an anchored rootwad.
914	0032.00	A landslide on the left bank measures approximately 100' long x 60' high and is contributing sediment ranging in size from silt to gravel.
985	0033.00	Seven-log structure covered by landslide.
1136	0040.00	A landslide on the left bank measures approximately 100' long x 50' high and is contributing sediment ranging in size from silt to boulders to the channel.
1768	0057.00	A road crosses the channel. The crossing is a 10' wide x 19' high x 58' long railcar bridge.
1868	0061.00	Concrete bridge abutments on both banks. No bridge crossing stream.
1911	0062.00	There is a 2' high plunge over a log.
2665	0086.00	Dry tributary on the right bank.
3072	0094.00	Fish habitat structure with 3 logs.
3534	0108.00	An erosion site on the left bank measures approximately 50' long x 10' high and is contributing sediment ranging in size from silt to cobble to the channel.
3652	0111.00	The channel changes from a G4 to an A3.

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- 3951      0123.00      LDA #02 contains 10 pieces of LWD and measures 8.5' 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 cobble and measures 7' wide x 15' long x 6' deep. Fish are present above the LDA. There is a 2.5' high boulder plunge onto bedrock.
- 4090      0128.00      LDA #03 contains approximately 30 pieces of LWD and measures 10' high x 51' wide x 20' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to cobble and measures 30' wide x 40' long x 5' deep. End of survey at LDA #03. A landslide on the left bank measures approximately 120' long x 30' high and is contributing sediment ranging in size from silt to boulders. The landslide is contributing large cobbles and boulders to LDA #03, creating the probable end of anadromy for salmonids. The LDA has a 6' high plunge and the LDA is situated in the middle of a 195' long length of channel with a 21% slope. There are three plunges above the LDA measuring 5' or higher, all without jump pools below. Two of the plunges are created by boulders. No fish were observed above the LDA.

## 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: Beartrap Creek

LLID: 1234471389996 Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Confluence Location: Quad: ZENI RIDGE Legal Description: T13NR14WS07 Latitude: 38:59:59.0N Longitude: 123:26:50.0W

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
1	0	DRY	0.8	122	122	3.0									
35	7	FLATWATER	27.3	40	1403	34.3	7.4	0.5	0.8	266	9304	129	4529		5
1	0	NOSURVEY	0.8	8	8	0.2									
41	41	POOL	32.0	26	1060	25.9	9.1	0.8	1.5	229	9395	249	10221	215	11
50	7	RIFFLE	39.1	30	1497	36.6	6.9	0.4	0.6	145	7239	53	2636		5
<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>		
128	55				4090					25938			17387		

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

Stream Name: Beartrap Creek

LLID: 1234471389996

Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Confluence Location: Quad: ZENI RIDGE

Legal Description: T13NR14WS07

Latitude: 38:59:59.0N

Longitude: 123:26:50.0W

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 (%)
34	4	LGR	26.6	29	984	24.1	6	0.3	0.6	156	5293	47	1588		1	87
16	3	HGR	12.5	32	513	12.5	7	0.5	0.9	130	2085	61	972		10	89
19	5	RUN	14.8	27	515	12.6	8	0.6	1	206	3908	104	1978		5	79
16	2	SRN	12.5	56	888	21.7	6	0.5	1	416	6658	193	3083		5	79
37	37	MCP	28.9	27	989	24.2	9	0.9	2.6	242	8961	268	9920	232	12	77
1	1	STP	0.8	23	23	0.6	5	0.5	1.1	115	115	92	92	58	5	90
2	2	LSBo	1.6	18	35	0.9	8	0.5	1.1	114	228	73	146	55	5	93
1	1	PLP	0.8	13	13	0.3	7	0.6	1.4	91	91	64	64	55	10	76
1	0	DRY	0.8	122	122	3.0										
1	0	NS	0.8	8	8	0.2										

Total Units  
128

Total Units Fully Measured  
55

Total Length (ft.)  
4090

Total Area (sq.ft.)  
27338

Total Volume (cu.ft.)  
17842

**Table 3 - Summary of Pool Types**

Stream Name: Beartrap Creek

LLID: 1234471389996

Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Confluence Location: Quad: ZENI RIDGE

Legal Description: T13NR14WS07

Latitude: 38:59:59.0N

Longitude: 123:26:50.0W

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
38	38	MAIN	93	27	1012	95	9.3	0.9	239	9076	228	8647	12
3	3	SCOUR	7	16	48	5	7.3	0.5	106	319	55	165	7

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
41	41	1060	9395	8811

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

Stream Name: Beartrap Creek LLID: 1234471389996 Drainage: Navarro River  
 Survey Dates: 9/28/2010 to 9/29/2010  
 Confluence Location: Quad: ZENI RIDGE Legal Description: T13NR14WS07 Latitude: 38:59:59.0N Longitude: 123:26:50.0W

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
37	MCP	90	0	0	30	81	7	19	0	0	0	0
1	STP	2	0	0	1	100	0	0	0	0	0	0
2	LSBo	5	0	0	2	100	0	0	0	0	0	0
1	PLP	2	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
41	0	0	34	83	7	17	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.5

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

Stream Name: Beartrap Creek

LLID: 1234471389996

Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Dry Units: 1

Confluence Location: Quad: ZENI RIDGE

Legal Description: T13NR14WS07

Latitude: 38:59:59.0N

Longitude: 123:26:50.0W

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
34	4	LGR	0	0	0	0	0	0	0	100	0
16	3	HGR	0	0	0	0	0	0	0	100	0
50	7	TOTAL RIFFLE	0	0	0	0	0	0	0	100	0
19	5	RUN	20	8	33	0	25	0	0	15	0
16	2	SRN	0	0	0	0	30	0	0	70	0
35	7	TOTAL FLAT	16	6	26	0	26	0	0	26	0
37	37	MCP	10	7	17	0	8	0	0	57	1
1	1	STP	0	0	40	0	0	0	0	60	0
2	2	LSBo	0	0	0	0	0	0	0	100	0
1	1	PLP	0	10	80	0	0	0	0	10	0
41	41	TOTAL POOL	9	7	18	0	7	0	0	59	1
1	0	NS									
128	55	TOTAL	9	6	18	0	9	0	0	57	1



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

Stream Name: Beartrap Creek

LLID: 1234471389996

Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Dry Units: 1

Confluence Location: Quad: ZENI RIDGE

Legal Description: T13NR14WS07

Latitude: 38:59:59.0N

Longitude: 123:26:50.0W

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
34	4	LGR	0	0	0	25	75	0	0
16	3	HGR	0	0	0	0	0	100	0
19	5	RUN	0	0	60	0	40	0	0
16	2	SRN	0	0	100	0	0	0	0
37	37	MCP	0	0	84	5	3	8	0
1	1	STP	0	0	0	0	0	0	100
2	2	LSBo	0	0	0	0	0	100	0
1	1	PLP	0	0	100	0	0	0	0

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

Stream Name: Beartrap Creek

LLID: 1234471389996

Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Confluence Location: Quad: ZENI RIDGE

Legal Description: T13NR14WS07

Latitude: 38:59:59.0N

Longitude: 123:26:50.0W

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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
80	47	53	0	94	89

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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 8 - Fish Habitat Inventory Data Summary**

Stream Name: Beartrap Creek LLID: 1234471389996 Drainage: Navarro River  
 Survey Dates: 9/28/2010 to 9/29/2010 Survey Length (ft.): 4090 Main Channel (ft.): 4090 Side Channel (ft.): 0  
 Confluence Location: Quad: ZENI RIDGE Legal Description: T13NR14WS07 Latitude: 38:59:59.0N Longitude: 123:26:50.0W

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 1**

Channel Type: G4	Canopy Density (%): 76.8	Pools by Stream Length (%): 25.1
Reach Length (ft.): 3652	Coniferous Component (%): 47.7	Pool Frequency (%): 30.0
Riffle/Flatwater Mean Width (ft.): 6.8	Hardwood Component (%): 52.3	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 88
Range (ft.): 15 to 28	Vegetative Cover (%): 90.7	2 to 2.9 Feet Deep: 12
Mean (ft.): 21	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 4	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.1	Occurrence of LWD (%): 13	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 54 - 58 Air (F): 48 - 70	LWD per 100 ft.:	Mean Pool Shelter Rating: 12
Dry Channel (ft): 122	Riffles: 3	
	Pools: 5	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 3 Gravel: 48 Sm Cobble: 27 Lg Cobble: 18 Boulder: 0 Bedrock: 3		
Embeddedness Values (%): 1. 42.4 2. 36.4 3. 15.2 4. 3.0 5. 3.0		

**STREAM REACH: 2**

Channel Type: A3	Canopy Density (%): 90.7	Pools by Stream Length (%): 33.1
Reach Length (ft.): 438	Coniferous Component (%): 45.5	Pool Frequency (%): 44.4
Riffle/Flatwater Mean Width (ft.): 8.3	Hardwood Component (%): 54.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 63
Range (ft.): 15 to 26	Vegetative Cover (%): 94.3	2 to 2.9 Feet Deep: 38
Mean (ft.): 20	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 5	Dominant Bank Substrate Type: Bedrock	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.1	Occurrence of LWD (%): 12	Mean Max Residual Pool Depth (ft.): 1.8
Water (F): 57 - 58 Air (F): 54 - 70	LWD per 100 ft.:	Mean Pool Shelter Rating: 8
Dry Channel (ft): 0	Riffles: 6	
	Pools: 5	
	Flat: 29	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 38 Sm Cobble: 50 Lg Cobble: 0 Boulder: 0 Bedrock: 13		
Embeddedness Values (%): 1. 25.0 2. 25.0 3. 37.5 4. 0.0 5. 12.5		

**Table 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: Beartrap Creek

LLID: 1234471389996

Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Confluence Location: Quad: ZENI RIDGE

Legal Description: T13NR14WS07

Latitude: 38:59:59.0N

Longitude: 123:26:50.0W

**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	11	17	25.5
Boulder	14	5	17.3
Cobble / Gravel	16	25	37.3
Sand / Silt / Clay	14	8	20.0

**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	9	11.8
Brush	5	3	7.3
Hardwood Trees	24	20	40.0
Coniferous Trees	22	23	40.9
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:** 2

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

StreamName: Beartrap Creek

LLID: 1234471389996

Drainage: Navarro River

Survey Dates: 9/28/2010 to 9/29/2010

Confluence Location: Quad: ZENI RIDGE

Legal Description: T13NR14WS07

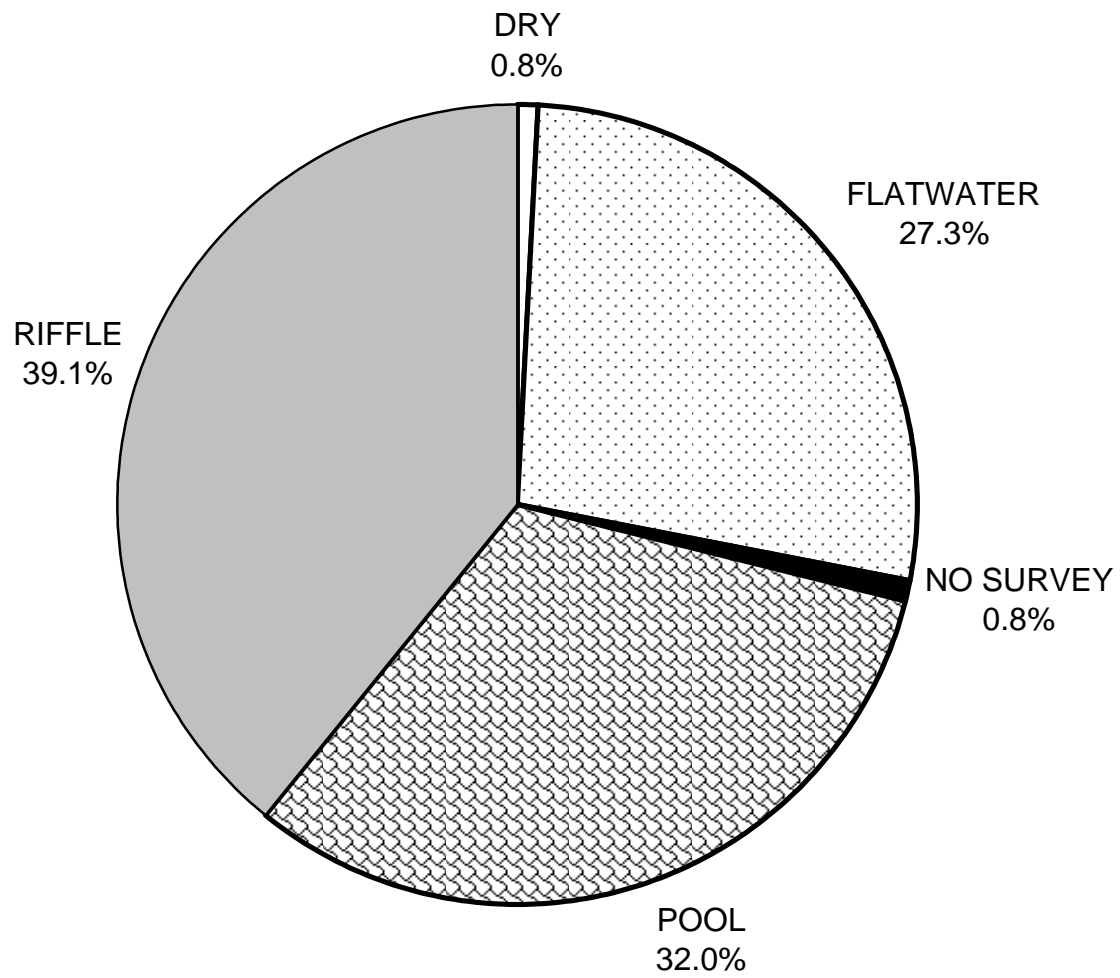
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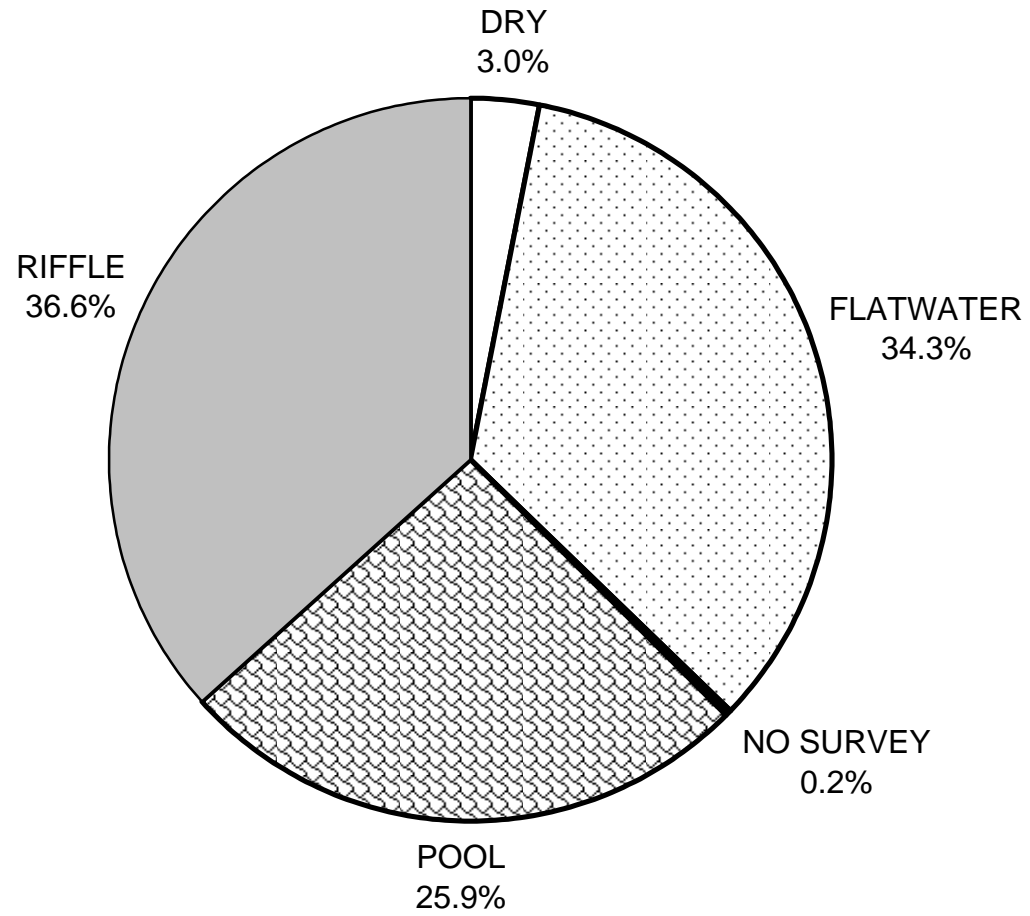
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	16	9
SMALL WOODY DEBRIS (%)	0	6	7
LARGE WOODY DEBRIS (%)	0	26	18
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	0	26	7
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	100	26	59
BEDROCK LEDGES (%)	0	0	1

# BEARTRAP CREEK 2010 HABITAT TYPES BY PERCENT OCCURRENCE



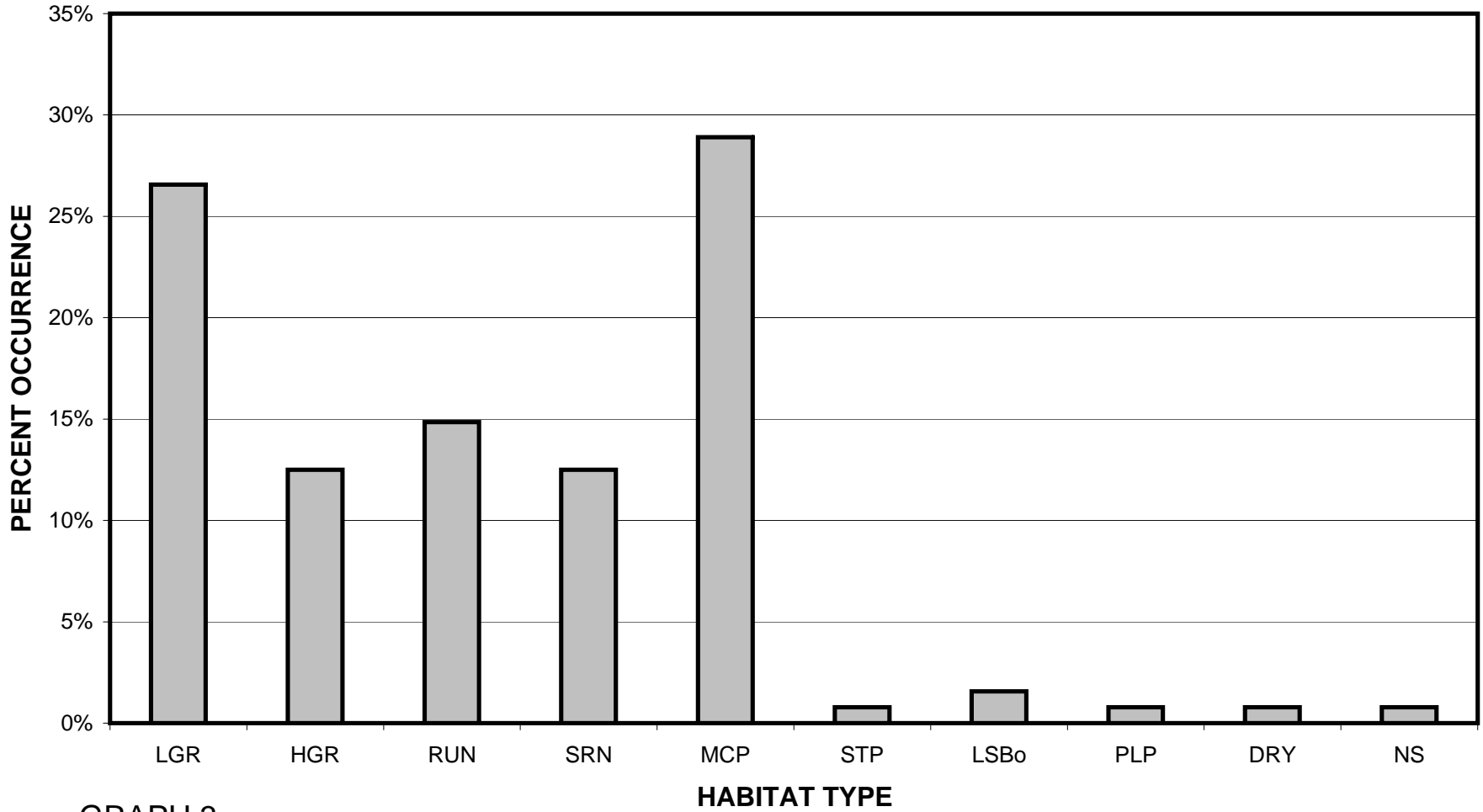
GRAPH 1

# BEARTRAP CREEK 2010 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

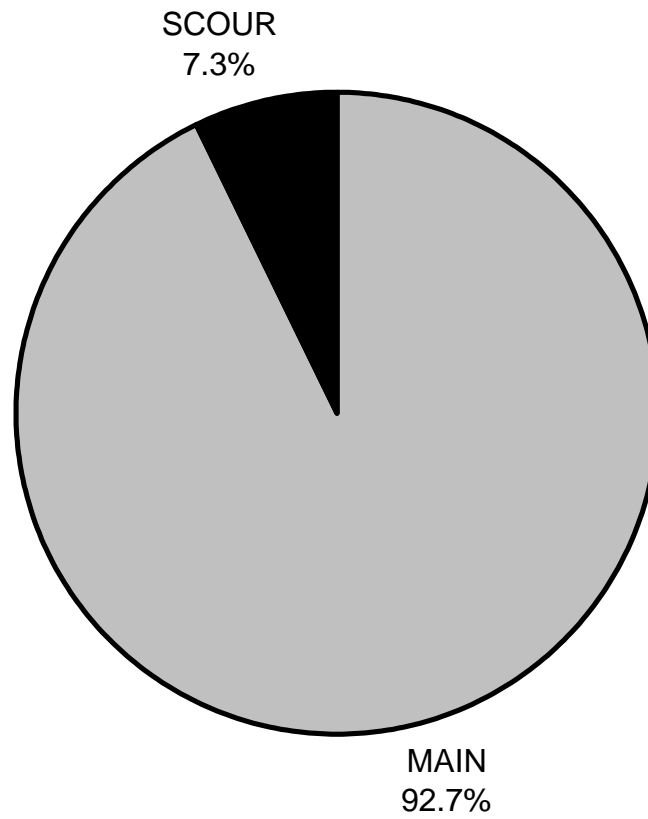
# BEARTRAP CREEK 2010 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 3

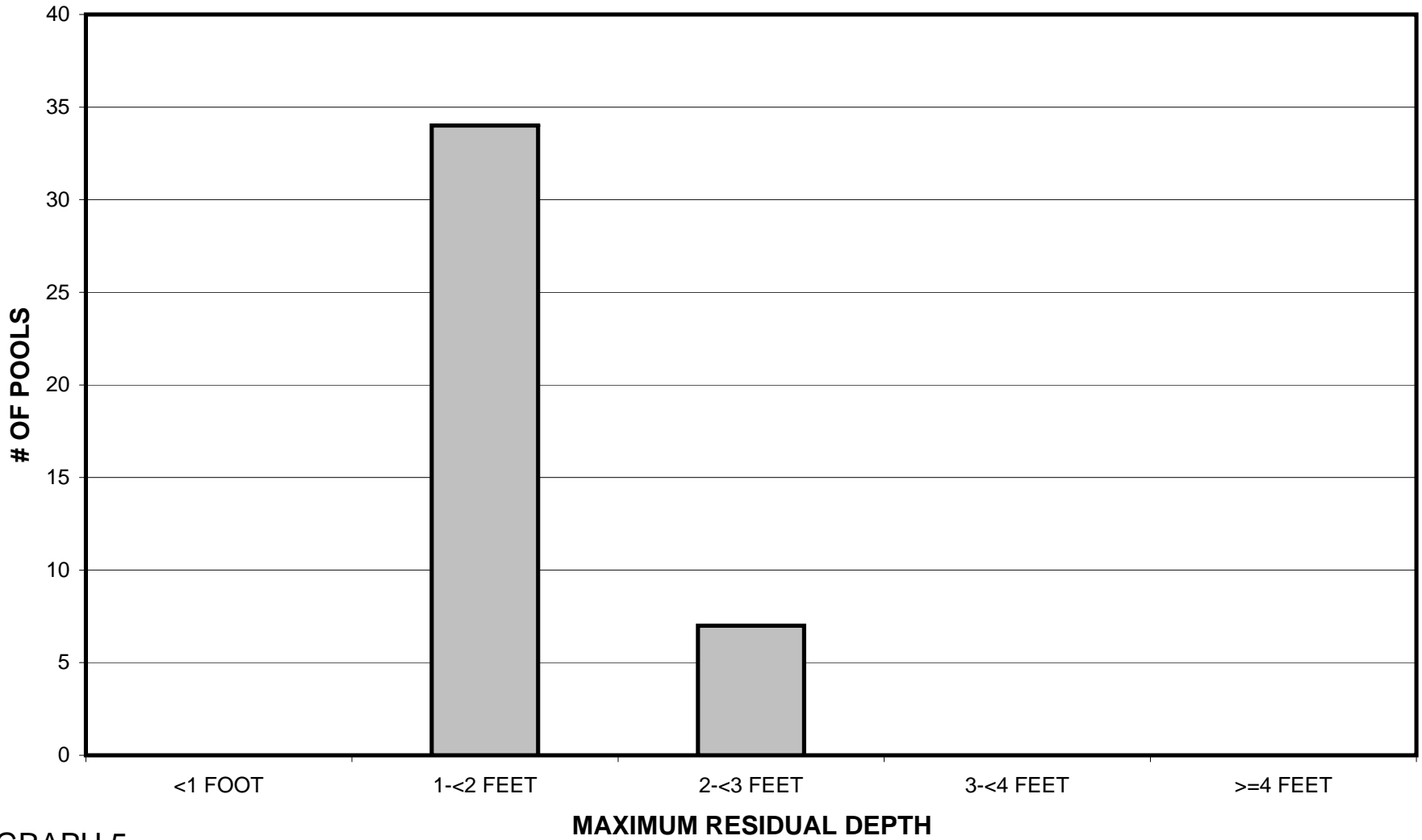


**BEARTRAP CREEK 2010  
POOL TYPES BY PERCENT OCCURRENCE**



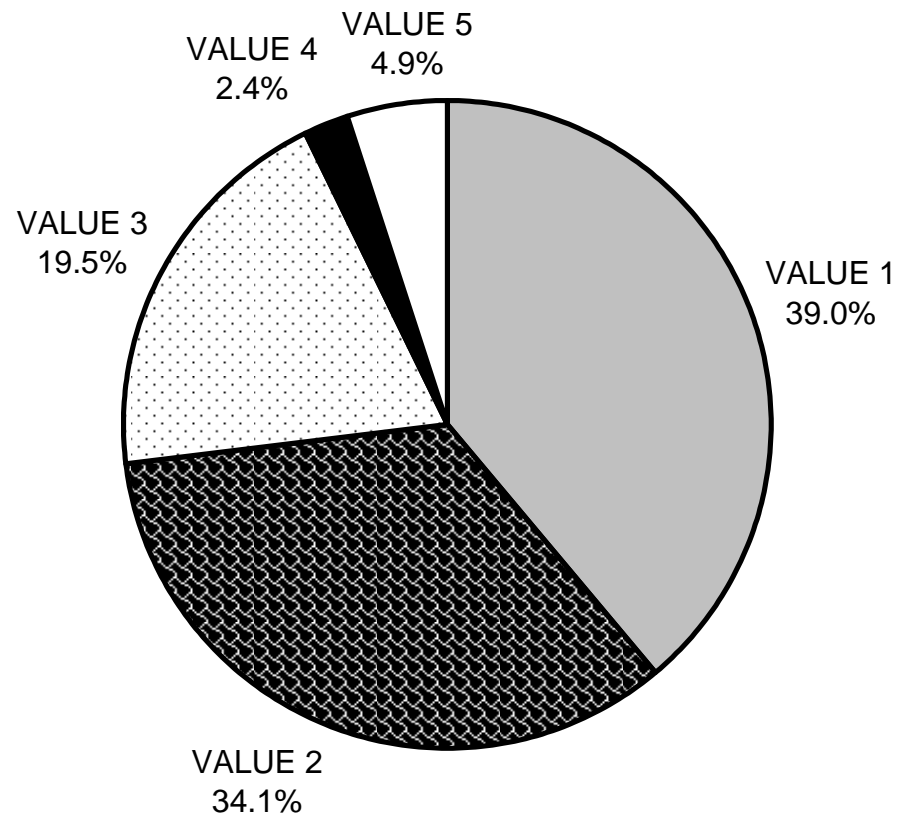
GRAPH 4

# BEARTRAP CREEK 2010 MAXIMUM DEPTH IN POOLS



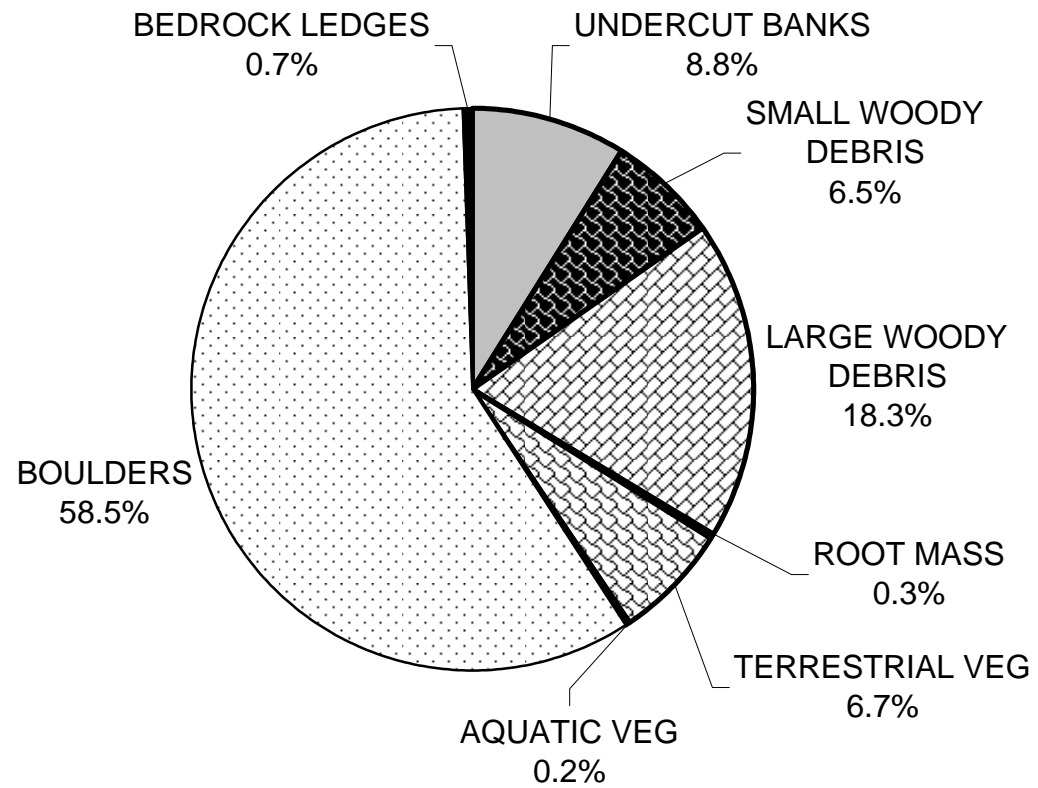
GRAPH 5

# BEARTRAP CREEK 2010 PERCENT EMBEDDEDNESS



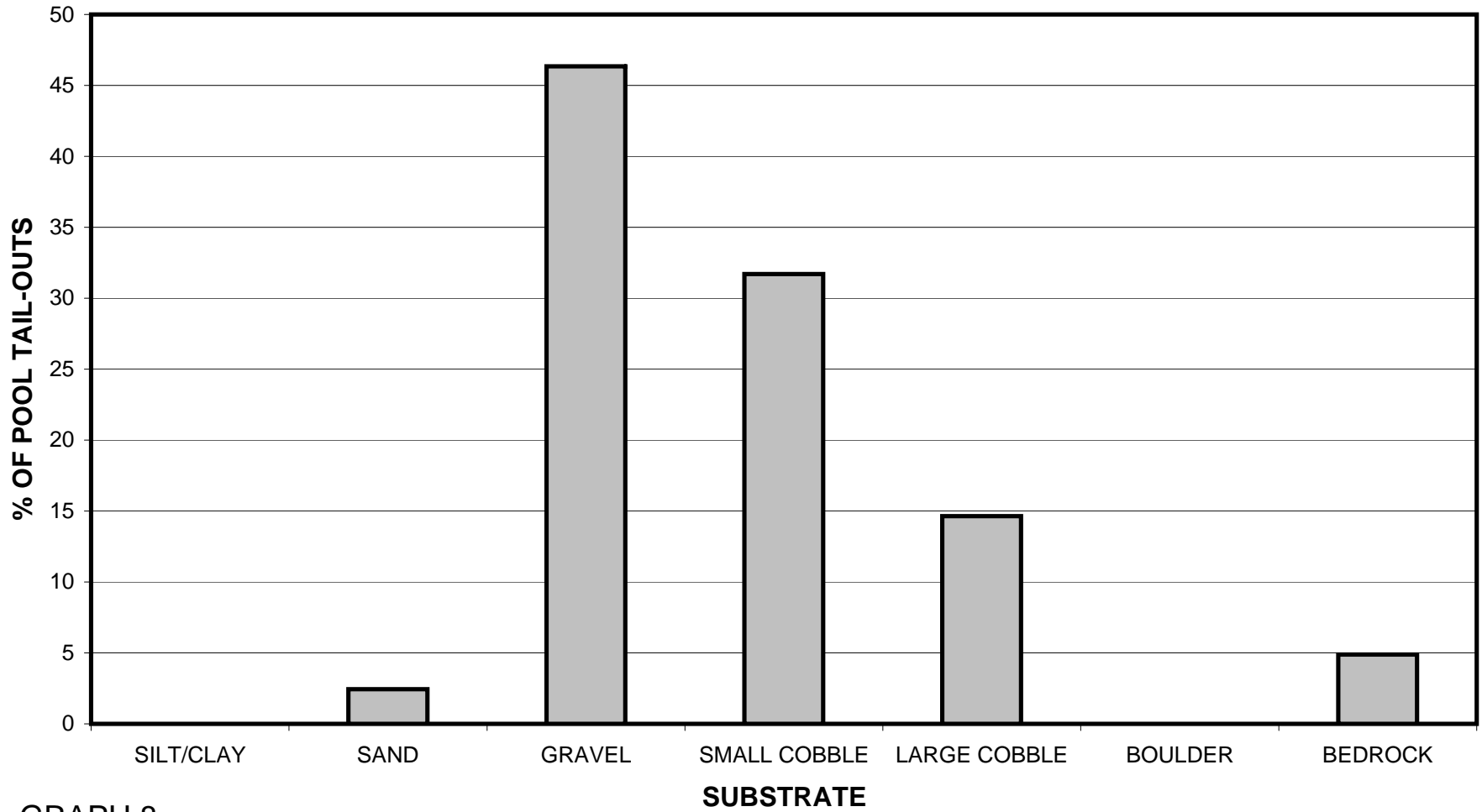
GRAPH 6

# BEARTRAP CREEK 2010 MEAN PERCENT COVER TYPES IN POOLS



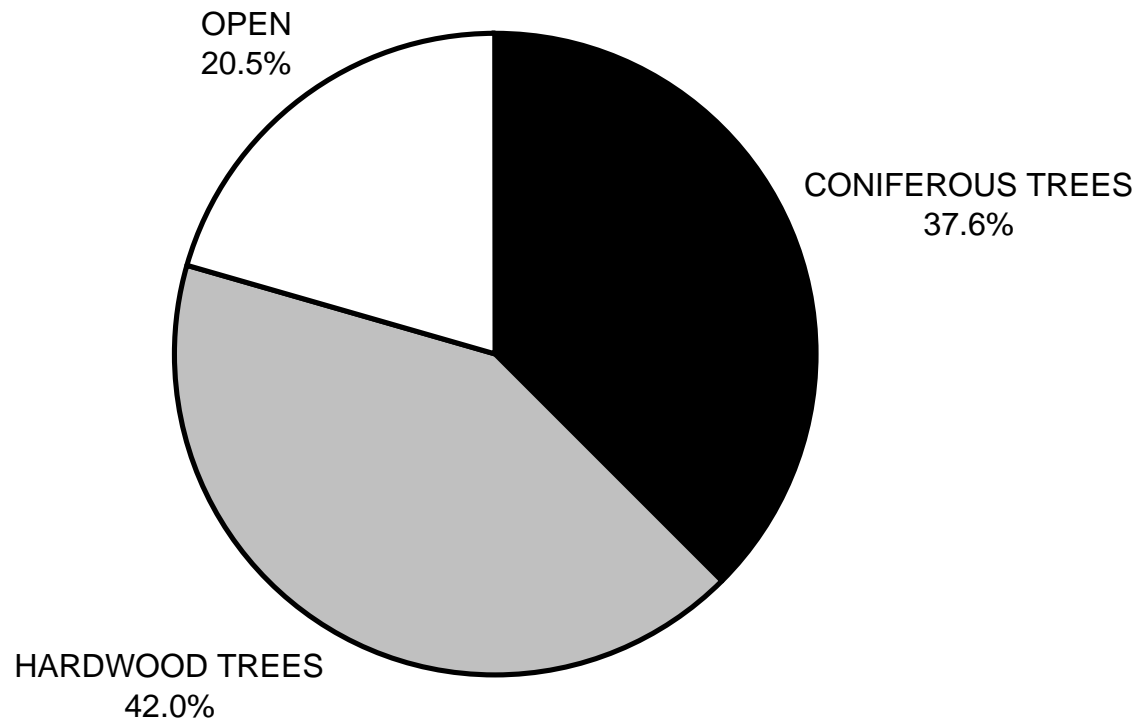
GRAPH 7

# BEARTRAP CREEK 2010 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



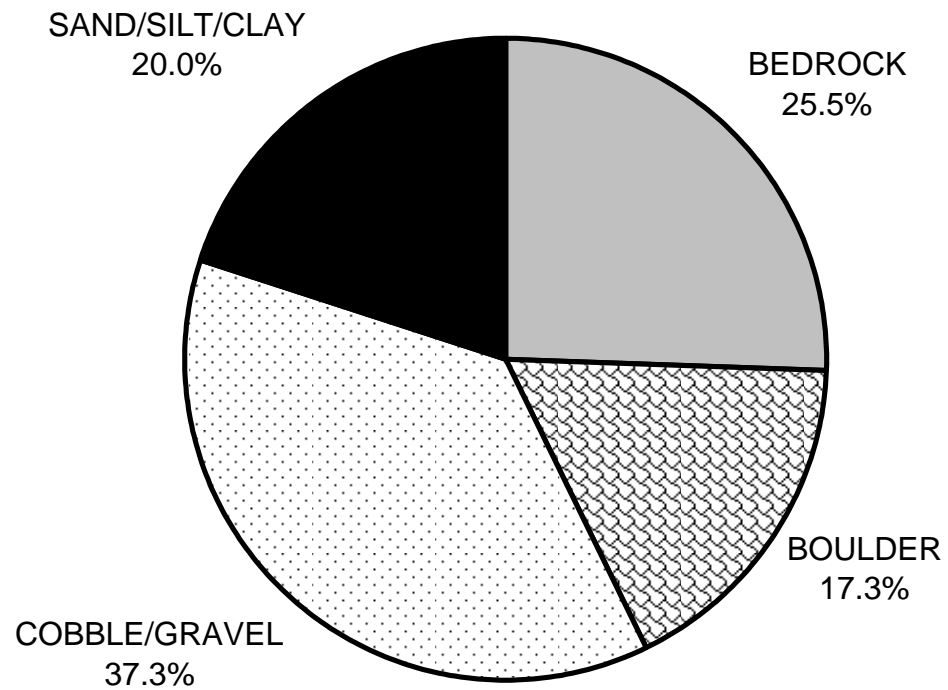
GRAPH 8

# BEARTRAP CREEK 2010 MEAN PERCENT CANOPY



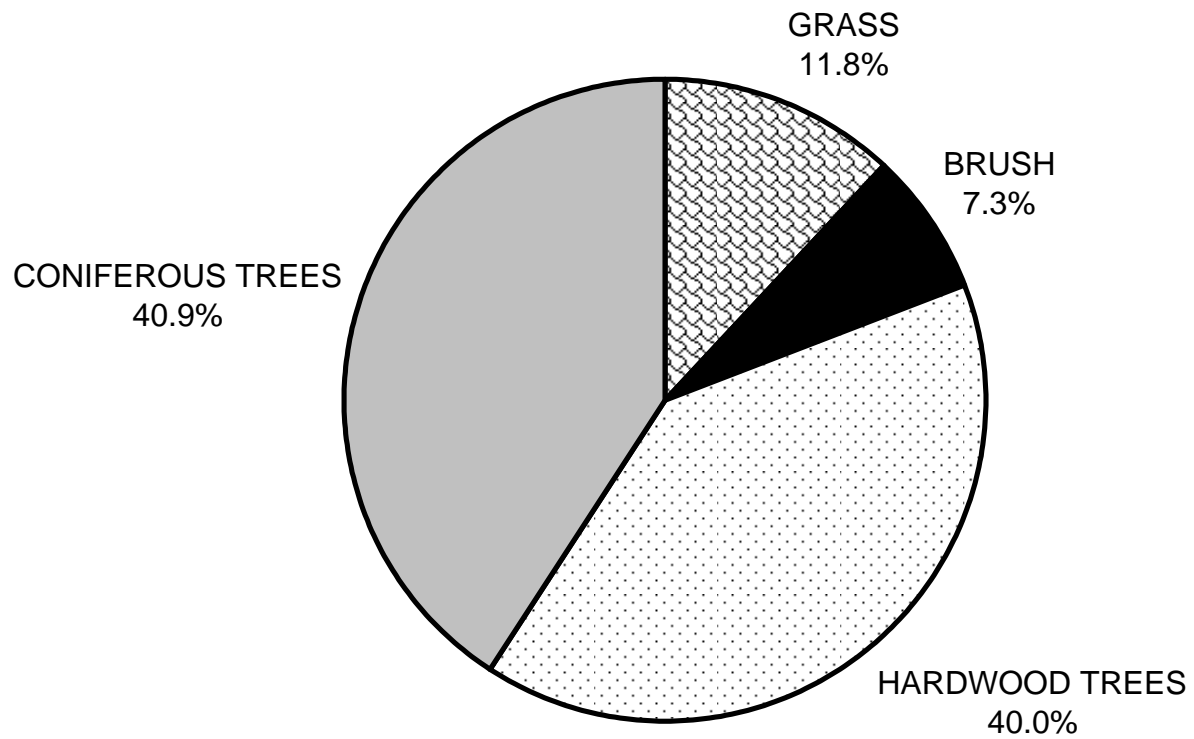
GRAPH 9

# BEARTRAP CREEK 2010 DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

**BEARTRAP CREEK 2010  
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11



