

STREAM INVENTORY REPORT

Little Bear Haven Creek

INTRODUCTION

A stream inventory was conducted from September 17 to September 19, 2012 on Little Bear Haven Creek. The survey began at the confluence with Middle Fork Ten Mile River and extended upstream 1.5 miles.

The Little 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 Little 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

Little Bear Haven Creek is a tributary to Middle 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). Little Bear Haven Creek's legal description at the confluence with Middle Fork Ten Mile River is T20N R16W S33. Its location is 39.5479 degrees north latitude and 123.6383 degrees west longitude, LLID number 1236370395479. Little Bear Haven Creek is a first order stream and has approximately 2.1 miles of blue line stream according to the USGS Dutchmans Knoll 7.5 minute quadrangle. Little Bear Haven Creek drains a watershed of approximately 3.0 square miles. Elevations range from about 190 feet at the mouth of the creek to 800 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, CA.

METHODS

The habitat inventory conducted in Little 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.

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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 Little 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". Little 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

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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 Little 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 Little 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 Little 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 Little Bear Haven Creek, the dominant composition type and the

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dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

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

11. Average Bankfull Width:

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

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Little Bear Haven Creek. In addition, underwater observations were made at eleven 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 Little 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 17 to September 19, 2012 was conducted by B. Leonard and T. Anderson (CDFW). The total length of the stream surveyed was 7,797 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.9 cfs on September 24, 2012.

Little Bear Haven Creek is a G4 channel type for 1,429 feet of the stream surveyed (Reach 1) and an F4 channel type for 6,368 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. F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

The water temperature taken during the survey period was 50 degrees Fahrenheit. Air temperatures ranged from 50 to 60 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 48% pool units, 33% flatwater units, 16% riffle units, and 2% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 48% flatwater units, 39% pool units, 11% riffle units, and 2% unsurveyed units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 44%; step run units, 24%; and low gradient riffle units,

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14% (Graph 3). Based on percent total length, step run units made up 40%, mid-channel pools units 35%, and low gradient riffle units 10%.

A total of 100 pools were identified (Table 3). Main channel pools were the most frequently encountered at 97% (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. Twenty-six of the 100 pools (26%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 100 pool tail-outs measured, 36 had a value of 2 (36%); 51 had a value of 3 (51%); six had a value of 4 (6%); seven had a value of 5 (7%) (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 0, flatwater habitat types had a mean shelter rating of 10, and pool habitats had a mean shelter rating of 38 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 39. Scour pools had a mean shelter rating of 20 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Little Bear Haven Creek. Graph 7 describes the pool cover in Little 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. Small cobble was the next most frequently observed dominant substrate type and occurred in 13% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Little 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 36% and 64%, respectively. Graph 9 describes the mean percent canopy in Little Bear Haven 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 47% sand/silt/clay, 40% cobble/gravel, and 13% bedrock (Graph 10). Brush was the dominant vegetation type observed in 47% of the units surveyed. Additionally, 47% of the units surveyed had coniferous trees as the dominant vegetation type, and 6% had deciduous trees as the dominant vegetation type (Graph 11).

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BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 11 sites for species composition and distribution in Little Bear Haven Creek on September 24, 2012. The sites were sampled by I. Mikus and M. Groff (CDFW).

In Reach 1, which comprised the first 1,429 feet of stream, one site was sampled. The reach sites yielded one young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), and six YOY coho salmon.

In Reach 2, 10 sites were sampled starting approximately 5,177 from the confluence with Middle Fork Ten Mile River and continuing upstream 1,797 feet. The reach sites yielded 75 YOY SH/RT, two age 1+ SH/RT, one age 2+ SH/RT, and four YOY coho salmon.

The following chart displays the information yielded from these sites:

2012 Little 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: G4 Channel Type									
09/24/12	1	006	Pool	317	1	0	0	6	0
Reach 2: F4 Channel Type									
09/24/12	2	138	Pool	5,225	4	0	0	2	0
	3	142	Pool	5,372	3	0	0	1	0
	4	144	Pool	5,468	14	1	0	0	0
	5	148	Pool	5,703	5	0	0	0	0
	6	151	Pool	5,792	4	0	0	1	0
	7	162	Pool	6,080	5	1	1	0	0
	8	166	Pool	6,330	7	0	0	0	0
	9	167	Run	6,347	3	0	0	0	0
	10	178	Pool	6,836	6	0	0	0	0
	11	182	Pool	6,974	24	0	0	0	0

DISCUSSION

Little Bear Haven Creek is a G4 channel type for the first 1,429 feet of stream surveyed and an F4 channel type for the remaining 6,368 feet. The suitability of G4 and F4 channel types for fish habitat improvement structures is as follows: G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover. F4 channel types

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are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperature recorded on the survey days September 17 to September 19, 2012 was 50 degrees Fahrenheit. Air temperatures ranged from 50 to 60 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 48% of the total length of this survey, riffles 11%, and pools 39%. Twenty-six of the 100 (26%) 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 deepen pool habitat is recommended.

Thirty-six of the 100 pool tail-outs measured had embeddedness ratings of 1 or 2. Fifty-seven of the pool tail-outs had embeddedness ratings of 3 or 4. Seven 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. Sediment sources in Little Bear Haven Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Eighty-six of the 100 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 38. 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 Little 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% and Reach 2 had a canopy density of 96%. The percentage of right and left bank covered with vegetation was 97% and 97%, respectively.

RECOMMENDATIONS

- 1) Little Bear Haven Creek should be managed as an anadromous, natural production stream.

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- 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.
- 4) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.
- 5) 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.

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 a G4. Road 10000 crosses the channel. The crossing is a 20' wide x 50' long x 23' high wooden bridge.
906	0023.00	Tributary #01 enters from the right bank. It contributes approximately 1% to Little Bear Haven Creek's flow. The water temperature of the tributary was 50 degrees Fahrenheit. The temperature of Little Bear Haven Creek downstream of the tributary was 50 degrees Fahrenheit and upstream of the tributary was 51 degrees Fahrenheit. The tributary is not accessible to fish due to an estimated 20% slope.
1099	0028.00	An erosion site on the right bank measures 10' high x 20' long. It is contributing woody debris and sediment ranging in size from silt to gravel to the channel.
1135	0030.00	There is a 1.5' high plunge.
1324	0037.00	The channel type changes from a G4 to an F4.
1665	0047.00	Log debris accumulation (LDA) #01 contains 10 pieces of large woody

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		debris (LWD) and measures 5' high x 14' wide x 8' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to gravel and measures 50' long x 4' deep. Fish were observed above the LDA.
2191	0060.00	Dry left bank tributary. An erosion site on the right bank measures approximately 15' high x 30' long. It is contributing sediment ranging in size from silt to cobble to the channel.
5965	0159.00	There is as 2.5' high plunge.
6063	0162.00	The left bank is eroding around a redwood tree's root mass. The erosion site measures 16' high x 30' long x 8' deep. It is contributing sediment ranging in size from silt to boulders to the channel. There is a landslide adjacent to the erosion site that measures 30' high x 20' long.
6366	0169.00	Approximately 30 conifers have collapsed into the channel forming a woody debris accumulation approximately 50' long and spanning the channel. The stream flows underneath the trees and they are not retaining sediment. The right bank is armored with boulder rip-rap.
6534	0171.00	LDA #05 contains approximately 25 pieces of LWD and measures 9' high x 25' wide x 45' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to small cobble. The LDA may be the remnants of an old crossing. Fish were observed above the LDA.
6567	0172.00	LDA #06 contains four pieces of LWD and measures 6' high x 14' wide x 11' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 20' wide x 50' long x 6' deep. Fish were observed above the LDA.
7410	0196.00	LDA #07 contains seven pieces of LWD and measures 3' high x 14' wide x 6' long. Water flows through the LDA and there are no visible gaps in it. The LDA is retaining sediment measuring 20' wide x 50' long x 3' deep. Fish were observed above the LDA.
7519	0200.00	Dry left bank tributary.
7597	0203.00	Unit is mostly covered in wood.
7773	0208.00	LDA #08 contains 11 pieces of LWD and measures 9' high x 13' wide x 20' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to small cobble and measures 50' wide x 150' long x 8' deep. End of survey at LDA#08. Visual observation 1,000' upstream of the end of survey revealed no fish.

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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: Little Bear Haven Creek

LLID: 1236370395479 Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Confluence Location: Quad: DUTCHMANS KNOLL Legal Description: T20NR16WS33 Latitude: 39:32:52.0N Longitude: 123:38:13.0W

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	0.5	17	17	0.2									
69	12	FLATWATER	33.2	54	3714	47.6	6.9	0.4	0.8	387	26704	172	11876		10
4	0	NOSURVEY	1.9	31	125	1.6									
100	100	POOL	48.1	31	3074	39.4	10.4	0.7	1.7	312	31172	323	32311	246	38
34	5	RIFFLE	16.3	26	867	11.1	7.4	0.2	0.3	169	5744	36	1212		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
208	117				7797					63619			45399		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Little Bear Haven Creek

LLID: 1236370395479

Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS33

Latitude: 39:32:52.0N

Longitude: 123:38:13.0W

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 (%)
29	3	LGR	13.9	26	745	9.6	8	0.2	0.3	205	5942	38	1115		0	100
5	2	HGR	2.4	24	122	1.6	6	0.3	0.5	115	575	31	157		0	100
19	5	RUN	9.1	33	630	8.1	7	0.5	0.9	341	6483	155	2945		7	96
50	7	SRN	24.0	62	3084	39.6	7	0.4	1.1	420	20986	184	9218		11	96
92	92	MCP	44.2	30	2744	35.2	10	0.7	5.7	297	27359	307	28279	236	39	96
1	1	CCP	0.5	24	24	0.3	9	0.3	1.1	216	216	130	130	65	10	95
4	4	STP	1.9	60	241	3.1	15	0.8	2.8	751	3004	848	3390	629	54	100
1	1	LSL	0.5	28	28	0.4	9	0.4	1.1	252	252	176	176	101	20	100
2	2	PLP	1.0	18	37	0.5	10	0.8	2.2	171	341	168	336	134	20	100
1	0	DRY	0.5	17	17	0.2										
4	0	NS	1.9	31	125	1.6										

Total Units
208

Total Units Fully Measured
117

Total Length (ft.)
7797

Total Area (sq.ft.)
65158

Total Volume (cu.ft.)
45746

Table 3 - Summary of Pool Types

Stream Name: Little Bear Haven Creek

LLID: 1236370395479

Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS33

Latitude: 39:32:52.0N

Longitude: 123:38:13.0W

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
97	97	MAIN	97	31	3009	98	10.4	0.7	315	30579	250	24271	39
3	3	SCOUR	3	22	65	2	9.3	0.7	198	593	123	368	20

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
100	100	3074	31172	24639

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

Stream Name: Little Bear Haven Creek

LLID: 1236370395479

Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS33

Latitude: 39:32:52.0N

Longitude: 123:38:13.0W

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
92	MCP	92	9	10	60	65	17	18	4	4	2	2
1	CCP	1	0	0	1	100	0	0	0	0	0	0
4	STP	4	0	0	2	50	2	50	0	0	0	0
1	LSL	1	0	0	1	100	0	0	0	0	0	0
2	PLP	2	1	50	0	0	1	50	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
100	10	10	64	64	20	20	4	4	2	2

Mean Maximum Residual Pool Depth (ft.): 1.7

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Little Bear Haven Creek

LLID: 1236370395479

Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Dry Units: 1

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS33

Latitude: 39:32:52.0N

Longitude: 123:38:13.0W

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
29	3	LGR	0	0	0	0	0	0	0	0	0
5	2	HGR	0	0	0	0	0	0	0	0	0
34	5	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
19	5	RUN	15	31	46	3	0	0	0	5	0
50	7	SRN	41	31	3	0	1	0	0	23	0
69	12	TOTAL FLAT	32	31	19	1	1	0	0	16	0
92	92	MCP	17	28	35	7	0	0	0	11	2
1	1	CCP	0	100	0	0	0	0	0	0	0
4	4	STP	11	18	23	16	0	0	8	8	18
1	1	LSL	0	10	90	0	0	0	0	0	0
2	2	PLP	0	10	65	0	0	0	5	20	0
100	100	TOTAL POOL	16	28	35	7	0	0	1	11	2
4	0	NS									
208	117	TOTAL	17	28	33	7	0	0	1	11	2

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Little Bear Haven Creek

LLID: 1236370395479

Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Dry Units: 1

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS33

Latitude: 39:32:52.0N

Longitude: 123:38:13.0W

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
29	3	LGR	0	0	100	0	0	0	0
5	2	HGR	0	0	50	0	50	0	0
19	5	RUN	0	0	80	20	0	0	0
50	7	SRN	0	0	86	0	0	14	0
92	92	MCP	9	3	80	1	0	3	3
1	1	CCP	0	0	100	0	0	0	0
4	4	STP	0	0	100	0	0	0	0
1	1	LSL	0	0	100	0	0	0	0
2	2	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Little Bear Haven Creek

LLID: 1236370395479 Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Confluence Location: Quad: DUTCHMANS Legal Description: T20NR16WS33 Latitude: 39:32:52.0N Longitude: 123:38:13.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	64	36	0	97	97

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Little Bear Haven Creek LLID: 1236370395479 Drainage: Rockport
 Survey Dates: 9/17/2012 to 9/19/2012 Survey Length (ft.): 7797 Main Channel (ft.): 7797 Side Channel (ft.): 0
 Confluence Location: Quad: DUTCHMANS Legal Description: T20NR16WS33 Latitude: 39:32:52.0N Longitude: 123:38:13.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: G4	Canopy Density (%): 98.3	Pools by Stream Length (%): 49.6
Reach Length (ft.): 1429	Coniferous Component (%): 55.0	Pool Frequency (%): 51.3
Riffle/Flatwater Mean Width (ft.): 8.3	Hardwood Component (%): 45.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 85
Range (ft.): 13 to 20	Vegetative Cover (%): 95.1	2 to 2.9 Feet Deep: 10
Mean (ft.): 16	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 3	Dominant Bank Substrate Type: Cobble/Gravel	>= 4 Feet Deep: 5
Base Flow (cfs.): 0.9	Occurrence of LWD (%): 20	Mean Max Residual Pool Depth (ft.): 1.7
Water (F): 50 - 50 Air (F): 50 - 60	LWD per 100 ft.:	Mean Pool Shelter Rating: 26
Dry Channel (ft): 0	Riffles: 3	
	Pools: 6	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 5 Sand: 0 Gravel: 65 Sm Cobble: 5 Lg Cobble: 5 Boulder: 0 Bedrock: 20		
Embeddedness Values (%): 1. 0.0 2. 40.0 3. 30.0 4. 0.0 5. 30.0		

STREAM REACH: 2

Channel Type: F4	Canopy Density (%): 96.1	Pools by Stream Length (%): 37.1
Reach Length (ft.): 6368	Coniferous Component (%): 66.8	Pool Frequency (%): 47.3
Riffle/Flatwater Mean Width (ft.): 6.4	Hardwood Component (%): 33.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 71
Range (ft.): 8 to 18	Vegetative Cover (%): 97.6	2 to 2.9 Feet Deep: 23
Mean (ft.): 13	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 5
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 1
Base Flow (cfs.): 0.9	Occurrence of LWD (%): 35	Mean Max Residual Pool Depth (ft.): 1.6
Water (F): 50 - 50 Air (F): 50 - 60	LWD per 100 ft.:	Mean Pool Shelter Rating: 42
Dry Channel (ft): 17	Riffles: 3	
	Pools: 11	
	Flat: 5	
Pool Tail Substrate (%): Silt/Clay: 5 Sand: 5 Gravel: 75 Sm Cobble: 15 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 35.0 3. 56.3 4. 7.5 5. 1.3		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Little Bear Haven Creek

LLID: 1236370395479

Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Confluence Location: Quad: DUTCHMANS

Legal Description: T20NR16WS33

Latitude: 39:32:52.0N

Longitude: 123:38:13.0W

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	14	16	12.8
Boulder	1	0	0.4
Cobble / Gravel	48	46	40.2
Sand / Silt / Clay	54	55	46.6

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	58	53	47.4
Hardwood Trees	5	9	6.0
Coniferous Trees	54	55	46.6
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

StreamName: Little Bear Haven Creek

LLID: 1236370395479

Drainage: Rockport

Survey Dates: 9/17/2012 to 9/19/2012

Confluence Location: Quad: DUTCHMANS

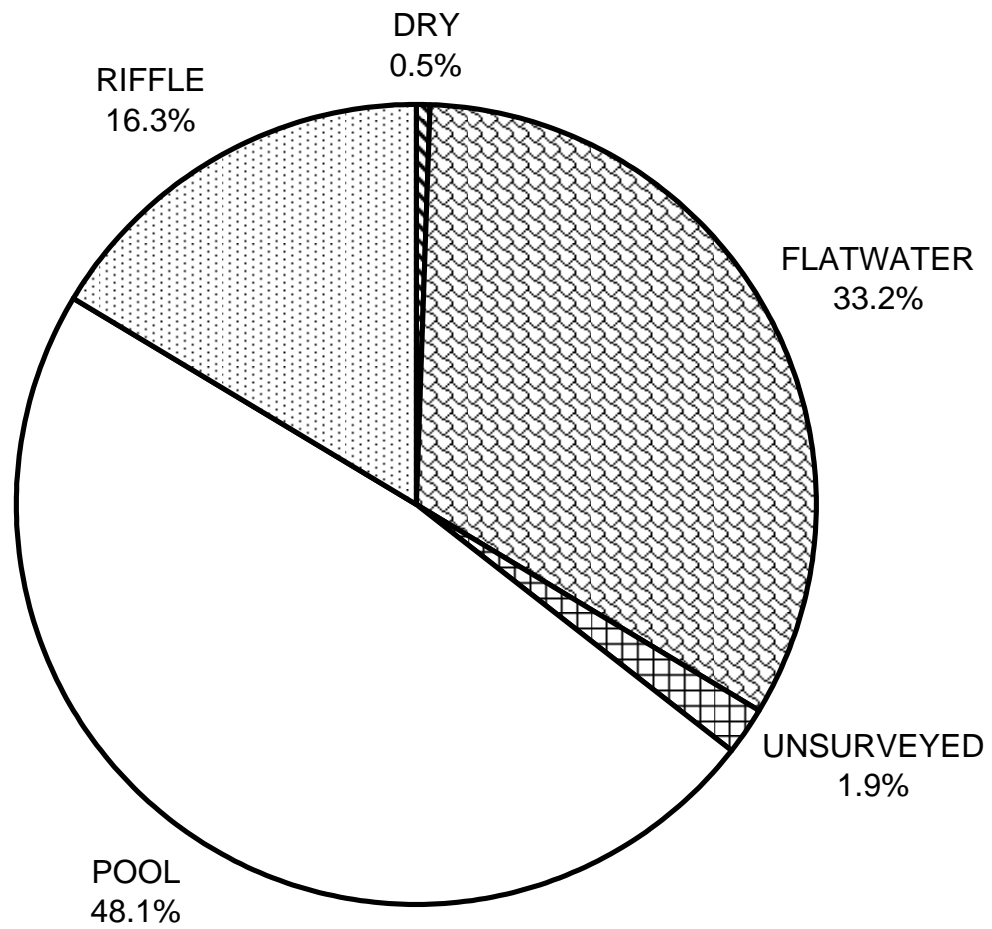
Legal Description: T20NR16WS33

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Longitude: 123:38:13.0W

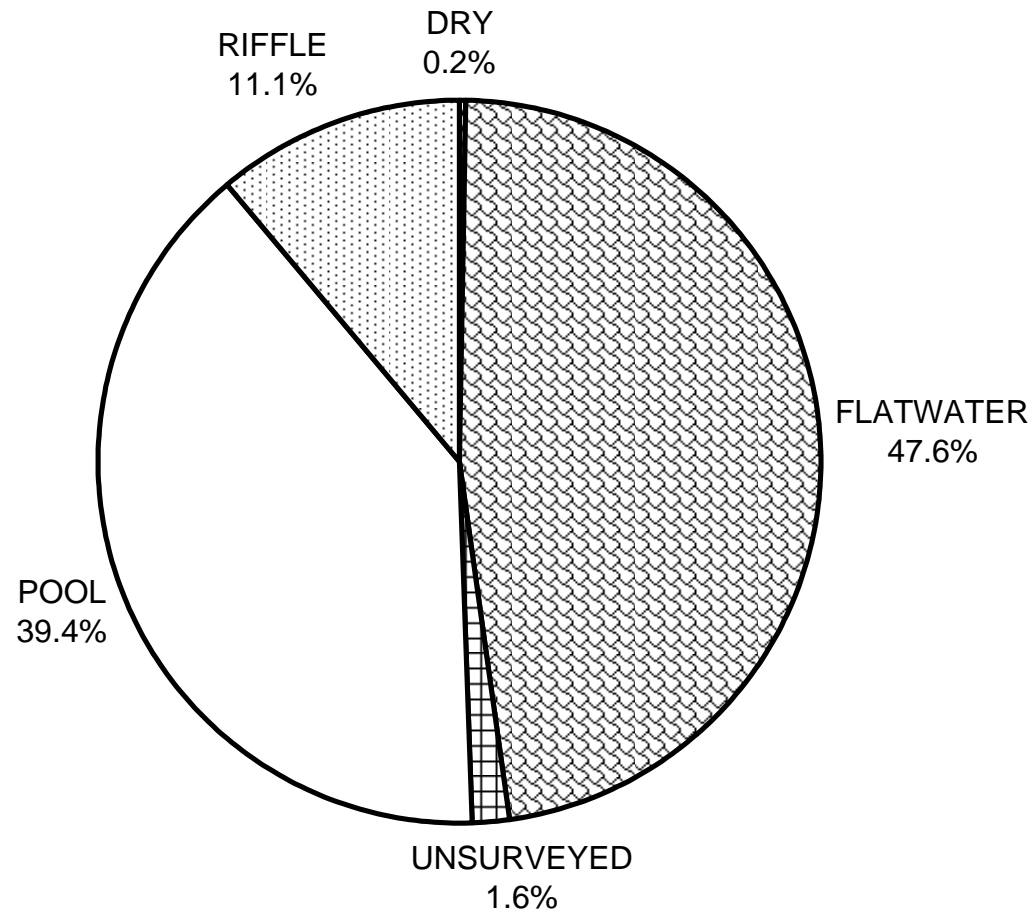
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	32	16
SMALL WOODY DEBRIS (%)	0	31	28
LARGE WOODY DEBRIS (%)	0	19	35
ROOT MASS (%)	0	1	7
TERRESTRIAL VEGETATION (%)	0	1	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	1
BOULDERS (%)	0	16	11
BEDROCK LEDGES (%)	0	0	2

LITTLE BEAR HAVEN CREEK 2020 HABITAT TYPES BY PERCENT OCCURRENCE



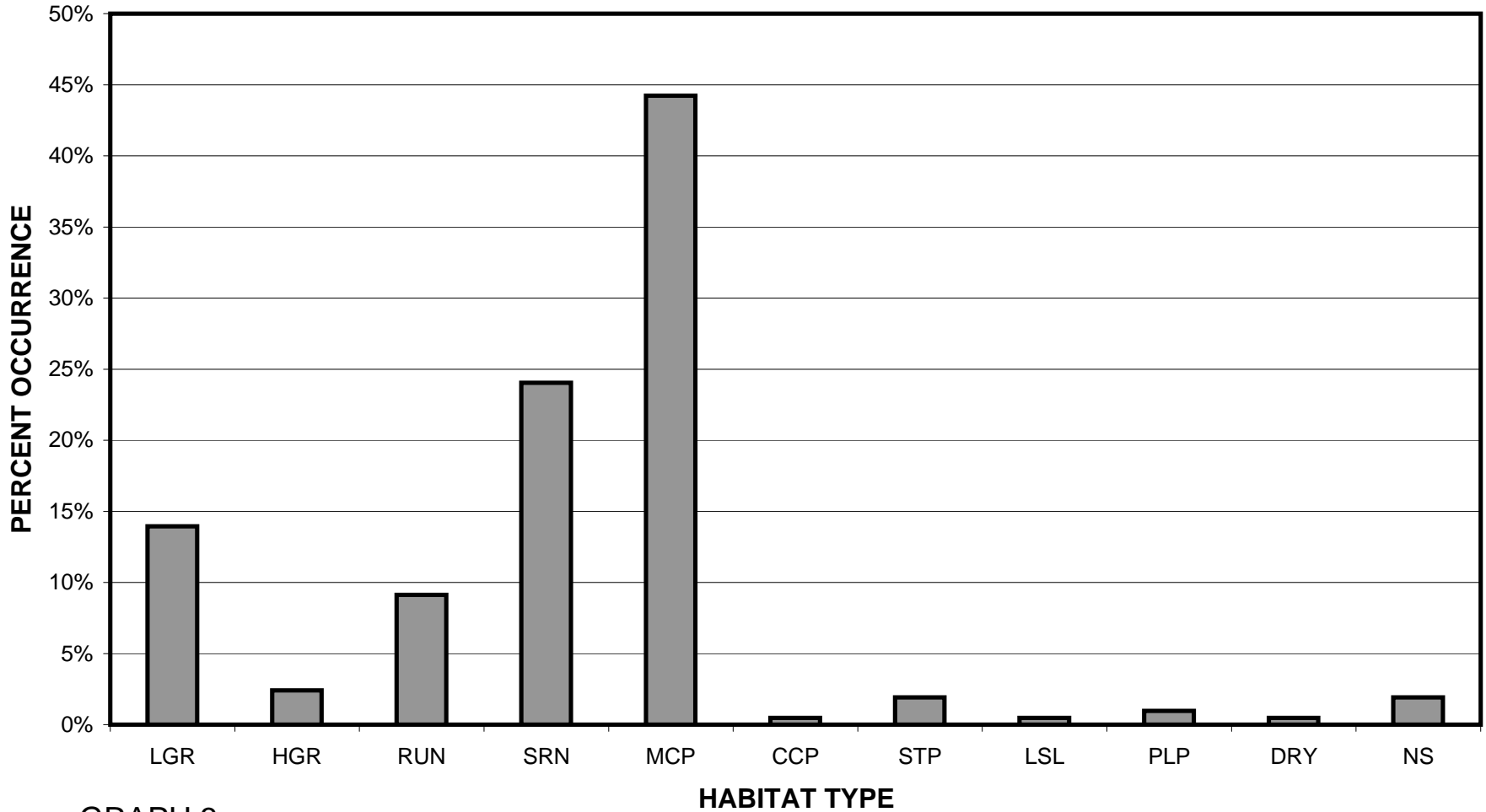
GRAPH 1

LITTLE BEAR HAVEN CREEK 2020 HABITAT TYPES BY PERCENT TOTAL LENGTH



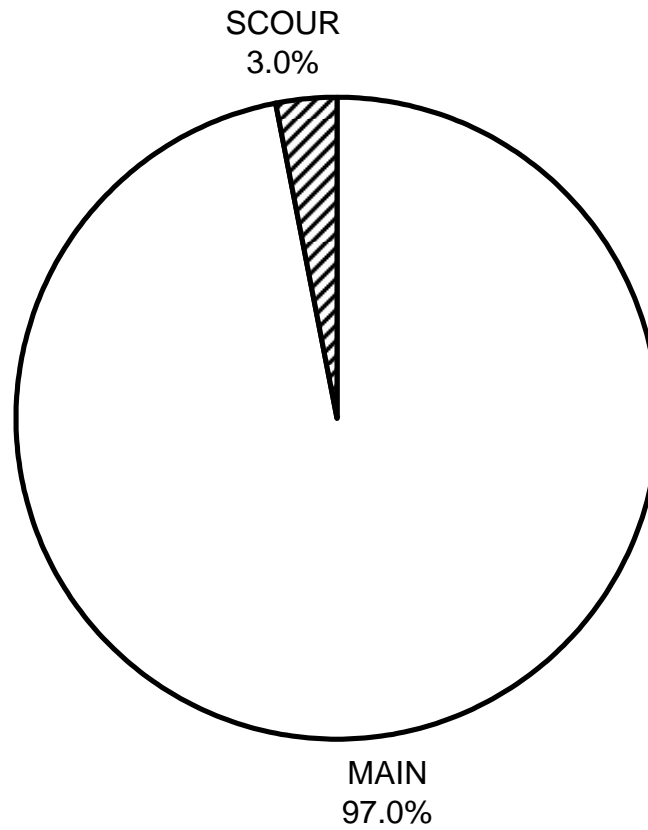
GRAPH 2

LITTLE BEAR HAVEN CREEK 2020 HABITAT TYPES BY PERCENT OCCURRENCE



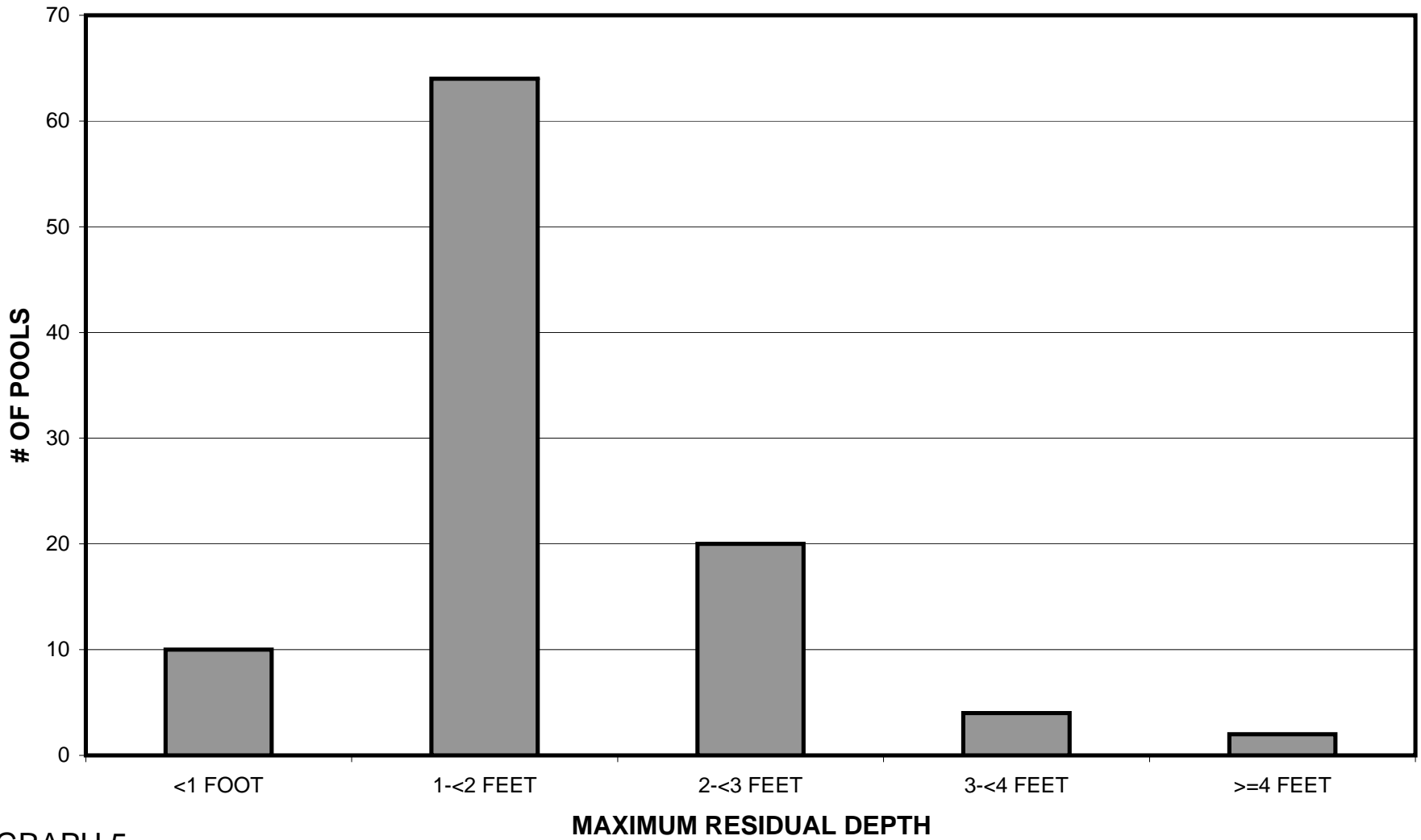
GRAPH 3

LITTLE BEAR HAVEN CREEK 2020 POOL TYPES BY PERCENT OCCURRENCE



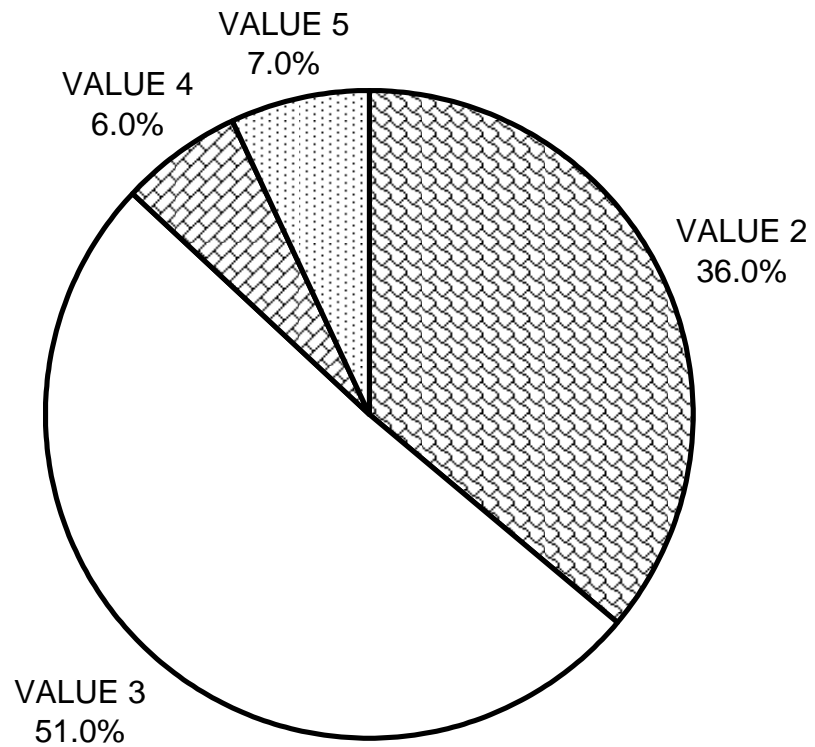
GRAPH 4

LITTLE BEAR HAVEN CREEK 2020 MAXIMUM DEPTH IN POOLS



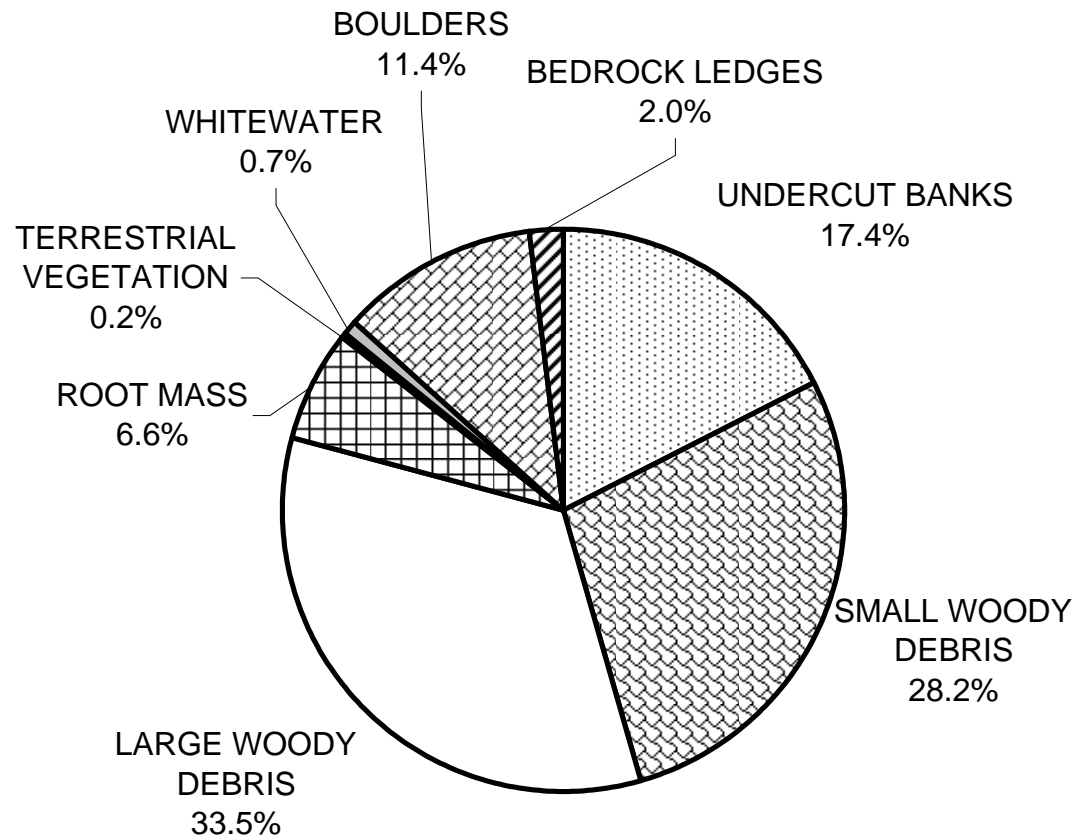
GRAPH 5

LITTLE BEAR HAVEN CREEK 2020 PERCENT EMBEDDEDNESS



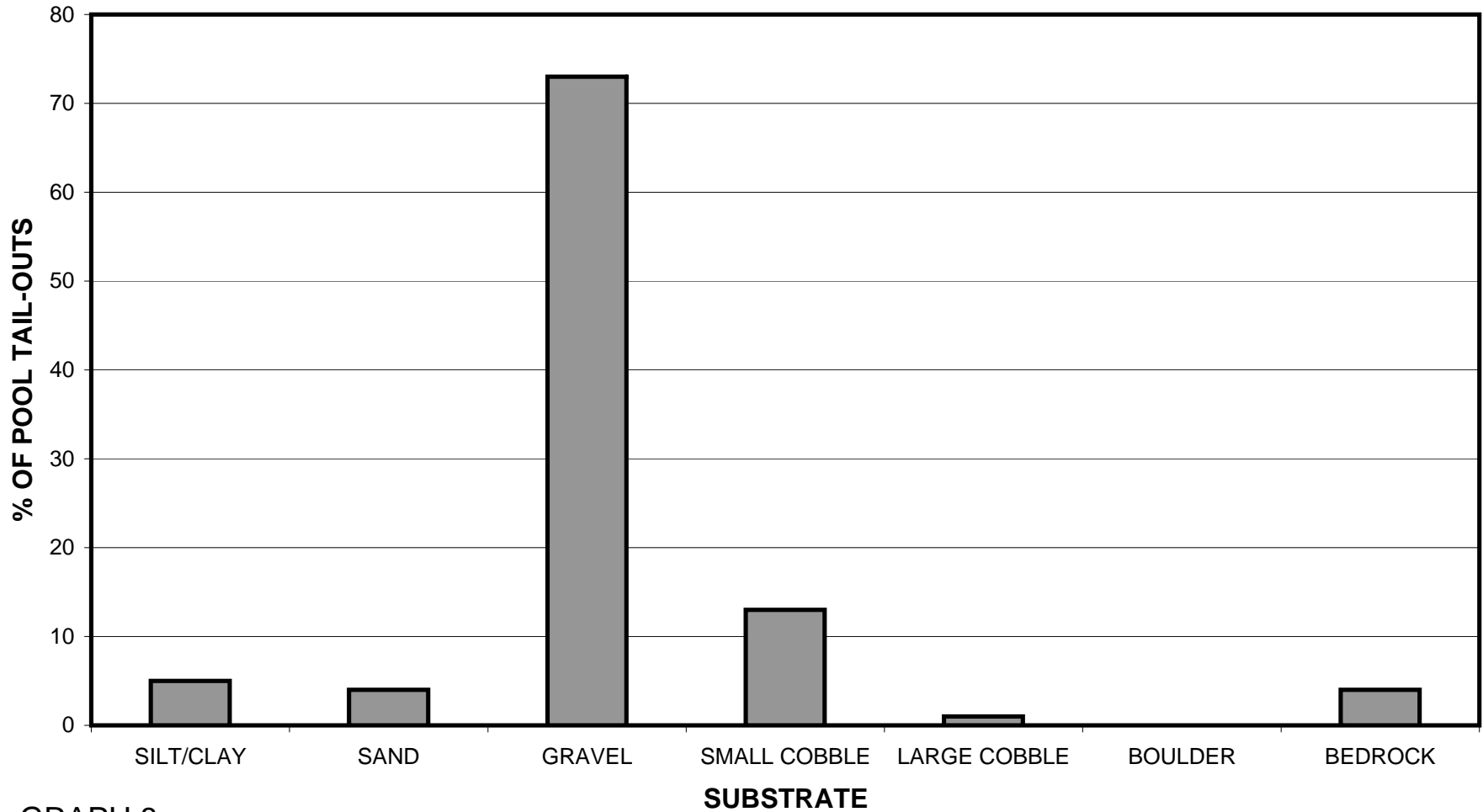
GRAPH 6

LITTLE BEAR HAVEN CREEK 2020 MEAN PERCENT COVER TYPES IN POOLS



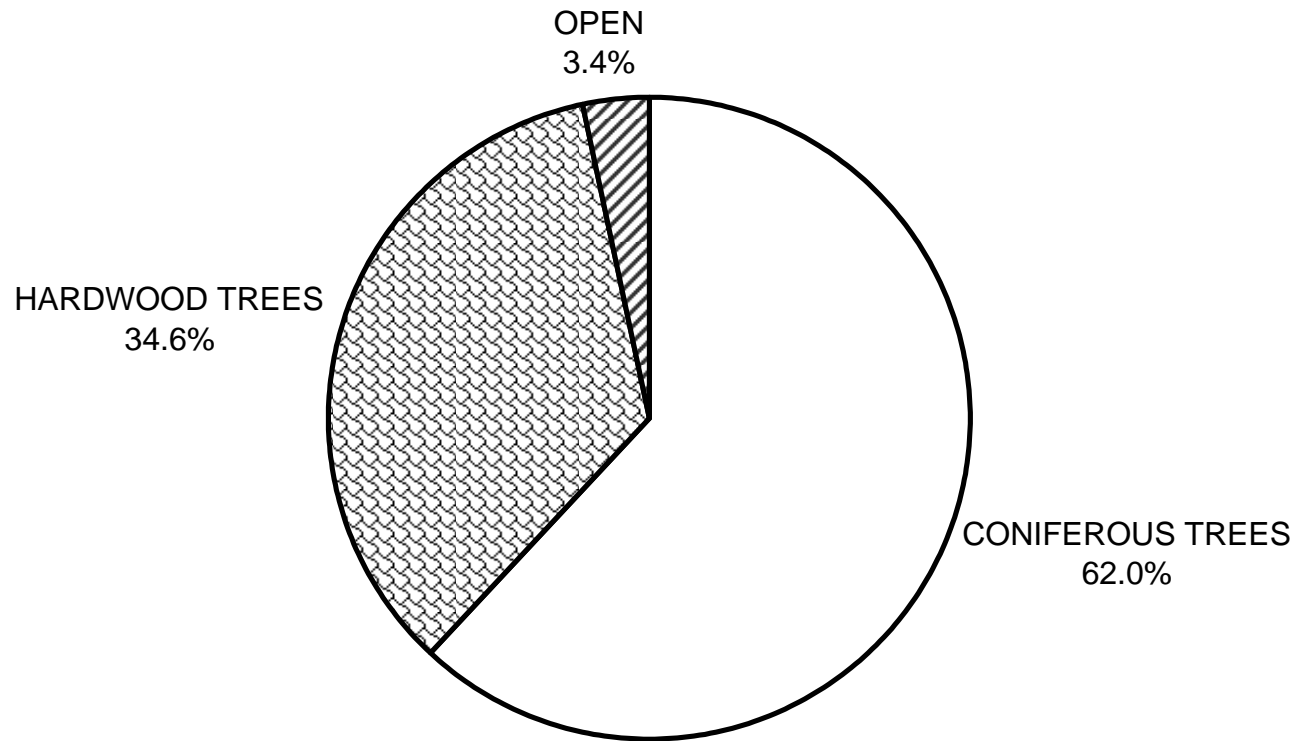
GRAPH 7

LITTLE BEAR HAVEN CREEK 2020 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



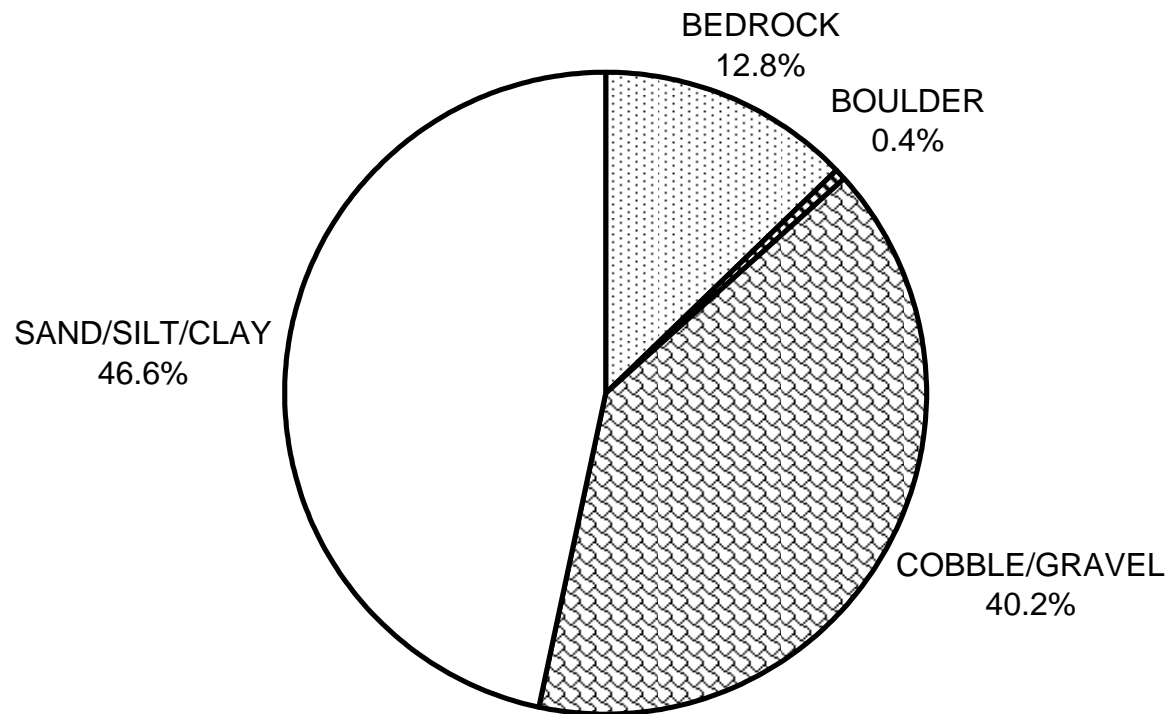
GRAPH 8

**LITTLE BEAR HAVEN CREEK 2020
MEAN PERCENT CANOPY**



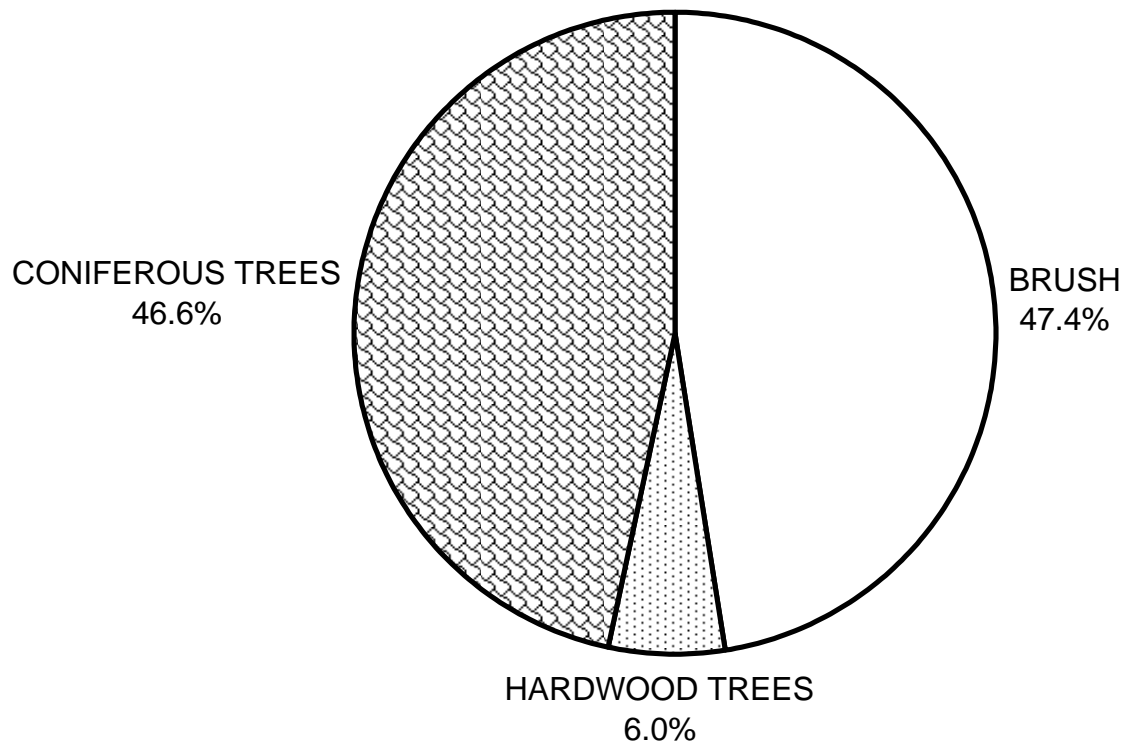
GRAPH 9

LITTLE BEAR HAVEN CREEK 2020 DOMINANT BANK COMPOSITION IN SURVEY REACH



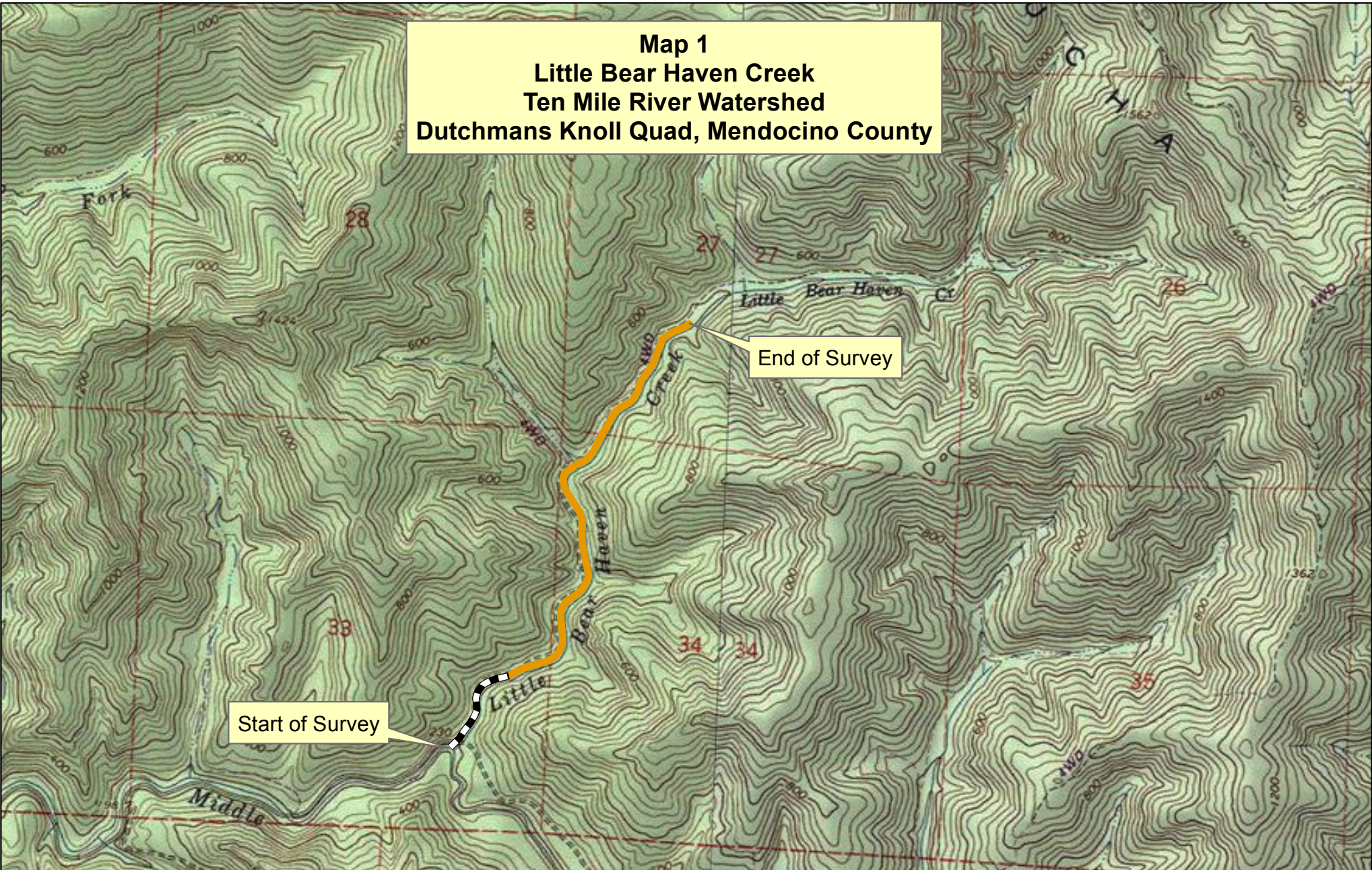
GRAPH 10



**LITTLE BEAR HAVEN CREEK 2020
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

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



-  Reach 1, Channel Type G4
-  Reach 2, Channel Type F4

