

STREAM INVENTORY REPORT

Bottom Creek

INTRODUCTION

A stream inventory was conducted from April 30 to May 8, 2012 on Bottom Creek. The survey began at the confluence with Little North Fork Navarro River and extended upstream 1.5 miles. Stream inventories and reports were also completed for two tributaries to Bottom Creek.

The Bottom 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 Bottom 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

Bottom Creek is a tributary to Little North Fork Navarro River, a tributary to North Branch North Fork Navarro River, a tributary to North Fork Navarro River, a tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Bottom Creek's legal description at the confluence with Little North Fork Navarro River is T16N R15W S36. Its location is 39.1986 degrees north latitude and 123.4796 degrees west longitude, LLID number 1234783391985. Bottom Creek is a first order stream and has approximately 2.2 miles of blue line stream according to the USGS Bailey Ridge 7.5 minute quadrangle. Bottom Creek drains a watershed of approximately 3.7 square miles. Elevations range from about 530 feet at the mouth of the creek to 850 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rural development. Vehicle access exists via a private logging road off of Masonite Industrial Road.

METHODS

The habitat inventory conducted in Bottom 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 Department of Fish and Wildlife (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 Bottom 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". Bottom 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 Bottom 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. 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 Bottom Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Bottom 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 Bottom 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 Bottom Creek. In addition, underwater observations were made at sixteen 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 Bottom 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 April 30 to May 8, 2012 was conducted by B. James, A. Blessing, and T. Anderson (WSP). The total length of the stream surveyed was 8,068 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.8 cfs on May 3, 2012.

Bottom Creek is a B4 channel type for 7,322 feet of the stream surveyed (Reach 1), and an E4 channel type for 746 feet of the stream surveyed (Reach 2). B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and gravel-dominant substrates. E4 channels are low gradient, meandering riffle/pool streams with low width/depth ratios and little deposition. They are very efficient and stable with a high meander width ratio and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 48 to 58 degrees Fahrenheit. Air temperatures ranged from 39 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 49% pool units, 32% flatwater units, 17% riffle units, and 1% marsh (unsurveyed) units (Graph 1). Based on total length of Level II habitat types there were 51% flatwater units, 36% pool units, 11% riffle units, and 2% marsh (unsurveyed) units (Graph 2).

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Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 46%; run units, 17%; and step run units, 16% (Graph 3). Based on percent total length, mid-channel pool units made up 33%, step run units 32%, and run units 18%.

A total of 108 pools were identified (Table 3). All of the pools encountered were main channel pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-five of the 108 pools (23%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 108 pool tail-outs measured, 50 had a value of 1 (46.3%); 42 had a value of 2 (38.9%); 16 had a value of 5 (14.8%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 5, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 16 (Table 1).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Bottom Creek. Graph 7 describes the pool cover in Bottom Creek. Undercut banks are 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 63% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 11% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Bottom Creek was 95%. Five percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 49% and 51%, respectively. Graph 9 describes the mean percent canopy in Bottom Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 96%. The mean percent left bank vegetated was 98%. The dominant elements composing the structure of the stream banks consisted of 97% sand/silt/clay and 3% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 62% of the units surveyed. Additionally, 30% of the units surveyed had deciduous trees as the dominant vegetation type, and 5% had grass as the dominant vegetation type (Graph 11).

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BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at sixteen sites for species composition and distribution in Bottom Creek on July 31, 2012. The sites were sampled by I. Mikus and M. Groff (CDFW).

In Reach 1, which comprised the first 7,322 feet of stream, sixteen sites were sampled. The reach sites yielded 27 young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), one age 1+ SH/RT, and 35 YOY coho salmon.

The following chart displays the information yielded from these sites:

2012 Bottom 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: B4 Channel Type									
07/31/12	1	006	Pool	168	1	0	0	6	0
	2	014	Pool	434	0	0	0	4	0
	3	022	Pool	689	0	0	0	5	0
	4	029	Pool	960	0	0	0	6	0
	5	039	Pool	1,314	0	0	0	13	0
	6	048	Pool	1,621	1	0	0	1	0
	7	050	Pool	1,698	3	0	0	0	0
	8	053	Pool	1,850	2	0	0	0	0
	9	055	Pool	1,913	2	0	0	0	0
	10	058	Pool	2,055	3	0	0	0	0
	11	059	Pool	2,085	5	0	0	0	0
	12	061	Pool	2,262	1	1	0	0	0
	13	081	Pool	3,048	2	0	0	0	0
	14	083	Pool	3,101	1	0	0	0	0
	15	084	Pool	3,124	0	0	0	0	0
	16	101	Pool	4,028	6	0	0	0	0

DISCUSSION

Bottom Creek is a B4 channel type for the first 7,322 feet of stream surveyed and an E4 channel type for the remaining 746 feet. The suitability of B4 and E4 channel types for fish habitat improvement structures is as follows: B4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. E4

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channel types are good for bank-placed boulders and fair for opposing wing-deflectors.

The water temperatures recorded on the survey days April 30 to May 8, 2012 ranged from 48 to 58 degrees Fahrenheit. Air temperatures ranged from 39 to 68 degrees Fahrenheit. This is a good water temperature range for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 51% of the total length of this survey, riffles 11%, and pools 36%. Twenty-five of the 108 (23%) 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.

Ninety-two of the 108 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Sixteen of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Eighty of the 108 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 16. The shelter rating in the flatwater habitats is 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Bottom Creek. Undercut banks are 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 95%. Reach 1 had a canopy density of 97% and Reach 2 had a canopy density of 79%. The percentage of right and left bank covered with vegetation was 96% and 98%, respectively.

RECOMMENDATIONS

- 1) Bottom 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 undercut banks. 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 Navarro River. The channel is a B4.
1913	0056.00	Sawyer Creek (Tributary #01) enters on the right bank. It contributes approximately 10% to Bottom Creek's flow. The water temperature of the tributary was 50 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 50 degrees Fahrenheit. For more information, see the 2012 Sawyer Creek Stream Habitat Inventory Report.
2802	0078.00	Log debris accumulation (LDA) #01 contains nine pieces of large woody debris (LWD) and measures 6' high x 20' wide x 9' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 5' wide x 20' long x 1' deep. There is a 2' high plunge over the LDA. Fish were observed above the LDA.
4543	0114.00	Spooner Creek (Tributary #02) enters on the right bank. It contributes approximately 15% to Bottom Creek's flow. The water temperature of the tributary was 52 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 52 degrees Fahrenheit. For more information, see the 2012 Spooner Creek Stream Habitat Inventory Report.
4796	0126.00	There is a 2' high plunge.
5287	0139.00	LDA #02 contains 24 pieces of LWD and measures 9.5' high x 26' wide x 24' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to small cobble and measures 30' wide x 13' long x 3' deep. Fish were not observed above the LDA.
5907	0155.00	LDA #03 contains five pieces of LWD and measures 4' high x 14' wide x 11.5' long. Water flows through the LDA and there are visible gaps in

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		it. Retained sediment ranges from silt to gravel and measures 6' wide x 1' long x 0.5' deep.
6255	0160.00	LDA #04 contains five pieces of LWD and measures 4.5' high x 22' wide x 13' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 5.5' wide x 15' long x 1' deep.
6697	0172.00	Tributary #03 enters on the right bank. It contributes approximately 5% to Bottom Creek's flow. The water temperature downstream and upstream of the tributary was 51 degrees Fahrenheit. The slope of the tributary is approximately 3%. The tributary is accessible to salmonids, but no fish were observed.
6748	0174.00	There is a 3' high plunge over log.
7037	0181.00	LDA #05 contains six pieces of LWD and measures 7' high x 11' wide x 11' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 3' wide x 10' long x 1' deep.
7048	0182.00	An erosion site on the right bank measures approximately 50' long x 8' high. It is contributing silt, sand, and gravel to the channel.
7211	0189.00	There is a 5' high plunge over a root mass.
7322	0197.00	The channel changes from a B4 to an E4.
8008	0219.00	End of survey. The channel becomes marshy.

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: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
71	11	FLATWATER	32.4	58	4087	50.7	6.2	0.4	0.8	342	24269	153	10829		4
1	0	NOSURVEY	0.5	24	24	0.3									
2	0	NOSURVEY_	0.9	64	128	1.6									
108	108	POOL	49.3	27	2935	36.4	8.0	0.6	1.5	228	24661	250	27024	174	16
37	11	RIFFLE	16.9	24	894	11.1	6.1	0.3	0.6	118	4377	46	1690		5
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
219	130				8068					53307			39542		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

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 (%)
32	7	LGR	14.6	24	771	9.6	6	0.3	0.8	89	2859	32	1009		4	90
3	2	HGR	1.4	25	75	0.9	6	0.3	0.8	219	657	84	251		5	100
2	2	CAS	0.9	24	48	0.6	6	0.5	0.9	119	238	57	114		8	98
37	6	RUN	16.9	40	1469	18.2	7	0.5	1	274	10129	123	4553		4	95
34	5	SRN	15.5	77	2618	32.4	6	0.4	1.2	423	14399	188	6388		4	90
100	100	MCP	45.7	27	2657	32.9	8	0.6	4.2	233	23322	260	25985	182	16	96
2	2	CCP	0.9	10	19	0.2	6	0.2	0.7	57	114	40	79	8	10	97
6	6	STP	2.7	43	259	3.2	5	0.5	2.4	204	1225	160	959	94	13	98
1	0	NS	0.5	24	24	0.3										
2	0	MAR	0.9	64	128	1.6										

Total Units
219

Total Units Fully Measured
130

Total Length (ft.)
8068

Total Area (sq.ft.)
52942

Total Volume (cu.ft.)
39339

Table 3 - Summary of Pool Types

Stream Name: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

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
108	108	MAIN	100	27	2935	100	8.0	0.6	228	24661	174	18430	16

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
108	108	2935	24661	18430

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

Stream Name: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

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
100	MCP	93	21	21	55	55	17	17	5	5	2	2
2	CCP	2	2	100	0	0	0	0	0	0	0	0
6	STP	6	2	33	3	50	1	17	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
108	25	23	58	54	18	17	5	5	2	2

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Dry Units: 0

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

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
32	8	LGR	27	17	0	33	0	0	0	23	0
3	2	HGR	0	5	0	50	0	0	0	45	0
2	2	CAS	25	20	40	0	0	0	15	0	0
37	12	TOTAL RIFFLE	21	15	8	30	0	0	3	23	0
37	6	RUN	34	20	0	42	0	0	0	4	0
34	5	SRN	57	27	0	0	7	0	0	10	0
71	11	TOTAL FLAT	42	22	0	26	3	0	0	6	0
100	100	MCP	39	17	16	7	2	0	4	13	1
2	2	CCP	60	15	0	10	0	15	0	0	0
6	6	STP	43	23	13	8	0	0	12	0	0
108	108	TOTAL POOL	40	17	16	7	2	0	4	12	1
1	0	NS									
2	0	MAR									
219	131	TOTAL	38	18	14	10	2	0	4	12	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Dry Units: 0

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

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
32	8	LGR	0	13	63	25	0	0	0
3	2	HGR	0	50	0	50	0	0	0
2	2	CAS	0	0	0	50	50	0	0
37	6	RUN	0	17	83	0	0	0	0
34	5	SRN	20	0	80	0	0	0	0
100	100	MCP	14	38	39	6	2	1	0
2	2	CCP	0	100	0	0	0	0	0
6	6	STP	17	50	33	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
95	51	49	0	96	98

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: Bottom Creek LLID: 1234783391985 Drainage: Navarro River
 Survey Dates: 4/30/2012 to 5/8/2012 Survey Length (ft.): 8068 Main Channel (ft.): 8068 Side Channel (ft.): 0
 Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR15WS36 Latitude: 39:11:55.0N Longitude: 123:28:42.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B4	Canopy Density (%): 96.7	Pools by Stream Length (%): 38.0
Reach Length (ft.): 7322	Coniferous Component (%): 50.5	Pool Frequency (%): 51.0
Riffle/Flatwater Mean Width (ft.): 6.3	Hardwood Component (%): 49.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 76
Range (ft.): 5 to 21	Vegetative Cover (%): 96.5	2 to 2.9 Feet Deep: 17
Mean (ft.): 13	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 5
Std. Dev.: 4	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 2
Base Flow (cfs.): 0.8	Occurrence of LWD (%): 15	Mean Max Residual Pool Depth (ft.): 1.6
Water (F): 48 - 58 Air (F): 39 - 68	LWD per 100 ft.:	Mean Pool Shelter Rating: 16
Dry Channel (ft): 0	Riffles: 3	
	Pools: 6	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 7 Sand: 6 Gravel: 68 Sm Cobble: 12 Lg Cobble: 1 Boulder: 4 Bedrock: 2		
Embeddedness Values (%): 1. 50.0 2. 38.0 3. 0.0 4. 0.0 5. 12.0		

STREAM REACH: 2

Channel Type: E4	Canopy Density (%): 78.9	Pools by Stream Length (%): 20.2
Reach Length (ft.): 746	Coniferous Component (%): 51.8	Pool Frequency (%): 34.8
Riffle/Flatwater Mean Width (ft.): 3.5	Hardwood Component (%): 48.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 88
Range (ft.): 5 to 5	Vegetative Cover (%): 99.5	2 to 2.9 Feet Deep: 13
Mean (ft.): 5	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 0
Std. Dev.: 0	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.8	Occurrence of LWD (%): 4	Mean Max Residual Pool Depth (ft.): 1.4
Water (F): 49 - 50 Air (F): 50 - 61	LWD per 100 ft.:	Mean Pool Shelter Rating: 9
Dry Channel (ft): 0	Riffles: 1	
	Pools: 10	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 50 Sand: 50 Gravel: 0 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 50.0 3. 0.0 4. 0.0 5. 50.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Confluence Location: Quad: BAILEY RIDGE

Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

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	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	7	2	3.4
Sand / Silt / Clay	124	129	96.6

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	7	5	4.6
Brush	8	1	3.4
Hardwood Trees	39	39	29.8
Coniferous Trees	77	86	62.2
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Bottom Creek

LLID: 1234783391985

Drainage: Navarro River

Survey Dates: 4/30/2012 to 5/8/2012

Confluence Location: Quad: BAILEY RIDGE

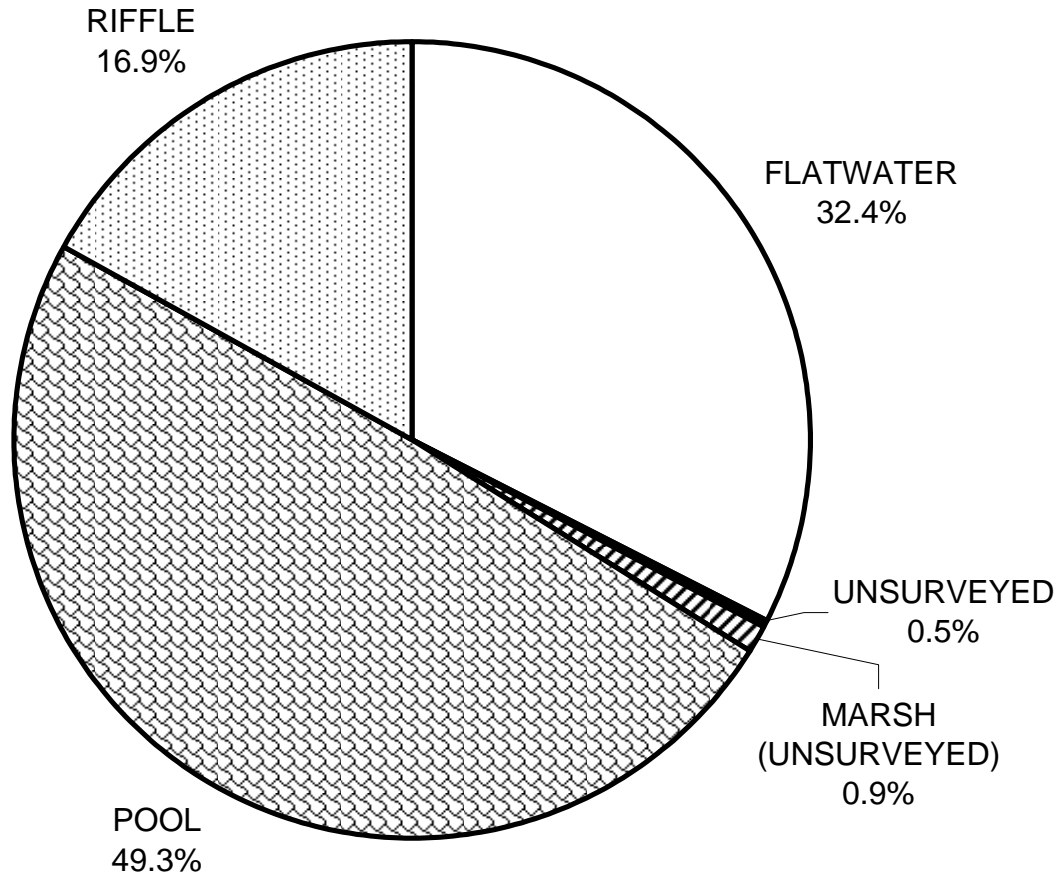
Legal Description: T16NR15WS36

Latitude: 39:11:55.0N

Longitude: 123:28:42.0W

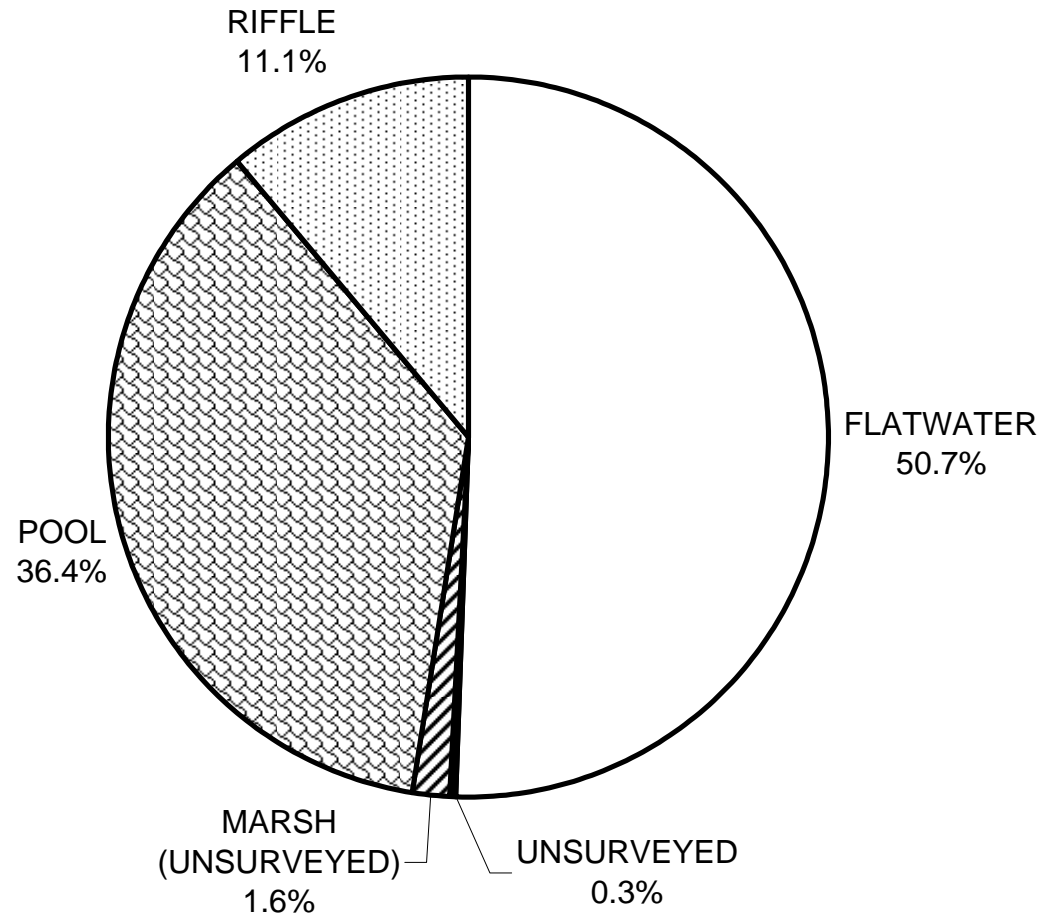
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	21	42	40
SMALL WOODY DEBRIS (%)	15	22	17
LARGE WOODY DEBRIS (%)	8	0	16
ROOT MASS (%)	30	26	8
TERRESTRIAL VEGETATION (%)	0	3	2
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	3	0	4
BOULDERS (%)	23	6	12
BEDROCK LEDGES (%)	0	0	1

BOTTOM CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



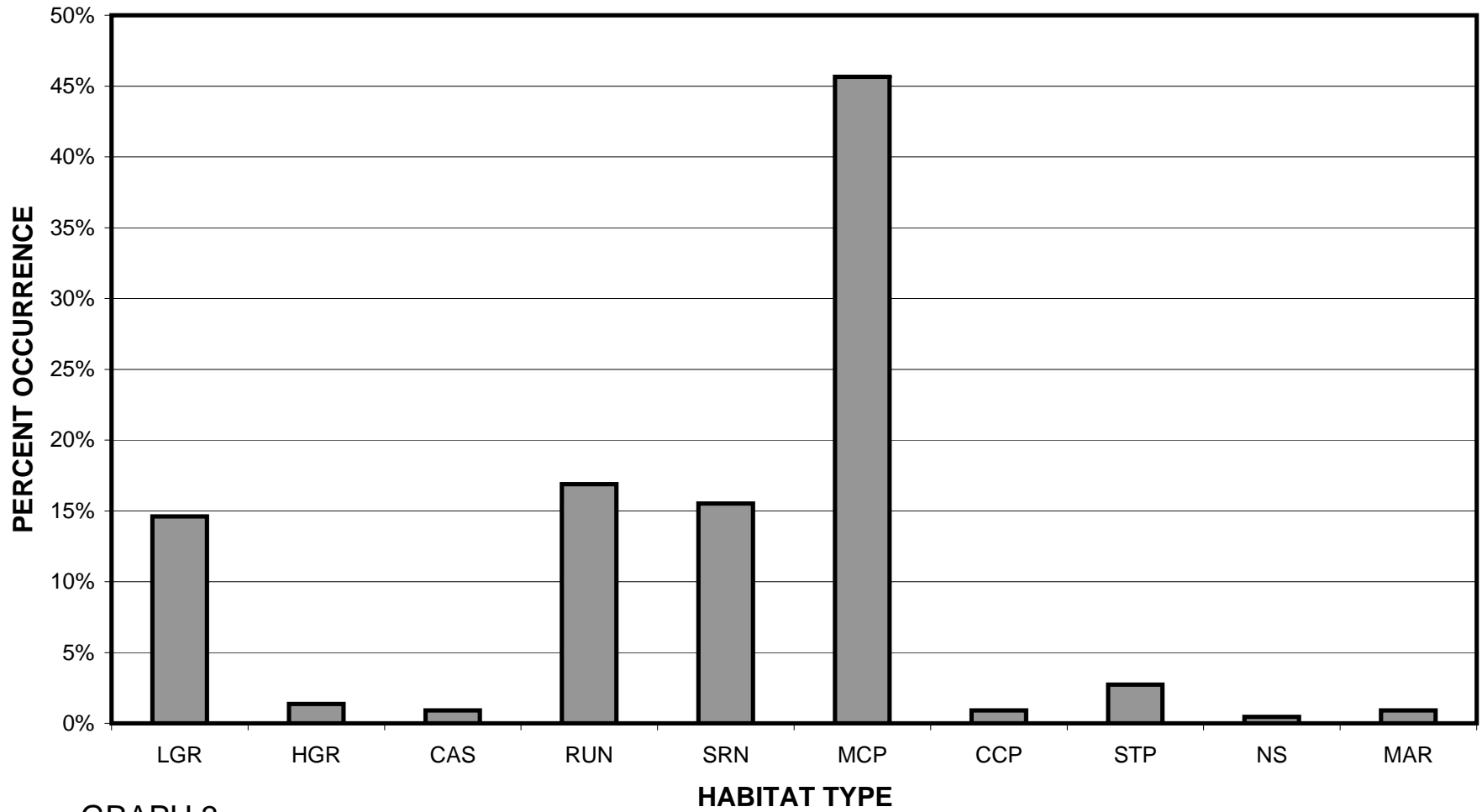
GRAPH 1

BOTTOM CREEK 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



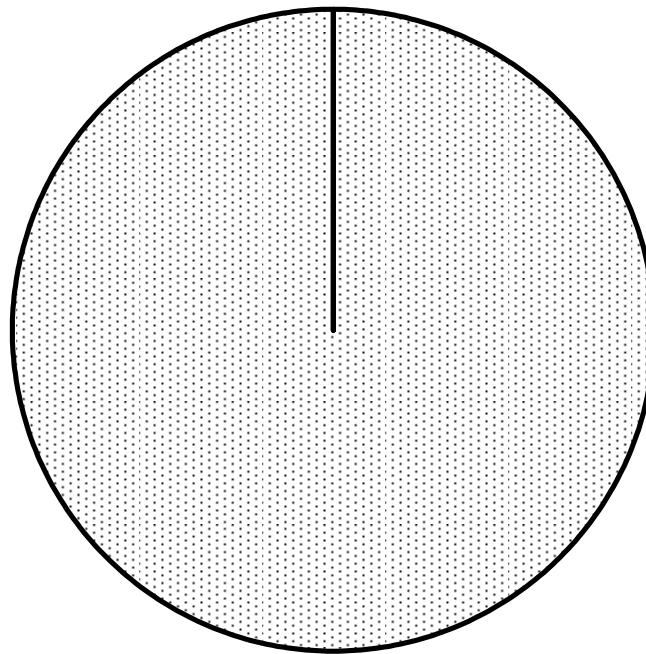
GRAPH 2

BOTTOM CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 3

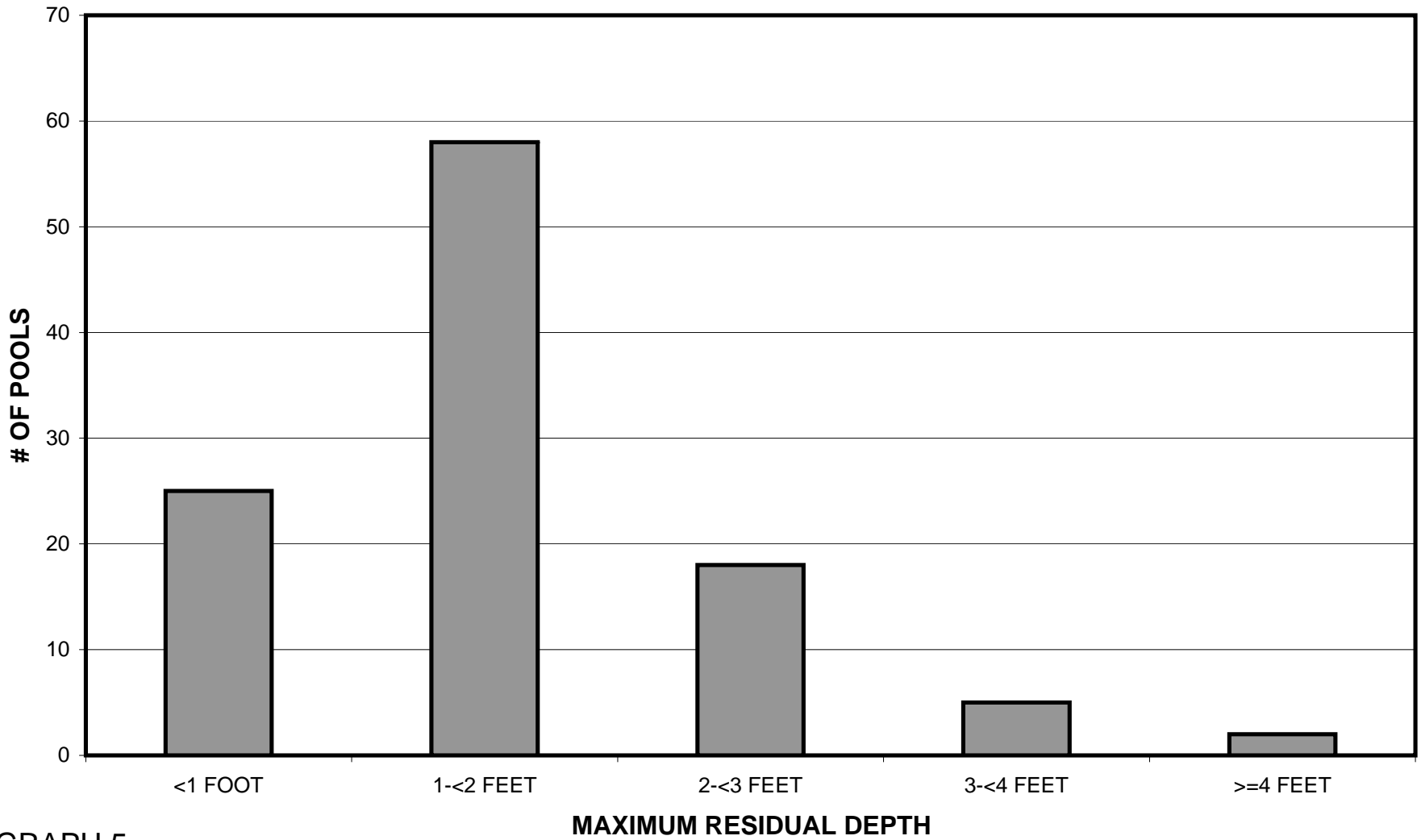
**BOTTOM CREEK 2012
POOL TYPES BY PERCENT OCCURRENCE**



MAIN
100.0%

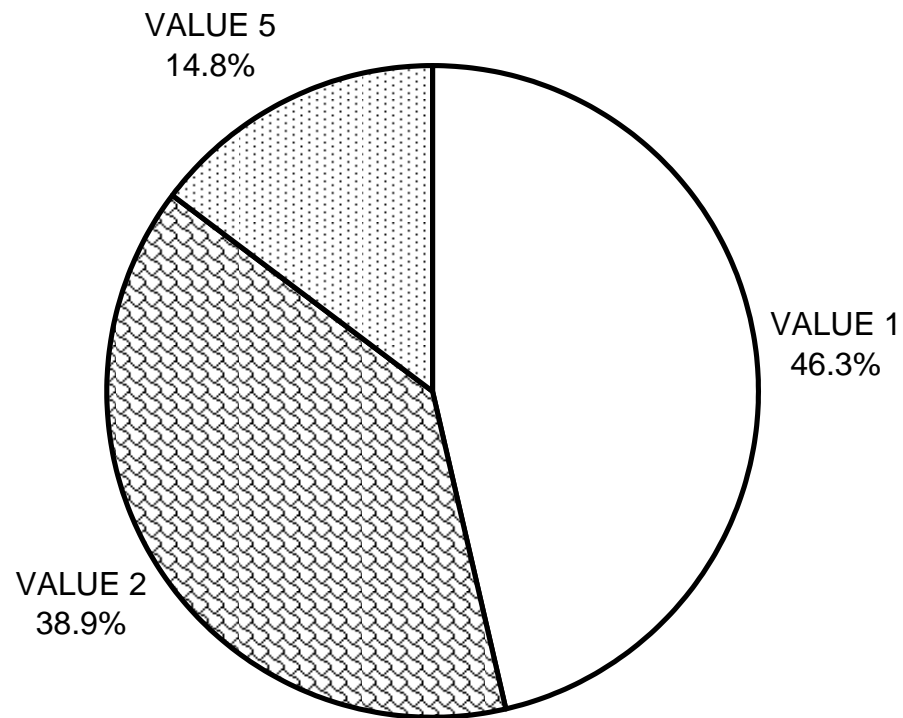
GRAPH 4

BOTTOM CREEK 2012 MAXIMUM DEPTH IN POOLS



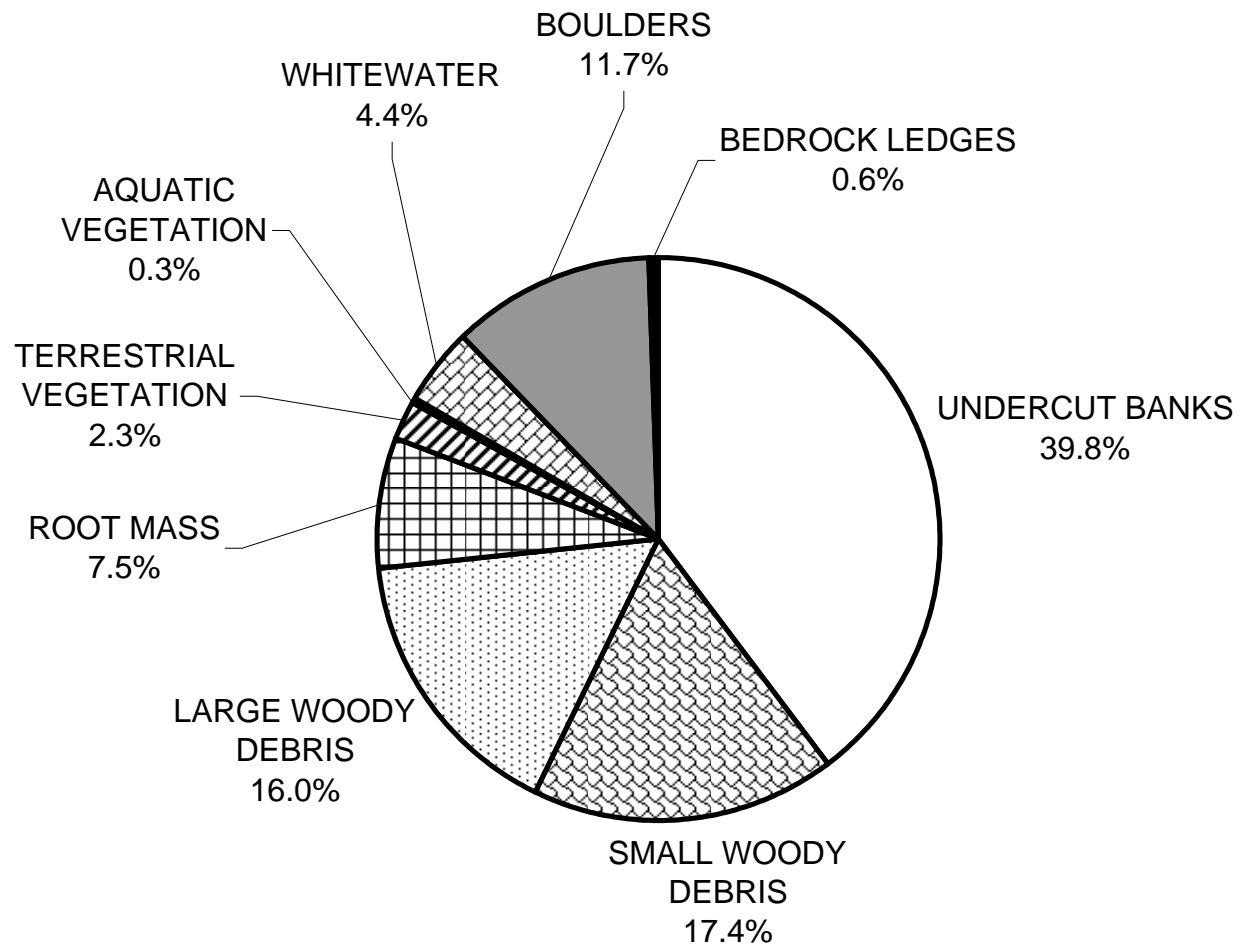
GRAPH 5

BOTTOM CREEK 2012 PERCENT EMBEDDEDNESS



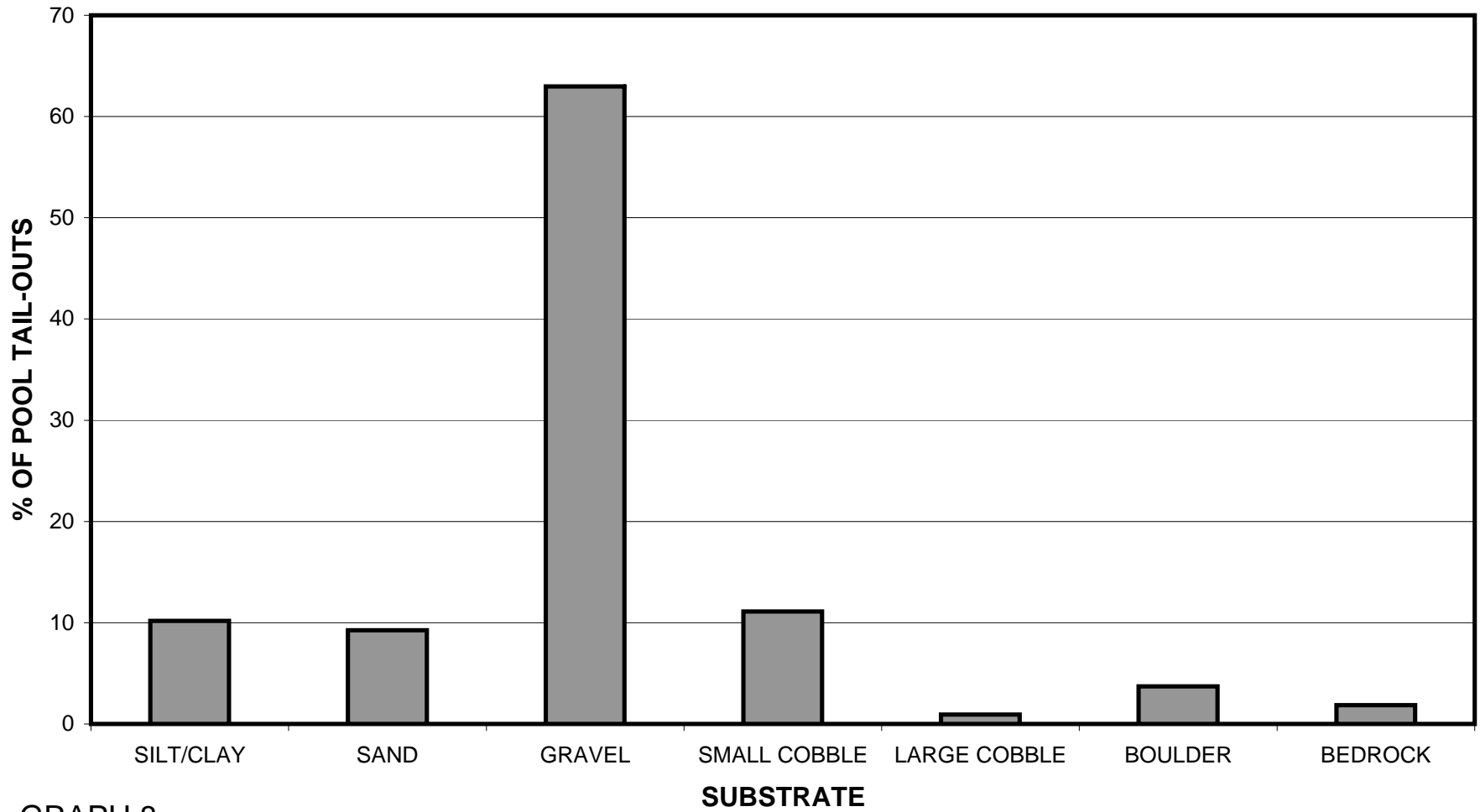
GRAPH 6

BOTTOM CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



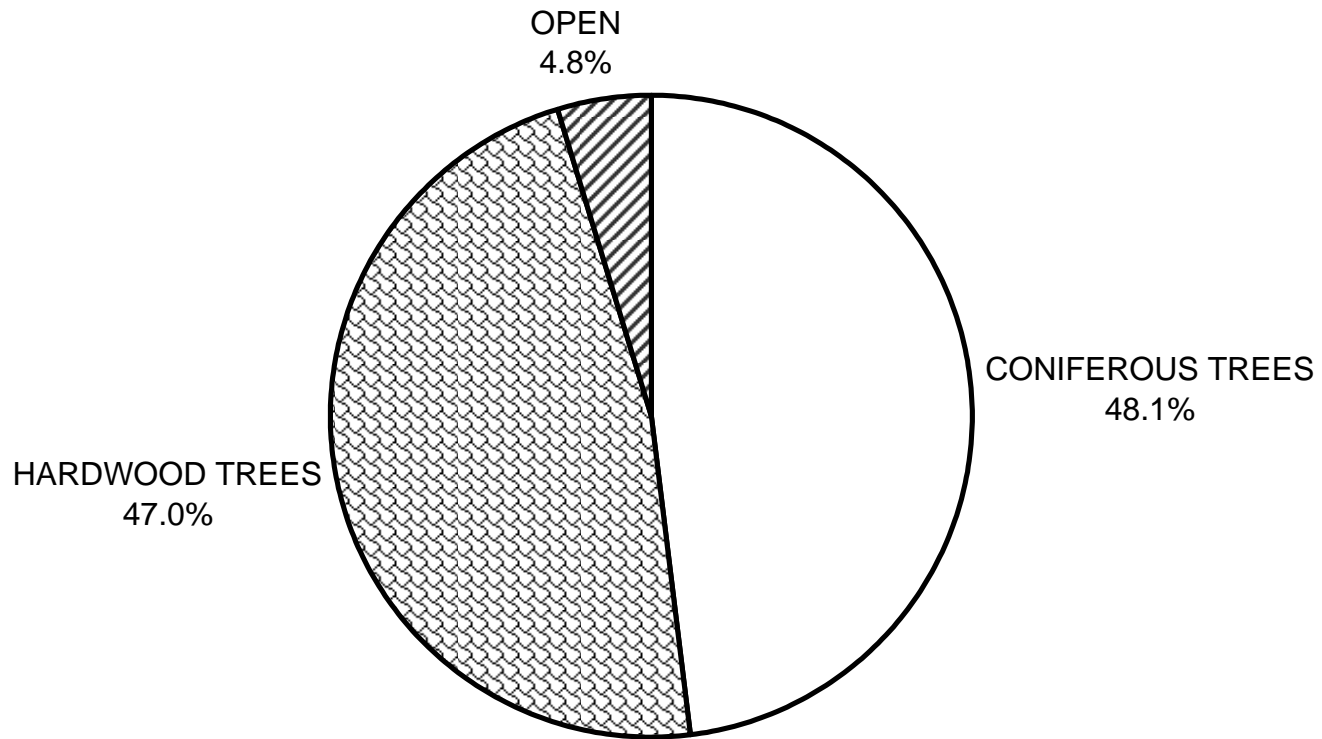
GRAPH 7

BOTTOM CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



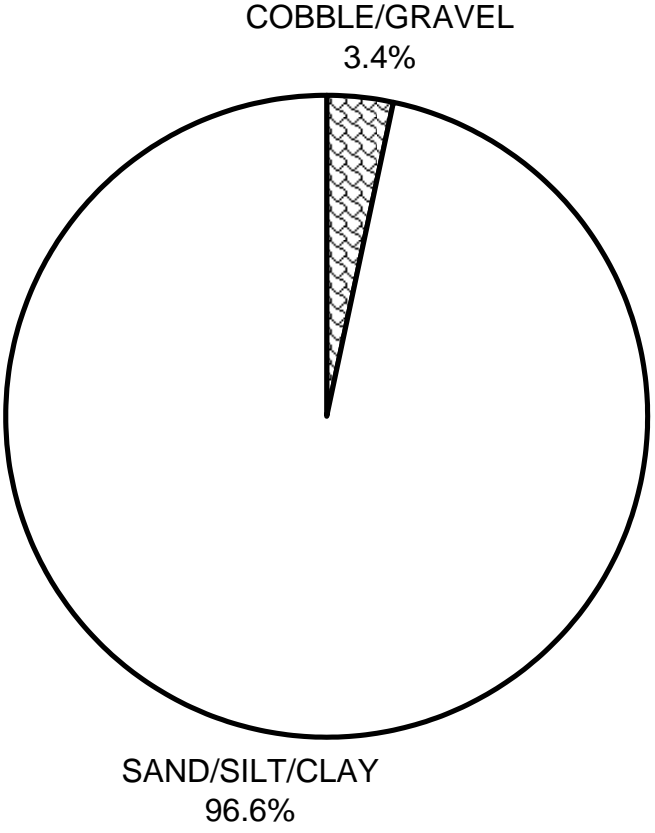
GRAPH 8

BOTTOM CREEK 2012 MEAN PERCENT CANOPY



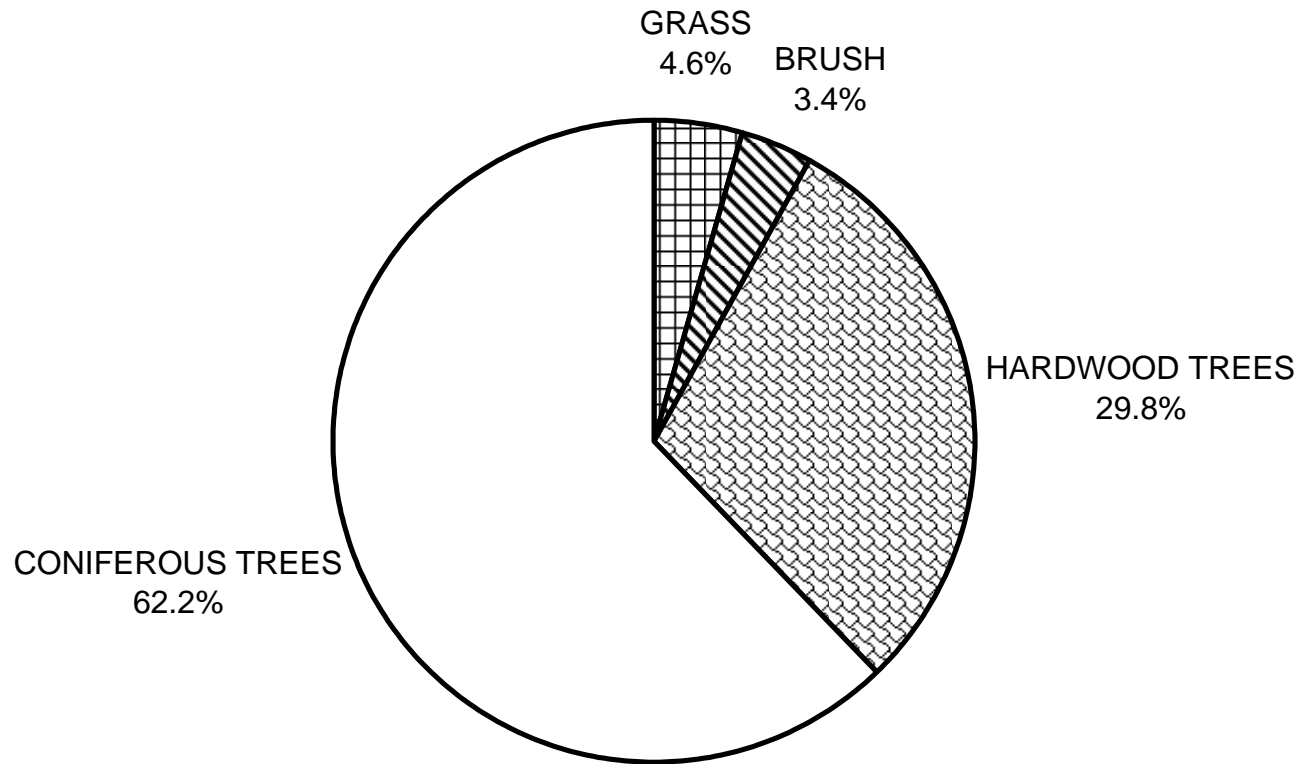
GRAPH 9

**BOTTOM CREEK 2012
DOMINANT BANK COMPOSITION IN SURVEY REACH**



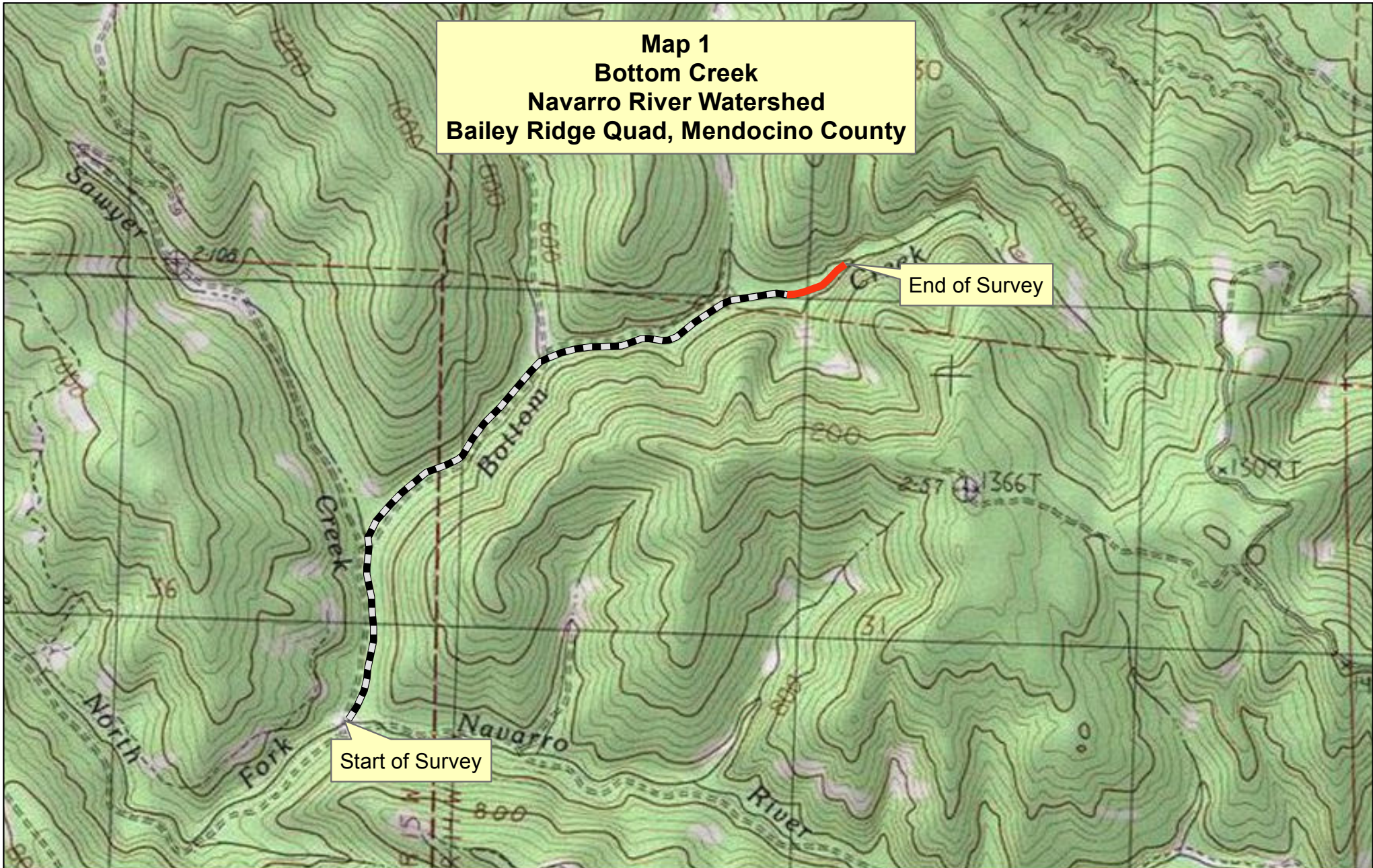
GRAPH 10

BOTTOM CREEK 2012 DOMINANT BANK VEGETATION IN SURVEY REACH



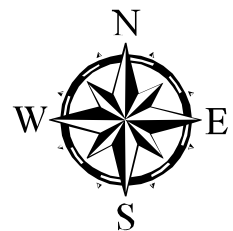
GRAPH 11



Map 1
Bottom Creek
Navarro River Watershed
Bailey Ridge Quad, Mendocino County



Start of Survey

End of Survey



-  Reach 1, Channel Type B4
-  Reach 2, Channel Type E4

