

STREAM INVENTORY REPORT

Barton Gulch

INTRODUCTION

A stream inventory was conducted from August 31 to October 11, 2011 on Barton Gulch. The survey began at the confluence with Navarro River and extended upstream 1.3 miles.

The Barton Gulch 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 Barton Gulch. 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

Barton Gulch is a tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Barton Gulch's legal description at the confluence with the Navarro River is T15N R16W S07. Its location is 39.17898 degrees north latitude and 123.68218 degrees west longitude, LLID number 1236810391790. Barton Gulch is a first order stream and has approximately 2 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Barton Gulch drains a watershed of approximately 1.8 square miles. Elevations range from about 240 feet at the mouth of the creek to 970 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 Highway 128.

METHODS

The habitat inventory conducted in Barton Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game (DFG) personnel that conducted the inventory were trained in standardized habitat inventory methods by the 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 crest (measured in the thalweg), dominant substrate composing the pool tail crest, and

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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 Barton Gulch 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". Barton Gulch 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.

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 Barton Gulch, embeddedness was

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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 Barton Gulch, 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 Barton Gulch, 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 Barton Gulch, 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.

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

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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 Barton Gulch. In addition, seven sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are 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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Barton Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length

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- 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 August 31 to October 11, 2011 was conducted by I. Mikus and M. Groff (DFG). The total length of the stream surveyed was 6,768 feet. A total distance of 2,330 feet of stream was not surveyed due to marshy areas. The data included in this report are for the 4,438 feet actually surveyed.

Barton Gulch is an F6 channel type for 1,252 feet of the stream surveyed (Reach 1), an determined channel type for 2,030 feet of the stream surveyed (Reach 2), and a C4 channel type for 3,486 feet of the stream surveyed (Reach 3). F6 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and silt-dominant substrates. C4 channels are meandering point-bar, riffle/pool, alluvial channels with broad well defined floodplain on low gradients and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 55 degrees Fahrenheit. Air temperatures ranged from 49 to 69 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 55% pool units, 30% flatwater units, 13% riffle units, 1% culvert units, and 1% dry units (Graph 1). Based on total length of Level II habitat types there were 51% pool units, 42% flatwater units, 6% riffle units, and 2% culvert 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, 53%; run units, 16%; and step run units 14% (Graph 3). Based on percent total length, mid-channel pool units made up 49%, step run units 26%, and run units 16%.

A total of 70 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. Eleven of the 70 pools (16%) had a residual depth of two feet or greater (Graph 5).

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The depth of cobble embeddedness was estimated at pool tail-outs. Of the 70 pool tail-outs measured, eight had a value of 1 (11.4%); 18 had a value of 2 (25.7%); 16 had a value of 3 (22.9%); 14 had a value of 4 (20%); 14 had a value of 5 (20%) (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 6, flatwater habitat types had a mean shelter rating of 7, and pool habitats had a mean shelter rating of 25 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 26. Scour pools had a mean shelter rating of 3 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Barton Gulch. Graph 7 describes the pool cover in Barton Gulch. 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 79% of the pool tail-outs. Silt/clay was the next most frequently observed dominant substrate type and occurred in 19% of the pool tail-outs.

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

For the stream reach surveyed, the mean percent right bank vegetated was 96%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 91% sand/silt/clay, 9% cobble/gravel, and 1% bedrock (Graph 10). Brush was the dominant vegetation type observed in 41% of the units surveyed. Additionally, 28% of the units surveyed had coniferous trees as the dominant vegetation type, and 22% had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted an electrofishing survey at seven sites for species composition and distribution in Barton Gulch on October 12, 2011. The water temperature taken during the electrofishing period of 0920 hours to 1000 hours was 53 degrees Fahrenheit. The air temperature was 55 degrees Fahrenheit. The sites were sampled by S. Monday, M. Groff, and I. Mikus (DFG).

In reach 1, which comprised the first 1,252 feet of stream, seven sites were sampled. The reach sites yielded two young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), two YOY coho salmon, 12 sculpin, and approximately 55 California roach.

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The following chart displays the information yielded from these sites:

2011 Barton Gulch electrofishing observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: F6 Channel Type									
10/12/11	1	004	Pool	97	0	0	0	1	0
	2	006	Pool	227	0	0	0	0	0
	3	007	Run	257	1	0	0	0	0
	4	008	Pool	284	0	0	0	0	0
	5	009	Step-run	300	0	0	0	0	0
	6	010	Pool	334	0	0	0	1	0
	7	011	Step-run	433	1	0	0	0	0

DISCUSSION

Barton Gulch is an F6 channel type for the first 1,252 feet of stream surveyed, an undetermined channel type for the next 2,030 feet due to a marsh, and a C4 channel type for the remaining 3,486 feet. The suitability of F6 and C4 channel types for fish habitat improvement structures is as follows: F6 channel types are good for bank-placed boulders and fair for plunge weirs, boulder clusters, single and opposing wing-deflectors, and log cover. C4 channel types are good for bank placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperatures recorded on the survey days August 31 to October 11, 2011 ranged from 52 to 55 degrees Fahrenheit. Air temperatures ranged from 49 to 69 degrees Fahrenheit. This is a suitable 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 42% of the total length of this survey, riffles 6%, and pools 51%. Eleven of the 70 (16%) 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 log structures that will deepen pool habitat is recommended.

Twenty-six of the 70 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty of the pool tail-outs had embeddedness ratings of 3 or 4. Fourteen of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or

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less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Barton Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fifty-five of the 70 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 25. The shelter rating in the flatwater habitats is 7. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Barton Gulch. 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 97%; Reach 3 had a canopy density of 97%. In general, revegetation projects are considered when canopy density is less than 80%. The percentage of right and left bank covered with vegetation was 96% and 96%, respectively.

RECOMMENDATIONS

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

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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 at the confluence with the Navarro River. The channel is an F6 (Reach 1).
97	0005.00	Highway 128 crosses the channel. The crossing is a 4.8' high x 6.3' wide x 66' long concrete box culvert. The slope of the culvert is approximately 3.5%. There is a 0.1' high plunge at the outlet; the maximum depth within 5' of the outlet is 1.4'.
163	0006.00	Dry right bank tributary.
257	0008.00	Log debris accumulation (LDA) #01 contains 14 pieces of large woody debris (LWD) and measures 4' high x 24' wide x 30' long. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish are present above the LDA.
606	0018.00	A landslide on the right bank measures approximately 50' long x 10' high; it is contributing silt to the channel. A landslide on the left bank measures approximately 20' long x 10' high; it is contributing silt to the channel.
648	0019.00	A landslide on the left bank measures approximately 100' long x 10' high; it is contributing silt and sand to the channel.
1252	0029.00	Approximately 2,030 feet of stream was not surveyed due to a large marsh. The marsh is Reach 2 and the channel type is undetermined.
3282	0030.00	End of marsh. The channel type is a C4 (Reach 3).
3631	0039.00	Approximately 300' of stream was not surveyed due to a marsh.
3931	0040.00	End of marsh.
4192	0048.00	Dry tributary on the left bank.
4478	0059.00	Left bank seep.
4696	0065.00	LDA #02 contains four pieces of LWD and measures 3.5' high x 15' wide x 12' long. Water flows through the LDA and there are no visible

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gaps in it. Retained sediment ranges from silt to gravel and measures 15' wide x 15' long x 1.5' deep. Fish are present above the LDA.

- 5163 0079.00 There was a 1+ salmonid observed.
- 5191 0080.00 LDA #03 contains four pieces of LWD and measures 4' high x 20' wide x 17' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 8' wide x 20' long x 1' deep. No fish were observed above the LDA.
- 5331 0088.00 There is an old Humboldt crossing site. The fill is causing most of the creek to flow underground.
- 5748 0100.00 LDA #04 contains four pieces of LWD and measures 4' high x 24' wide x 14' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 15' wide x 40' long x 1.5' deep.
- 6274 0116.00 Right bank seep.
- 6290 0117.00 LDA #05 contains nine pieces of LWD and measures 5' high x 37' wide x 15' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 10' wide x 100' long x 1' deep. There is a 4' high plunge over the LDA. It is a possible barrier to juvenile and adult salmonids.
- 6733 0129.00 End of survey due to extent of landowner permission to access.

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: 1236810391790

LLID: 1236810391790 Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0

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
1	0	CULVERT	0.8	66	66	1.5									
1	0	DRY	0.8	9	9	0.2									
38	7	FLATWATER	29.9	49	1851	41.7	7.6	0.4	0.7	244	9257	100	3800		7
2	0	NOSURVEY_		1165	2330										
70	70	POOL	55.1	32	2250	50.7	7.7	0.9	1.5	232	16263	266	18638	215	25
17	4	RIFFLE	13.4	15	262	5.9	3.3	0.2	0.3	57	972	9	161		6
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
129	81				6768					26492			22599		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: 1236810391790

LLID: 1236810391790

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0W

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 (%)
15	4	LGR	11.8	15	224	5.0	3	0.2	0.4	57	858	9	142		6	99
2	0	HGR	1.6	19	38	0.9										
20	4	RUN	15.7	35	697	15.7	10	0.3	0.9	214	4274	63	1262		5	95
18	3	SRN	14.2	64	1154	26.0	5	0.5	0.9	284	5103	149	2686		10	94
1	1	TRP	0.8	51	51	1.1	6	0.9	1.6	281	281	365	365	252	10	99
67	67	MCP	52.8	32	2165	48.8	8	0.8	3.9	234	15687	261	17487	210	26	97
1	1	LSL	0.8	12	12	0.3	9	0.4	0.7	108	108	76	76	43	0	99
1	1	PLP	0.8	22	22	0.5	8	3.7	4.8	187	187	711	711	692	5	100
1	0	DRY	0.8	9	9	0.2										
1	0	CUL	0.8	66	66	1.5										
2	0	MAR		1165	2330											

Total Units
129

Total Units Fully Measured
81

Total Length (ft.)
6768

Total Area (sq.ft.)
26497

Total Volume (cu.ft.)
22728

Table 3 - Summary of Pool Types

Stream Name: 1236810391790

LLID: 1236810391790

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0W

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
68	68	MAIN	97	33	2216	98	7.7	0.8	235	15968	211	14327	26
2	2	SCOUR	3	17	34	2	8.8	2.1	148	295	368	735	3

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
70	70	2250	16262	15062

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

Stream Name: 1236810391790

LLID: 1236810391790

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0W

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
1	TRP	1	0	0	1	100	0	0	0	0	0	0
67	MCP	96	6	9	51	76	8	12	2	3	0	0
1	LSL	1	1	100	0	0	0	0	0	0	0	0
1	PLP	1	0	0	0	0	0	0	0	0	1	100

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
70	7	10	52	74	8	11	2	3	1	1

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: 1236810391790

LLID: 1236810391790

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Dry Units: 1

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0W

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
15	4	LGR	0	100	0	0	0	0	0	0	0
2	0	HGR									
17	4	TOTAL RIFFLE	0	100	0	0	0	0	0	0	0
20	4	RUN	0	50	0	0	50	0	0	0	0
18	3	SRN	30	28	28	0	15	0	0	0	0
38	7	TOTAL FLAT	15	39	14	0	33	0	0	0	0
1	1	TRP	100	0	0	0	0	0	0	0	0
67	67	MCP	20	32	37	0	11	0	0	0	0
1	1	LSL	0	0	0	0	0	0	0	0	0
1	1	PLP	100	0	0	0	0	0	0	0	0
70	70	TOTAL POOL	23	31	35	0	11	0	0	0	0
1	0	CUL									
2	0	MAR									
129	81	TOTAL	22	34	33	0	12	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: 1236810391790 LLID: 1236810391790 Drainage: Navarro River
 Survey Dates: 8/31/2011 to 10/11/2011 Dry Units: 1
 Confluence Location: Quad: ELK Legal Description: T15NR16WS07 Latitude: 39:10:44.0N Longitude: 123:40:52.0W

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
15	4	LGR	25	0	75	0	0	0	0
2	0	HGR	0	0	0	0	0	0	0
20	4	RUN	50	0	50	0	0	0	0
18	3	SRN	0	0	100	0	0	0	0
1	1	TRP	0	0	100	0	0	0	0
67	67	MCP	52	3	45	0	0	0	0
1	1	LSL	100	0	0	0	0	0	0
1	1	PLP	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: 1236810391790

LLID: 1236810391790

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	44	56	0	96	96

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: 1236810391790 LLID: 1236810391790 Drainage: Navarro River
 Survey Dates: 8/31/2011 to 10/11/2011 Survey Length (ft.): 6768 Main Channel (ft.): 6768 Side Channel (ft.): 0
 Confluence Location: Quad: ELK Legal Description: T15NR16WS07 Latitude: 39:10:44.0N Longitude: 123:40:52.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F6	Canopy Density (%): 97.2	Pools by Stream Length (%): 53.3
Reach Length (ft.): 1252	Coniferous Component (%): 23.1	Pool Frequency (%): 50.0
Riffle/Flatwater Mean Width (ft.): 4.5	Hardwood Component (%): 76.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Grass	< 2 Feet Deep: 93
Range (ft.): 11 to 15	Vegetative Cover (%): 84.1	2 to 2.9 Feet Deep: 7
Mean (ft.): 13	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 8	Mean Max Residual Pool Depth (ft.): 1.3
Water (F): 52 - 53 Air (F): 49 - 56	LWD per 100 ft.:	Mean Pool Shelter Rating: 11
Dry Channel (ft): 0	Riffles: 2	
	Pools: 1	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 79 Sand: 0 Gravel: 7 Sm Cobble: 0 Lg Cobble: 7 Boulder: 0 Bedrock: 7		
Embeddedness Values (%): 1. 0.0 2. 0.0 3. 0.0 4. 21.4 5. 78.6		

STREAM REACH: 2

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 2030	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): 11 to 11	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.): 11	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.: 0	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs.): 0.0	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 52 - 52 Air (F): 56 - 56	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: C4	Canopy Density (%): 96.6	Pools by Stream Length (%): 45.4
Reach Length (ft.): 3486	Coniferous Component (%): 49.4	Pool Frequency (%): 56.0
Riffle/Flatwater Mean Width (ft.): 6.3	Hardwood Component (%): 50.6	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 82
Range (ft.): 7 to 24	Vegetative Cover (%): 99.1	2 to 2.9 Feet Deep: 13
Mean (ft.): 14	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 4
Std. Dev.: 6	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 2
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 29	Mean Max Residual Pool Depth (ft.): 1.6
Water (F): 52 - 55	Air (F): 56 - 69	LWD per 100 ft.:
Dry Channel (ft): 9	Riffles: 7	Pools: 4
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 4	Sand: 0	Gravel: 96
	Sm Cobble: 0	Lg Cobble: 0
	Boulder: 0	Bedrock: 0
Embeddedness Values (%): 1. 14.3	2. 32.1	3. 28.6
	4. 19.6	5. 5.4

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: 1236810391790

LLID: 1236810391790

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0W

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	1	0	0.6
Boulder	0	0	0.0
Cobble / Gravel	6	8	8.6
Sand / Silt / Clay	74	73	90.7

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	8	7	9.3
Brush	35	31	40.7
Hardwood Trees	14	22	22.2
Coniferous Trees	24	21	27.8
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

StreamName: 1236810391790

LLID: 1236810391790

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/11/2011

Confluence Location: Quad: ELK

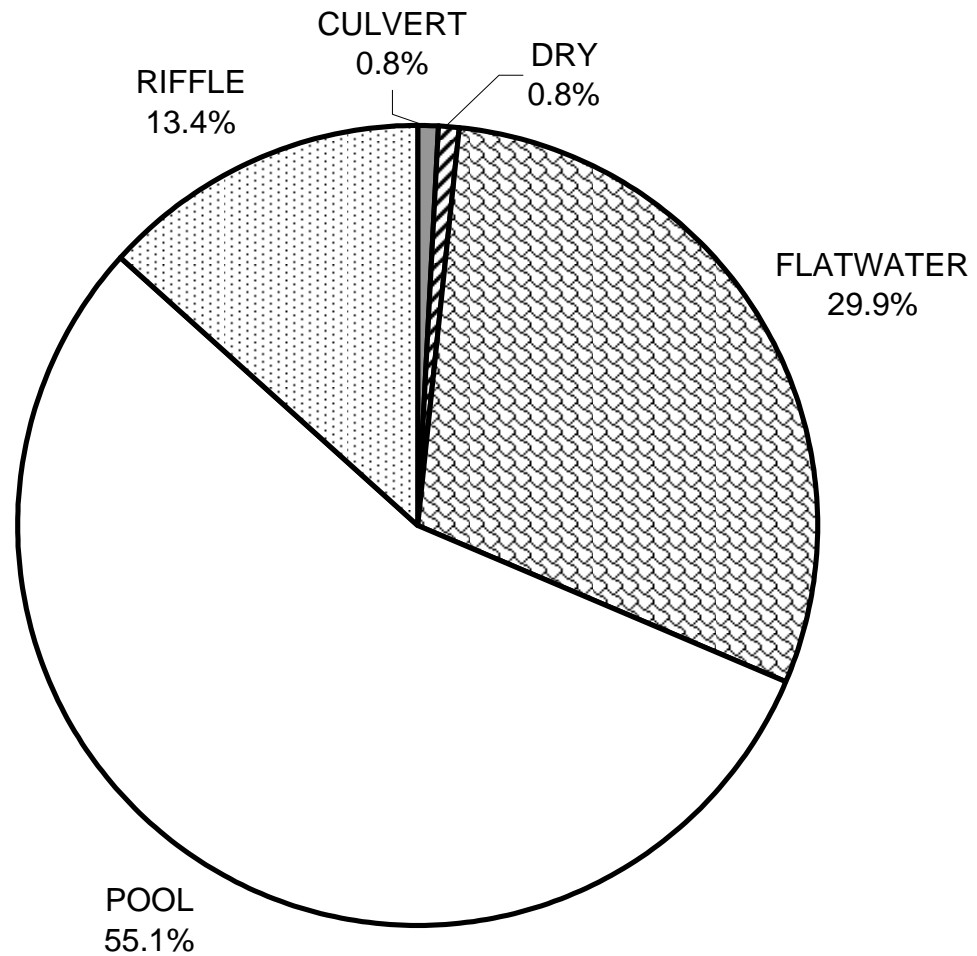
Legal Description: T15NR16WS07

Latitude: 39:10:44.0N

Longitude: 123:40:52.0W

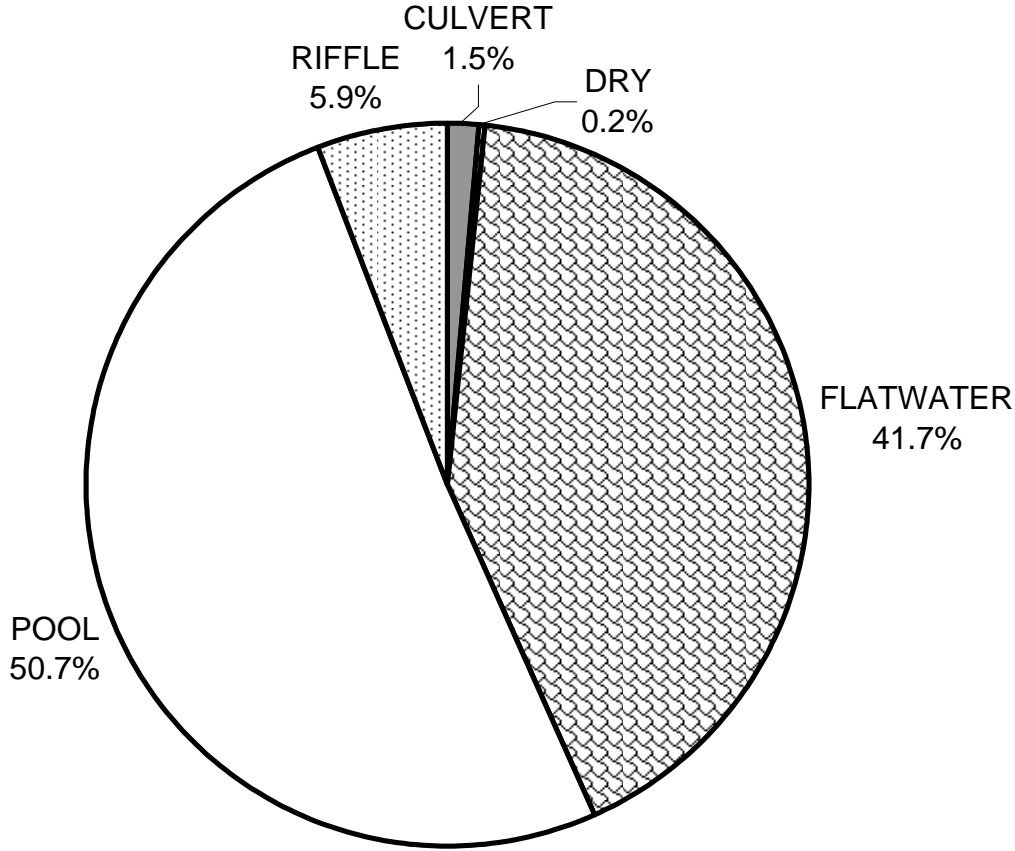
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	15	23
SMALL WOODY DEBRIS (%)	100	39	31
LARGE WOODY DEBRIS (%)	0	14	35
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	0	33	11
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	0
BEDROCK LEDGES (%)	0	0	0

BARTON GULCH 2011 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

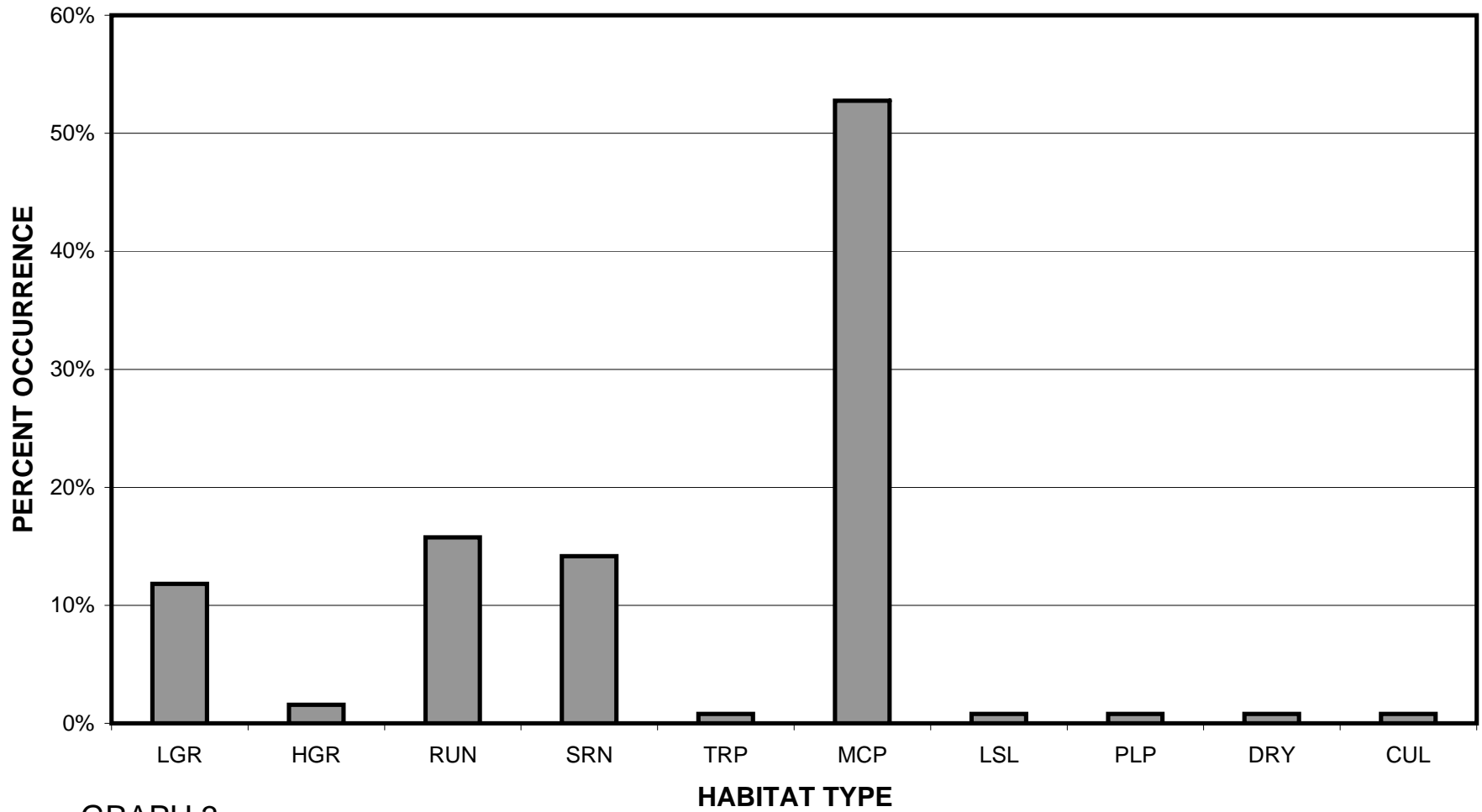
**BARTON GULCH 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH**



GRAPH 2

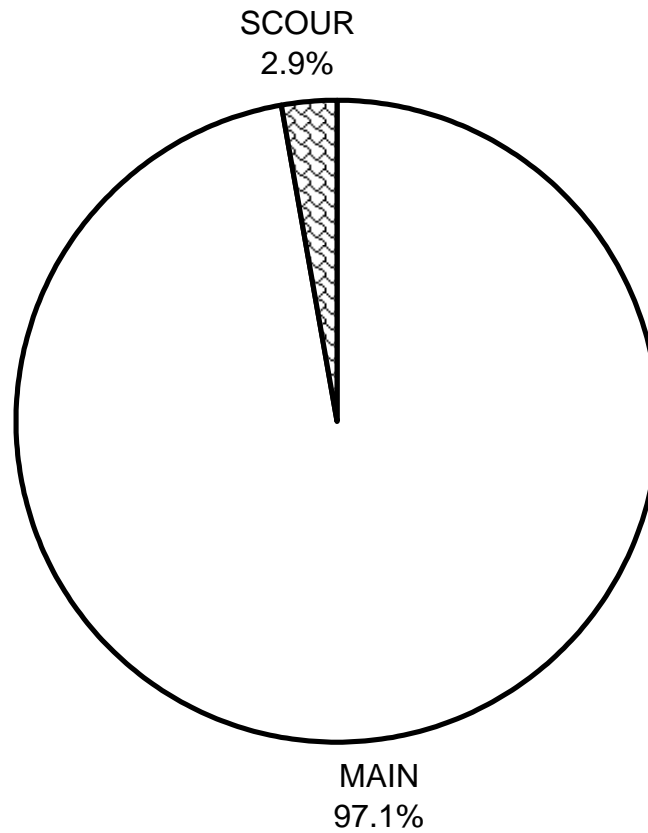
BARTON GULCH 2011

HABITAT TYPES BY PERCENT OCCURRENCE



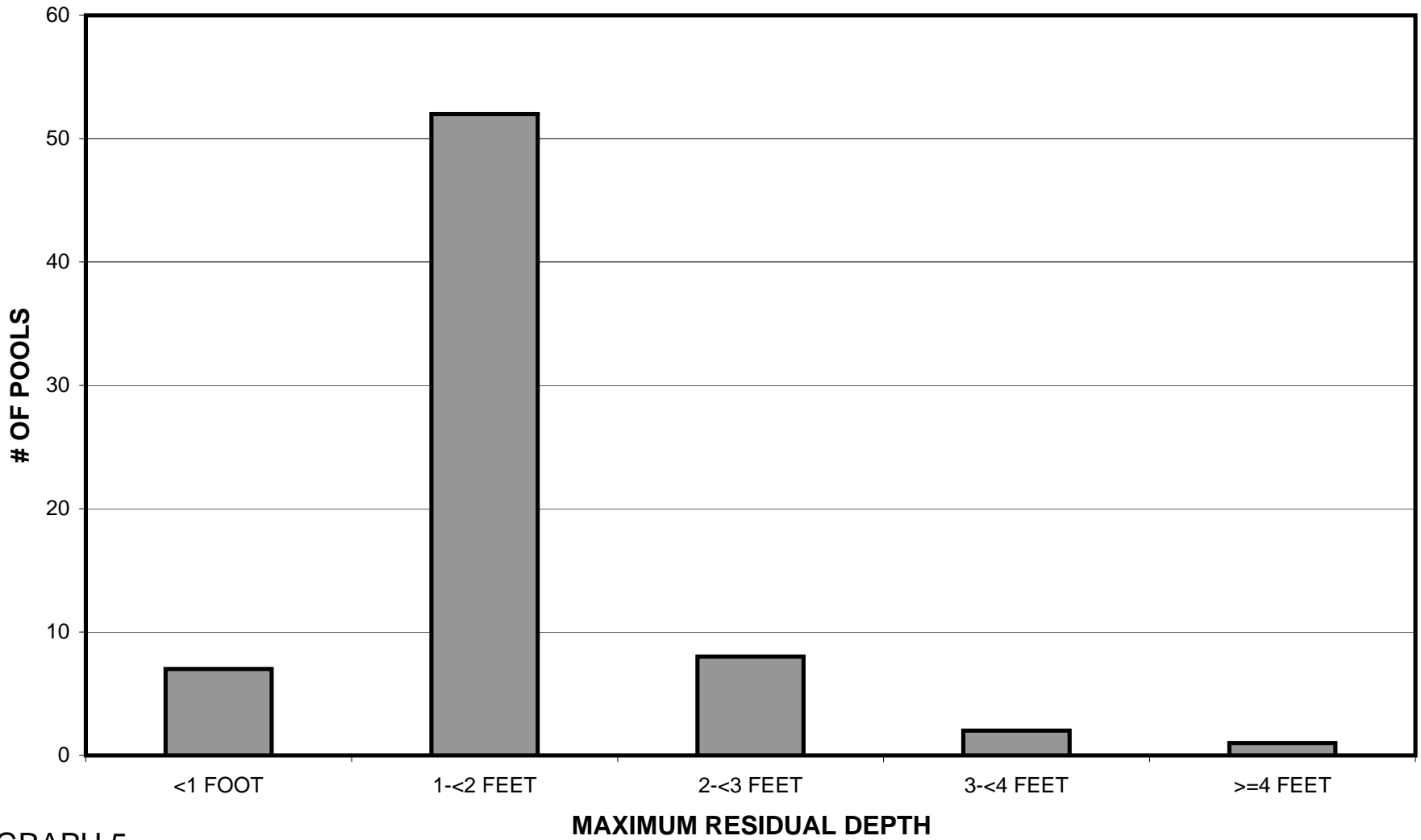
GRAPH 3

BARTON GULCH 2011 POOL TYPES BY PERCENT OCCURRENCE



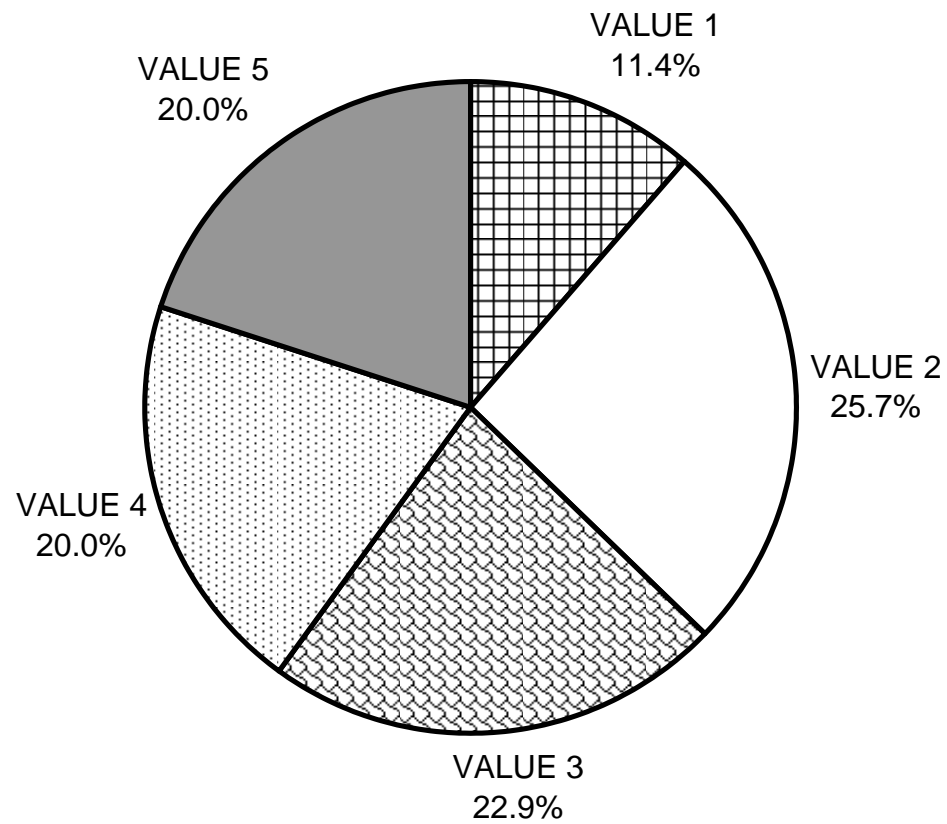
GRAPH 4

BARTON GULCH 2011 MAXIMUM DEPTH IN POOLS



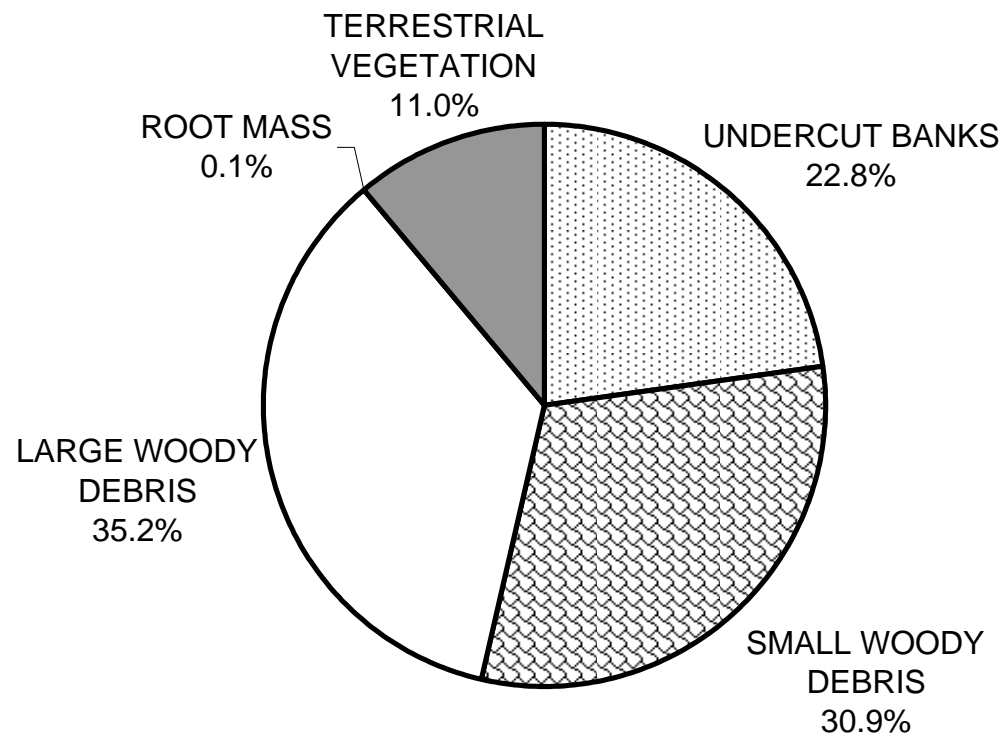
GRAPH 5

BARTON GULCH 2011 PERCENT EMBEDDEDNESS



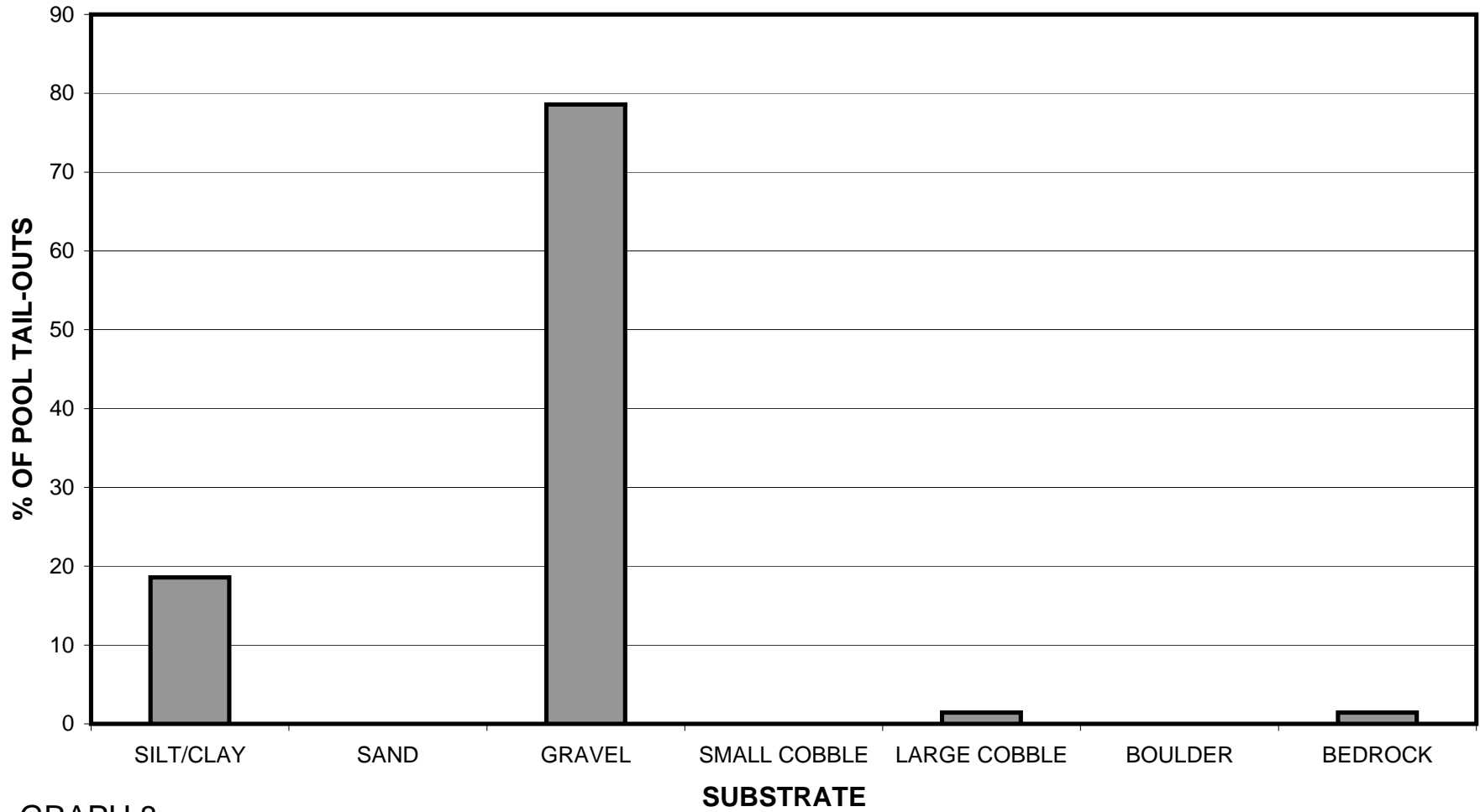
GRAPH 6

BARTON GULCH 2011 MEAN PERCENT COVER TYPES IN POOLS



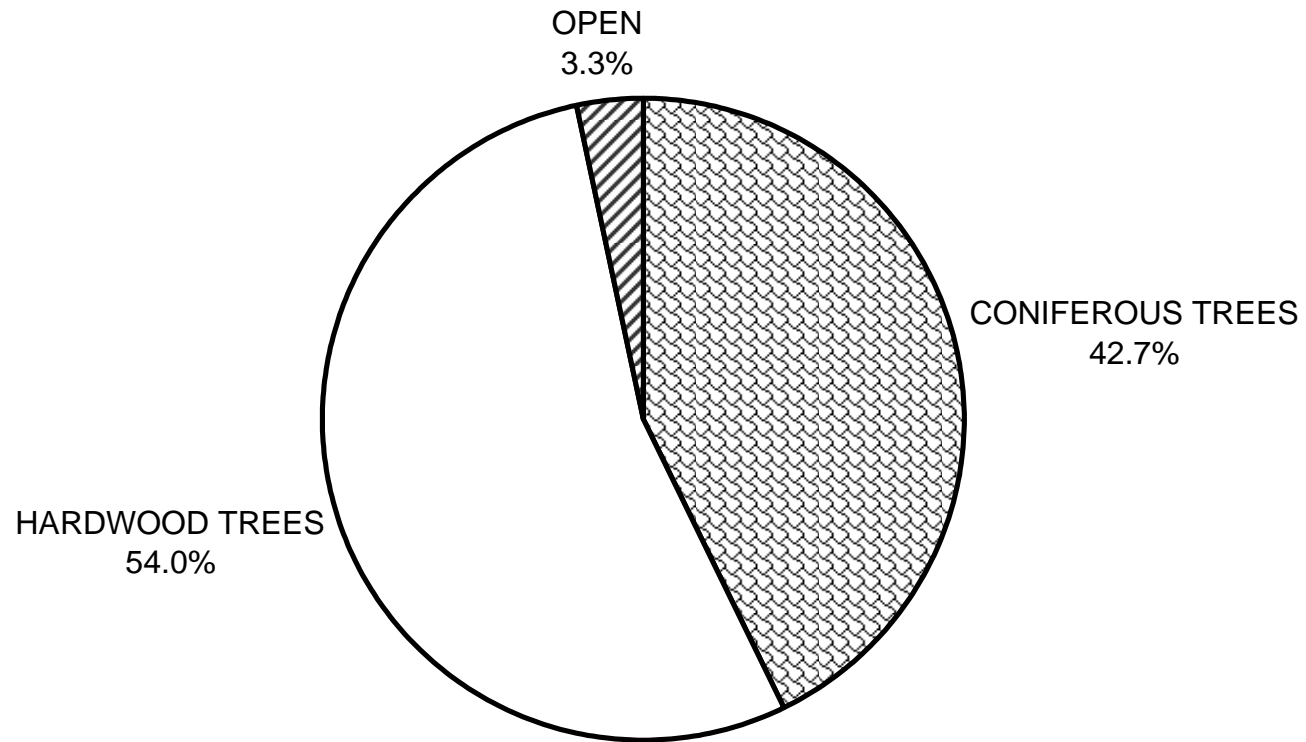
GRAPH 7

BARTON GULCH 2011 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



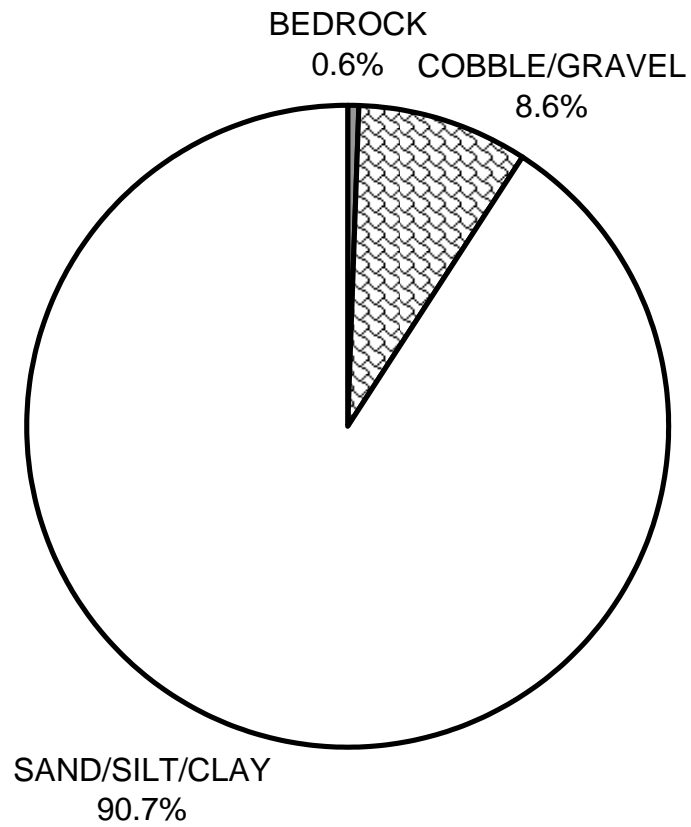
GRAPH 8

BARTON GULCH 2011 MEAN PERCENT CANOPY



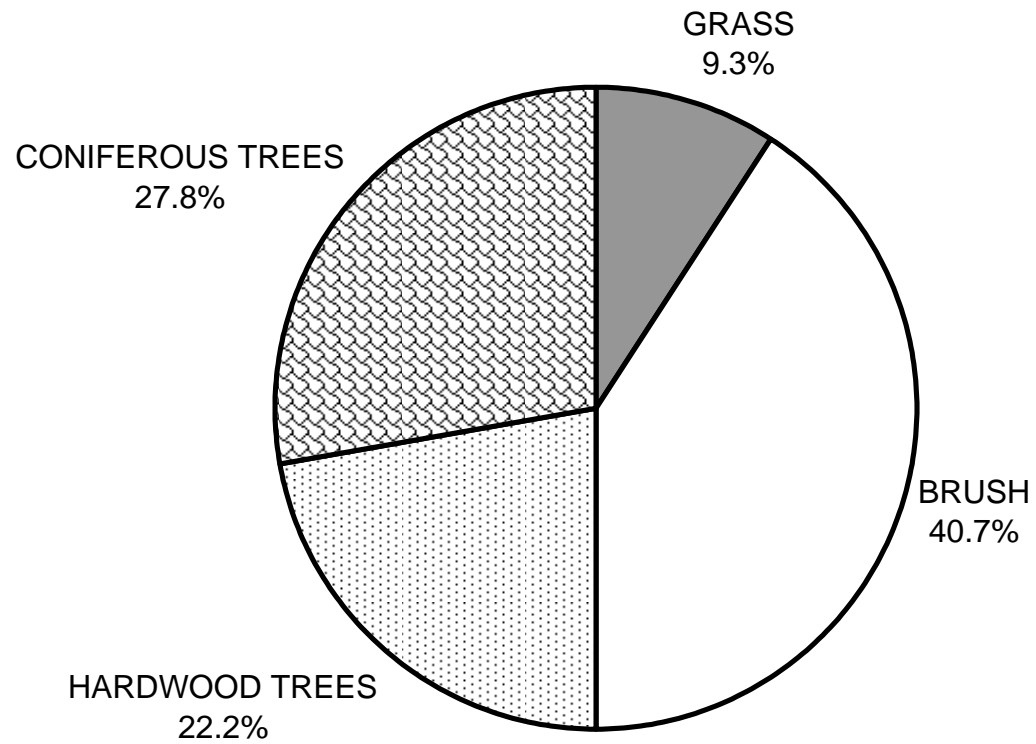
GRAPH 9

**BARTON GULCH 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

BARTON GULCH 2011 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

