

# **STREAM INVENTORY REPORT**

## **Berry Gulch**

### INTRODUCTION

A stream inventory was conducted from August 31 to September 2, 2009 on Berry Gulch. The survey began at the confluence with Little North Fork Big River and extended upstream 2.5 miles. A stream inventory and report was also completed for one tributary to Berry Gulch.

The Berry 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 Berry 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

Berry Gulch is a tributary to Little North Fork Big River, tributary to Big River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Berry Gulch's legal description at the confluence with Little North Fork Big River is T17N R16W S08. Its location is 39.3481 north latitude and 123.6729 west longitude, LLID number 1236717393481. Berry Gulch is a second order stream and has approximately 2.7 miles of blue line stream according to the USGS Mathison Peak 7.5 minute quadrangle. Berry Gulch drains a watershed of approximately 2.8 square miles. Elevations range from about 169 feet at the mouth of the creek to 715 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely owned by the Jackson Demonstration State Forest and is managed for timber production, research, and recreation. Vehicle access exists via Highway 20 east of Highway 1 in Fort Bragg.

### METHODS

The habitat inventory conducted in Berry Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

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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 Berry 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". Berry 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

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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 Berry Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

### 6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Berry 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 Berry 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 Berry Gulch, 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 Berry Gulch. In addition, underwater observations were made at eight sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## DATA ANALYSIS

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

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

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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 Berry Gulch 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 August 31, 2009 to September 2, 2009, was conducted by M.Groff, J. Coombes, and J. Ferreira (WSP). The total length of the stream surveyed was 13,012 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.34 cfs on September 9, 2009.

Berry Gulch is an E3 channel type for 13,012 feet of the stream surveyed (Reach 1). E3 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 cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 51 to 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% flatwater units, 31% riffle units, and 25% pool units (Graph 1). Based on total length of Level II habitat types there were 38% flatwater units, 28% riffle units, and 23% pool units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 29%; run units, 21%; and mid-channel pool

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units, 17% (Graph 3). Based on percent total length, low gradient riffle units made up 26%, step run units 22%, run units 16%, and mid-channel pool units 16%.

A total of 96 pools were identified (Table 3). Main channel pools were the most frequently encountered at 71% (Graph 4), and comprised 70% 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-eight of the 96 pools (29%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 96 pool tail-outs measured, 24 had a value of 1 (25%); 44 had a value of 2 (45.8%); 12 had a value of 3 (12.5%); 1 had a value of 4 (1%); 15 had a value of 5 (15.6%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 1, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 19 (Table 1). Of the pool types, backwater pools had the highest mean shelter rating at 25. Scour pools had a mean shelter rating of 23 and main channel pools had a mean shelter rating of 17 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Berry Gulch. Graph 7 describes the pool cover in Berry 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 60% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 20% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Berry Gulch was 96%. Four percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 19% and 81%, respectively. Graph 9 describes the mean percent canopy in Berry Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 98%. The mean percent left bank vegetated was 98%. The dominant elements composing the structure of the stream banks consisted of 77% sand/silt/clay, 17% cobble/gravel, 5% bedrock (Graph 10). Hardwood trees were the dominant vegetation type observed in 84.5% of the units surveyed. Additionally, 11.6% of the units surveyed had coniferous trees as the dominant vegetation type, and 3.9% had brush as the dominant vegetation type (Graph 11).

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### BIOLOGICAL INVENTORY RESULTS

Eight sites were snorkel surveyed for species composition and distribution in Berry Gulch on September 9, 2009. The water temperature taken during the sampling period of 1132 to 1230 was 54 degrees Fahrenheit. The sites were sampled by S. McSmith and I. Mikus (DFG).

The following chart displays the information yielded from these sites:

2009 Berry Gulch underwater observations.

Date	Survey Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: E3 Channel Type									
09/09/09	1	004	5.6	147	1	0	0	9	0
09/09/09	2	016	5.3	645	3	0	0	0	0
09/09/09	3	024	5.2	1,064	8	0	0	0	0
09/09/09	4	030	5.6	1,410	2	0	0	0	0
09/09/09	5	033	4.2	1,514	2	0	0	0	0
09/09/09	6	105	4.3	4,084	0	1	0	0	0
09/09/09	7	107	4.2	4,150	0	1	0	0	0
09/09/09	8	118	5.1	4,312	0	0	0	0	0

### DISCUSSION

Berry Gulch is an E3 channel type for the entire 13,012 feet of the stream surveyed (Reach 1). The suitability of E3 channel types for fish habitat improvement structures is as follows: E3 channel types are good for bank-placed boulders and fair for opposing wing-deflectors.

The water temperatures recorded on the survey days August 31, 2009 to September 2, 2009, ranged from 53 to 58 degrees Fahrenheit. Air temperatures ranged from 51 to 62 degrees Fahrenheit. To make any conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 38% of the total length of this survey, riffles 28%, and pools 23%. Twenty-eight of the 96 (29%) 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 that will increase or deepen pool habitat is recommended.

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Sixty-eight of the 96 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirteen of the pool tail-outs had embeddedness ratings of 3 or 4. Fifteen 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 Berry Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seventy-seven of the 96 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 was 19. The shelter rating in the flatwater habitats was 4. 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 Berry 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 96%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 98% and 98%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

## **RECOMMENDATIONS**

- 1) Berry 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) Due to the landslide at 307 feet, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.



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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 #:	Comment:
0	0001.00	Start of survey at the confluence with Little North Fork Big River. The channel is an E3.
30	0002.00	A woody debris pile on right bank is encroaching on the channel.
119	0004.00	There is a 1' high plunge over a log.
228	0008.00	A landslide on the right bank measures approximately 30' high x 15' long. It is contributing large woody debris (LWD) and sediment ranging in size from silt to cobble to the stream. LWD is starting to accumulate in the channel.
307	0012.00	A landslide on the left bank measures approximately 150' high x 170' long. It is contributing woody debris to the stream and also sediment ranging in size from silt to boulders. Woody debris is blocking the channel, forming a possible barrier to salmonids. The debris pile is accumulating fine sediment for approximately 350' upstream.
913	0021.00	First unit outside of the influence of Little North Fork Big River.
1373	0030.00	There is a 1' high plunge over a log. There is a blown-out culvert from the road on the left bank { 1' diameter corrugated metal pipe (CMP) } in the middle of the pool.
1714	0037.00	LWD is starting to accumulate in the channel. The debris pile consists of five pieces of LWD with associated small woody debris (SWD).
2180	0051.00	Not surveyed due to a debris accumulation in the channel.
3704	0097.00	Erosion on the right bank measures approximately 40' long x 8' high. It is contributing fine sediment.
4058	0105.00	Tributary #01 (North Fork Berry Gulch) enters from the left bank. See the 2009 North Fork Berry Gulch Stream Habitat Inventory Report.
4150	0108.00	A 6.1' tall bedrock sheet with a 43% slope presents a possible barrier to salmonids. No fish were observed above this point.

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4464	0125.00	There is a 2' high plunge over a log.
4548	0128.00	Log debris accumulation (LDA) #01 is 5.5' high x 14' wide x 5' long and consists of six pieces of large woody debris (LWD). Water flows through the LDA and gaps are visible. The sediment retained ranges from silt to gravel and measures 3' wide x 5' long x 3' deep. It is not a possible barrier to salmonids. No fish were seen above the LDA.
5185	0155.00	Not surveyed due to a debris accumulation in the channel.
5294	0157.00	A landslide on the left bank measures approximately 80' high x 30' long. It is contributing fine sediment and SWD.
6014	0184.00	Erosion on the right bank measuring approximately 30' long x 15' high is contributing fine sediment.
6267	0192.00	LDA #02 is 6' high x 30' wide x 5' long and consists of 15 pieces of LWD. There are gaps visible in the LDA. The flow is subsurface. The sediment retained ranges from silt to gravel and measures 20' wide x 20' long x 3' deep. The 6' high plunge over the logs is a possible barrier to salmonids. No fish were seen above the LDA.
6653	0198.00	A landslide on left bank measures approximately 20' high x 15' long. It is contributing woody debris to the stream and sediment ranging in size from silt to cobble. LDA #03 is 4.5' high x 18' wide x 3' long and consists of 6 pieces of LWD. There are gaps visible in the LDA. The flow is subsurface. The retained sediment ranges from silt to gravel and measures 6' wide x 20' long x 2' deep. The 3' high plunge into a pool full of woody debris is a possible barrier to salmonids. No fish were observed above the LDA.
6799	0203.00	Woody debris is spanning the channel.
6942	0207.00	Woody debris is spanning the channel.
7141	0213.00	Erosion on the left bank measuring approximately 15' long x 5' high is contributing sediment ranging in size from silt to gravel.
7214	0215.00	There is a 2' high plunge. The right bank is cutting around a root wad. The affected section of bank measures approximately 15' long x 6' high.
7596	0230.00	Erosion on the right bank measuring approximately 25' long x 6' high is contributing fine sediment.
7726	0235.00	Erosion on the right bank measuring approximately 60' long x 6' high is contributing fine sediment.

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7799	0237.00	A landslide on the left bank measuring approximately 40' long x 25' high is contributing SWD and fine sediment to the stream. Woody debris is starting to accumulate in the channel.
8000	0244.00	LDA #04 is 6' high x 15' wide x 5' long and consists of eight pieces of LWD. There are no gaps visible in the LDA. The flow is subsurface. The retained sediment ranges from silt to gravel and measures 10' wide x 30' long x 4' deep. The 6' high plunge over the logs is a possible barrier to salmonids. No fish were observed above the LDA.
8222	0252.00	LDA #05 is 6' high x 20' wide x 6' long and consists of eight pieces of LWD. There are no gaps visible in the LDA and the flow is subsurface. The retained sediment ranges from silt to gravel and measures 10' wide x 15' long x 2.5' deep. The 5' high plunge over the logs is a possible barrier to salmonids. No fish were observed above the LDA.
8373	0257.00	There is a 2.5' high plunge.
8423	0259.00	Erosion on the left bank measuring approximately 40' high x 25' long is contributing fine sediment.
8442	0260.00	LDA #06 is 10' high x 40' wide x 27' long and consists of 10 pieces of LWD. There are no gaps visible in the LDA and the flow is subsurface. The retained sediment ranges from silt to gravel and measures 20' wide x 15' long x 6' deep. The 10' high plunge over the logs is a possible barrier to salmonids. No fish were observed above the LDA.
9595	0298.00	Flow on the left bank is cutting around a redwood root wad. The affected section of bank measures approximately 20' long x 12' high and is contributing fine sediment. LWD is starting to accumulate in the channel.
9734	0303.00	There is a dry tributary with 1' diameter CMP extending approximately 6' out of the left bank.
9912	0308.00	LDA #07 is 6.5' high x 19' wide x 7' long and consists of seven pieces of LWD. There are no gaps visible in the LDA and the flow is subsurface. The retained sediment ranges from silt to gravel and measures 15' wide x 8' long x 4' deep. The 6.5' high plunge over the logs is a possible barrier to salmonids. No fish were observed above the LDA.
10309	0325.00	A SWD accumulation measuring 3' high x 9' wide x 3' long is storing a volume of fine sediment measuring approximately 1' high x 3' wide x 4' long.

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10363	0327.00	There is a dry tributary on left bank.
10501	0336.00	Erosion on the left bank measuring approximately 40' long x 8' high is contributing fine sediment.
10543	0337.00	LDA #08 is 4.5' high x 18' wide x 5' long and consists of seven pieces of LWD. There are no gaps visible in the LDA and water flows through. The LDA is retaining fine sediment measuring 6' wide x 7' long x 2' deep. The 4.5' high plunge over the logs is a possible barrier to salmonids. No fish were observed above the LDA.
10596	0338.00	LWD is starting to accumulate in the channel.
10632	0339.00	LWD is starting to accumulate in the channel. SWD is blocking the channel.
10653	0341.00	LDA #09 is 6.5' high x 12' wide x 3' long and consists of one piece of LWD. There are no gaps visible in the LDA and water flows through it. The retained sediment ranges from silt to gravel and measures 6' wide x 8' long x 3' deep. The 3' high plunge over the log is a possible barrier to salmonids. No fish were observed above the LDA.
10865	0352.00	Not surveyed due to woody debris filling the channel.
10957	0357.00	There is a 2' plunge.
11111	0363.00	Road 550 crosses the channel. The culvert is a 6.5' high x 7' wide x 69' long CMP with a 0.5' plunge. The culvert is a possible barrier to juvenile salmonids.
11222	0367.00	LWD is starting to accumulate in the channel.
11422	0374.00	The channel is full of woody debris.
12928	0397.00	Road 550 crosses the channel. The culvert is a 2' high x 2' wide x 18' long CMP with no plunge. The culvert is a possible barrier to salmonids. The culvert is dry on both ends.
13012	0400.00	End of survey due to degrading habitat. The stream is intermittent above the Road 550 crossing. Visual observation 500' upstream of the culvert showed LWD and SWD are blocking more than 70% of the channel. The channel is inundated with fine sediment and there are no pools.

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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: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0

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
2	0	CULVERT	0.5	44	87	0.7									
42	0	DRY	10.9	29	1210	10.4									
128	19	FLATWATER	33.1	34	4379	37.5	5.8	0.5	0.8	143	18292	68	8751		4
8	0	NOSURVEY		46	371										
5	0	NOSURVEY_		195	977										
96	96	POOL	24.8	28	2707	23.2	9.4	1.0	1.8	273	26184	312	29995	267	19
119	14	RIFFLE	30.7	28	3281	28.1	5.4	0.2	0.3	105	12521	23	2714		1
Total Units 400	Total Units Fully Measured 129				Total Length (ft.) 13012						Total Area (sq.ft.) 56996.88		Total Volume (cu.ft.) 41460.65		

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

Stream Name: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0W

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 (%)
112	12	LGR	28.9	27	3074	26.4	6	0.1	0.6	104	11618	18	1999		1	97
5	1	HGR	1.3	37	185	1.6	7	0.5	1.1	206	1029	103	515		10	96
2	1	BRS	0.5	11	22	0.2	2	0.1	0.4	22	45	2	4		0	99
83	16	RUN	21.4	22	1830	15.7	6	0.5	1.2	139	11516	69	5738		5	96
45	3	SRN	11.6	57	2549	21.9	4	0.4	1	165	7431	64	2892		0	98
67	67	MCP	17.3	28	1879	16.1	9	1.0	4.8	268	17967	311	20837	263	17	96
1	1	CCP	0.3	26	26	0.2	10	0.9	1.4	260	260	260	260	234	5	96
1	1	CRP	0.3	25	25	0.2	8	1.5	2.5	200	200	300	300	300	5	98
6	6	LSL	1.6	30	180	1.5	9	0.7	2.5	255	1531	190	1142	155	9	97
4	4	LSR	1.0	30	120	1.0	11	0.5	1.6	352	1406	243	974	179	36	93
7	7	LSBk	1.8	37	258	2.2	7	0.6	1.8	262	1834	200	1399	165	18	97
8	8	PLP	2.1	21	166	1.4	13	1.6	4.2	295	2359	518	4144	487	34	95
2	2	DPL	0.5	26	53	0.5	12	1.3	2.5	314	627	470	941	395	25	99
42	0	DRY	10.9	29	1210	10.4										97
2	0	CUL	0.5	44	87	0.7										
8	0	NS		46	371											
5	0	MAR		195	977											

Total Units  
400

Total Units Fully Measured  
129

Total Length (ft.)  
13012

Total Area (sq.ft.)  
57822.56

Total Volume (cu.ft.)  
41143.71



Table 3 - Summary of Pool Types

Stream Name: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0W

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	71	28	1905	70	9.2	1.0	268	18227	262	17833	17
26	26	SCOUR	27	29	749	28	10.0	0.9	282	7330	269	6996	23
2	2	BACKWATER	2	27	53	2	11.5	1.3	314	627	395	791	25
Total Units 96	Total Units Fully Measured 96				Total Length (ft.) 2707					Total Area (sq.ft.) 26184.1		Total Volume (cu.ft.) 25619.64	

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

Stream Name: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0W

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
67	MCP	70	4	6	46	69	12	18	3	4	2	3
1	CCP	1	0	0	1	100	0	0	0	0	0	0
1	CRP	1	0	0	0	0	1	100	0	0	0	0
6	LSL	6	0	0	5	83	1	17	0	0	0	0
4	LSR	4	0	0	4	100	0	0	0	0	0	0
7	LSBk	7	0	0	7	100	0	0	0	0	0	0
8	PLP	8	0	0	1	13	4	50	2	25	1	13
2	DPL	2	0	0	0	0	2	100	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
96			4	4	64	67	20	21	5	5	3	3

Mean Maximum Residual Pool Depth (ft.): 1.8

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

Stream Name: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Dry Units: 42

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0W

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
112	12	LGR	0	0	10	90	0	0	0	0	0
5	1	HGR	0	0	0	0	0	0	0	100	0
2	1	BRS	0	0	0	0	0	0	0	0	0
119	14	TOTAL RIFFLE	0	0	5	45	0	0	0	50	0
83	16	RUN	28	35	25	0	0	0	0	13	0
45	4	SRN	0	0	0	0	0	0	0	0	0
128	20	TOTAL FLAT	28	35	25	0	0	0	0	13	0
67	67	MCP	11	32	42	10	2	0	0	1	2
1	1	CCP	0	0	0	100	0	0	0	0	0
1	1	CRP	0	50	0	50	0	0	0	0	0
6	6	LSL	10	17	73	0	0	0	0	0	0
4	4	LSR	21	10	68	0	1	0	0	0	0
7	7	LSBk	37	30	7	6	20	0	0	0	0
8	8	PLP	19	11	61	10	0	0	0	0	0
2	2	DPL	0	10	50	0	40	0	0	0	0
96	96	TOTAL POOL	13	27	44	10	4	0	0	1	1
2	0	CUL									
8	0	NS									
5	0	MAR									
400	130	TOTAL	14	27	41	10	4	0	0	3	1

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

Stream Name: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Dry Units: 42

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0W

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
112	12	LGR	0	0	67	25	8	0	0
5	1	HGR	0	0	0	0	0	100	0
2	1	BRS	0	0	0	0	0	0	100
83	16	RUN	0	0	88	6	6	0	0
45	3	SRN	0	0	100	0	0	0	0
67	67	MCP	19	1	79	0	0	0	0
1	1	CCP	0	0	0	100	0	0	0
1	1	CRP	0	0	100	0	0	0	0
6	6	LSL	0	0	100	0	0	0	0
4	4	LSR	25	0	75	0	0	0	0
7	7	LSBk	0	0	100	0	0	0	0
8	8	PLP	38	0	50	0	0	0	13
2	2	DPL	50	0	50	0	0	0	0

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

Stream Name: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
96	81	19	0	98	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.

Stream Name: Berry Gulch	LLID: 1236717393481	Drainage: Big River
Survey Dates: 8/31/2009 to 9/2/2009	Survey Length (ft.): 13012	Main Channel (ft.): 13012
		Side Channel (ft.): 0
Confluence Location: Quad: MATHISON PEAK	Legal Description: T17NR16WS08	Latitude: 39:20:53.0N
		Longitude: 123:40:18.0W

STREAM REACH: 1

Channel Type: E3

Reach Length (ft.): 13012

Riffle/Flatwater Mean Width (ft.): 5.6

BFW:

Range (ft.): 7 to 25

Mean (ft.): 15

Std. Dev.: 5

Base Flow (cfs.): 0.3

Water (F): 53 - 58    Air (F): 51 - 62

Dry Channel (ft): 1210

Canopy Density (%): 96.4

Coniferous Component (%): 81.1

Deciduous Component (%): 18.9

Dominant Bank Vegetation: Deciduous Trees

Vegetative Cover (%): 98.2

Dominant Shelter: Large Woody Debris

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 27

LWD per 100 ft.:

Riffles: 1

Pools: 7

Flat: 3

Pools by Stream Length (%): 20.8

Pool Frequency (%): 24.0

Residual Pool Depth (%):

< 2 Feet Deep: 71

2 to 2.9 Feet Deep: 21

3 to 3.9 Feet Deep: 5

>= 4 Feet Deep: 3

Mean Max Residual Pool Depth (ft.): 1.8

Mean Pool Shelter Rating: 19

Pool Tail Substrate (%): Silt/Clay: 8    Sand: 1    Gravel: 60    Sm Cobble: 20    Lg Cobble: 4    Boulder: 1    Bedrock: 5

Embeddedness Values (%): 1. 25.0    2. 45.8    3. 12.5    4. 1.0    5. 15.6

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

Stream Name: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

Longitude: 123:40:18.0W

**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	6	8	5.43
Boulder	0	1	0.39
Cobble / Gravel	23	22	17.44
Sand / Silt / Clay	100	98	76.74

**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	0.00
Brush	4	6	3.88
Hardwood Trees	112	106	84.50
Coniferous Trees	13	17	11.63
No Vegetation	0	0	0.00

**Total Stream Cobble Embeddedness Values:**

2

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

StreamName: Berry Gulch

LLID: 1236717393481

Drainage: Big River

Survey Dates: 8/31/2009 to 9/2/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS08

Latitude: 39:20:53.0N

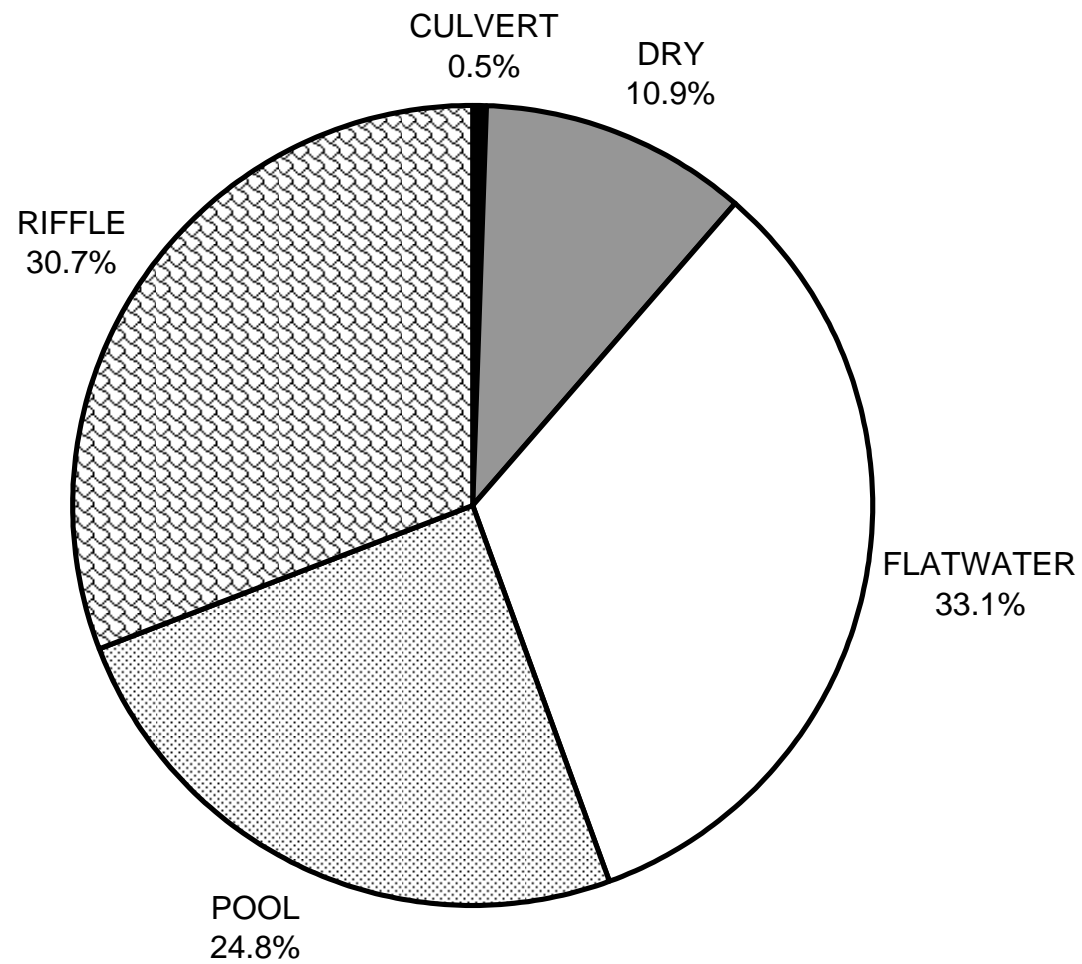
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	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	28	13
SMALL WOODY DEBRIS (%)	0	35	27
LARGE WOODY DEBRIS (%)	5	25	44
ROOT MASS (%)	45	0	10
TERRESTRIAL VEGETATION (%)	0	0	4
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	50	13	1
BEDROCK LEDGES (%)	0	0	1

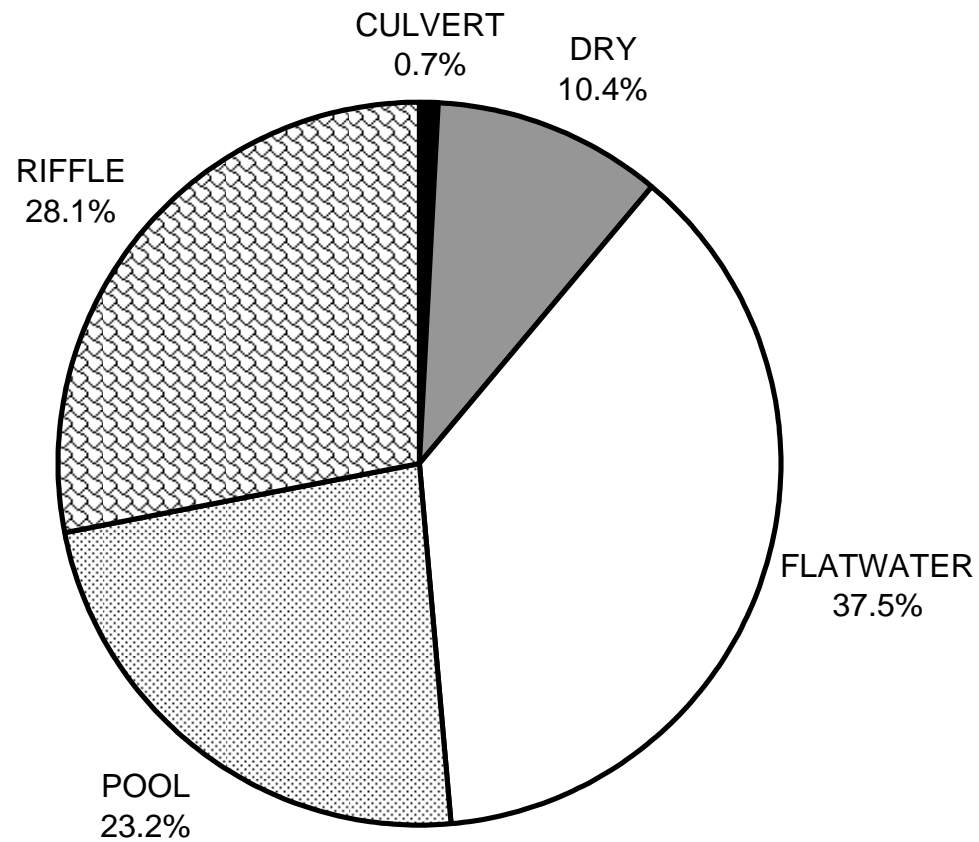


**BERRY GULCH 2009**  
**HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 1

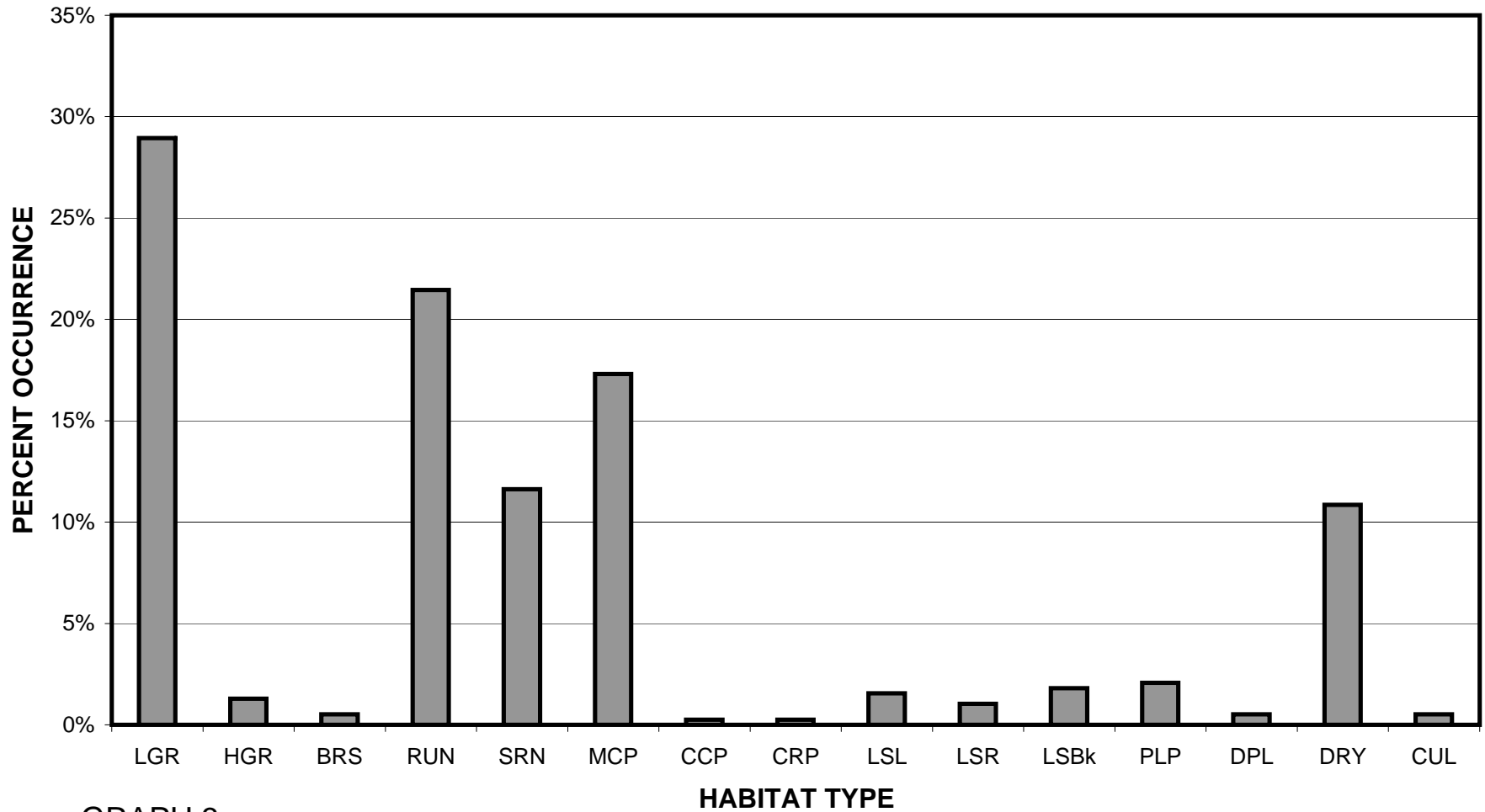
**BERRY GULCH 2009**  
**HABITAT TYPES BY PERCENT TOTAL LENGTH**



GRAPH 2

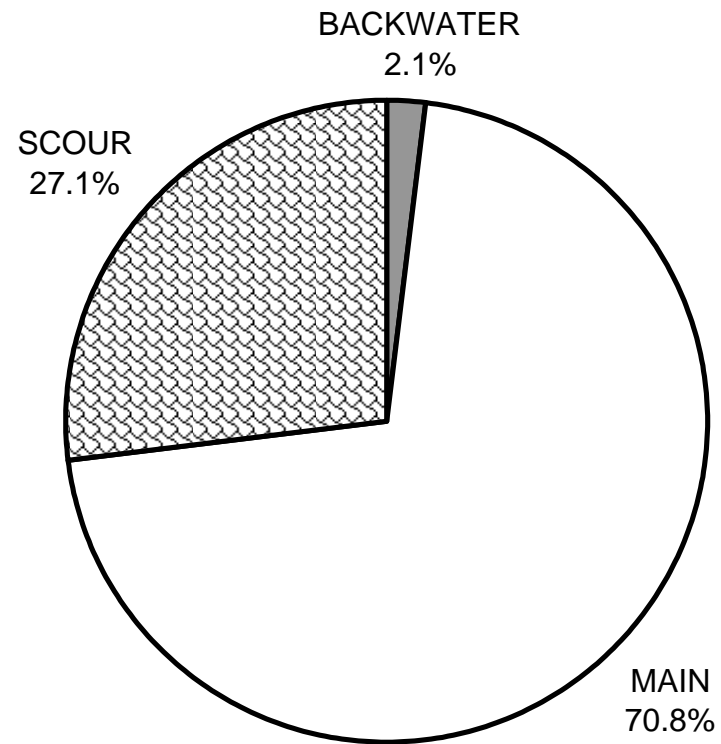
# BERRY GULCH 2009

## HABITAT TYPES BY PERCENT OCCURRENCE



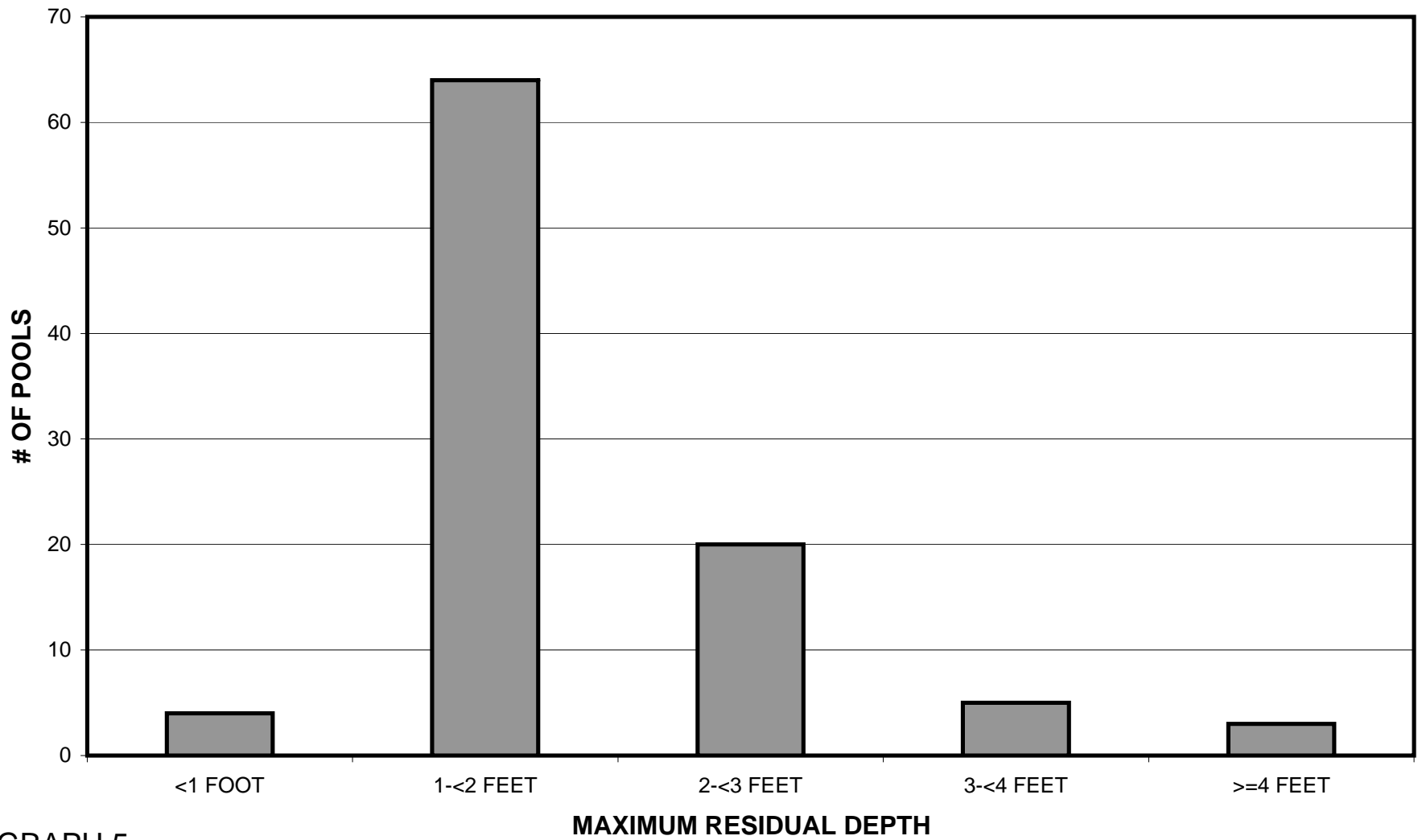
GRAPH 3

**BERRY GULCH 2009**  
**POOL TYPES BY PERCENT OCCURRENCE**



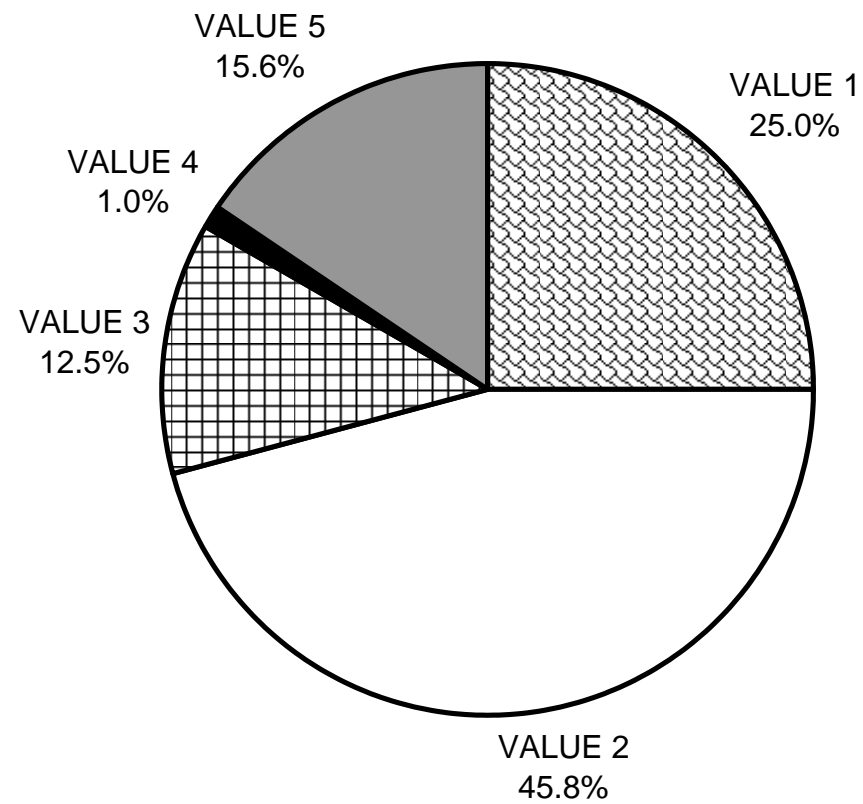
GRAPH 4

**BERRY GULCH 2009  
MAXIMUM DEPTH IN POOLS**



GRAPH 5

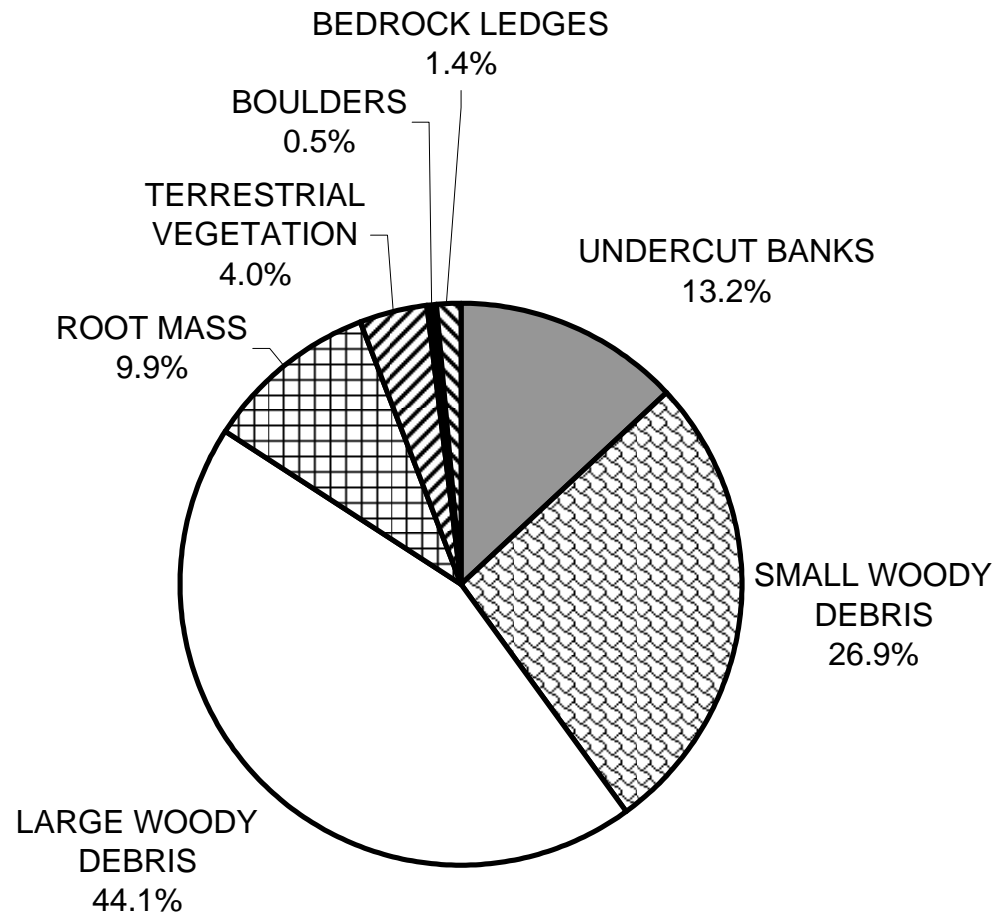
# BERRY GULCH 2009 PERCENT EMBEDDEDNESS



GRAPH 6

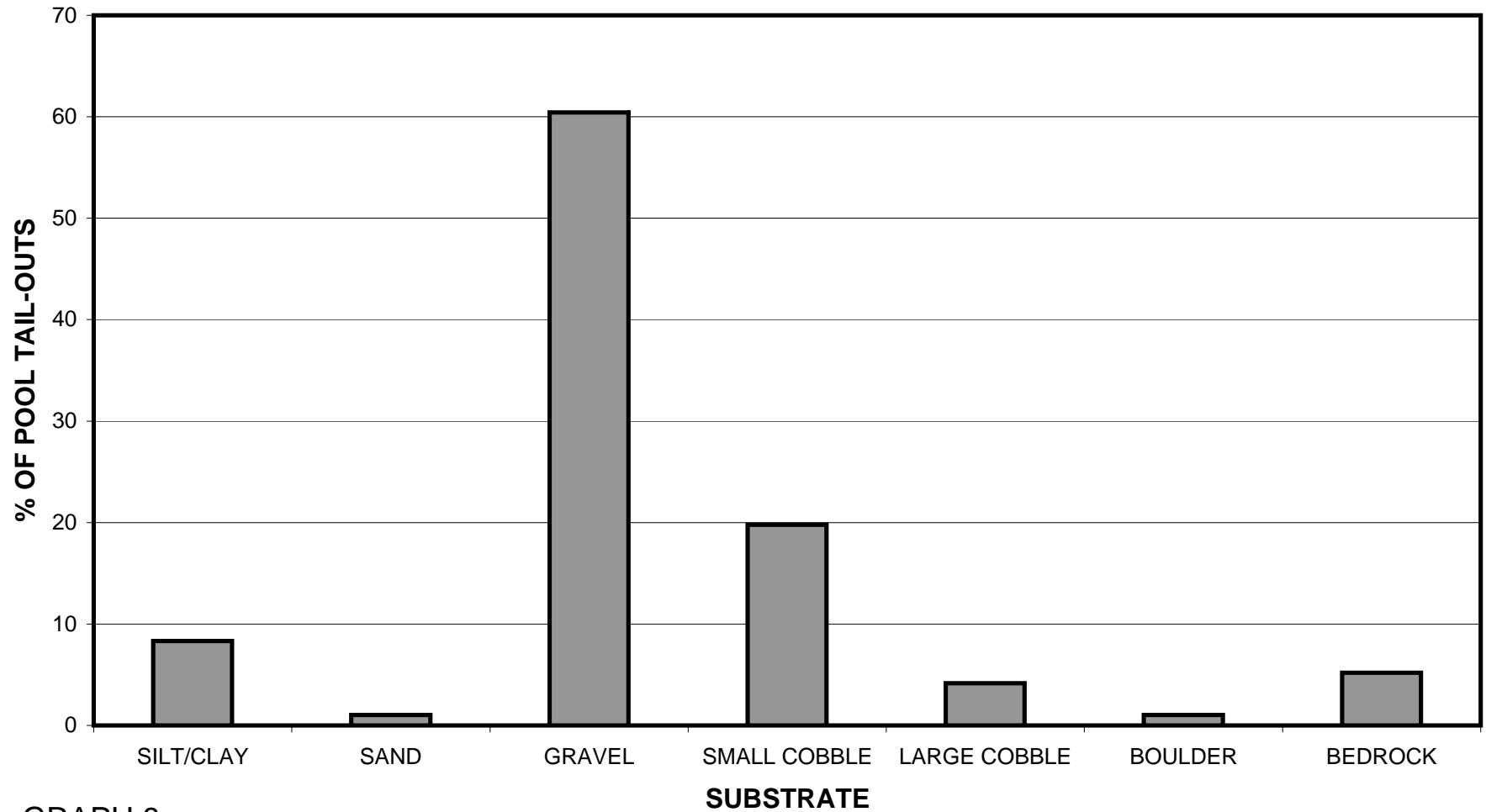
# BERRY GULCH 2009

## MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

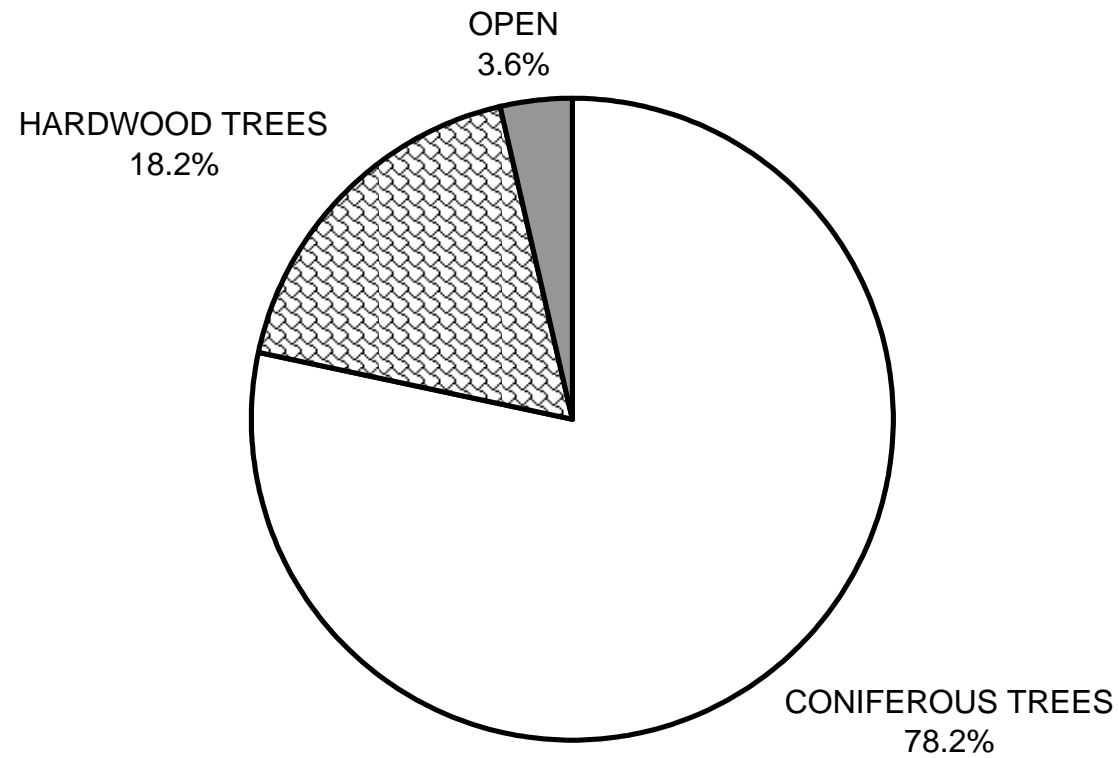
**BERRY GULCH 2009**  
**SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



GRAPH 8

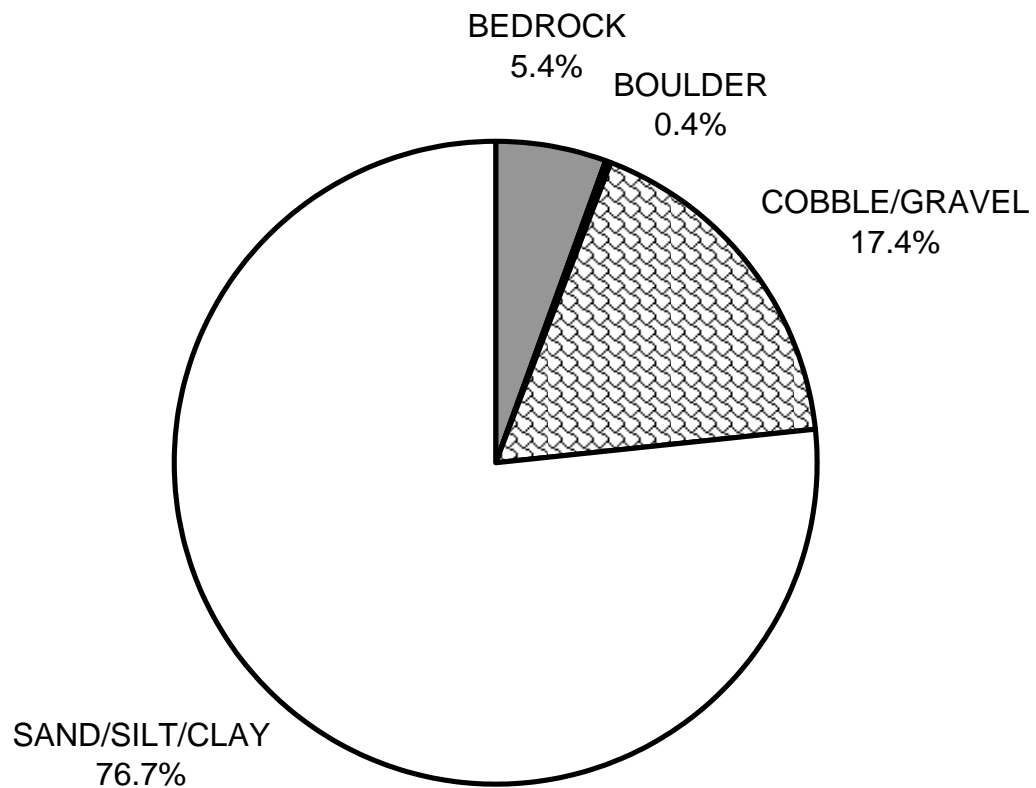


**BERRY GULCH 2009  
MEAN PERCENT CANOPY**



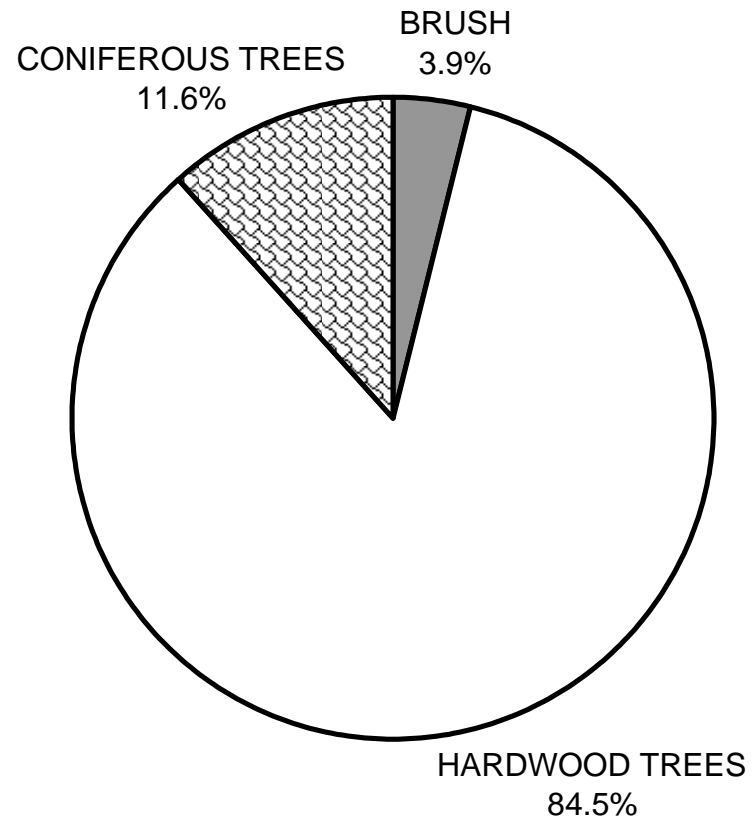
GRAPH 9

**BERRY GULCH 2009**  
**DOMINANT BANK COMPOSITION IN SURVEY REACH**



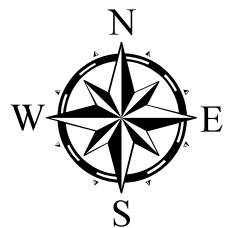
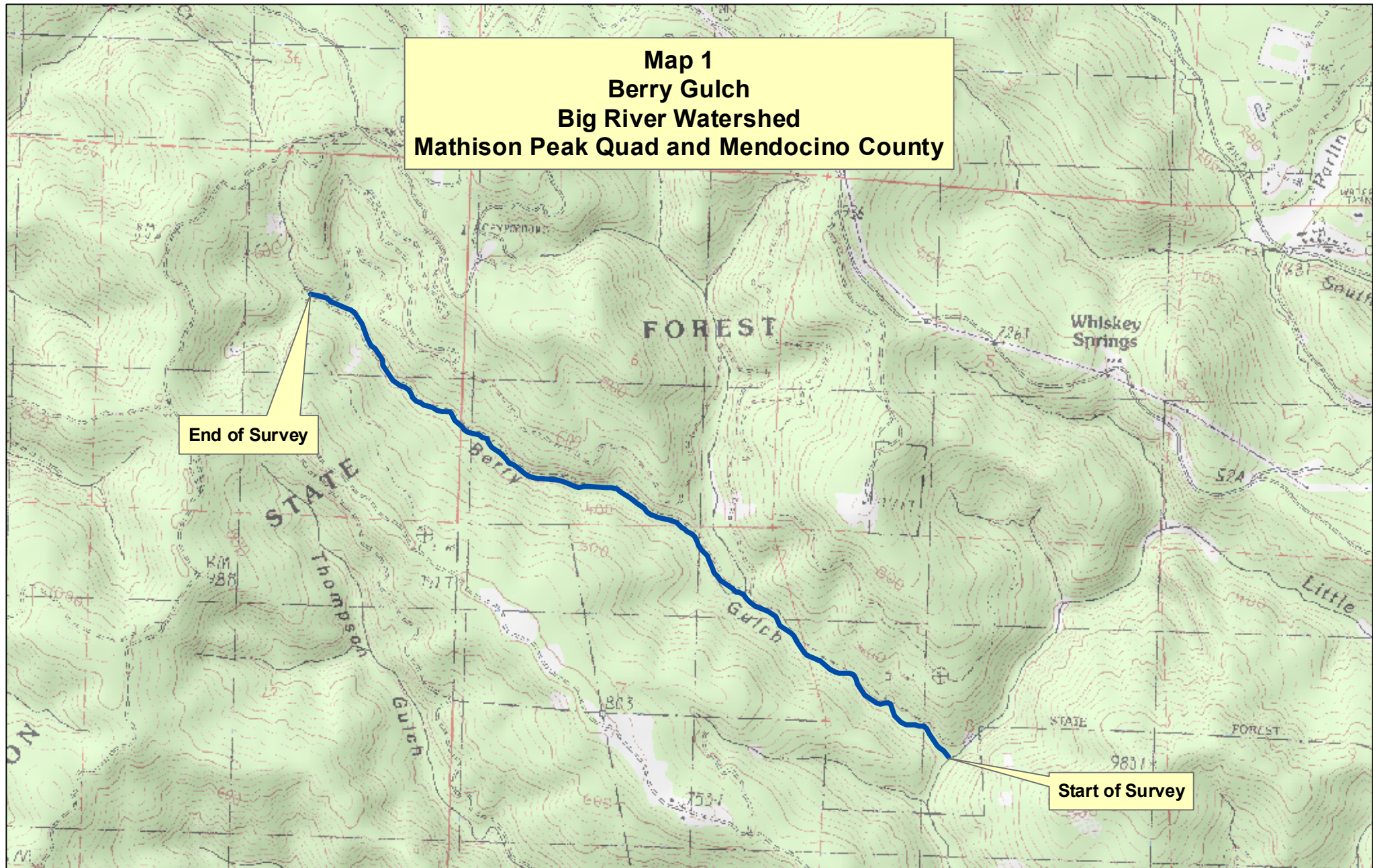
GRAPH 10

**BERRY GULCH 2009**  
**DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

**Map 1**  
**Berry Gulch**  
**Big River Watershed**  
**Mathison Peak Quad and Mendocino County**



**Legend**

— Reach 1, E3 Channel Type

0 2,100 4,200 Feet

