

# **STREAM INVENTORY REPORT**

## **Railroad Gulch**

### INTRODUCTION

A stream inventory was conducted from October 25 to October 26, 2011 on Railroad Gulch. The survey began at the confluence with the Albion River and extended upstream one mile.

The Railroad 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 Railroad 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

Railroad Gulch is a tributary to the Albion River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Railroad Gulch's legal description at the confluence with the Albion River is T16N R16W S09. Its location is 39.2632 degrees north latitude and 123.6475 degrees west longitude, LLID number 1236463392632. Railroad Gulch is a first order stream and has approximately 1.7 miles of blue line stream according to the USGS Mathison Peak 7.5 minute quadrangle. Railroad Gulch drains a watershed of approximately 2.6 square miles. Elevations range from about 150 feet at the mouth of the creek to 970 feet in the headwaters. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via a private logging road off Comptche-Ukiah Road.

### METHODS

The habitat inventory conducted in Railroad 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

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crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

### HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Railroad 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". Railroad 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 Railroad 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 Railroad 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 Railroad 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 Railroad 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 Railroad Gulch. In addition, underwater observations were made at 16 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## **DATA ANALYSIS**

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

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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Railroad 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

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- 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 October 25 to October 26, 2011 conducted by M. Groff and I. Mikus (DFG). The total length of the stream surveyed was 5,431 feet.

Stream flow was not measured on Railroad Gulch.

Railroad Gulch is a G4 channel type for 1,642 feet of the stream surveyed (Reach 1), an E4 channel type for 2,197 feet of the stream surveyed (Reach 2), a B4 channel type for 1,093 feet of the stream surveyed (Reach 3), and an A4 channel type for 499 feet of the stream surveyed (Reach 4). G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width/depth ratios 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. 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. A4 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 48 to 54 degrees Fahrenheit. Air temperatures ranged from 39 to 55 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% pool units, 27% flatwater units, 25% dry units, and 13% riffle units (Graph 1). Based on total length of Level II habitat types there were 54% dry units, 25% pool units, 16% flatwater units, and 4% riffle units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 28%; dry units 25%; and run units, 19% (Graph 3). Based on percent total length, dry units made up 54%, mid-channel pool units 20%, and run units 9%.

A total of 59 pools were identified (Table 3). Main channel pools were the most frequently encountered at 81% (Graph 4), and comprised 84% of the total length of all pools (Table 3).

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Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-four of the 59 pools (41%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 59 pool tail-outs measured, 33 had a value of 1 (55.9%); 18 had a value of 2 (30.5%); two had a value of 4 (3.4%); six had a value of 5 (10.2%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 0, and pool habitats had a mean shelter rating of 7 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 7. Main channel pools a mean shelter rating of 6 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Railroad Gulch. Graph 7 describes the pool cover in Railroad Gulch. 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 88% of the pool tail-outs. Silt/clay was the next most frequently observed dominant substrate type and occurred in 5% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Railroad Gulch was 97%. Three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 18% and 82%, respectively. Graph 9 describes the mean percent canopy in Railroad Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 94% sand/silt/clay, 4% cobble/gravel, 2% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 61% of the units surveyed. Additionally, 22% of the units surveyed had brush as the dominant vegetation type, and 15% had deciduous trees as the dominant vegetation type (Graph 11).

## **BIOLOGICAL INVENTORY RESULTS**

Survey teams conducted a snorkel survey at 16 sites for species composition and distribution in Railroad Gulch on November 2, 2011. Water temperatures taken during the sample period of 1100 hours to 1145 hours ranged from 47 to 49 degrees Fahrenheit. Air temperatures ranged from 45 to 46 degrees Fahrenheit. The sites were sampled by S. Monday and M. Groff (DFG).

In reach 1, which comprised the first 1,642 feet of stream, 15 sites were sampled. The reach sites yielded no fish.

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In reach 2, one site was sampled starting approximately 1,835 from the confluence with the Albion River and continuing upstream 24 feet. The reach sites yielded no fish.

The following chart displays the information yielded from these sites:

2011 Railroad Gulch underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: G4 Channel Type									
11/02/11	1	004	Pool	56	0	0	0	0	0
	2	006	Pool	110	0	0	0	0	0
	3	007	Pool	130	0	0	0	0	0
	4	009	Pool	170	0	0	0	0	0
	5	016	Pool	295	0	0	0	0	0
	6	018	Pool	383	0	0	0	0	0
	7	021	Pool	429	0	0	0	0	0
	8	031	Pool	577	0	0	0	0	0
	9	037	Pool	748	0	0	0	0	0
	10	045	Pool	1,030	0	0	0	0	0
	11	053	Pool	1,202	0	0	0	0	0
	12	058	Pool	1,134	0	0	0	0	0
	13	064	Pool	1,451	0	0	0	0	0
	14	067	Pool	1,531	0	0	0	0	0
	15	071	Pool	1,628	0	0	0	0	0
Reach 2: E4 Channel Type									
	16	082	Pool	1,859	0	0	0	0	0

## DISCUSSION

Railroad Gulch is a G4 channel type for the first 1,642 feet of stream surveyed, an E4 channel type for the next 2,197 feet, a B4 channel type for the next 1,093 feet, and an A4 channel type for the remaining 499 feet. The suitability of G4, E4, B4, and A4 channel types for fish habitat improvement structures is as follows: G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover. E4 channel types are good for bank-placed boulders and fair for opposing wing-deflectors. B4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. A4 channels are generally not suitable for fish habitat improvement projects.

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The water temperatures recorded on the survey days October 25 to October 26, 2011 ranged from 48 to 54 degrees Fahrenheit. Air temperatures ranged from 39 to 55 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 16% of the total length of this survey, riffles 4%, and pools 25%. Twenty-four of the 59 (41%) 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 increase or deepen pool habitat is recommended for Reaches 1 and 2.

Fifty-one of the 59 pool tail-outs measured had embeddedness ratings of 1 or 2. Two of the pool tail-outs had embeddedness ratings of 3 or 4. Six 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.

Fifty-four of the 59 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 7. The shelter rating in the flatwater habitats is 0. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Railroad Gulch. 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 97%. Reach 1 had a canopy density of 98%, Reach 2 had a canopy density of 96%, Reach 3 had a canopy density of 99%, and Reach 4 had a canopy density of 98%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 99% and 99%, 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) Railroad 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.

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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 the Albion River. The channel is a G4.
252	0016.00	Dry tributary on the left bank.
557	0031.00	There is a 2.5' high plunge over root mass.
697	0037.00	There is a 3' high plunge over root mass.
1045	0048.00	There is a 2' high plunge over root mass and woody debris.
1266	0058.00	There is a 2.5' high plunge over root mass and woody debris.
1387	0063.00	A logging road crosses the channel. The crossing is a 6.4' high x 11' wide x 53' long railcar bridge.
1591	0071.00	There is a step-pool with two plunges. The first plunge is 3' high over root mass and woody debris. The second plunge is 3.5' high over root mass.
1642	0074.00	The channel changes from a G4 to an E4.
1835	0082.00	There is a 1.5' high plunge over root mass.
2015	0088.00	There is a 2.5' high plunge over redwood root.
2221	0098.00	Small woody debris is accumulating on redwood roots that span the channel.
2242	0099.00	There is a 3' high plunge over root mass.
2681	0102.00	Dry tributary on the left bank.
3624	0123.00	Dry tributary on the left bank.

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3839	0129.00	The channel changes from an E4 to a B4.
3883	0131.00	There is a 3' high plunge over silt/clay.
3958	0137.00	Log debris accumulation (LDA) #01 contains six pieces of large woody debris (LWD) and measures 3.5' high x 12' wide x 45' long. Water does not flow through the LDA; the channel is dry for 51' above it. There are visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 10' wide x 50' long x 2' deep.
4921	0157.00	There is a 2' high plunge over root mass and woody debris.
4932	0158.00	There is a 2' high plunge over root mass. The channel changes from a B4 to an A4.
4982	0161.00	There is a 3' high plunge over root mass.
5159	0163.00	Redwood roots have grown into the channel and created a steep cascade (currently dry) that may be a barrier to salmonids. The slope is approximately 30% over 20 feet.
5317	0166.00	End of survey. There is a 74' long LWD/boulder cascade with a slope of 23%. The initial plunge is 5' high over a rootwad and LWD. Above the cascade the channel is mostly dry for over 1,000 feet. Eight short, shallow pools were observed in this distance. No fish were observed during the length of the survey.

## **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: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0

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
42	0	DRY	25.3	70	2948	54.3									
44	10	FLATWATER	26.5	20	878	16.2	3.2	0.4	0.8	66	2884	27	1200		0
59	59	POOL	35.5	23	1382	25.4	6.4	1.1	1.9	152	8956	188	11087	175	7
21	10	RIFFLE	12.7	11	223	4.1	2.0	0.1	0.2	15	324	2	32		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
166	79				5431					12163			12320		

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

Stream Name: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

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 (%)
18	8	LGR	10.8	11	195	3.6	2	0.1	0.4	16	285	2	28		0	98
3	2	HGR	1.8	9	28	0.5	2	0.1	0.3	14	42	1	4		0	97
32	6	RUN	19.3	15	483	8.9	3	0.4	1	50	1592	23	746		0	97
12	4	SRN	7.2	33	395	7.3	3	0.4	0.9	89	1071	33	399		0	99
46	46	MCP	27.7	24	1104	20.3	6	1.0	4.7	147	6762	162	7461	150	6	97
2	2	STP	1.2	25	50	0.9	8	1.3	3.2	248	496	403	807	381	13	98
1	1	CRP	0.6	12	12	0.2	13	1.9	2.9	156	156	312	312	296	20	99
1	1	LSBk	0.6	16	16	0.3	6	0.8	1.5	88	88	79	79	70	0	99
9	9	PLP	5.4	22	200	3.7	7	1.6	4.4	162	1454	270	2428	255	7	99
42	0	DRY	25.3	70	2948	54.3										

Total Units  
166

Total Units Fully Measured  
79

Total Length (ft.)  
5431

Total Area (sq.ft.)  
11945

Total Volume (cu.ft.)  
12264

**Table 3 - Summary of Pool Types**

Stream Name: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

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
48	48	MAIN	81	24	1154	84	6.2	1.0	151	7258	160	7682	6
11	11	SCOUR	19	21	228	16	7.6	1.5	154	1698	242	2666	7
Total Units 59	Total Units Fully Measured 59				Total Length (ft.) 1382					Total Area (sq.ft.) 8956		Total Volume (cu.ft.) 10348	

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

Stream Name: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

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
46	MCP	78	1	2	29	63	14	30	1	2	1	2
2	STP	3	0	0	1	50	0	0	1	50	0	0
1	CRP	2	0	0	0	0	1	100	0	0	0	0
1	LSBk	2	0	0	1	100	0	0	0	0	0	0
9	PLP	15	0	0	3	33	2	22	3	33	1	11

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
59	1	2	34	58	17	29	5	8	2	3

Mean Maximum Residual Pool Depth (ft.): 1.9

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

Stream Name: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Dry Units: 42

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

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
18	8	LGR	0	0	0	0	0	0	0	0	0
3	2	HGR	0	0	0	0	0	0	0	0	0
21	10	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
32	6	RUN	0	0	0	0	0	0	0	0	0
12	4	SRN	0	0	0	0	0	0	0	0	0
44	10	TOTAL FLAT	0	0	0	0	0	0	0	0	0
46	46	MCP	44	30	17	7	0	0	0	0	1
2	2	STP	40	10	50	0	0	0	0	0	0
1	1	CRP	75	20	5	0	0	0	0	0	0
1	1	LSBk	0	0	0	0	0	0	0	0	0
9	9	PLP	60	33	7	0	0	0	0	0	0
59	59	TOTAL POOL	47	29	18	6	0	0	0	0	1
166	79	TOTAL	47	29	18	6	0	0	0	0	1

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

Stream Name: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Dry Units: 42

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

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
18	8	LGR	13	0	75	13	0	0	0
3	2	HGR	0	0	100	0	0	0	0
32	6	RUN	33	0	67	0	0	0	0
12	4	SRN	0	0	100	0	0	0	0
46	46	MCP	17	2	78	0	0	0	2
2	2	STP	0	0	100	0	0	0	0
1	1	CRP	100	0	0	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
9	9	PLP	22	0	78	0	0	0	0

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

Stream Name: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	82	18	0	99	99

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: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Survey Length (ft.): 5431

Main Channel (ft.): 5431

Side Channel (ft.): 0

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: G4

Reach Length (ft.): 1642

Riffle/Flatwater Mean Width (ft.): 2.5

BFW:

Range (ft.): 6 to 12

Mean (ft.): 9

Std. Dev.: 2

Base Flow (cfs.): 0.0

Water (F): 52 - 54

Air (F): 47 - 53

Dry Channel (ft): 105

Canopy Density (%): 97.5

Coniferous Component (%): 78.7

Hardwood Component (%): 21.3

Dominant Bank Vegetation: Coniferous Trees

Vegetative Cover (%): 98.8

Dominant Shelter: Undercut Banks

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 14

LWD per 100 ft.:

Riffles: 1

Pools: 3

Flat: 2

Pools by Stream Length (%): 53.2

Pool Frequency (%): 42.5

Residual Pool Depth (%):

< 2 Feet Deep: 55

2 to 2.9 Feet Deep: 32

3 to 3.9 Feet Deep: 13

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.9

Mean Pool Shelter Rating: 7

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 3

Gravel: 94

Sm Cobble: 0

Lg Cobble: 0

Boulder: 0

Bedrock: 3

Embeddedness Values (%): 1. 61.3

2. 32.3

3. 0.0

4. 0.0

5. 6.5

STREAM REACH: 2

Channel Type: E4

Reach Length (ft.): 2197

Riffle/Flatwater Mean Width (ft.): 2.9

BFW:

Range (ft.): 7 to 10

Mean (ft.): 8

Std. Dev.: 1

Base Flow (cfs.): 0.0

Water (F): 53 - 54

Air (F): 39 - 55

Dry Channel (ft): 1532

Canopy Density (%): 96.3

Coniferous Component (%): 89.1

Hardwood Component (%): 10.9

Dominant Bank Vegetation: Coniferous Trees

Vegetative Cover (%): 99.9

Dominant Shelter: Small Woody Debris

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 4

LWD per 100 ft.:

Riffles: 0

Pools: 6

Flat: 2

Pools by Stream Length (%): 17.0

Pool Frequency (%): 30.9

Residual Pool Depth (%):

< 2 Feet Deep: 76

2 to 2.9 Feet Deep: 18

3 to 3.9 Feet Deep: 0

>= 4 Feet Deep: 6

Mean Max Residual Pool Depth (ft.): 1.7

Mean Pool Shelter Rating: 5

Pool Tail Substrate (%): Silt/Clay: 0

Sand: 0

Gravel: 94

Sm Cobble: 6

Lg Cobble: 0

Boulder: 0

Bedrock: 0

Embeddedness Values (%): 1. 58.8

2. 35.3

3. 0.0

4. 0.0

5. 5.9

## Summary of Fish Habitat Elements By Stream Reach

### STREAM REACH: 3

Channel Type: B4	Canopy Density (%): 98.5	Pools by Stream Length (%): 10.6
Reach Length (ft.): 1093	Coniferous Component (%): 83.9	Pool Frequency (%): 31.0
Riffle/Flatwater Mean Width (ft.): 2.3	Hardwood Component (%): 16.1	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 44
Range (ft.): 6 to 14	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep: 33
Mean (ft.): 9	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 11
Std. Dev.: 4	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 11
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 4	Mean Max Residual Pool Depth (ft.): 2.3
Water (F): 48 - 54 Air (F): 44 - 44	LWD per 100 ft.:	Mean Pool Shelter Rating: 8
Dry Channel (ft): 884	Riffles: 0	
	Pools: 8	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 33 Sand: 0 Gravel: 56 Sm Cobble: 11 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 44.4 2. 11.1 3. 0.0 4. 22.2 5. 22.2		

### STREAM REACH: 4

Channel Type: A4	Canopy Density (%): 98.2	Pools by Stream Length (%): 4.0
Reach Length (ft.): 499	Coniferous Component (%): 77.0	Pool Frequency (%): 22.2
Riffle/Flatwater Mean Width (ft.): 2.7	Hardwood Component (%): 23.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 50
Range (ft.): 6 to 8	Vegetative Cover (%): 99.5	2 to 2.9 Feet Deep: 50
Mean (ft.): 7	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 0	Mean Max Residual Pool Depth (ft.): 2.0
Water (F): 53 - 54 Air (F): 44 - 46	LWD per 100 ft.:	Mean Pool Shelter Rating: 3
Dry Channel (ft): 427	Riffles: 5	
	Pools: 5	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 100 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: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

Longitude: 123:38:47.0W

**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	2	1.9
Boulder	0	0	0.0
Cobble / Gravel	3	3	3.8
Sand / Silt / Clay	75	74	94.3

**Mean Percentage of Dominant Stream Bank Vegetation**

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	4	0	2.5
Brush	17	17	21.5
Hardwood Trees	12	11	14.6
Coniferous Trees	45	51	60.8
No Vegetation	1	0	0.6

**Total Stream Cobble Embeddedness Values:**

2

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

StreamName: Railroad Gulch

LLID: 1236463392632

Drainage: Albion River

Survey Dates: 10/25/2011 to 10/26/2011

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS09

Latitude: 39:15:48.0N

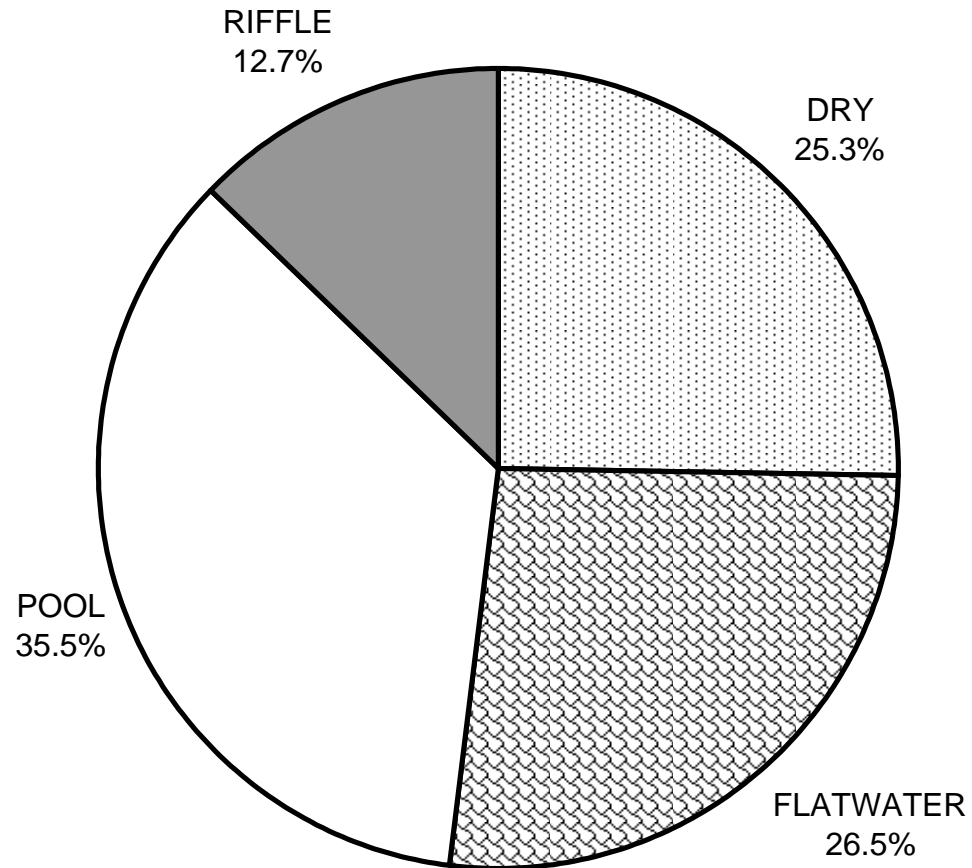
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	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	47
SMALL WOODY DEBRIS (%)	0	0	29
LARGE WOODY DEBRIS (%)	0	0	18
ROOT MASS (%)	0	0	6
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	0
BEDROCK LEDGES (%)	0	0	1

# RAILROAD GULCH 2011

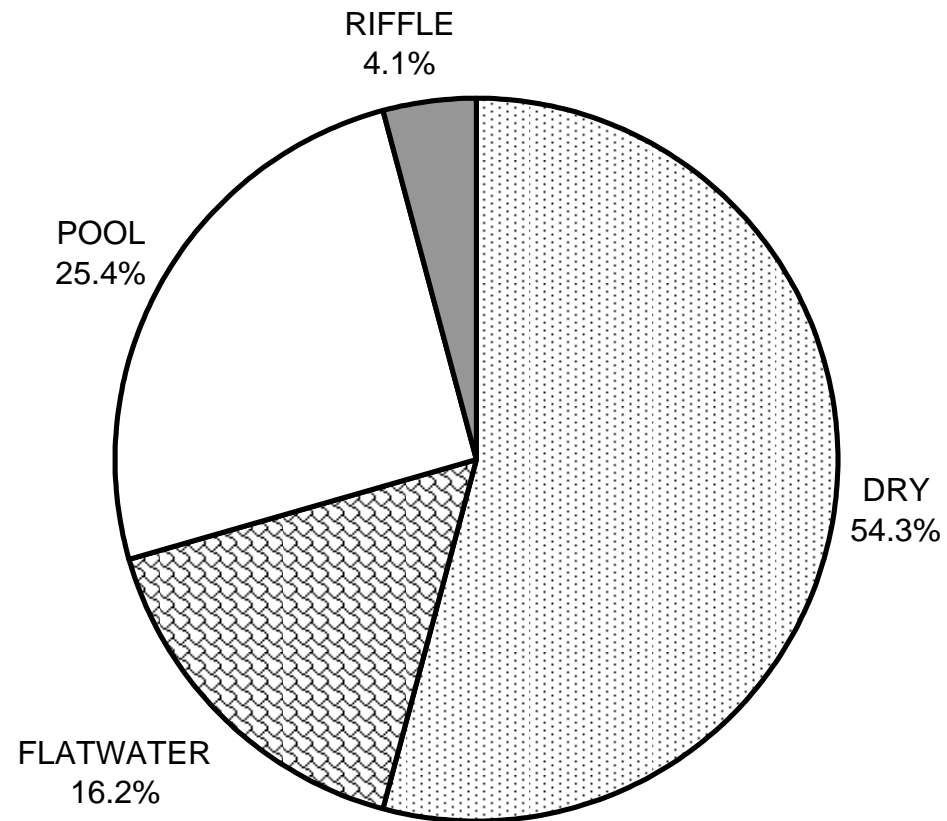
## HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

# RAILROAD GULCH 2011

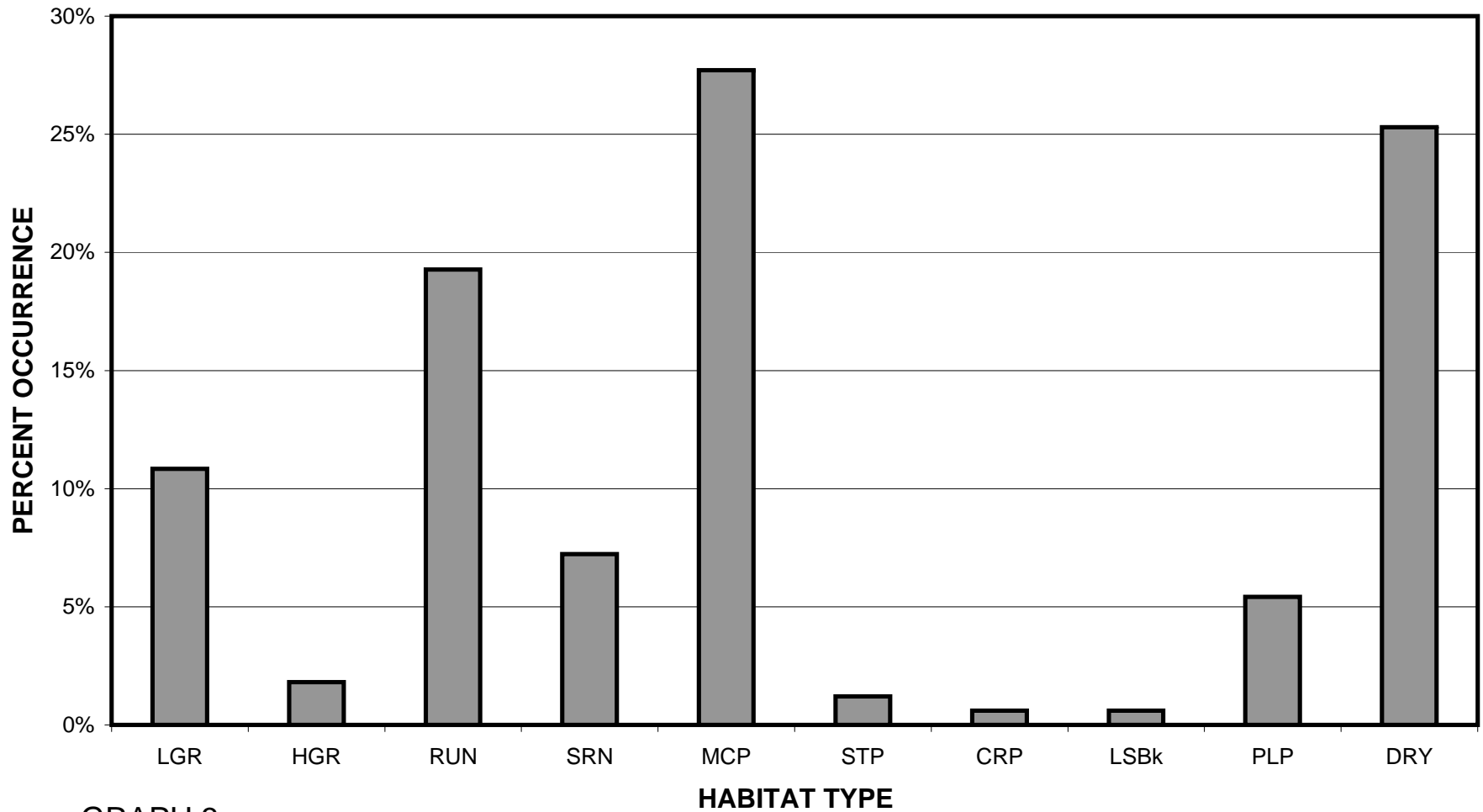
## HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

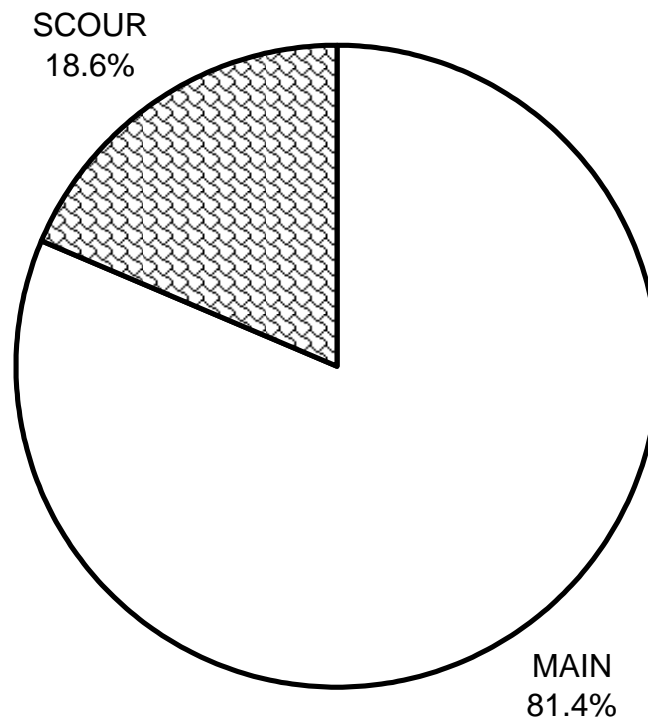
# RAILROAD GULCH 2011

## HABITAT TYPES BY PERCENT OCCURRENCE



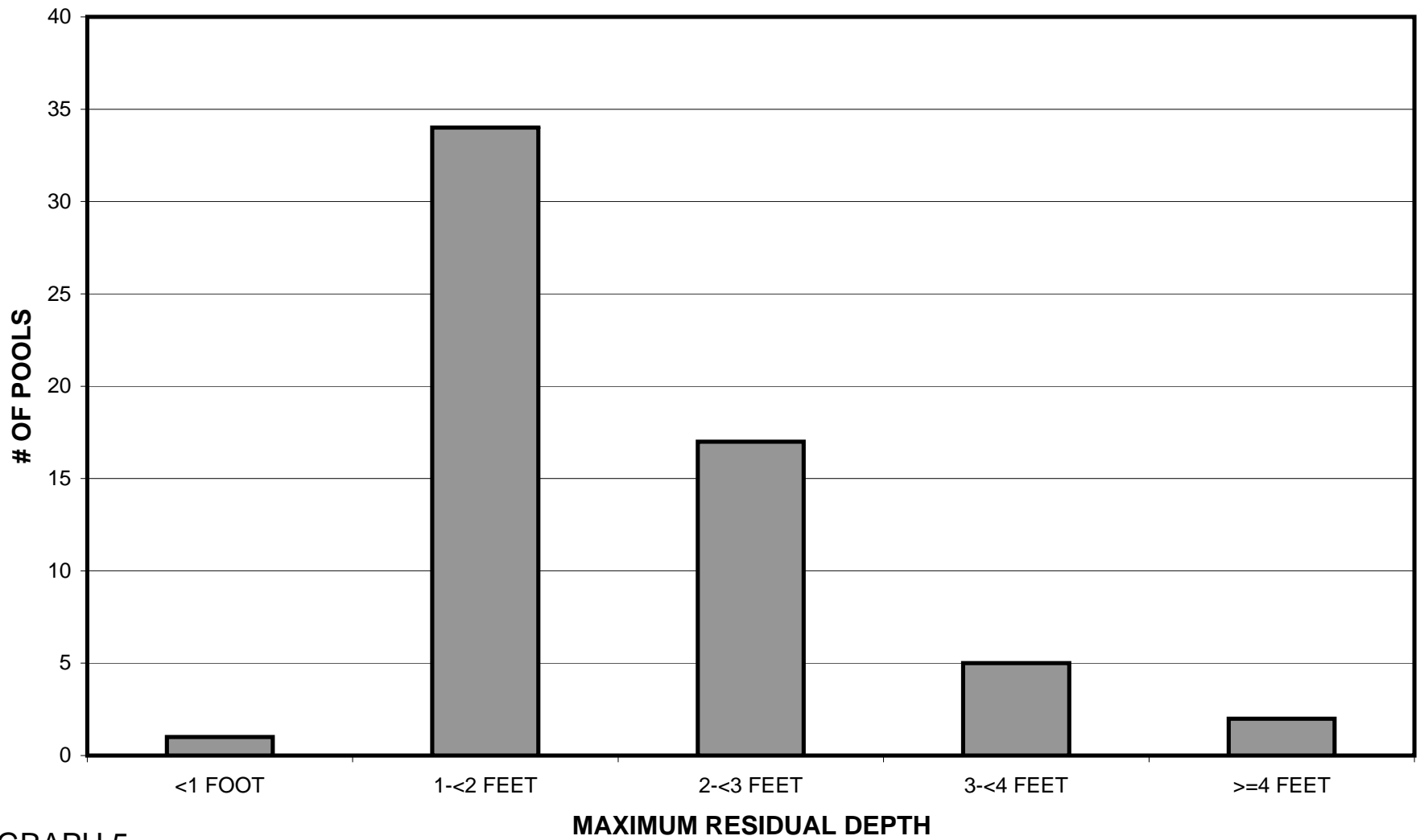
GRAPH 3

**RAILROAD GULCH 2011  
POOL TYPES BY PERCENT OCCURRENCE**



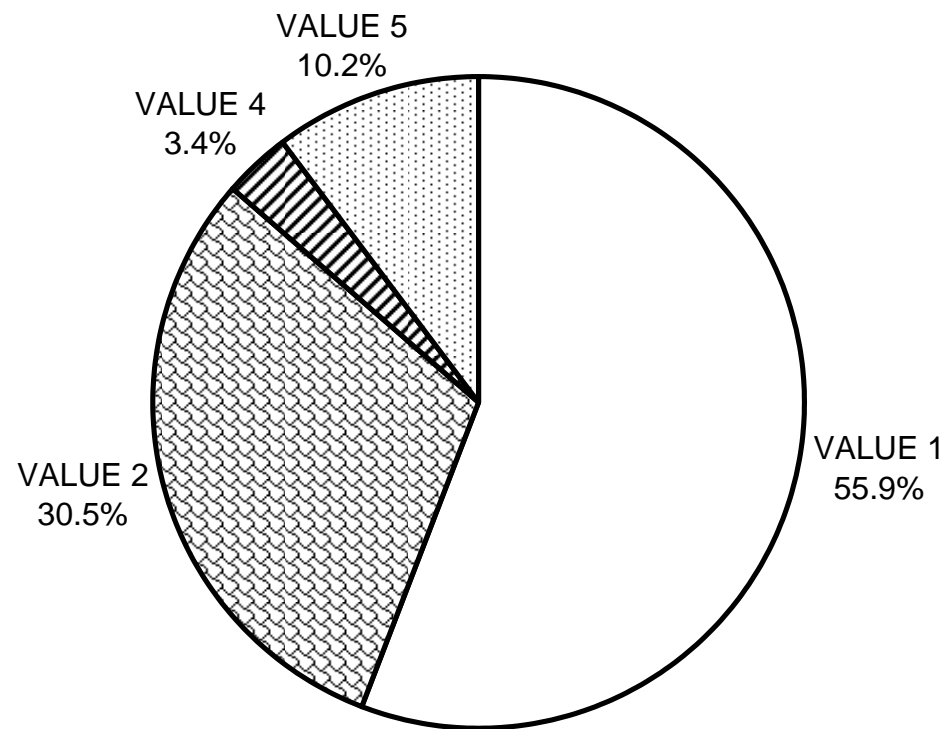
GRAPH 4

# RAILROAD GULCH 2011 MAXIMUM DEPTH IN POOLS



GRAPH 5

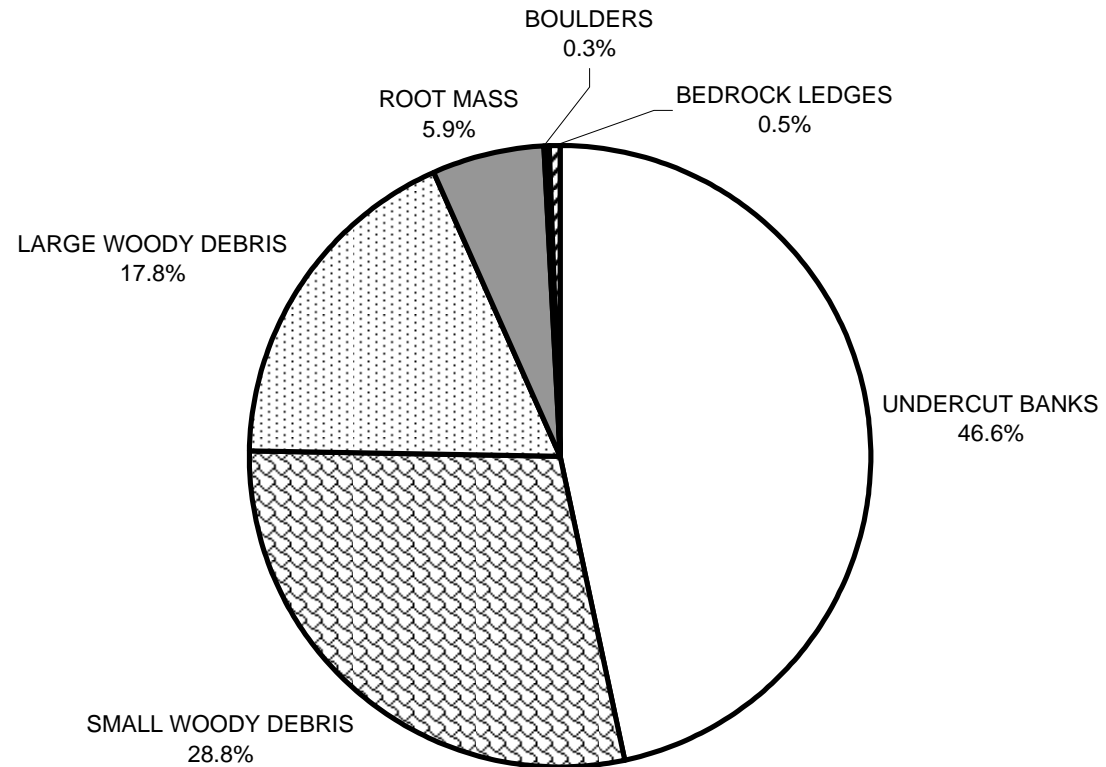
# RAILROAD GULCH 2011 PERCENT EMBEDDEDNESS



GRAPH 6

# RAILROAD GULCH 2011

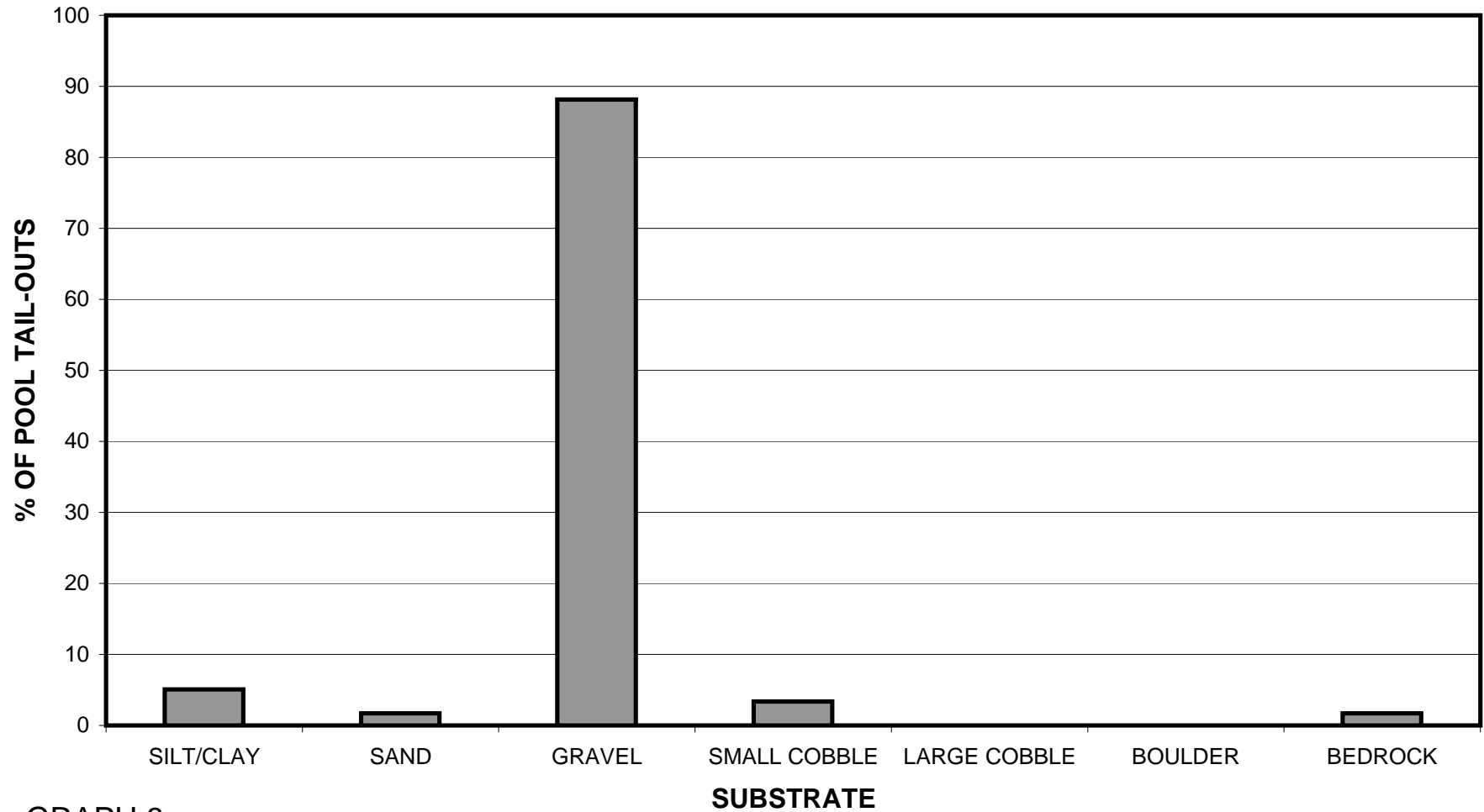
## MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

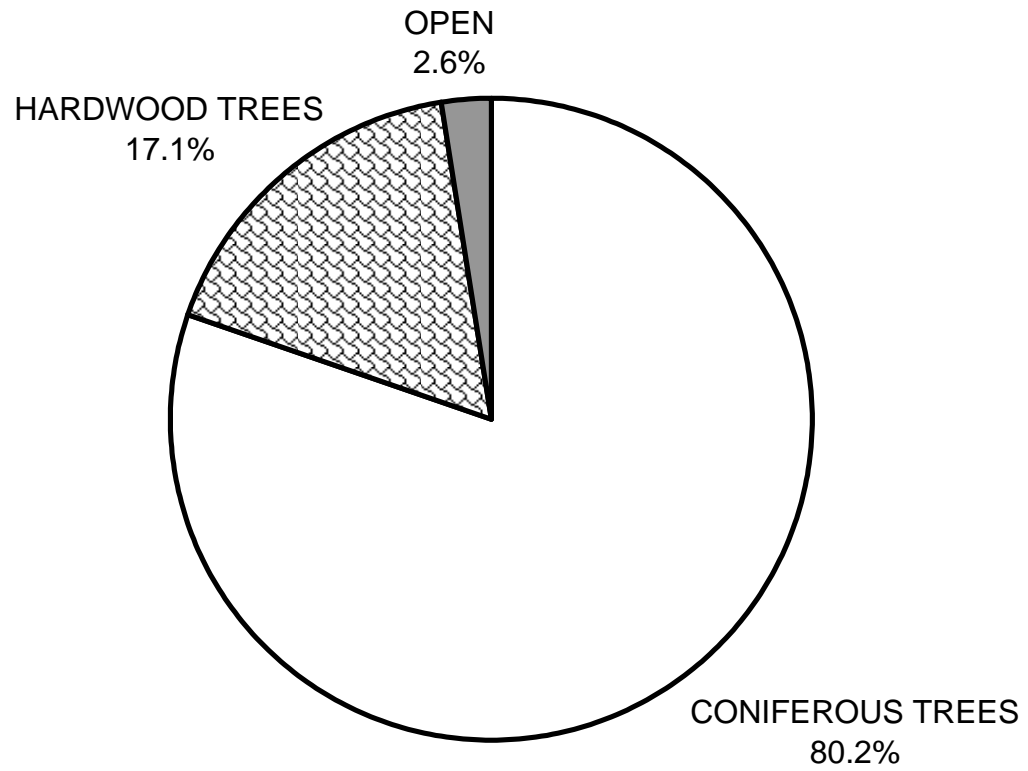
# RAILROAD GULCH 2011

## SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

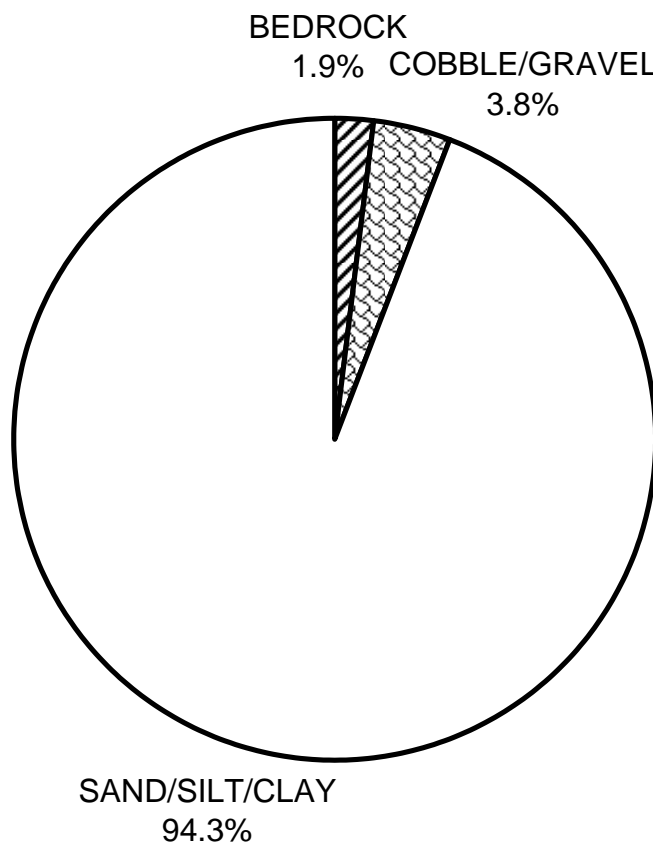
# RAILROAD GULCH 2011 MEAN PERCENT CANOPY



GRAPH 9

# RAILROAD GULCH 2011

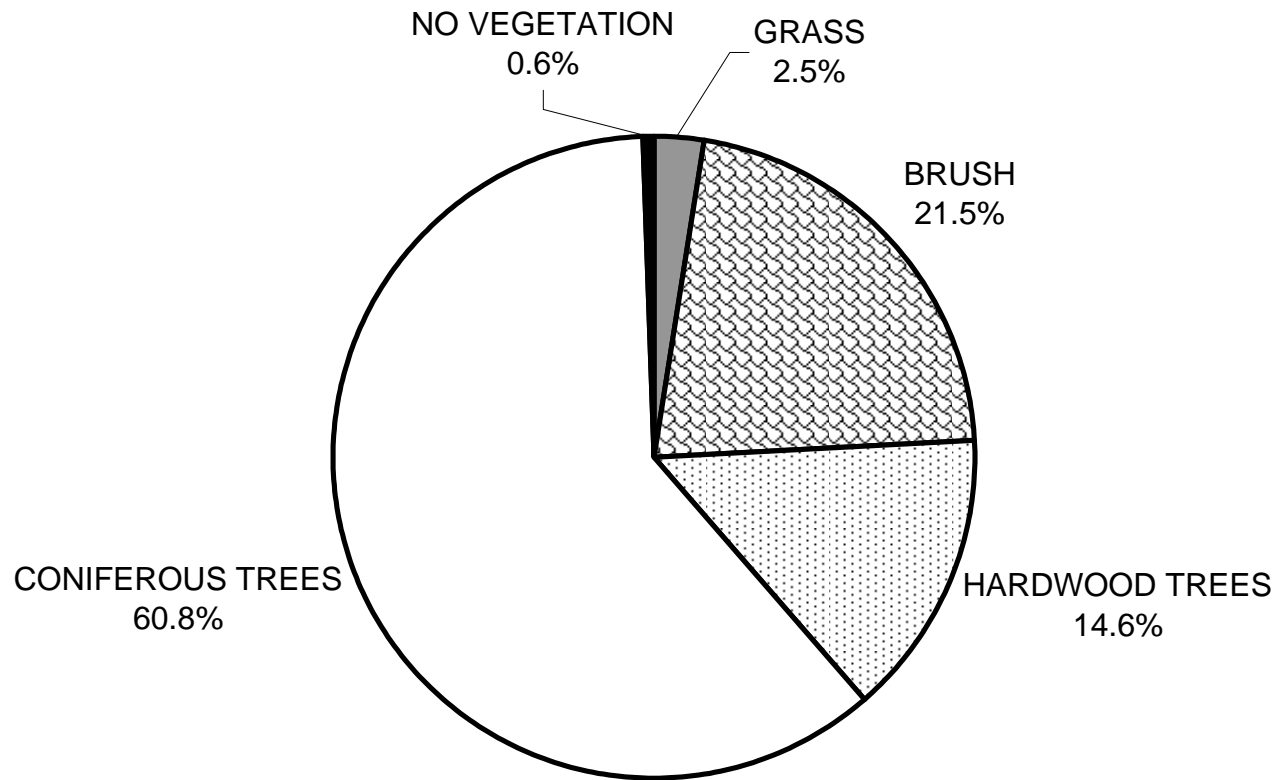
## DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

# RAILROAD GULCH 2011

## DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

**Map 1**  
**"East" Railroad Gulch**  
**Albion River Watershed**  
**Mathison Peak Quad, Mendocino County**

Start of Survey

End of Survey

**Legend**

- Reach 1, G4 Channel Type
- Reach 2, E4 Channel Type
- Reach 3, B4 Channel Type
- Reach 4, A4 Channel Type

0 970 1,940 Feet

