



CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Railroad Gulch

INTRODUCTION

A stream inventory was conducted from July 21 to July 28, 2015 on Railroad Gulch. The survey began at the confluence with the Albion River and extended upstream 2.7 miles. A stream inventory and report was also completed for one tributary to Railroad Gulch.

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 Chinook salmon, 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 R17W S23. Its location is 39.2404 degrees north latitude and 123.7200 degrees west longitude, LLID number 1237188392406. Railroad Gulch is a second order stream and has approximately 1.7 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Railroad Gulch drains a watershed of approximately 4.4 square miles. Elevations range from about 10 feet at the mouth of the creek to 400 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 a private logging road off of Airport Road, south of Fort Bragg.

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 Watershed Stewards Project (WSP) members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Wildlife (CDFW). The 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 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 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 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 unsuitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

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6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is 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. The shelter rating is then calculated by multiplying the qualitative shelter value by the percent of the unit covered. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

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

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In 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 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

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(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 fifteen 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 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

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

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HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of July 21 to July 28, 2015 was conducted by J. Murphrey, T. Brown, and J. Lee (WSP). The total length of the stream surveyed was 14,037 feet.

Stream flow was not measured on Railroad Gulch.

Railroad Gulch is an E5 channel type for 10,161 feet of the stream surveyed (Reach 1) and a B4 channel type for 3,876 feet of the stream surveyed (Reach 2). E5 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 sand-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.

Water temperatures taken during the survey period ranged from 57 to 70 degrees Fahrenheit. Air temperatures ranged from 60 to 78 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% flatwater units, 34% riffle units, 28% pool units, and 3% dry units (Graph 1). Based on total length of Level II habitat types there were 54% flatwater units, 21% riffle units, 19% pool units, 4% unsurveyed marsh units, and 2% dry units (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 33%; mid-channel pool units, 28%; and step run units 21% (Graph 3). Based on percent total length, step run units made up 37%, low gradient riffle units 21%, and mid-channel pool units 19%.

A total of 101 pools were identified (Table 3). All of the pools encountered were main channel pools.

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-six of the 101 pools (26%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 101 pool tail-outs measured, 13 had a value of 2 (12.9%); 42 had a value of 3 (41.6%); 14 had a value of 4 (13.9%); 32 had a value of 5 (31.7%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. Additionally, a value of 5 was assigned to tail-outs deemed unsuitable 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 13, and pool habitats had a mean shelter rating of 22 (Table 1).

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Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Railroad Gulch. Graph 7 describes the pool cover in Railroad 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 80% of the pool tail-outs. Sand was the next most frequently observed dominant substrate type and occurred in 12% 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 35% and 65%, respectively. Graph 9 describes the mean percent canopy in Railroad 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 92% sand/silt/clay and 8% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 34% of the units surveyed. Additionally, 30% of the units surveyed had hardwood trees as the dominant vegetation type, and 22% had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 15 sites for species composition and distribution in Railroad Gulch on September 2, 2015 (Table A). The sites were sampled by D. Lam and B. Starks (CDFW).

In Reach 1, which comprised the first 10,161 feet of stream, nine sites were sampled. The reach sites yielded four age 1+ steelhead trout (SH), 48 young-of-the-year (YOY) coho salmon, two age 1+ salmon, two juvenile Chinook salmon, two sculpin, and one California/coastal giant salamander.

In Reach 2, six sites were sampled starting approximately 10,234 feet from the confluence with the Albion River and continuing upstream 2,441 feet. The reach sites yielded five YOY SH and five YOY coho salmon.

During this survey, the upper-most observation of juvenile coho salmon occurred at 39.2205 degrees north latitude, 123.6999 degrees west longitude, approximately 2.1 miles above the confluence with the Albion River.

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Table A. Summary of results for a fish composition and distribution survey within Railroad Gulch, 2015.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	Steelhead Trout			Coho Salmon		Additional Aquatic Species Observed
					YOY	1+	2+	YOY	1+	
Reach 1: E5 Channel Type										
09/02/15	1	013	Pool	1,710	0	1	0	1	0	
09/02/15	2	023	Pool	2,198	0	1	0	2	0	CHIN
09/02/15	3	028	Pool	2,498	0	1	0	4	0	SCP
09/02/15	4	031	Pool	2,587	0	0	0	1	0	
09/02/15	5	089	Run	5,493	0	0	0	4	0	
09/02/15	6	113	Pool	6,391	0	0	0	5	1	
09/02/15	7	134	Pool	7,127	0	1	0	15	0	
09/02/15	8	159	Run	7,873	0	0	0	10	1	
09/02/15	9	200	Pool	9,380	0	0	0	6	0	CGS
Reach 2: B4 Channel Type										
09/02/15	10	226	Pool	10,253	0	0	0	4	0	
09/02/15	11	270	Pool	11,487	0	0	0	1	0	
09/02/15	12	298	Pool	12,219	0	0	0	0	0	
09/02/15	13	307	Run	12,522	1	0	0	0	0	
09/02/15	14	310	Pool	12,613	2	0	0	0	0	
09/02/15	15	313	Pool	12,675	2	0	0	0	0	

Species Abbreviations: CGS=Coastal/California Giant Salamander; CHIN=Chinook Salmon; SCP=Sculpin (Unidentified Species)

DISCUSSION

Railroad Gulch is an E5 channel type for the first 10,161 feet of stream surveyed and a B4 channel type for the remaining 3,876 feet. The suitability of E5 and B4 channel types for fish habitat improvement structures is as follows: E5 channels are good for bank-placed boulders and fair for opposing wing-deflectors. B4 channels are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 21 to July 28, 2015 ranged from 57 to 70 degrees Fahrenheit. Air temperatures ranged from 60 to 78 degrees Fahrenheit. This is a suitable water temperature for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 54% of the total length of this survey, riffles 21%, and pools 19%. Twenty-six of the 101 (26%) pools had a maximum residual depth greater than two feet.

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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 structures that will increase or deepen pool habitat is recommended.

Thirteen of the 101 pool tail-outs measured had embeddedness ratings of 1 or 2. Fifty-six of the pool tail-outs had embeddedness ratings of 3 or 4. Thirty-two 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 Railroad Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Eighty-three of the 101 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 22. The shelter rating in the flatwater habitats is 13. 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 Railroad 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% and Reach 2 had a canopy density of 97%. The percentage of right and left bank covered with vegetation was 98% and 98%, respectively.

RECOMMENDATIONS

Railroad Gulch should be managed as an anadromous, natural production stream. Recommendations for potential habitat improvement activities are based on target habitat values suitable for salmonids in California's north coast streams. Considering the results from this stream habitat inventory, factors that affect salmonid productivity and CDFW's professional judgment, the following list prioritizes habitat improvement activities in Railroad Gulch. Keep in mind, watershed and stream ecosystem processes, land use alterations, changes in land ownership, and other factors could potentially change the order of these recommendations or create the need to remove/add recommendations in the future.

- 1) 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.
- 2) 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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- 3) The limited water temperature data available suggest that maximum temperatures are above 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 three to five years.

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 an E5.
656	0004.00	620 foot long unsurveyed marsh.
2461	0028.00	Log debris accumulation (LDA) #01 contains three pieces of large woody debris (LWD) and measures approximately 5' high x 25' wide x 3' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures approximately 25' wide x 10' long x 4' deep. There is a 2' high plunge over the LDA. Fish were observed above it.
6091	0105.00	LDA #02 contains 12 pieces of LWD and measures approximately 5' high x 45' wide x 18' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures approximately 40' wide x 30' long x 4' deep. There is a 3' high plunge over the LDA. Fish were observed above it.
6910	0130.00	LDA #03 contains seven pieces of LWD and measures approximately 6' high x 40' wide x 15' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to small cobble and measures approximately 35' wide x 50' long x 3' deep. Fish were observed above the LDA.
7151	0136.00	Tributary #01 enters on the left bank. It contributes approximately 15% to Railroad Gulch's flow. The water temperature of the tributary was 57 degrees Fahrenheit; the water temperature downstream and upstream of the confluence was 58 degrees Fahrenheit. The slope of the tributary is 1-2%.
9217	0197.00	Tributary #02 enters on the left bank. It contributes approximately 10% to Railroad Gulch's flow. The water temperature of the tributary was 58 degrees Fahrenheit, the water temperature downstream of the confluence

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was 60 degrees Fahrenheit, and the water temperature upstream of the confluence was 59 degrees Fahrenheit.

10150	0220.00	Tributary #03 enters on the right bank. It contributes approximately 25% to Railroad Gulch's flow. The water temperature of the tributary was 57 degrees Fahrenheit, the water temperature downstream of the confluence was 58 degrees Fahrenheit, and the water temperature upstream of the confluence was 57 degrees Fahrenheit. The slope over the first 300 feet of the tributary is 1-3%, and then increases to 20-30%.
10161	0221.00	The channel changes from an E5 to a B4.
11521	0272.00	Dry left bank tributary.
12070	0293.00	There is a 1.5' high plunge over woody debris.
12196	0298.00	LDA #04 contains five pieces of LWD and measures approximately 3.5' high x 16' wide x 5' long. Water does not flow through the LDA; the channel is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures approximately 16' wide x 30' long x 2' deep. There is a 2' high plunge over the LDA. Fish were observed above it.
13326	0338.00	LDA #05 contains seven pieces of LWD and measures approximately 7' high x 16' wide x 6' long. Water does not flow through the LDA; the channel is dry above it. There are visible gaps in the LDA. Retained sediment ranges from silt to large cobble and measures approximately 17' wide x 20' long x 3' deep. There is a 3' high plunge over the LDA. Fish were not observed above it.
13534	0345.00	LDA #06 contains six pieces of LWD and measures approximately 6' high x 14' wide x 8' long. Water does not flow through the LDA; the channel is dry above it. There are visible gaps in the LDA. Retained sediment ranges from silt to small cobble and measures approximately 20' wide x 40' long x 3' deep.
13922	0361.00	There is a 1' high plunge.
14021	0366.00	End of survey; stream splits in two. Both channels have little water and little available habitat. 400 feet upstream from the confluence the slope of the right bank channel increases to 25-30%. 1,500 upstream from the confluence the slope of the left bank channel increases to 40%. Both channels are overgrown with vegetation and only 2-3 feet wide. No fish were observed above LDA #05 and HU# 338.

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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]	

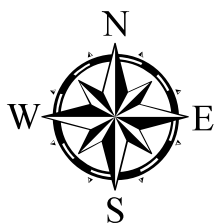
Map 1
Railroad Gulch
Albion River Watershed
Elk Quad, Mendocino County



Albion River Watershed

Start of Survey

End of Survey

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-  Reach 1: E5 Channel Type
-  Reach 2: B4 Channel Type

0 0.15 0.3 0.6
Miles



Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0

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
10	0	DRY	2.7	25	253	1.8									
130	18	FLATWATER	35.5	58	7570	53.9	5.4	0.5	0.9	287	37338	164	21382		13
1	0	NOSURVEY_	0.3	620	620	4.4									
101	101	POOL	27.6	26	2633	18.8	9.1	0.6	1.6	248	25066	219	22163	170	22
124	13	RIFFLE	33.9	24	2961	21.1	4.0	0.2	0.4	76	9439	16	1983		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
366	132				14037					71843			45527		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

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 (%)
121	10	LGR	33.1	24	2917	20.8	4	0.2	0.5	89	10743	18	2181		0	98
2	2	HGR	0.5	16	31	0.2	2	0.2	0.3	31	63	6	12		0	99
1	1	BRS	0.3	13	13	0.1	3	0.4	1.1	39	39	16	16		0	100
55	6	RUN	15.0	43	2366	16.9	6	0.5	2	255	14007	159	8721		11	95
75	12	SRN	20.5	69	5204	37.1	5	0.4	1.9	303	22762	167	12557		15	95
101	101	MCP	27.6	26	2633	18.8	9	0.6	3.8	248	25066	219	22163	170	22	97
10	0	DRY	2.7	25	253	1.8										100
1	0	MAR	0.3	620	620	4.4										

Total Units
366

Total Units Fully Measured
132

Total Length (ft.)
14037

Total Area (sq.ft.)
72679

Total Volume (cu.ft.)
45650

Table 3 - Summary of Pool Types

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

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
101	101	MAIN	100	26	2633	100	9.1	0.6	248	25066	170	17008	22

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
101	101	2633	25066	17008

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

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

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
101	MCP	100	14	14	61	60	22	22	4	4	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
101	14	14	61	60	22	22	4	4	0	0

Mean Maximum Residual Pool Depth (ft.): 1.6

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Dry Units: 10

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

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
121	10	LGR	0	0	0	0	0	0	0	0	0
2	2	HGR	0	0	0	0	0	0	0	0	0
1	1	BRS	0	0	0	0	0	0	0	0	0
124	13	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
55	6	RUN	37	9	8	0	46	0	0	0	0
75	12	SRN	16	27	16	0	33	4	0	3	0
130	18	TOTAL FLAT	24	20	13	0	38	3	0	2	0
101	101	MCP	12	30	31	2	19	1	1	2	0
101	101	TOTAL POOL	12	30	31	2	19	1	1	2	0
1	0	MAR									
366	132	TOTAL	14	29	29	2	22	2	1	2	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Dry Units: 10

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

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
121	10	LGR	0	0	70	20	10	0	0
2	2	HGR	0	0	50	0	0	0	50
1	1	BRS	0	0	0	0	0	0	100
55	6	RUN	0	33	67	0	0	0	0
75	12	SRN	0	33	58	8	0	0	0
101	101	MCP	10	39	49	2	0	1	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	65	35	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.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Survey Length (ft.): 14037

Main Channel (ft.): 14037

Side Channel (ft.): 0

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: E5

Reach Length (ft.): 10161

Riffle/Flatwater Mean Width (ft.): 5.6

BFW:

Range (ft.): 11 to 27

Mean (ft.): 16

Std. Dev.: 3

Base Flow (cfs.): 0.0

Water (F): 57 - 70

Air (F): 60 - 72

Dry Channel (ft): 0

Canopy Density (%): 97.2

Coniferous Component (%): 54.2

Hardwood Component (%): 45.8

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 98.4

Dominant Shelter: Small Woody Debris

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 24

LWD per 100 ft.:

Riffles: 3

Pools: 8

Flat: 2

Pools by Stream Length (%): 19.9

Pool Frequency (%): 30.0

Residual Pool Depth (%):

< 2 Feet Deep: 70

2 to 2.9 Feet Deep: 27

3 to 3.9 Feet Deep: 3

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.7

Mean Pool Shelter Rating: 21

Pool Tail Substrate (%): Silt/Clay: 9

Sand: 15

Gravel: 76

Sm Cobble: 0

Lg Cobble: 0

Boulder: 0

Bedrock: 0

Embeddedness Values (%): 1. 0.0

2. 4.5

3. 39.4

4. 12.1

5. 43.9

STREAM REACH: 2

Channel Type: B4

Reach Length (ft.): 3876

Riffle/Flatwater Mean Width (ft.): 3.3

BFW:

Range (ft.): 6 to 17

Mean (ft.): 10

Std. Dev.: 4

Base Flow (cfs.): 0.0

Water (F): 57 - 59

Air (F): 61 - 78

Dry Channel (ft): 253

Canopy Density (%): 97.3

Coniferous Component (%): 81.4

Hardwood Component (%): 18.6

Dominant Bank Vegetation: Coniferous Trees

Vegetative Cover (%): 97.8

Dominant Shelter: Large Woody Debris

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 29

LWD per 100 ft.:

Riffles: 5

Pools: 14

Flat: 7

Pools by Stream Length (%): 15.7

Pool Frequency (%): 24.0

Residual Pool Depth (%):

< 2 Feet Deep: 83

2 to 2.9 Feet Deep: 11

3 to 3.9 Feet Deep: 6

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.3

Mean Pool Shelter Rating: 23

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

Sand: 6

Gravel: 89

Sm Cobble: 6

Lg Cobble: 0

Boulder: 0

Bedrock: 0

Embeddedness Values (%): 1. 0.0

2. 28.6

3. 45.7

4. 17.1

5. 8.6

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	8	14	8.3
Sand / Silt / Clay	124	118	91.7

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	25	13	14.4
Brush	28	30	22.0
Hardwood Trees	44	35	29.9
Coniferous Trees	35	54	33.7
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 4

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

StreamName: Railroad Gulch

LLID: 1237188392406

Drainage: Albion River

Survey Dates: 7/21/2015 to 7/28/2015

Confluence Location: Quad: ELK

Legal Description: T16NR17WS23

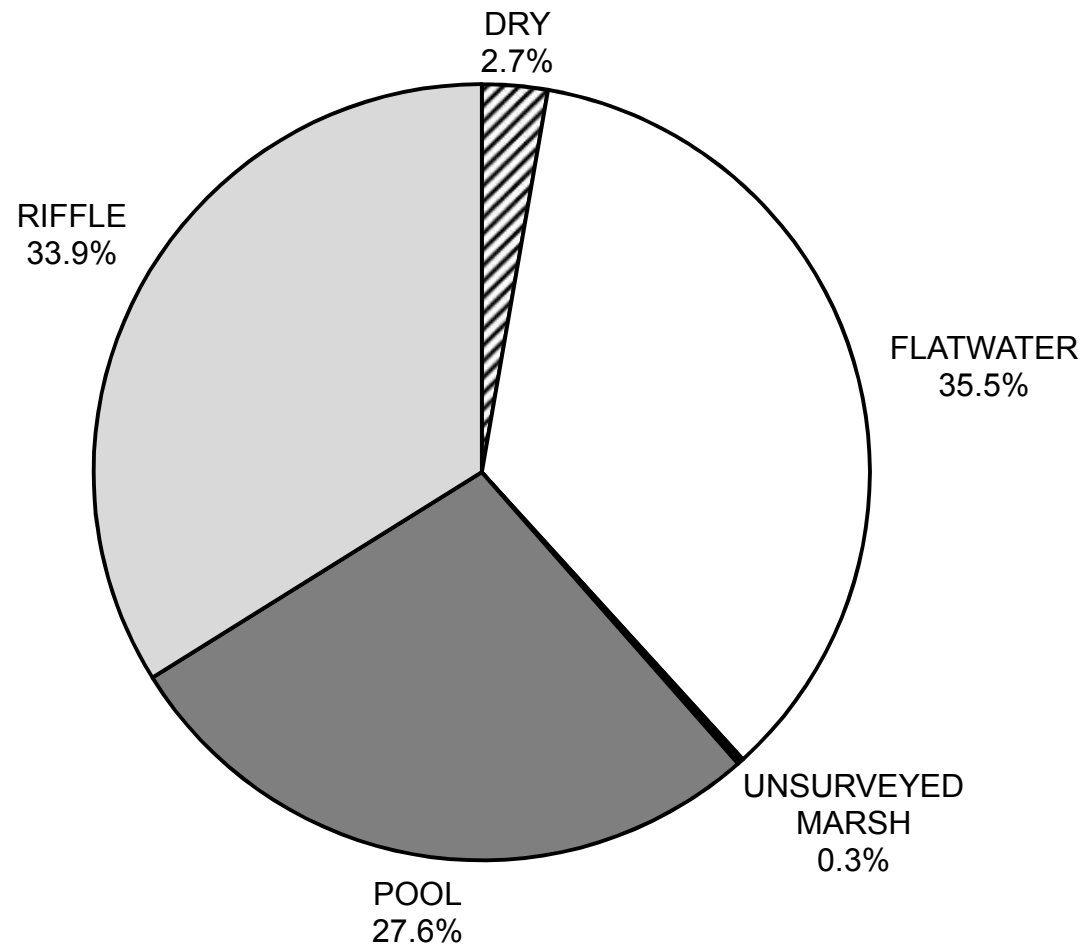
Latitude: 39:14:26.0N

Longitude: 123:43:08.0W

	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	24	12
SMALL WOODY DEBRIS (%)	0	20	30
LARGE WOODY DEBRIS (%)	0	13	31
ROOT MASS (%)	0	0	2
TERRESTRIAL VEGETATION (%)	0	38	19
AQUATIC VEGETATION (%)	0	3	1
WHITEWATER (%)	0	0	1
BOULDERS (%)	0	2	2
BEDROCK LEDGES (%)	0	0	0

RAILROAD GULCH 2015

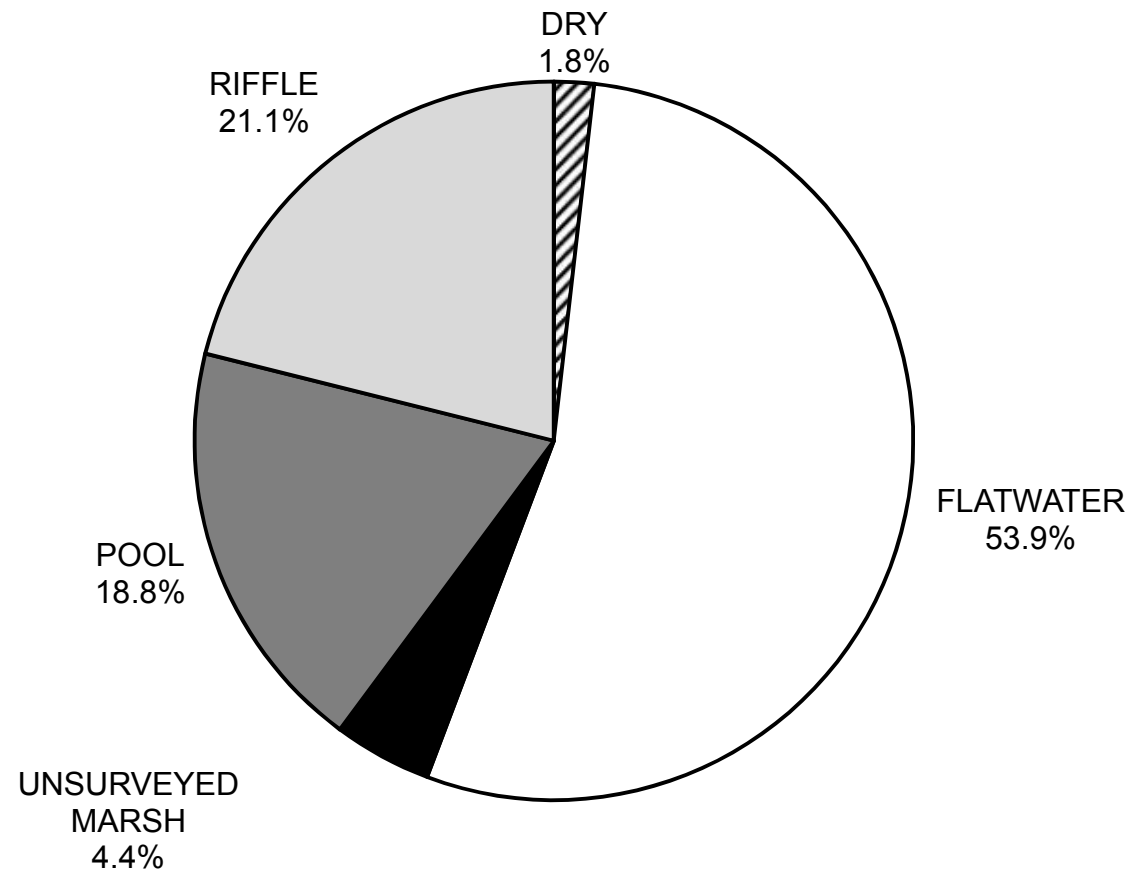
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

RAILROAD GULCH 2015

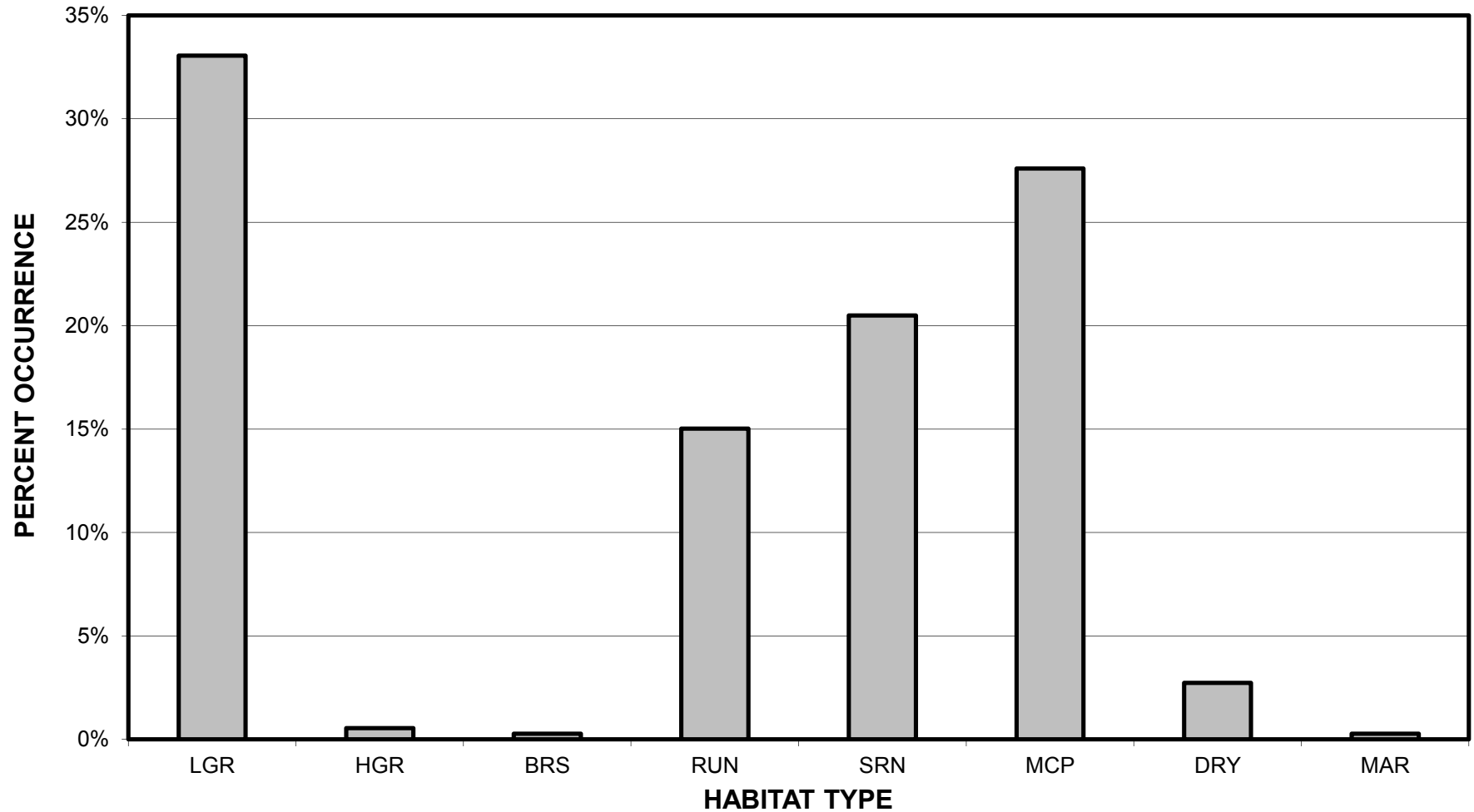
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

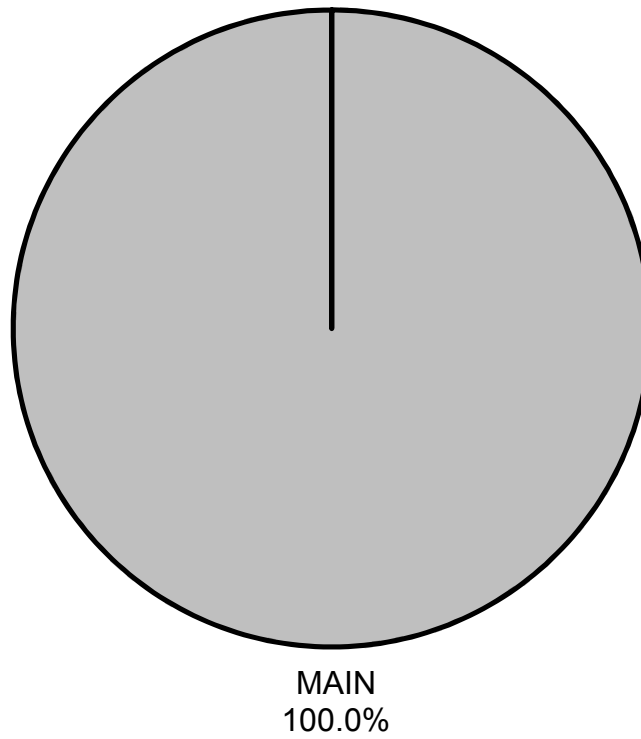
RAILROAD GULCH 2015

HABITAT TYPES BY PERCENT OCCURRENCE



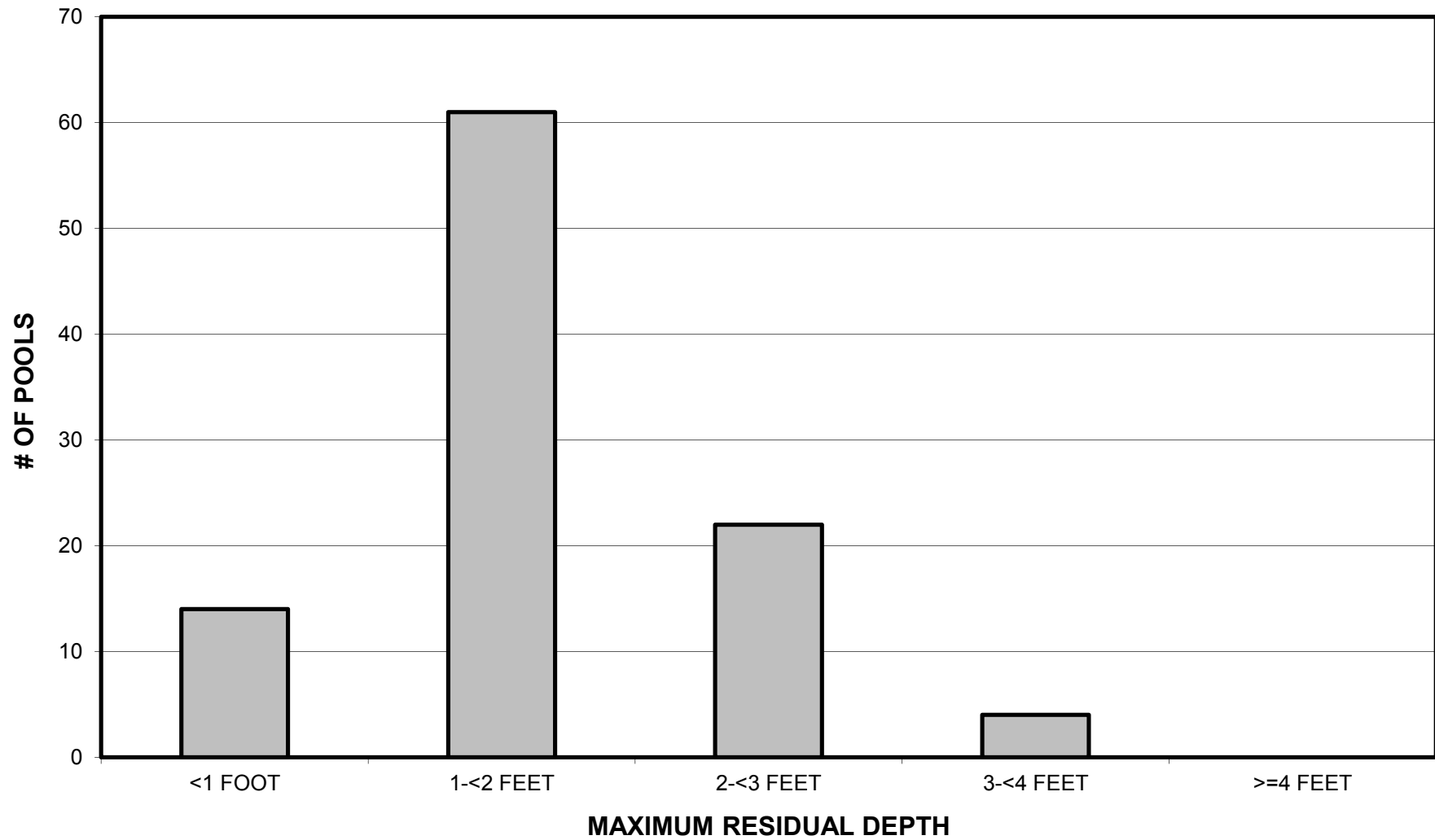
GRAPH 3

RAILROAD GULCH 2015
POOL TYPES BY PERCENT OCCURRENCE



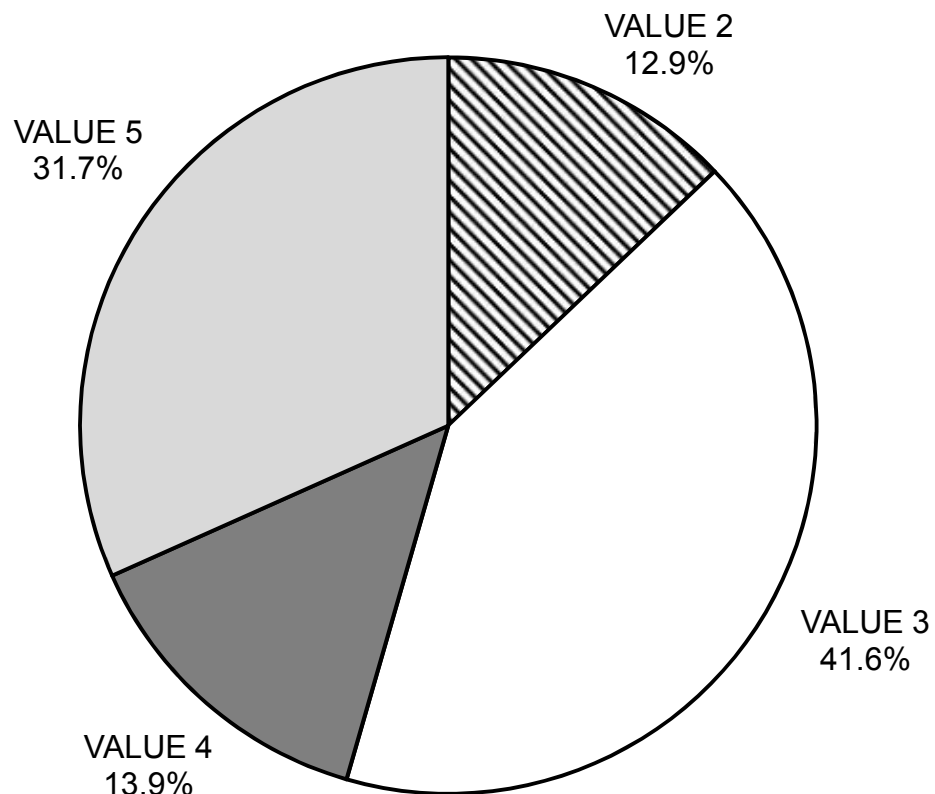
GRAPH 4

RAILROAD GULCH 2015 MAXIMUM DEPTH IN POOLS



GRAPH 5

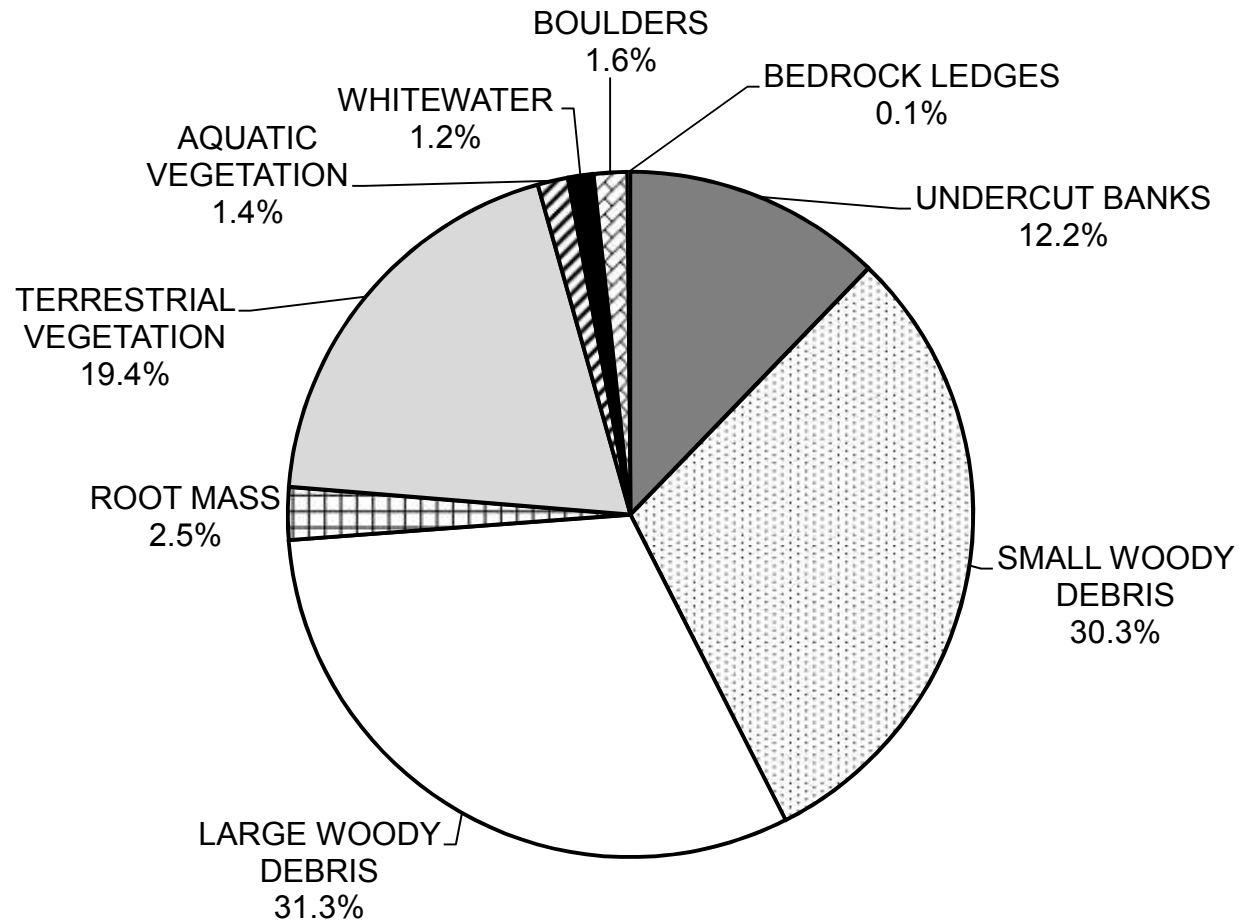
RAILROAD GULCH 2015 PERCENT EMBEDDEDNESS



GRAPH 6

RAILROAD GULCH 2015

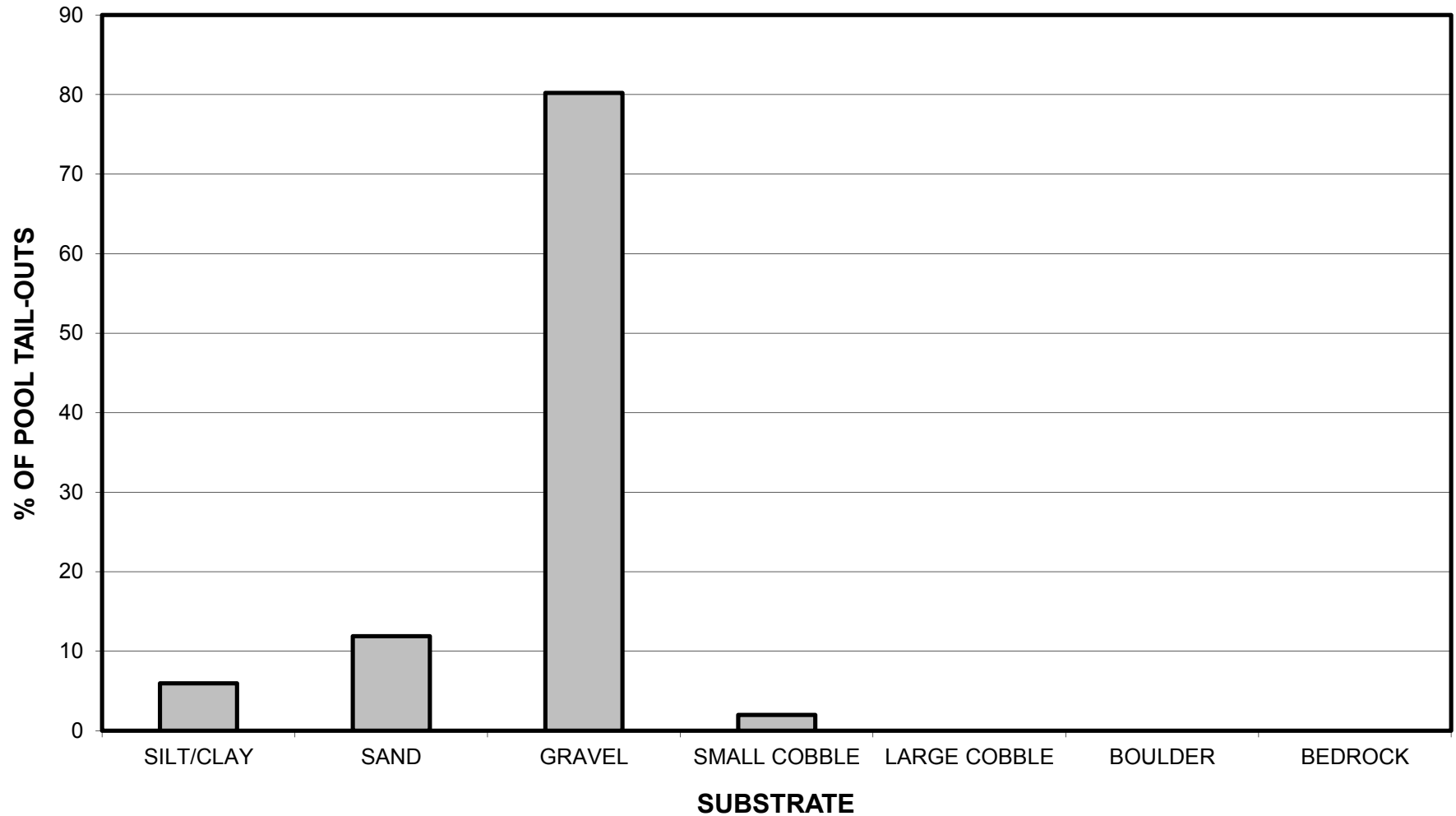
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

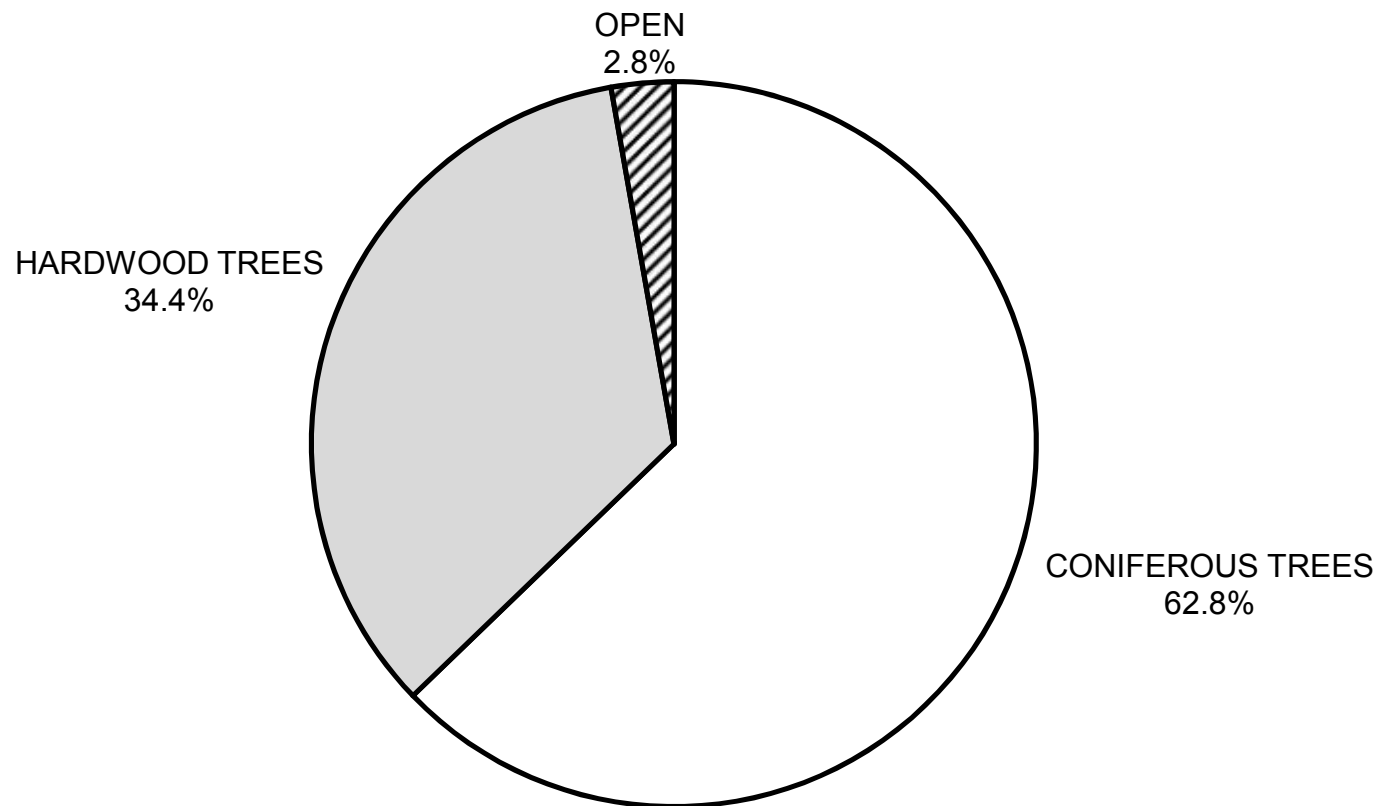
RAILROAD GULCH 2015

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

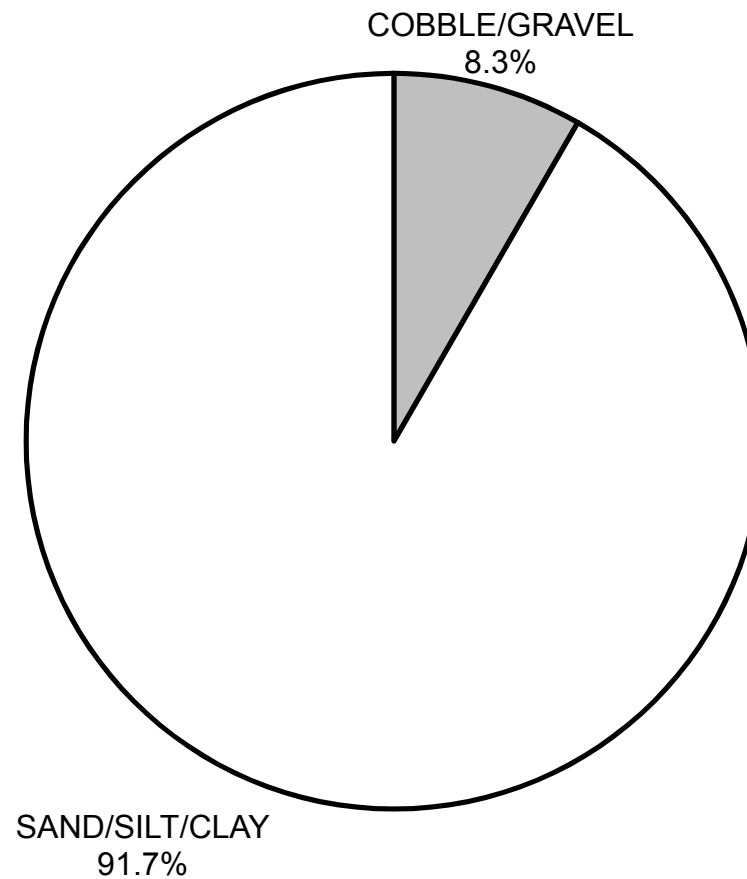


GRAPH 8

RAILROAD GULCH 2015 MEAN PERCENT CANOPY

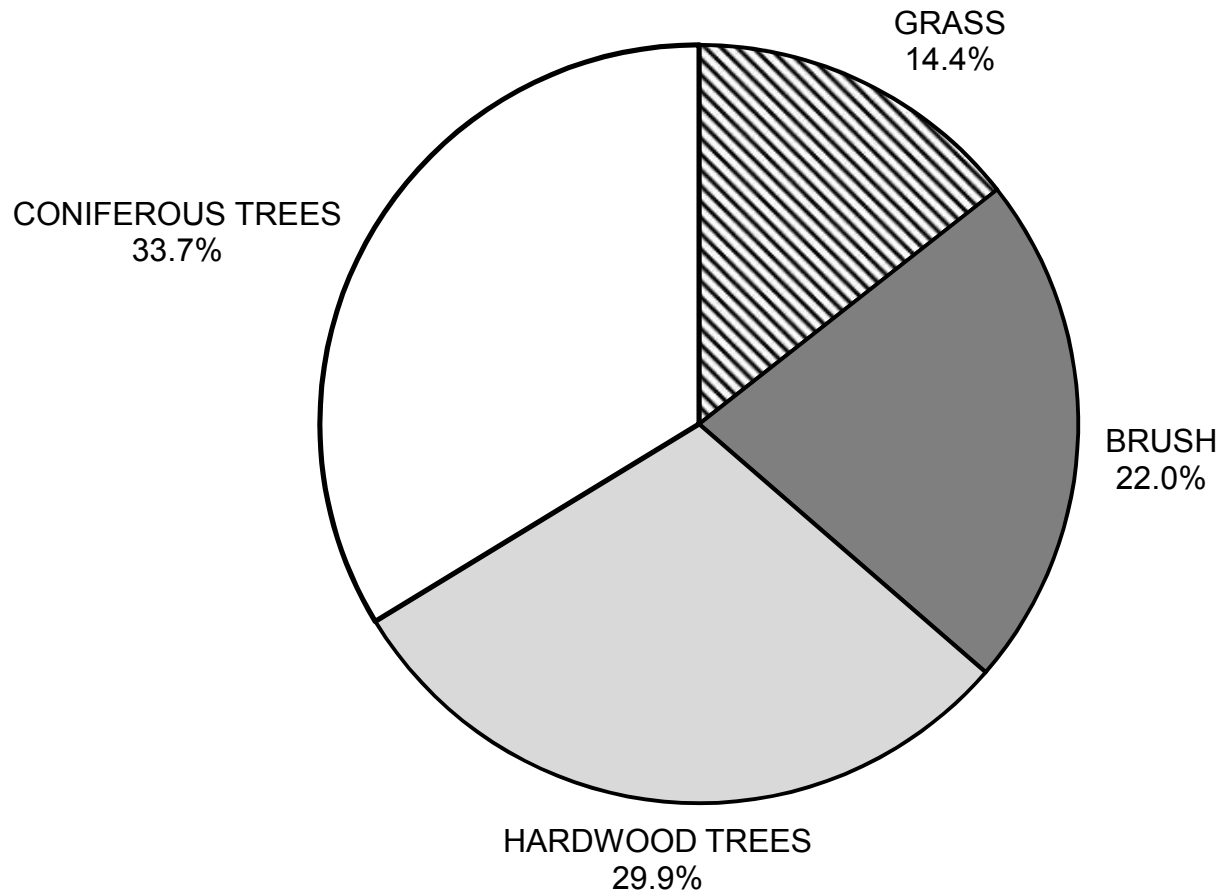


RAILROAD GULCH 2015
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

RAILROAD GULCH 2015
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11