STREAM INVENTORY REPORT

Rail Creek

INTRODUCTION

A stream inventory was conducted during May 6 to May 8, 2008 on Rail Creek. The survey began 349' upstream of the confluence with the Rail Creek reservoir and extended upstream 1.8 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Rail Creek.

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

Rail Creek is a tributary to East Fork Scott River, a tributary to the Scott River, a tributary to Klamath River, which drains to the Pacific Ocean. It is located in Siskiyou County, California (Map 1). Rail Creek's legal description at the confluence with East Fork Scott River is T41N R07W S20. Its location is 41.3839 degrees north latitude and 122.6767 degrees west longitude, LLID number 1226766413838. Rail Creek is a third order stream and has approximately 15.7 miles of blue line stream according to the USGS Gazelle Mountain 7.5 minute quadrangle. Rail Creek drains a watershed of approximately 9.2 square miles. Elevations range from about 4,000 feet at the mouth of the creek to 6,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The upper watershed is primarily national forest and is managed for recreation, while the lower watershed is entirely privately owned by rural residents. Vehicle access exists via highway 101, to 299 East, to 3 North, to Gazelle Callahan Road to Rail Creek Road.

METHODS

The habitat inventory conducted in Rail Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and 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.

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 Rail Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Rail Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

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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 Rail Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Rail Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

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

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Rail Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Rail Creek, 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 (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.

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 Rail Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools

- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of May 6 to May 8, 2008 was conducted by Isaac Mikus and Sean McSmith (DFG). The total length of the stream surveyed was 9,437 feet with an additional 652 feet of side channel. A section of Rail Creek from 4,926 feet upstream of the confluence to 5,649 feet was not surveyed due to lack of landowner access permission. The data included in this report are for the 8,714 feet actually surveyed.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 44.8 cfs on May 7, 2008.

Rail Creek is a C3 channel type for 1,982 feet of the stream surveyed (Reach 1), a B3 channel type for 1,645 feet of the stream surveyed (Reach 2), an A2 channel type for 1,951 feet of the stream surveyed (Reach 3), an unsurveyed channel for 723 feet of the stream surveyed (Reach 4), and an A2 channel type for 3,788 feet of the stream surveyed (Reach 5).

C3 channels are low gradient meandering point-bar riffle/pool alluvial channels with broad well defined floodplain on low gradients and cobble-dominant substrates. B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks and cobble substrate. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 37 to 44 degrees Fahrenheit. Air temperatures ranged from 40 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44% riffle units, 31% flatwater units and 25% pool units (Graph 1). Based on total length of Level II habitat types there were 55% riffle units, 33% flatwater units and 12% pool units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 26% high gradient riffle units, 19% mid-channel pool units and 17% run units (Graph 3). Based on percent total length, 33% were high gradient riffle units, 20% step run units and 13% low gradient riffle units.

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A total of 35 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 80% (Graph 4), and comprised 78% 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. Two of the 35 pools (6%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 35 pool tail-outs measured, 26 had a value of 1 (74.3%); one had a value of 2 (2.9%); eight had a value of 5 (22.9%) (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 69, flatwater habitat types had a mean shelter rating of 43, and pool habitats had a mean shelter rating of 55 (Table 1). Of the pool types, scour pools had the highest mean shelter rating at 83. Main channel pools had a mean shelter rating of 49 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Whitewater is the dominant cover types in Rail Creek. Graph 7 describes the pool cover in Rail Creek. Whitewater is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Boulders were observed in 31% of pool tail-outs and large cobble observed in 29% of pool tail-outs.

The mean percent canopy density for the surveyed length of Rail Creek was 41%. Fifty-nine percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 3% and 97%, respectively. Graph 9 describes the mean percent canopy in Rail Creek. Though the at the time of survey deciduous trees were only beginning to produce foliage; a survey later in the year probably would have shown a significantly higher canopy rating.

For the stream reach surveyed, the mean percent right bank vegetated was 88%. The mean percent left bank vegetated was 92%. The dominant elements composing the structure of the stream banks consisted of 44% sand/silt/clay, 34% cobble/gravel, 16% bedrock and 6% boulders, (Graph 10). Coniferous trees were the dominant vegetation type observed in 54% of the units surveyed. Additionally, 39% of the units surveyed had hardwood trees as the dominant vegetation type, 6% had brush and 2% had no vegetation (Graph 11).

DISCUSSION

Rail Creek is a C3 channel type for the first 1,982 feet of stream surveyed, a B3 channel type for the next 1,645 feet, an A2 channel type for the next 1,951 feet, an unknown channel type for 723

of unsurveyed stream, and an A2 for the remaining 3,788 feet. The suitability of these channel types for fish habitat improvement structures is as follows:

A C3 channel type is excellent for bank-placed boulders and good for plunge weirs; boulder clusters; single and opposing wing deflectors; log cover. A B3 channel type is excellent for plunge weirs; boulder clusters and bank-placed boulders; single and opposing wing-deflectors; log cover. An A2 channel type is generally not suitable for fish habitat improvement structure suitability; A2 channel types are high energy streams with stable stream banks and poor gravel retention capabilities.

The water temperatures recorded on the survey days May 6 to May 8, 2008, ranged from 37 to 44 degrees Fahrenheit. Air temperatures ranged from 40 to 72 degrees Fahrenheit. To make any further 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 33% of the total length of this survey, riffles 55%, and pools 12%. The pools are relatively shallow, with only two of the 35 (6%) pools having a maximum residual depth greater than three feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum residual depth of at least three 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 for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Twenty seven of the 35 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Eight 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 Rail Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirty of the 35 pool tail-outs had silt, sand, large cobble, boulders or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools was 55. The shelter rating in the flatwater habitats was 43. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by whitewater in Rail Creek. Whitewater is the dominant cover type in pools followed by boulders. 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 41%. Reach 1 had a canopy density of 26%, Reach 2 had a canopy density of 52%, Reach 3 had a canopy density of 39% and Reach 5 had a canopy density of 45%. In general, revegetation projects are considered when canopy

density is less than 80%. Note: deciduous trees were just putting out foliage, the canopy values will change significantly as the summer progresses.

The percentage of right and left bank covered with vegetation was 88% and 92% 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) Rail Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within/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 3 to 5 years.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from whitewater. Adding high quality complexity with woody cover in the pools is desirable.

5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

6) 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.

7) Increase the canopy on Rail Creek by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

8) Suitable size spawning substrate on Rail Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

9) There are several log debris accumulations present on Rail Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

10) There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

11) Due to the high gradient of the stream like at -------- and -------- 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.

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	The start of the survey was 349' above the confluence with a reservoir. The 349' before the start of the survey was a multi-channel delta, which is probably a D4 channel type. The delta was mostly a long run with one deep pool, it contained good quality spawning gravels. During the course of the survey, Rail Creek was nearly at bankfull discharge. Due to the survey being carried out in early May, the deciduous trees had not unfurled their leaves and thus the canopy values were low and skewed towards the conifers. Also, due to the high flows bubble curtains were the main shelter type, as the flow drops the bubble curtain cover will decrease.
623	0011.00	Channel type #1 was taken at near the top of this unit.
1241	0019.00	There was a water diversion culvert at the bottom of this unit. The culvert was approximately 1.4' in diameter and 10' long. It was situated so that it would pick up water even in low flows. The culvert was purposely blocked with a piece of metal at the time of the survey. Less then 0.1 cfs was flowing through the blocked culvert at the time of the survey. The diversion ditch at the outlet of the culvert was made of rock and soil.
1330	0020.00	The channel type changed at the bottom of this unit. The gradient of this new reach was surveyed over a distance of 745 feet at its downstream end. The slope was found to be 2.2%.
1634	0022.00	There was a 2' high plunge at the top of this unit.
1634	0022.00	There was a right bank slide measuring 20' long x 15' high, contributing silt and gravels to the channel.

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1988	0027.00	Bridge #01 was for a private drive. The bridge is made of creosote logs and 2 x 8s placed on their sides. It measures 18' wide x 8.5' high x 23.2' long.
2940	0050.00	Tributary #1 entered from the left bank. It was flowing at less then 0.1 cfs, and was contributing to less then 1% of Rail Creek's flow. The temperature of the tributary was 47 degrees Fahrenheit. The temperature of Rail Creek upstream and downstream of the tributary was 40 degrees Fahrenheit. The tributary was not accessible to fish and it had a 10% slope, no fish were observed in it. Upon further investigation it was found that the tributary came from underground 200' upstream and it came up cloudy, possibly indicating it was greywater or used irrigation water. It seemed to be creating some foam bubbles in Rail Creek.
3425	0058.00	There were old dam abutments on the left and right banks made of rock and concrete.
3425	0058.00	This unit was a possible barrier to coho salmon. It was high gradient and was made up of multiple small cascading waterfalls, the largest of which had a jump height of 3.5'.
3729	0063.00	There was a 1.5' high plunge.
4103	0069.00	There was a 1.3' high plunge.
4926	0081.00	This section of stream was unsurveyed because we didn't have permission from the landowner. It was separated as a new reach as protocol required.
5788	0086.00	There was a 2.5' high plunge.
7002	0102.00	Tributary #02 entered from the right bank. It was flowing at less then 0.1 cfs and was contributing to approximately 1% of Rail Creek's flow. The temperature of the tributary was 44 degrees Fahrenheit, the temperature of Rail Creek upstream and downstream was 38 degrees Fahrenheit. It was not accessible to fish due to its high slope and low flow, its slope was 15%. No fish were observed in it. Its bankfull width was about 4 feet. There was a 2.5' plunge at the top of this habitat unit.
7052	0103.00	A good portion of this unit was a high enough slope to impede the passage of steelhead trout.
7382	0106.00	There was a 1.5' high plunge at the top of this unit.
7638	0108.00	This unit poses a possible barrier to salmonids due to a high gradient and waterfalls, the tallest of which was approximately 7 feet high.

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8468	0117.00	Tributary #3 entered from the right bank. It was flowing at less than 1 cfs and was contributing to approximately 2% of the flow of Rail Creek. The temperature of the tributary was 42 degrees Fahrenheit, and the temperature of Rail Creek upstream and downstream was 39 degrees Fahrenheit. The tributary was accessible to adult salmonids although its slope was 8%, no fish were observed.
8795	0122.00	There was a 3.9' high waterfall at the top of this unit.
8902	0124.00	This unit was a probable end of anadromy due to a 6' high waterfall with no jump pool.
9106	0126.00	There was a left bank slide measuring 40' high x 12' wide. The slide was contributing silt and gravel to the channel.
9361	0129.00	This unit marks the forest service property boundary.
9437	0130.00	The survey ended at the forest survey property boundary.

REFERENCES

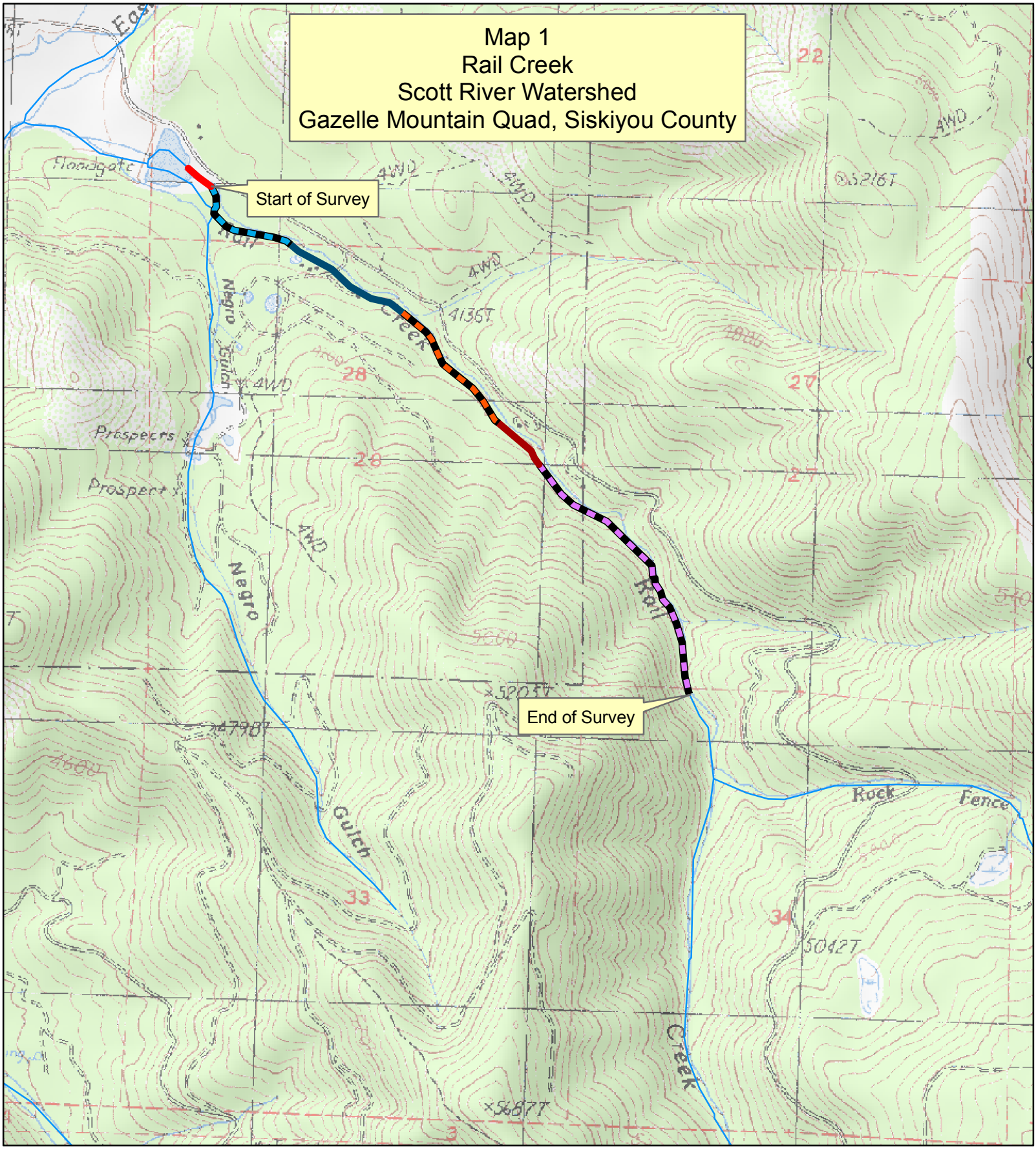
Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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]	



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Legend

- Reservoir Delta, Not Surveyed
- Reach 1, C3 Channel Type
- Reach 2, B3 Channel Type
- Reach 3, A2 Channel Type
- Reach 4, No Channel Type
- Reach 5, A2 Channel Type

0 670 1,340 Feet

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

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0

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
43	11	FLATWATER	30.7	71	3066	32.7	15.6	1.6	2.3	765	32905	1213	52161		43
1	0	NOSURVEY	0.7	723	723										
35	35	POOL	25.0	32	1114	11.9	16.8	0.9	1.8	511	17871	1253	43857	446	55
61	7	RIFFLE	43.6	85	5186	55.4	15.0	1.3	1.8	1098	66975	1643	100226		69

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
140	53	10089	117751	196243

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

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 (%)
19	2	LGR	13.6	66	1246	13.3	14	1.2	2	2156	40955	3437	65300		23	29
36	5	HGR	25.7	87	3127	33.4	15	1.4	2.4	675	24297	926	33319		90	35
6	0	CAS	4.3	136	813	8.7									60	32
24	6	RUN	17.1	51	1216	13.0	17	1.5	2.8	648	15559	958	22989		33	35
19	5	SRN	13.6	97	1850	19.8	14	1.8	3.7	906	17205	1519	28865		54	49
27	27	MCP	19.3	31	840	9.0	16	0.7	2.6	486	13122	1108	29910	353	46	43
1	1	CCP	0.7	32	32	0.3	18	1.2	2.6	576	576	1498	1498	691	105	26
1	1	LSL	0.7	30	30	0.3	21	1.5	2.5	630	630	1701	1701	945	30	33
6	6	PLP	4.3	35	212	2.3	17	1.3	4.2	591	3543	1791	10748	741	92	49
1	0	NS	0.7	723	723											

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
140	53	10089	115887	194330

Table 3 - Summary of Pool Types

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

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
28	28	MAIN	80	31	872	78	16.5	0.7	489	13698	365	10226	49
7	7	SCOUR	20	35	242	22	17.9	1.3	596	4173	770	5389	83

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
35	35	1114	17871	15615

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

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

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
27	MCP	77	4	15	17	63	6	22	0	0	0	0
1	CCP	3	0	0	0	0	1	100	0	0	0	0
1	LSL	3	0	0	0	0	1	100	0	0	0	0
6	PLP	17	0	0	1	17	3	50	0	0	2	33

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
35	4	11	18	51	11	31	0	0	2	6

Mean Maximum Residual Pool Depth (ft.): 1.8

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008 Dry Units: 0

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

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
19	2	LGR	0	28	0	0	0	0	65	8	0
36	5	HGR	0	11	4	0	0	0	73	12	0
6	1	CAS	0	0	0	0	0	0	90	5	5
61	8	TOTAL RIFFLE	0	14	3	0	0	0	73	10	1
24	6	RUN	2	18	1	11	13	0	52	4	0
19	5	SRN	0	17	0	0	0	0	75	8	0
43	11	TOTAL FLAT	1	17	0	6	7	0	62	6	0
27	27	MCP	1	11	4	2	2	0	68	12	1
1	1	CCP	50	20	0	0	0	0	30	0	0
1	1	LSL	0	5	45	0	0	0	50	0	0
6	6	PLP	3	3	1	0	1	0	88	4	1
35	35	TOTAL POOL	2	10	4	1	2	0	69	10	1
1	0	NS									
140	54	TOTAL	2	12	3	2	3	0	69	9	1

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008 Dry Units: 0

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

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
19	2	LGR	0	0	0	0	100	0	0
36	5	HGR	0	0	0	20	60	20	0
6	1	CAS	0	0	0	0	0	100	0
24	6	RUN	17	0	17	17	33	17	0
19	5	SRN	0	0	20	0	20	40	20
27	27	MCP	4	0	19	7	15	26	30
1	1	CCP	0	0	0	0	100	0	0
1	1	LSL	0	0	0	0	100	0	0
6	6	PLP	0	0	17	50	0	0	33

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
41	97	3	0	88	92

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: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008 Survey Length (ft.): 10089 Main Channel (ft.): 9437 Side Channel (ft.): 652

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: C3
Reach Length (ft.): 1330
Riffle/Flatwater Mean Width (ft.): 15.0
BFW:
Range (ft.): 13 to 29
Mean (ft.): 19
Std. Dev.: 7
Base Flow (cfs.): 44.8
Water (F): 44 - 44 Air (F): 64 - 72
Dry Channel (ft): 0

Canopy Density (%): 26.8
Coniferous Component (%): 94.3
Hardwood Component (%): 5.7
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 98.4
Dominant Shelter: Small Woody Debris
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 10
LWD per 100 ft.:
Riffles: 1
Pools: 2
Flat: 1

Pools by Stream Length (%): 9.5
Pool Frequency (%): 24.1
Residual Pool Depth (%):
< 2 Feet Deep: 71
2 to 2.9 Feet Deep: 29
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.5
Mean Pool Shelter Rating: 35

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 14 Gravel: 29 Sm Cobble: 14 Lg Cobble: 43 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 85.7 2. 0.0 3. 0.0 4. 0.0 5. 14.3

STREAM REACH: 2

Channel Type: B3
Reach Length (ft.): 1645
Riffle/Flatwater Mean Width (ft.): 16.5
BFW:
Range (ft.): 20 to 29
Mean (ft.): 21
Std. Dev.: 2
Base Flow (cfs.): 44.8
Water (F): 39 - 44 Air (F): 40 - 68
Dry Channel (ft): 0

Canopy Density (%): 52.6
Coniferous Component (%): 97.3
Hardwood Component (%): 2.7
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 83.8
Dominant Shelter: Whitewater
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 3
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 17.1
Pool Frequency (%): 25.8
Residual Pool Depth (%):
< 2 Feet Deep: 75
2 to 2.9 Feet Deep: 13
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 13
Mean Max Residual Pool Depth (ft.): 1.7
Mean Pool Shelter Rating: 49

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 0 Sm Cobble: 0 Lg Cobble: 38 Boulder: 38 Bedrock: 25

Embeddedness Values (%): 1. 75.0 2. 0.0 3. 0.0 4. 0.0 5. 25.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: A2
Reach Length (ft.): 1951
Riffle/Flatwater Mean Width (ft.): 14.3
BFW:
Range (ft.): 18 to 23
Mean (ft.): 20
Std. Dev.: 2
Base Flow (cfs.): 44.8
Water (F): 40 - 44 Air (F): 54 - 63
Dry Channel (ft): 0

Canopy Density (%): 39.0
Coniferous Component (%): 98.3
Hardwood Component (%): 1.7
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 90.8
Dominant Shelter: Whitewater
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 1
LWD per 100 ft.:
Riffles: 1
Pools: 1
Flat: 1

Pools by Stream Length (%): 8.9
Pool Frequency (%): 20.0
Residual Pool Depth (%):
< 2 Feet Deep: 67
2 to 2.9 Feet Deep: 17
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 17
Mean Max Residual Pool Depth (ft.): 2.0
Mean Pool Shelter Rating: 62

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 0 Sm Cobble: 33 Lg Cobble: 33 Boulder: 0 Bedrock: 33
Embeddedness Values (%): 1. 100.0 2. 0.0 3. 0.0 4. 0.0 5. 0.0

STREAM REACH: 4

Channel Type: NA
Reach Length (ft.): 723
Riffle/Flatwater Mean Width (ft.):
BFW:
Range (ft.): 16 to 16
Mean (ft.): 16
Std. Dev.: 0
Base Flow (cfs.): 44.8
Water (F): 38 - 38 Air (F): 41 - 41
Dry Channel (ft): 0

Canopy Density (%):
Coniferous Component (%):
Hardwood Component (%):
Dominant Bank Vegetation:
Vegetative Cover (%): 0.0
Dominant Shelter:
Dominant Bank Substrate Type:
Occurrence of LWD (%):
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 0.0
Pool Frequency (%): 0.0
Residual Pool Depth (%):
< 2 Feet Deep:
2 to 2.9 Feet Deep:
3 to 3.9 Feet Deep:
>= 4 Feet Deep:
Mean Max Residual Pool Depth (ft.):
Mean Pool Shelter Rating:

Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 5

Channel Type: A2
Reach Length (ft.): 3788
Riffle/Flatwater Mean Width (ft.): 16.0
BFW:
Range (ft.): 14 to 22
Mean (ft.): 18
Std. Dev.: 3
Base Flow (cfs.): 44.8
Water (F): 37 - 39 Air (F): 41 - 55
Dry Channel (ft): 0

Canopy Density (%): 45.2
Coniferous Component (%): 98.4
Hardwood Component (%): 1.6
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 86.7
Dominant Shelter: Whitewater
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 0
LWD per 100 ft.:
Riffles: 1
Pools: 0
Flat: 1

Pools by Stream Length (%): 12.4
Pool Frequency (%): 28.6
Residual Pool Depth (%):
< 2 Feet Deep: 50
2 to 2.9 Feet Deep: 50
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.9
Mean Pool Shelter Rating: 66

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 0 Sm Cobble: 0 Lg Cobble: 14 Boulder: 57 Bedrock: 29
Embeddedness Values (%): 1. 57.1 2. 7.1 3. 0.0 4. 0.0 5. 35.7

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

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	10	7	15.7
Boulder	4	3	6.5
Cobble / Gravel	21	16	34.3
Sand / Silt / Clay	19	28	43.5

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	0.0
Brush	4	2	5.6
Hardwood Trees	21	21	38.9
Coniferous Trees	29	29	53.7
No Vegetation	0	2	1.9

Total Stream Cobble Embeddedness Values: 2

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

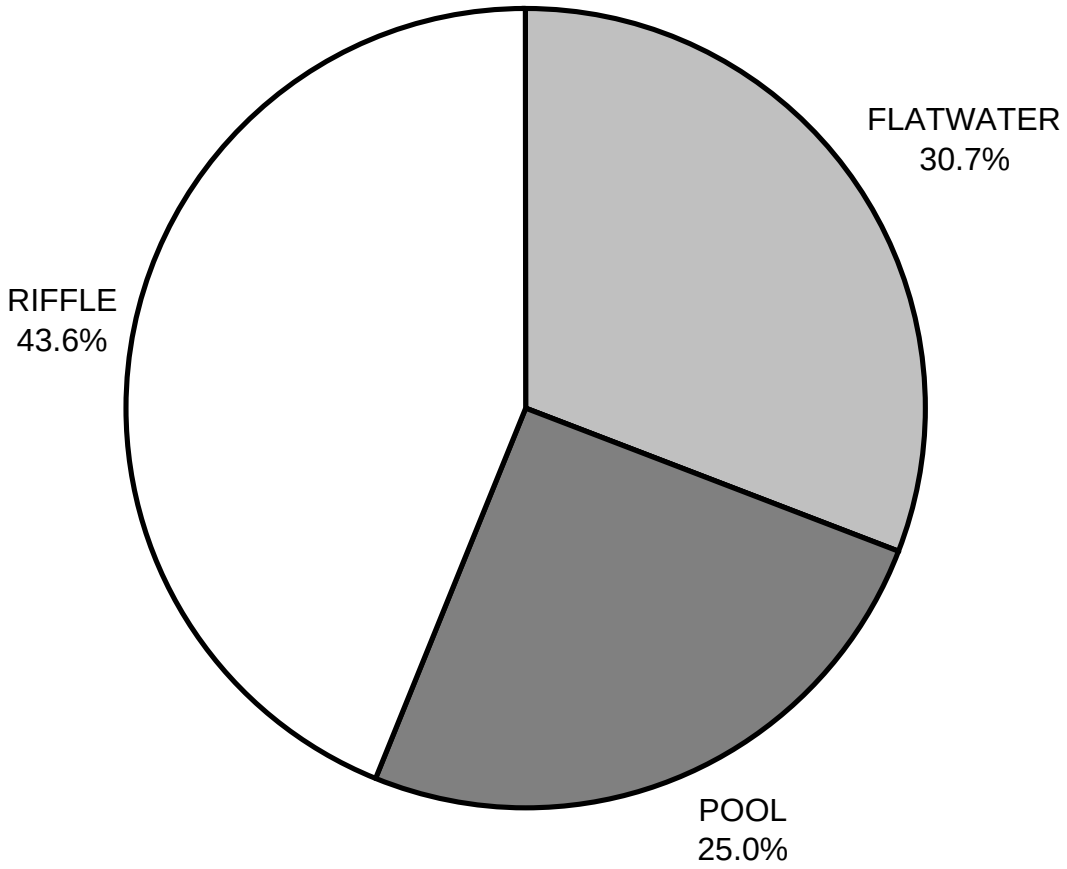
StreamName: Rail Creek LLID: 1226766413838 Drainage: Scott River

Survey Dates: 5/6/2008 to 5/8/2008

Confluence Location: Quad: GAZELLE MTN. Legal Description: T41NR07WS20 Latitude: 41:23:02.0N Longitude: 122:40:36.0W

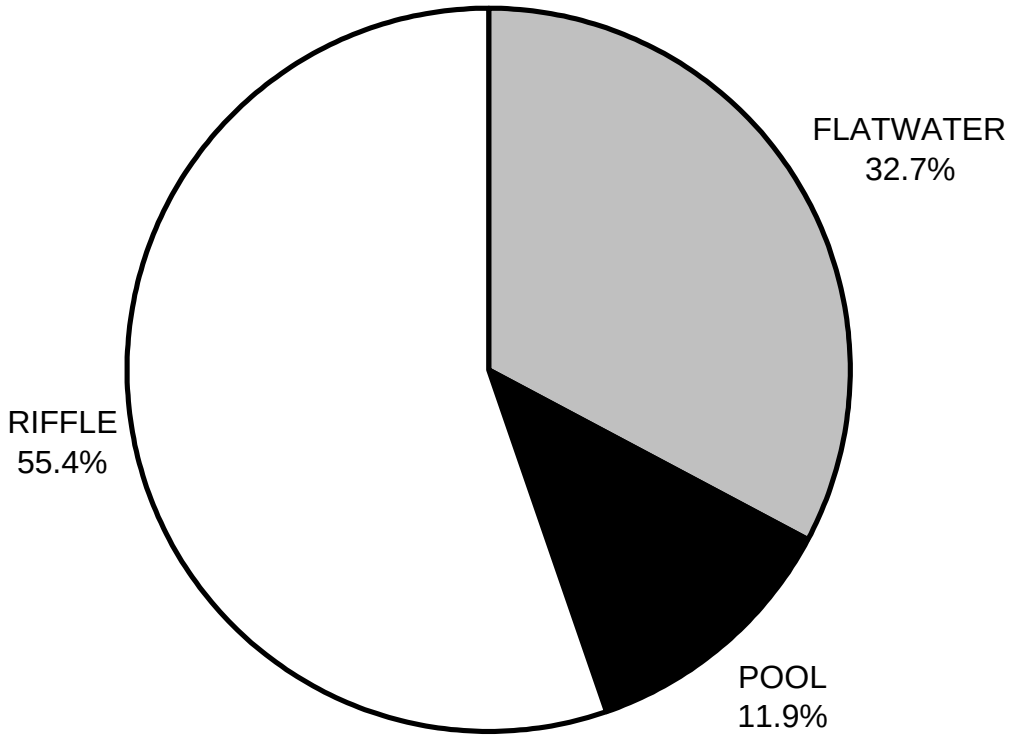
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	1	2
SMALL WOODY DEBRIS (%)	14	17	10
LARGE WOODY DEBRIS (%)	3	0	4
ROOT MASS (%)	0	6	1
TERRESTRIAL VEGETATION (%)	0	7	2
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	73	62	69
BOULDERS (%)	10	6	10
BEDROCK LEDGES (%)	1	0	1

RAIL CREEK 2008
HABITAT TYPES BY PERCENT OCCURRENCE



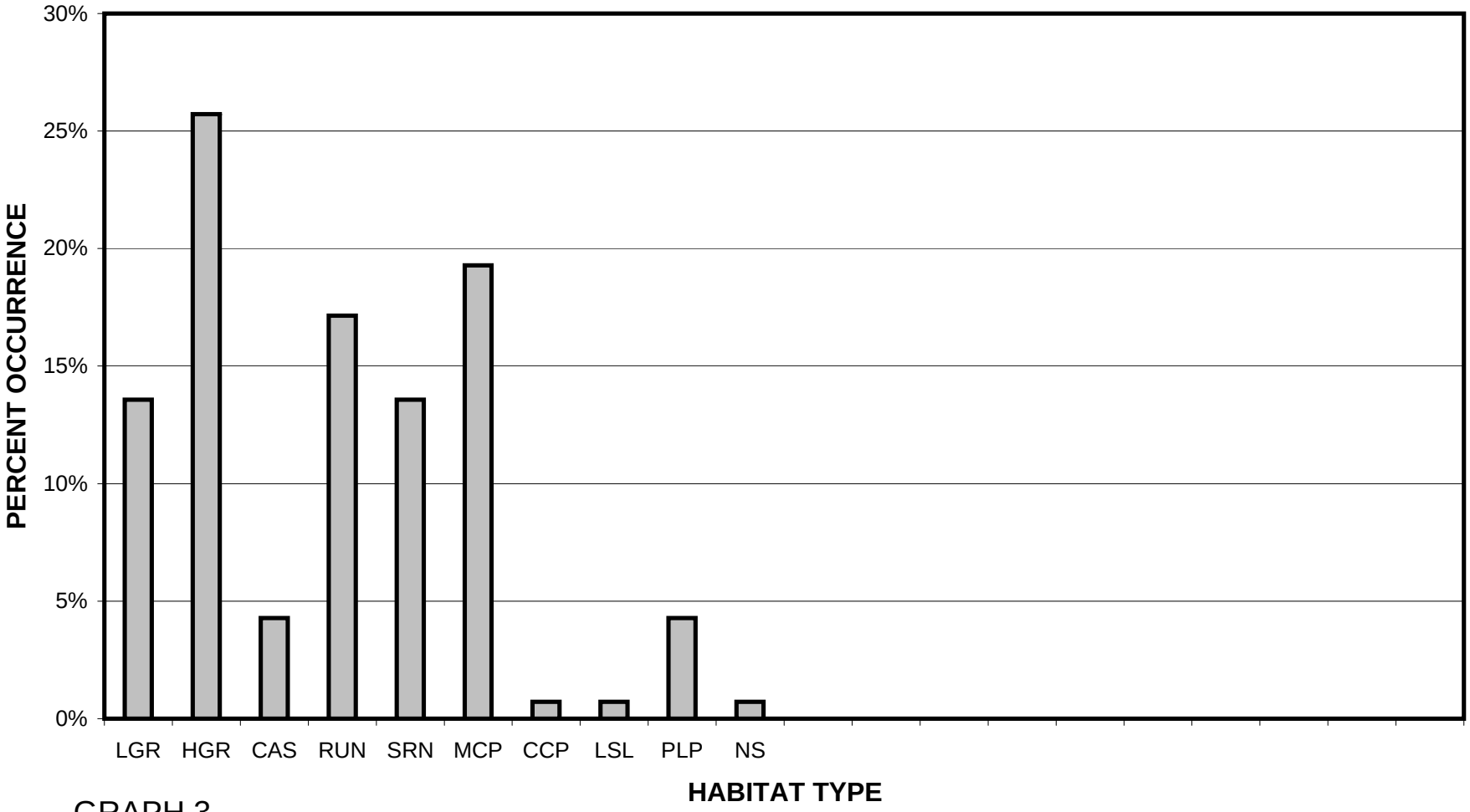
GRAPH 1

RAIL CREEK 2008
HABITAT TYPES BY PERCENT TOTAL LENGTH



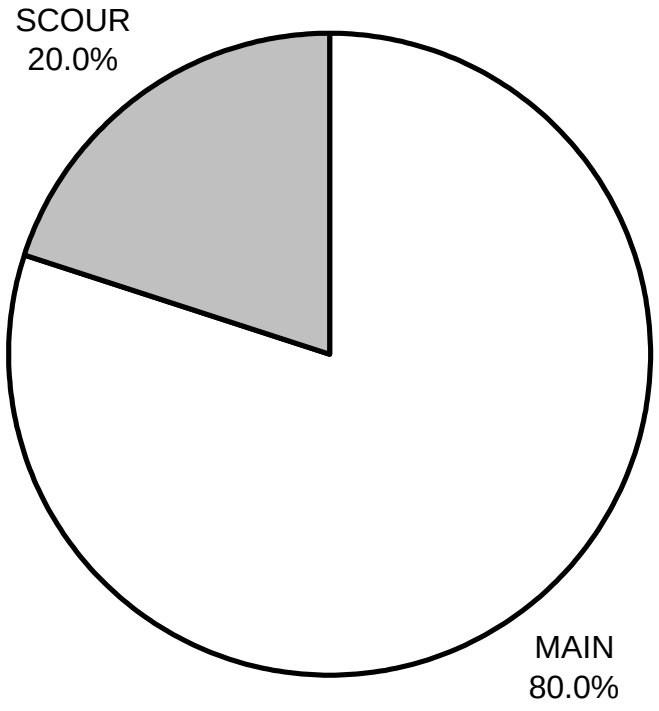
GRAPH 2

RAIL CREEK 2008
HABITAT TYPES BY PERCENT OCCURRENCE



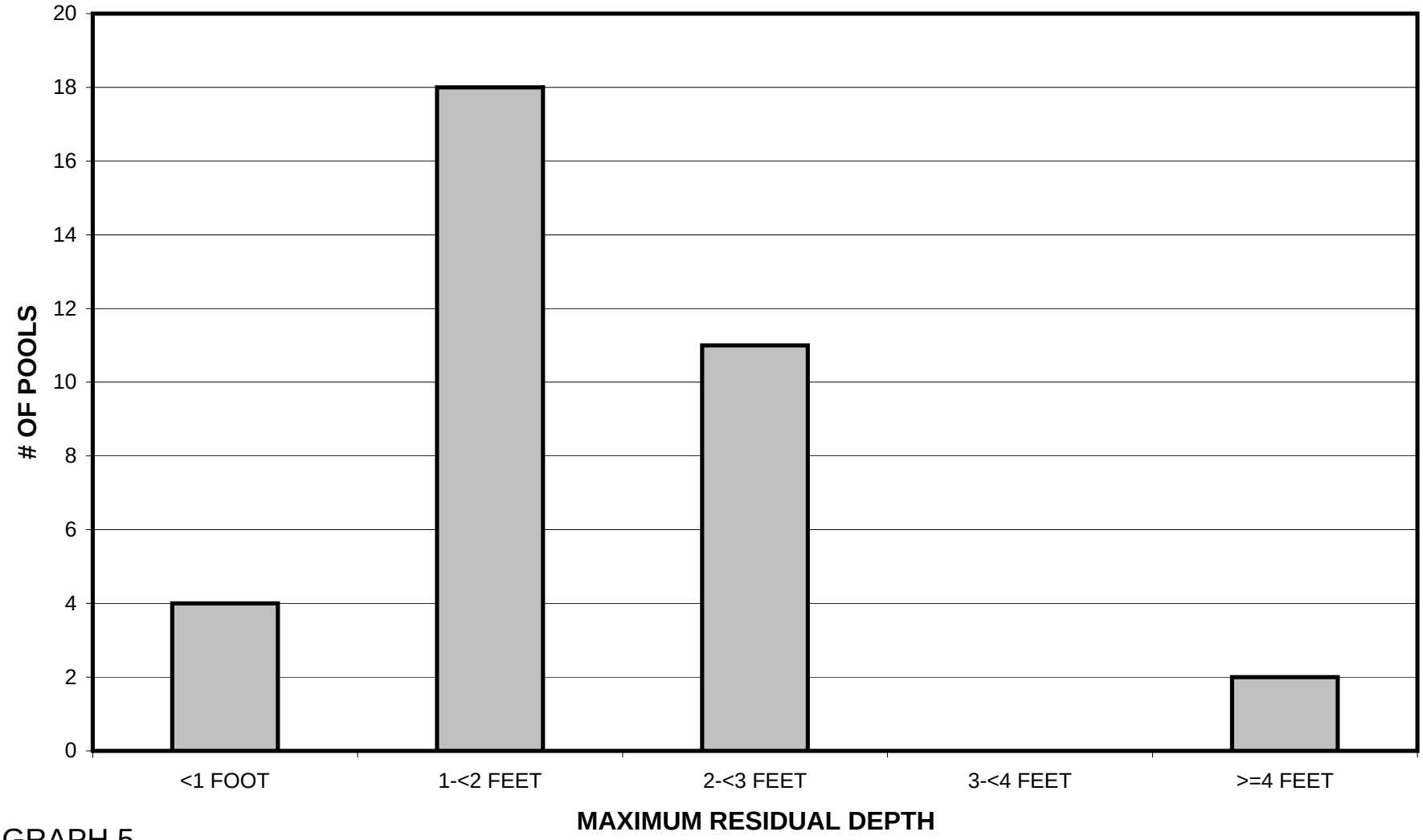
GRAPH 3

RAIL CREEK 2008
POOL TYPES BY PERCENT OCCURRENCE



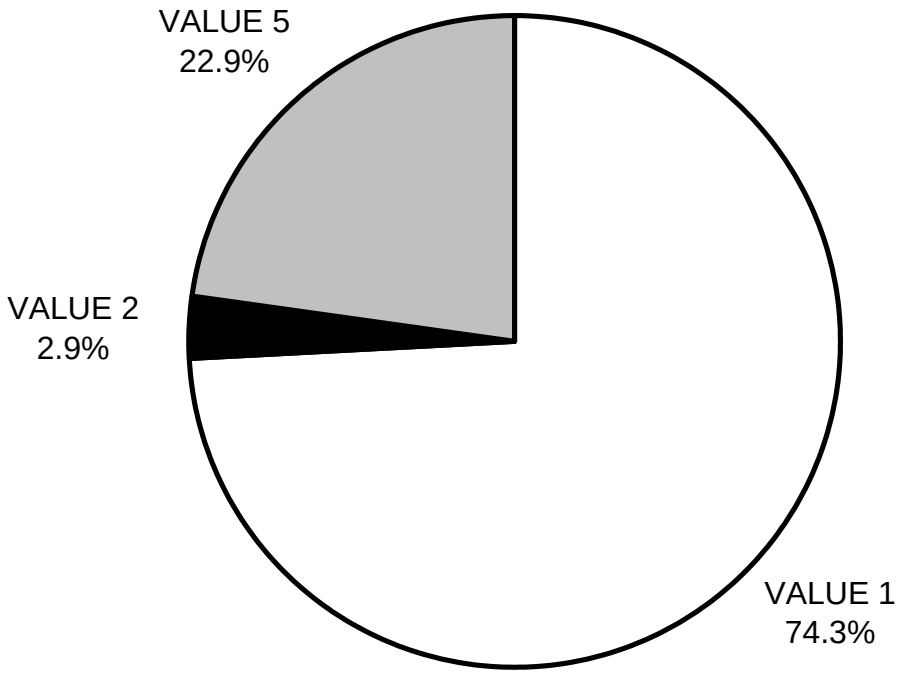
GRAPH 4

RAIL CREEK 2008
MAXIMUM DEPTH IN POOLS



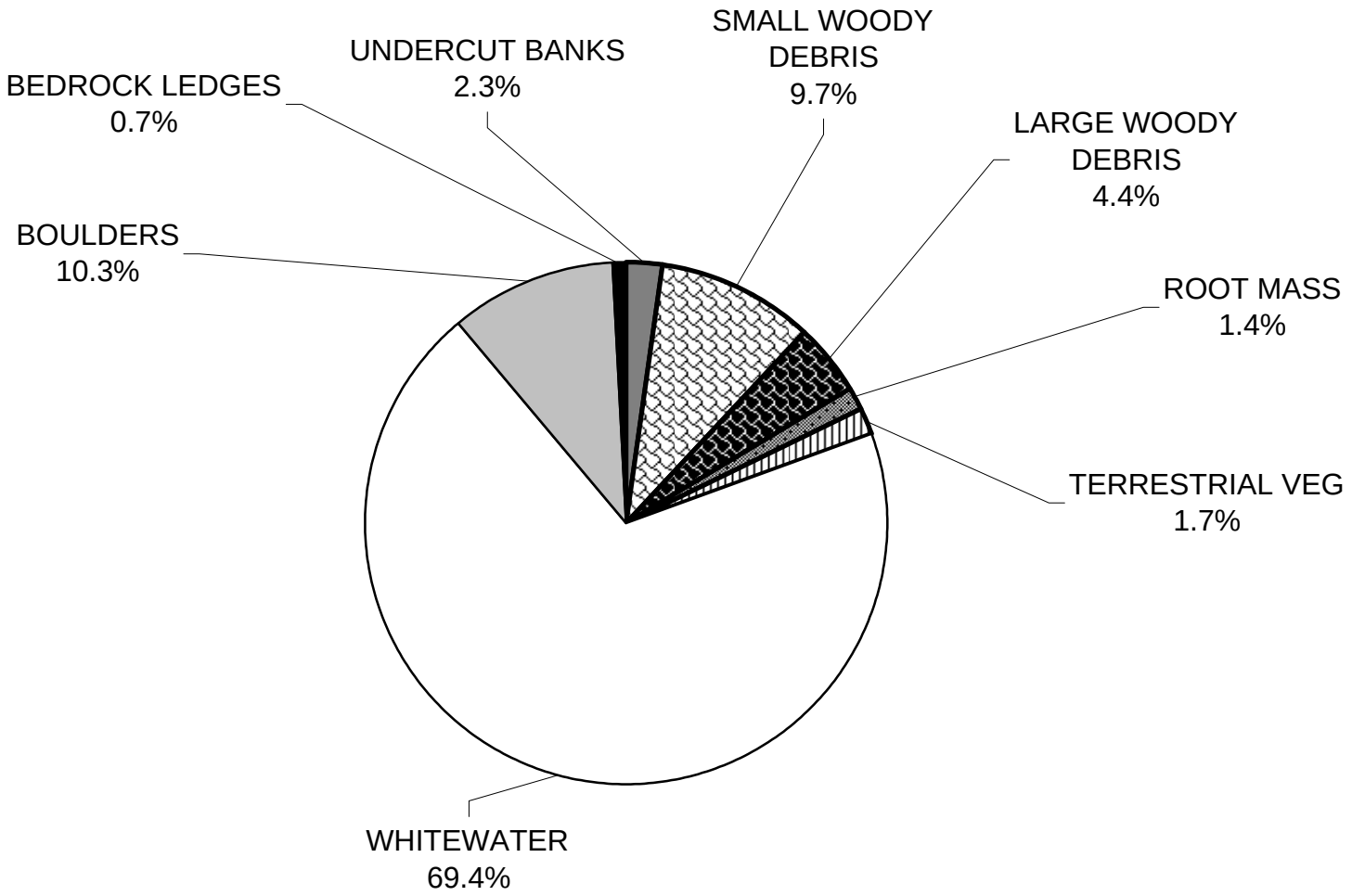
GRAPH 5

RAIL CREEK 2008
PERCENT EMBEDDEDNESS



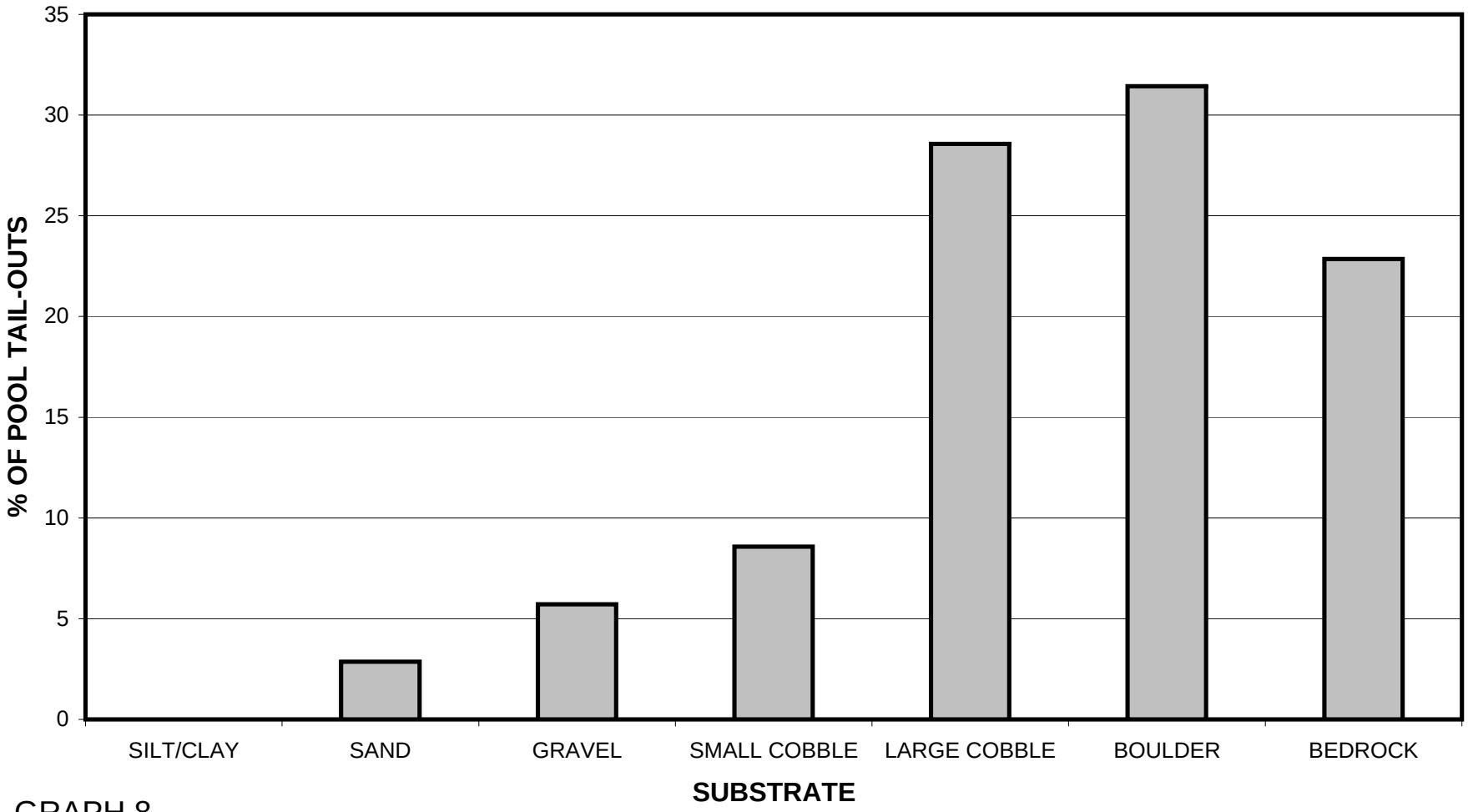
GRAPH 6

RAIL CREEK 2008
MEAN PERCENT COVER TYPES IN POOLS



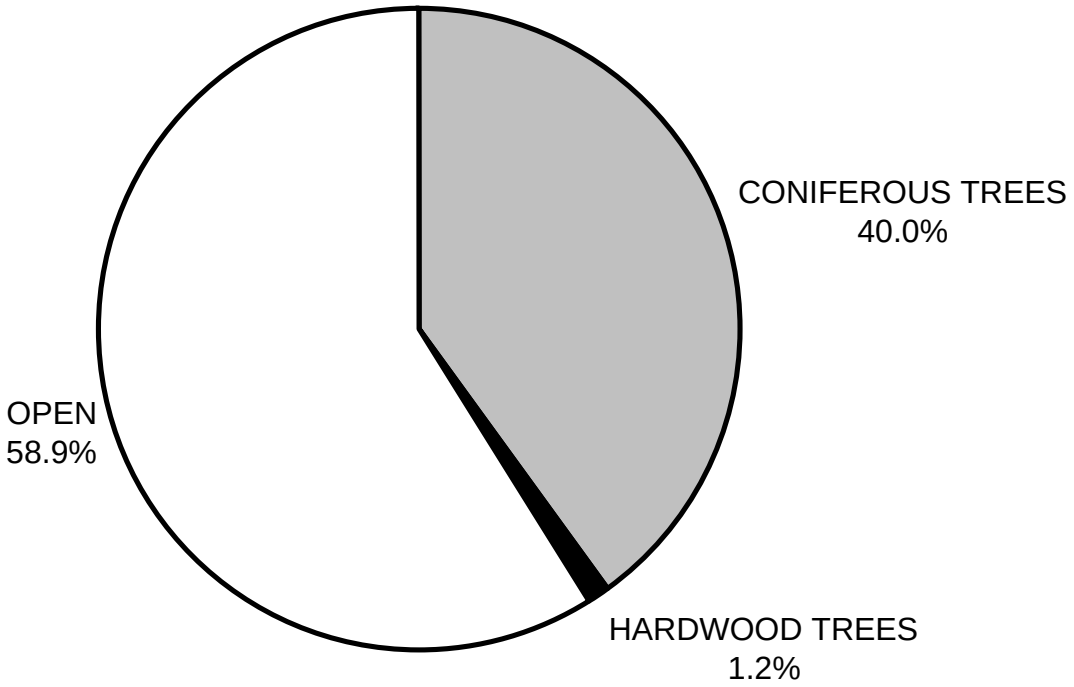
GRAPH 7

RAIL CREEK 2008
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



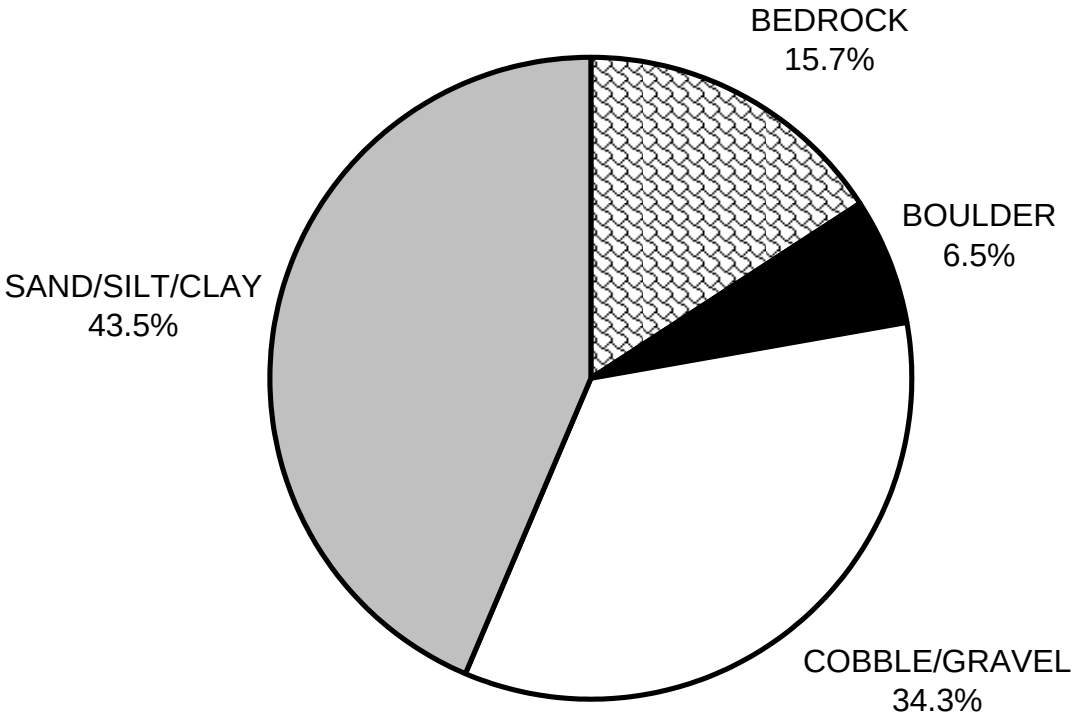
GRAPH 8

RAIL CREEK 2008
MEAN PERCENT CANOPY



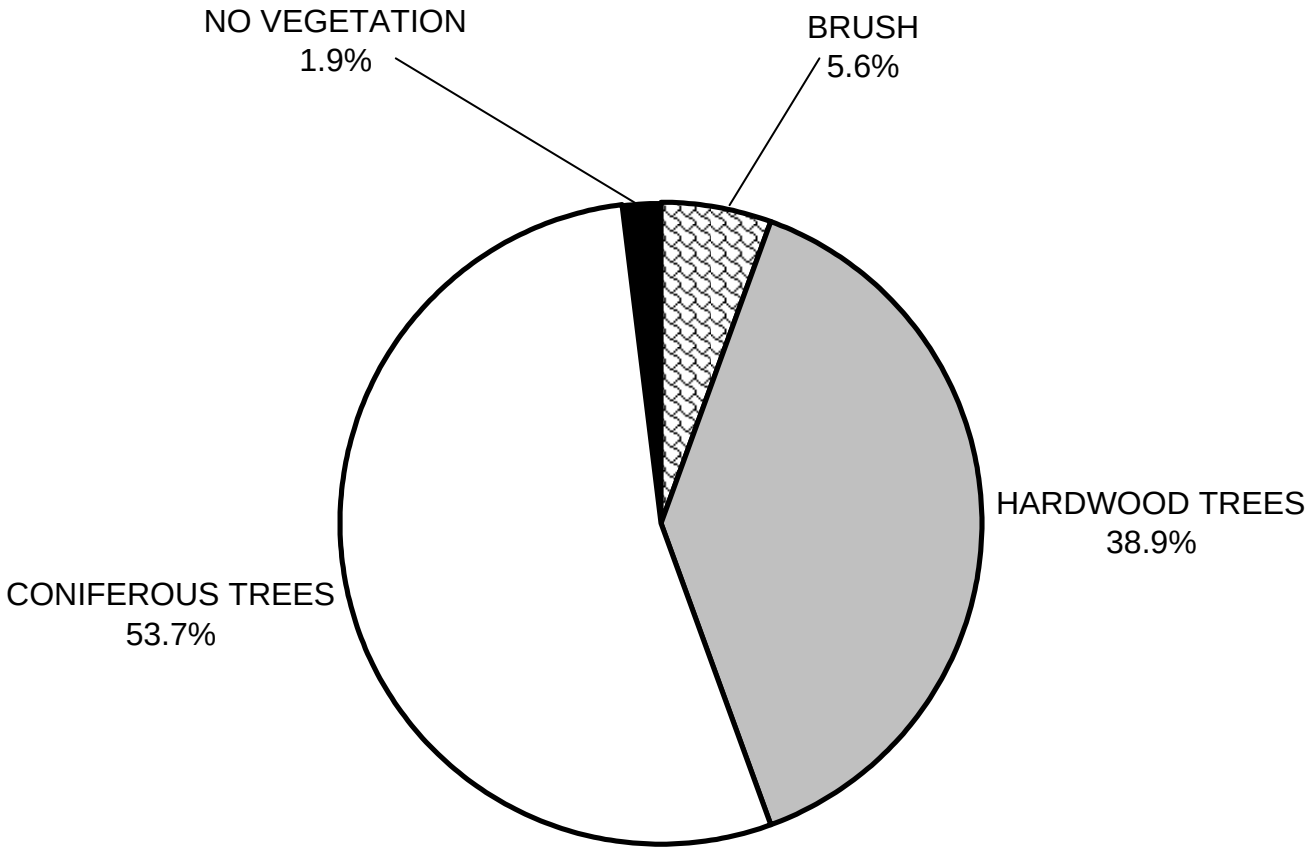
GRAPH 9

RAIL CREEK 2008
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

RAIL CREEK 2008
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11