

# **STREAM INVENTORY REPORT**

## **Rocky Gulch**

### **INTRODUCTION**

A stream inventory was conducted from June 9 to June 11, 2008 on Rocky Gulch. The survey began at the confluence with Washington Gulch and extended upstream 2.1 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Rocky Gulch.

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**

Rocky Gulch is a tributary to Washington Gulch, which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Rocky Gulch's legal description at the confluence with Washington Gulch is T05N R01E S09. Its location is 40.8311 north latitude and 124.0813 west longitude, LLID number 1240800408312. Rocky Gulch is a second order stream and has approximately 3.5 miles of blue line stream according to the USGS Arcata South 7.5 minute quadrangle. Rocky Gulch drains a watershed of approximately 1.5 square miles. Elevations range from about 3 feet at the mouth of the creek to 1,025 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production, livestock grazing and residential housing. Vehicle access exists via Highway 101 between the Indianola and Bayside Cutoffs.

### **METHODS**

The habitat inventory conducted in Rocky Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Department of Fish and Game (DFG), Fish and Wildlife Scientific Aides 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.

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

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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. 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 Rocky 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 Rocky 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 Rocky 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.

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### 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 Rocky 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 June 9 to June 11, 2008 was conducted by I. Mikus and S. McSmith, (DFG). The total length of the stream surveyed was 11,325 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.43 cfs on June 12, 2008.

Rocky Gulch is an E6 channel type for 4,614 feet of the stream surveyed (Reach 1), a C4 channel type for 2,286 feet of the stream surveyed (Reach 2), a G4 channel type for 3,159 feet of the stream surveyed (Reach 3), and an A3 channel type for 1,266 feet of the stream surveyed (Reach 4). E6 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 silt/clay-dominant substrates. C4 channels are meandering point-bar, riffle/pool, alluvial channels with broad well defined floodplain on low gradients and gravel-dominant substrates. G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios, very stable with gravel-dominant substrates. A3 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 48 to 66 degrees Fahrenheit. Air temperatures ranged from 46 to 66 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 38% flatwater units, 33% pool units, 27% riffle units, and 2% culvert units (Graph 1). Based on total length of Level II habitat types there were 54% flatwater units, 25% pool units, 19% riffle units, and 2% culvert 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, 24%; low gradient riffle units, 22%; and run units, 21% (Graph 3). Based on percent total length, run units made up 24%, mid-channel pool units 22%, and run units 19%.

A total of 75 pools were identified (Table 3). Main channel pools were the most frequently encountered at 73% (Graph 4), and comprised 88% 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. Twelve of the 75 pools (16%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 75 pool tail-outs measured, 3 had a value of 1 (4%); 10 had a value of 2 (13.3%); 11 had a value of 3 (14.7%); 38 had a value of 4 (50.7%); 13 had a value of 5 (17.3%) (Graph 6). On this scale, a value of 1

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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 8, flatwater habitat types had a mean shelter rating of 41, and pool habitats had a mean shelter rating of 42 (Table 1). Of the pool types, scour pools had the highest mean shelter rating of 50. Main channel pools had a mean shelter rating at 39. (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Rocky Gulch. Graph 7 describes the pool cover in Rocky 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 59% of pool tail-outs. Silt/clay substrate was the next most dominant substrate observed in 21% of pool tail-outs.

The mean percent canopy density for the surveyed length of Rocky Gulch was 64%. Thirty-six percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 74% and 26%, respectively. Graph 9 describes the mean percent canopy in Rocky Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 98%. The dominant elements composing the structure of the stream banks consisted of 85% sand/silt/clay, 9% cobble/gravel, 6% boulder, and 1% bedrock (Graph 10). Deciduous trees were the dominant vegetation type observed in 43% of the units surveyed. Additionally, 25% of the units surveyed had brush and grass as the dominant vegetation types, and 8% had coniferous as the dominant vegetation type (Graph 11).

## DISCUSSION

Rocky Gulch is an E6 channel type for 4,614 feet of the stream surveyed (Reach 1), a C4 channel type for 2,286 feet of the stream surveyed (Reach 2), a G4 channel type for 3,159 feet of the stream surveyed (Reach 3), and an A3 channel type for 1,266 feet of the stream surveyed (Reach 4). The suitability of E6, C4, G4, and A3 channel types for fish habitat improvement structures is as follows: E6 channel types are good for bank-placed boulders and fair for opposing wing-deflectors. C4 channel types are good for bank placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover. A3 channel types are generally not suitable for fish habitat improvement structures.

The water temperatures recorded on the survey days June 9 to June 11, 2008 ranged from 48 to 66 degrees Fahrenheit. Air temperatures ranged from 46 to 66 degrees Fahrenheit. To make any

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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 54% of the total length of this survey, riffles 19%, and pools 25%. Twelve of the 75 (16%) pools measured 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. With the exception of Reach 4, installing structures that will increase or deepen pool habitat is recommended.

Thirteen of the 75 pool tail-outs measured had embeddedness ratings of 1 or 2. Forty-nine of the pool tail-outs had embeddedness ratings of 3 or 4. Thirteen 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 Rocky Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fifty-five of the 75 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 42. The shelter rating in the flatwater habitats was 41. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Rocky Gulch. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 64%. Reach 1 had a canopy density of 18.7%, Reach 2 had a canopy density of 61.9%, Reach 3 had a canopy density of 90.6%, and Reach 4 had a canopy density of 90.6%. 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 98%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

## RECOMMENDATIONS

- 1) Rocky 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) 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) 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.
- 5) Increase the canopy in Reach 1 and Reach 2 on Rocky Gulch by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels.

### 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 survey began at the upstream end of the tidegate. The tidegate has rip-rap upstream and downstream on the left bank extending 20 feet. The channel type is an E6.
191	0004.00	There is a tidegate on the left bank which may be part of a diversion channel.
734	0007.00	Tributary #01 is flowing from the right bank with an estimated cubic feet per second (cfs) measuring considerably less than 1cfs; contributing to only 1% of the flow of Rocky Gulch. The temperature upstream as well as downstream of the confluence is 61 degrees Fahrenheit, while the tributary itself is 58 degrees Fahrenheit. The tributary does appear accessible to fish for the first 50 feet explored though none were observed. The slope was measured to be 1%. The tributary is draining pasture land.
2490	0013.00	Tributary #02 (Halverson Creek) is flowing from the right bank with an estimated cubic feet per second (cfs) measuring considerably less than 1cfs; contributing only 2% of the flow to Rocky Gulch. The temperature upstream is 56 degrees Fahrenheit; downstream of the confluence is 61 degrees Fahrenheit, while the tributary itself is 52 degrees Fahrenheit. The tributary does appear accessible to fish for the first 70 feet explored, none were observed. The slope was measured to be 3%. The Old



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Arcata Road culvert on Halverson Creek is a potential barrier to juveniles due to plunge height.

There are salmonid young-of-the-year (YOY) observed near the top of this unit. Bridge #01 is a metal bridge 323' into current habitat unit that measures 13' wide x 20' long.

3263	0019.00	There is a structure containing 3 logs associated with boulders and anchored to a large redwood tree.
3425	0023.00	There is structure containing 2 logs.
4387	0039.00	There is a fenced access point for cattle in this unit. The substrate is sand bagged concrete.
4709	0044.00	There is a grade control weir at top of this unit.
5110	0051.00	Bridge #02 is a footbridge at the bottom of this unit, it is constructed of wood and measures 3.1' high x 7' wide x 17' long.
5227	0054.00	Culvert #01 is a new metal arch culvert with a gravel bottom. The culvert serves as a footpath. It measures 3' high at the outlet and 2.2' high at the inlet, 16.5' wide and 32' long. It has a slope of 1.3%, no plunge and is not a barrier.
5298	0056.00	There is rip-rap and a structure containing 2 logs that is providing shelter and bank protection. A weir at top of unit is helping to scour a pool.
5330	0057.00	There is a plunge measuring 0.9 feet. Both banks are rip-rapped and there is a weir at top of unit providing plunge scour.
5361	0059.00	Culvert #02 located at Old Arcata Road is a newly constructed arch culvert made of metal with a natural bottom. It measures 4' high at the outlet, 17' wide x 60' long, and 5' high at inlet. The slope is less than 2%, there is no plunge and is not a barrier.
5421	0060.00	Tributary #03 is flowing from the left bank with an estimated flow (cfs) measuring considerably less than 1cfs; contributing only 2% of the flow to Rocky Gulch. The temperature upstream as well as downstream of the confluence is 52 degrees Fahrenheit, as is the tributary. While the tributary does appear accessible to fish for the first 50 feet explored, none were observed. The slope was measured to be 2%. The tributary enters Rocky Gulch on the upstream side of Old Arcata Road.
5680	0065.00	Access is provided via Bridge #03, a footbridge constructed of wood measuring 4.5' high x 3.5' wide x 8' long.

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5838	0066.00	There is a plunge measuring 0.6'.
5937	0072.00	There is a fence constructed of hog wire and wood that spans across the creek 3' above the water surface.
6213	0082.00	Access is provided via Culvert #03 which is a metal culvert in good condition with a natural bottom (actual bottom is buried). It measures 4.5' in diameter, 3' high at outlet, and 4.2' high at inlet. It has a <2% slope.
6417	0091.00	There is a hog wire fence across creek. In the last 50 feet there are two cattle exclusion fences.
7093	0105.00	Rip-rap lines both banks for about 150'. Access is provided via Bridge #04, a new concrete and steel bridge for Rocky Creek Road. It measures 8.5' tall x 40' long x and 16' wide.
7201	0107.00	There is a plunge measuring 1.3' over boulder.
7235	0109.00	Tributary #04 is flowing from the left bank with an estimated cubic feet per second (cfs) measuring considerably less than 1cfs; contributing only 5% of the flow to Rocky Gulch. The temperature upstream of the confluence is 50 degrees Fahrenheit; downstream is 52 degrees Fahrenheit and the tributary is 54 degrees Fahrenheit. The tributary does not appear accessible to fish for the first 25 feet explored, none were observed. The slope was measured to be 6%. The mouth of the tributary is blocked with old heavy timbers.
8336	0135.00	Log debris accumulation (LDA) #01 is 7' high x 14' wide x 21' long. It consists of 6 pieces of large woody debris. Water does flow through visible gaps and no sediment is being retained.
8359	0138.00	There is a 1.0' plunge.
8399	0141.00	There is a large stump measuring 11' wide in the creek.
8640	0148.00	Log debris accumulation #02 is 5' high x 20' wide x 3' long. It consists of 5 pieces of large woody debris. Water does flow through visible gaps. The sediment being retained is 12' wide x 100' long x 2' deep and ranges in size from silt to large cobble. It is a possible barrier to adults and juveniles.
8995	0154.00	There is a 3.5' plunge.
9127	0158.00	There is a 2.5' plunge.

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9162	0160.00	There is a rust lined metal culvert. A plunge is at the outlet measuring 0.4' and there is a maximum depth within 5' that measures 1.0'. The slope is 3.8%. This culvert is a possible barrier to adult and juvenile salmonids.
9273	0164.00	There is a 2' road draining plastic culvert on the right bank.
9407	0167.00	There is a 2.2' log plunge. There is a landslide on the left bank measuring 20' long x 20' high.
9789	0180.00	There is a 1.0' log plunge.
9996	0189.00	There is a landslide on the left bank measuring 15' high x 15' long.
10042	0190.00	A 1+ salmonid was observed.
10267	0193.00	Log debris accumulation (LDA) #03 is 6' high x 15' wide x 5' long. It consists of 6 pieces or large woody debris. Water does flow through visible gaps. The sediment being retained is 4' wide x 50' long x 2' deep and ranges in size from silt to small cobble. It is a possible barrier to adult and juvenile salmonids.
10371	0197.00	There is a 1.3' log plunge.
10453	0201.00	There is a 2.3' log plunge.
10474	0203.00	At the top of this unit there is culvert on the right bank with no water flowing through at the inlet. Half of Rocky Gulch's flow, however, is coming from under the culvert. Upstream the creek flow is greatly reduced. This is an old crossing that has blown out and is causing significant subsurface flow. There is a flag for "PWA Site #639".
10766	0210.00	There was a 20-30mm long YOY observed.
10916	0213.00	LDA at this unit retaining sediment and creating subsurface flow.
11235	0227.00	There is a 2.6' log plunge.
11303	0229.00	There is a 4' log plunge.
11314	0230.00	Log debris accumulation (LDA) #04 is 8' high x 30' wide x 14' long. It consists of 8 pieces or large woody debris. Water does flow through visible gaps. The sediment being retained is 10' wide x 60' long x 3' deep and ranges in size from silt to large cobble. Possible end of

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anadromy due to consecutive plunges with inadequate jump pools.  
There is a 2.5' log plunge.

11325	0230.00	End of survey due to plunges and flow constriction at an LDA. A visual observation revealed multiple waterfalls and a sustained greater than 10% slope over 100 feet. No YOY were observed upstream.
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## REFERENCES

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

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### LEVEL III and LEVEL IV HABITAT TYPES

#### RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

#### CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

#### FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

#### MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

#### SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

#### BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

#### ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

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

Stream Name: Rocky Gulch LLID: 1240800408312 Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: ARCATA SOUTH Legal Description: T05NR01ES09 Latitude: 40:49:52.0N Longitude: 124:04:48.0W

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
4	0	CULVERT	1.7	43	172	1.5									
1	0	DRY	0.4	24	24	0.2									
88	11	FLATWATER	38.3	69	6105	53.9	5.8	0.5	0.7	666	58597	411	36171		41
1	0	NOSURVEY	0.4	11	11	0.1									
75	75	POOL	32.6	38	2860	25.3	8.0	0.8	1.4	326	24430	466	34929	189	42
61	12	RIFFLE	26.5	35	2153	19.0	5.3	0.2	0.4	143	8743	29	1761		8
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
230	98				11325					91769			72861		

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

Stream Name: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

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 (%)
50	10	LGR	21.7	33	1661	14.7	5	0.2	0.7	148	7387	29	1460		9	64
11	2	HGR	4.8	45	492	4.3	6	0.3	0.5	121	1333	27	300		3	89
4	1	GLD	1.7	311	1244	11.0	10	0.8	1.3	4180	16720	3344	13376		10	0
48	7	RUN	20.9	46	2185	19.3	5	0.4	0.9	130	6226	67	3202		63	57
36	3	SRN	15.7	74	2676	23.6	6	0.4	1	746	26839	237	8525		2	80
55	55	MCP	23.9	46	2526	22.3	8	0.7	3.4	386	21233	564	31032	207	39	59
2	2	CRP	0.9	49	98	0.9	8	0.6	1.7	465	930	592	1184	277	75	45
2	2	LSL	0.9	12	23	0.2	9	0.6	1.1	104	207	81	163	61	45	92
16	16	PLP	7.0	13	213	1.9	9	1.0	2.4	129	2060	159	2550	133	48	81
1	0	DRY	0.4	24	24	0.2										
4	0	CUL	1.7	43	172	1.5										
1	0	NS	0.4	11	11	0.1										

Total Units  
230

Total Units Fully Measured  
98

Total Length (ft.)  
11325

Total Area (sq.ft.)  
82936

Total Volume (cu.ft.)  
61791

Table 3 - Summary of Pool Types

Stream Name: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

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
55	55	MAIN	73	46	2526	88	7.5	0.7	386	21233	207	11368	39
20	20	SCOUR	27	17	334	12	9.2	0.9	160	3197	140	2808	50
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
75	75				2860					24430		14175	



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

Stream Name: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

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
55	MCP	73	7	13	41	75	5	9	2	4	0	0
2	CRP	3	0	0	2	100	0	0	0	0	0	0
2	LSL	3	1	50	1	50	0	0	0	0	0	0
16	PLP	21	1	6	10	63	5	31	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
75	9	12	54	72	10	13	2	3	0	0

Mean Maximum Residual Pool Depth (ft.): 1.4

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

Stream Name: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Dry Units: 1

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

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
50	10	LGR	0	34	18	0	35	0	0	14	0
11	2	HGR	0	0	0	0	0	0	0	100	0
61	12	TOTAL RIFFLE	0	29	16	0	31	0	0	24	0
4	1	GLD	0	0	0	0	0	100	0	0	0
48	7	RUN	7	11	14	0	54	10	0	4	0
36	3	SRN	20	15	5	0	0	0	0	60	0
88	11	TOTAL FLAT	8	10	12	0	42	19	0	9	0
55	55	MCP	15	17	22	2	21	13	0	10	0
2	2	CRP	0	0	0	0	0	100	0	0	0
2	2	LSL	20	33	48	0	0	0	0	0	0
16	16	PLP	12	17	40	0	0	0	5	26	0
75	75	TOTAL POOL	14	17	27	1	15	11	1	13	0
4	0	CUL									
1	0	NS									
230	98	TOTAL	12	17	24	1	19	11	1	14	0

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

Stream Name: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Dry Units: 1

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

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
50	10	LGR	0	0	60	20	20	0	0
11	2	HGR	0	0	0	50	50	0	0
4	1	GLD	100	0	0	0	0	0	0
48	8	RUN	38	13	50	0	0	0	0
36	3	SRN	0	0	100	0	0	0	0
55	55	MCP	67	9	22	2	0	0	0
2	2	CRP	100	0	0	0	0	0	0
2	2	LSL	50	50	0	0	0	0	0
16	16	PLP	56	38	6	0	0	0	0

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

Stream Name: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
64	26	74	11	99	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: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Survey Length (ft.): 11325

Main Channel (ft.): 11325

Side Channel (ft.): 0

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: E6

Reach Length (ft.): 4614

Riffle/Flatwater Mean Width (ft.): 5.8

BFW:

Range (ft.): 12 to 38

Mean (ft.): 19

Std. Dev.: 10

Base Flow (cfs.): 0.4

Water (F): 58 - 66

Air (F): 59 - 66

Dry Channel (ft): 0

Canopy Density (%): 18.7

Coniferous Component (%): 34.4

Hardwood Component (%): 65.6

Dominant Bank Vegetation: Grass

Vegetative Cover (%): 98.6

Dominant Shelter: Aquatic Vegetation

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 5

LWD per 100 ft.:

Riffles: 0

Pools: 1

Flat: 0

Pools by Stream Length (%): 39.6

Pool Frequency (%): 41.5

Residual Pool Depth (%):

< 2 Feet Deep: 76

2 to 2.9 Feet Deep: 18

3 to 3.9 Feet Deep: 6

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.6

Mean Pool Shelter Rating: 87

Pool Tail Substrate (%): Silt/Clay: 82

Sand: 0

Gravel: 18

Sm Cobble: 0

Lg Cobble: 0

Boulder: 0

Bedrock: 0

Embeddedness Values (%): 1. 0.0

2. 0.0

3. 5.9

4. 17.6

5. 76.5

STREAM REACH: 2

Channel Type: C4

Reach Length (ft.): 2286

Riffle/Flatwater Mean Width (ft.): 5.4

BFW:

Range (ft.): 5 to 15

Mean (ft.): 11

Std. Dev.: 3

Base Flow (cfs.): 0.4

Water (F): 51 - 66

Air (F): 50 - 66

Dry Channel (ft): 0

Canopy Density (%): 61.9

Coniferous Component (%): 9.3

Hardwood Component (%): 90.7

Dominant Bank Vegetation: Hardwood Trees

Vegetative Cover (%): 99.0

Dominant Shelter: Undercut Banks

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 9

LWD per 100 ft.:

Riffles: 1

Pools: 3

Flat: 0

Pools by Stream Length (%): 27.7

Pool Frequency (%): 44.1

Residual Pool Depth (%):

< 2 Feet Deep: 88

2 to 2.9 Feet Deep: 8

3 to 3.9 Feet Deep: 4

>= 4 Feet Deep: 0

Mean Max Residual Pool Depth (ft.): 1.4

Mean Pool Shelter Rating: 24

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

Sand: 0

Gravel: 81

Sm Cobble: 19

Lg Cobble: 0

Boulder: 0

Bedrock: 0

Embeddedness Values (%): 1. 7.7

2. 30.8

3. 23.1

4. 38.5

5. 0.0

### Summary of Fish Habitat Elements By Stream Reach

#### STREAM REACH: 3

Channel Type: G4	Canopy Density (%): 90.7	Pools by Stream Length (%): 8.3
Reach Length (ft.): 3159	Coniferous Component (%): 32.8	Pool Frequency (%): 22.2
Riffle/Flatwater Mean Width (ft.): 6.4	Hardwood Component (%): 67.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 80
Range (ft.): 10 to 15	Vegetative Cover (%): 98.0	2 to 2.9 Feet Deep: 20
Mean (ft.): 13	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.4	Occurrence of LWD (%): 36	Mean Max Residual Pool Depth (ft.): 1.4
Water (F): 48 - 52	Air (F): 46 - 56	Mean Pool Shelter Rating: 40
Dry Channel (ft): 0	LWD per 100 ft.:	
	Riffles: 2	
	Pools: 12	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 5	Sand: 0	Gravel: 70
	Sm Cobble: 15	Lg Cobble: 0
	Boulder: 10	Bedrock: 0
Embeddedness Values (%): 1. 5.0	2. 10.0	3. 10.0
	4. 75.0	5. 0.0

#### STREAM REACH: 4

Channel Type: A3	Canopy Density (%): 90.6	Pools by Stream Length (%): 10.8
Reach Length (ft.): 1266	Coniferous Component (%): 35.0	Pool Frequency (%): 30.0
Riffle/Flatwater Mean Width (ft.): 3.3	Hardwood Component (%): 65.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 92
Range (ft.): 10 to 10	Vegetative Cover (%): 99.5	2 to 2.9 Feet Deep: 8
Mean (ft.): 10	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 0	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.4	Occurrence of LWD (%): 48	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 50 - 50	Air (F): 53 - 54	Mean Pool Shelter Rating: 22
Dry Channel (ft): 24	LWD per 100 ft.:	
	Riffles: 4	
	Pools: 20	
	Flat: 5	
Pool Tail Substrate (%): Silt/Clay: 8	Sand: 8	Gravel: 50
	Sm Cobble: 25	Lg Cobble: 0
	Boulder: 8	Bedrock: 0
Embeddedness Values (%): 1. 0.0	2. 0.0	3. 16.7
	4. 83.3	5. 0.0

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

Stream Name: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

**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	2	1.0
Boulder	6	5	5.7
Cobble / Gravel	10	7	8.8
Sand / Silt / Clay	81	83	84.5

**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	22	26	24.7
Brush	28	20	24.7
Hardwood Trees	43	40	42.8
Coniferous Trees	4	11	7.7
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:**

4

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

StreamName: Rocky Gulch

LLID: 1240800408312

Drainage: Eureka Plain

Survey Dates: 6/9/2008 to 6/11/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES09

Latitude: 40:49:52.0N

Longitude: 124:04:48.0W

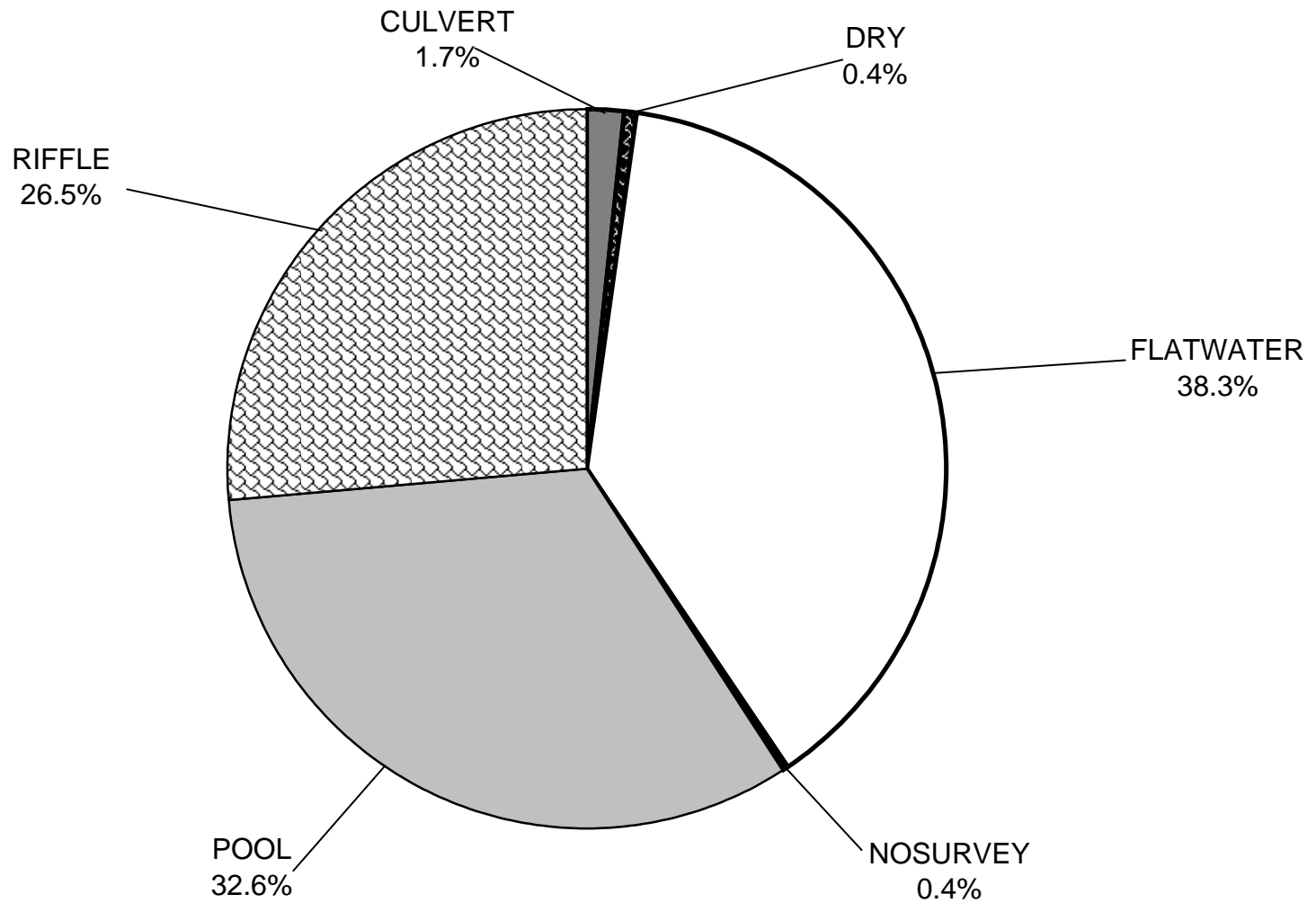
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	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
<hr/>			
UNDERCUT BANKS (%)	0	8	14
SMALL WOODY DEBRIS (%)	29	10	17
LARGE WOODY DEBRIS (%)	16	12	27
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	31	42	15
AQUATIC VEGETATION (%)	0	19	11
WHITEWATER (%)	0	0	1
BOULDERS (%)	24	9	13
BEDROCK LEDGES (%)	0	0	0



# ROCKY GULCH 2008

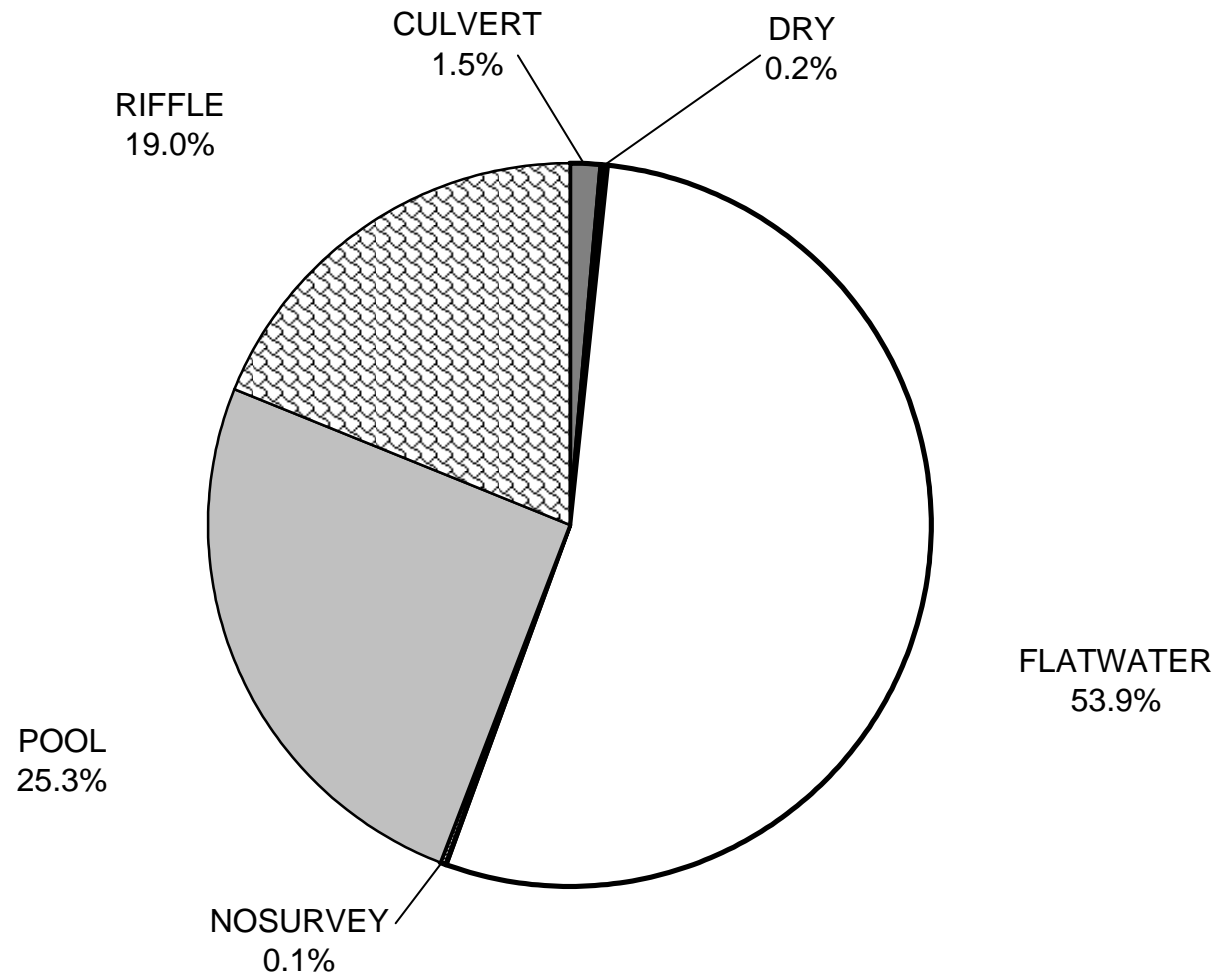
## HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

# ROCKY GULCH 2008

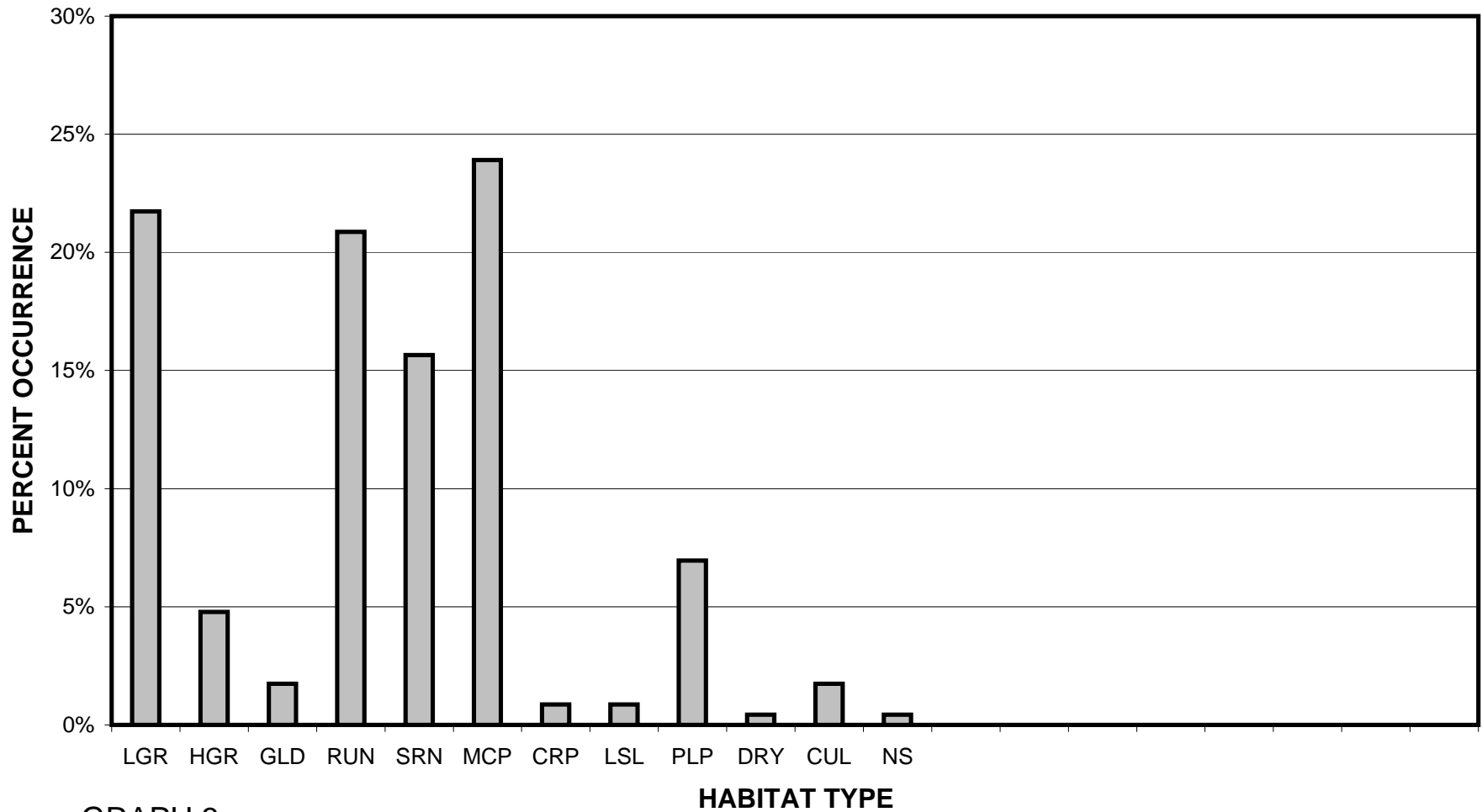
## HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

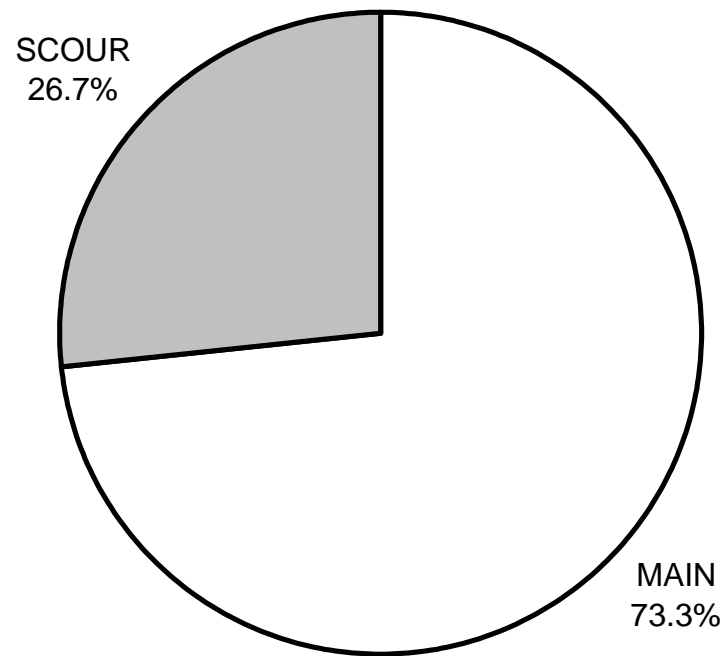
# ROCKY GULCH 2008

## HABITAT TYPES BY PERCENT OCCURRENCE



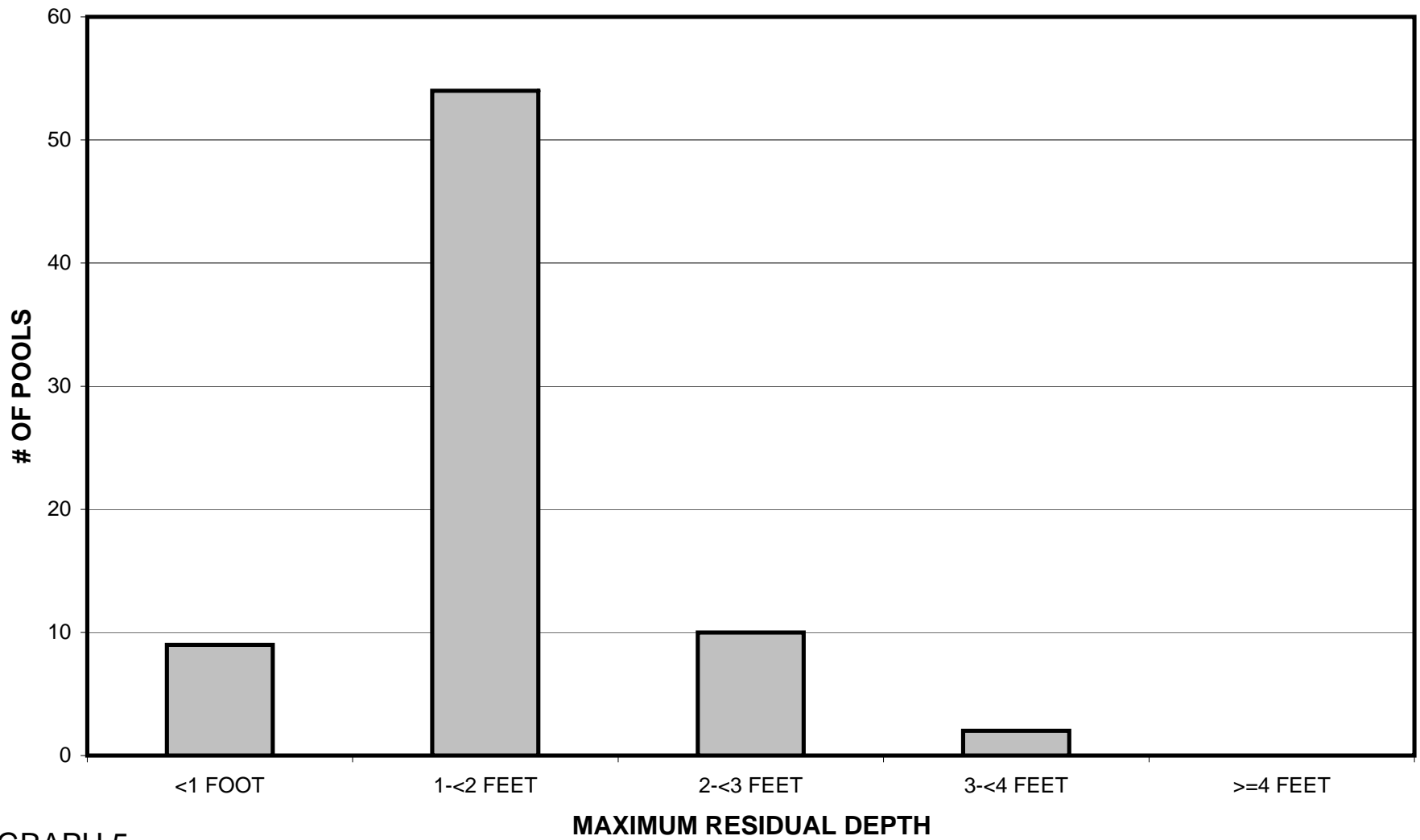
GRAPH 3

**ROCKY GULCH 2008**  
**POOL TYPES BY PERCENT OCCURRENCE**



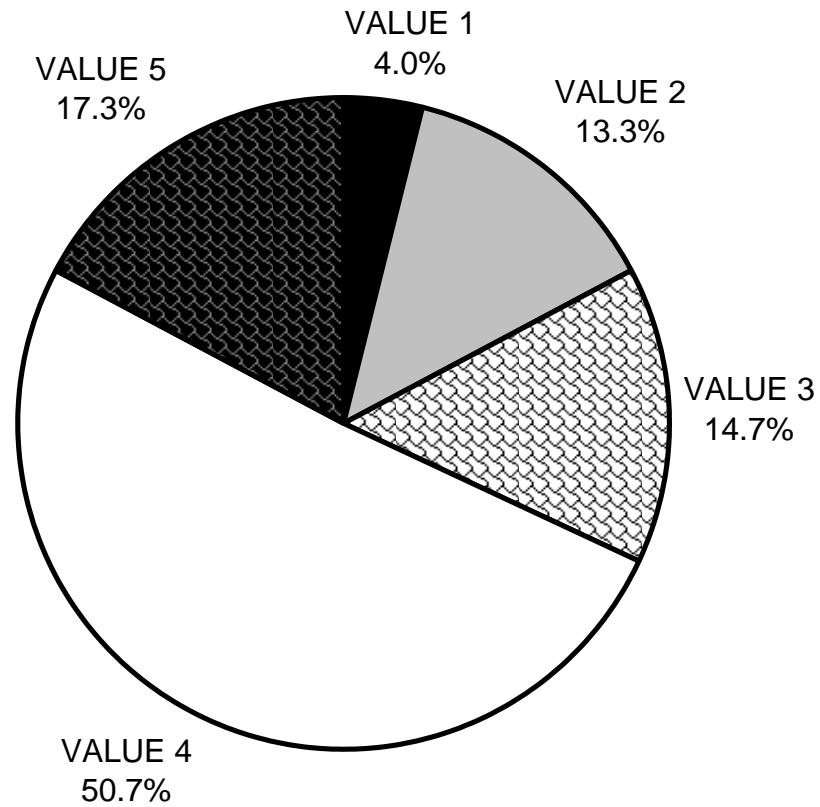
GRAPH 4

# ROCKY GULCH 2008 MAXIMUM DEPTH IN POOLS



GRAPH 5

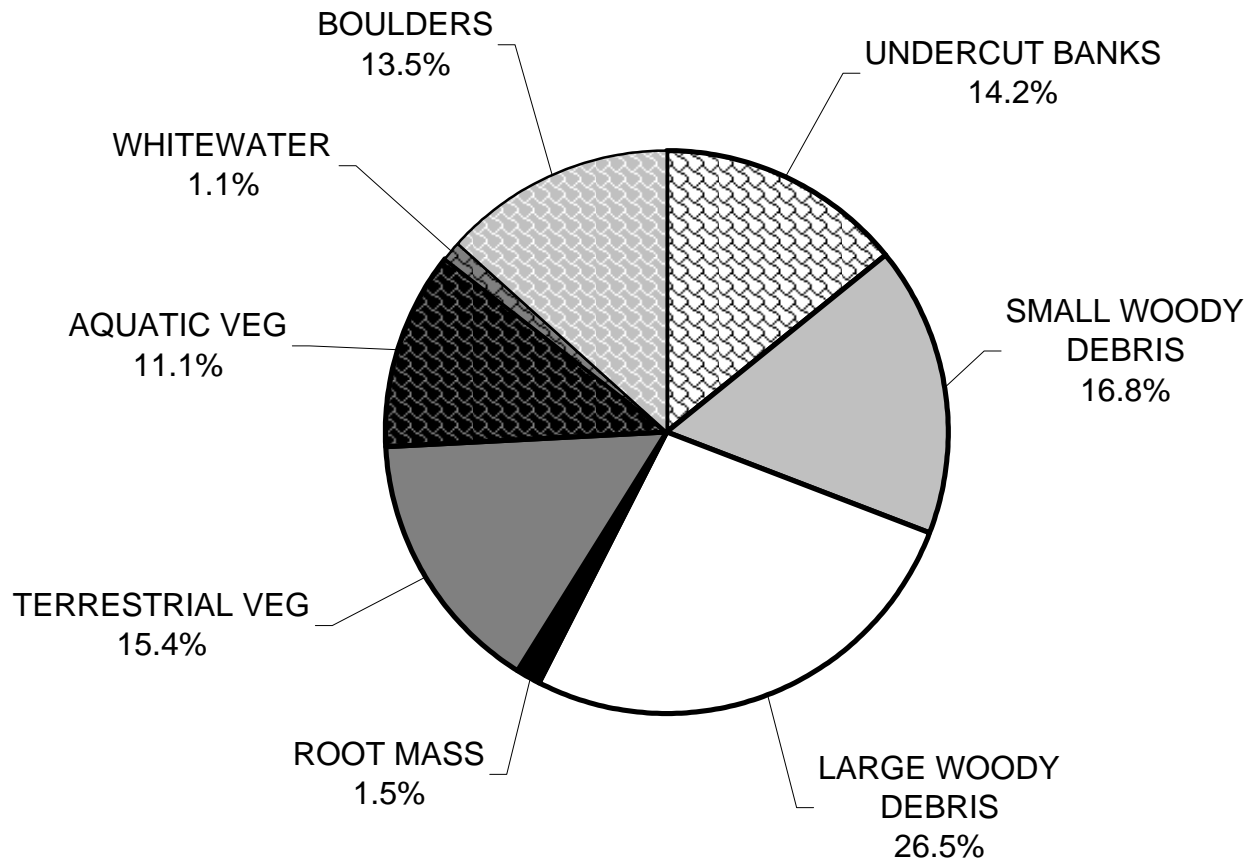
# ROCKY GULCH 2008 PERCENT EMBEDDEDNESS



GRAPH 6

# ROCKY GULCH 2008

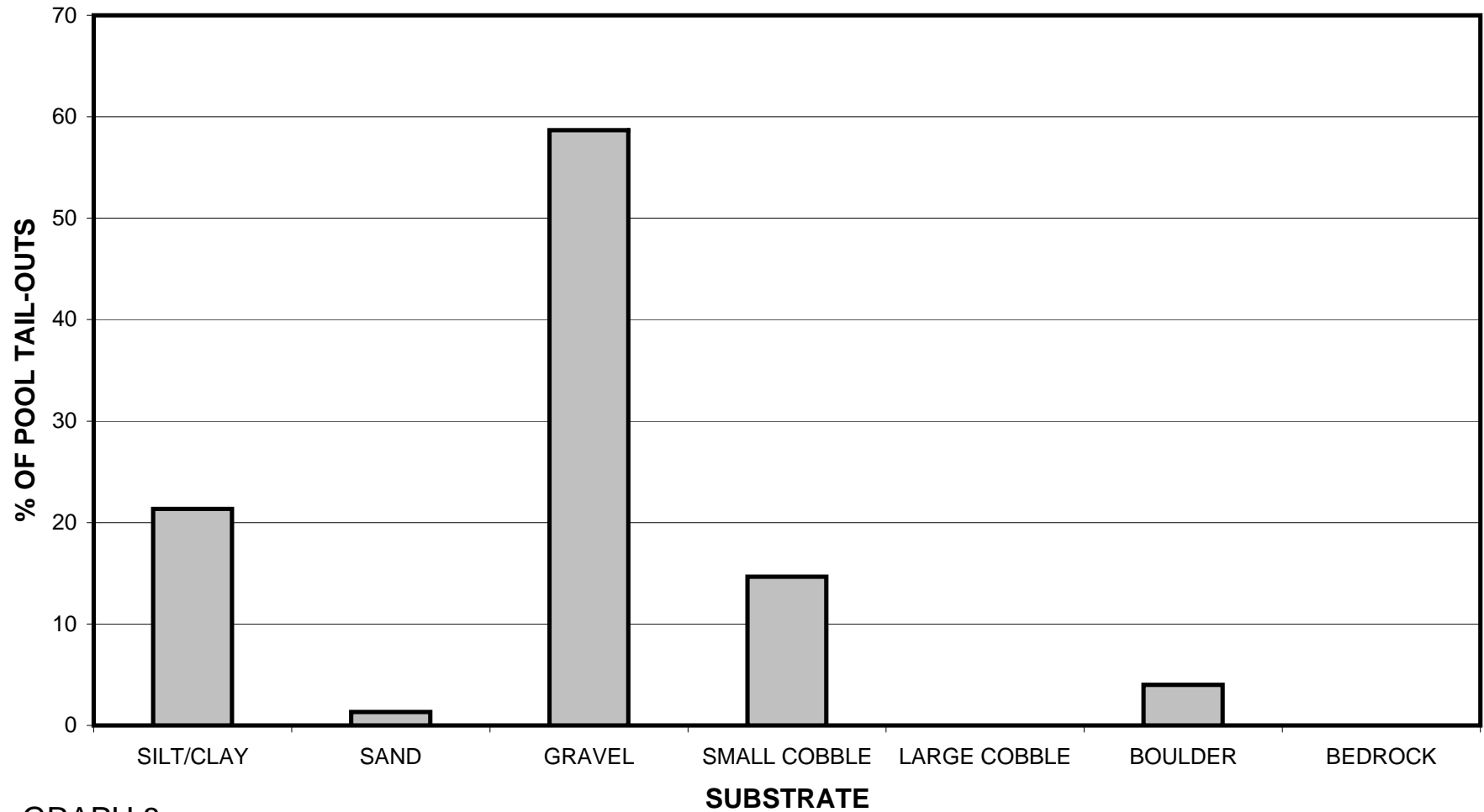
## MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

# ROCKY GULCH 2008

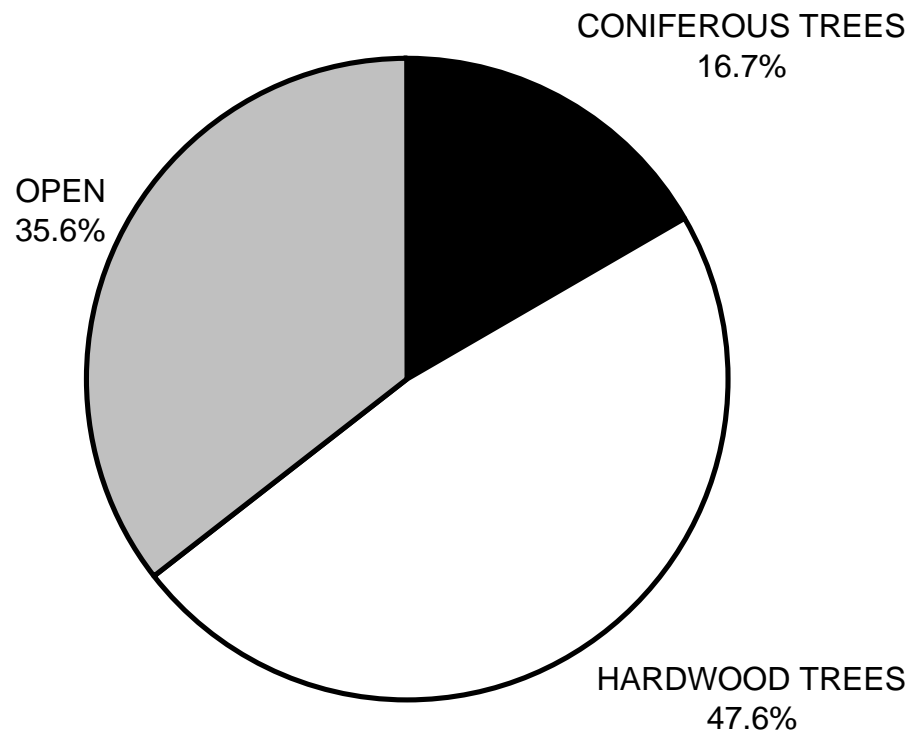
## SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

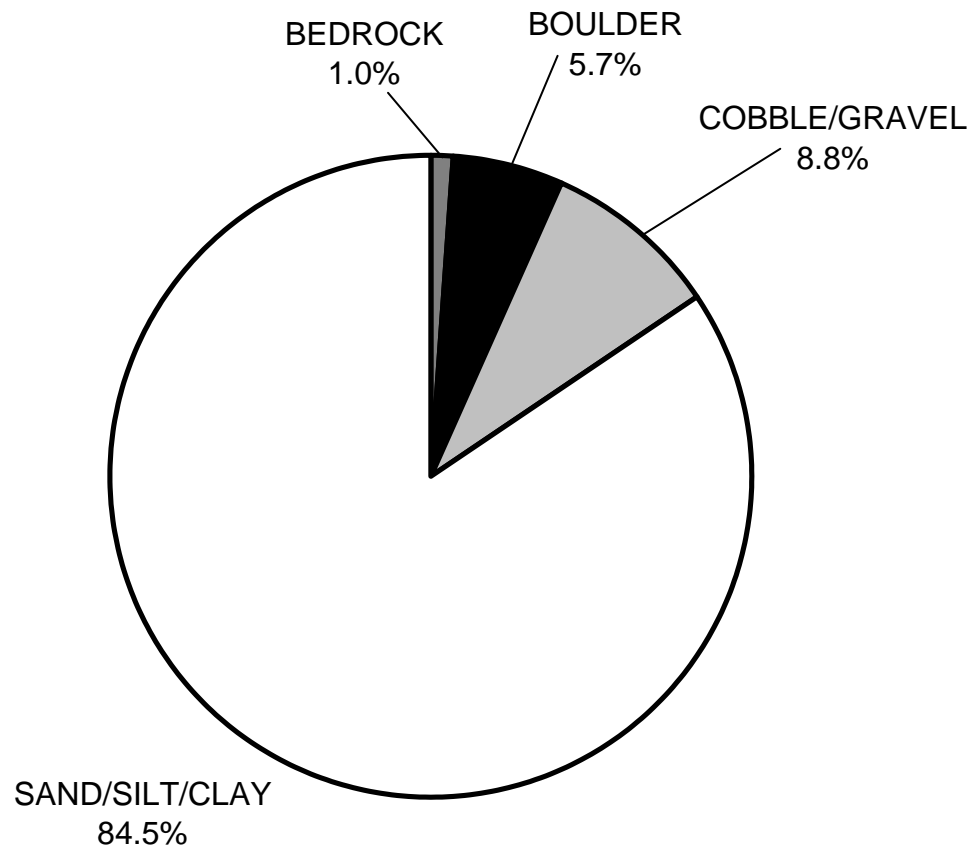


**ROCKY GULCH 2008  
MEAN PERCENT CANOPY**



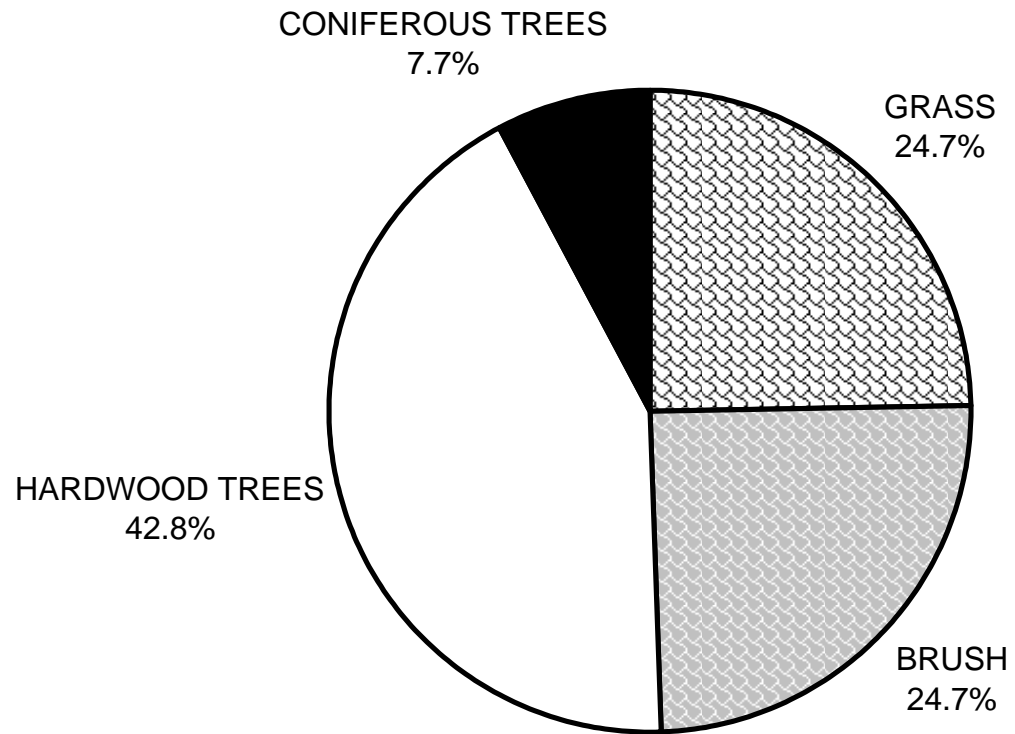
GRAPH 9

**ROCKY GULCH 2008**  
**DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**ROCKY GULCH 2008**  
**DOMINANT BANK VEGETATION IN SURVEY REACH**

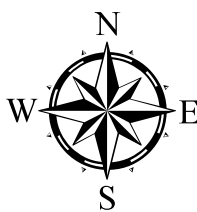
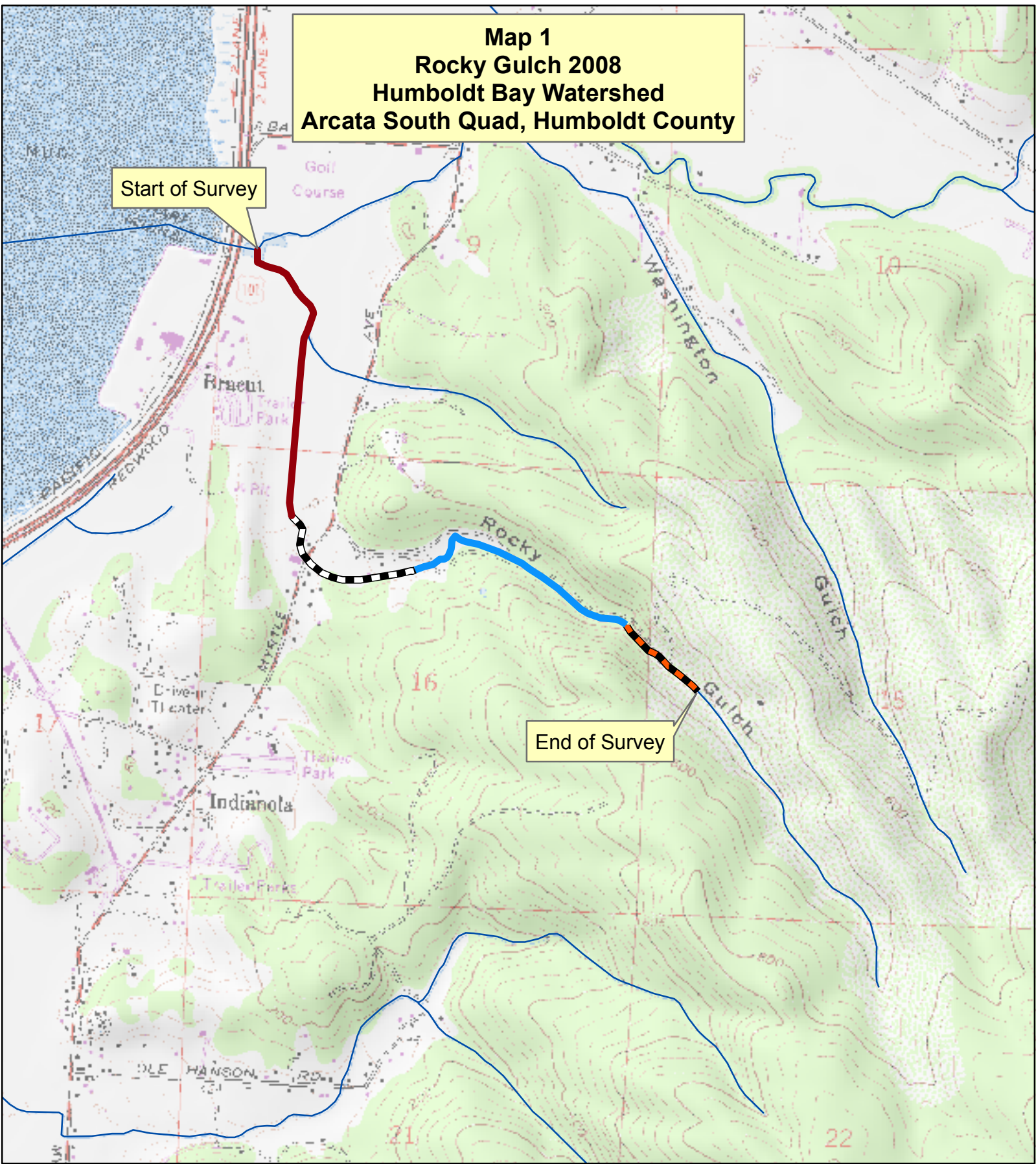


GRAPH 11

**Map 1**  
**Rocky Gulch 2008**  
**Humboldt Bay Watershed**  
**Arcata South Quad, Humboldt County**

Start of Survey

End of Survey



**Legend**

- Reach 1, E6 Channel Type
- Reach 2, C4 Channel Type
- Reach 3, G4 Channel Type
- Reach 4, A3 Channel Type

0 640 1,280 Feet

