

# STREAM INVENTORY REPORT

## Roller Gulch

### INTRODUCTION

A stream inventory was conducted on August 30, 2011 on Roller Gulch. The survey began at the confluence with Ray Gulch and extended upstream 0.5 miles.

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

Roller Gulch is a tributary to Ray Gulch, tributary to Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Roller Gulch's legal description at the confluence with Ray Gulch is T15N R16W S08. Its location is 39.1729 degrees north latitude and 123.6530 degrees west longitude, LLID number 1236519391729. Roller Gulch is a first order stream and has approximately 0.5 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Roller Gulch drains a watershed of approximately 0.9 square miles. Elevations range from about 55 feet at the mouth of the creek to 550 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 128.

### METHODS

The habitat inventory conducted in Roller Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The survey crew 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.

## Roller Gulch

### 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 Roller 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". Roller 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 Roller 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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

## Roller Gulch

### 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. In Roller 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. Next, 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. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Roller 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 Roller Gulch, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

### 10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

### 11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy

## **Roller Gulch**

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 Roller Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

### HABITAT INVENTORY RESULTS

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

The habitat inventory of August 30, 2011 was conducted by I. Mikus and M. Groff (DFG). The total length of the stream surveyed was 2,542 feet. The first 1,830 feet of Roller Gulch were not

## Roller Gulch

surveyable due to the large marsh at the confluence of Roller Gulch and Ray Gulch. The data included in this report are for the 712 feet actually surveyed.

Stream flow was not measured on Roller Gulch.

The first 1,830 feet of Roller Gulch is a marsh therefore it was not surveyed (Reach 1). Roller Gulch is a C4 channel type for the remaining 712 feet of the stream surveyed (Reach 2). C4 channels are meandering point-bar, riffle/pool, alluvial channels with broad well defined floodplain on low gradients and gravel-dominant substrates.

The water temperature taken during the survey period was 55 degrees Fahrenheit. Air temperatures ranged from 58 to 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% pool units, 30% flatwater units, 20% dry units, and 17% riffle units (Graph 1). Based on total length of Level II habitat types there were 43% flatwater units, 32% pool units, 18% dry units, and 7% riffle units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 30%; dry units, 20%; step run units, 17%; and low gradient riffle units, 17% (Graph 3). Based on percent total length, step run units made up 31%, mid-channel pool units 31%, and dry units 18%.

A total of 10 pools were identified (Table 3). Main channel pools were the most frequently encountered at 90% (Graph 4), and comprised 96% 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. Four of the 10 pools (40%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 10 pool tail-outs measured, 6 had a value of 1 (60%); 4 had a value of 2 (40%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 10, and pool habitats had a mean shelter rating of 15 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 17. Scour pools had a mean shelter rating of 0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial vegetation is the dominant cover type in Roller Gulch. Graph 7 describes the pool cover in Roller Gulch. Small woody debris is the dominant pool cover type followed by undercut banks.

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 100% of the pool tail-outs.

## **Roller Gulch**

The mean percent canopy density for the surveyed length of Roller Gulch was 92%. Eight percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 32% and 68%, respectively. Graph 9 describes the mean percent canopy in Roller Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 100% sand/silt/clay (Graph 10). Brush was the dominant vegetation type observed in 75% of the units surveyed. Additionally, 21% of the units surveyed had coniferous trees as the dominant vegetation type, and 4% had deciduous trees as the dominant vegetation type (Graph 11).

## DISCUSSION

The first 1,830 feet of Roller Gulch is a marsh therefore it was not surveyed. Roller Gulch is a C4 channel type for the remaining 712 feet that were actually surveyed. The suitability of C4 channel types for fish habitat improvement structures is as follows: C4 channels are good for bank placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperature recorded on the survey day August 30, 2011 was 55 degrees Fahrenheit. Air temperatures ranged from 58 to 62 degrees Fahrenheit. This is a suitable water temperature range for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 43% of the surveyed length of this stream, riffles 7%, and pools 32%. Four of the 10 (40%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

All of the 10 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. None 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.

All of the 10 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools is 15. The shelter rating in the flatwater habitats is 10. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by terrestrial vegetation in Roller Gulch. Small woody debris is the dominant cover type in pools followed by undercut banks. 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.

## Roller Gulch

The mean percent canopy density for the length of stream surveyed (Reach 2) was 92%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 100% and 100%, 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) Roller 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.

### COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey. The first 1,830 feet of Roller Gulch were not surveyable due to the large marsh surrounding the confluence with Ray Gulch. This unsurveyed length constitutes Reach 1.
1830	0002.00	Start of data collection. The channel is a C4 (Reach 2).
2303	0024.00	Log debris accumulation #01 contains two pieces of large woody debris and measures 3' high x 19' wide x 2' long. Water does not flow through the LDA; the stream is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 8' wide x 30' long x 2' deep. It is a possible barrier to juvenile and adult salmonids.
2312	0025.00	There is a possible rootwad plunge barrier. It is currently dry above and below.
2532	0031.00	End of survey. Above the end of survey point there is a 500' long dry section. Approximately 50' downstream of a dry left bank tributary there is a section with flow that continues for approximately 300'; it has one pool and the rest is shallow step-runs. Above the wet section, the creek gains gradient and goes dry.

## **Roller Gulch**

### 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.



## Roller Gulch

### 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: Roller Gulch

LLID: 1236519391729 Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08 Latitude: 39:10:22.0N Longitude: 123:39:07.0

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
6	0	DRY	20.0	21	126	17.7									
9	3	FLATWATER	30.0	34	306	43.0	2.5	0.3	0.7	68	609	27	239		10
1	0	NOSURVEY_		1830	1830										
10	10	POOL	33.3	23	228	32.0	6.7	1.0	1.7	151	1511	174	1739	158	15
5	1	RIFFLE	16.7	10	52	7.3	1.5	0.1	0.1	18	88	1	4		0
<b>Total Units</b>	<b>Total Units Fully Measured</b>				<b>Total Length (ft.)</b>					<b>Total Area (sq.ft.)</b>			<b>Total Volume (cu.ft.)</b>		
31	14				2542					2208			1982		

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

Stream Name: Roller Gulch

LLID: 1236519391729

Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08

Latitude: 39:10:22.0N

Longitude: 123:39:07.0W

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 (%)
5	1	LGR	16.7	10	52	7.3	2	0.1	0.1	18	88	1	4		0	73
4	2	RUN	13.3	22	87	12.2	3	0.4	0.8	68	273	30	120		5	92
5	1	SRN	16.7	44	219	30.8	2	0.3	0.7	67	333	20	100		20	97
9	9	MCP	30.0	24	218	30.6	7	1.0	2.5	160	1441	180	1620	163	17	93
1	1	PLP	3.3	10	10	1.4	7	1.7	2.4	70	70	119	119	119	0	98
6	0	DRY	20.0	21	126	17.7										
1	0	MAR		1830	1830											

Total Units  
31

Total Units Fully Measured  
14

Total Length (ft.)  
2542

Total Area (sq.ft.)  
2204

Total Volume (cu.ft.)  
1963

**Table 3 - Summary of Pool Types**

Stream Name: Roller Gulch

LLID: 1236519391729

Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08

Latitude: 39:10:22.0N

Longitude: 123:39:07.0W

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
9	9	MAIN	90	24	218	96	6.7	1.0	160	1441	163	1463	17
1	1	SCOUR	10	10	10	4	7.0	1.7	70	70	119	119	0

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
10	10	228	1511	1582

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

Stream Name: Roller Gulch LLID: 1236519391729 Drainage: Navarro River  
 Survey Dates: 8/30/2011 to 8/30/2011  
 Confluence Location: Quad: ELK Legal Description: T15NR16WS08 Latitude: 39:10:22.0N Longitude: 123:39:07.0W

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
9	MCP	90	2	22	4	44	3	33	0	0	0	0
1	PLP	10	0	0	0	0	1	100	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
10	2	20	4	40	4	40	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.7

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

Stream Name: Roller Gulch

LLID: 1236519391729

Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Dry Units: 6

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08

Latitude: 39:10:22.0N

Longitude: 123:39:07.0W

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
5	1	LGR	0	0	0	0	0	0	0	0	0
5	1	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
4	2	RUN	0	10	0	0	90	0	0	0	0
5	1	SRN	0	20	80	0	0	0	0	0	0
9	3	TOTAL FLAT	0	15	40	0	45	0	0	0	0
9	9	MCP	29	34	9	0	28	0	0	0	0
1	1	PLP	0	0	0	0	0	0	0	0	0
10	10	TOTAL POOL	29	34	9	0	28	0	0	0	0
1	0	MAR									
31	14	TOTAL	24	30	15	0	31	0	0	0	0

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

Stream Name: Roller Gulch

LLID: 1236519391729

Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Dry Units: 6

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08

Latitude: 39:10:22.0N

Longitude: 123:39:07.0W

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
5	1	LGR	0	0	100	0	0	0	0
4	2	RUN	50	0	50	0	0	0	0
5	1	SRN	0	0	100	0	0	0	0
9	9	MCP	22	0	78	0	0	0	0
1	1	PLP	100	0	0	0	0	0	0

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

Stream Name: Roller Gulch

LLID: 1236519391729

Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08

Latitude: 39:10:22.0N

Longitude: 123:39:07.0W

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Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
92	68	32	0	100	100

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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 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: Roller Gulch

LLID: 1236519391729

Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08

Latitude: 39:10:22.0N

Longitude: 123:39:07.0W

**Mean Percentage of Dominant Stream Bank Substrate**

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	14	14	100.0

**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	11	10	75.0
Hardwood Trees	0	1	3.6
Coniferous Trees	3	3	21.4
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:** 1

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

StreamName: Roller Gulch

LLID: 1236519391729

Drainage: Navarro River

Survey Dates: 8/30/2011 to 8/30/2011

Confluence Location: Quad: ELK

Legal Description: T15NR16WS08

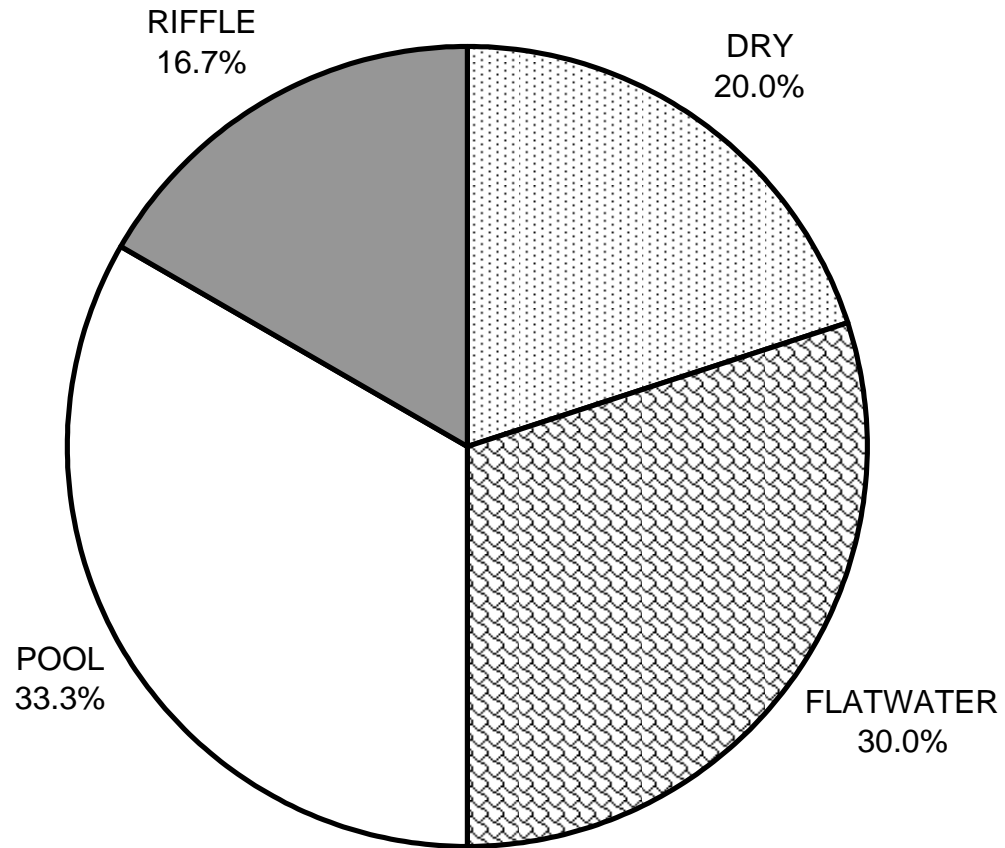
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Longitude: 123:39:07.0W

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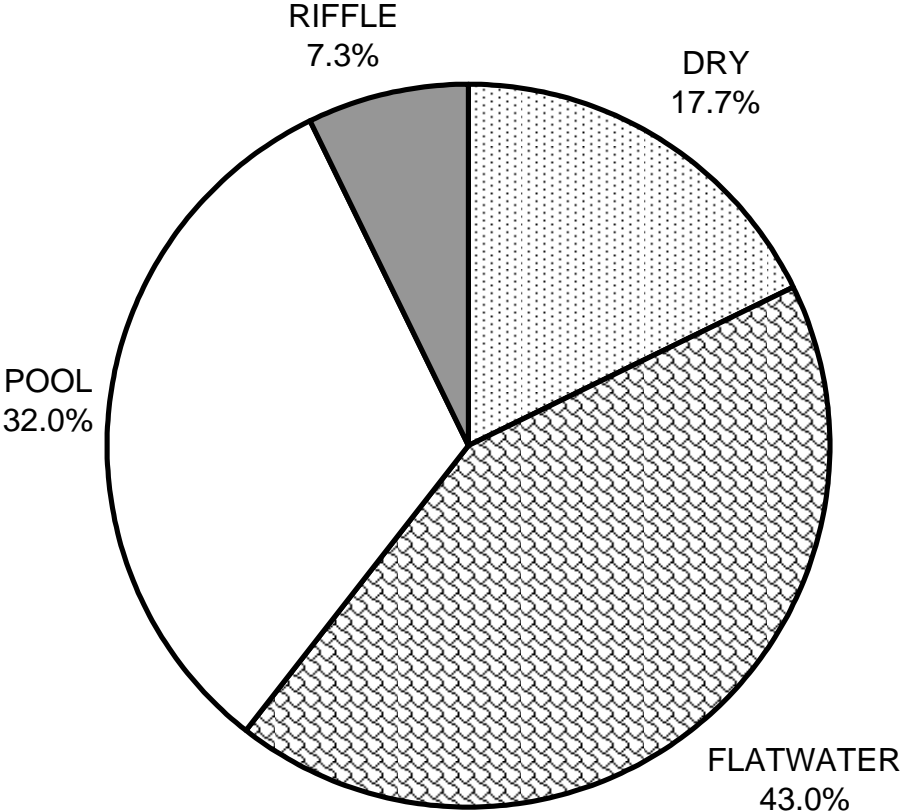
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	0	29
SMALL WOODY DEBRIS (%)	0	15	34
LARGE WOODY DEBRIS (%)	0	40	9
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	0	45	28
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	0
BEDROCK LEDGES (%)	0	0	0

# ROLLER GULCH 2011 HABITAT TYPES BY PERCENT OCCURRENCE



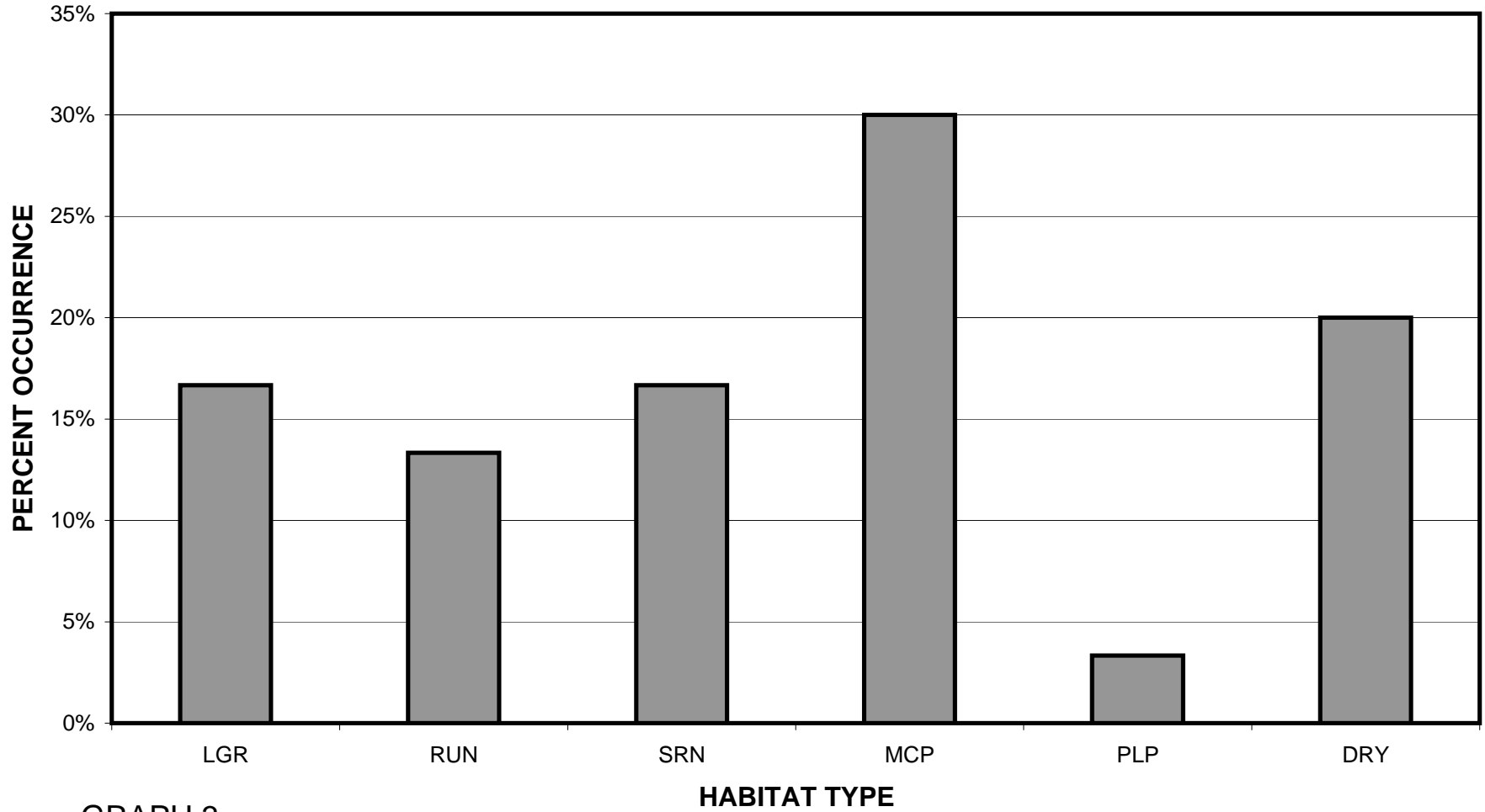
GRAPH 1

**ROLLER GULCH 2011  
HABITAT TYPES BY PERCENT TOTAL LENGTH**



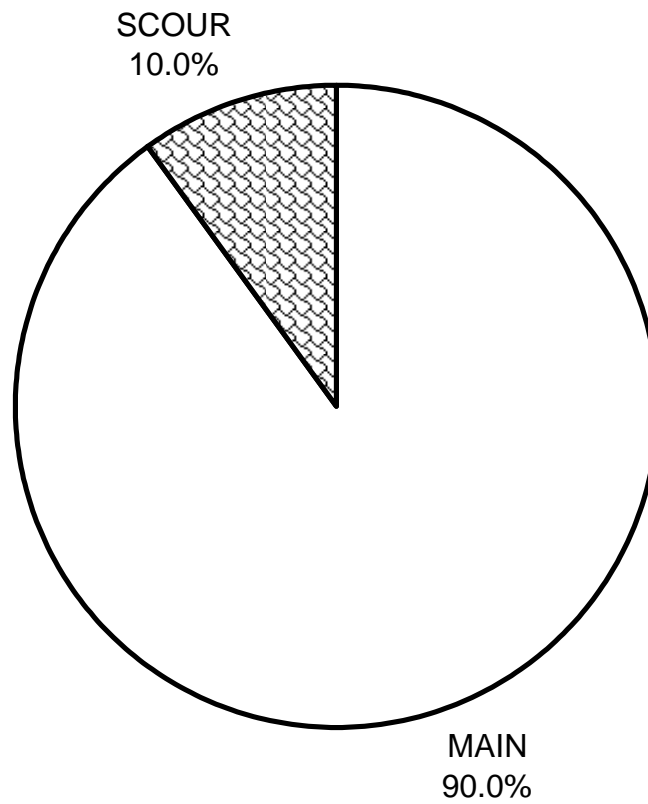
GRAPH 2

# ROLLER GULCH 2011 HABITAT TYPES BY PERCENT OCCURRENCE



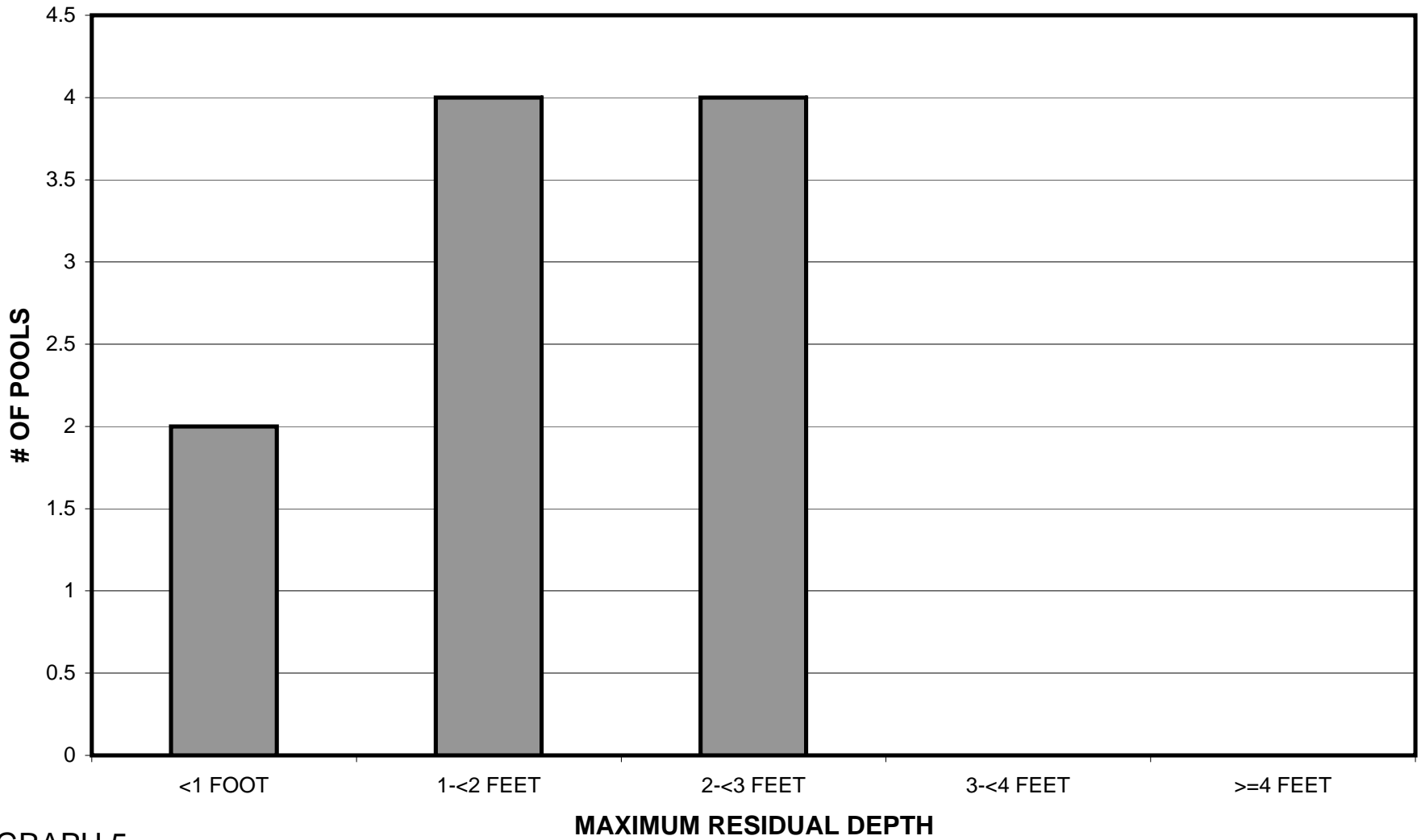
GRAPH 3

# ROLLER GULCH 2011 POOL TYPES BY PERCENT OCCURRENCE



GRAPH 4

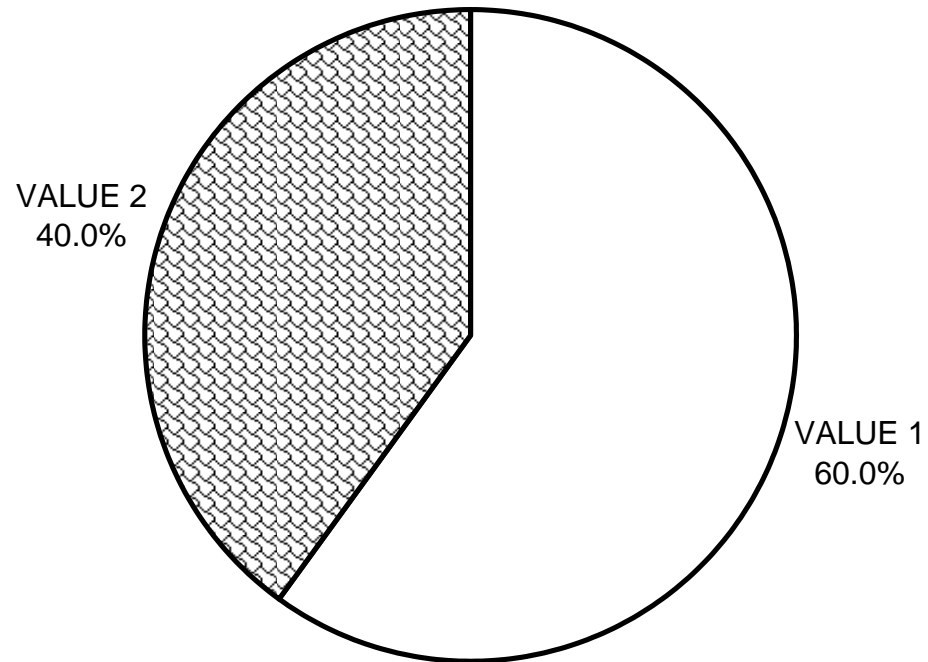
# ROLLER GULCH 2011 MAXIMUM DEPTH IN POOLS



GRAPH 5

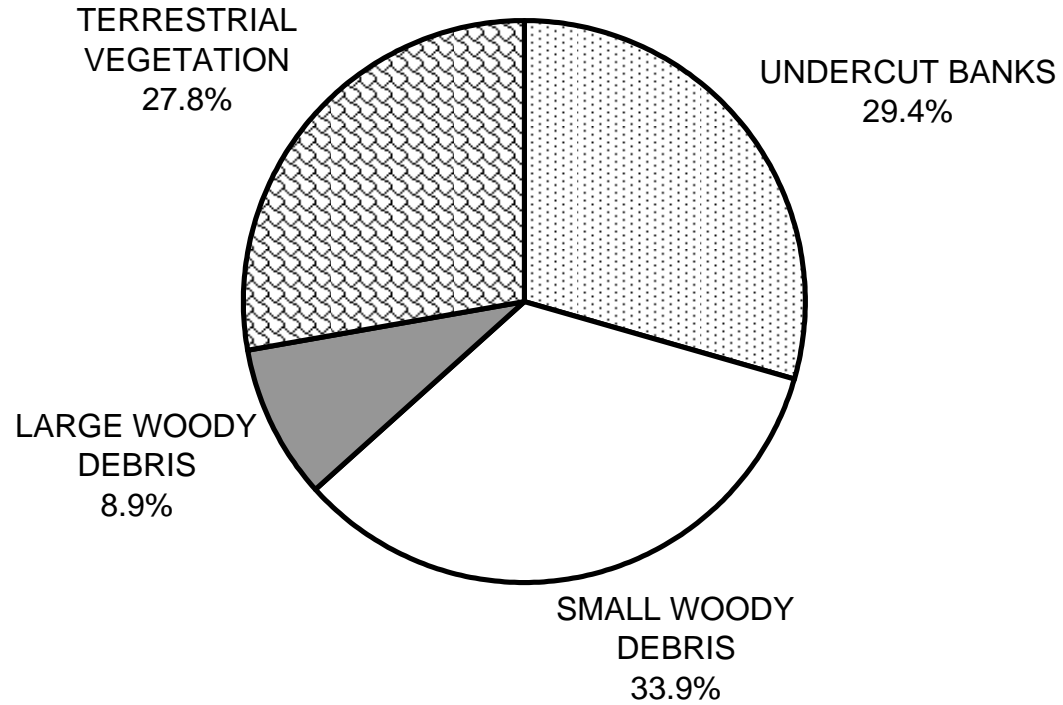


# ROLLER GULCH 2011 PERCENT EMBEDDEDNESS



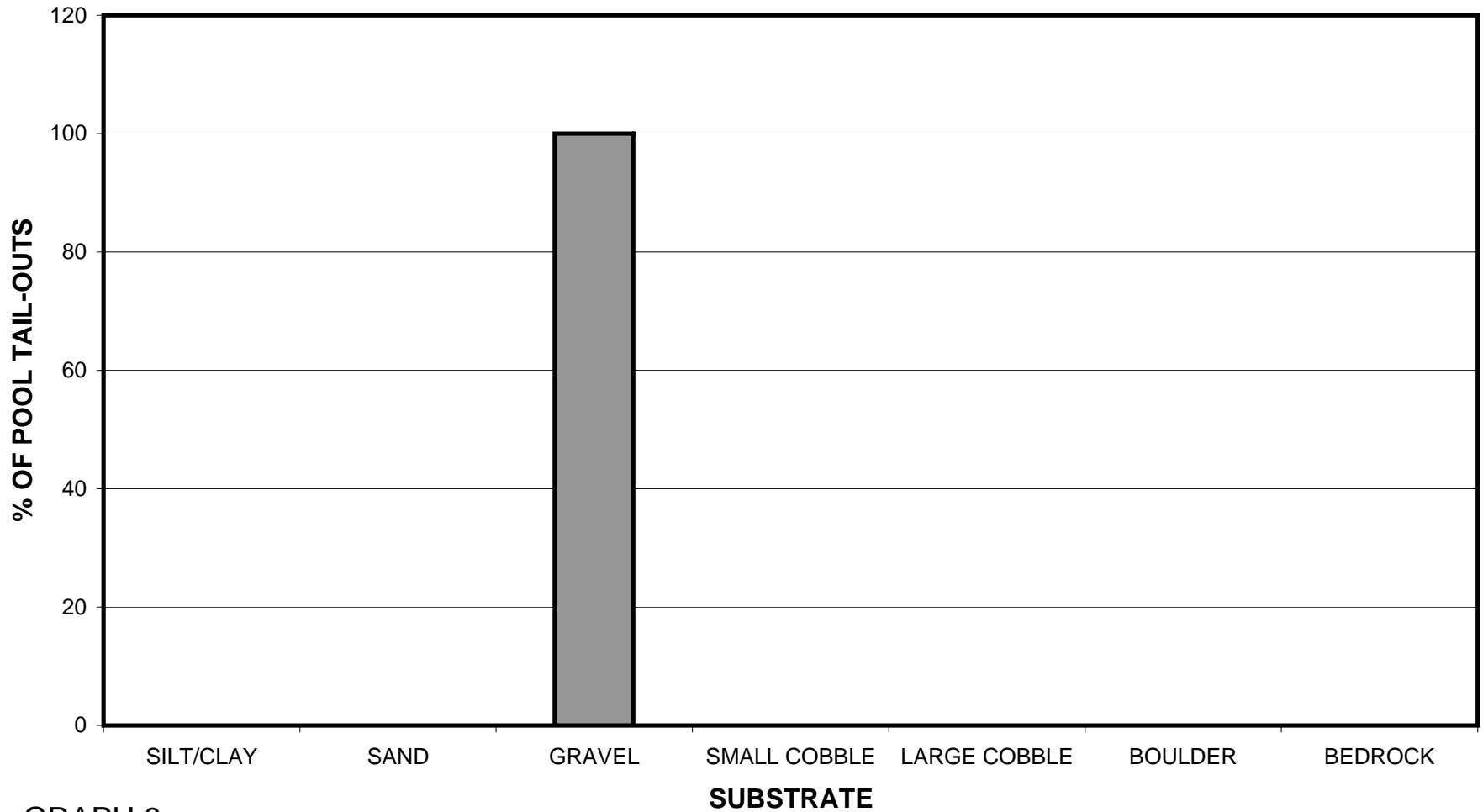
GRAPH 6

# ROLLER GULCH 2011 MEAN PERCENT COVER TYPES IN POOLS



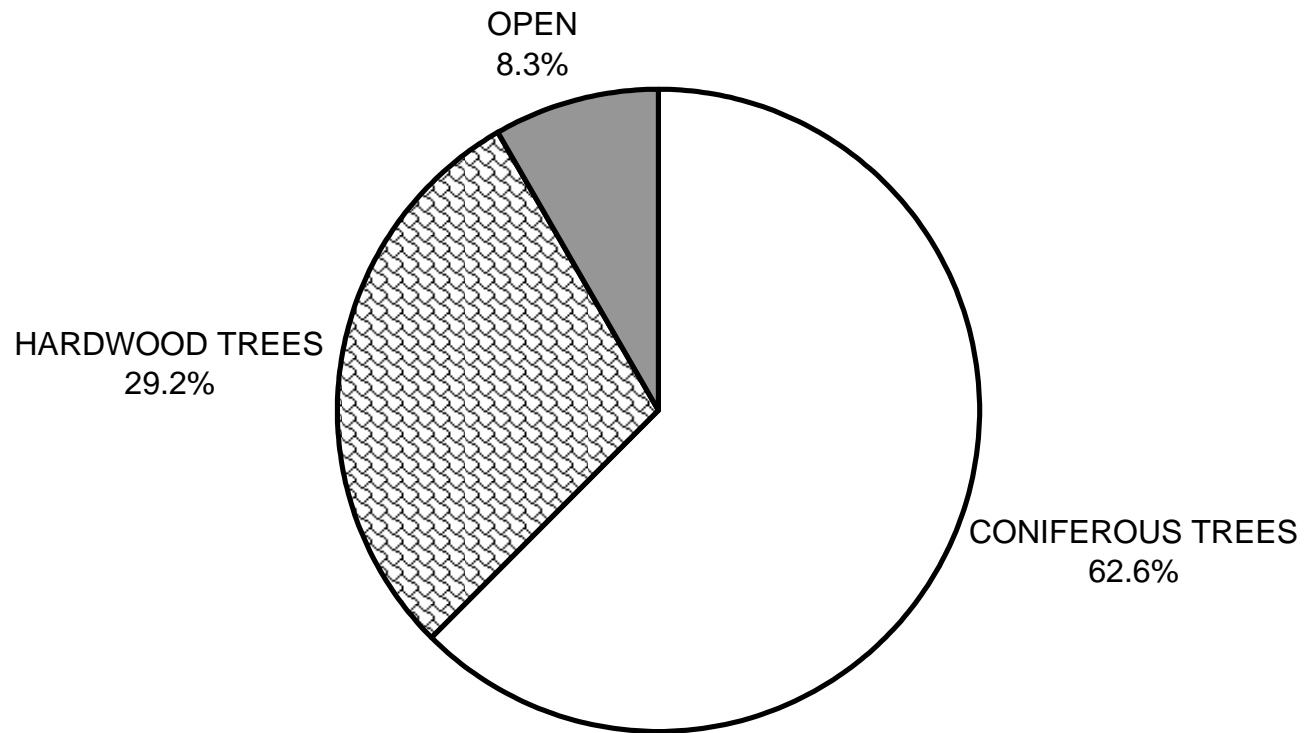
GRAPH 7

# ROLLER GULCH 2011 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



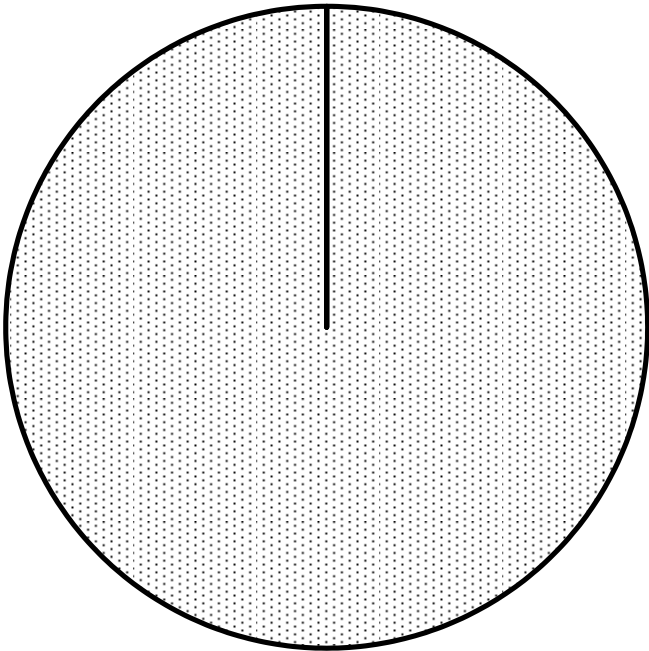
GRAPH 8

# ROLLER GULCH 2011 MEAN PERCENT CANOPY



GRAPH 9

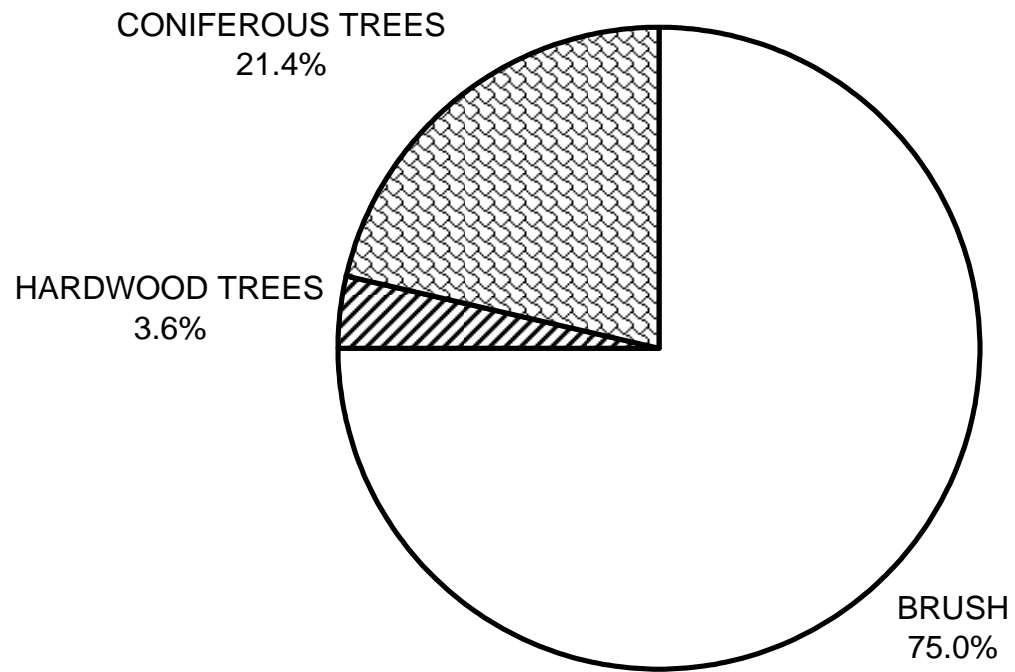
**ROLLER GULCH 2011  
DOMINANT BANK COMPOSITION IN SURVEY REACH**



SAND/SILT/CLAY  
100.0%

GRAPH 10

# ROLLER GULCH 2011 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

