

STREAM INVENTORY REPORT

Morrison Gulch

INTRODUCTION

A stream inventory was conducted from July 17 to July 29, 2008 on Morrison Gulch. The survey began at the confluence with Jacoby Creek and extended upstream 1.0 mile.

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

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Morrison Gulch is a tributary to Jacoby Creek, tributary to Arcata Bay, tributary to Mad River Slough, which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Morrison Gulch's legal description at the confluence with Jacoby Creek is T05N R01E S11. Its location is 40.8247° north latitude and 124.0363° west longitude, LLID number 1240364408247. Morrison Gulch is a first order stream and has approximately 1.3 miles of blue line stream according to the USGS Arcata South 7.5 minute quadrangle. Morrison Gulch drains a watershed of approximately 1.0 square mile. Elevations range from about 76 feet at the mouth of the creek to 900 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via South Quarry Road off of Jacoby Creek Road in Bayside.

METHODS

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

Morrison 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 Morrison 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". Morrison 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 Morrison 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.

Morrison 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. 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 Morrison 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Morrison 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 Morrison 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.

Morrison Gulch

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Detailed biological sampling (electrofishing and/or underwater observation) was not conducted on Morrison Gulch during the 2008 survey season. Fish presence was observed from the stream banks in Morrison Gulch. Bank observation techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

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

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

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

Morrison Gulch

- 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 July 17 to July 29, 2008 was conducted by M. Westersund and B. Leonard (WSP). The total length of the stream surveyed was 5,216 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.12 cfs on August 30, 2008.

Morrison Gulch is an E4 channel type for 5,216 feet of the stream surveyed (Reach 1). E4 channels are low gradient, meandering riffle/pool streams with low width/depth ratios and little deposition. They are very efficient and stable with a high meander width ratio and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 48 to 57 degrees Fahrenheit. Air temperatures ranged from 49 to 62 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% pool units, 36% flatwater units, 22% riffle units, 2% dry units, and 1% no survey units (Graph 1). Based on total length of Level II habitat types there were 52% flatwater units, 32% pool units, 13% riffle units, and 2% dry units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 39%; run units, 27%; and low gradient riffle units, 18% (Graph 3). Based on percent total length, run units made up 35%, mid-channel pool units 31%, and step run units 18%.

A total of 80 pools were identified (Table 3). Main channel pools were the most frequently encountered at 98% (Graph 4), and comprised 97% 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. Eleven of the 80 pools (14%) had a residual depth of two feet or greater (Graph 5).

Morrison Gulch

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 80 pool tail-outs measured, 51 had a value of 1 (64%); 17 had a value of 2 (21%); 4 had a value of 3 (5%); and 8 had a value of 5 (10%) (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 5, flatwater habitat types had a mean shelter rating of 2, and pool habitats had a mean shelter rating of 14 (Table 1). Of the pool types, scour pools had the highest mean shelter rating at 28. Main channel pools had a mean shelter rating of 14 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Morrison Gulch. Graph 7 describes the pool cover in Morrison Gulch. Large 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 72% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 12% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Morrison Gulch was 94%. Six percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 71% and 29%, respectively. Graph 9 describes the mean percent canopy in Morrison Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 89%. The mean percent left bank vegetated was 89%. The dominant elements composing the structure of the stream banks consisted of 87% sand/silt/clay, 6% cobble/gravel, 4% bedrock, and 3% boulder (Graph 10). Hardwood trees were the dominant vegetation type observed in 60.5% of the units surveyed. Additionally, 25.8% of the units surveyed had brush as the dominant vegetation type, and 13.7% had coniferous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Salmonids were observed from the stream banks during the survey.

DISCUSSION

Morrison Gulch is an E4 channel type for 5,216 feet of the stream surveyed (Reach 1). The suitability of E4 channel types for fish habitat improvement structures is as follows: E4 channel types are good for bank-placed boulders and fair for opposing wing-deflectors.

Morrison Gulch

The water temperatures recorded on the survey days July 17 to July 29, 2008, ranged from 48 to 57 degrees Fahrenheit. Air temperatures ranged from 49 to 62 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 52% of the total length of this survey, riffles 13%, and pools 32%. Eleven of the 80 (14%) 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. Installing structures that will increase or deepen pool habitat is recommended.

Sixty-eight of the 80 pool tail-outs measured had embeddedness ratings of 1 or 2. Four 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.

Sixty-eight of the 80 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 14. The shelter rating in the flatwater habitats was 2. 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 Morrison Gulch. Large woody debris is the dominant cover type in pools followed by undercut banks.

The mean percent canopy density for the stream was 94%. The percentage of right and left bank covered with vegetation was 89% and 89%, respectively.

RECOMMENDATIONS

- 1) Morrison 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.
- 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 large wood but the shelter rating is below the target value. Adding high quality complexity with woody cover in the pools is desirable.

Morrison Gulch

COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at confluence with Jacoby Creek.
389	0012.00	The creek flows subsurface in this unit.
700	0019.00	There is a boulder weir.
719	0020.00	There is a boulder structure.
738	0021.00	There is a boulder structure.
807	0023.00	Entire unit is a culvert.
1162	0033.00	There is a culvert at the top of the unit. Tributary #01, located on the left bank, contributes 1% of the downstream flow to Morrison Gulch. The temperature downstream of the confluence was 55 degrees Fahrenheit, the temperature of the tributary was 50 degrees Fahrenheit, and the temperature upstream of the confluence was 55 degrees Fahrenheit. The slope of the tributary was 3% and does not appear to be accessible to fish. No fish were observed in the 100' explored.
2383	0081.00	Tributary #02, located on the right bank, contributes to ~1% of Morrison Gulch's flow. The temperature of Morrison Gulch upstream and downstream of the tributary was 50 degrees Fahrenheit. The temperature of the tributary was 54 degrees Fahrenheit. The slope of the tributary was 4%, the tributary is not accessible to fish at the current flow and no fish were observed in the tributary.
3023	0109.00	There is a culvert 16' into unit. The culvert is 46' long.
3215	0113.00	Log debris accumulation (LDA) #01 contains 1 piece of large woody debris (LWD) and measures 3' high x 7' wide x 2' long with water flowing through and no visible gaps. Sediment retention ranges from sand to gravel and measures 5' wide x 3' long x 1' deep. Fish were observed above the barrier.
3256	0115.00	There is a bedrock waterfall with a 2' high jump.
3279	0117.00	There is a two foot drop at the top of this unit.

Morrison Gulch

3587	0129.00	Salmonid young-of-the-year (YOY) was observed.
3630	0131.00	LDA #02 contains 4 pieces of LWD and measures 6' high x 11' wide x 10' long with water flowing through and visible gaps. Sediment retention ranges from sand to small cobble and measures 4' wide x 15' long x 1' deep.
3759	0140.00	A salmonid YOY was observed.
4083	0150.00	LDA #03 contains 4 pieces of LWD and measures 5' high x 8' wide x 9' long with water flowing through and no visible gaps. Sediment retention ranges from sand to small cobble and measures 6' wide x 10' long x 3' deep.
4295	0152.00	LDA #04 contains 3 pieces of LWD and measures 6' high x 6' wide x 6' long with water flowing through and no visible gaps. Sediment retention ranges from sand to gravel and measures 7' wide x 4' long x 1' deep. Fish were observed above the LDA.
4725	0172.00	There is an underground spring.
5052	0189.00	There is a 20% stream gradient.
5078	0191.00	There is a 1.5' fall that serves as a possible barrier.
5093	0192.00	End of survey due to a 1.5' fall that serves as a possible barrier.

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.

Morrison 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: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES11

Latitude: 40:49:29.0N

Longitude: 124:02:11.0

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
3	0	DRY	1.5	28	83	1.6									
71	8	FLATWATER	35.9	39	2735	52.4	4.1	0.3	1.5	124	8773	33	2318		3
1	0	NOSURVEY	0.5	12	12	0.2									
80	80	POOL	40.4	21	1689	32.4	7.1	2.0	1.3	155	12436	278	22242	249	15
43	8	RIFFLE	21.7	16	697	13.4	4.1	0.1	0.5	34	1463	6	222		5
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
198	96				5216					22672			24781		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES11

Latitude: 40:49:29.0N

Longitude: 124:02:11.0W

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 (%)
36	6	LGR	18.2	17	627	12.0	3	0.1	2	23	824	5	144		6	92
7	2	HGR	3.5	10	70	1.3	5	0.2	0.4	50	353	9	60		3	95
53	7	RUN	26.8	34	1816	34.8	4	0.3	9	121	6398	33	1760		3	96
18	1	SRN	9.1	51	919	17.6	4	0.2	0.5	144	2583	29	517		2	95
78	78	MCP	39.4	21	1637	31.4	7	2.0	5	156	12181	283	22059	253	14	94
1	1	LSL	0.5	29	29	0.6	6	0.8	2	139	139	125	125	111	45	
1	1	PLP	0.5	23	23	0.4	5	0.4	1.3	115	115	58	58	46	10	
3	0	DRY	1.5	28	83	1.6										
1	0	NS	0.5	12	12	0.2										

Total Units
198

Total Units Fully Measured
96

Total Length (ft.)
5216

Total Area (sq.ft.)
22594

Total Volume (cu.ft.)
24723

Table 3 - Summary of Pool Types

Stream Name: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES11

Latitude: 40:49:29.0N

Longitude: 124:02:11.0W

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
78	78	MAIN	98	21	1637	97	7.2	2.0	156	12181	253	19772	14
2	2	SCOUR	3	26	52	3	5.5	0.6	127	254	79	157	28

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
80	80	1689	12436	19930

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

Stream Name: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES11

Latitude: 40:49:29.0N

Longitude: 124:02:11.0W

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
78	MCP	98	23	29	45	58	8	10	1	1	1	1
1	LSL	1	0	0	0	0	1	100	0	0	0	0
1	PLP	1	0	0	1	100	0	0	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
80	23	29	46	58	9	11	1	1	1	1

Mean Maximum Residual Pool Depth (ft.): 1.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Dry Units: 3

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES11

Latitude: 40:49:29.0N

Longitude: 124:02:11.0W

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
36	5	LGR	0	59	41	0	0	0	0	0	0
7	2	HGR	0	70	0	0	0	0	0	30	0
43	7	TOTAL RIFFLE	0	61	33	0	0	0	0	6	0
53	7	RUN	17	18	0	20	32	0	0	13	0
18	1	SRN	0	15	0	0	85	0	0	0	0
71	8	TOTAL FLAT	14	18	0	17	39	0	0	11	0
78	78	MCP	16	15	45	6	8	0	0	8	2
1	1	LSL	15	15	65	5	0	0	0	0	0
1	1	PLP	0	10	90	0	0	0	0	0	0
80	80	TOTAL POOL	15	15	46	6	8	0	0	8	2
1	0	NS	0								
198	95	TOTAL	14	17	42	6	10	0	0	8	2

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Morrison Gulch LLID: 1240364408247 Drainage: Eureka Plain
 Survey Dates: 7/17/2008 to 7/29/2008 Dry Units: 3
 Confluence Location: Quad: ARCATA SOUTH Legal Description: T05NR01ES11 Latitude: 40:49:29.0N Longitude: 124:02:11.0W

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
36	5	LGR	0	20	80	0	0	0	0
7	2	HGR	0	50	0	50	0	0	0
53	6	RUN	17	33	50	0	0	0	0
18	1	SRN	0	0	100	0	0	0	0
78	75	MCP	7	55	35	0	0	3	1
1	1	LSL	0	100	0	0	0	0	0
1	1	PLP	0	100	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES11

Latitude: 40:49:29.0N

Longitude: 124:02:11.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
94	29	71	0	89	89

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: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Confluence Location: Quad: ARCATA SOUTH

Legal Description: T05NR01ES11

Latitude: 40:49:29.0N

Longitude: 124:02:11.0W

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	4	4	4.2
Boulder	3	2	2.6
Cobble / Gravel	6	5	5.8
Sand / Silt / Clay	82	84	87.4

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	26	23	25.8
Hardwood Trees	54	61	60.5
Coniferous Trees	15	11	13.7
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Morrison Gulch

LLID: 1240364408247

Drainage: Eureka Plain

Survey Dates: 7/17/2008 to 7/29/2008

Confluence Location: Quad: ARCATA SOUTH

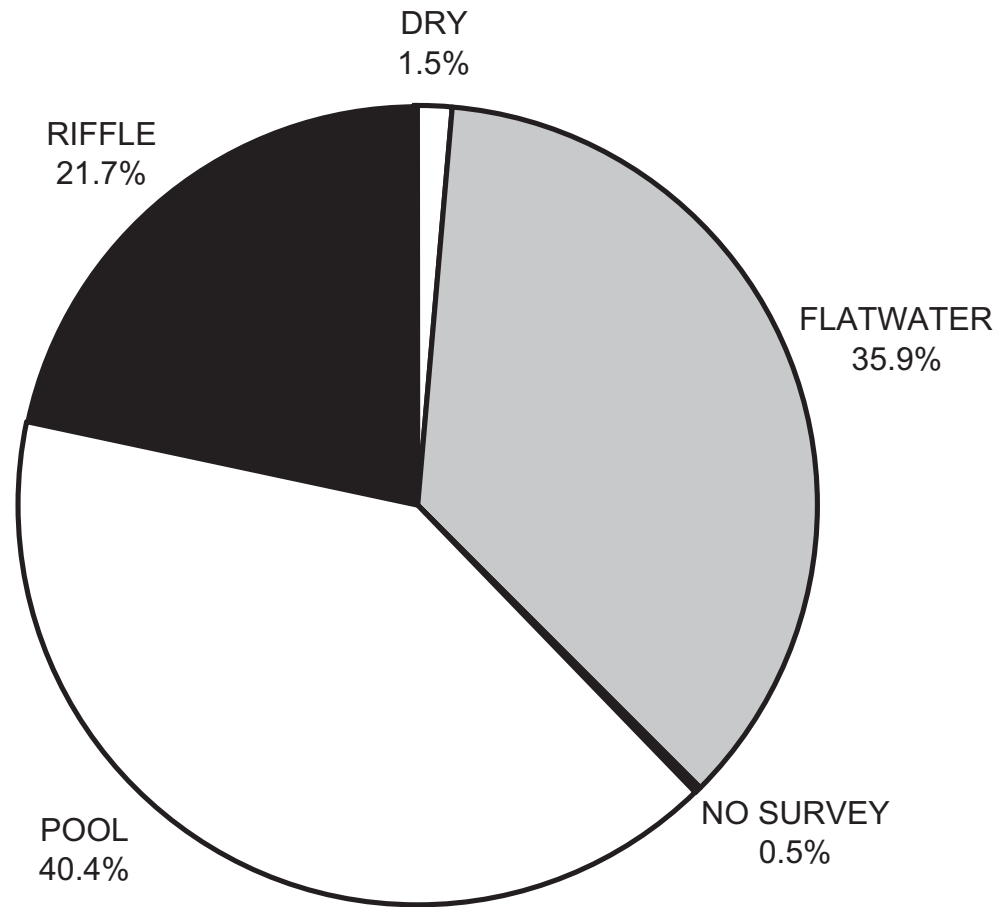
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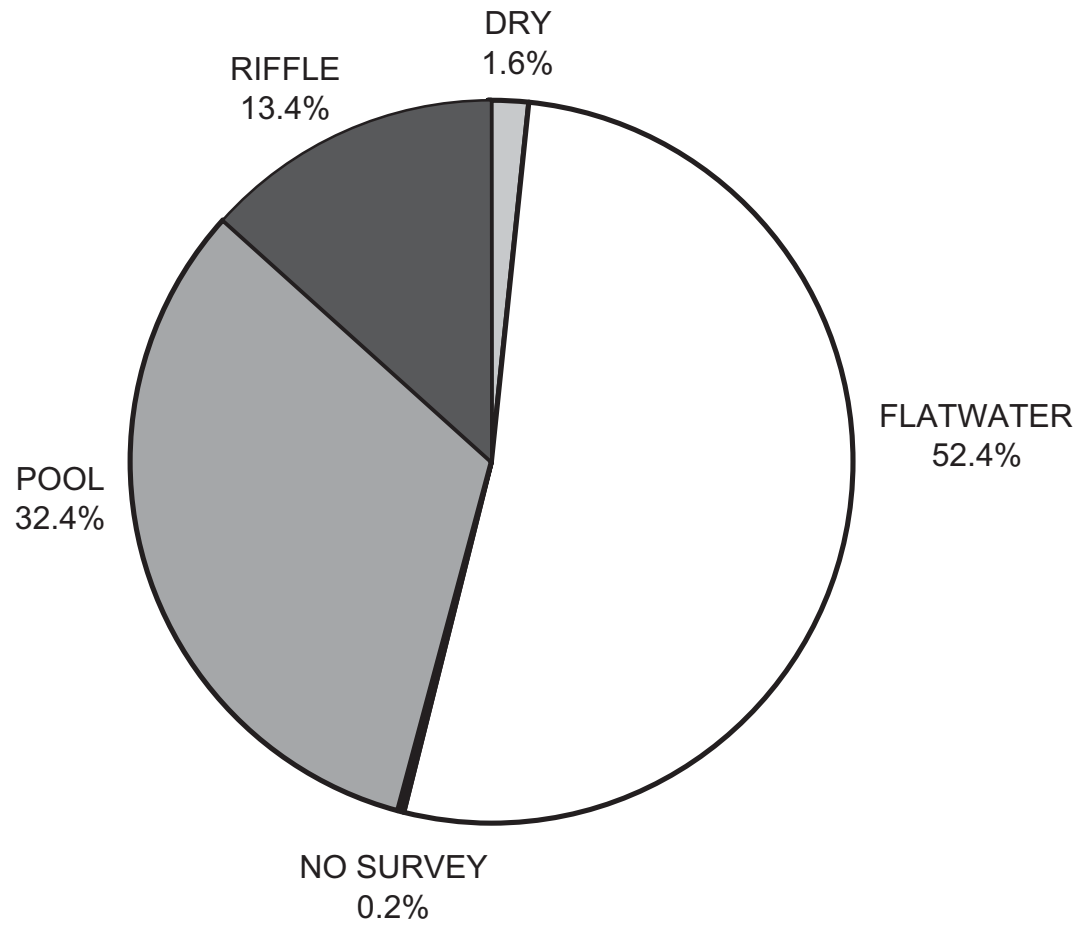
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	14	15
SMALL WOODY DEBRIS (%)	61	18	15
LARGE WOODY DEBRIS (%)	33	0	46
ROOT MASS (%)	0	17	6
TERRESTRIAL VEGETATION (%)	0	39	8
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	6	11	8
BEDROCK LEDGES (%)	0	0	2

MORRISON GULCH 2008 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

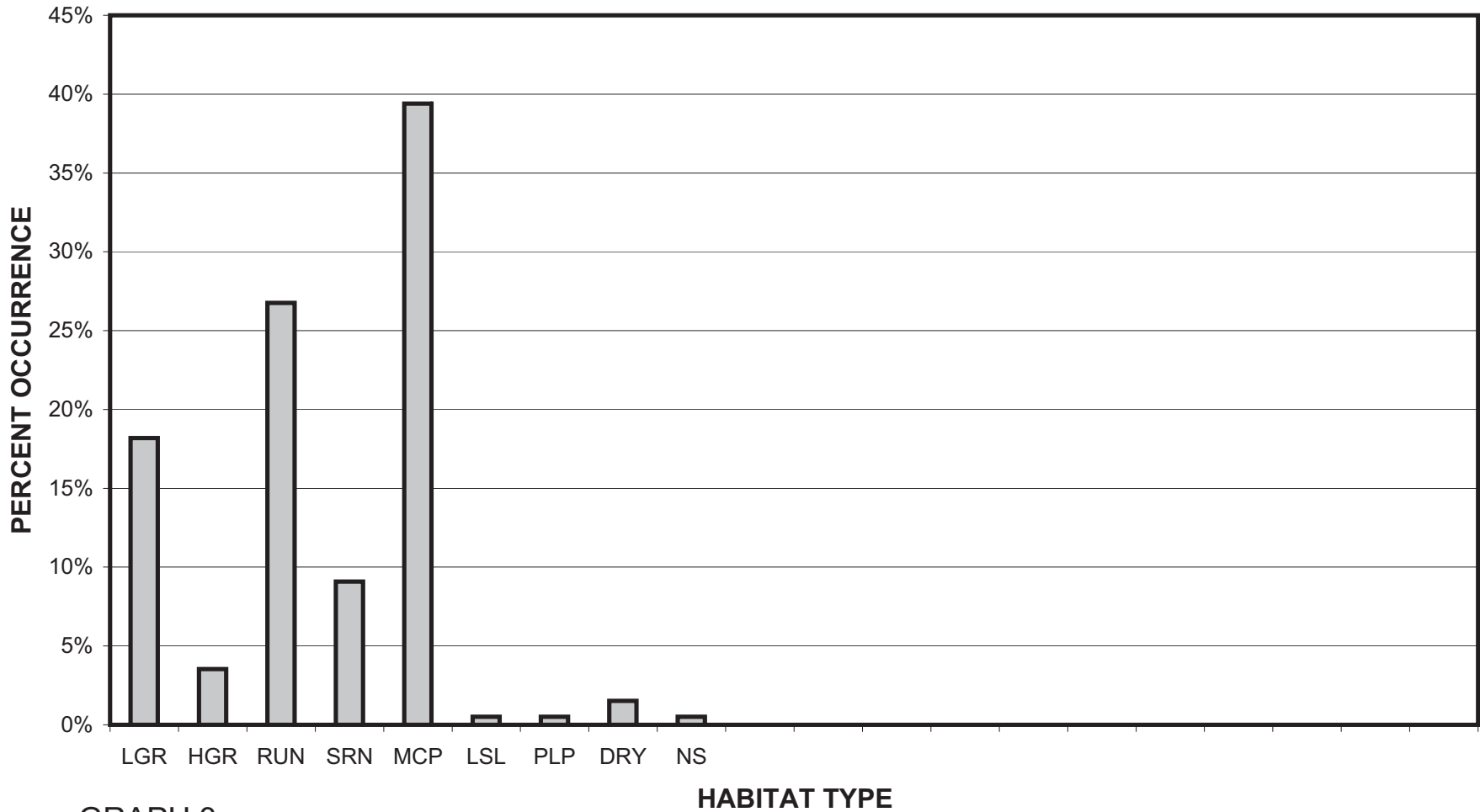
MORRISON GULCH 2008 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

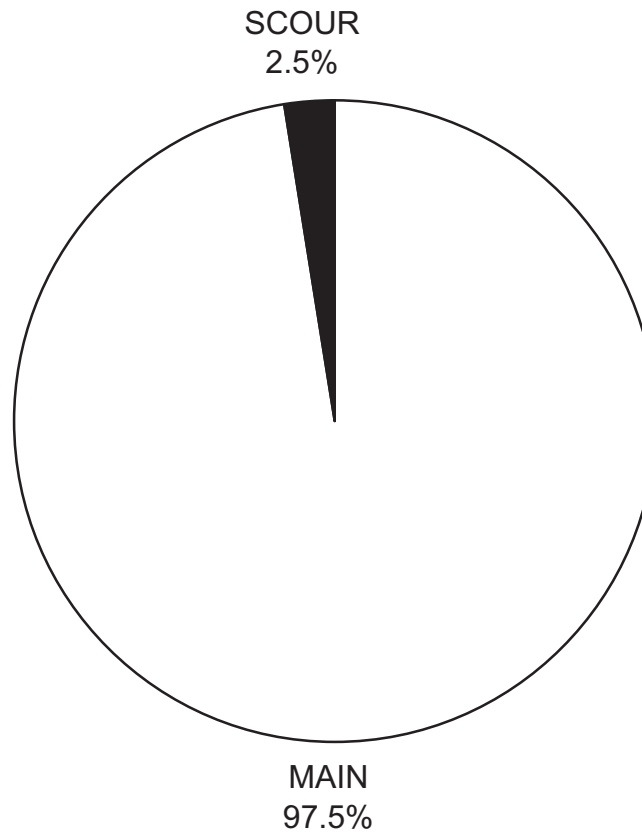
MORRISON GULCH 2008

HABITAT TYPES BY PERCENT OCCURRENCE



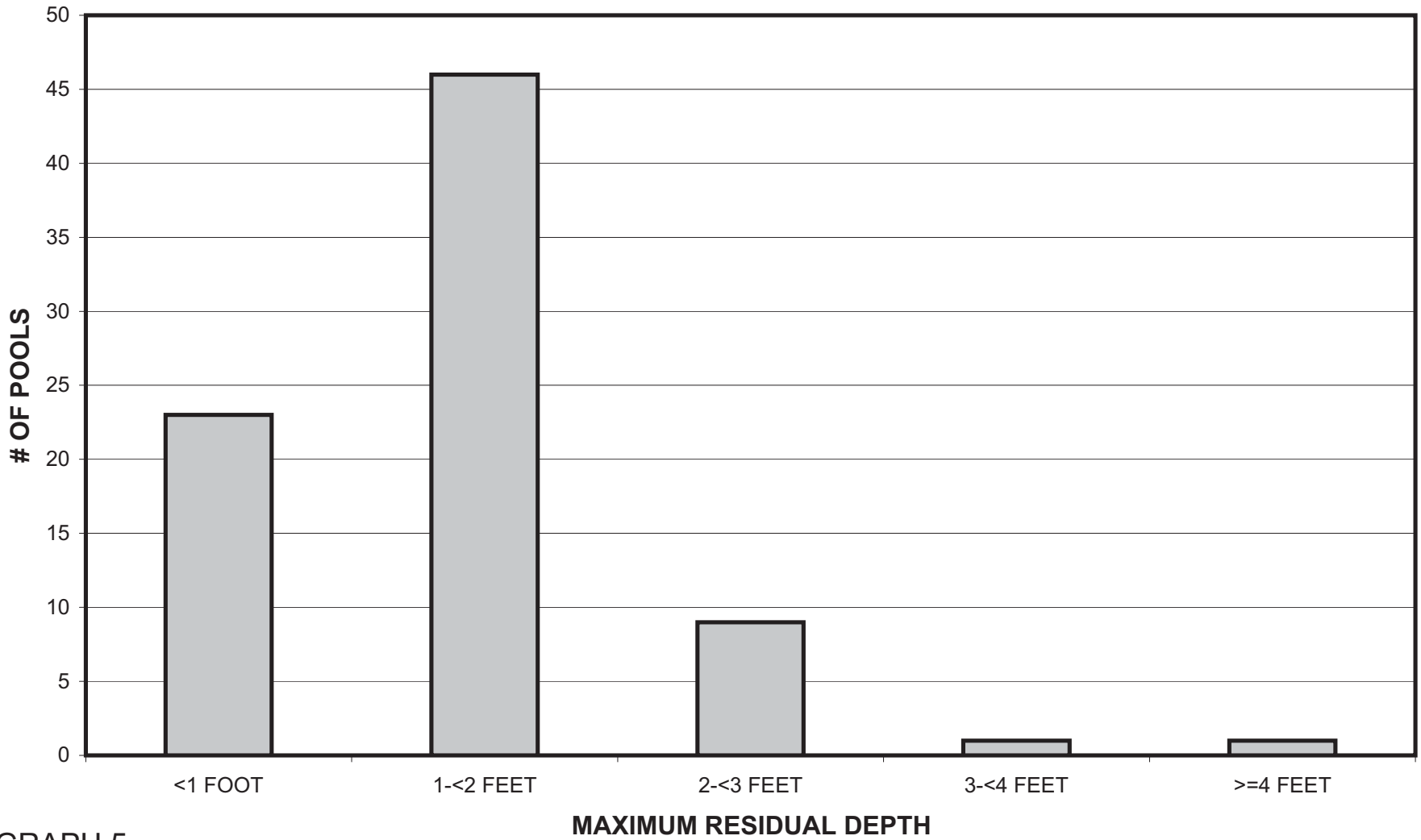
GRAPH 3

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



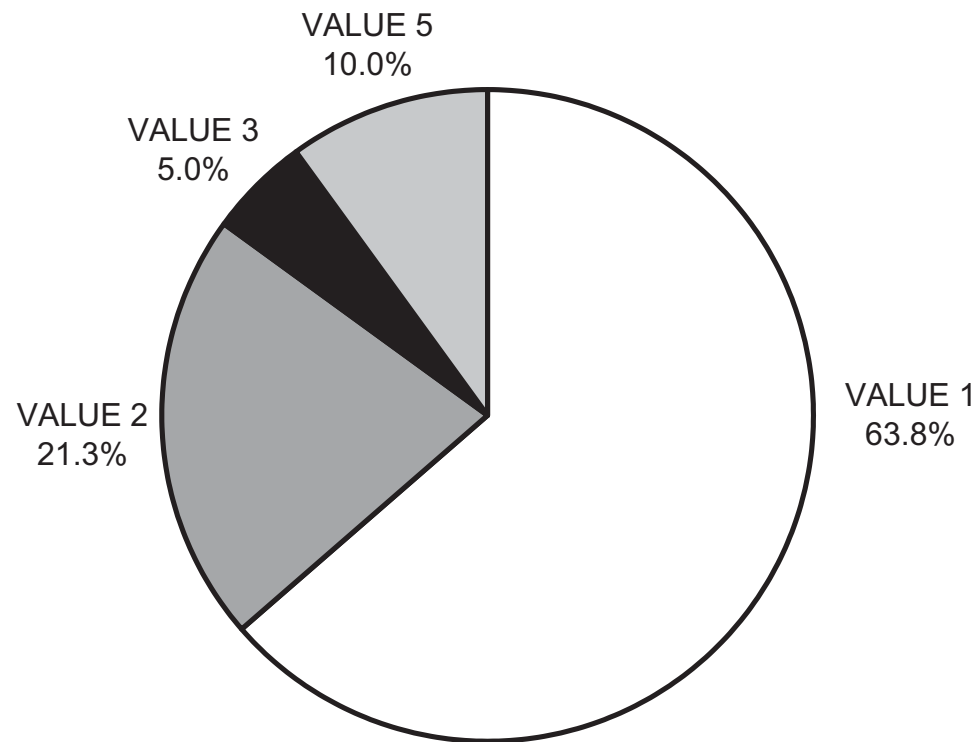
GRAPH 4

MORRISON GULCH 2008 MAXIMUM DEPTH IN POOLS



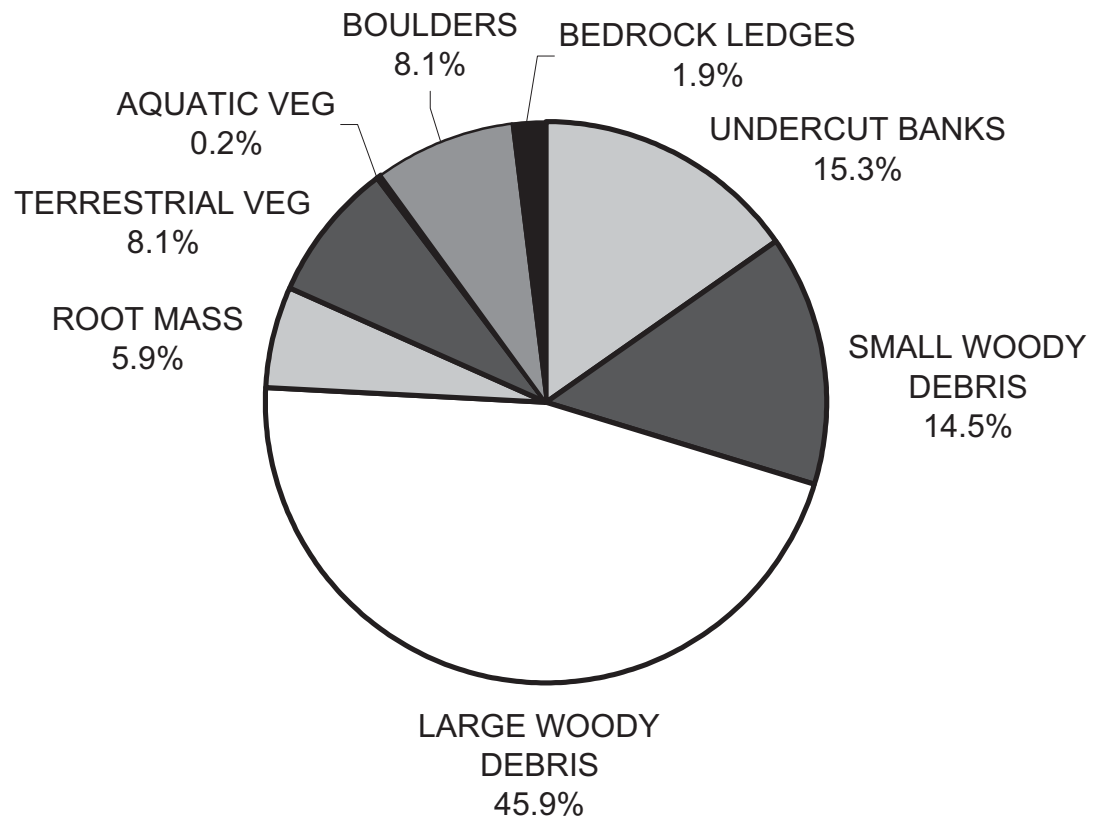
GRAPH 5

MORRISON GULCH 2008 PERCENT EMBEDDEDNESS



GRAPH 6

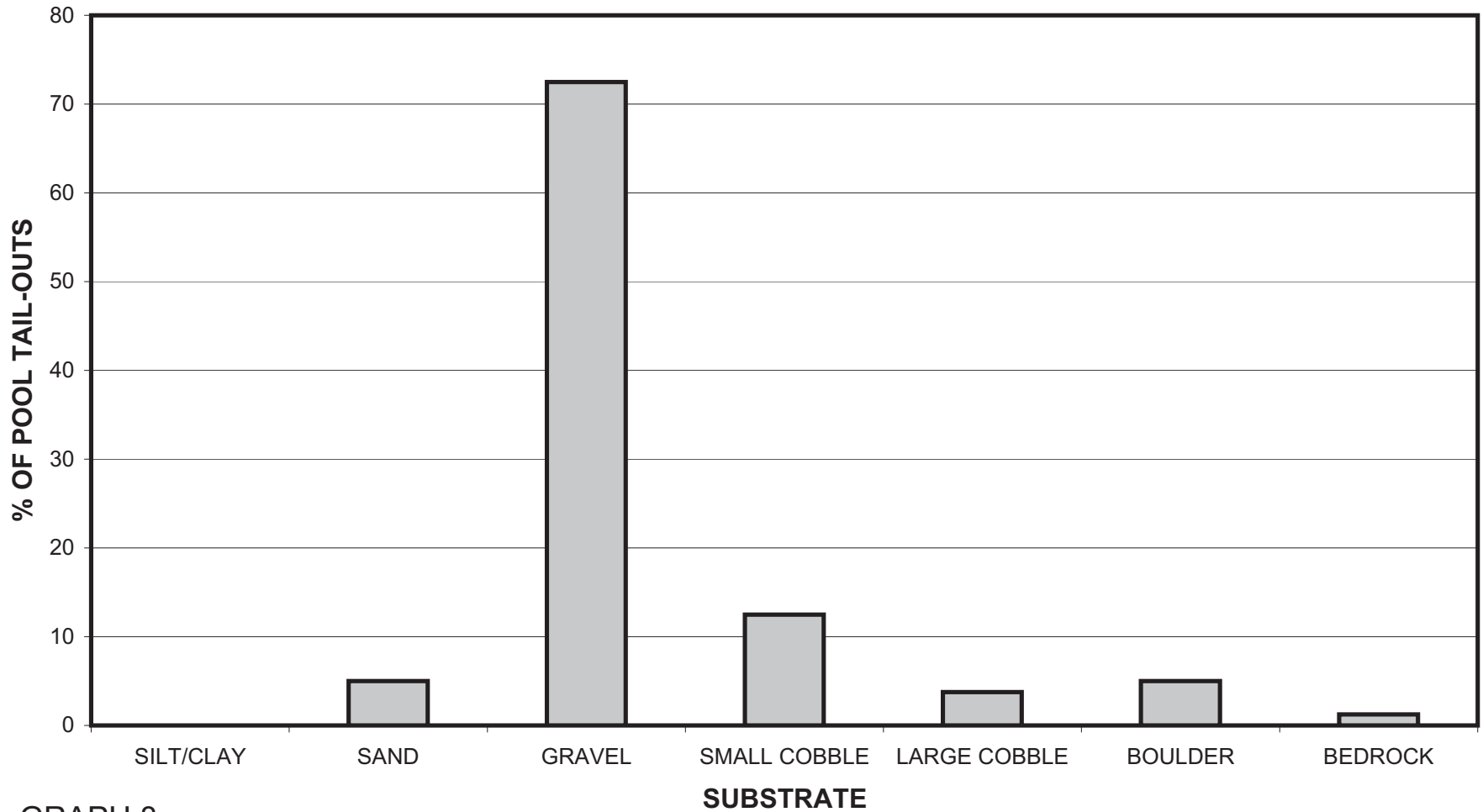
MORRISON GULCH 2008 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

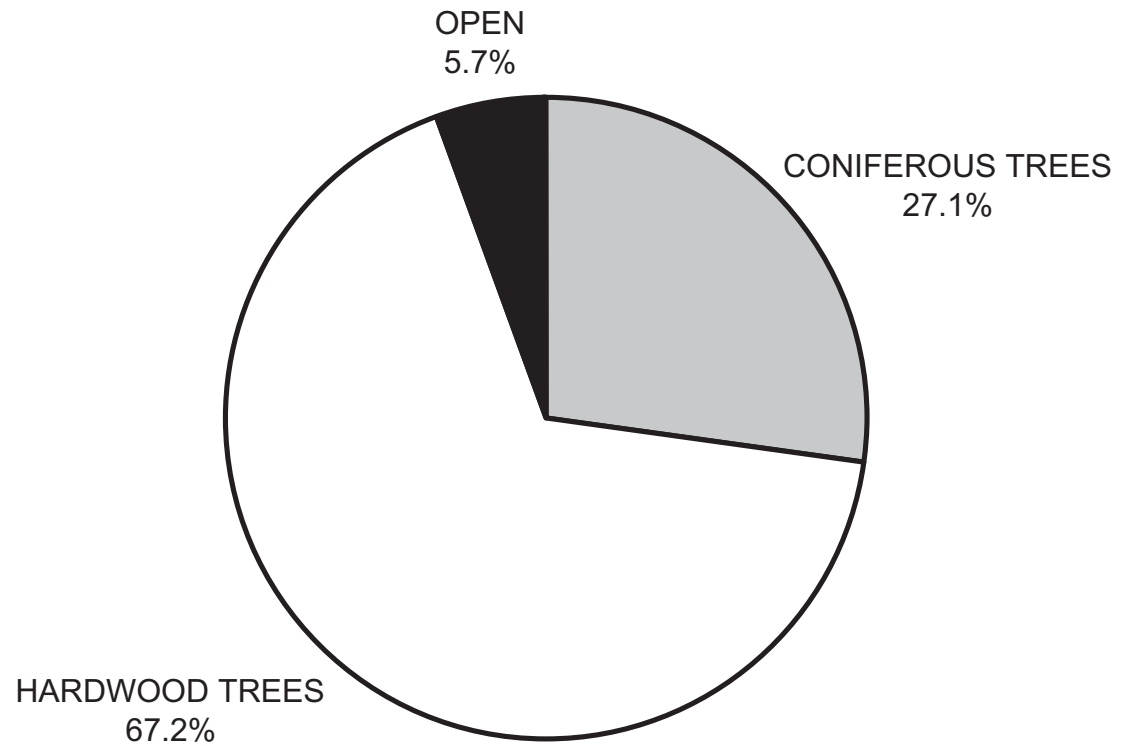
MORRISON GULCH 2008

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



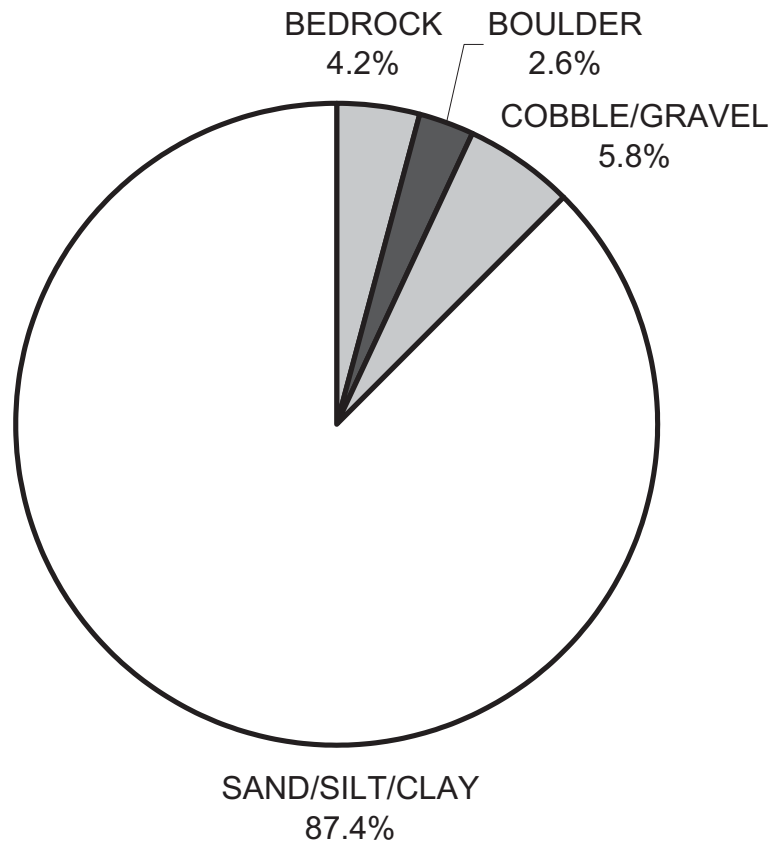
GRAPH 8

MORRISON GULCH 2008 MEAN PERCENT CANOPY



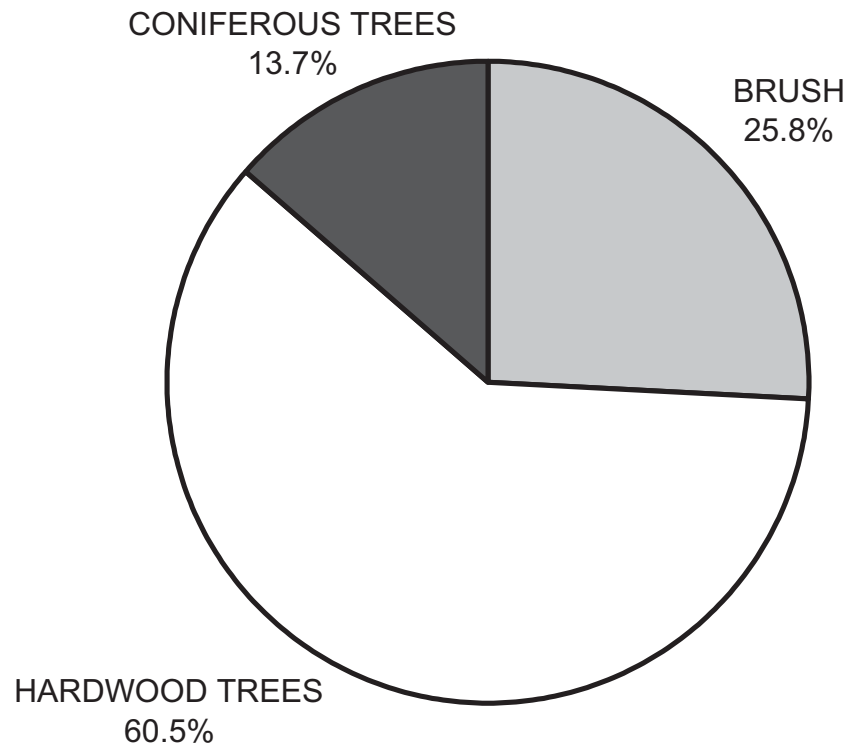
GRAPH 9

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



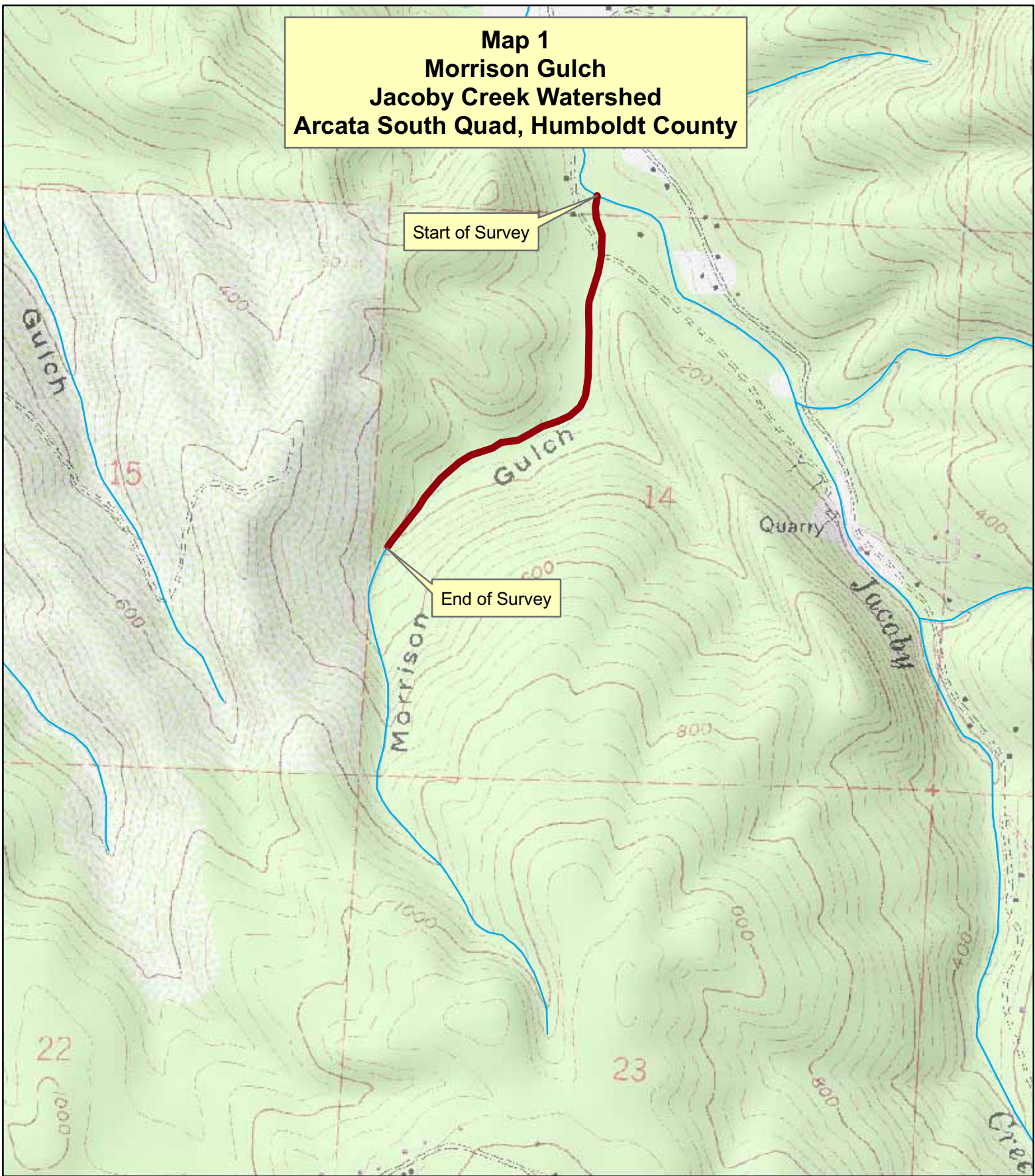
GRAPH 10

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



GRAPH 11

Map 1
Morrison Gulch
Jacoby Creek Watershed
Arcata South Quad, Humboldt County



Start of Survey

End of Survey



Legend

 Reach 1, E4 Channel Type

0 750 1,500 Feet

