STREAM INVENTORY REPORT

Mustard Gulch

INTRODUCTION

A stream inventory was conducted on August 31, 2011 on Mustard Gulch. The survey began at the confluence with the Navarro River and extended upstream 0.3 miles.

The Mustard Gulch inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Mustard Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for 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

Mustard Gulch is a tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Mustard Gulch's legal description at the confluence with the Navarro River is T15N R16W S16. Its location is 39.16584 degrees north latitude and 123.64249 degrees west longitude, LLID number 1236413391659. Mustard Gulch is a first order stream and has approximately 0.6 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Mustard Gulch drains a watershed of approximately 0.8 square miles. Elevations range from about 10 feet at the mouth of the creek to 600 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 Mustard Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game (DFG) personnel and Watershed Stewards Project/AmeriCorps (WSP) members that conducted the inventory were trained in standardized habitat inventory methods by the DFG. This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the

parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Mustard 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". Mustard 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 Mustard 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.

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 Mustard 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 Mustard 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 Mustard Gulch, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

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

11. Average Bankfull Width:

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

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Mustard Gulch. In addition, six sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling 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 Mustard 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

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- 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 31, 2011 was conducted by A. Blessing and T. Anderson (DFG). The total length of the stream surveyed was 1,820 feet.

Stream flow was not measured on Mustard Gulch.

Mustard Gulch is a F6 channel type for the entire length of the survey, 1,820 feet (Reach 1). F6 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and silt-dominant substrates.

The water temperature taken during the survey period was 52 degrees Fahrenheit. The air temperature was 65 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% flatwater units, 40% pool units, 10% riffle units, and 10% culvert units (Graph 1). Based on total length of Level II habitat types there were 92% flatwater units, 5% pool units, 2% culvert units, and 1% riffle units (Graph 2).

Three Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step-run units, 40%; and mid-channel pool units, 40% (Graph 3). Based on percent total length, step run units made up 92%, mid-channel pool units 5%, and culvert units 2%.

A total of four pools were identified (Table 3). Main channel pools were the most frequently encountered at 100% (Graph 4), and comprised 100% 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. One of the four pools (25%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the four pool tail-outs measured, all of them had a value of 5 (100%) (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 not suitable 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. Flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 34 (Table 1).

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Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Mustard Gulch. Graph 7 describes the pool cover in Mustard 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. Silt/clay was the dominant substrate observed in 100% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Mustard Gulch was 100%. Of the canopy present, the mean percentages of hardwood and coniferous trees were 0% and 100%, respectively. Graph 9 describes the mean percent canopy in Mustard 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). Coniferous trees were the dominant vegetation type observed in 80% of the units surveyed. Additionally, 20% of the units surveyed had grass as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted an electrofishing survey at six sites for species composition and distribution in Mustard Gulch on October 12, 2011. The water temperature taken during the electrofishing period of 1130 hours to 1200 hours was 55 degrees Fahrenheit. The air temperature was 70 degrees Fahrenheit. The sites were sampled by S. Monday, M. Groff, and I. Mikus (DFG).

In reach 1, which comprised the first 1,820 feet of stream, six sites were sampled. The reach sites yielded one young-of-the-year steelhead/rainbow trout (SH/RT), one coho salmon, and 12 sculpin.

The following chart displays the information yielded from these sites:

2011 Mustard Gulch electrofishing observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
Reach 1: F6 Channel Type									
10/12/11	1	002	Step-run	435	1	0	0	1	0
	2	003	Pool	459	0	0	0	0	0
	3	006	Pool	559	0	0	0	0	0
	4	007	Step-run	749	0	0	0	0	0
	5	008	Pool	777	0	0	0	0	0
	6	009	Step-run	1,809	0	0	0	0	0

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DISCUSSION

Mustard Gulch is an F6 channel type for the entire length of the survey, 1,820 feet. The suitability of F6 channel types for fish habitat improvement structures is as follows: F6 channel types are good for bank-placed boulders and fair for plunge weirs, boulder clusters, single and opposing wing-deflectors, and log cover.

The water temperature recorded on the survey day August 31, 2011 was 52 degrees Fahrenheit. The air temperature was 65 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 92% of the total length of this survey, riffles 1%, and pools 5%. One of the 4 (25%) 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. Installing log structures that will increase or deepen pool habitat is recommended.

None of the 4 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. All four 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 4 pool tail-outs had silt, sand, large cobble, boulders or bedrock as the dominant substrate. This is generally considered unsuitable for spawning salmonids.

The mean shelter rating for pools is 34. The shelter rating in the flatwater habitats is 5. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in Mustard Gulch. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 100%. 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.

RECOMMENDATIONS

1) Mustard 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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with the Navarro River. The channel is an F6 for the entire length of the survey, 1,820 feet.
459	0004.00	Highway 128 crosses the channel. The crossing is a 4.5' high x 4.5' wide x 45' long concrete box culvert. The slope of the culvert is less than 1% and there is no plunge at the outlet.
1820	0010.00	End of survey due to marsh.

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: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0

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
1	0	CULVERT	10.0	45	45	2.5									
4	1	FLATWATER	40.0	418	1673	91.9	4.0	0.1	0.5	103	410	10	41		5
4	4	POOL	40.0	23	91	5.0	7.8	1.2	1.6	174	697	319	1277	267	34
1	0	RIFFLE	10.0	11	11	0.6									

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
10	5	1820	1107	1318

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

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 (%)
1	0	LGR	10.0	11	11	0.6										
4	1	SRN	40.0	418	1673	91.9	4	0.1	0.5	103	410	10	41		5	100
4	4	MCP	40.0	23	91	5.0	8	1.2	3.8	174	697	319	1277	267	34	100
1	0	CUL	10.0	45	45	2.5										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
10	5	1820	1107	1318

Table 3 - Summary of Pool Types

Stream Name: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

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
4	4	MAIN	100	23	91	100	7.8	1.2	174	697	267	1068	34

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
4	4	91	696	1068

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

Stream Name: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

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
4	MCP	100	2	50	1	25	0	0	1	25	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
4	2	50	1	25	0	0	1	25	0	0

Mean Maximum Residual Pool Depth (ft.): 1.6

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011 Dry Units: 0

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

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
1	0	LGR									
1	0	TOTAL RIFFLE									
4	1	SRN	0	100	0	0	0	0	0	0	0
4	1	TOTAL FLAT	0	100	0	0	0	0	0	0	0
4	4	MCP	0	48	53	0	0	0	0	0	0
4	4	TOTAL POOL	0	48	53	0	0	0	0	0	0
1	0	CUL									
10	5	TOTAL	0	58	42	0	0	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011 Dry Units: 0

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

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
1	0	LGR	0	0	0	0	0	0	0
4	1	SRN	100	0	0	0	0	0	0
4	4	MCP	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

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

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: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011 Survey Length (ft.): 1820 Main Channel (ft.): 1820 Side Channel (ft.): 0

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F6
Reach Length (ft.): 1820
Riffle/Flatwater Mean Width (ft.): 4.0
BFW:
Range (ft.): 12 to 12
Mean (ft.): 12
Std. Dev.: 0
Base Flow (cfs.): 0.0
Water (F): 52 - 52 Air (F): 65 - 65
Dry Channel (ft): 0

Canopy Density (%): 99.6
Coniferous Component (%): 100.0
Hardwood Component (%): 0.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 100.0
Dominant Shelter: Small Woody Debris
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 42
LWD per 100 ft.:
Riffles: 0
Pools: 11
Flat: 1

Pools by Stream Length (%): 5.0
Pool Frequency (%): 40.0
Residual Pool Depth (%):
< 2 Feet Deep: 75
2 to 2.9 Feet Deep: 0
3 to 3.9 Feet Deep: 25
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.6
Mean Pool Shelter Rating: 34

Pool Tail Substrate (%): Silt/Clay: 100 Sand: 0 Gravel: 0 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 0.0 2. 0.0 3. 0.0 4. 0.0 5. 100.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

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	5	5	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	1	1	20.0
Brush	0	0	0.0
Hardwood Trees	0	0	0.0
Coniferous Trees	4	4	80.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 5

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

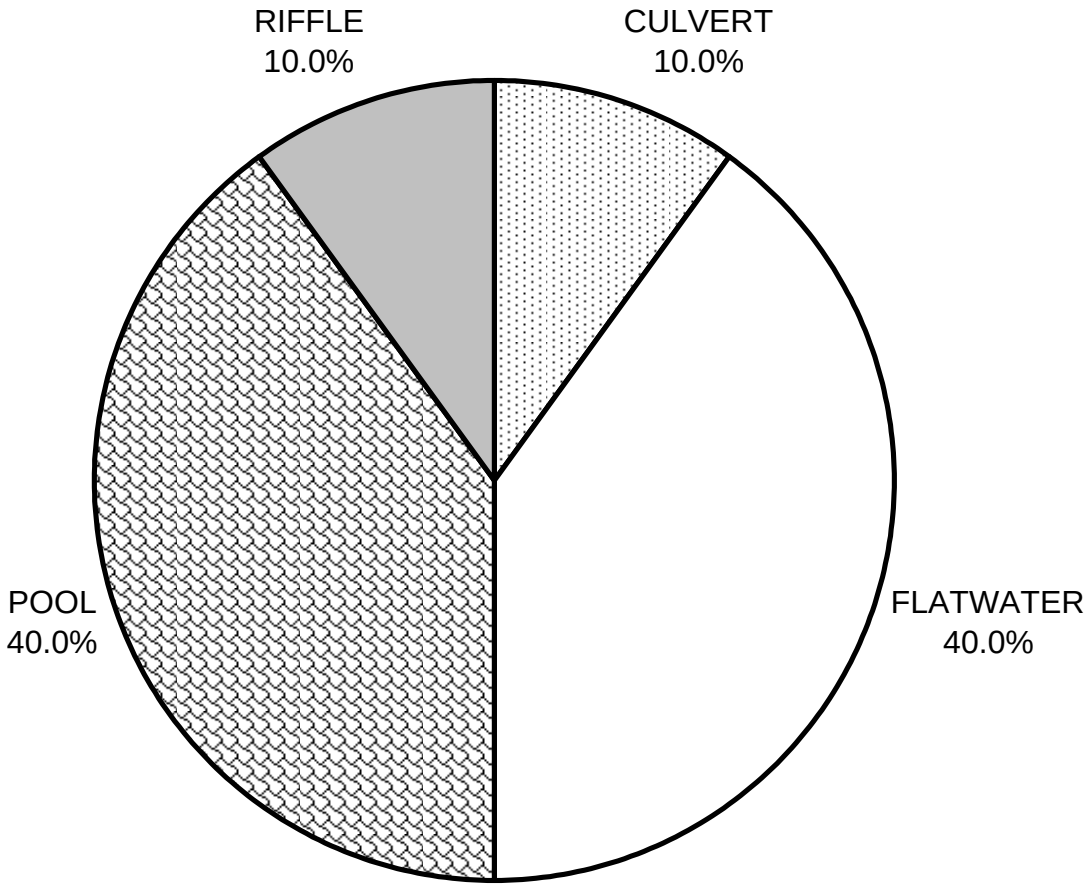
StreamName: Mustard Gulch LLID: 1236413391659 Drainage: Navarro River

Survey Dates: 8/31/2011 to 8/31/2011

Confluence Location: Quad: ELK Legal Description: T15NR16WS16 Latitude: 39:09:57.0N Longitude: 123:38:29.0W

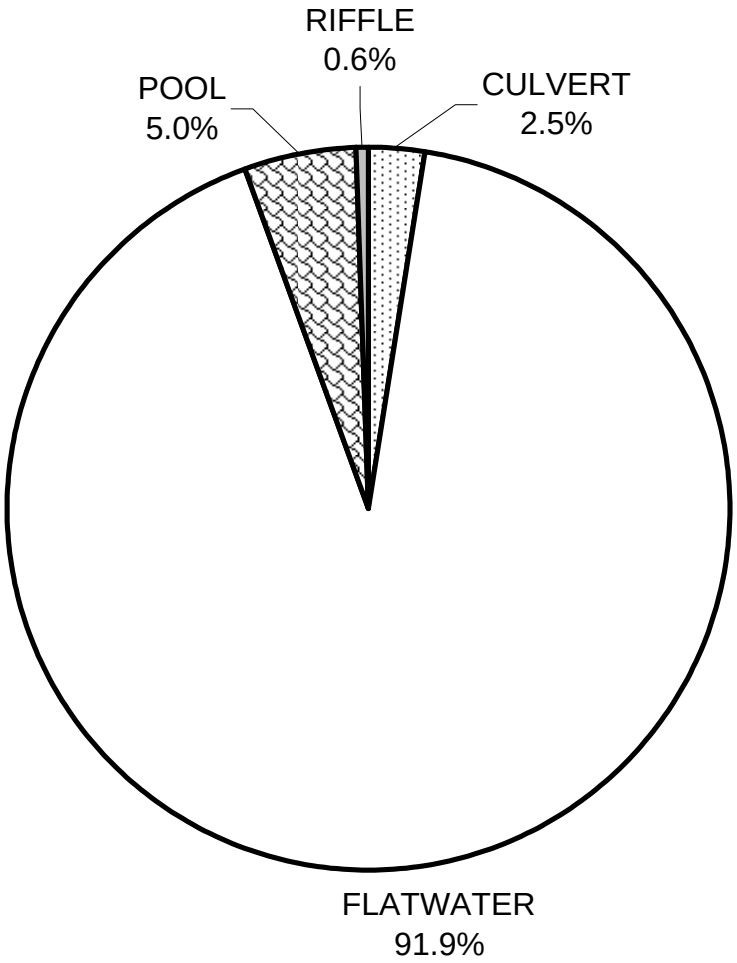
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)		0	0
SMALL WOODY DEBRIS (%)		100	48
LARGE WOODY DEBRIS (%)		0	53
ROOT MASS (%)		0	0
TERRESTRIAL VEGETATION (%)		0	0
AQUATIC VEGETATION (%)		0	0
WHITEWATER (%)		0	0
BOULDERS (%)		0	0
BEDROCK LEDGES (%)		0	0

MUSTARD GULCH 2011
HABITAT TYPES BY PERCENT OCCURRENCE



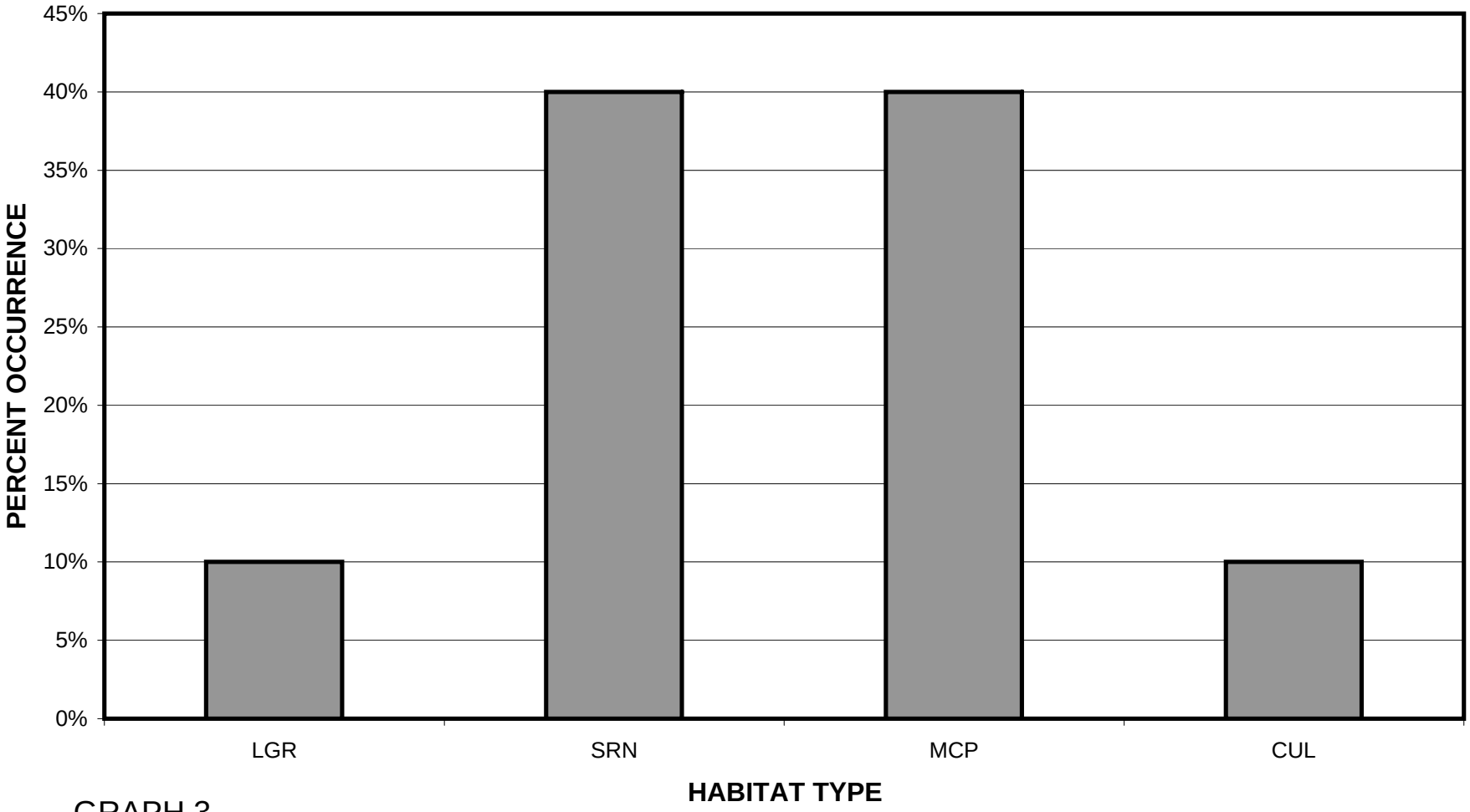
GRAPH 1

MUSTARD GULCH 2011
HABITAT TYPES BY PERCENT TOTAL LENGTH



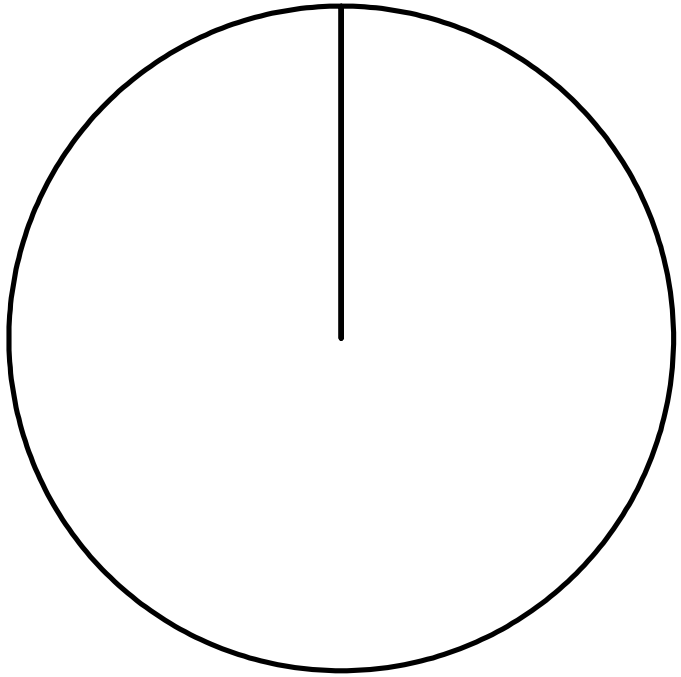
GRAPH 2

MUSTARD GULCH 2011
HABITAT TYPES BY PERCENT OCCURRENCE



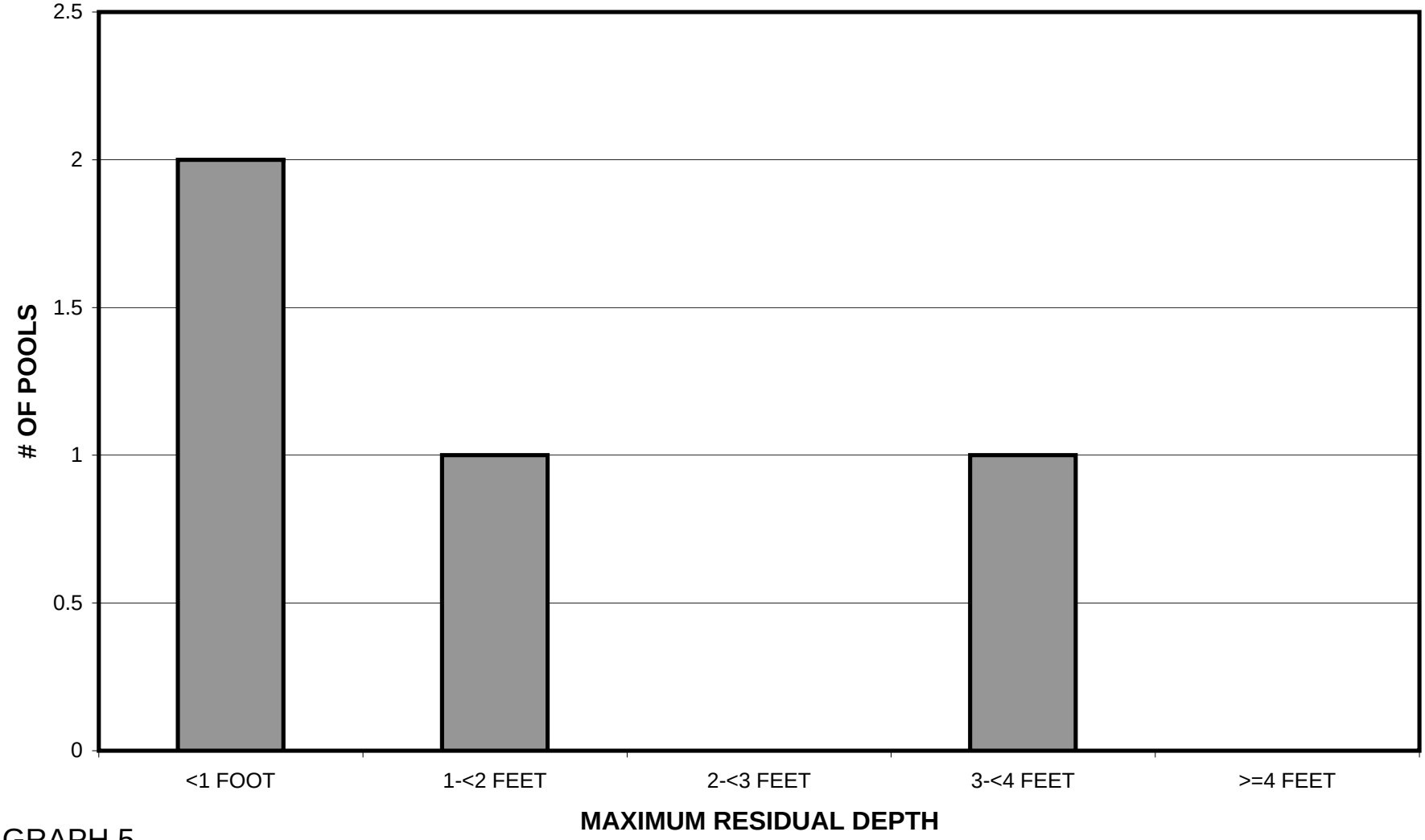
GRAPH 3

MUSTARD GULCH 2011
POOL TYPES BY PERCENT OCCURRENCE



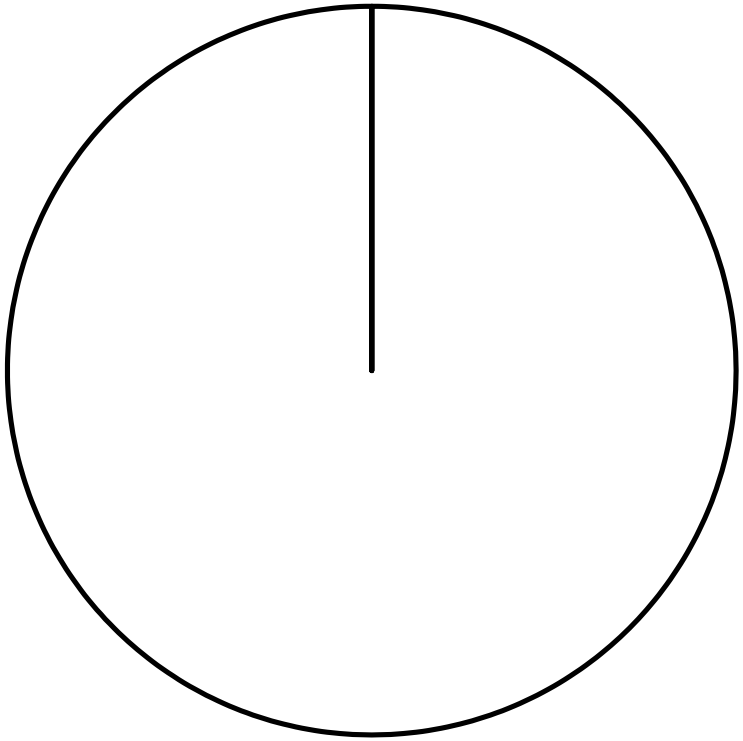
GRAPH 4

MUSTARD GULCH 2011
MAXIMUM DEPTH IN POOLS



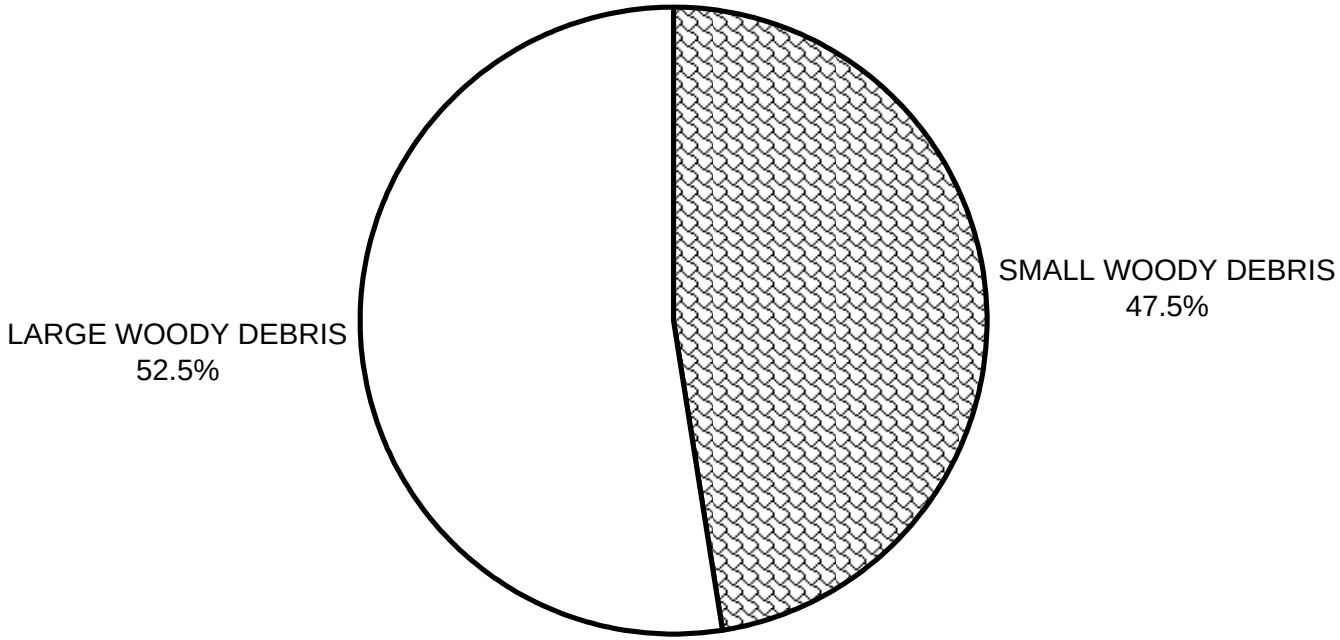
GRAPH 5

MUSTARD GULCH 2011
PERCENT EMBEDDEDNESS



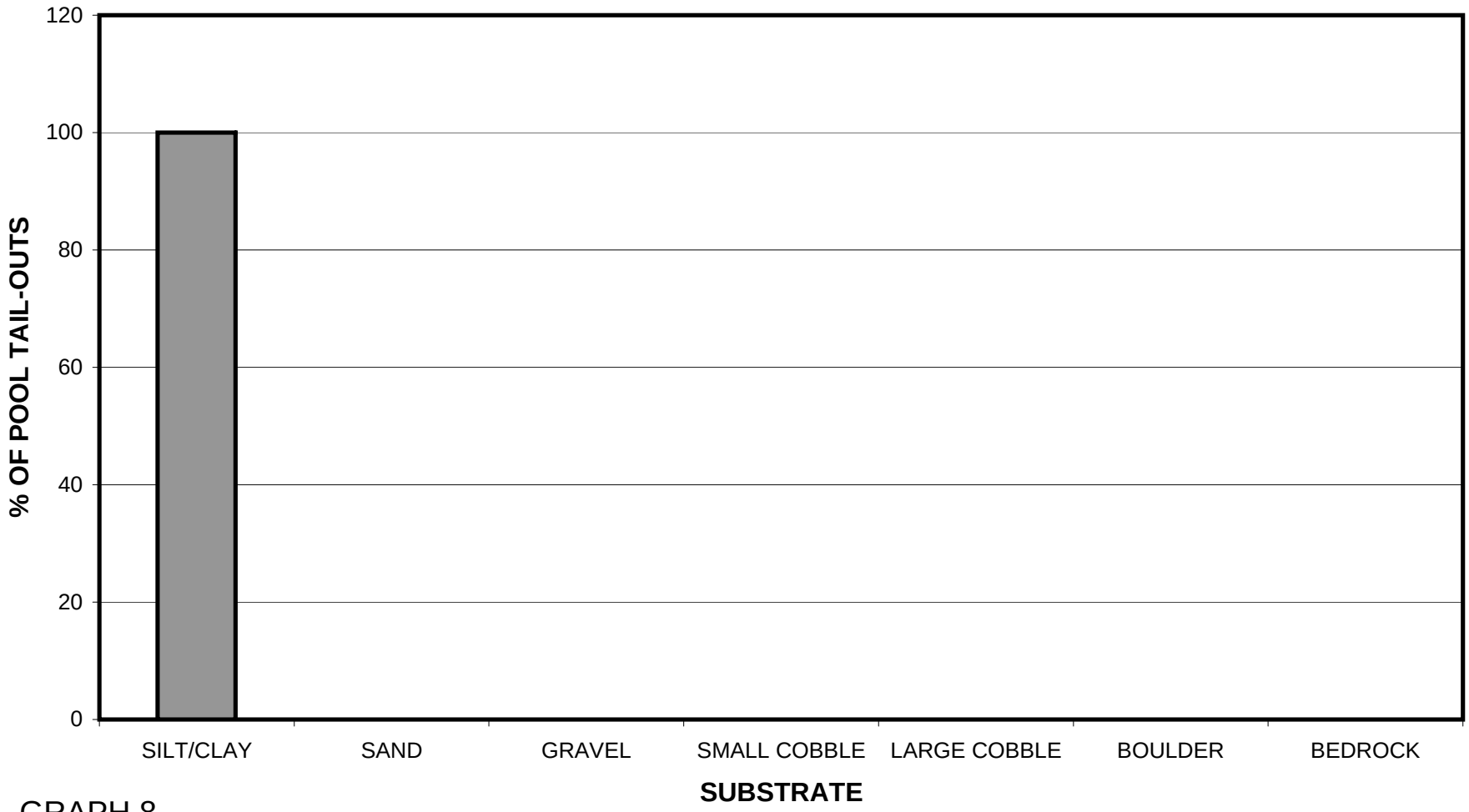
GRAPH 6

MUSTARD GULCH 2011
MEAN PERCENT COVER TYPES IN POOLS



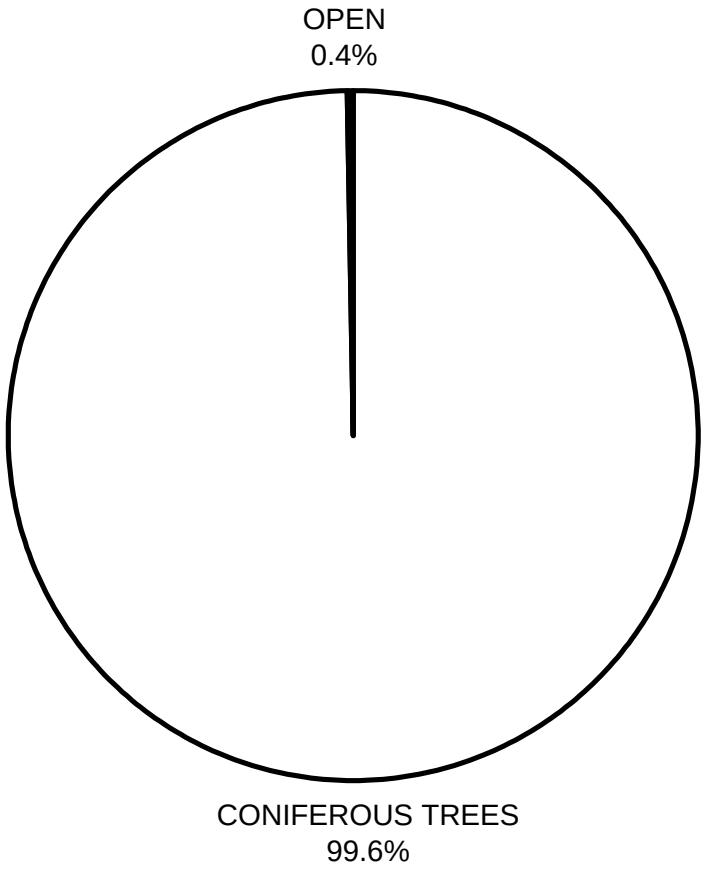
GRAPH 7

MUSTARD GULCH 2011
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



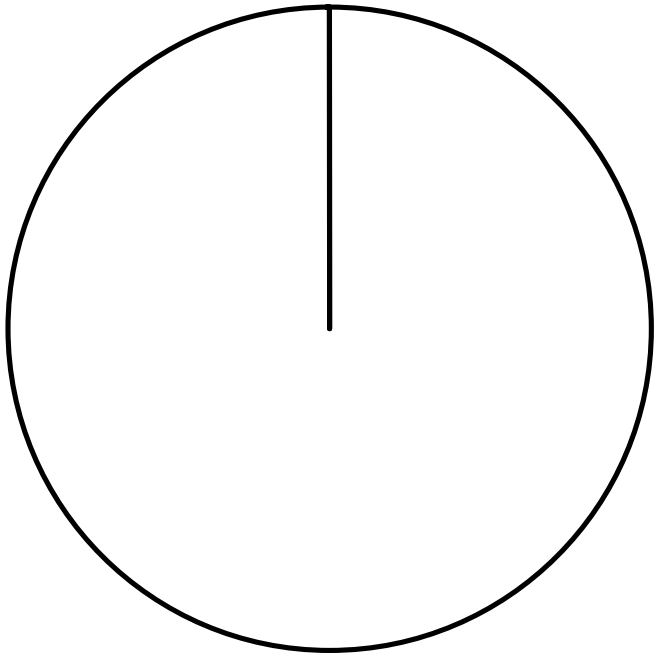
GRAPH 8

MUSTARD GULCH 2011
MEAN PERCENT CANOPY



GRAPH 9

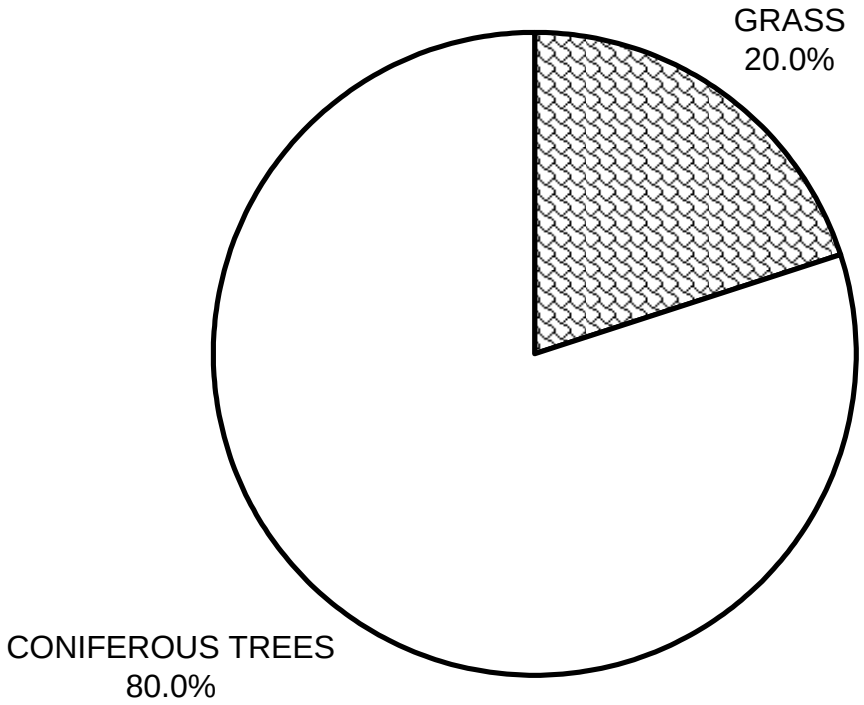
MUSTARD GULCH 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH



SAND/SILT/CLAY
100.0%

GRAPH 10

MUSTARD GULCH 2011
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11