

STREAM INVENTORY REPORT

Dead Horse Gulch

INTRODUCTION

A stream inventory was conducted from August 22 to August 23, 2011 on Dead Horse Gulch. The survey began at the confluence with the North Fork Navarro River and extended upstream 0.5 miles.

The Dead Horse 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 Dead Horse 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

Dead Horse Gulch is a tributary to the North Fork Navarro River, tributary to Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Dead Horse Gulch's legal description at the confluence with the North Fork Navarro River is T15N R16W S15. Its location is 39.1544 degrees north latitude and 123.6111 degrees west longitude, LLID number 1236099391545. Dead Horse Gulch is a first order stream and has approximately 1.4 miles of blue line stream according to the USGS Navarro 7.5 minute quadrangle. Dead Horse Gulch drains a watershed of approximately 0.4 square miles. Elevations range from about 220 feet at the mouth of the creek to 1,000 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 Dead Horse 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

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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 Dead Horse 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". Dead Horse 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 Dead Horse Gulch, embeddedness

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

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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 Dead Horse Gulch. In addition, nine 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 Dead Horse 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

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- 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 22 to August 23, 2011 was conducted by A. Blessing and T. Anderson (DFG). The total length of the stream surveyed was 2,422 feet with an additional 165 feet of side channel.

Stream flow was not measured on Dead Horse Gulch.

Dead Horse Gulch is a C6 channel type for 2,282 feet of the stream surveyed (Reach 1), and a G4 channel type for 305 feet of the stream surveyed (Reach 2). C6 channels are meandering point-bar, riffle/pool, alluvial channels with broad well defined floodplain on low gradients and silt-dominant substrates. G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 45 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 77 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 38% pool units, 30% flatwater units, 20% riffle units, 9% dry units, 1% culvert units, and 1% no survey units (Graph 1). Based on total length of Level II habitat types there were 60% flatwater units, 18% pool units, 9% riffle units, 6% dry units, 6% no survey units, and 1% culvert 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, 28%; step run units, 26%; and low gradient riffle units, 16% (Graph 3). Based on percent total length, step run units made up 55%, mid-channel pool units 14%, and low gradient riffle units 7%.

A total of 26 pools were identified (Table 3). Main channel pools were the most frequently encountered at 73% (Graph 4), and comprised 78% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Six of the 26 pools (23%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 26 pool tail-outs measured, 24 had a value of 2 (92.3%); 2 had a value of 5 (7.7%) (Graph 6). On this scale, a

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value of 1 indicates the highest quality of spawning substrate. 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. Riffle habitat types had a mean shelter rating of 2, flatwater habitat types had a mean shelter rating of 27, and pool habitats had a mean shelter rating of 41 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 42. Scour pools had a mean shelter rating of 39 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Dead Horse Gulch. Graph 7 describes the pool cover in Dead Horse 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 77% of the pool tail-outs. Sand 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 Dead Horse Gulch was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 29% and 71%, respectively. Graph 9 describes the mean percent canopy in Dead Horse Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 98%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 94% sand/silt/clay, and 6% cobble/gravel (Graph 10). Coniferous trees were the dominant vegetation type observed in 44% of the units surveyed. Additionally, 33% of the units surveyed had grass as the dominant vegetation type, and 15% had deciduous as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted an electrofishing survey at nine sites for species composition and distribution in Dead Horse Gulch on October 12, 2011. The water temperature taken during the survey period of 1230 hours to 1300 hours was 55 degrees Fahrenheit. The air temperature was 67 degrees Fahrenheit. The sites were sampled by S. Monday, M. Groff and I. Mikus (DFG).

In reach 1, which comprised the first 2,282 feet of stream, nine sites were sampled. The reach sites yielded two young-of-the-year steelhead/rainbow trout (SH/RT), one age 1+ SH/RT, and two coho salmon.

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The following chart displays the information yielded from these sites:

2011 Dead Horse 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: C6 Channel Type									
10/12/11	1	002	Pool	109	0	0	0	0	0
	2	004	Pool	152	0	0	0	0	0
	3	005	Step-run	302	0	0	0	0	0
	4	006	Pool	311	0	0	0	1	0
	5	007	Run	358	0	0	0	1	0
	6	009	Step-run	462	0	0	0	0	0
	7	012	Pool	676	1	1	0	0	0
	8	014	Pool	758	0	0	0	0	0
	9	016	Pool	836	1	0	0	0	0

DISCUSSION

Dead Horse Gulch is a C6 channel type for the first 2,282 feet of stream surveyed, and a G4 channel type for the remaining 305 feet. The suitability of C6 and G4 channel types for fish habitat improvement structures is as follows: C6 channels are good for bank-placed boulders and log cover and fair for plunge weirs. G4 channels are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days August 22 to August 23, 2011, ranged from 45 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 77 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 60% of the total length of this survey, riffles 9%, and pools 18%. Six of the 26 (23%) 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 structures that will increase or deepen pool habitat is recommended.

Twenty-four of the 26 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Two 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.

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Twenty-one of the 26 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 41. The shelter rating in the flatwater habitats is 27. 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 Dead Horse 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.

The mean percent canopy density for the stream was 98%. Reach 1 had a canopy density of 98%; Reach 2 had a canopy density of 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 98% and 99%, respectively.

RECOMMENDATIONS

- 1) Dead Horse 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 small woody debris. Adding high quality complexity with woody cover in the pools is desirable.
- 4) There are several log debris accumulations present on Dead Horse Gulch that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.
- 5) Treat the bridge site at 358' to prevent the soil on top of the bridge from entering the stream and the high flows from diverting from the channel.

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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 North Fork Navarro River. The channel is a C6.
122	0004.00	Highway 128 crosses the channel. The crossing is a 3' high x 4.5' wide x 30' long concrete culvert. The slope of the culvert is 1%; there is no plunge at the outlet.
358	0008.00	There is a relic log stringer bridge across this unit. The soil on top of the stringer logs is collapsing into the creek. During higher flows, the bridge diverts flow out of the main channel, down the right bank. A channel has been formed and at higher flows, water diverts away from Deadhorse Gulch and flows for approximately 1000' along Highway 128.
1361	0035.00	Log debris accumulation (LDA) #01 contains four pieces of large woody debris (LWD) and measures 7.5' high x 18' wide x 17' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 8' wide x 2' long x 1.5' deep. There is a 3' high plunge over the LDA. It is a possible barrier to juvenile and adult salmonids.
1498	0043.00	LDA #02 contains 42 pieces of LWD and measures 23' high x 40' wide x 144' long. Water flows through the LDA and there are visible gaps. Retained sediment ranges from sand to cobble and measures 18' wide x 30' long x 10' deep. It is a possible barrier to juvenile and adult salmonids.
2117	0051.00	The channel changes from a C6 to a G4.
2133	0052.00	LDA #03 contains six pieces of LWD and measures 9' high x 14' wide x 29' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from sand to cobble and measures 14' wide x 20' long x 1.5' deep. It is a possible barrier to juvenile and adult salmonids.
2173	0055.00	Tributary #01 enters on the left bank. The water temperature of the tributary is 51 degrees Fahrenheit; the water temperature downstream and upstream of the tributary is 54 degrees Fahrenheit. The slope of the tributary is approximately 2%.

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2410 0066.00 End of survey due to 221' long dry section with a 26% slope.

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: Dead Horse Gulch

LLID: 1236099391545 Drainage: Navarro River

Survey Dates: 8/22/2011 to 8/23/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR16WS15

Latitude: 39:09:16.0N

Longitude: 123:36:36.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
1	0	CULVERT	1.4	30	30	1.2									
6	0	DRY	8.7	28	167	6.5									
21	5	FLATWATER	30.4	74	1548	59.8	3.1	0.4	0.7	305	6398	116	2441		27
1	0	NOSURVEY	1.4	144	144	5.6									
26	26	POOL	37.7	18	457	17.7	7.2	0.7	1.4	135	3511	150	3893	130	41
14	5	RIFFLE	20.3	17	241	9.3	4.1	0.1	0.2	63	876	10	147		2
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
69	36				2587					10784			6481		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Dead Horse Gulch

LLID: 1236099391545

Drainage: Navarro River

Survey Dates: 8/22/2011 to 8/23/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR16WS15

Latitude: 39:09:16.0N

Longitude: 123:36:36.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
11	3	LGR	15.9	16	173	6.7	5	0.1	0.2	68	743	7	74		2	92
2	1	HGR	2.9	32	63	2.4	4	0.3	0.5	105	211	32	63		5	100
1	1	CAS	1.4	5	5	0.2	1	0.1	0.2	5	5	1	1		0	100
3	1	RUN	4.3	46	137	5.3	4	0.4	0.8	233	699	93	280		60	100
18	4	SRN	26.1	78	1411	54.5	3	0.4	0.9	323	5806	122	2196		19	99
19	19	MCP	27.5	19	357	13.8	7	0.7	2.9	148	2809	169	3217	147	42	98
7	7	PLP	10.1	14	100	3.9	7	0.8	2.1	100	702	97	676	84	39	100
6	0	DRY	8.7	28	167	6.5										
1	0	CUL	1.4	30	30	1.2										
1	0	NS	1.4	144	144	5.6										

Total Units
69

Total Units Fully Measured
36

Total Length (ft.)
2587

Total Area (sq.ft.)
10974

Total Volume (cu.ft.)
6506

Table 3 - Summary of Pool Types

Stream Name: Dead Horse Gulch

LLID: 1236099391545

Drainage: Navarro River

Survey Dates: 8/22/2011 to 8/23/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR16WS15

Latitude: 39:09:16.0N

Longitude: 123:36:36.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating
19	19	MAIN	73	19	357	78	7.3	0.7	148	2809	147	2792	42
7	7	SCOUR	27	14	100	22	6.9	0.8	100	702	84	589	39

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
26	26	457	3510	3381

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

Stream Name: Dead Horse Gulch LLID: 1236099391545 Drainage: Navarro River
 Survey Dates: 8/22/2011 to 8/23/2011
 Confluence Location: Quad: NAVARRO Legal Description: T15NR16WS15 Latitude: 39:09:16.0N Longitude: 123:36:36.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
19	MCP	73	3	16	12	63	4	21	0	0	0	0
7	PLP	27	0	0	5	71	2	29	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
26	3	12	17	65	6	23	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.4

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Dead Horse Gulch LLID: 1236099391545 Drainage: Navarro River
 Survey Dates: 8/22/2011 to 8/23/2011 Dry Units: 6
 Confluence Location: Quad: NAVARRO Legal Description: T15NR16WS15 Latitude: 39:09:16.0N Longitude: 123:36:36.0W

Habitat Units	Units Fully Measured	Habitat Type	Mean % Undercut Banks	Mean % SWD	Mean % LWD	Mean % Root Mass	Mean % Terr. Vegetation	Mean % Aquatic Vegetation	Mean % White Water	Mean % Boulders	Mean % Bedrock Ledges
11	3	LGR	0	60	0	0	40	0	0	0	0
2	1	HGR	0	0	0	0	0	0	0	100	0
1	1	CAS	0	0	0	0	0	0	0	0	0
14	5	TOTAL RIFFLE	0	30	0	0	20	0	0	50	0
3	1	RUN	75	5	15	5	0	0	0	0	0
18	4	SRN	15	30	15	1	39	0	0	0	0
21	5	TOTAL FLAT	27	25	15	2	31	0	0	0	0
19	19	MCP	26	34	30	3	4	3	0	0	0
7	7	PLP	31	46	16	4	0	0	2	1	0
26	26	TOTAL POOL	27	38	26	4	3	2	1	0	0
1	0	CUL									
1	0	NS									
69	36	TOTAL	25	35	23	3	8	2	0	3	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Dead Horse Gulch LLID: 1236099391545 Drainage: Navarro River
 Survey Dates: 8/22/2011 to 8/23/2011 Dry Units: 6
 Confluence Location: Quad: NAVARRO Legal Description: T15NR16WS15 Latitude: 39:09:16.0N Longitude: 123:36:36.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
11	3	LGR	33	0	67	0	0	0	0
2	1	HGR	0	0	100	0	0	0	0
1	1	CAS	100	0	0	0	0	0	0
3	1	RUN	100	0	0	0	0	0	0
18	4	SRN	100	0	0	0	0	0	0
19	19	MCP	37	42	21	0	0	0	0
7	7	PLP	0	71	29	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Dead Horse Gulch LLID: 1236099391545 Drainage: Navarro River
 Survey Dates: 8/22/2011 to 8/23/2011
 Confluence Location: Quad: NAVARRO Legal Description: T15NR16WS15 Latitude: 39:09:16.0N Longitude: 123:36:36.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	71	29	0	98	99

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: Dead Horse Gulch LLID: 1236099391545 Drainage: Navarro River
 Survey Dates: 8/22/2011 to 8/23/2011 Survey Length (ft.): 2587 Main Channel (ft.): 2422 Side Channel (ft.): 165
 Confluence Location: Quad: NAVARRO Legal Description: T15NR16WS15 Latitude: 39:09:16.0N Longitude: 123:36:36.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: C6	Canopy Density (%): 97.9	Pools by Stream Length (%): 15.8
Reach Length (ft.): 2117	Coniferous Component (%): 67.5	Pool Frequency (%): 35.8
Riffle/Flatwater Mean Width (ft.): 3.9	Hardwood Component (%): 32.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Grass	< 2 Feet Deep: 79
Range (ft.): 5 to 20	Vegetative Cover (%): 97.9	2 to 2.9 Feet Deep: 21
Mean (ft.): 10	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 20	Mean Max Residual Pool Depth (ft.): 1.4
Water (F): 45 - 58 Air (F): 54 - 77	LWD per 100 ft.:	Mean Pool Shelter Rating: 43
Dry Channel (ft): 148	Riffles: 2	
	Pools: 6	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 11 Sand: 16 Gravel: 68 Sm Cobble: 5 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 89.5 3. 0.0 4. 0.0 5. 10.5		

STREAM REACH: 2

Channel Type: G4	Canopy Density (%): 100.0	Pools by Stream Length (%): 31.5
Reach Length (ft.): 305	Coniferous Component (%): 87.1	Pool Frequency (%): 43.8
Riffle/Flatwater Mean Width (ft.): 1.0	Hardwood Component (%): 12.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 71
Range (ft.): 5 to 20	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep: 29
Mean (ft.): 12	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0
Std. Dev.: 7	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 19	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 50 - 51 Air (F): 62 - 62	LWD per 100 ft.:	Mean Pool Shelter Rating: 36
Dry Channel (ft): 19	Riffles: 5	
	Pools: 5	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 100 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 0.0 2. 100.0 3. 0.0 4. 0.0 5. 0.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Dead Horse Gulch

LLID: 1236099391545

Drainage: Navarro River

Survey Dates: 8/22/2011 to 8/23/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR16WS15

Latitude: 39:09:16.0N

Longitude: 123:36:36.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	2	2	5.6
Sand / Silt / Clay	34	34	94.4

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	13	11	33.3
Brush	3	2	6.9
Hardwood Trees	3	8	15.3
Coniferous Trees	17	15	44.4
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Dead Horse Gulch

LLID: 1236099391545

Drainage: Navarro River

Survey Dates: 8/22/2011 to 8/23/2011

Confluence Location: Quad: NAVARRO

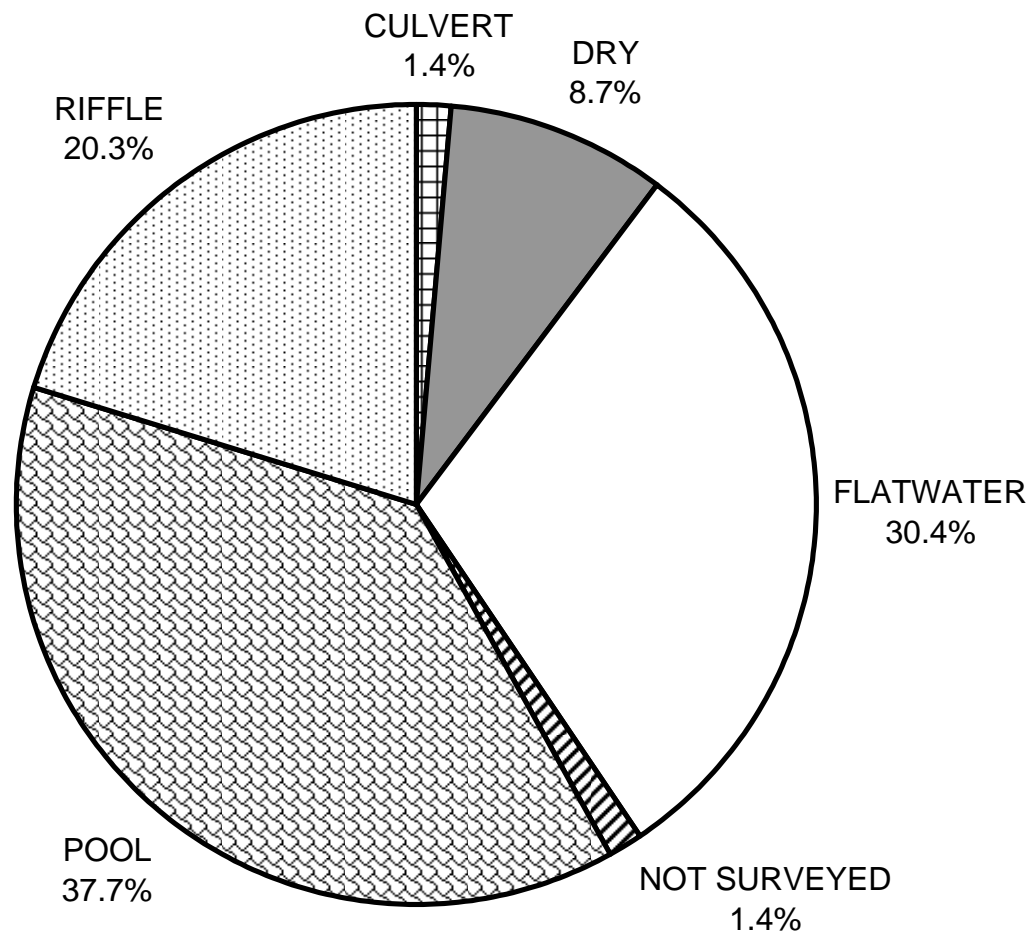
Legal Description: T15NR16WS15

Latitude: 39:09:16.0N

Longitude: 123:36:36.0W

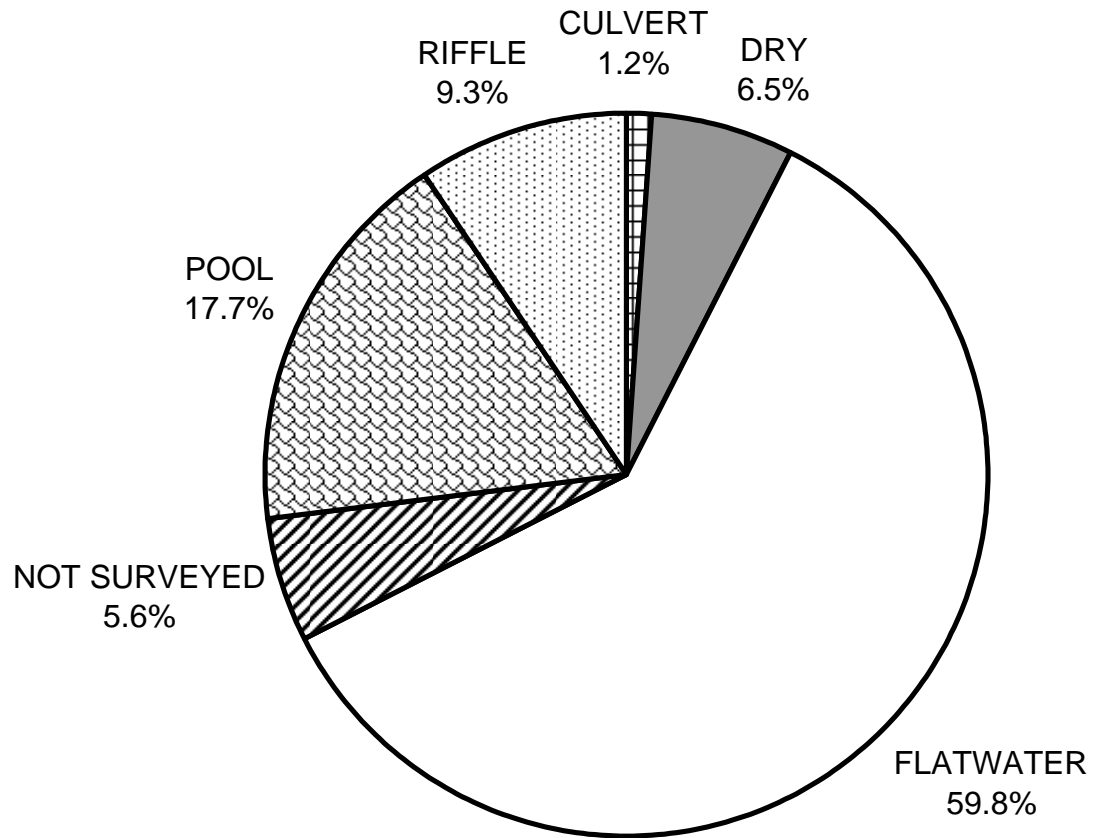
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	27	27
SMALL WOODY DEBRIS (%)	30	25	38
LARGE WOODY DEBRIS (%)	0	15	26
ROOT MASS (%)	0	2	4
TERRESTRIAL VEGETATION (%)	20	31	3
AQUATIC VEGETATION (%)	0	0	2
WHITEWATER (%)	0	0	1
BOULDERS (%)	50	0	0
BEDROCK LEDGES (%)	0	0	0

DEAD HORSE GULCH 2011 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

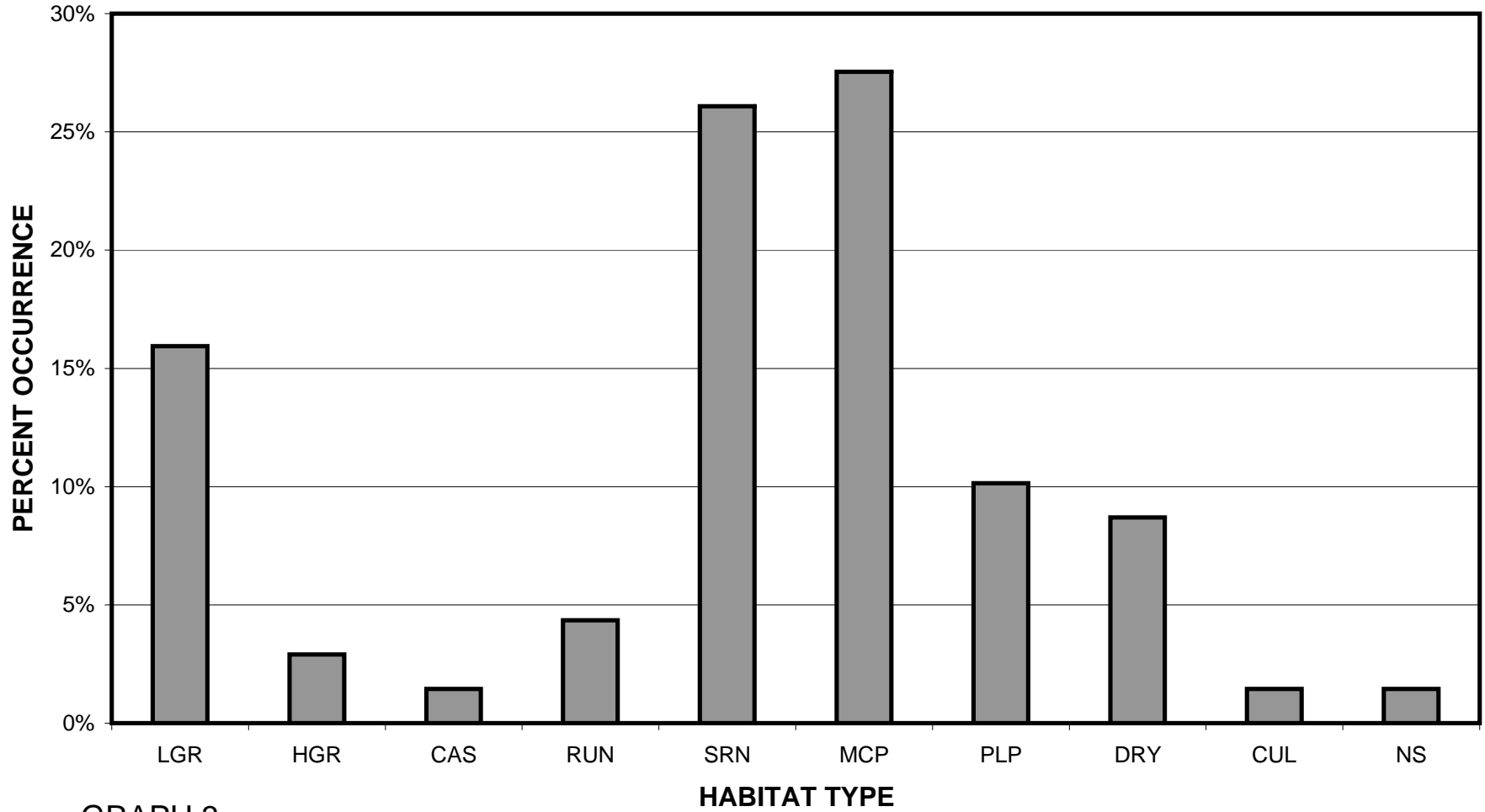
DEAD HORSE GULCH 2011 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

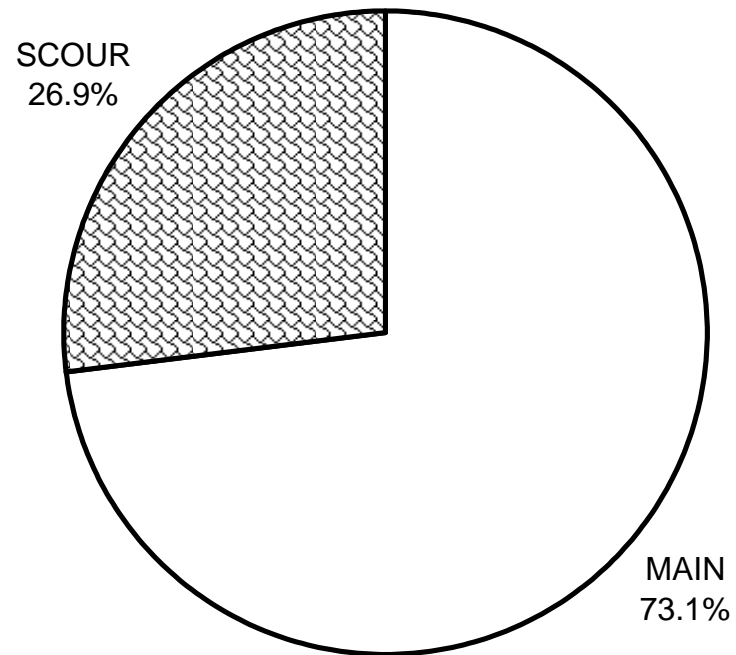
DEAD HORSE GULCH 2011

HABITAT TYPES BY PERCENT OCCURRENCE



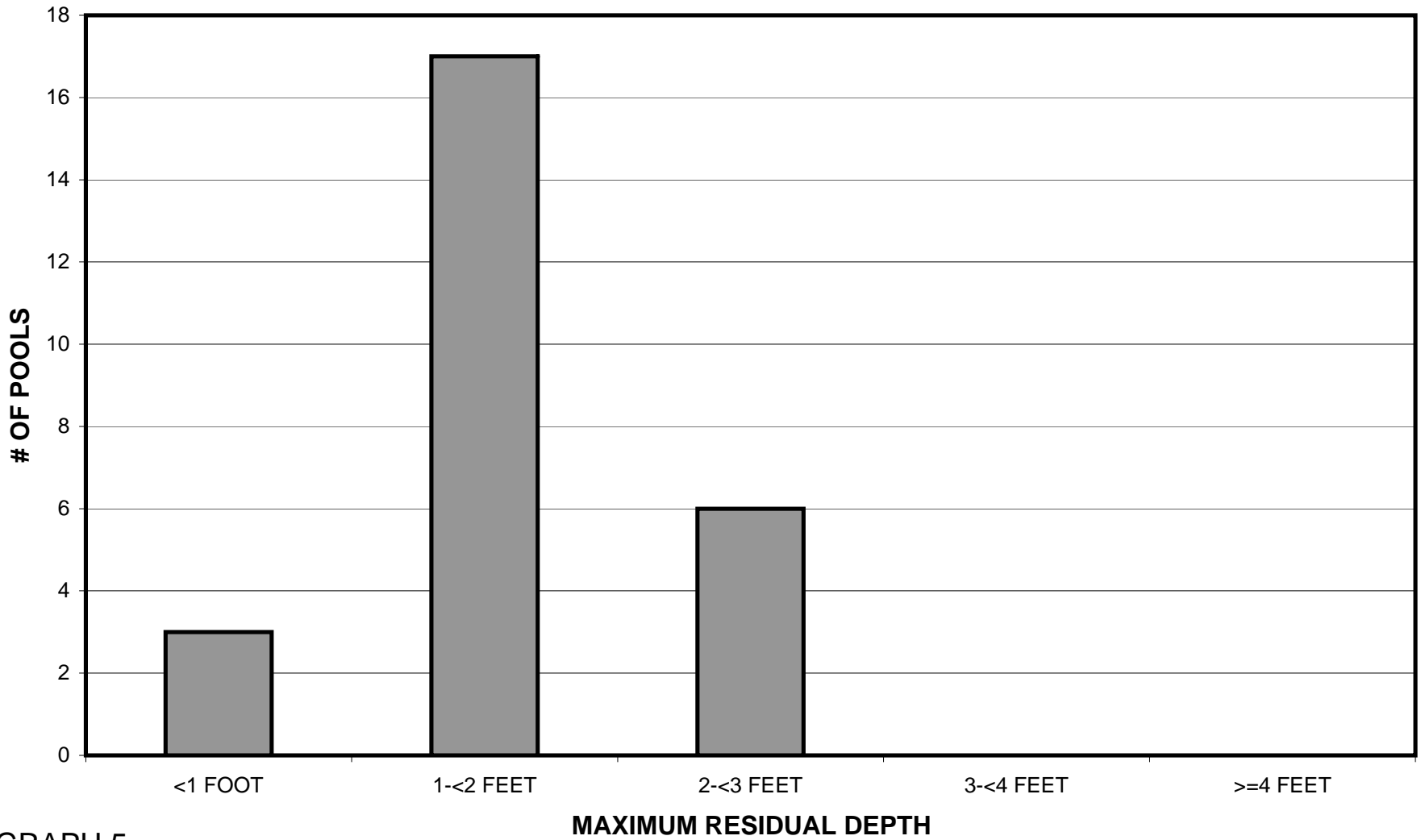
GRAPH 3

DEAD HORSE GULCH 2011 POOL TYPES BY PERCENT OCCURRENCE



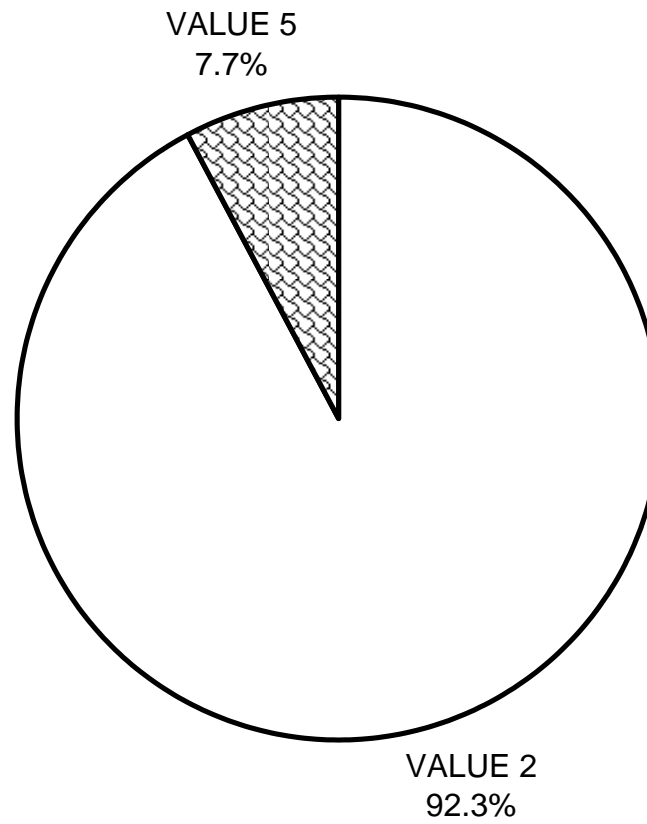
GRAPH 4

DEAD HORSE GULCH 2011 MAXIMUM DEPTH IN POOLS



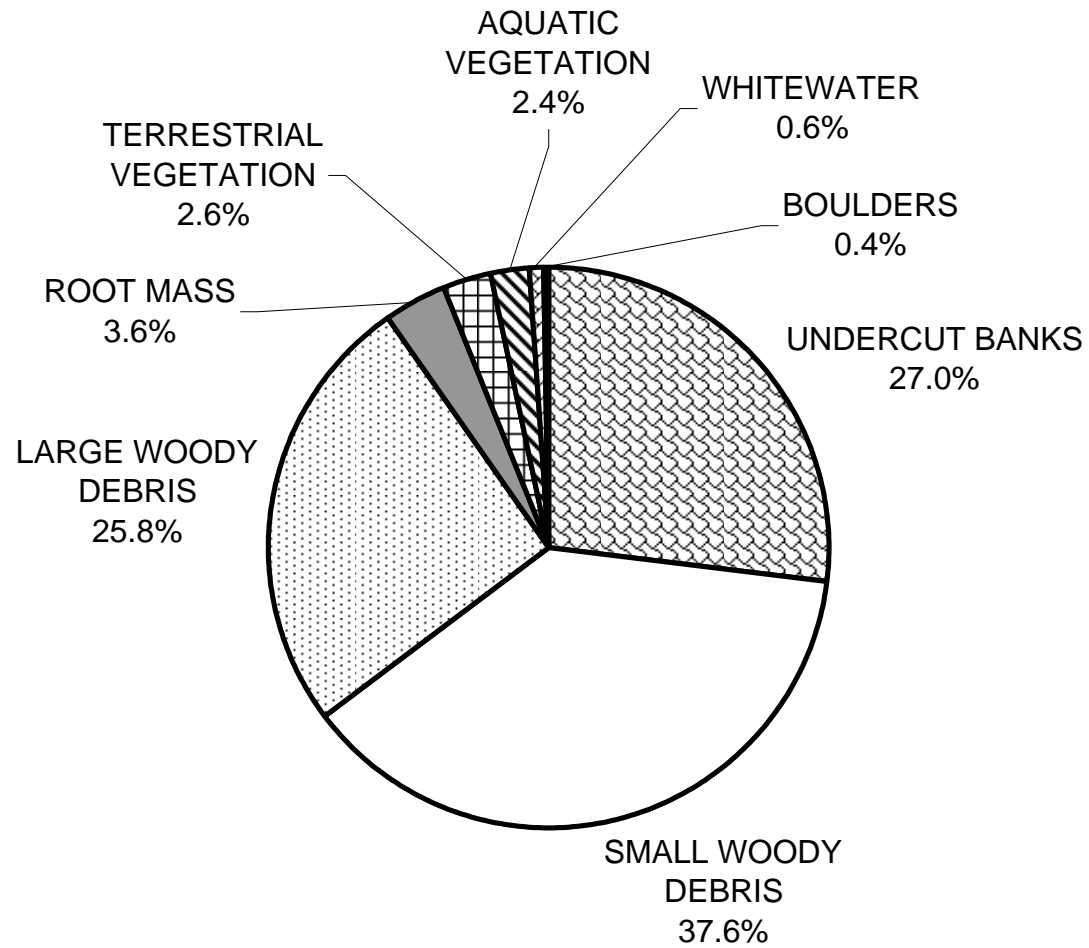
GRAPH 5

DEAD HORSE GULCH 2011 PERCENT EMBEDDEDNESS



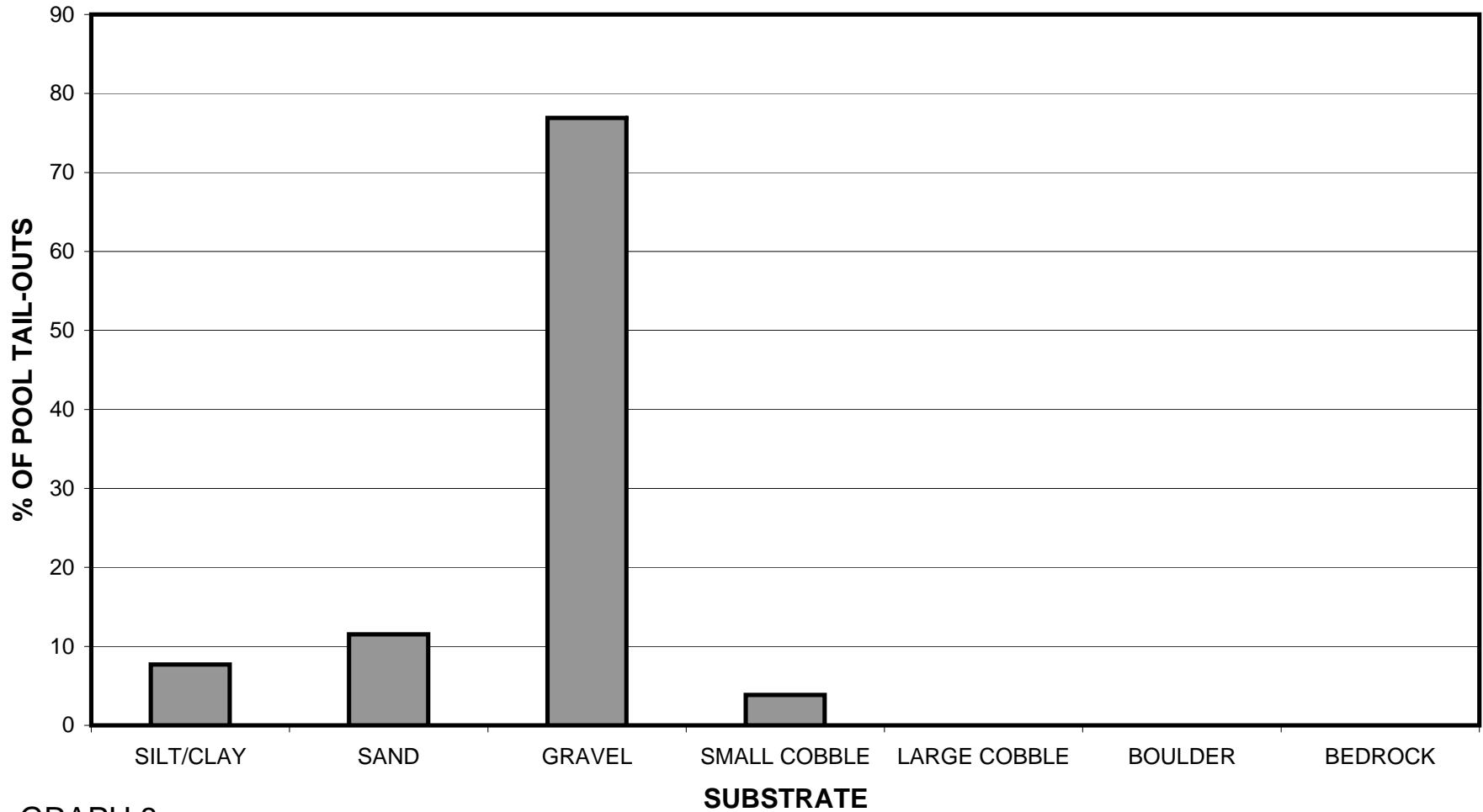
GRAPH 6

DEAD HORSE GULCH 2011 MEAN PERCENT COVER TYPES IN POOLS



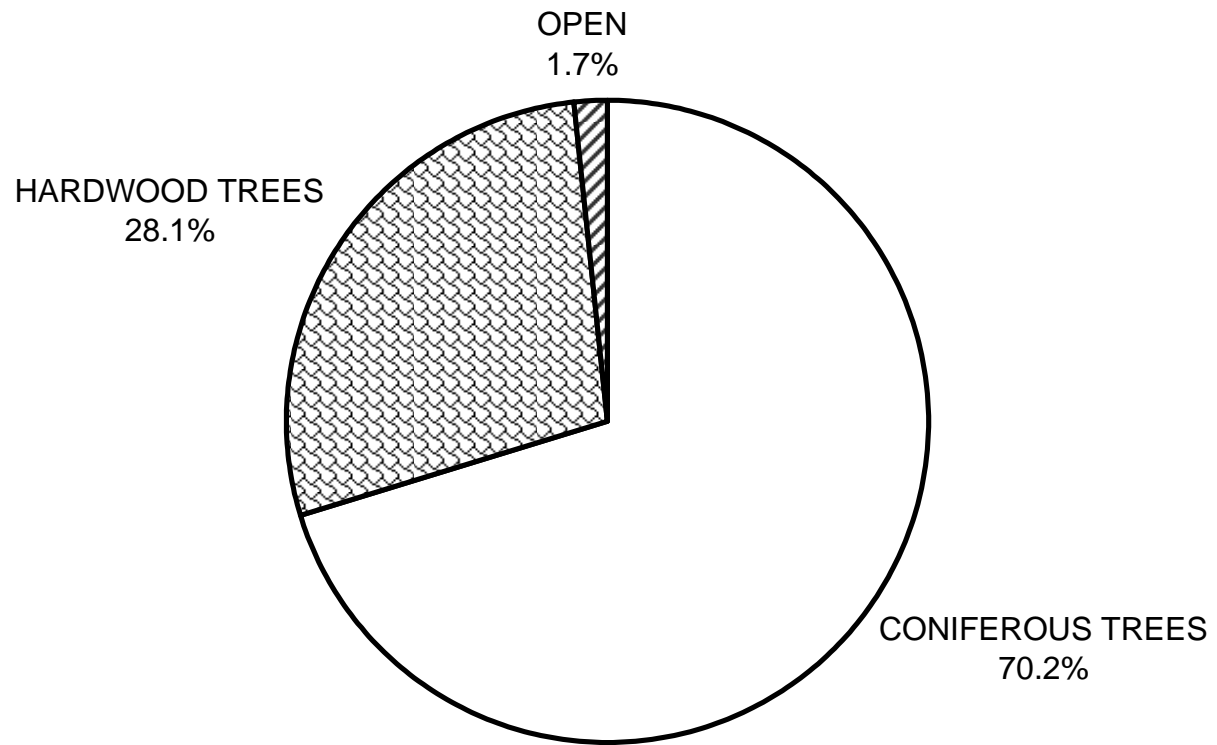
GRAPH 7

DEAD HORSE GULCH 2011 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



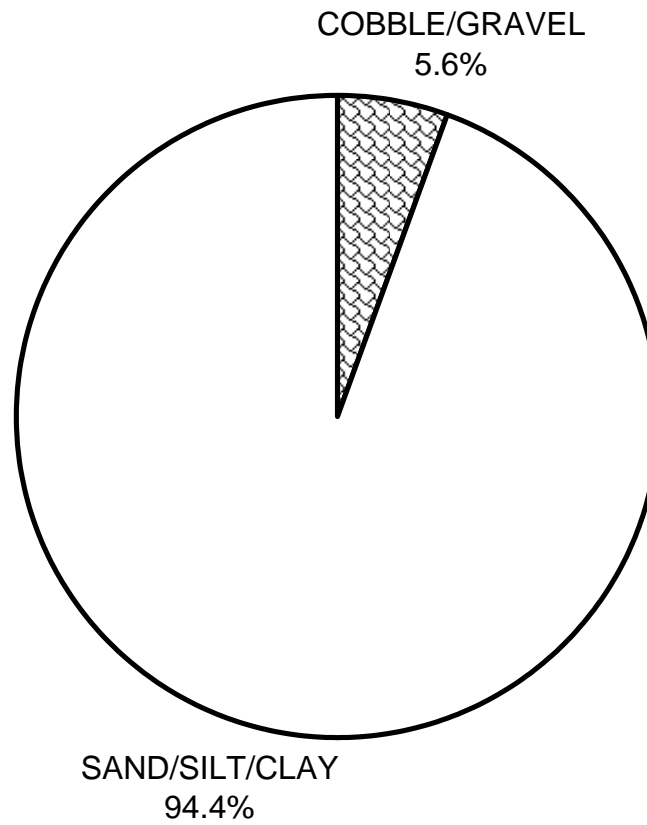
GRAPH 8

DEAD HORSE GULCH 2011 MEAN PERCENT CANOPY



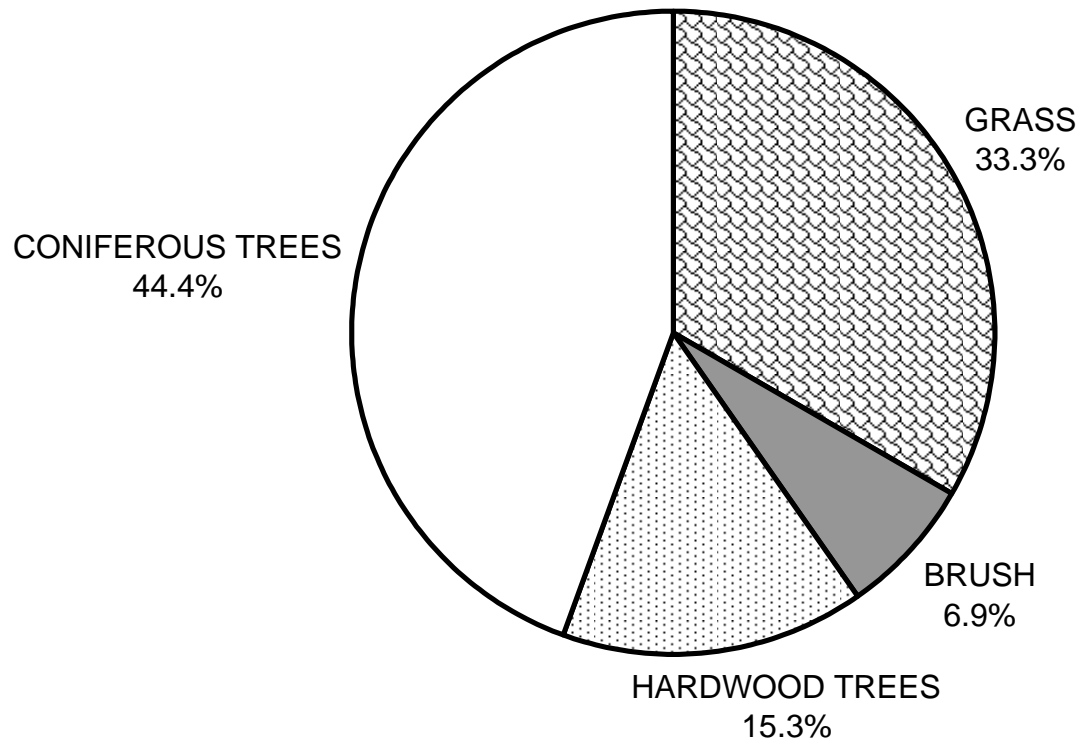
GRAPH 9

**DEAD HORSE GULCH 2011
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

DEAD HORSE GULCH 2011 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

