

STREAM INVENTORY REPORT

Neefus Gulch

INTRODUCTION

A stream inventory was conducted from August 31 to October 18, 2011 on Neefus Gulch. The survey began at the confluence with the North Fork Navarro River and extended upstream 0.8 miles.

The Neefus 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 Neefus 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

Neefus 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). Neefus Gulch's legal description at the confluence with the North Fork Navarro River is T15N R15W S07. Its location is 39.1693 degrees north latitude and 123.5674 degrees west longitude, LLID number 1235662391694. Neefus Gulch is a first order stream and has approximately 2.2 miles of blue line stream according to the USGS Navarro 7.5 minute quadrangle. Neefus Gulch drains a watershed of approximately 1.3 square miles. Elevations range from about 110 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, recreation, and rural development. Vehicle access exists via Masonite Road off of Highway 128.

METHODS

The habitat inventory conducted in Neefus 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

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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 Neefus 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". Neefus 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 Neefus Gulch, embeddedness was

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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 Neefus 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 Neefus 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 Neefus 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 Neefus Gulch. In addition, 21 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 Neefus Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence

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- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of August 31 to October 18, 2011 was conducted by A. Blessing, T. Anderson, R. Spencer, and B. James (WSP). The total length of the stream surveyed was 4,345 feet.

Stream flow was not measured on Neefus Gulch.

Neefus Gulch is an F4 channel type for the entire length of the survey, 4,345 feet (Reach 1). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 58 degrees Fahrenheit. Air temperatures ranged from 52 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% pool units, 32% flatwater units, 23% dry units, 5% riffle units, and 1% culvert units (Graph 1). Based on total length of Level II habitat types there were 36% dry units, 34% flatwater units, 26% pool units, 4% riffle 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, 35%; dry units, 23%; and step run units, 22% (Graph 3). Based on percent total length, dry units made up 36%, step run units 31%, and mid channel pool units 21%.

A total of 34 pools were identified (Table 3). Main channel pools were the most frequently encountered at 91% (Graph 4), and comprised 93% 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. Nine of the 34 pools (26%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 34 pool tail-outs measured, 21 had a value of 1 (61.8%); 11 had a value of 2 (32.4%); two had a value of 3 (5.9%) (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.

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A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 6, and pool habitats had a mean shelter rating of 28 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 110. Scour pools had a mean shelter rating of 30. Main channel pools had a mean shelter rating of 25 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Neefus Gulch. Graph 7 describes the pool cover in Neefus Gulch. Undercut banks are the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 79% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 15% of the pool tail-outs

The mean percent canopy density for the surveyed length of Neefus Gulch was 96%. Four percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 13% and 87%, respectively. Graph 9 describes the mean percent canopy in Neefus Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 98%. The mean percent left bank vegetated was 98%. The dominant elements composing the structure of the stream banks consisted of 82% sand/silt/clay, 17% cobble/gravel, and 1% boulder (Graph 10). Coniferous trees were the dominant vegetation type observed in 67% of the units surveyed. Additionally, 21% of the units surveyed had grass as the dominant vegetation type, and 9% had deciduous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted an electrofishing survey at 21 sites for species composition and distribution in Neefus Gulch on October 12 and October 19, 2011. The water temperature taken during the electrofishing periods was 57 degrees Fahrenheit. Air temperatures ranged from 64 to 71 degrees Fahrenheit. The sites were sampled by S. Monday, M. Groff, and I. Mikus (DFG).

In reach 1, which comprised the first 4,345 feet of stream, 21 sites were sampled. The reach sites yielded three age 1+ steelhead/rainbow trout (SH/RT), 12 coho salmon, and three three-spine stickleback.

The following chart displays the information yielded from these sites:

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2011 Neefus 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: F4 Channel Type									
10/12/11	1	006	Pool	940	0	1	0	11	0
	2	018	Pool	1,306	0	0	0	0	0
	3	020	Pool	1,343	0	1	0	1	0
	4	021	Run	1,659	0	0	0	0	0
	5	022	Run	1,677	0	0	0	0	0
	6	024	Pool	1,737	0	0	0	0	0
	7	026	Step-run	1,785	0	0	0	0	0
	8	028	Step-run	1,869	0	0	0	0	0
	9	029	Pool	1,904	0	0	0	0	0
	10	030	Pool	2,011	0	0	0	0	0
	11	0.6	Pool	2,137	0	0	0	0	0
	12	038	Pool	2,183	0	0	0	0	0
	13	040	Pool	2,234	0	0	0	0	0
	14	041	Step-run	2,250	0	0	0	0	0
	15	043	Pool	2,297	0	1	0	0	0
	16	044	Step-run	2,397	0	0	0	0	0
	17	045	Pool	2,463	0	0	0	0	0
	18	047	Step-run	2,515	0	0	0	0	0
	19	048	Pool	2,570	0	0	0	0	0
	20	068	Pool	3,310	0	0	0	0	0
	21	070	Pool	3,343	0	0	0	0	0

DISCUSSION

Neefus Gulch is an F4 channel type for the entire length of the survey, 4,345 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperatures recorded on the survey days August 31 to October 18, 2011 ranged from 51 to 58 degrees Fahrenheit. Air temperatures ranged from 52 to 76 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 34% of the total length of this survey, riffles 4%, and pools 26%. Nine of the 34 (26%) 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

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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.

Thirty-two of the 34 pool tail-outs measured had embeddedness ratings of 1 or 2. Two of the pool tail-outs had embeddedness ratings of 3 or 4. None of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

Thirty-two of the 34 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 28. The shelter rating in the flatwater habitats is 6. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Neefus Gulch. Undercut banks are 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 96%. 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%.

RECOMMENDATIONS

- 1) Neefus 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 undercut banks. Adding high quality complexity with woody cover in the pools is desirable.
- 5) Conduct a fish passage assessment on the stream crossing on Appian Way located 2,961 feet from the confluence. If the crossing is determined to be a barrier to fish passage replace the two culverts with a crossing that will provide unimpeded fish passage.
- 6) Explore alternatives for fish passage at the dam located at 4,345 feet.

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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 an F4 for the entire length of the survey. The first 751' feet of Neefus Gulch are dry. Two roads cross the channel in this dry section. The first crossing is a 9' wide x 21' long x 3.5' high metal and concrete bridge. The second crossing (Masonite Road) is a 70' long x 18' wide x 13.5' high metal bridge. Neefus Gulch has too little flow to measure.
1317	0020.00	Log debris accumulation (LDA) #01 contains eight pieces of large woody debris (LWD) and measures 8' high x 11' wide x 30' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from sand to gravel and measures 14' wide x 25' long x 2' deep.
1343	0021.00	There is a 316' long dry section.
2234	0041.00	LDA #02 contains one piece of LWD and measures 5.4' high x 11' wide x 11.5' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to cobble and measures 10' wide x 20' long x 2.5' deep. Fish are present above the LDA.
2961	0060.00	Appian Way crosses the channel. The crossing consists of two culverts. The first culvert is a 5' high x 5.3' wide x 34' long metal pipe with a 2% slope. There is a 3' high plunge at the outlet; the maximum depth within 5' of the outlet is 3.7'. The bottom of the culvert is lined with asphalt. The second culvert is parallel to the first. It is a 3.2' high x 2.7' wide x 40' long corrugated metal pipe. The plunge at the outlet is 5' high. There is no rust line. Both culverts are a possible barrier to juvenile and adult salmonids.
3583	0075.00	LDA #03 contains three pieces of LWD and measures 6' high x 13' wide x 5' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to cobble and measures 10' wide x 10' long x 3' deep.
4345	0087.00	End of survey at a dam. Landowner access permission was not granted above the reservoir.

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REFERENCES

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

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

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

CASCADE

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

FLATWATER

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

MAIN CHANNEL POOLS

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

SCOUR POOLS

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

BACKWATER POOLS

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

ADDITIONAL UNIT DESIGNATIONS

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

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

Stream Name: 1235662391694

LLID: 1235662391694 Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Confluence Location: Quad: NAVARRO Legal Description: T15NR15WS07 Latitude: 39:10:10.0N Longitude: 123:33:58.0

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	1.1	34	34	0.8									
20	0	DRY	23.0	77	1543	35.5									
28	4	FLATWATER	32.2	52	1465	33.7	5.4	0.2	0.5	211	5921	44	1239		6
34	34	POOL	39.1	33	1112	25.6	7.7	1.0	1.7	251	8528	288	9791	270	28
4	1	RIFFLE	4.6	48	191	4.4	7.5	0.1	0.2	216	864	22	86		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
87	39				4345					15314			11116		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

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 (%)
4	1	LGR	4.6	48	191	4.4	8	0.1	0.2	216	864	22	86		0	98
9	2	RUN	10.3	15	135	3.1	6	0.2	0.5	121	1089	17	153		8	90
19	2	SRN	21.8	70	1330	30.6	5	0.2	0.9	302	5737	71	1357		5	92
30	30	MCP	34.5	31	926	21.3	7	0.9	3.7	221	6626	224	6730	206	24	96
1	1	STP	1.1	107	107	2.5	10	1.0	1.4	1067	1067	1067	1067	1067	60	100
2	2	PLP	2.3	30	60	1.4	12	2.2	4	351	702	891	1781	868	30	99
1	1	BPB	1.1	19	19	0.4	7	1.6	2.5	133	133	213	213	213	110	99
20	0	DRY	23.0	77	1543	35.5										
1	0	CUL	1.1	34	34	0.8										

Total Units
87

Total Units Fully Measured
39

Total Length (ft.)
4345

Total Area (sq.ft.)
16218

Total Volume (cu.ft.)
11388

Table 3 - Summary of Pool Types

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

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
31	31	MAIN	91	33	1033	93	7.4	0.9	248	7693	234	7246	25
2	2	SCOUR	6	30	60	5	11.5	2.2	351	702	868	1737	30
1	1	BACKWATER	3	19	19	2	7.0	1.6	133	133	213	213	110

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
34	34	1112	8528	9196

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

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

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
30	MCP	88	2	7	21	70	6	20	1	3	0	0
1	STP	3	0	0	1	100	0	0	0	0	0	0
2	PLP	6	0	0	1	50	0	0	0	0	1	50
1	BPB	3	0	0	0	0	1	100	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
34	2	6	23	68	7	21	1	3	1	3

Mean Maximum Residual Pool Depth (ft.): 1.7

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Dry Units: 20

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

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
4	1	LGR	0	0	0	0	0	0	0	0	0
4	1	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
9	2	RUN	0	10	0	50	0	40	0	0	0
19	2	SRN	0	40	0	5	0	0	0	55	0
28	4	TOTAL FLAT	0	25	0	28	0	20	0	28	0
30	30	MCP	41	30	14	8	3	0	0	4	0
1	1	STP	40	15	25	20	0	0	0	0	0
2	2	PLP	10	15	50	5	0	0	0	20	0
1	1	BPB	30	70	0	0	0	0	0	0	0
34	34	TOTAL POOL	39	30	16	8	2	0	0	5	0
1	0	CUL									
87	39	TOTAL	35	29	15	10	2	2	0	7	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Dry Units: 20

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

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
4	1	LGR	0	0	100	0	0	0	0
9	2	RUN	0	0	100	0	0	0	0
19	2	SRN	0	0	100	0	0	0	0
30	30	MCP	7	7	83	3	0	0	0
1	1	STP	0	0	100	0	0	0	0
2	2	PLP	0	0	100	0	0	0	0
1	1	BPB	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
96	87	13	0	98	98

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Survey Length (ft.): 4345

Main Channel (ft.): 4345

Side Channel (ft.): 0

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07 Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

Summary of Fish Habitat Elements By Stream Reach**STREAM REACH: 1**

Channel Type: F4

Canopy Density (%): 95.8

Pools by Stream Length (%): 25.6

Reach Length (ft.): 4345

Coniferous Component (%): 87.3

Pool Frequency (%): 39.1

Riffle/Flatwater Mean Width (ft.): 5.8

Hardwood Component (%): 12.7

Residual Pool Depth (%):

BFW:

Dominant Bank Vegetation: Coniferous Trees

< 2 Feet Deep: 74

Range (ft.): 5 to 15

Vegetative Cover (%): 98.3

2 to 2.9 Feet Deep: 21

Mean (ft.): 12

Dominant Shelter: Undercut Banks

3 to 3.9 Feet Deep: 3

Std. Dev.: 3

Dominant Bank Substrate Type: Sand/Silt/Clay

>= 4 Feet Deep: 3

Base Flow (cfs.): 0.0

Occurrence of LWD (%): 14

Mean Max Residual Pool Depth (ft.): 1.7

Water (F): 51 - 70 Air (F): 52 - 76

LWD per 100 ft.:

Mean Pool Shelter Rating: 28

Dry Channel (ft): 1543

Riffles: 1

Pools: 3

Flat: 1

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 6 Gravel: 79 Sm Cobble: 15 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 61.8 2. 32.4 3. 5.9 4. 0.0 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

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	1	1.3
Cobble / Gravel	9	4	16.7
Sand / Silt / Clay	30	34	82.1

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	10	6	20.5
Brush	2	1	3.8
Hardwood Trees	2	5	9.0
Coniferous Trees	25	27	66.7
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 1

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

StreamName: 1235662391694

LLID: 1235662391694

Drainage: Navarro River

Survey Dates: 8/31/2011 to 10/18/2011

Confluence Location: Quad: NAVARRO

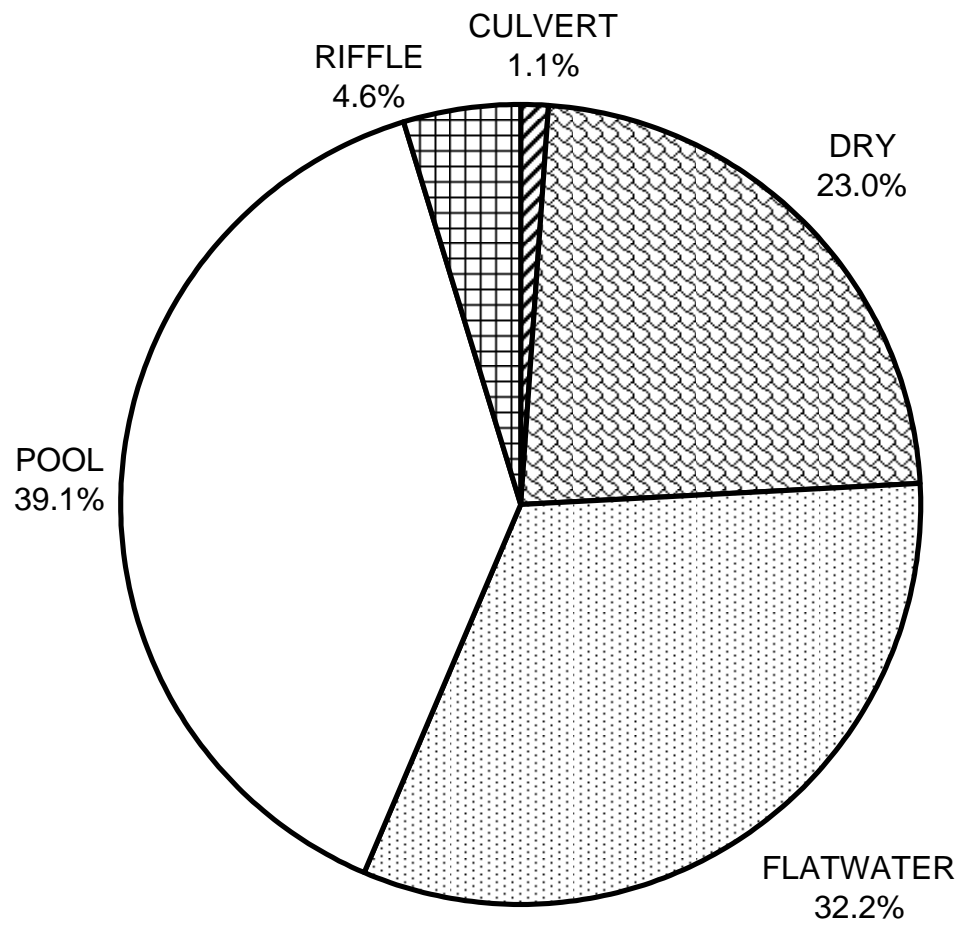
Legal Description: T15NR15WS07

Latitude: 39:10:10.0N

Longitude: 123:33:58.0W

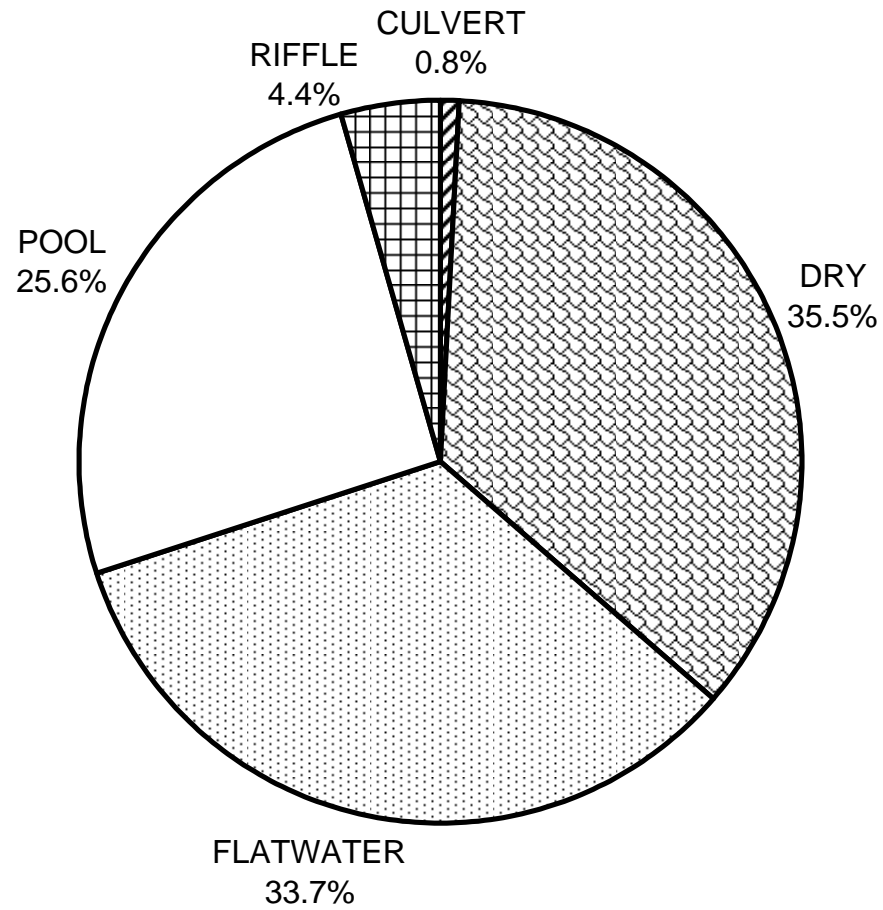
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	39
SMALL WOODY DEBRIS (%)	0	25	30
LARGE WOODY DEBRIS (%)	0	0	16
ROOT MASS (%)	0	28	8
TERRESTRIAL VEGETATION (%)	0	0	2
AQUATIC VEGETATION (%)	0	20	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	28	5
BEDROCK LEDGES (%)	0	0	0

NEEFUS GULCH 2011 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

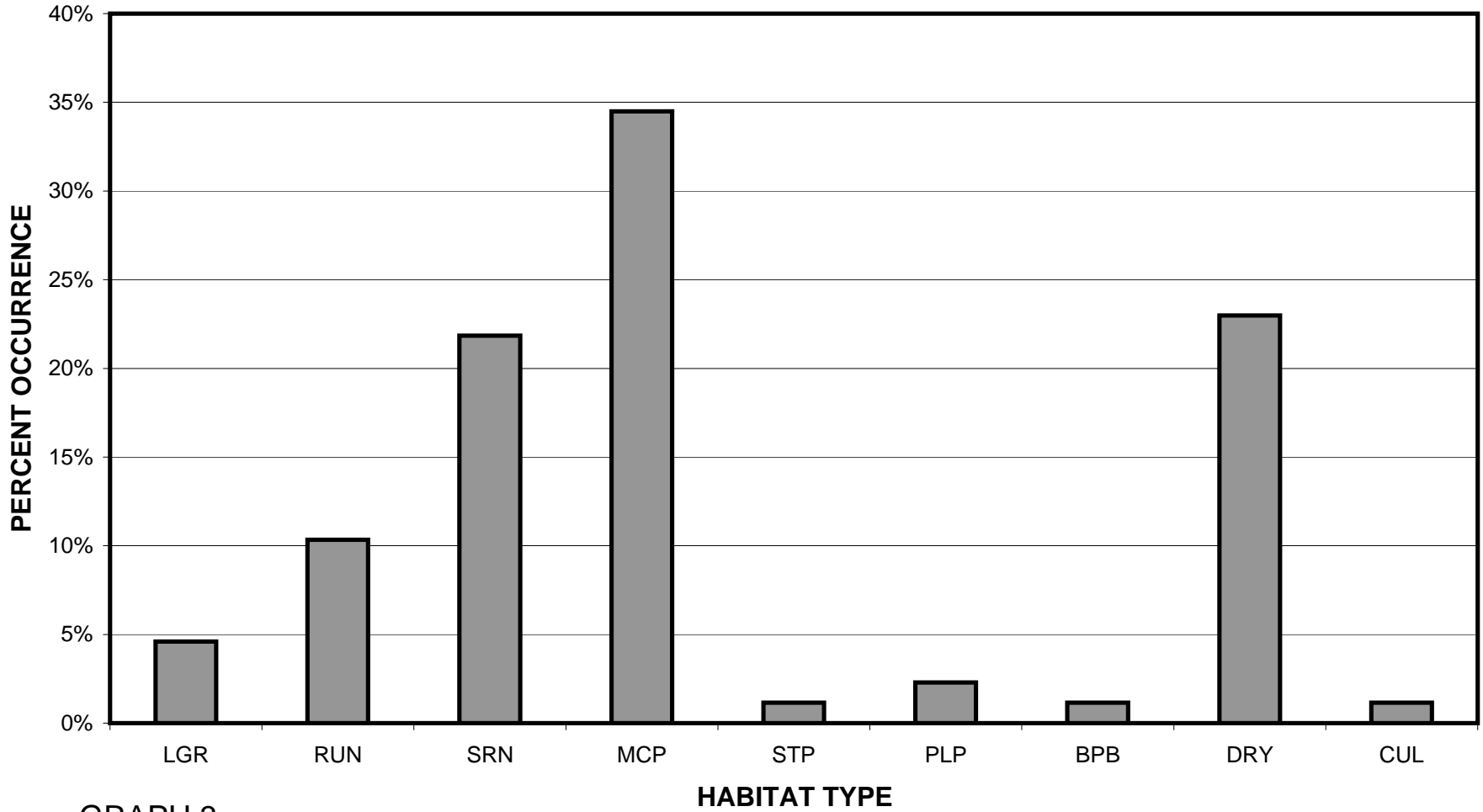
NEEFUS GULCH 2011 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

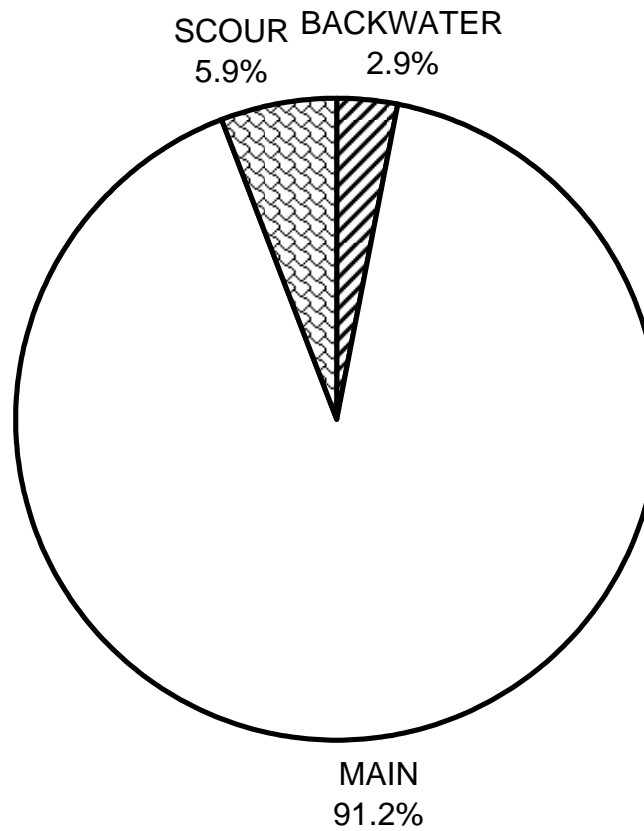
NEEFUS GULCH 2011

HABITAT TYPES BY PERCENT OCCURRENCE



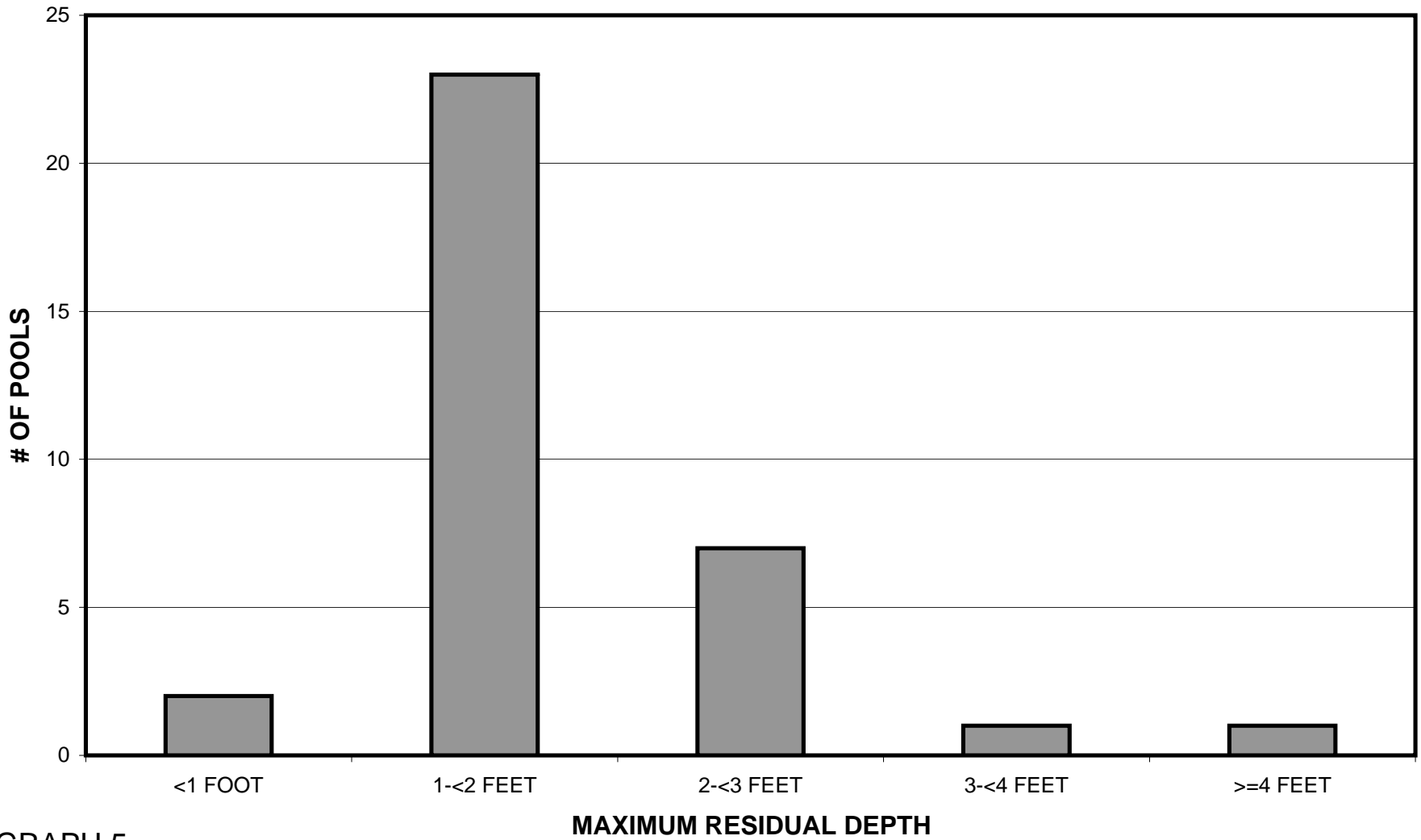
GRAPH 3

NEEFUS GULCH 2011 POOL TYPES BY PERCENT OCCURRENCE



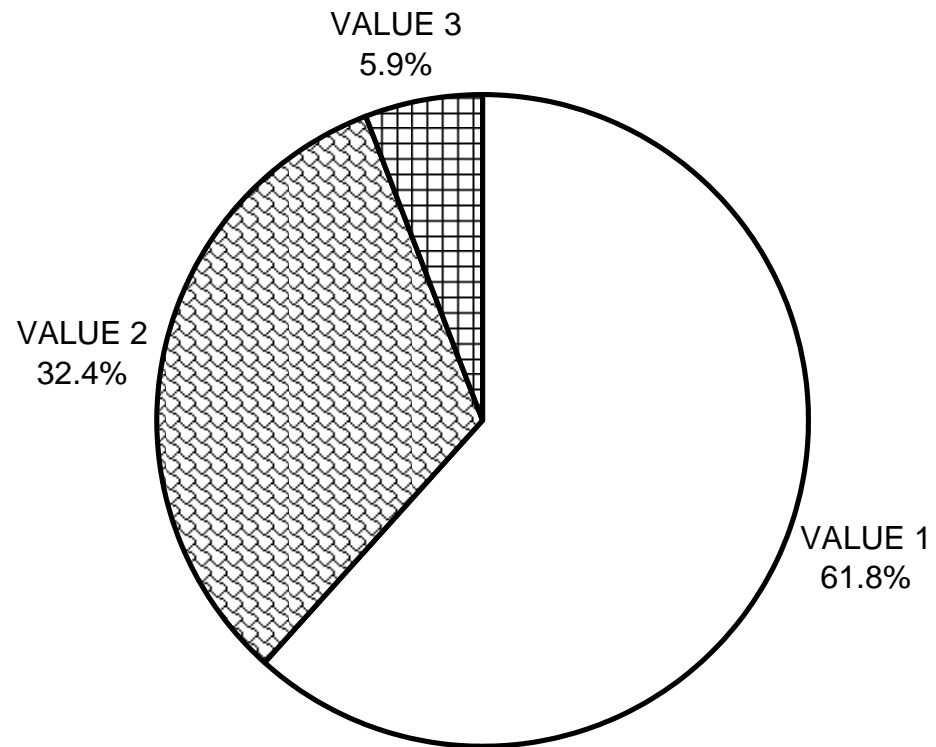
GRAPH 4

NEEFUS GULCH 2011 MAXIMUM DEPTH IN POOLS



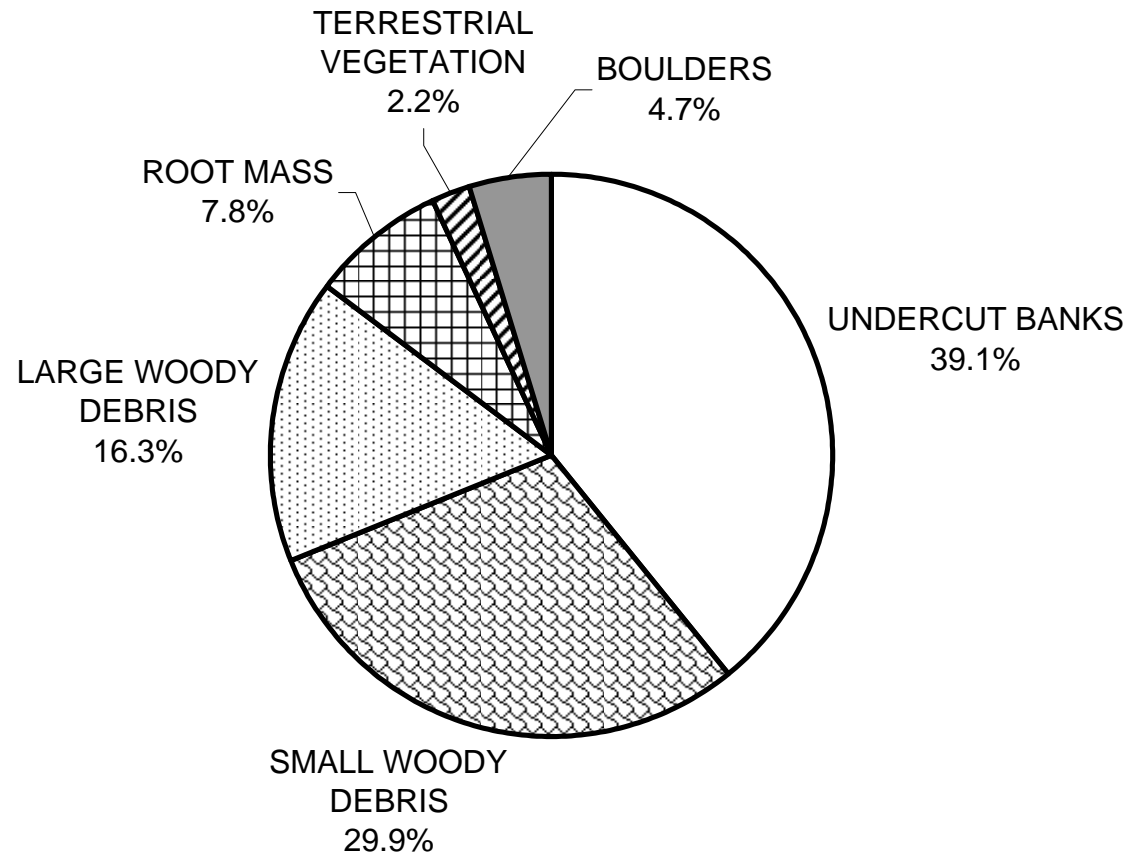
GRAPH 5

NEEFUS GULCH 2011 PERCENT EMBEDDEDNESS



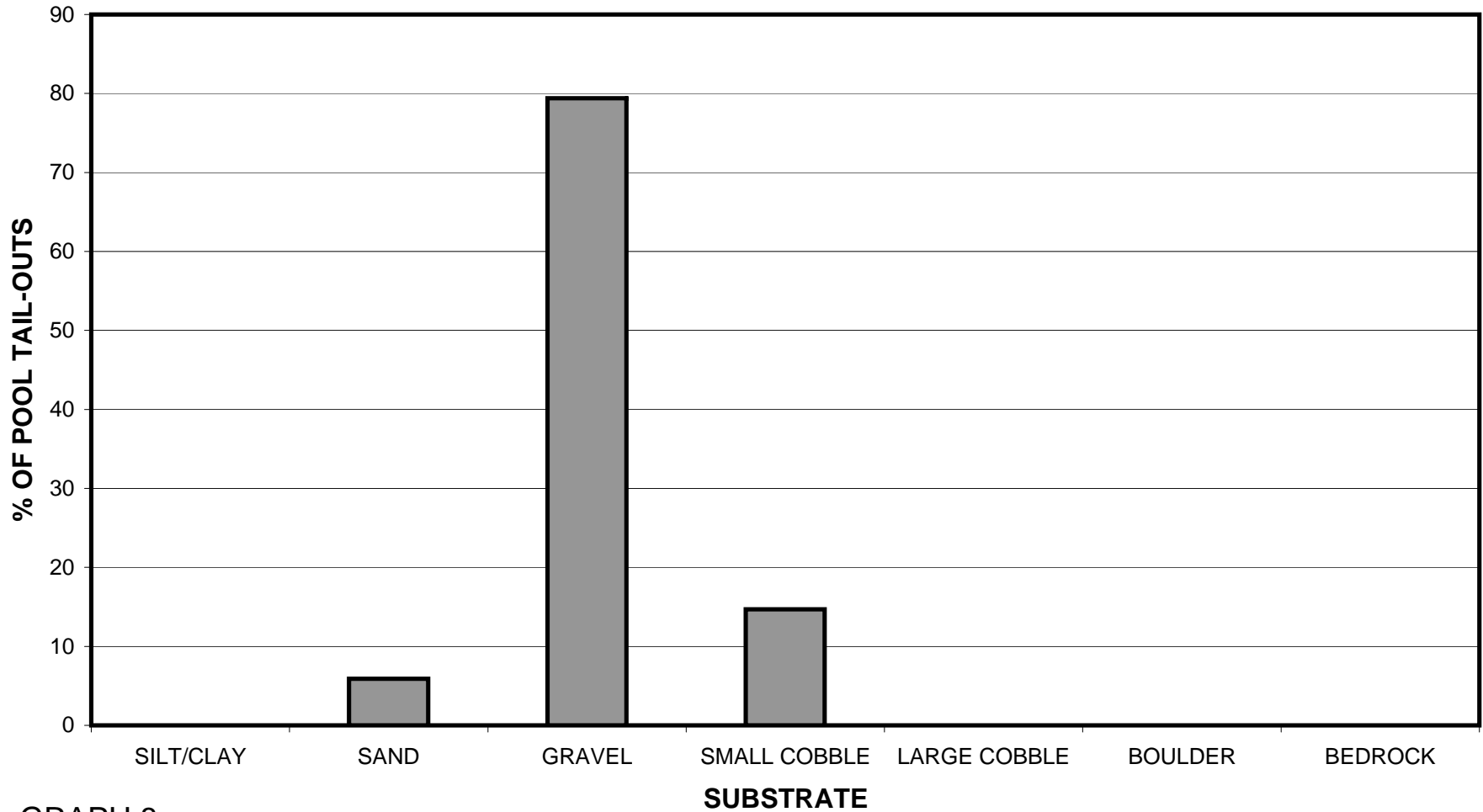
GRAPH 6

NEEFUS GULCH 2011 MEAN PERCENT COVER TYPES IN POOLS



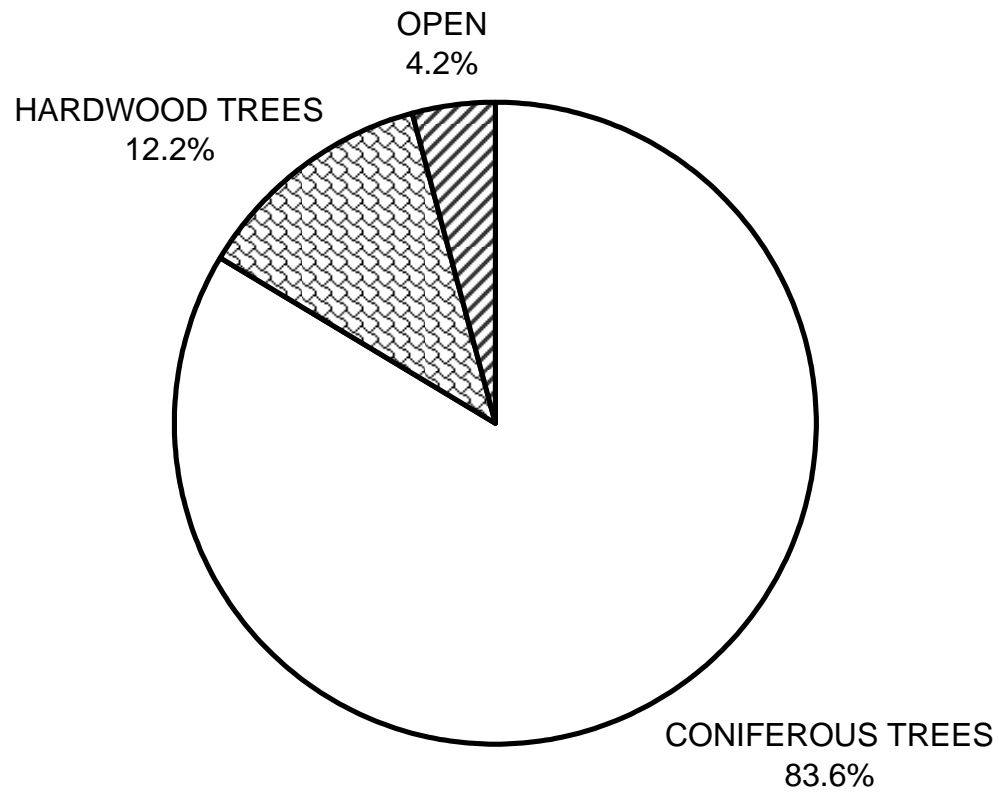
GRAPH 7

NEEFUS GULCH 2011 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



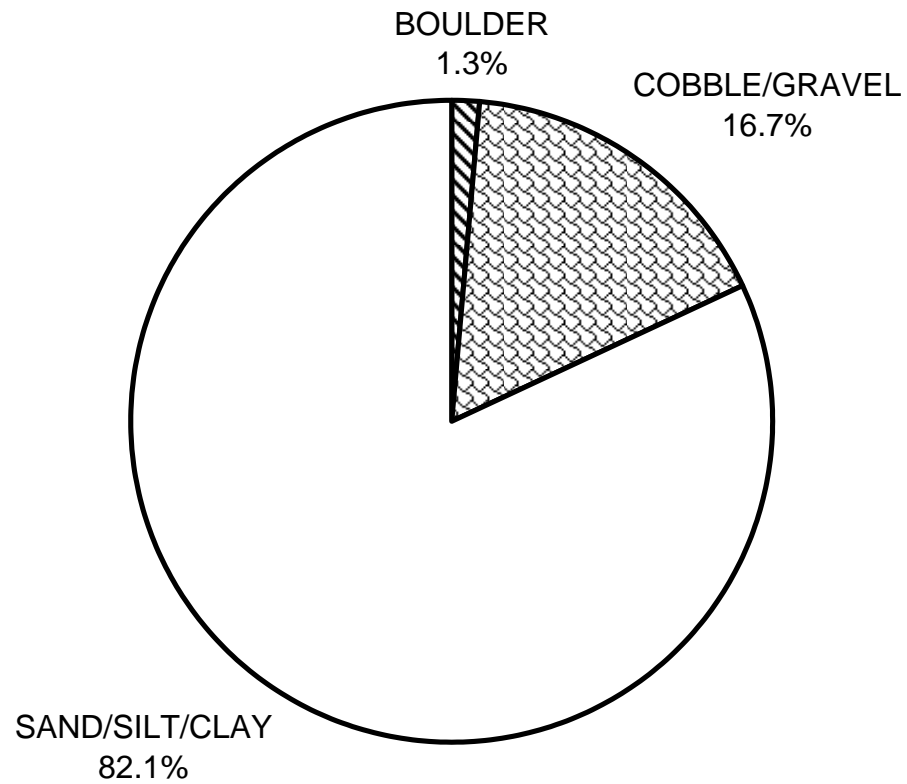
GRAPH 8

NEEFUS GULCH 2011 MEAN PERCENT CANOPY



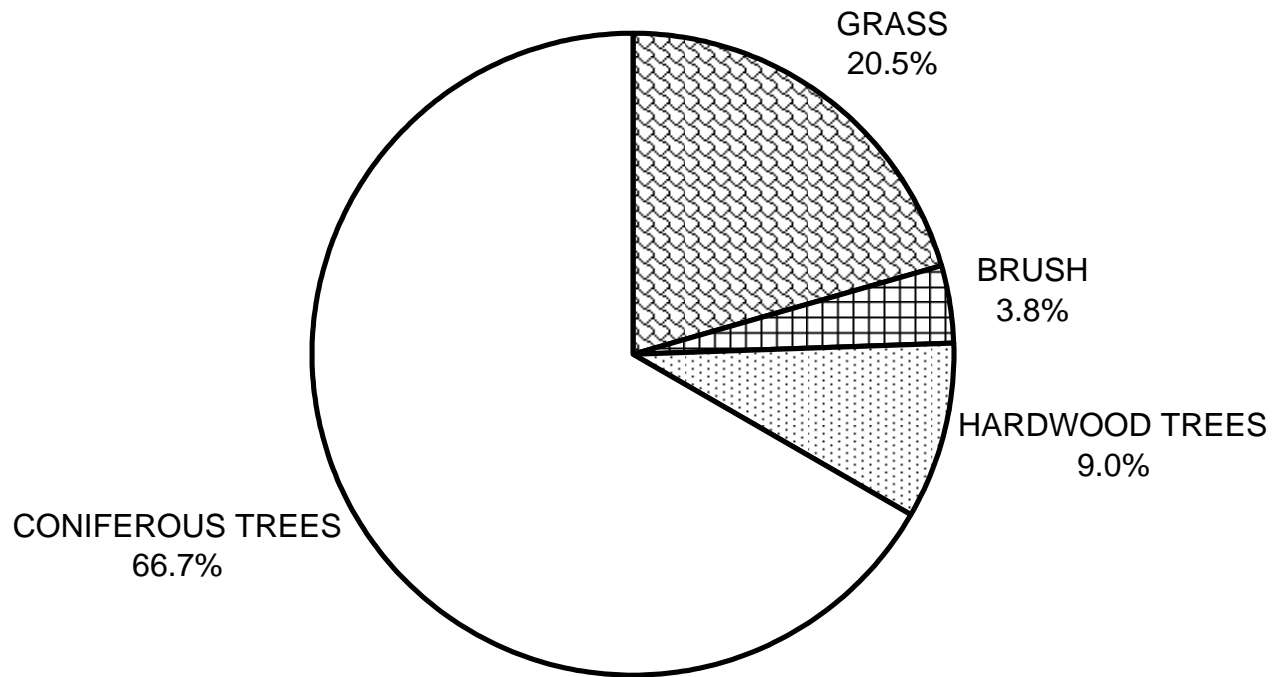
GRAPH 9

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



GRAPH 10

**NEEFUS GULCH 2011
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

