

# STREAM INVENTORY REPORT

## Jug Handle Creek

### INTRODUCTION

A stream inventory was conducted from July 15 to August 5, 2008 on Jug Handle Creek. The survey began at the confluence with Pacific Ocean and extended upstream 3.7 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Jug Handle Creek.

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

Jug Handle Creek drains to the Pacific Ocean, located in Mendocino County, California (Map 1). Jug Handle Creek's legal description at the confluence with Pacific Ocean is T18N R18W S36. Its location is 39.3768 degrees north latitude and 123.8172 degrees west longitude, LLID number 1238161393769. Jug Handle Creek is a first order stream and has approximately 4 miles of blue line stream according to the USGS Fort Bragg 7.5 minute quadrangle. Jug Handle Creek drains a watershed of approximately 2.6 square miles. Elevations range from about 0 feet at the mouth of the creek to 700 feet in the headwater areas. Mixed hardwood and mixed conifer forest dominates the watershed. The watershed is primarily state park land and is managed for recreation. Vehicle access exists via U.S Highway 1.

### METHODS

The habitat inventory conducted in Jug Handle Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members and Pacific States Marine Fisheries Commission (PSMFC) Fisheries Technicians that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

### SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

## Jug Handle Creek

### 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 Jug Handle Creek 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". Jug Handle Creek 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 Jug Handle Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

## Jug Handle Creek

### 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 Jug Handle Creek, 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 Jug Handle Creek, 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 Jug Handle Creek, 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.

## Jug Handle Creek

### 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.

## 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 Jug Handle Creek include:

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

## Jug Handle Creek

### HABITAT INVENTORY RESULTS

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

The habitat inventory of July 15 to August 5, 2008 was conducted by R. Swan and J. Johnson (WSP), and W. Holloway and D. Wright (PSMFC). The total length of the stream surveyed was 19,664 feet with an additional 67 feet of side channel. The first 1,457 feet of stream was not surveyed due to tidal influence. The data included in this report is for the 18,207 feet actually surveyed.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.99 cfs on August 5, 2008.

Jug Handle Creek is an unknown channel type for 1,457 feet of the stream (Reach 1), an F5 channel type for 4,692 feet of the stream surveyed (Reach 2), and an F4 channel type for 13,582 feet of the stream surveyed (Reach 3). F5 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios, very stable with sand-dominant substrates. F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios, very stable with gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 54 to 60 degrees Fahrenheit. Air temperatures ranged from 48 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 51% pool units, 33% flatwater units, and 16% riffle units (Graph 1). Based on total length of Level II habitat types there were 51% flatwater units, 39% pool units, and 10% riffle units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were lateral scour pool - log enhanced units, 39%; step run units, 24%; and low gradient riffle units, 16% (Graph 3). Based on percent total length, step run units made up 42%, lateral scour pool – log enhanced units 29%, and low gradient riffle units 10%.

A total of 169 pools were identified (Table 3). Scour pools were the most frequently encountered at 92% (Graph 4), and comprised 91% 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. Forty-six of the 169 pools (27%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 169 pool tail-outs measured, 16 had a value of 1 (9.5%); 38 had a value of 2 (22.5%); 50 had a value of 3 (29.6%); 38 had a value of 4 (22.5%); 27 had a value of 5 (16%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

## **Jug Handle Creek**

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 25, flatwater habitat types had a mean shelter rating of 61, and pool habitats had a mean shelter rating of 92 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 96. Main channel pools had a mean shelter rating of 51. Backwater pools had a mean shelter rating of 30 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Jug Handle Creek. Graph 7 describes the pool cover in Jug Handle Creek. 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. Gravel was the dominant substrate observed in 72% of the pool tail-outs. Sand was the next most frequently observed dominant substrate type and occurred in 14% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Jug Handle Creek was 91%. Nine percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 63% and 37%, respectively. Graph 9 describes the mean percent canopy in Jug Handle Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 86%. The mean percent left bank vegetated was 85%. The dominant elements composing the structure of the stream banks consisted of 99% sand/silt/clay and 1% boulder (Graph 10). Brush was the dominant vegetation type observed in 74% of the units surveyed. Additionally, 23% of the units surveyed had grass as the dominant vegetation type, and 3% had coniferous trees as the dominant vegetation type (Graph 11).

## **DISCUSSION**

The first 1,457 feet of Jug Handle Creek were not surveyed. Jug Handle Creek is an F5 channel type for the next 4,692 feet of stream surveyed and an F4 channel type for the remaining 13,582 feet of stream surveyed. The suitability of F5 and F4 channel types for fish habitat improvement structures is as follows: F5 and 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 July 15 to August 5, 2008 ranged from 54 to 60 degrees Fahrenheit. Air temperatures ranged from 48 to 72 degrees Fahrenheit. 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 51% of the total length of this survey, riffles 10%, and pools 39%. Forty-six of the 169 (27%) 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

## **Jug Handle Creek**

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 large wood structures that will increase or deepen pool habitat is recommended.

Fifty-four of the 169 pool tail-outs measured had embeddedness ratings of 1 or 2. Eighty-eight of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-seven 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. Sediment sources in Jug Handle Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One hundred thirty-eight of the 169 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 92. The shelter rating in the flatwater habitats is 61. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Jug Handle Creek. 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 91%. Reach 2 had a canopy density of 97.3%, Reach 3 had a canopy density of 90.1%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 86% and 85%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

### **RECOMMENDATIONS**

- 1) Jug Handle Creek 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.
- 4) Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

## Jug Handle Creek

### 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 Pacific Ocean. Habitat data was not collected for the first 1,457 feet of Jug Handle Creek due to the influence of the Pacific Ocean and the presence of a coastal lagoon.
1457	0002.00	Start of habitat data collection. The channel is an F5. A 1+ salmonid was observed.
1584	0003.00	A footbridge spans the channel. The bridge measures 5' high x 14.5' long x 4.8' wide.
2121	0010.00	Log debris accumulation (LDA) #01.
3012	0021.00	LDA #02 contains more than 15 pieces of large woody debris (LWD) and measures 10' high x 7.5' wide x 50' long. Water flows through and there are visible gaps. The LDA is retaining sand. Fish are present above the LDA.
3505	0034.00	A young-of-the-year (YOY) salmonid was observed.
3763	0037.00	LDA #03 contains seven pieces of LWD and measures 3.8' high x 15' wide x 25' long. Water flows through and there are visible gaps. The LDA is retaining sand measuring 9.7' wide x 20.5' long x 1.3' deep. Fish are present above the LDA.
4880	0050.00	Tributary #01 enters on the right bank. The water temperature downstream of the tributary is 57 degrees Fahrenheit, the water temperature of the tributary is 46 degrees Fahrenheit, and the water temperature upstream of the confluence is 58 degrees Fahrenheit. The tributary is not accessible to fish.
5004	0051.00	Rusty metal tracks line the bottom of the channel. A wooden plank is inserted into the width of the stream creating a potential dam. The creek flows along the right bank over the wooden plank.
5244	0054.00	There is a dry tributary on the left bank.
6149	0064.00	The channel changes from an F5 to an F4.



## Jug Handle Creek

7395	0079.00	LDA #04 contains more than nine pieces of LWD and measures 5' high x 20' wide x 12.5' long. Water flows through and there are visible gaps. The LDA is retaining sand measuring 11.5' wide x 17' long x 4.5' deep. Fish are present above the LDA.
8180	0095.00	LDA #05 contains 15 pieces of LWD and measures 5' high x 40' wide x 20' long. Water flows through and there are visible gaps. Retained sediment ranges from silt to gravel and measures 20' wide x 25' long x 1.5' deep. Fish are present above the LDA.
8418	0099.00	Woody debris is accumulating in the channel.
8533	0102.00	LDA #06 contains eight pieces of LWD and measures 5.5' high x 30' wide x 25' long. Water flows through and there are visible gaps. Retained sediment ranges from silt to gravel and measures 7' wide x 10' long x 1' deep. Fish are present above the LDA.
8647	0105.00	Woody debris is accumulating in the channel.
9354	0117.00	LDA #07 contains 13 pieces of LWD and measures 6.5' high x 30' wide x 40' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to sand and measures 14' wide x 20' long x 2.5' deep. Fish are present above the LDA.
9446	0119.00	Tributary #02 enters on the left bank. It contributes approximately 15% to the flow of Jug Handle Creek. The water temperature downstream of the tributary is 56 degrees Fahrenheit, the water temperature of the tributary is 56 degrees Fahrenheit, and the water temperature upstream of the confluence is 59 degrees Fahrenheit. The tributary is accessible to salmonids, but no fish were observed.
9892	0123.00	LDA #08 contains 13 pieces of LWD and measures 6' high x 25' wide x 20' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to sand and measures 5' wide x 10' long x 1.5' deep. Fish are present above the LDA.
10010	0125.00	A small debris accumulation is causing significant silt, sand & gravel retention.
10236	0129.00	Woody debris is accumulating in the channel.
10500	0132.00	Tributary #03 enters on the right bank. It contributes approximately 5% to the flow of Jug Handle Creek. The tributary is accessible to salmonids, but no fish were observed.

## Jug Handle Creek

12368	0172.00	LDA #09 contains more than 12 pieces of LWD and measures 8' high x 30' wide x 33' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 18' wide x 100' long x 2' deep. Fish are present above the LDA.
12440	0174.00	LDA #10 contains more than 15 pieces of LWD and measures 5' high x 25' wide x 15' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 30' wide x 15' long x 2' deep. Fish are present above the LDA.
12766	0181.00	LDA #11 contains 13 pieces of LWD and measures 6' high x 35' wide x 17' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 11' wide x 28' long x 2' deep. Fish are present above the LDA.
14193	0215.00	LDA #12 contains nine pieces of LWD and measures 7' high x 30' wide x 20' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 17' wide x 15' long x 1.5' deep. Fish are present above the LDA.
14836	0225.00	LDA #13 contains more than 15 pieces of LWD and measures 6' high x 40' wide x 16' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 30' wide x 20' long x 3.5' deep. Fish are present above the LDA.
14909	0227.00	Tributary #04 enters on the right bank. The water temperature downstream and upstream of the tributary is 55 degrees Fahrenheit; the water temperature of the tributary is 57 degrees Fahrenheit. The tributary is accessible to fish, but no fish were observed.
16124	0260.00	LDA #14 contains eight pieces of LWD and measures 7.5' high x 35' wide x 15' long. Water does not flow through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 30' wide x 45' long x 3' deep. Fish are present above the LDA.
16395	0270.00	LDA #15 contains five pieces of LWD and measures 6' high x 35' wide x 10' long. Water flows through and there are visible gaps. Retained sediment ranges from silt to small cobble and measures 21' wide x 17' long x 2' deep. Fish are present above the LDA.
16785	0279.00	Left bank erosion measures 20' long x 30' high.
16953	0284.00	Woody debris is accumulating in the channel and retaining sediment.
17136	0288.00	LDA #16 contains more than eight pieces of LWD and measures 5.5' high x 30' wide x 15' long. Water flows through and there are no

## Jug Handle Creek

		visible gaps. Retained sediment ranges from silt to gravel and measures 12' wide x 10' long x 1' deep. Fish are present above the LDA.
17223	0291.00	Left bank erosion measures 40' long x 50' high. Tributary #05 enters on the right bank.
17856	0303.00	Tributary #06 enters on the left bank.
18031	0304.00	LDA #17 is retaining sediment measuring 25' long x 8' wide x 2' high.
18587	0312.00	Woody debris is accumulating in the channel.
18799	0317.00	Culvert #01 spans the channel.
18922	0319.00	LDA #18 contains seven pieces of LWD and measures 6' high x 27' wide x 10' long. Water flows through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 12' wide x 25' long x 2.5' deep. Fish are present above the LDA.
19123	0321.00	YOY salmonid observed.
19263	0325.00	LDA #19 contains 13 pieces of LWD and measures 7' high x 18' wide x 16' long. Water flows through and there are visible gaps. Retained sediment ranges from silt to small cobble and measures 13' wide x 25' long x 15' deep. Fish are present above the LDA.
19398	0330.00	One+ steelhead observed.
19476	0332.00	LDA #20 contains 20 pieces of LWD and measures 5.5' high x 20' wide x 35' long. Water flows through and there are visible gaps. Retained sediment ranges from sand to large cobble and measures 15' wide x 25' long x 1.5' deep.
19664	0334.00	End of survey due to a large LDA and diminished habitat.

## 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.

## Jug Handle Creek

### 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: Jug Handle Creek

LLID: 1238161393769 Drainage: Noyo River

Survey Dates: 7/15/2008 to 8/5/2008

Confluence Location: Quad: FORT BRAGG Legal Description: T18NR18WS36 Latitude: 39:22:37.0N Longitude: 123:48:58.0

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	DRY	0.3	48	48	0.3									
110	29	FLATWATER	33.0	85	9346	51.3	6.3	0.5	0.9	393	43222	206	22697		61
2	0	NOSURVEY		754	1507										
169	169	POOL	50.8	42	7015	38.5	9.9	0.8	1.7	409	69185	469	79189	353	92
53	14	RIFFLE	15.9	34	1815	10.0	5.8	0.3	0.6	119	6326	36	1898		25
<b>Total Units</b>	<b>Total Units Fully Measured</b>				<b>Total Length (ft.)</b>					<b>Total Area (sq.ft.)</b>			<b>Total Volume (cu.ft.)</b>		
335	212				19731					118733			103784		

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

Stream Name: Jug Handle Creek

LLID: 1238161393769

Drainage: Noyo River

Survey Dates: 7/15/2008 to 8/5/2008

Confluence Location: Quad: FORT BRAGG

Legal Description: T18NR18WS36

Latitude: 39:22:37.0N

Longitude: 123:48:58.0W

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 (%)
53	14	LGR	15.9	34	1815	10.0	6	0.3	0.9	119	6326	36	1898		25	91
30	7	RUN	9.0	60	1788	9.8	6	0.5	1.5	251	7528	162	4857		62	92
80	22	SRN	24.0	94	7558	41.5	6	0.5	1.5	438	35048	220	17638		60	92
12	12	MCP	3.6	40	483	2.7	7	1.2	3.1	292	3510	475	5705	423	50	94
1	1	CCP	0.3	25	25	0.1	6	1.1	1.6	143	143	171	171	157	60	100
9	9	CRP	2.7	42	378	2.1	9	0.9	2.5	415	3738	408	3671	304	49	90
131	131	LSL	39.3	41	5327	29.2	10	0.8	4.4	417	54679	479	62791	358	100	91
9	9	LSR	2.7	55	493	2.7	8	0.6	2.6	447	4020	378	3401	269	60	95
2	2	LSBk	0.6	56	112	0.6	9	1.2	2.2	439	878	643	1286	503	120	88
2	2	LSBo	0.6	23	46	0.3	8	0.9	1.7	150	300	180	361	140	120	84
2	2	PLP	0.6	20	40	0.2	12	1.2	3	265	530	485	970	388	133	88
1	1	DPL	0.3	111	111	0.6	12	0.0	1.1	1388	1388	833	833		30	97
1	0	DRY	0.3	48	48	0.3										
2	0	NS		754	1507											

Total Units  
335

Total Units Fully Measured  
212

Total Length (ft.)  
19731

Total Area (sq.ft.)  
118088

Total Volume (cu.ft.)  
103582

**Table 3 - Summary of Pool Types**

Stream Name: Jug Handle Creek

LLID: 1238161393769

Drainage: Noyo River

Survey Dates: 7/15/2008 to 8/5/2008

Confluence Location: Quad: FORT BRAGG

Legal Description: T18NR18WS36

Latitude: 39:22:37.0N

Longitude: 123:48:58.0W

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
13	13	MAIN	8	39	508	7	7.2	1.1	281	3652	402	5231	51
155	155	SCOUR	92	41	6396	91	10.1	0.8	414	64146	349	54064	96
1	1	BACKWATER	1	111	111	2	12.5	0.0	1388	1388		0	30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
169	169	7015	69185	59295





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

Stream Name: Jug Handle Creek

LLID: 1238161393769

Drainage: Noyo River

Survey Dates: 7/15/2008 to 8/5/2008

Dry Units: 1

Confluence Location: Quad: FORT BRAGG

Legal Description: T18NR18WS36

Latitude: 39:22:37.0N

Longitude: 123:48:58.0W

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
53	14	LGR	0	55	7	0	38	0	1	0	0
53	14	TOTAL RIFFLE	0	55	7	0	38	0	1	0	0
30	7	RUN	1	43	16	0	40	0	0	0	0
80	22	SRN	5	36	25	0	30	0	0	3	0
110	29	TOTAL FLAT	4	38	23	0	33	0	0	2	0
12	12	MCP	3	32	17	0	43	0	0	6	0
1	1	CCP	0	50	0	0	50	0	0	0	0
9	9	CRP	8	21	17	0	54	0	0	0	0
131	131	LSL	5	29	49	2	14	0	0	1	0
9	9	LSR	4	19	9	58	9	0	0	0	0
2	2	LSBk	8	15	20	0	23	0	0	15	20
2	2	LSBo	0	0	25	0	15	0	5	55	0
2	2	PLP	20	10	20	0	20	0	15	15	0
1	1	DPL	0	20	40	10	30	0	0	0	0
169	169	TOTAL POOL	5	27	42	4	19	0	0	2	0
2	0	NS									
335	212	TOTAL	4	31	37	4	22	0	0	2	0



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

Stream Name: Jug Handle Creek

LLID: 1238161393769

Drainage: Noyo River

Survey Dates: 7/15/2008 to 8/5/2008

Confluence Location: Quad: FORT BRAGG

Legal Description: T18NR18WS36

Latitude: 39:22:37.0N

Longitude: 123:48:58.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
91	37	63	0	86	85

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: Jug Handle Creek LLID: 1238161393769 Drainage: Noyo River  
 Survey Dates: 7/15/2008 to 8/5/2008 Survey Length (ft.): 19731 Main Channel (ft.): 19664 Side Channel (ft.): 67  
 Confluence Location: Quad: FORT BRAGG Legal Description: T18NR18WS36 Latitude: 39:22:37.0N Longitude: 123:48:58.0W

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 1**

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 1457	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): to	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.:	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs.): 1.0	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 59 - 59 Air (F): 54 - 54	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

**STREAM REACH: 2**

Channel Type: F5	Canopy Density (%): 97.3	Pools by Stream Length (%): 57.1
Reach Length (ft.): 4692	Coniferous Component (%): 20.8	Pool Frequency (%): 61.3
Riffle/Flatwater Mean Width (ft.): 8.4	Hardwood Component (%): 79.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 63
Range (ft.): 14 to 16	Vegetative Cover (%): 82.8	2 to 2.9 Feet Deep: 29
Mean (ft.): 15	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 8
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 1.0	Occurrence of LWD (%): 37	Mean Max Residual Pool Depth (ft.): 1.8
Water (F): 58 - 60 Air (F): 48 - 54	LWD per 100 ft.:	Mean Pool Shelter Rating: 71
Dry Channel (ft): 0	Riffles: 2	
	Pools: 7	
	Flat: 3	
Pool Tail Substrate (%): Silt/Clay: 5 Sand: 50 Gravel: 45 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 26.3 2. 10.5 3. 7.9 4. 2.6 5. 52.6		

### Summary of Fish Habitat Elements By Stream Reach

**STREAM REACH: 3**

Channel Type: F4	Canopy Density (%): 90.1	Pools by Stream Length (%): 31.9
Reach Length (ft.): 13515	Coniferous Component (%): 41.0	Pool Frequency (%): 48.2
Riffle/Flatwater Mean Width (ft.): 5.7	Hardwood Component (%): 59.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 76
Range (ft.): 6 to 16	Vegetative Cover (%): 86.3	2 to 2.9 Feet Deep: 20
Mean (ft.): 9	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 2
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 2
Base Flow (cfs.): 1.0	Occurrence of LWD (%): 37	Mean Max Residual Pool Depth (ft.): 1.7
Water (F): 54 - 59 Air (F): 48 - 72	LWD per 100 ft.:	Mean Pool Shelter Rating: 98
Dry Channel (ft): 48	Riffles: 3	
	Pools: 10	
	Flat: 4	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 4 Gravel: 80 Sm Cobble: 12 Lg Cobble: 2 Boulder: 0 Bedrock: 2		
Embeddedness Values (%): 1. 4.6 2. 26.0 3. 35.9 4. 28.2 5. 5.3		

**Table 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: Jug Handle Creek

LLID: 1238161393769

Drainage: Noyo River

Survey Dates: 7/15/2008 to 8/5/2008

Confluence Location: Quad: FORT BRAGG

Legal Description: T18NR18WS36

Latitude: 39:22:37.0N

Longitude: 123:48:58.0W

**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	2	0.5
Boulder	2	1	0.7
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	210	209	98.8

**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	51	48	23.3
Brush	153	159	73.6
Hardwood Trees	0	0	0.0
Coniferous Trees	8	5	3.1
No Vegetation	0	0	0.0

**Total Stream Cobble Embeddedness Values:** 3

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

StreamName: Jug Handle Creek

LLID: 1238161393769

Drainage: Noyo River

Survey Dates: 7/15/2008 to 8/5/2008

Confluence Location: Quad: FORT BRAGG

Legal Description: T18NR18WS36

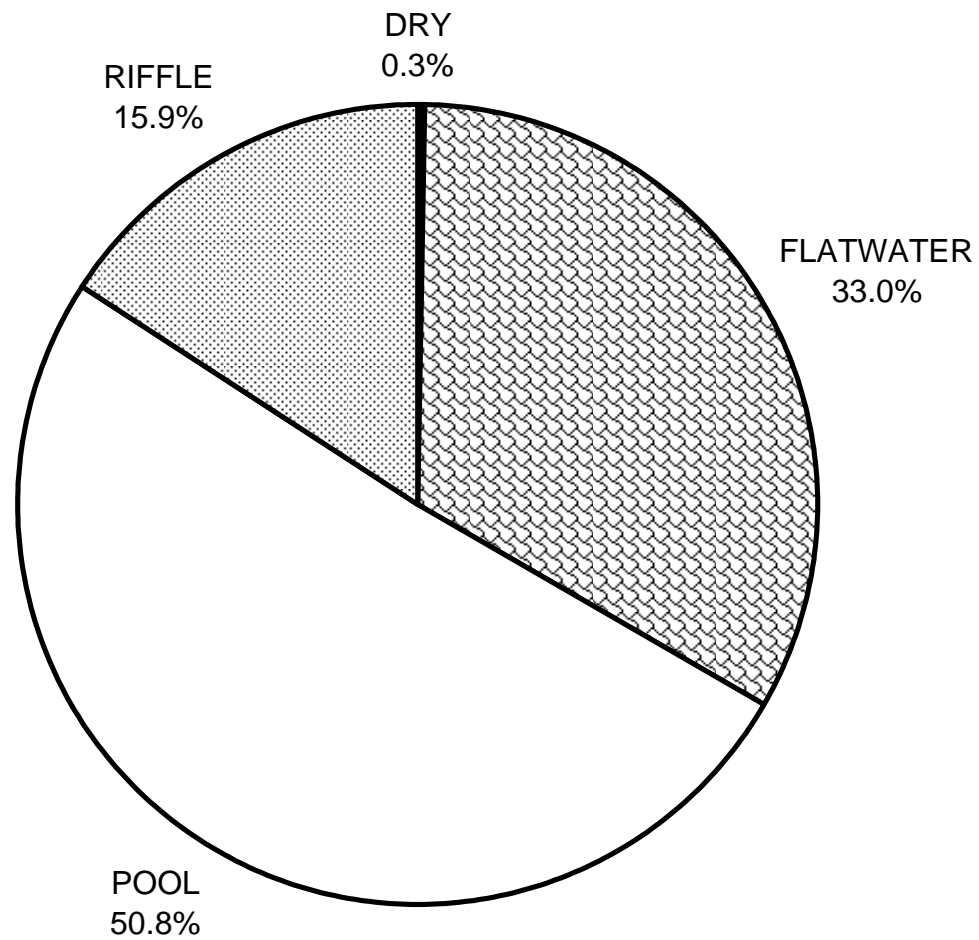
Latitude: 39:22:37.0N

Longitude: 123:48:58.0W

---

	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	4	5
SMALL WOODY DEBRIS (%)	55	38	27
LARGE WOODY DEBRIS (%)	7	23	42
ROOT MASS (%)	0	0	4
TERRESTRIAL VEGETATION (%)	38	33	19
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	1	0	0
BOULDERS (%)	0	2	2
BEDROCK LEDGES (%)	0	0	0

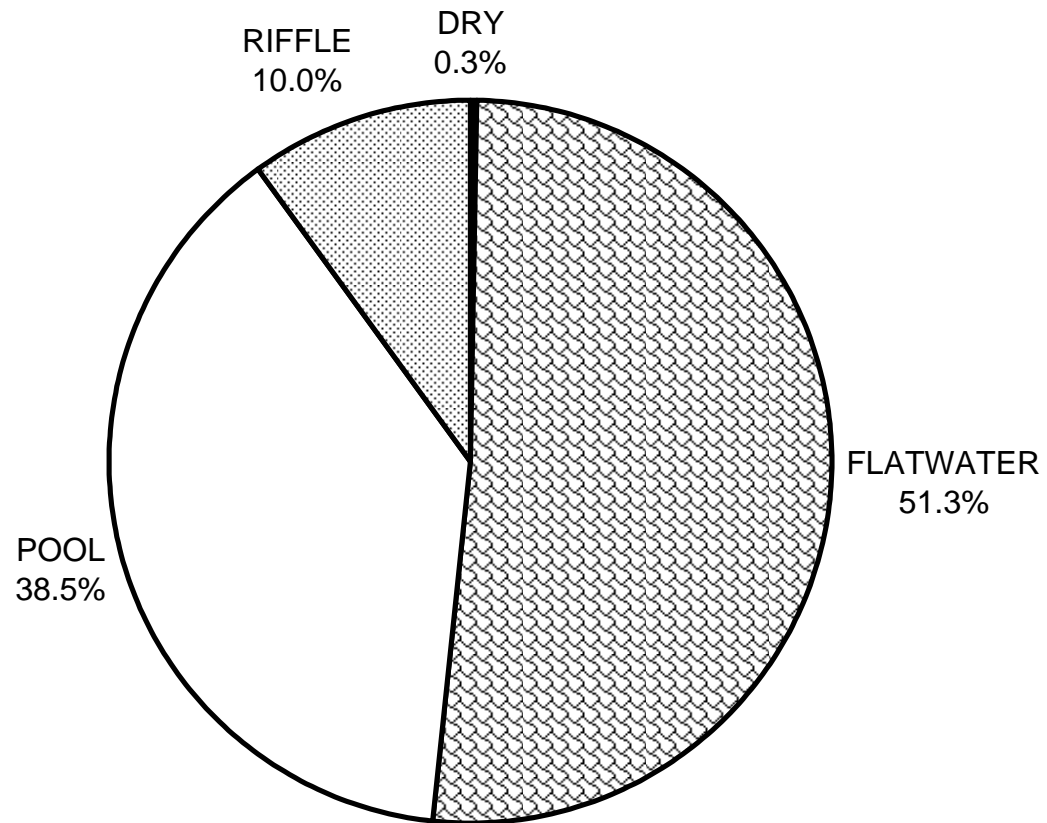
# JUG HANDLE CREEK 2008 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

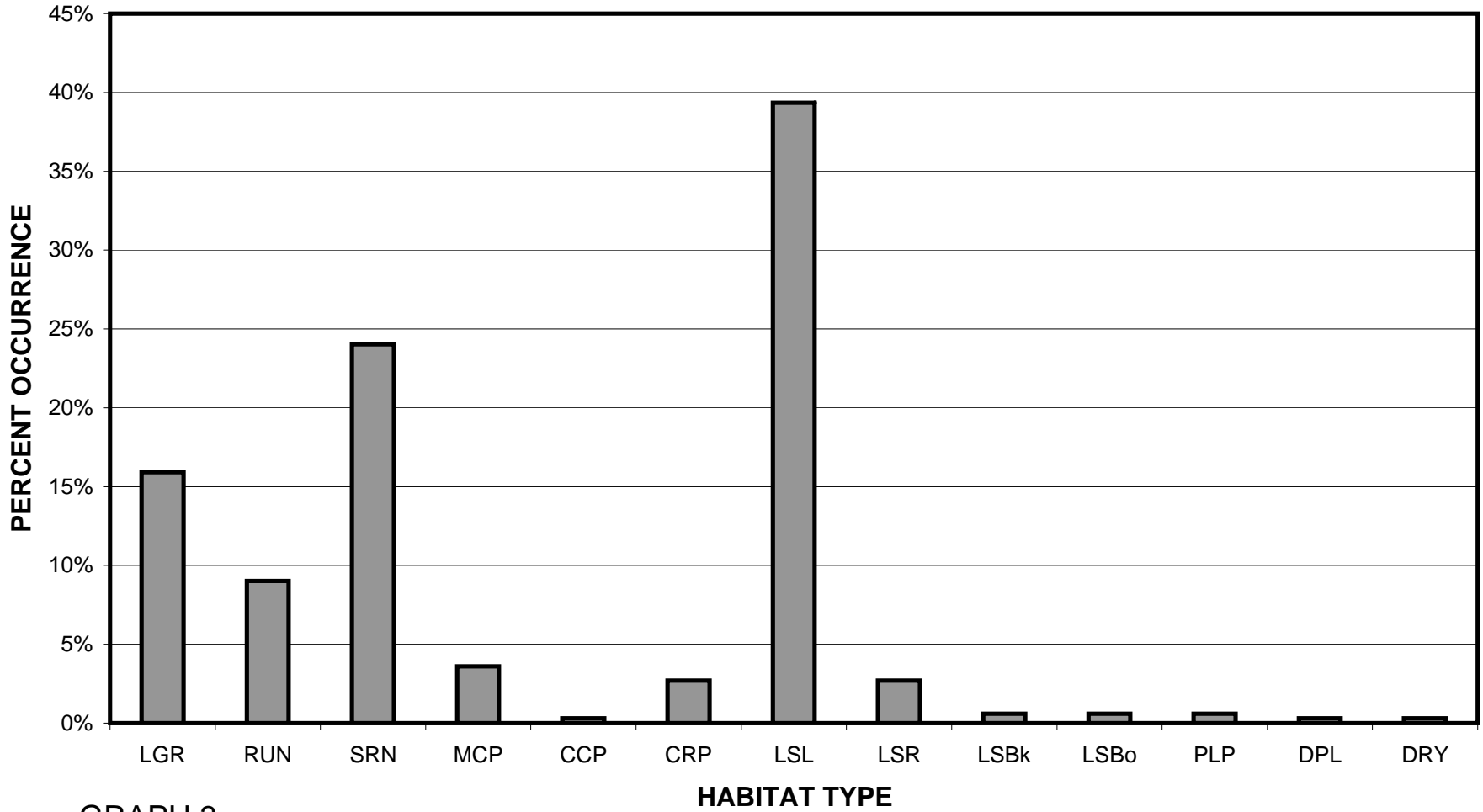


# JUG HANDLE CREEK 2008 HABITAT TYPES BY PERCENT TOTAL LENGTH



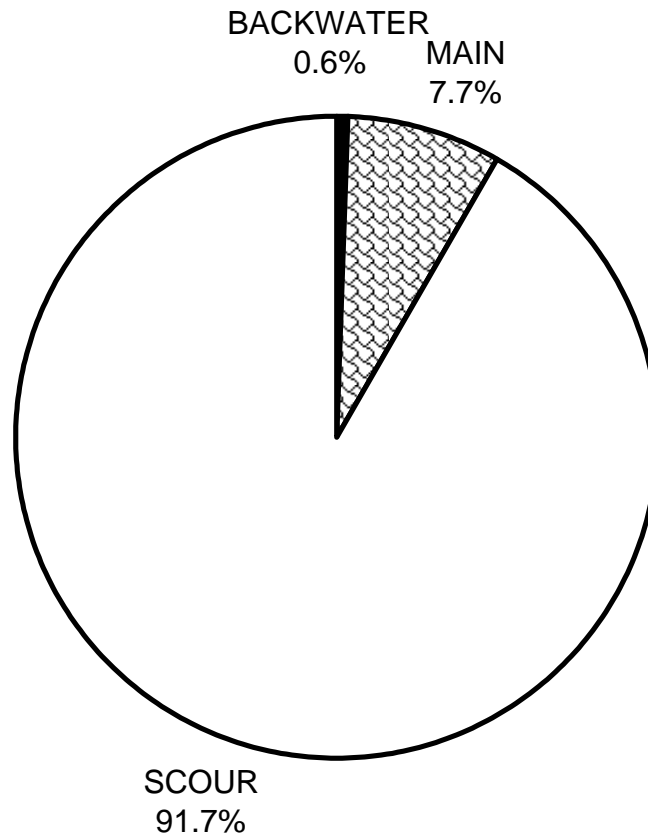
GRAPH 2

# JUG HANDLE CREEK 2008 HABITAT TYPES BY PERCENT OCCURRENCE



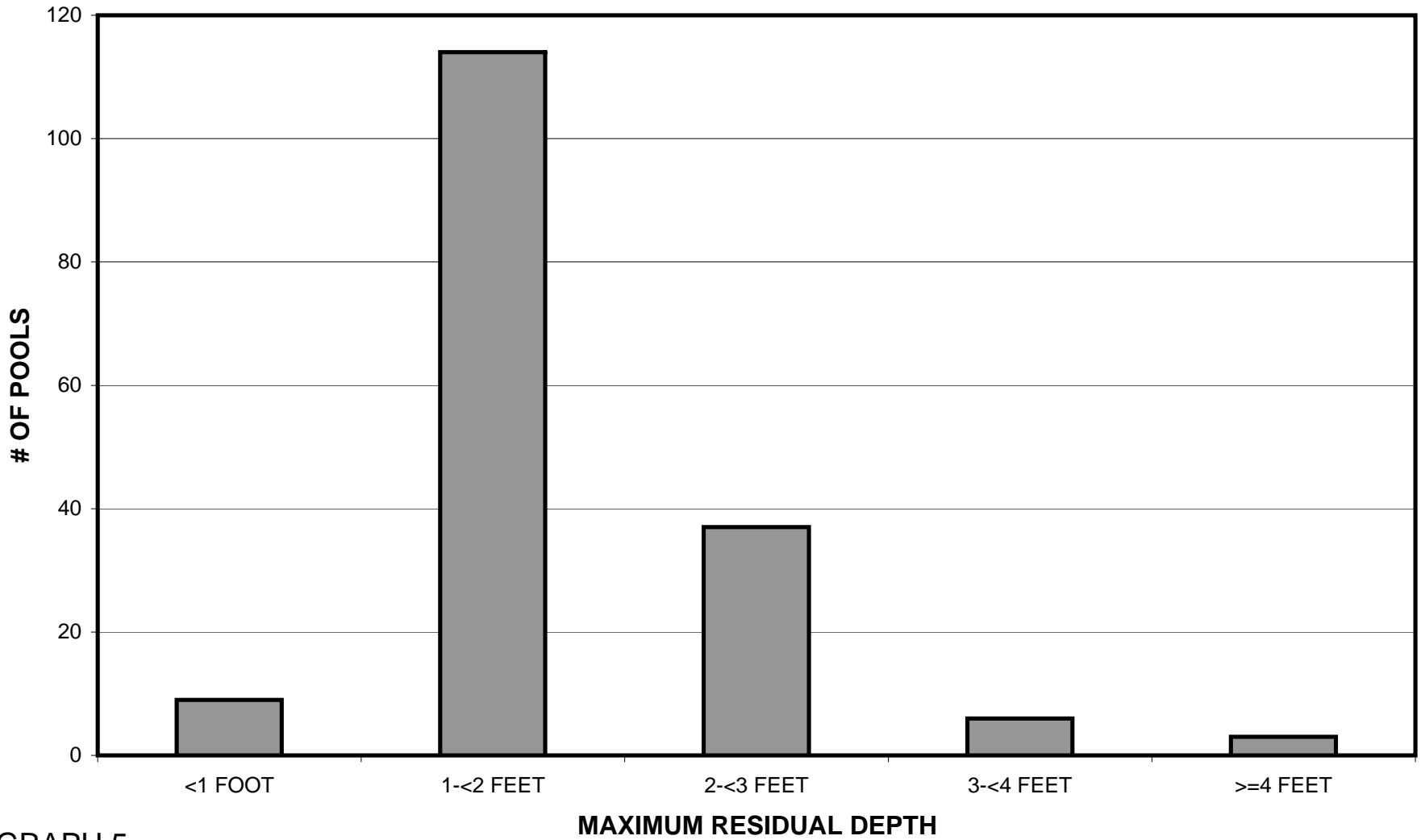
GRAPH 3

# JUG HANDLE CREEK 2008 POOL TYPES BY PERCENT OCCURRENCE



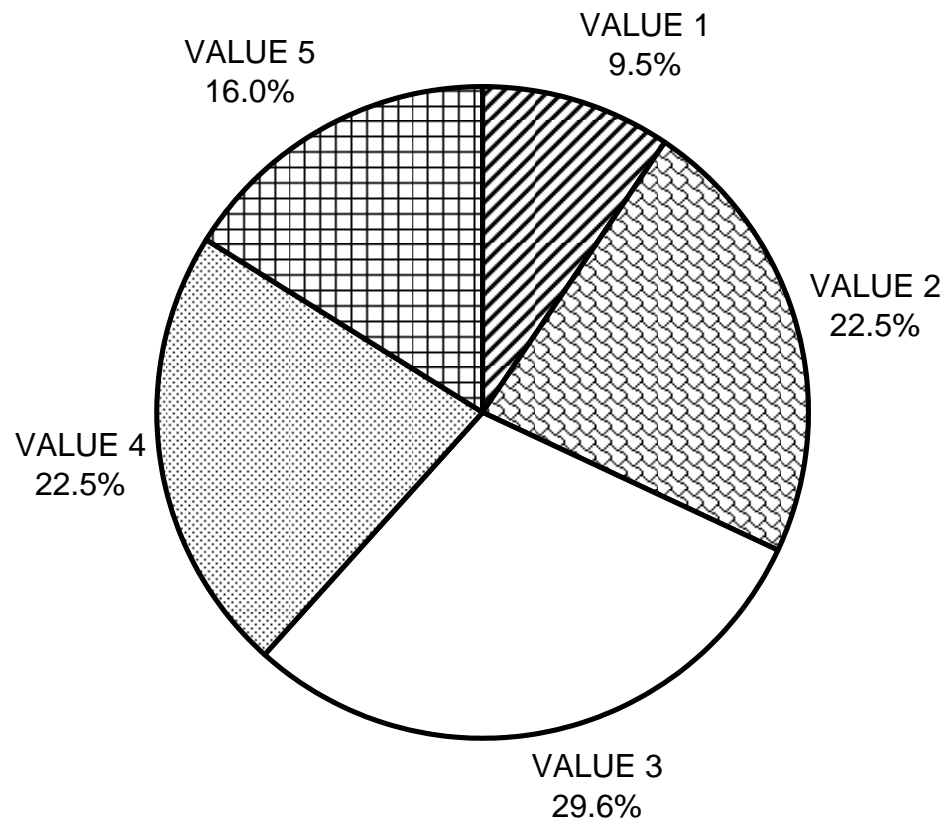
GRAPH 4

# JUG HANDLE CREEK 2008 MAXIMUM DEPTH IN POOLS



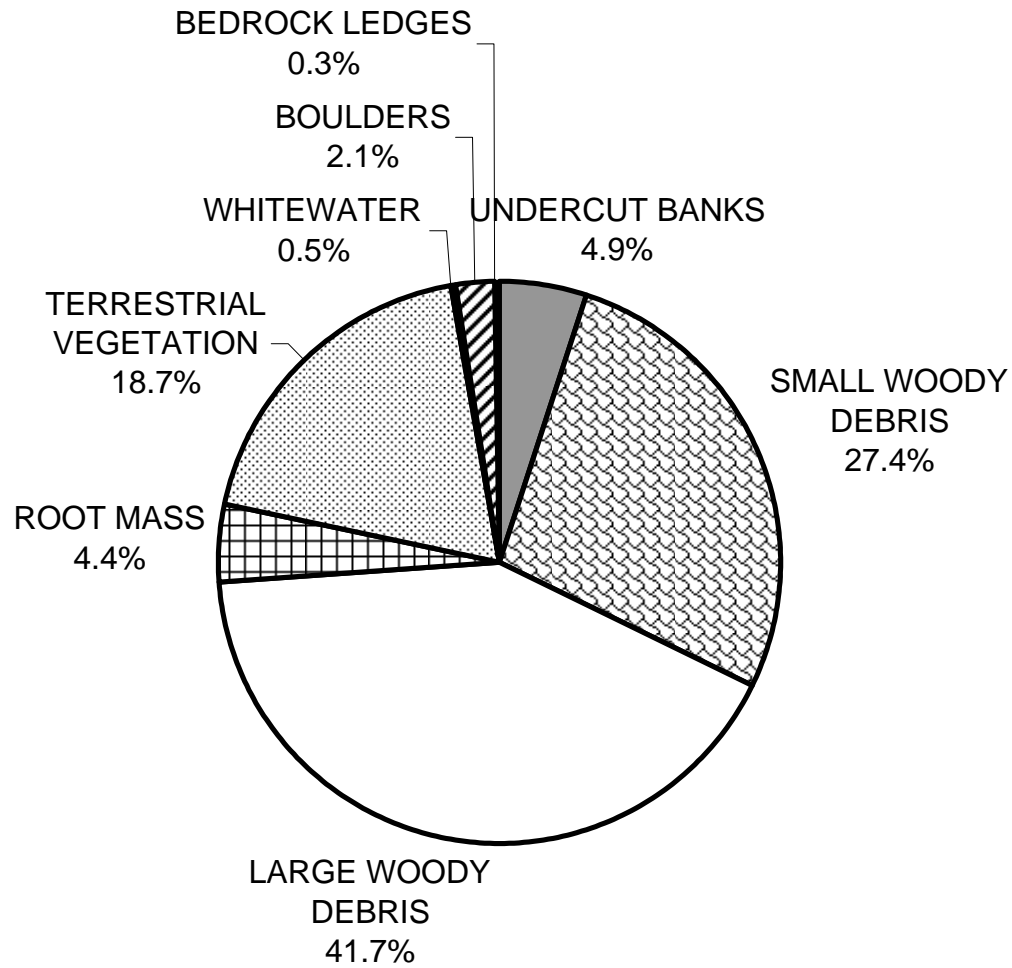
GRAPH 5

# JUG HANDLE CREEK 2008 PERCENT EMBEDDEDNESS



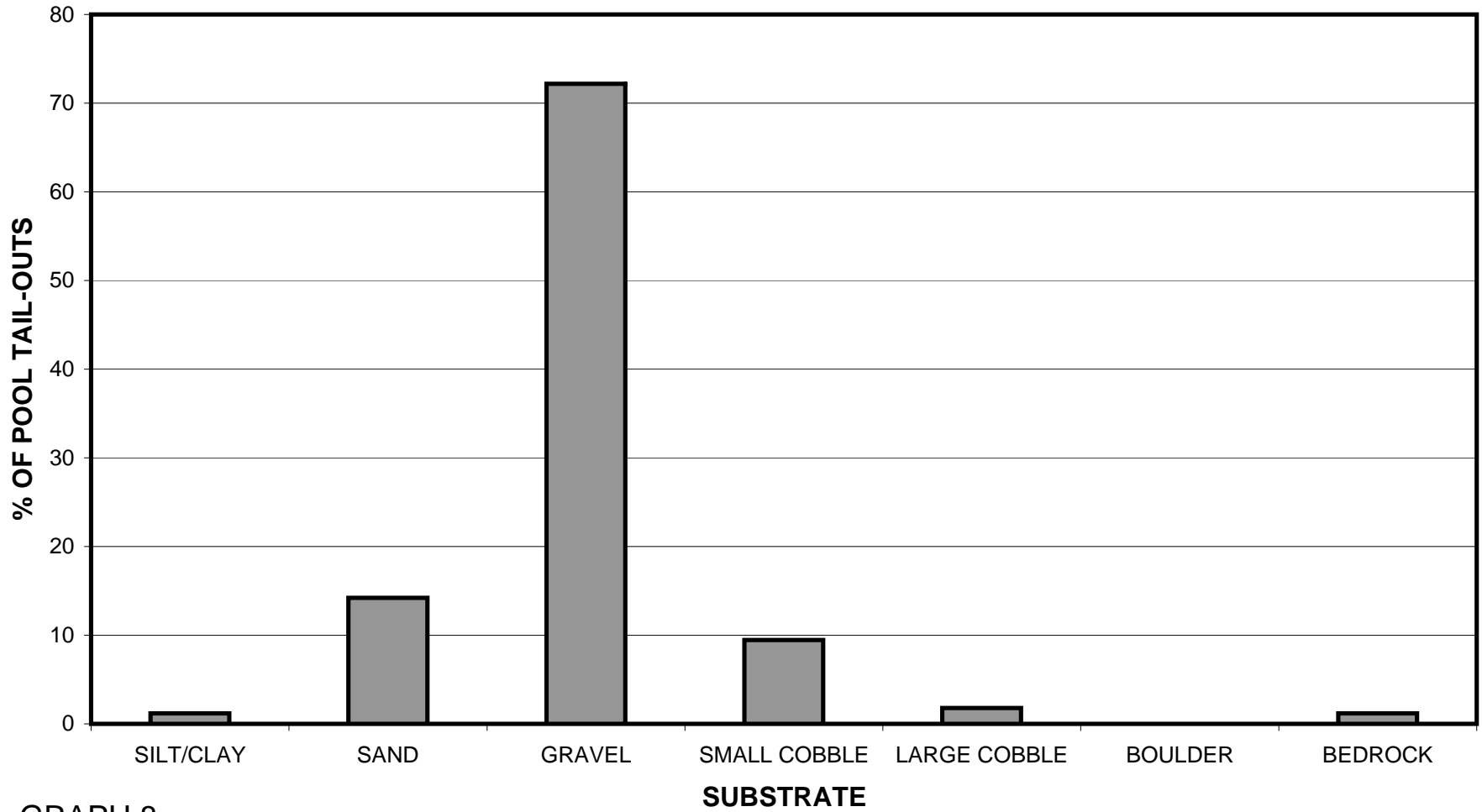
GRAPH 6

# JUG HANDLE CREEK 2008 MEAN PERCENT COVER TYPES IN POOLS



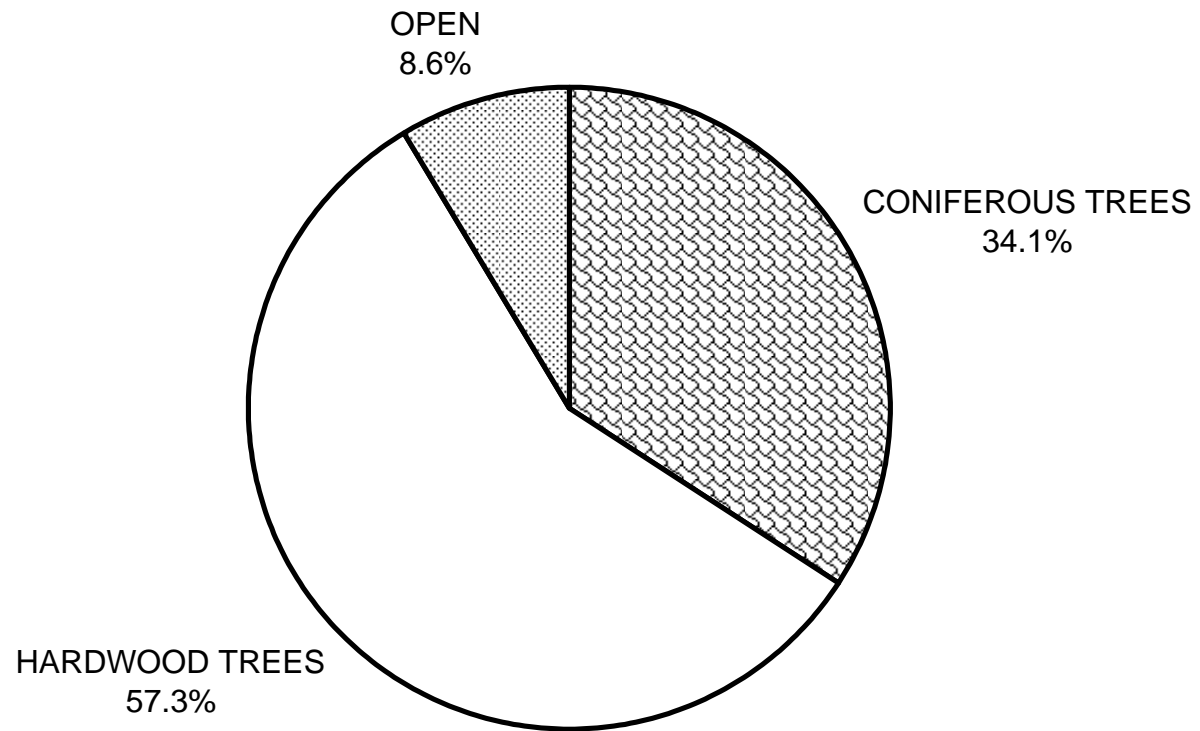
GRAPH 7

# JUG HANDLE CREEK 2008 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

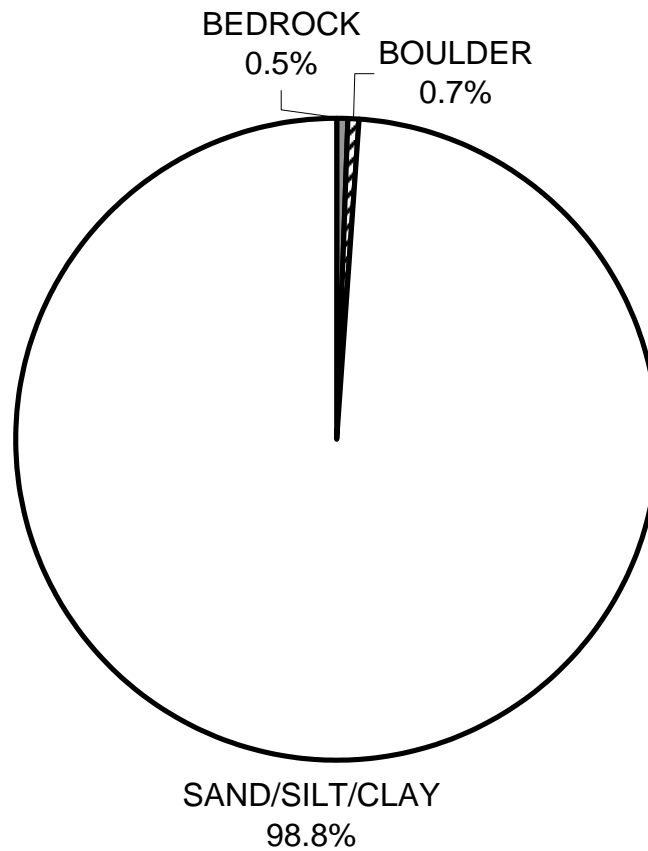
# JUG HANDLE CREEK 2008 MEAN PERCENT CANOPY



GRAPH 9

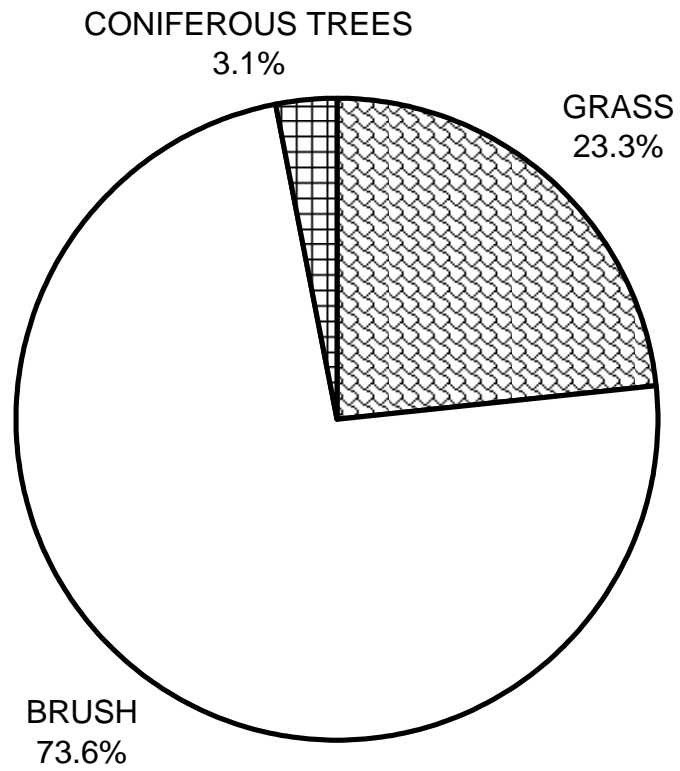


**JUG HANDLE CREEK 2008  
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

# JUG HANDLE CREEK 2008 DOMINANT BANK VEGETATION IN SURVEY REACH



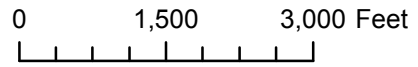
GRAPH 11

**Map 1**  
**Jug Handle Creek**  
**Jug Handle Watershed**  
**Fort Bragg Quad, Mendocino County**

Start of Survey

End of Survey

- Legend**
- Reach 1, Unsurveyed
  - Reach 2, F5 Channel Type
  - Reach 3, F4 Channel Type



Reach lengths and end survey point are approximate.

