

# STREAM INVENTORY REPORT

## Cook Creek

### INTRODUCTION

A stream inventory was conducted from May 23 to June 20, 2012 on Cook Creek. The survey began at the confluence with North Branch North Fork Navarro River and extended upstream 3.4 miles.

The Cook Creek 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 Cook Creek. 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

Cook Creek is a tributary to North Branch North Fork Navarro River, tributary to North Fork Navarro River, tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Cook Creek's legal description at the confluence with North Branch North Fork Navarro River is T15N R15W S06. Its location is 39.1871 degrees north latitude and 123.5499 degrees west longitude, LLID number 1235485391870. Cook Creek is a first order stream and has approximately 2.9 miles of blue line stream according to the USGS Navarro 7.5 minute quadrangle. Cook Creek drains a watershed of approximately 3.3 square miles. Elevations range from about 215 feet at the mouth of the creek to 600 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Masonite Industrial Road.

### METHODS

The habitat inventory conducted in Cook Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Wildlife (DFW) personnel and Watershed Stewards Project/AmeriCorps (WSP) members that conducted the inventory were trained in standardized habitat inventory methods by the DFW. 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

## Cook Creek

their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

### HABITAT INVENTORY COMPONENTS

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

## Cook Creek

### 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 Cook 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 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 Cook 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 Cook 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 Cook 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.

## Cook Creek

### 10. Large Woody Debris Count:

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

### 11. Average Bankfull Width:

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

## BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Cook Creek. In addition, underwater observations were made at 15 sites using techniques 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 Wildlife. 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

## Cook Creek

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

### HABITAT INVENTORY RESULTS

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

The habitat inventory of May 23 to June 20, 2012 was conducted by C. Tiffany, T. Anderson, R. Spencer, B. James (WSP), and B. Leonard (DFW). The total length of the stream surveyed was 17,800 feet with an additional 217 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.29 cfs on June 4, 2012.

Cook Creek is an F4 channel type for 3,127 feet of the stream surveyed (Reach 1), a B2 channel type for 6,672 feet of the stream surveyed (Reach 2), and an F3 channel type for 8,218 feet of the stream surveyed (Reach 3). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. B2 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and boulder-dominant substrates. F3 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 50 to 57 degrees Fahrenheit. Air temperatures ranged from 51 to 77 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% pool units, 30% flatwater units, 15% riffle units, 8% dry units, and 1% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 38% flatwater units, 34% pool units, 15% riffle units, 13% dry units, and 1% unsurveyed units (Graph 2).

## Cook Creek

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 44%; run units, 25%; and low gradient riffle units, 13% (Graph 3). Based on percent total length, mid-channel pool units made up 31%, run units 29%, low gradient riffle units 13%, and dry units 13%.

A total of 190 pools were identified (Table 3). Main channel pools were the most frequently encountered at 97% (Graph 4), and comprised 98% 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-seven of the 189 pools (25%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 190 pool tail-outs measured, 51 had a value of 1 (26.8%); 116 had a value of 2 (61.1%); 17 had a value of 3 (8.9%); 3 had a value of 4 (1.6%); 3 had a value of 5 (1.6%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 4, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 14 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 22. Main channel pools had a mean shelter rating of 14 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Cook Creek. Graph 7 describes the pool cover in Cook Creek. Small woody debris is the dominant pool cover type followed by large 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 71% 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 Cook Creek was 93%. Seven percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 46% and 54%, respectively. Graph 9 describes the mean percent canopy in Cook Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 92%. The mean percent left bank vegetated was 93%. The dominant elements composing the structure of the stream banks consisted of 82% sand/silt/clay, 14% cobble/gravel, 2% bedrock, and 2% boulders (Graph 10). Coniferous trees were the dominant vegetation type observed in 70% of the units surveyed. Additionally, 27% of the units surveyed had deciduous trees as the dominant vegetation type, and 3% had grass as the dominant vegetation type (Graph 11).

## Cook Creek

### BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 15 sites for species composition and distribution in Cook Creek on August 20, 2012. The sites were sampled by I. Mikus and M. Groff (DFW).

In Reach 1, which comprised the first 3,127 feet of stream, eight sites were sampled. The reach sites yielded 40 three-spine stickleback, two California roach, and one sculpin.

In Reach 2, seven sites were sampled starting approximately 3,269 from the confluence with North Branch North Fork Navarro River and continuing upstream 1,846 feet. The reach sites yielded two age 1+ steelhead/rainbow trout.

The following chart displays the information yielded from these sites:

2012 Cook Creek underwater 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									
08/20/12	1	002	Pool	77	0	0	0	0	0
	2	010	Pool	618	0	0	0	0	0
	3	013	Pool	802	0	0	0	0	0
	4	015	Pool	1,164	0	0	0	0	0
	5	039	Pool	2,136	0	0	0	0	0
	6	044	Pool	2,516	0	0	0	0	0
	7	046	Pool	2,632	0	0	0	0	0
	8	049	Pool	2,881	0	0	0	0	0
Reach 2: B2 Channel Type									
	9	055	Pool	3,269	0	0	0	0	0
	10	083	Pool	4,144	0	0	0	0	0
	11	090	Pool	4,426	0	1	0	0	0
	12	092	Pool	4,490	0	0	0	0	0
	13	099	Pool	4,777	0	1	0	0	0
	14	101	Pool	4,823	0	0	0	0	0
	15	106	Pool	5,115	0	0	0	0	0

### DISCUSSION

Cook Creek is an F4 channel type for the first 3,127 feet of stream surveyed, a B2 channel type

## Cook Creek

for the next 6,672 feet, and an F3 channel type for the remaining 8,218 feet. The suitability of F4, B2, and F3 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. B2 channel types excellent for plunge weirs, single and opposing wing-deflectors, and log cover. F3 channel types are good for bank-placed boulders, single and opposing wing-deflectors and fair for plunge weirs, boulder clusters, channel constrictors and log cover.

The water temperatures recorded on the survey days May 23 to June 20, 2012 ranged from 50 to 57 degrees Fahrenheit. Air temperatures ranged from 51 to 77 degrees Fahrenheit. This is a good 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 38% of the total length of this survey, riffles 15%, and pools 34%. Forty-seven of the 189 (25%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing large wood structures that will increase or deepen pool habitat is recommended.

One hundred sixty-seven of the 190 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty of the pool tail-outs had embeddedness ratings of 3 or 4. Three 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.

One hundred forty-eight of the 190 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 14. The shelter rating in the flatwater habitats is 4. 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 Cook Creek. Small woody debris is the dominant cover type in pools followed by large 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 93%. Reach 1 had a canopy density of 83%, Reach 2 had a canopy density of 93%, and Reach 3 had a canopy density of 97%. The percentage of right and left bank covered with vegetation was 92% and 93%, respectively.



## Cook Creek

### RECOMMENDATIONS

- 1) Cook 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 small woody debris. Adding high quality complexity with woody cover in the pools is desirable.

### COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at the confluence with North Branch North Fork Navarro River. The channel is an F4.
618	0011.00	LDA #11 contains two pieces of LWD and measures 5' high x 10' wide x 7' long. Water does not flow through the LDA, the channel is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to cobble and measures 6' wide x 48' long x 3' deep. Fish are present above the LDA.
3127	0055.00	The channel changes from an F4 to a B2.
3632	0069.00	There are two 3' high plunges.
7501	0164.00	Log debris accumulation (LDA) #01 contains six pieces of large woody debris (LWD) and measures 5' high x 40' wide x 12' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to boulders and measures 12' wide x 30' long x 2' deep. Fish are present above the LDA.
8209	0189.00	Tributary #01 enters on the right bank. It contributes approximately 2% to Cook Creek's flow. The water temperature of the tributary was 50 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 50 degrees Fahrenheit. The slope of the tributary is approximately 40%. The tributary is not accessible to salmonids.

## Cook Creek

8259	0190.00	LDA #02 contains seven pieces of LWD and measures 12' high x 25' wide x 14' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to cobble and measures 15' wide x 7' long x 1' deep. Fish are present above the LDA.
8376	0194.00	There is a 3' high plunge.
8396	0195.00	There is a 1' high plunge.
9582	0223.00	The channel changes from a B2 to an F3.
10047	0238.00	LDA #03 contains 15 pieces of LWD and measures 5' high x 18' wide x 39' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to gravel and measures 6' wide x 8' long x 1' deep. Fish are present above the LDA.
10406	0247.00	LDA #04 contains three pieces of LWD and measures 5' high x 26' wide x 5' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 7' wide x 20' long x 2' deep. Fish are present above the LDA.
10655	0258.00	LDA #05 contains 25 pieces of LWD and measures 10' high x 25' wide x 85' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to cobble and measures 3' wide x 25' long x 1' deep. Fish are present above the LDA. A landslide on the right bank measures approximately 12' high x 25' long.
11230	0271.00	LDA #06 contains seven pieces of LWD and measures 6' high x 20' wide x 7' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to large cobble and measures 5' wide x 16' long x 2.5' deep. Fish are present above the LDA.
11614	0281.00	Fish observed.
11913	0288.00	LDA #07 contains two pieces of LWD and measures 5' high x 14' wide x 9' long. Water does not flow through the LDA; there is a small dry section above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to cobble and measures 5' wide x 12' long x 1.5' deep. Fish are present above the LDA.
13275	0315.00	LDA #08 contains 13 pieces of LWD and measures 7' high x 17' wide x 43' long. Water does not flow through the LDA, the channel is dry above it. There are visible gaps in the LDA. Retained sediment ranges from silt to cobble and measures 6' wide x 59' long x 3' deep. Fish are present above the LDA.

## Cook Creek

- 13371 0317.00 LDA #09 contains four pieces of LWD and measures 4' high x 11' wide x 20' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to cobble and measures 15' wide x 14' long x 2' deep. Fish are present above the LDA.
- 13741 0329.00 LDA #10 contains two pieces of LWD and measures 5' high x 10' wide x 3' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 15' wide x 14' long x 2' deep. Fish are present above the LDA.
- 14304 0339.00 LDA #12 contains 13 pieces of LWD and measures 6' high x 26' wide x 30' long. Water does not flow through the LDA, the channel is dry above it. There are no visible gaps in it. Retained sediment ranges from silt to boulders and measures 8' wide x 45' long x 3' deep. Fish are present above the LDA.
- 14787 0342.00 LDA #13 contains nine pieces of LWD and measures 7' high x 15' wide x 25' long. Water does not flow through the LDA, the channel is dry above it. There are visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 10' wide x 15' long x 2.5' deep. Fish are present above the LDA.
- 14989 0347.00 LDA #14 contains six pieces of LWD and measures 7' high x 24' wide x 35' long. Water does not flow through the LDA, the channel is dry above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to boulders and measures 15' wide x 51' long x 2.5' deep. Fish are present above the LDA.
- 15388 0353.00 A landslide measures approximately 25' long x 35' high.
- 15737 0364.00 Tributary #02 enters on the left bank. It contributes approximately 30% to Cook Creek's flow. The water temperature of the tributary was 52 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 52 degrees Fahrenheit. The slope of the tributary is approximately 14%. There is a 7' high plunge approximately 50' upstream from the mouth.
- 15856 0368.00 LDA #15 contains six pieces of LWD and measures 7' high x 9' wide x 20' long. Water does not flow through the LDA, the channel is dry above it. There are visible gaps in the LDA. Retained sediment ranges from silt to boulders and measures 8' wide x 40' long x 3' deep. There is a 4' high plunge over the LDA. No fish were observed above this LDA.
- 16536 0383.00 LDA #16 contains five pieces of LWD and measures 5' high x 6' wide x 15' long. Water does not flow through the LDA, the channel is dry

## Cook Creek

above it. There are visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 2.5' wide x 19' long x 3' deep.

16757 0390.00 LDA #17 contains seven pieces of LWD and measures 6' high x 20' wide x 16' long. Water does not flow through the LDA, the channel is dry for over 100' above it. There are visible gaps in the LDA. Retained sediment ranges from silt to cobble and measures 3.5' wide x 12' long x 2' deep.

17765 0402.00 A logging road crosses the channel. The crossing consists of two parallel culverts. The culvert on the right bank is blocked. The open culvert is made of corrugated metal and measures 3.2' high x 3.2' wide x 35' long. The slope of the culvert is approximately 15% and there is a 3' high plunge at the outlet. The bottom is rusty. The channel is dry for at least 200 feet above the culvert. End of survey.

## 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.

## Cook 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: Cook Creek

LLID: 1235485391870 Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

Longitude: 123:32:55.0

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	0.2	35	35	0.2									
32	0	DRY	7.8	71	2286	12.7									
122	14	FLATWATER	29.8	56	6844	38.0	6.5	0.4	0.7	481	58650	216	26403		4
3	0	NOSURVEY	0.7	52	157	0.9									
190	189	POOL	46.3	32	6058	33.6	8.2	0.7	1.6	270	51326	294	55792	239	14
62	10	RIFFLE	15.1	43	2637	14.6	8.7	0.3	0.5	290	17949	87	5400		4
<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>		
410	213				18017					127925			87595		

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

Stream Name: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

Longitude: 123:32:55.0W

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	7	LGR	12.9	44	2333	12.9	9	0.2	1	312	16561	85	4528		4	93
7	1	HGR	1.7	38	269	1.5	11	0.5	0.8	439	3072	219	1536		5	95
2	2	BRS	0.5	18	35	0.2	6	0.2	0.6	134	269	27	53		3	99
103	11	RUN	25.1	50	5175	28.7	6	0.4	1.2	467	48084	220	22708		3	92
19	3	SRN	4.6	88	1669	9.3	8	0.4	1	532	10102	202	3830		7	84
182	181	MCP	44.4	31	5594	31.0	8	0.7	3.4	258	46999	262	47717	210	14	93
3	3	STP	0.7	115	344	1.9	8	1.2	4	1049	3148	2020	6060	1845	18	93
1	1	LSBk	0.2	33	33	0.2	10	0.3	1	314	314	219	219	94	5	100
4	4	PLP	1.0	22	87	0.5	10	1.7	7.6	213	854	441	1764	391	26	92
32	0	DRY	7.8	71	2286	12.7										89
1	0	CUL	0.2	35	35	0.2										
3	0	NS	0.7	52	157	0.9										

Total Units  
410

Total Units Fully Measured  
213

Total Length (ft.)  
18017

Total Area (sq.ft.)  
129403

Total Volume (cu.ft.)  
88416

**Table 3 - Summary of Pool Types**

Stream Name: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

Longitude: 123:32:55.0W

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
185	184	MAIN	97	32	5938	98	8.1	0.7	271	50160	237	43800	14
5	5	SCOUR	3	24	120	2	9.7	1.4	233	1167	332	1660	22

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
190	189	6058	51327	45459



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

Stream Name: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

Longitude: 123:32:55.0W

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
181	MCP	96	23	13	114	63	40	22	4	2	0	0
3	STP	2	0	0	2	67	0	0	0	0	1	33
1	LSBk	1	0	0	1	100	0	0	0	0	0	0
4	PLP	2	0	0	2	50	1	25	0	0	1	25

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
189	23	12	119	63	41	22	4	2	2	1

Mean Maximum Residual Pool Depth (ft.): 1.6

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

Stream Name: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Dry Units: 32

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06 Latitude: 39:11:13.0N

Longitude: 123:32:55.0W

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	7	LGR	0	40	0	0	0	3	0	57	0
7	1	HGR	0	0	0	0	0	0	0	100	0
2	2	BRS	0	0	0	0	0	0	0	100	0
62	10	TOTAL RIFFLE	0	24	0	0	0	2	0	74	0
103	11	RUN	39	13	0	14	4	2	0	28	0
19	3	SRN	10	37	30	3	0	3	0	13	3
122	14	TOTAL FLAT	28	22	11	10	3	3	0	22	1
182	182	MCP	15	37	20	3	7	0	1	16	0
3	3	STP	0	55	5	3	0	2	5	30	0
1	1	LSBk	0	0	0	0	0	0	0	100	0
4	4	PLP	0	19	30	18	0	0	18	16	0
190	190	TOTAL POOL	14	37	20	3	6	0	2	17	0
1	0	CUL									
3	0	NS									
410	214	TOTAL	14	36	19	3	6	1	2	18	0

**Table 6 - Summary of Dominant Substrates By Habitat Type**

Stream Name: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Dry Units: 32

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

Longitude: 123:32:55.0W

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
53	7	LGR	0	14	57	0	29	0	0
7	1	HGR	0	0	100	0	0	0	0
2	2	BRS	0	0	0	0	0	0	100
103	11	RUN	0	9	82	9	0	0	0
19	3	SRN	0	33	33	33	0	0	0
182	182	MCP	19	42	32	3	1	1	1
3	3	STP	67	33	0	0	0	0	0
1	1	LSBk	0	0	0	0	100	0	0
4	4	PLP	50	50	0	0	0	0	0

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

Stream Name: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

Longitude: 123:32:55.0W

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Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
93	54	46	0	92	93

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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: Cook Creek LLID: 1235485391870 Drainage: Navarro River  
 Survey Dates: 5/23/2012 to 6/20/2012 Survey Length (ft.): 18017 Main Channel (ft.): 17800 Side Channel (ft.): 217  
 Confluence Location: Quad: NAVARRO Legal Description: T15NR15WS06 Latitude: 39:11:13.0N Longitude: 123:32:55.0W

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

**STREAM REACH: 1**

Channel Type: F4	Canopy Density (%): 83.3	Pools by Stream Length (%): 25.3
Reach Length (ft.): 3127	Coniferous Component (%): 62.1	Pool Frequency (%): 42.6
Riffle/Flatwater Mean Width (ft.): 10.3	Hardwood Component (%): 37.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 78
Range (ft.): 15 to 21	Vegetative Cover (%): 92.5	2 to 2.9 Feet Deep: 17
Mean (ft.): 17	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 4
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.3	Occurrence of LWD (%): 9	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 51 - 52 Air (F): 51 - 61	LWD per 100 ft.:	Mean Pool Shelter Rating: 12
Dry Channel (ft): 0	Riffles: 1	
	Pools: 6	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 4 Sand: 26 Gravel: 39 Sm Cobble: 13 Lg Cobble: 13 Boulder: 4 Bedrock: 0		
Embeddedness Values (%): 1. 8.7 2. 87.0 3. 0.0 4. 0.0 5. 4.3		

**STREAM REACH: 2**

Channel Type: B2	Canopy Density (%): 92.7	Pools by Stream Length (%): 44.5
Reach Length (ft.): 6455	Coniferous Component (%): 49.8	Pool Frequency (%): 51.7
Riffle/Flatwater Mean Width (ft.): 6.7	Hardwood Component (%): 50.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 71
Range (ft.): 6 to 90	Vegetative Cover (%): 91.2	2 to 2.9 Feet Deep: 25
Mean (ft.): 21	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 1
Std. Dev.: 18	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 2
Base Flow (cfs.): 0.3	Occurrence of LWD (%): 12	Mean Max Residual Pool Depth (ft.): 1.7
Water (F): 50 - 57 Air (F): 52 - 69	LWD per 100 ft.:	Mean Pool Shelter Rating: 14
Dry Channel (ft): 146	Riffles: 2	
	Pools: 3	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 3 Sand: 2 Gravel: 78 Sm Cobble: 11 Lg Cobble: 3 Boulder: 2 Bedrock: 0		
Embeddedness Values (%): 1. 34.1 2. 49.5 3. 12.1 4. 3.3 5. 1.1		

### Summary of Fish Habitat Elements By Stream Reach

**STREAM REACH: 3**

Channel Type: F3	Canopy Density (%): 96.8	Pools by Stream Length (%): 28.0
Reach Length (ft.): 8218	Coniferous Component (%): 56.5	Pool Frequency (%): 42.2
Riffle/Flatwater Mean Width (ft.): 4.5	Hardwood Component (%): 43.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 79
Range (ft.): 15 to 50	Vegetative Cover (%): 93.2	2 to 2.9 Feet Deep: 19
Mean (ft.): 27	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 3
Std. Dev.: 9	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.3	Occurrence of LWD (%): 28	Mean Max Residual Pool Depth (ft.): 1.6
Water (F): 52 - 54 Air (F): 52 - 77	LWD per 100 ft.:	Mean Pool Shelter Rating: 14
Dry Channel (ft): 2140	Riffles: 1	
	Pools: 9	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 3 Sand: 25 Gravel: 71 Sm Cobble: 1 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 23.7 2. 67.1 3. 7.9 4. 0.0 5. 1.3		

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

Stream Name: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

Longitude: 123:32:55.0W

**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	5	3	1.9
Boulder	9	1	2.3
Cobble / Gravel	27	32	13.8
Sand / Silt / Clay	173	178	82.0

**Mean Percentage of Dominant Stream Bank Vegetation**

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	7	6	3.0
Brush	0	1	0.2
Hardwood Trees	62	52	26.6
Coniferous Trees	144	155	69.9
No Vegetation	1	0	0.2

**Total Stream Cobble Embeddedness Values:**

2

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

StreamName: Cook Creek

LLID: 1235485391870

Drainage: Navarro River

Survey Dates: 5/23/2012 to 6/20/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS06

Latitude: 39:11:13.0N

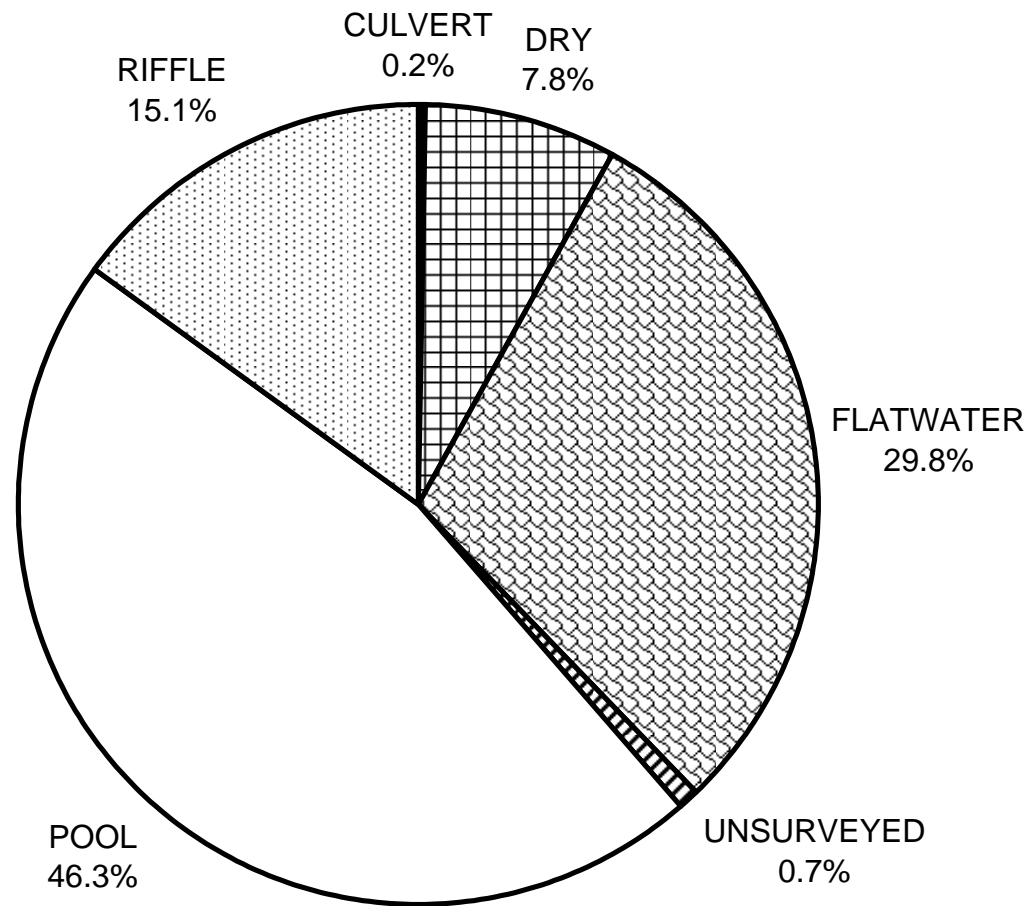
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	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	28	14
SMALL WOODY DEBRIS (%)	24	22	37
LARGE WOODY DEBRIS (%)	0	11	20
ROOT MASS (%)	0	10	3
TERRESTRIAL VEGETATION (%)	0	3	6
AQUATIC VEGETATION (%)	2	3	0
WHITEWATER (%)	0	0	2
BOULDERS (%)	74	22	17
BEDROCK LEDGES (%)	0	1	0

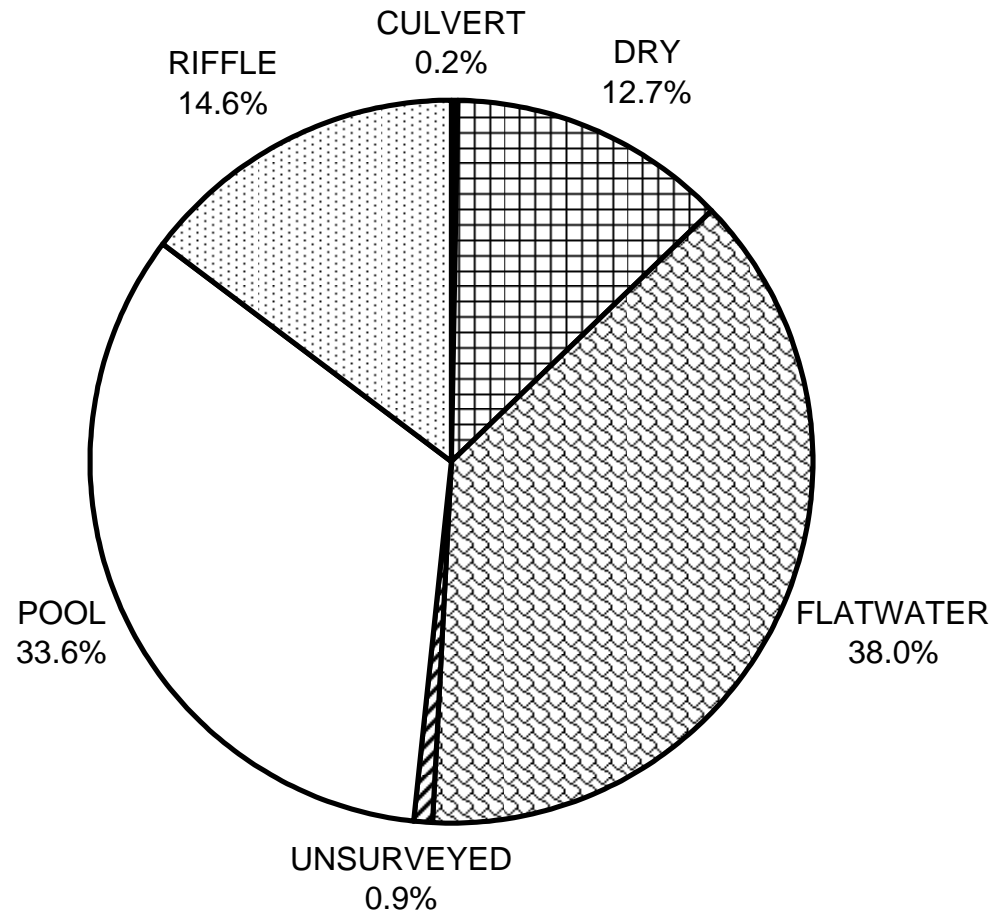


# COOK CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

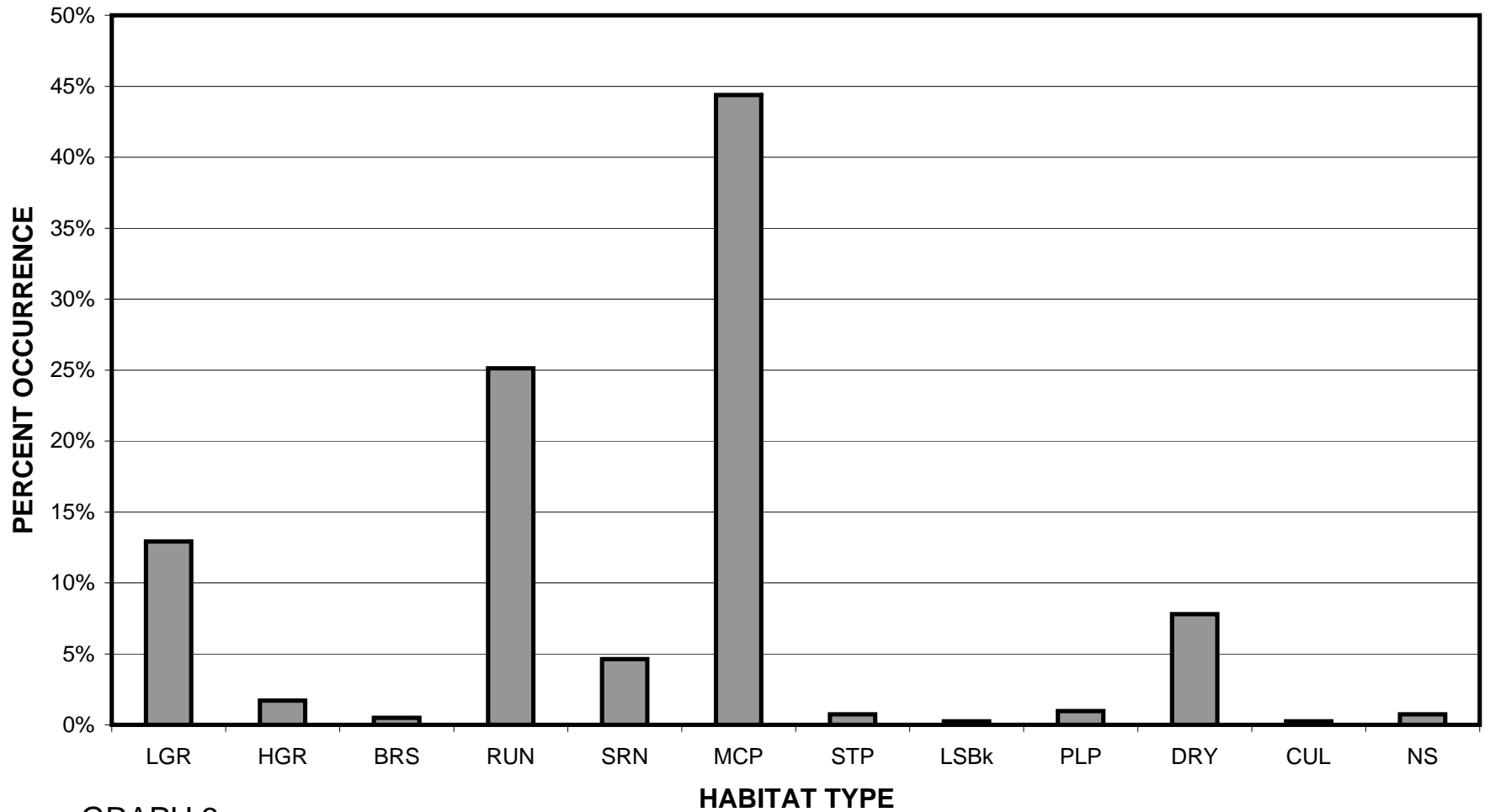
# COOK CREEK 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

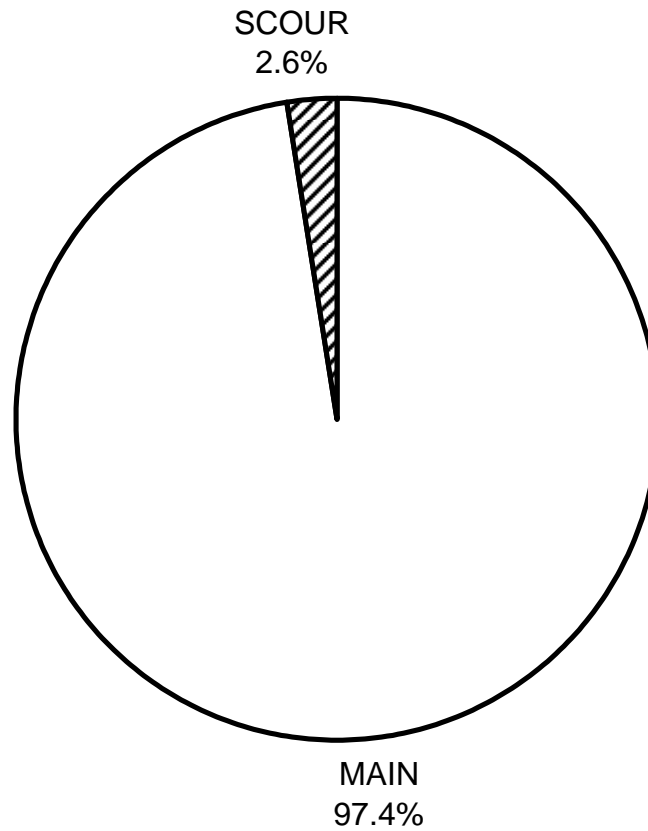
# COOK CREEK 2012

## HABITAT TYPES BY PERCENT OCCURRENCE



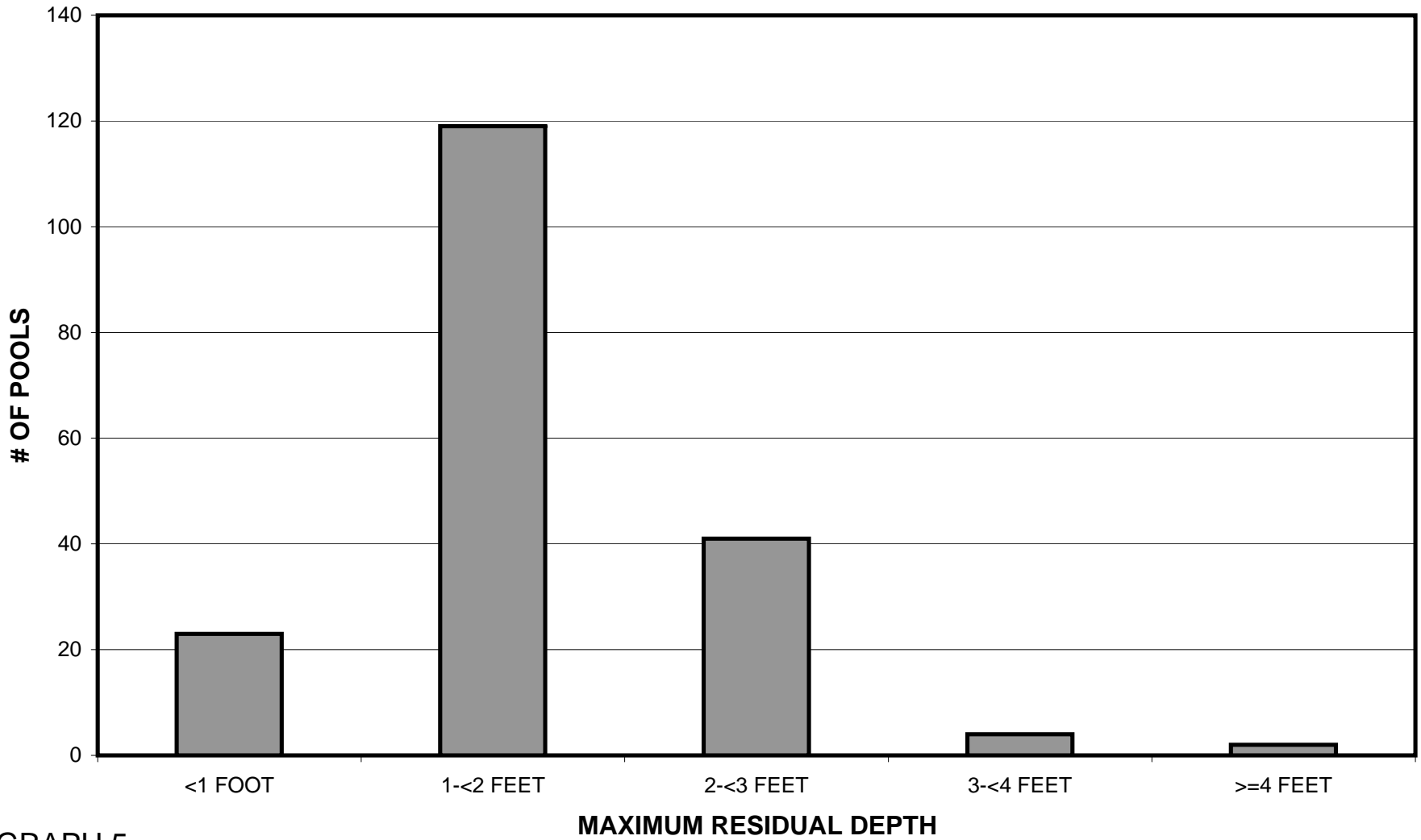
GRAPH 3

**COOK CREEK 2012  
POOL TYPES BY PERCENT OCCURRENCE**



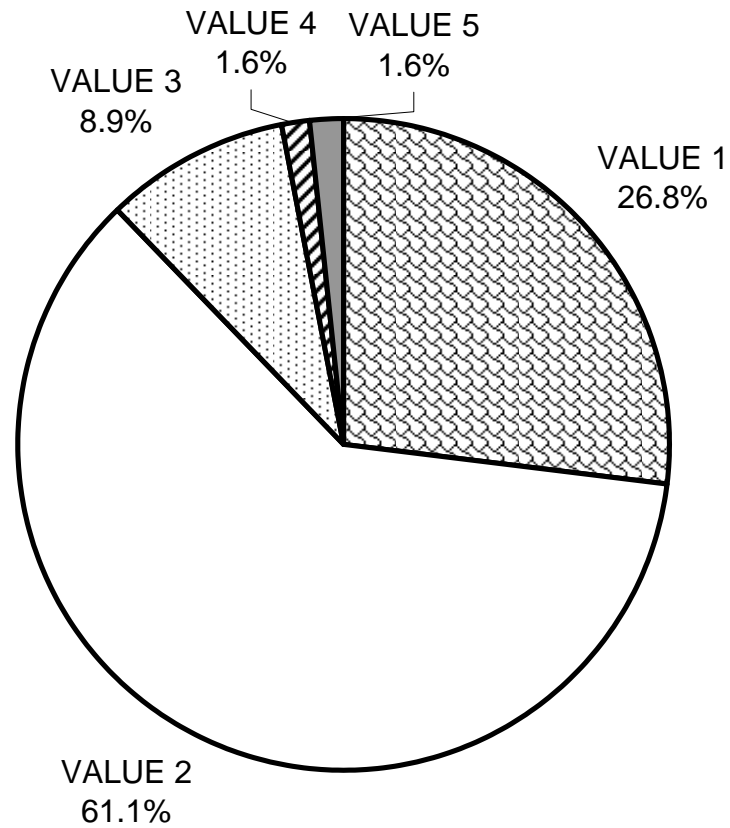
GRAPH 4

# COOK CREEK 2012 MAXIMUM DEPTH IN POOLS



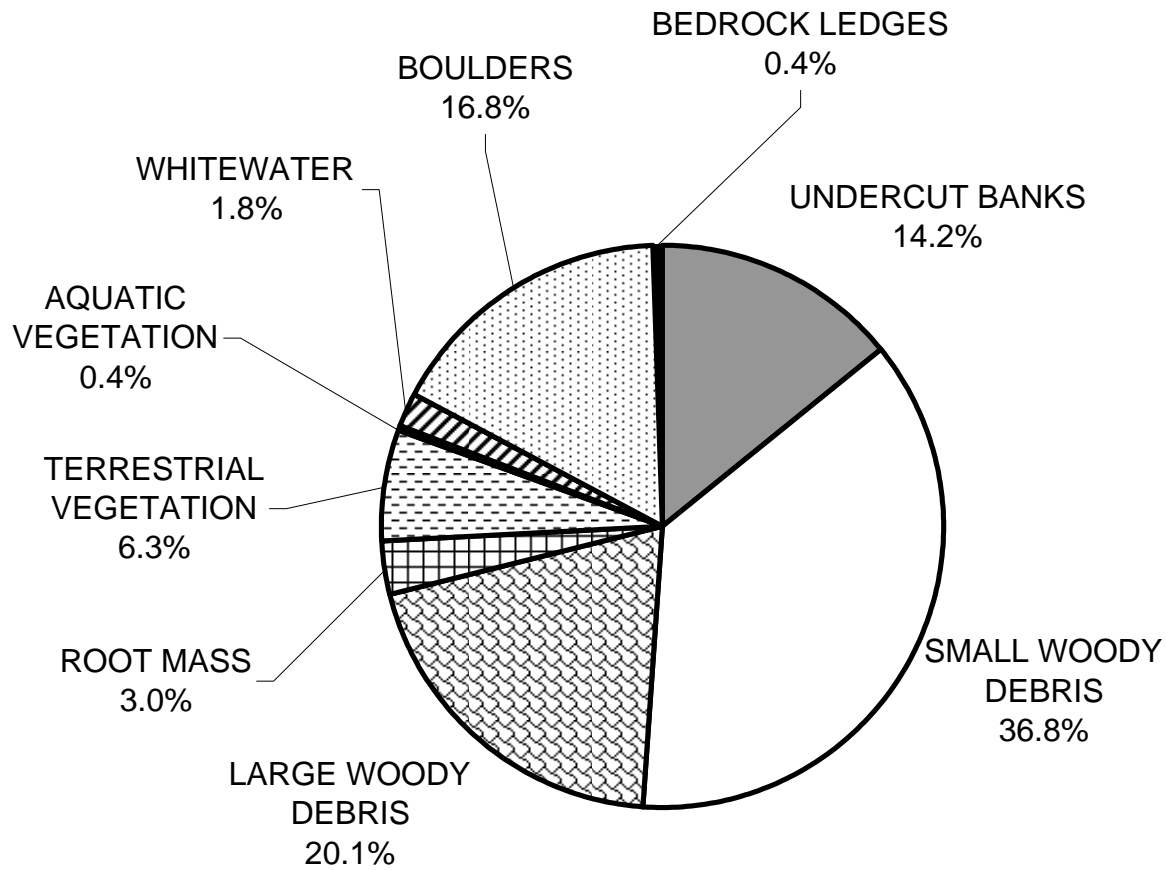
GRAPH 5

# COOK CREEK 2012 PERCENT EMBEDDEDNESS



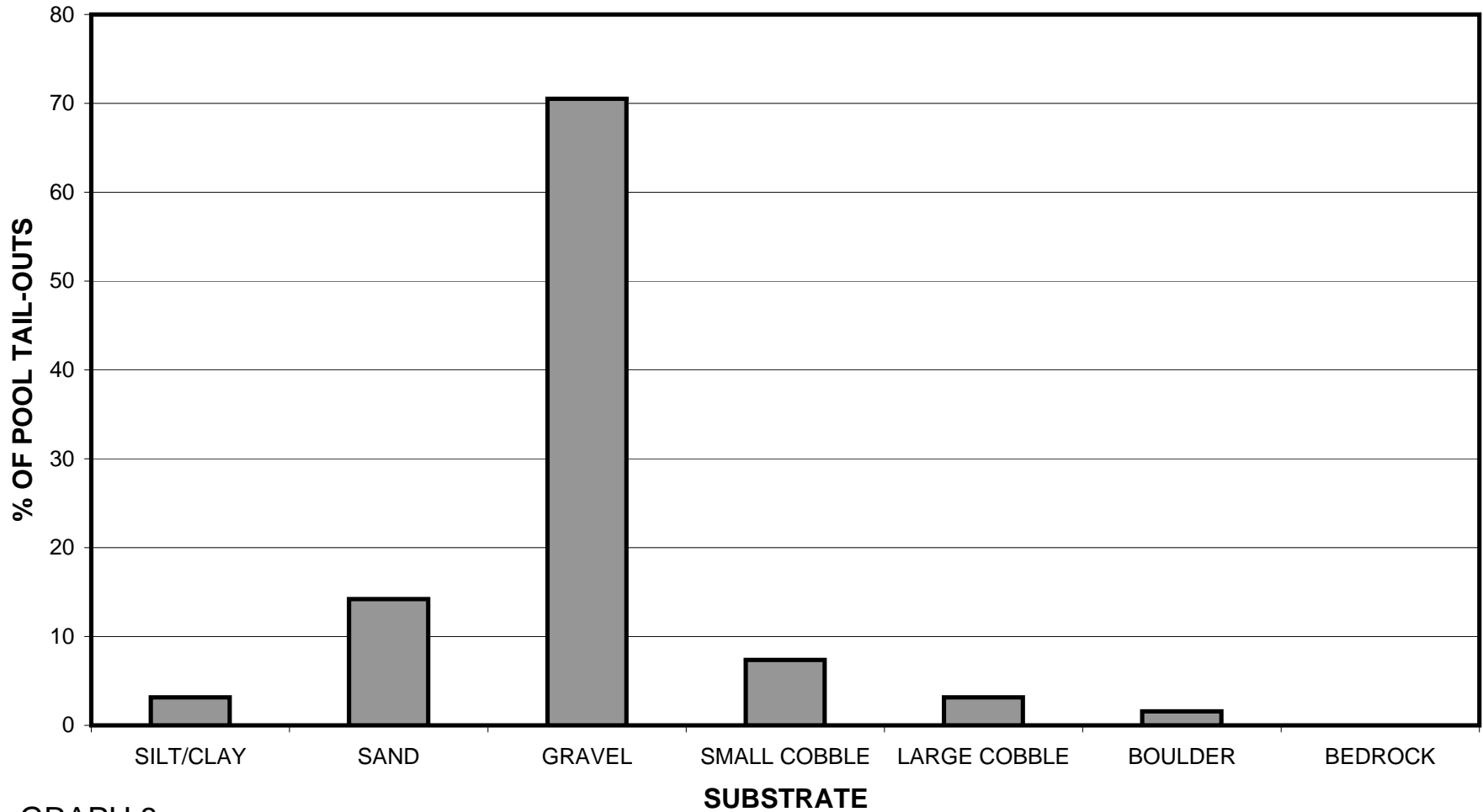
GRAPH 6

# COOK CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

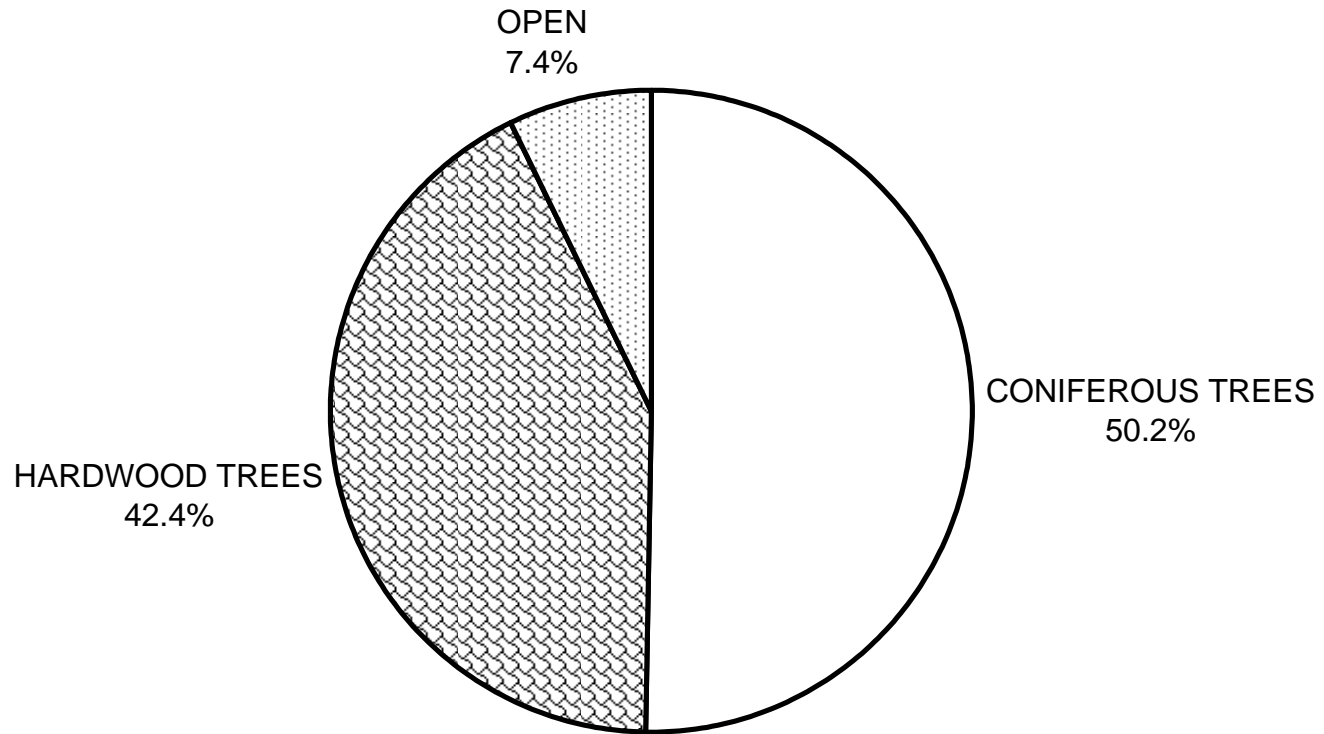
# COOK CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

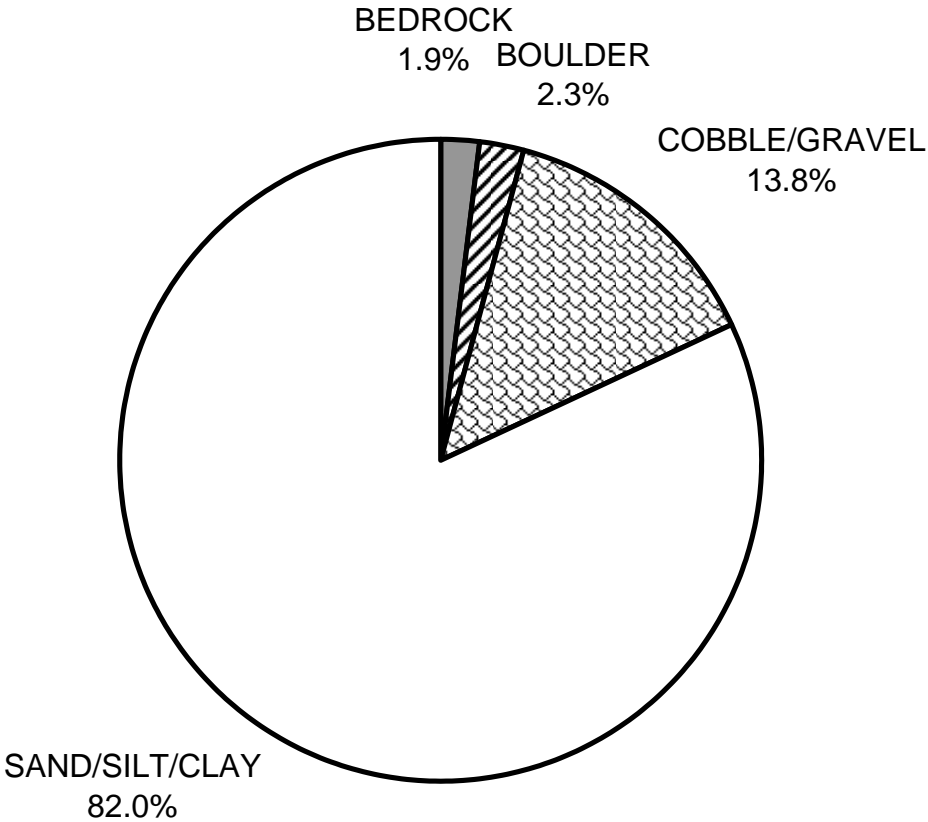


# COOK CREEK 2012 MEAN PERCENT CANOPY



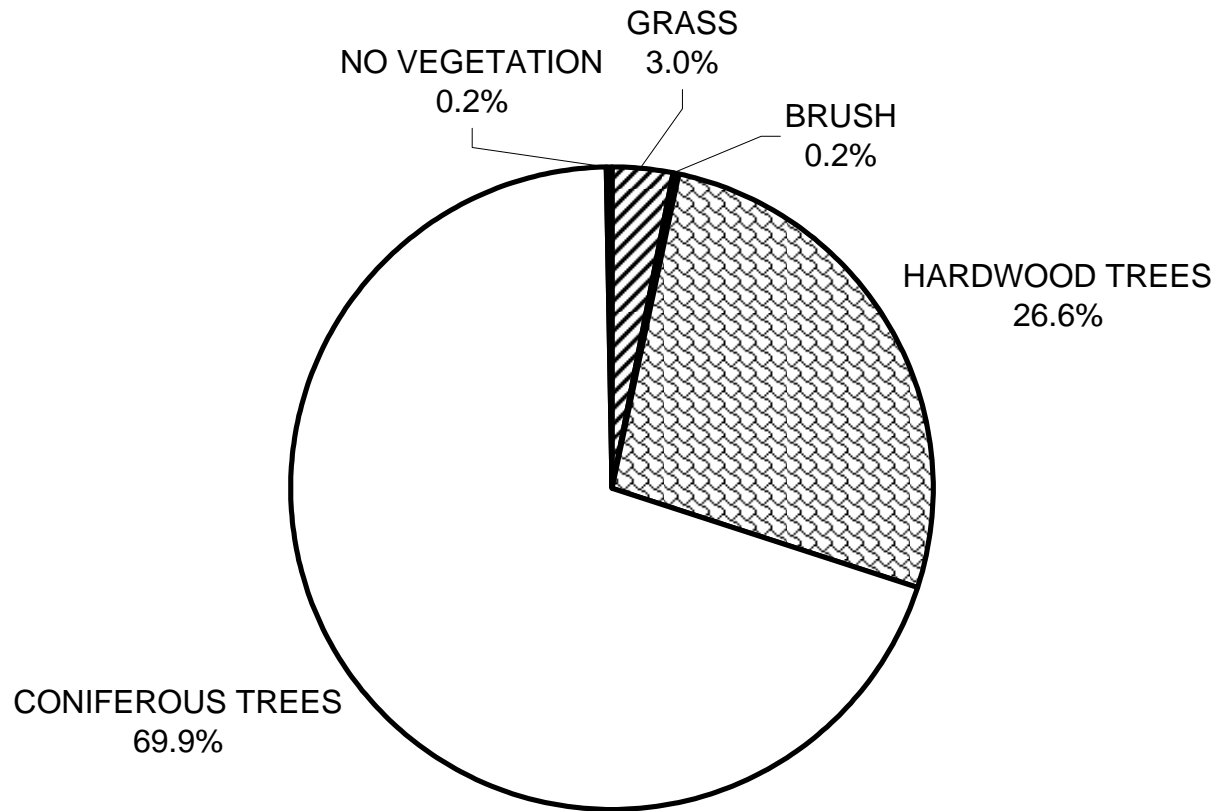
GRAPH 9

**COOK CREEK 2012  
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

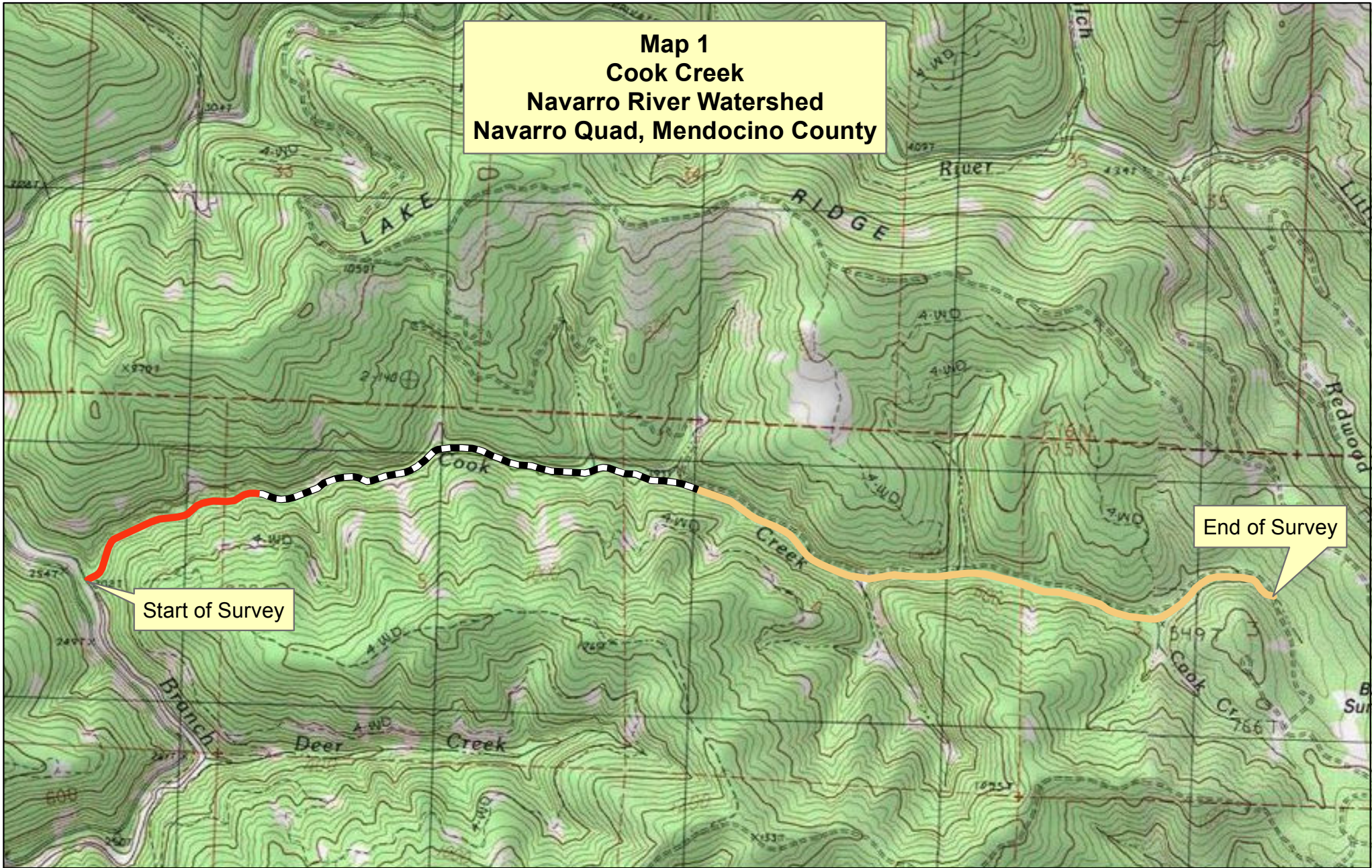
# COOK CREEK 2012 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

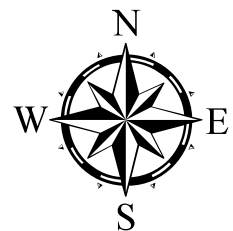


**Map 1**  
**Cook Creek**  
**Navarro River Watershed**  
**Navarro Quad, Mendocino County**



Start of Survey

End of Survey



- Reach 1, Channel Type F4
- - - Reach 2, Channel Type B2
- Reach 3, Channel Type F3

