STREAM INVENTORY REPORT

Stockhoff Creek

INTRODUCTION

A stream inventory was conducted from July 8, 2008 to July 16, 2008 on Stockhoff Creek. The survey began at the confluence with Pacific Ocean and extended upstream 1.6 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Stockhoff 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

Stockhoff Creek is a tributary to the Pacific Ocean, located in Sonoma County, California (Map 1). Stockhoff Creek's legal description at the confluence with Pacific Ocean is T08N R13W S10. Its location is 38.5469 north latitude and 123.2963 west longitude, LLID number 1232964385470. Stockhoff Creek is an intermittent stream and has no blue line stream according to the USGS Plantation 7.5 minute quadrangle. Stockhoff Creek drains a watershed of approximately 2.1 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 and is managed for recreation. Vehicle access exists via Highway 1 at Stillwater Cove County Park.

METHODS

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

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail 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 Stockhoff 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". Stockhoff 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 Stockhoff 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.

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

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 Stockhoff 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

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HABITAT INVENTORY RESULTS

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

The habitat inventory of July 8 to July 16, 2008, was conducted by H. Colton, T. Pool, and A. Askim (WSP). The total length of the stream surveyed was 8,433 feet with an additional 61 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.38 cfs on July 9, 2008.

Stockhoff Creek is an F6 channel type for 2,425 feet of the stream surveyed (Reach 1), a C2 channel type for 974 feet of the stream surveyed (Reach 2), an A2 channel type for 1,160 feet of the stream surveyed (Reach 3), and a C2 channel type for 3,935 feet of the stream surveyed (Reach 4). F6 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and silt/clay-dominant substrates. C2 channels are meandering point-bar, riffle/pool, alluvial channels with broad well defined floodplain on low gradients and boulder-dominant substrates. A2 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and boulder-dominant substrates.

Water temperatures taken during the survey period ranged from 50 to 57 degrees Fahrenheit. Air temperatures ranged from 52 to 65 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% pool units, 31% flatwater units, and 20% riffle units (Graph 1). Based on total length of Level II habitat types there were 47% flatwater units, 26% pool units, and 20% riffle units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 25%; run units, 16%; and step pool units, 14% (Graph 3). Based on percent total length, run units made up 31%, step pool units 19%, and step run units 13%.

A total of 32 pools were identified (Table 3). Main channel pools were the most frequently encountered at 97% (Graph 4), and comprised 99% 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. Eleven of the 32 pools (34%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 32 pool tail-outs measured, 7 had a value of 2 (21.9%); 12 had a value of 3 (37.5%); 13 had a value of 4 (40.6%) (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 unsuited 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 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, scour pools had the highest mean shelter rating of 24. Main channel pools a mean shelter rating of 14 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Stockhoff Creek. Graph 7 describes the pool cover in Stockhoff Creek. Large woody debris is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was the dominant substrate observed in 34% of the pool tail-outs. Gravel was the next most frequently observed dominant substrate type and occurred in 31% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Stockhoff Creek was 91%. Nine percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 36% and 64%, respectively. Graph 9 describes the mean percent canopy in Stockhoff Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 89%. The mean percent left bank vegetated was 86%. The dominant elements composing the structure of the stream banks consisted of 56% sand/silt/clay, 36% cobble/gravel and 9% boulder (Graph 10). Coniferous trees were the dominant vegetation type observed in 62% of the units surveyed. Additionally, 24% of the units surveyed had grass as the dominant vegetation type, and 12% had deciduous tress as the dominant vegetation type (Graph 11).

DISCUSSION

Stockhoff Creek is an F6 channel type for the first 2,425 feet of stream surveyed (Reach 1), a C2 channel type for the next 974 feet (Reach 2), an A2 channel type for the next 1,160 feet (Reach 3) and a C2 channel type for the remaining 3,935 feet (Reach 4). The suitability of F6, C2, A2 channel types for fish habitat improvement structures is as follows: F6 channel types are good for bank-placed boulders and fair for plunge weirs, boulder clusters, single and opposing wing-deflectors, and log cover. C2 channel types are good for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. A2 channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days July 8 to July 16, 2008, ranged from 50 to 57 degrees Fahrenheit. Air temperatures ranged from 52 to 65 degrees Fahrenheit. To make any conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 47% of the total length of this survey, riffles 20%, pools 26%, 7% dry units and 1% culvert units. Eleven of the 32 (34%) 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.

Seven of the 32 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-five 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. Sediment sources in Stockhoff Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-one of the 32 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 large woody debris in Stockhoff Creek. Large woody debris is the dominant cover type in pools followed by boulders. 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 1 had a canopy density of 88.4%, Reach 2 had a canopy density of 90%, Reach 3 had a canopy density of 91.5%, and Reach 4 had a canopy density of 97.3%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 89% and 86%, 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) Stockhoff 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.

5) There are several log debris accumulations present on Stockhoff Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

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 Pacific Ocean. There is a culvert going under Highway 1. The culvert is made out of concrete and is 6.3' high x 12' wide x and 66' long. There is no plunge height and no slope. The culvert is in good condition and is not a barrier to fish.
719	0019.00	A foot bridge crosses over the creek. The bridge is 7.5' high x 23' wide x 4' long and is made out of wood.
1331	0028.00	Salmonid young-of-the-year (YOY) are present in this habitat unit.
1458	0030.00	Log debris accumulation (LDA) #01 contains 10 pieces of large woody debris (LWD) and measures 5.6' high x 28' wide x 10.5' long. Water flows through visible gaps. Retained sediment ranges from gravel to small cobble and measures 9.1' wide x 9.6' long x 2.9' deep. It is a possible barrier to juvenile and adult salmonids. Fish are not present above the LDA.
1985	0034.00	LDA #02 contains 10 pieces of LWD and measures 6.6' high x 21' wide x 15' long. Water flows through visible gaps. Retained sediment ranges from sand to gravel and measures 5' wide x 7' long x 2' deep.
2425	0038.00	The channel type changes from F6 to C2. A sculpin is present in this habitat unit. Tributary #01 enters on the right bank. It is not flowing. The water temperature downstream of the tributary is 54 degrees Fahrenheit, the water temperature of the tributary is 53 degrees Fahrenheit, and the

		water temperature upstream of the confluence is 55 degrees Fahrenheit. It is not accessible to fish and no fish are present. Three logs block the stream making it non accessible to fish.
2909	0041.00	LDA #03 contains 23 pieces of LWD and measures 7.2' high x 24' wide x 24' long. Water flows through visible gaps. Retained sediment ranges from sand to gravel and measures 5' wide x 7' long x 2' deep.
3138	0044.00	The channel type changes from C2 to A2.
3483	0047.00	LDA #04 contains 5 pieces of LWD and measures 8.1' high x 16' wide x 14.2' long. Water flows through visible gaps. Retained sediment is primarily cobble and measures 5.3' wide x 12.6' long x 1.2' deep.
3710	0049.00	A foot bridge crosses over the creek. The bridge measures 12 ft high, 5.4 ft wide, 48.5 ft long and is made out of metal and wood.
4489	0054.00	LDA #05 contains 5 pieces of LWD and measures 6.3' high x 29.5' wide x 8.9' long. Water flows through visible gaps. There is no sediment retention.
4572	0057.00	LDA #06 contains 6 pieces of LWD and measures 7.6' high x 14.7' wide x 7.5' long. Water flows through visible gaps. Retained sediment is primarily cobble and measures 15' wide x 12' long x 0.5' deep.
4849	0060.00	LDA #07 contains 11 pieces of LWD and measures 8.9' high x 24' wide x 12' long. Water flows through visible gaps. Retained sediment is primarily sand and measures 4' wide x 7.5' long x 1.7' deep.
5262	0065.00	LDA #08 contains 2 pieces of LWD and measures 4.3' high x 10.3' wide x 6' long. Water flows/does not flow through and there are visible/no visible gaps. Retained sediment is primarily cobble and measures 5' wide x 6.4' long x 0.7' deep. LDA #09 contains 3 pieces of LWD and measures 5.5' high x 31' wide x 7.5' long. Water flows through and there are no visible gaps. Retained sediment is primarily cobble and measures 14' wide x 16.2' long x 3' deep.
6156	0068.00	LDA #10 contains 2 pieces of LWD and measures 5.5' high x 31' wide x 7.5' long. Water flows through and there are no visible gaps. Retained sediment is primarily cobble and measures 14' wide x 16.2' long x 3' deep.
6800	0072.00	LDA #11 contains 4 pieces of LWD and measures 5.7' high x 17' wide x 2.5' long. Water flows through and there are no visible gaps.

		Retained sediment is primarily gravel and measures 17’ wide x 30’ long x 1.2’ deep.
7127	0074.00	LDA #12 contains 7 pieces of LWD and measures 9.9’ high x 17’ wide x 18.5’ long. Water flows through and there are no visible gaps. Retained sediment is primarily gravel and measures 4.6’ wide x 10’ long x 0.4’ deep.
7137	0075.00	LDA #13 contains 10 pieces of LWD and measures 10.4’ high x 12.2’ wide x 36’ long. Water does not flow through though there are visible gaps. Retained sediment is primarily gravel and measures 7’ wide x 10’ long x 0.4’ deep.
7973	0077.00	LDA #14 contains 4 pieces of LWD and measures 7.7’ high x 17.2’ wide x 2.9’ long. Water does not flow through and there are no visible gaps. Retained sediment is primarily sand and measures 11.7’ wide x 9.5’ long x 1.2’ deep.
8433	0079.00	End of survey due to the stream channel dimensions being hard to define and dense vegetation.

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: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

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	1.3	66	66	0.8									
4	0	DRY	5.0	138	553	6.5									
25	8	FLATWATER	31.3	159	3968	46.7	4.6	0.5	0.9	615	15370	346	8646		4
2	0	NOSURVEY	2.5	4	8	0.1									
32	32	POOL	40.0	70	2242	26.4	9.0	1.1	1.9	570	18229	732	23416	613	14
16	5	RIFFLE	20.0	104	1657	19.5	5.9	0.3	0.5	771	12335	283	3625		4

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
80	45	8494	45934	35687

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

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 (%)
9	3	LGR	11.3	72	646	7.6	6	0.3	0.5	393	3533	118	1060		1	89
5	1	HGR	6.3	137	683	8.0	7	0.4	0.7	1949	9744	779	3897		8	94
2	1	CAS	2.5	164	328	3.9	3			728	1456				8	80
4	1	GLD	5.0	55	220	2.6	5	0.4	0.7	191	763	76	305		10	94
13	3	RUN	16.3	205	2660	31.3	5	0.6	1.3	926	12038	637	8279		3	96
8	4	SRN	10.0	136	1088	12.8	4	0.4	1	487	3899	195	1560		3	86
20	20	MCP	25.0	32	632	7.4	9	1.2	4.8	288	5760	368	7360	326	16	91
11	11	STP	13.8	145	1593	18.8	7	0.9	3.7	1100	12095	1381	15196	1115	10	95
1	1	PLP	1.3	17	17	0.2	22	2.2	3.9	374	374	860	860	823	24	90
4	0	DRY	5.0	138	553	6.5										
1	0	CUL	1.3	66	66	0.8										
2	0	NS	2.5	4	8	0.1										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
80	45	8494	49663	38517

Table 3 - Summary of Pool Types

Stream Name: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

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	97	72	2225	99	8.6	1.1	576	17855	606	18781	14
1	1	SCOUR	3	17	17	1	22.0	2.2	374	374	823	823	24

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
32	32	2242	18229	19604

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

Stream Name: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

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
20	MCP	63	3	15	8	40	8	40	0	0	1	5
11	STP	34	2	18	8	73	0	0	1	9	0	0
1	PLP	3	0	0	0	0	0	0	1	100	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
32	5	16	16	50	8	25	2	6	1	3

Mean Maximum Residual Pool Depth (ft.): 1.9

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008 Dry Units: 4

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

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
9	3	LGR	100	0	0	0	0	0	0	0	0
5	1	HGR	50	0	0	0	0	0	50	0	0
2	1	CAS	0	0	0	0	0	0	0	50	50
16	5	TOTAL RIFFLE	50	0	0	0	0	0	17	17	17
4	1	GLD	20	0	0	0	80	0	0	0	0
13	3	RUN	90	0	0	0	10	0	0	0	0
8	4	SRN	23	0	27	43	0	0	0	7	0
25	8	TOTAL FLAT	36	0	16	26	18	0	0	4	0
20	20	MCP	31	8	22	23	1	0	0	16	0
11	11	STP	5	5	45	1	1	0	7	36	0
1	1	PLP	0	10	90	0	0	0	0	0	0
32	32	TOTAL POOL	21	7	32	15	1	0	3	22	0
1	0	CUL									
2	0	NS									
80	45	TOTAL	25	5	28	15	3	0	3	20	1

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008 Dry Units: 4

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

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
9	3	LGR	0	0	67	0	33	0	0
5	1	HGR	0	0	0	0	100	0	0
2	1	CAS	0	0	0	0	0	0	100
4	1	GLD	0	0	100	0	0	0	0
13	3	RUN	0	33	0	0	67	0	0
8	4	SRN	0	0	25	25	50	0	0
20	20	MCP	0	45	25	15	10	5	0
11	11	STP	18	9	0	18	27	27	0
1	1	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
91	64	36	0	89	86

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: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008 Survey Length (ft.): 8494 Main Channel (ft.): 8433 Side Channel (ft.): 61

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F6
Reach Length (ft.): 2425
Riffle/Flatwater Mean Width (ft.): 6.3
BFW:
Range (ft.): 8 to 28
Mean (ft.): 18
Std. Dev.: 9
Base Flow (cfs.): 0.4
Water (F): 54 - 57 Air (F): 55 - 65
Dry Channel (ft): 0

Canopy Density (%): 88.4
Coniferous Component (%): 48.3
Hardwood Component (%): 51.7
Dominant Bank Vegetation: Grass
Vegetative Cover (%): 84.7
Dominant Shelter: Undercut Banks
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 23
LWD per 100 ft.:
Riffles: 0
Pools: 4
Flat: 0

Pools by Stream Length (%): 43.5
Pool Frequency (%): 45.9
Residual Pool Depth (%):
< 2 Feet Deep: 53
2 to 2.9 Feet Deep: 29
3 to 3.9 Feet Deep: 12
>= 4 Feet Deep: 6
Mean Max Residual Pool Depth (ft.): 2.2
Mean Pool Shelter Rating: 21

Pool Tail Substrate (%): Silt/Clay: 29 Sand: 0 Gravel: 29 Sm Cobble: 35 Lg Cobble: 0 Boulder: 0 Bedrock: 6

Embeddedness Values (%): 1. 0.0 2. 29.4 3. 29.4 4. 41.2 5. 0.0

STREAM REACH: 2

Channel Type: C2
Reach Length (ft.): 974
Riffle/Flatwater Mean Width (ft.): 5.2
BFW:
Range (ft.): 16 to 28
Mean (ft.): 21
Std. Dev.: 5
Base Flow (cfs.): 0.4
Water (F): 57 - 57 Air (F): 53 - 63
Dry Channel (ft): 0

Canopy Density (%): 90.0
Coniferous Component (%): 80.0
Hardwood Component (%): 20.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 78.8
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 12
LWD per 100 ft.:
Riffles: 3
Pools: 9
Flat: 0

Pools by Stream Length (%): 26.7
Pool Frequency (%): 42.9
Residual Pool Depth (%):
< 2 Feet Deep: 100
2 to 2.9 Feet Deep: 0
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.1
Mean Pool Shelter Rating: 13

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 33 Sm Cobble: 33 Lg Cobble: 0 Boulder: 33 Bedrock: 0

Embeddedness Values (%): 1. 0.0 2. 0.0 3. 66.7 4. 33.3 5. 0.0

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: A2
Reach Length (ft.): 1099
Riffle/Flatwater Mean Width (ft.):
BFW:
Range (ft.): 16 to 16
Mean (ft.): 16
Std. Dev.: 0
Base Flow (cfs.): 0.4
Water (F): 50 - 57 Air (F): 53 - 55
Dry Channel (ft): 0

Canopy Density (%): 91.5
Coniferous Component (%): 100.0
Hardwood Component (%): 0.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 87.3
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 40
LWD per 100 ft.:
Riffles: 3
Pools: 3
Flat: 1

Pools by Stream Length (%): 30.9
Pool Frequency (%): 36.4
Residual Pool Depth (%):
< 2 Feet Deep: 75
2 to 2.9 Feet Deep: 25
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.5
Mean Pool Shelter Rating: 7

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 50 Sm Cobble: 50 Lg Cobble: 0 Boulder: 0 Bedrock: 0
Embeddedness Values (%): 1. 0.0 2. 0.0 3. 75.0 4. 25.0 5. 0.0

STREAM REACH: 4

Channel Type: C2
Reach Length (ft.): 3935
Riffle/Flatwater Mean Width (ft.): 3.6
BFW:
Range (ft.): 14 to 26
Mean (ft.): 19
Std. Dev.: 6
Base Flow (cfs.): 0.4
Water (F): 50 - 53 Air (F): 52 - 55
Dry Channel (ft): 553

Canopy Density (%): 97.3
Coniferous Component (%): 74.6
Hardwood Component (%): 25.4
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 94.5
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 27
LWD per 100 ft.:
Riffles: 2
Pools: 6
Flat: 1

Pools by Stream Length (%): 14.5
Pool Frequency (%): 32.0
Residual Pool Depth (%):
< 2 Feet Deep: 75
2 to 2.9 Feet Deep: 25
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.6
Mean Pool Shelter Rating: 4

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 38 Gravel: 25 Sm Cobble: 25 Lg Cobble: 0 Boulder: 13 Bedrock: 0
Embeddedness Values (%): 1. 0.0 2. 25.0 3. 25.0 4. 50.0 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

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	4	4	8.9
Cobble / Gravel	16	16	35.6
Sand / Silt / Clay	25	25	55.6

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	12	10	24.4
Brush	0	0	0.0
Hardwood Trees	6	5	12.2
Coniferous Trees	27	29	62.2
No Vegetation	0	1	1.1

Total Stream Cobble Embeddedness Values: 3

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

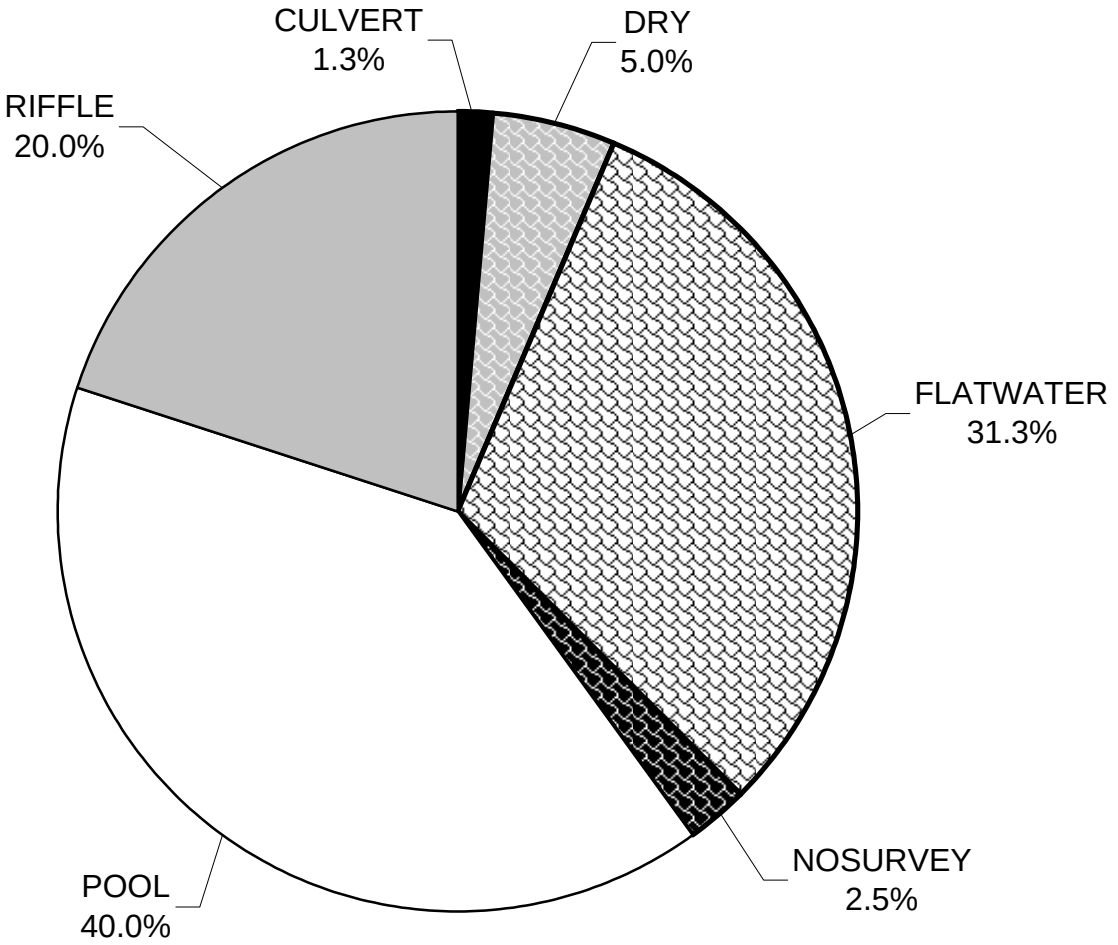
StreamName: Stockhoff Creek LLID: 1232964385470 Drainage: Gualala River

Survey Dates: 7/8/2008 to 7/16/2008

Confluence Location: Quad: PLANTATION Legal Description: T08NR13WS10 Latitude: 38:32:49.0N Longitude: 123:17:47.0W

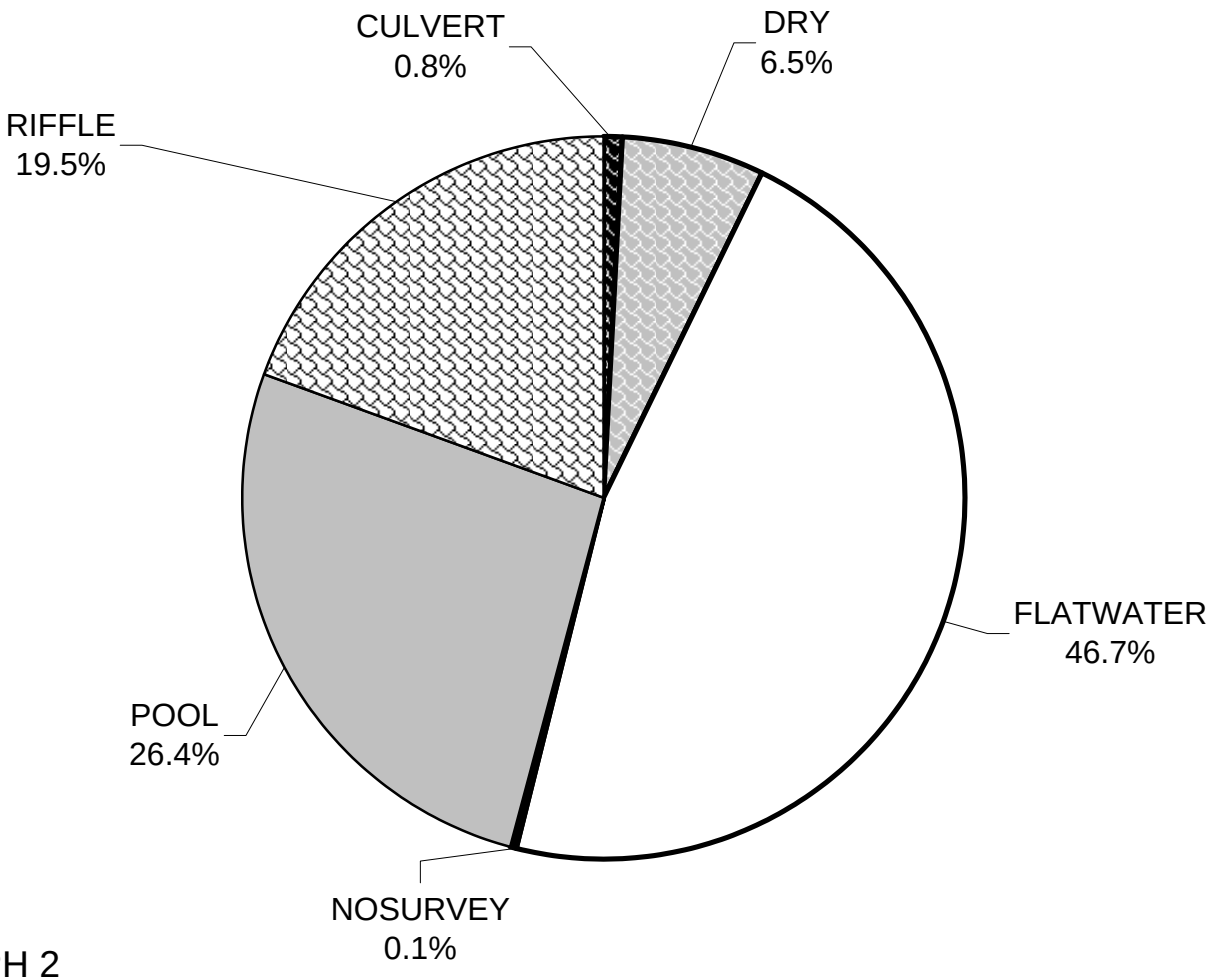
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	50	36	21
SMALL WOODY DEBRIS (%)	0	0	7
LARGE WOODY DEBRIS (%)	0	16	32
ROOT MASS (%)	0	26	15
TERRESTRIAL VEGETATION (%)	0	18	1
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	17	0	3
BOULDERS (%)	17	4	22
BEDROCK LEDGES (%)	17	0	0

STOCKHOFF CREEK 2008
HABITAT TYPES BY PERCENT OCCURRENCE



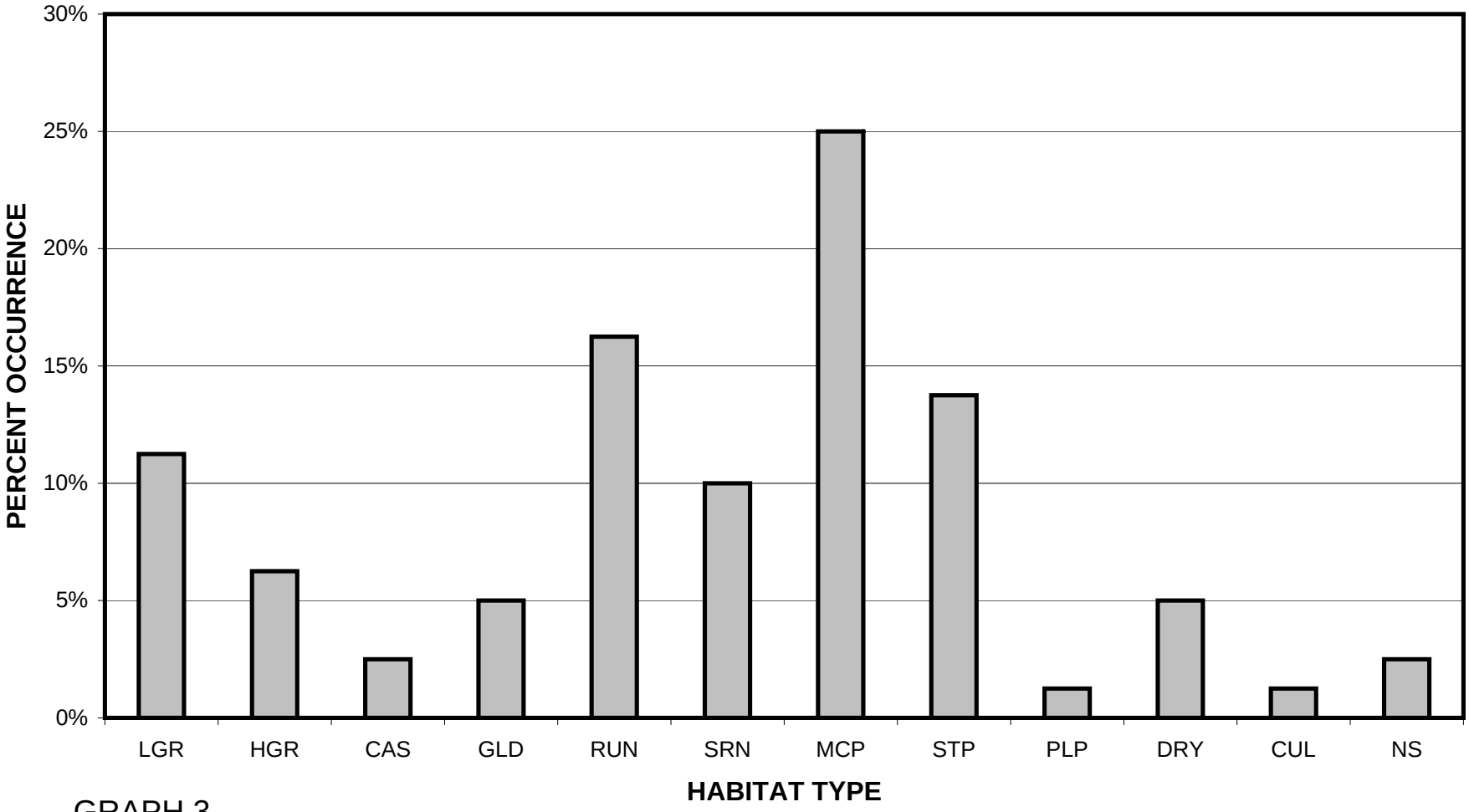
GRAPH 1

STOCKHOFF CREEK 2008
HABITAT TYPES BY PERCENT TOTAL LENGTH



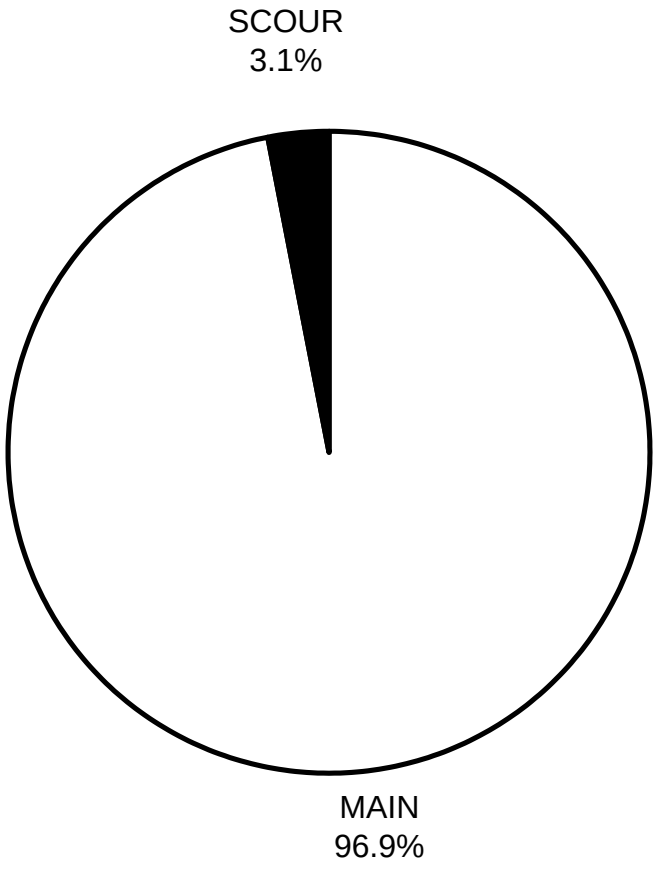
GRAPH 2

STOCKHOFF CREEK 2008
HABITAT TYPES BY PERCENT OCCURRENCE



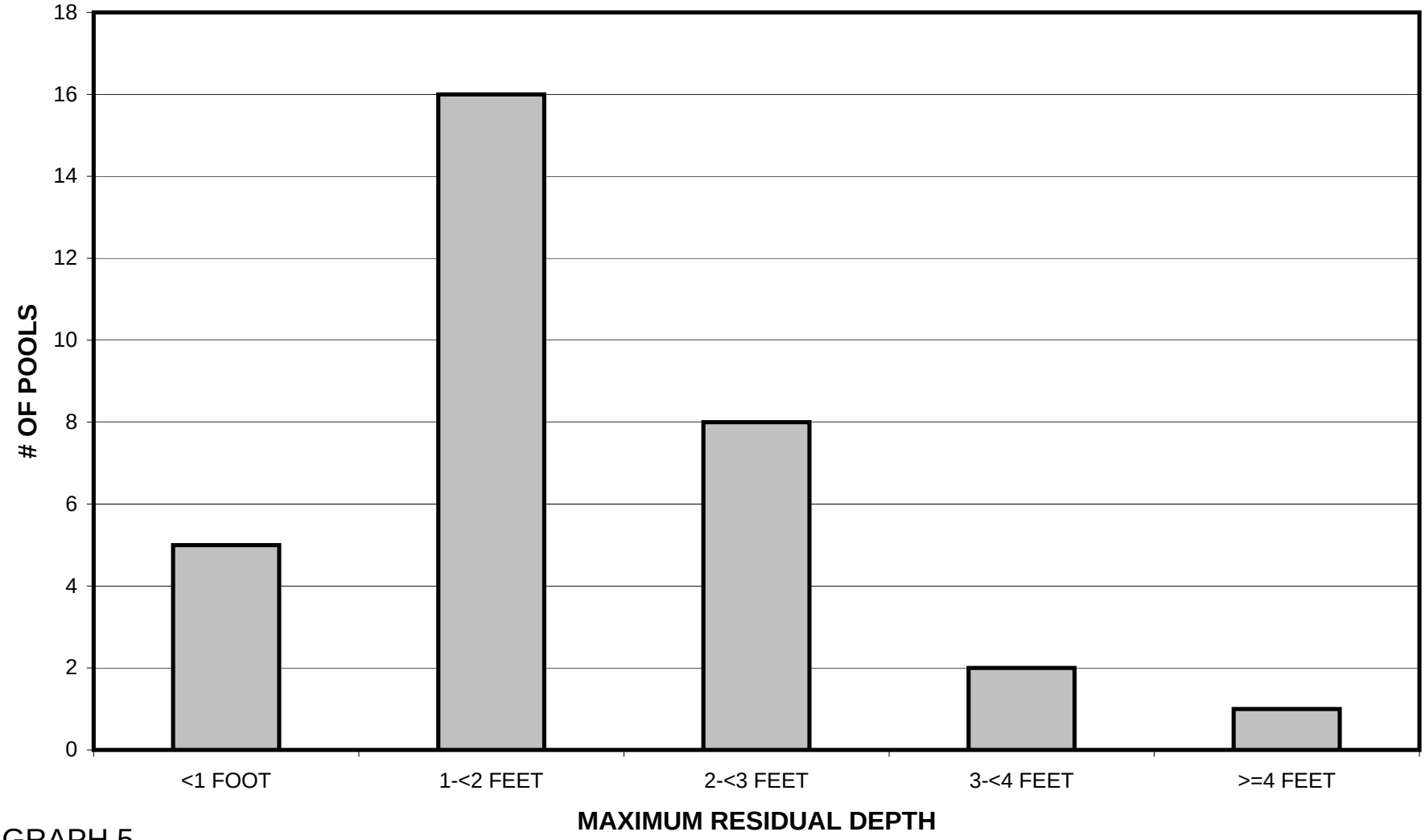
GRAPH 3

STOCKHOFF CREEK 2008
POOL TYPES BY PERCENT OCCURRENCE



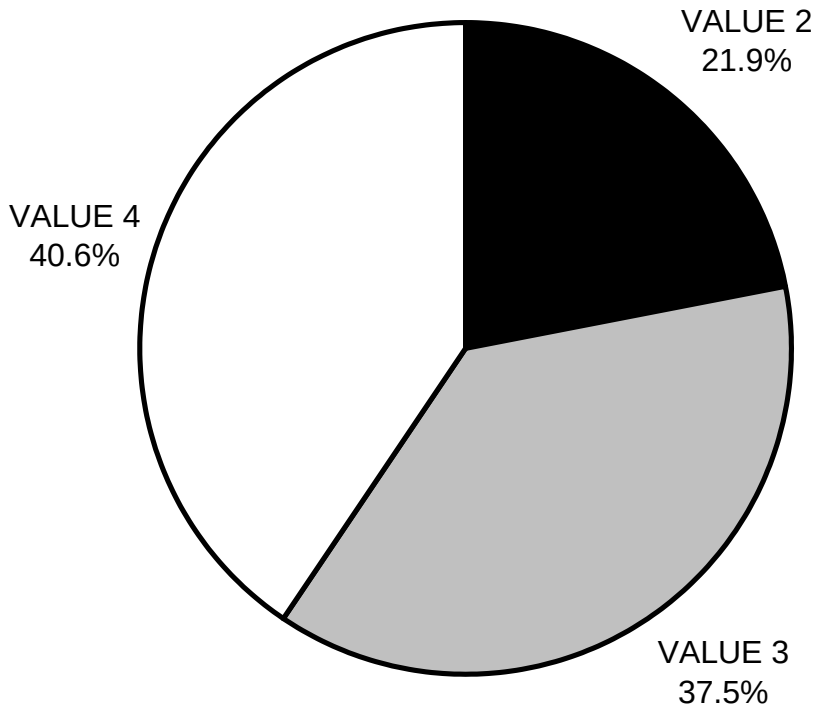
GRAPH 4

STOCKHOFF CREEK 2008
MAXIMUM DEPTH IN POOLS



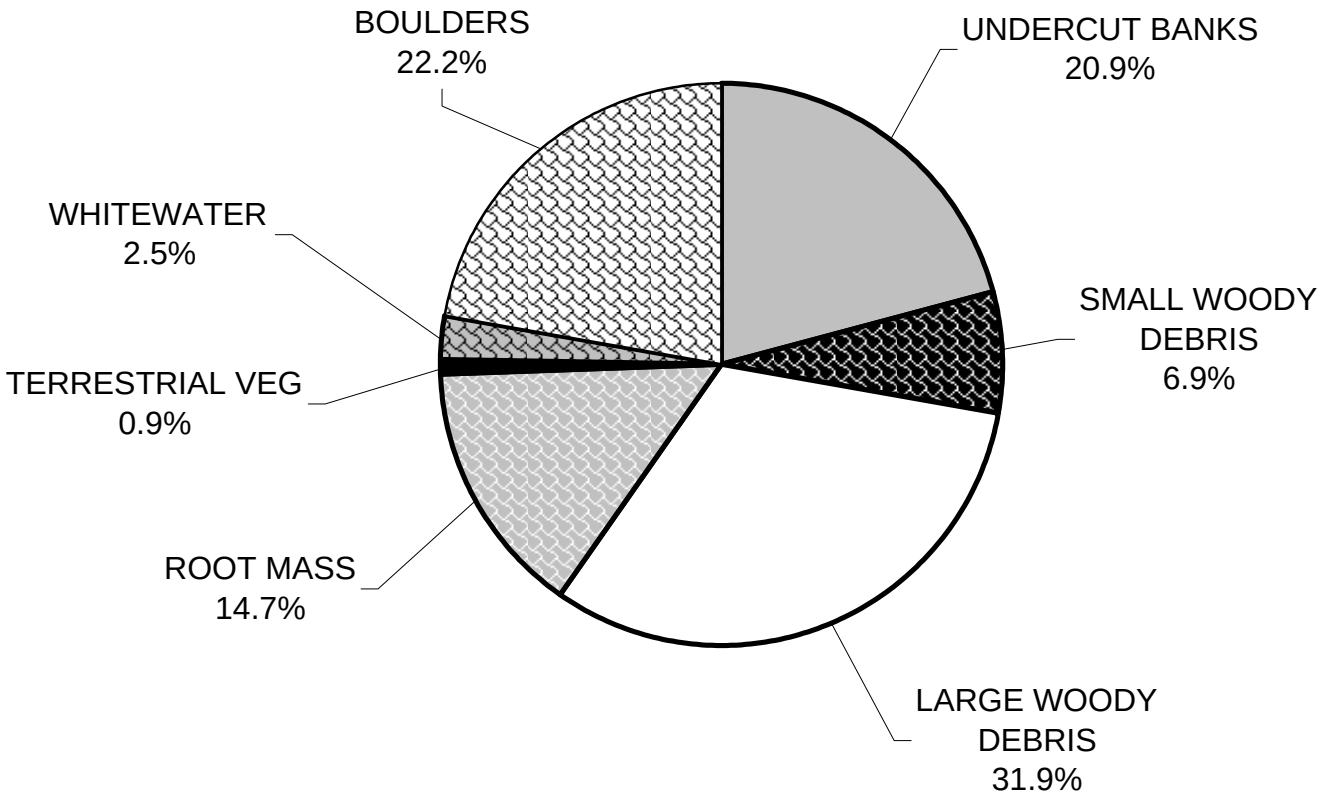
GRAPH 5

STOCKHOFF CREEK 2008
PERCENT EMBEDDEDNESS



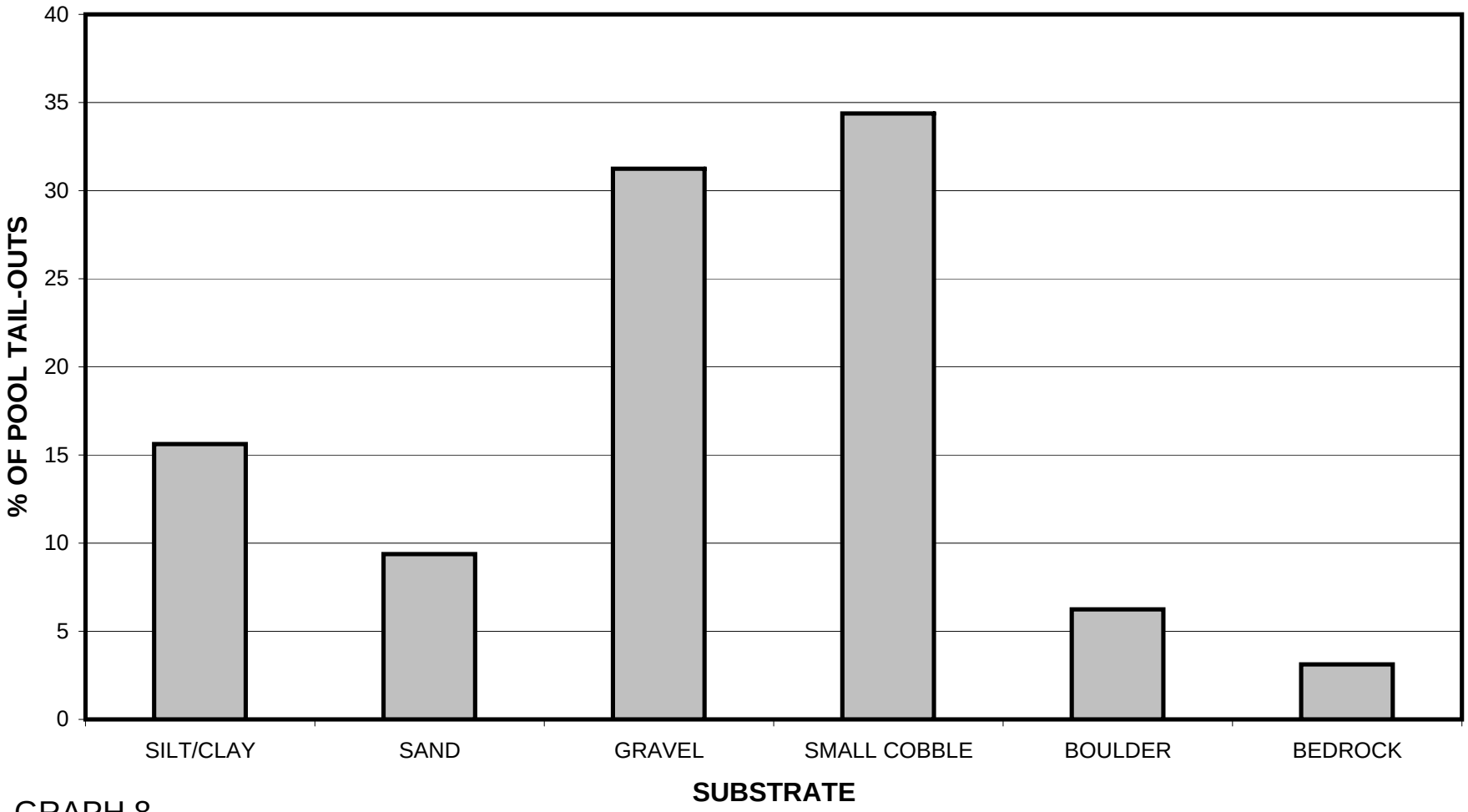
GRAPH 6

STOCKHOFF CREEK 2008
MEAN PERCENT COVER TYPES IN POOLS



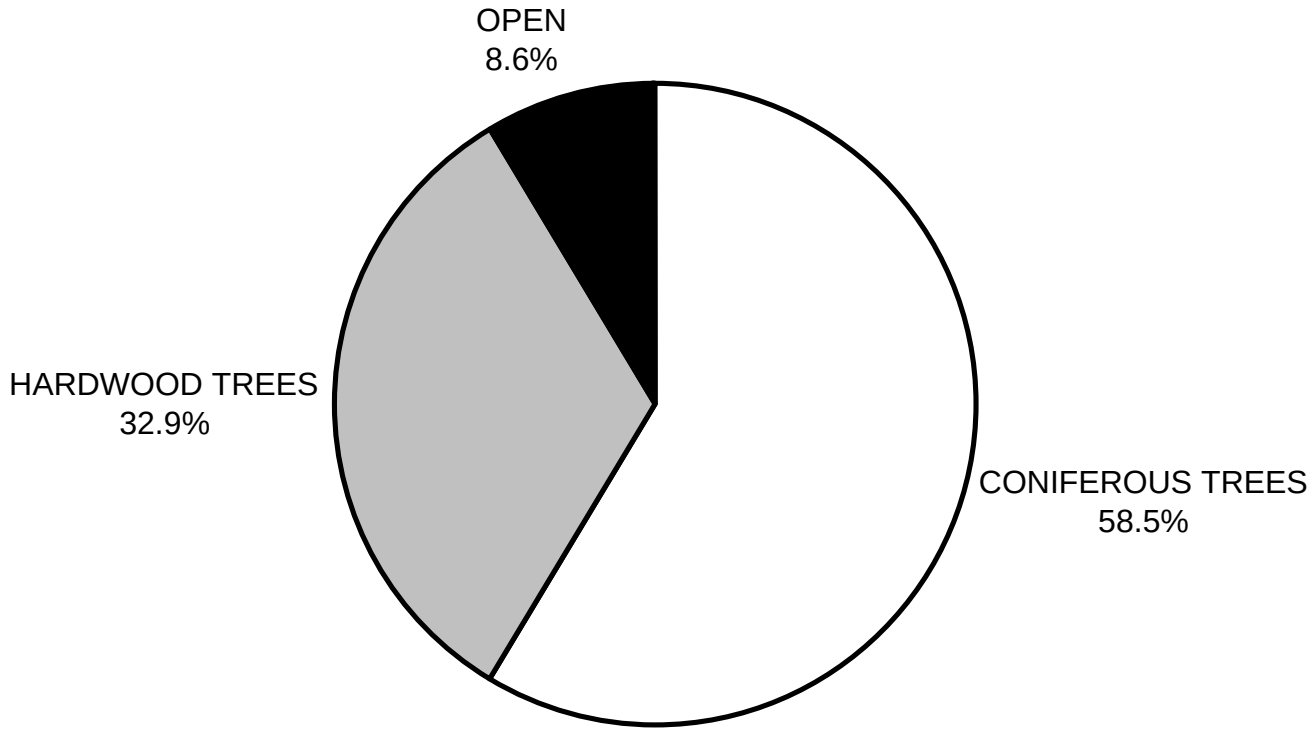
GRAPH 7

STOCKHOFF CREEK 2008
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



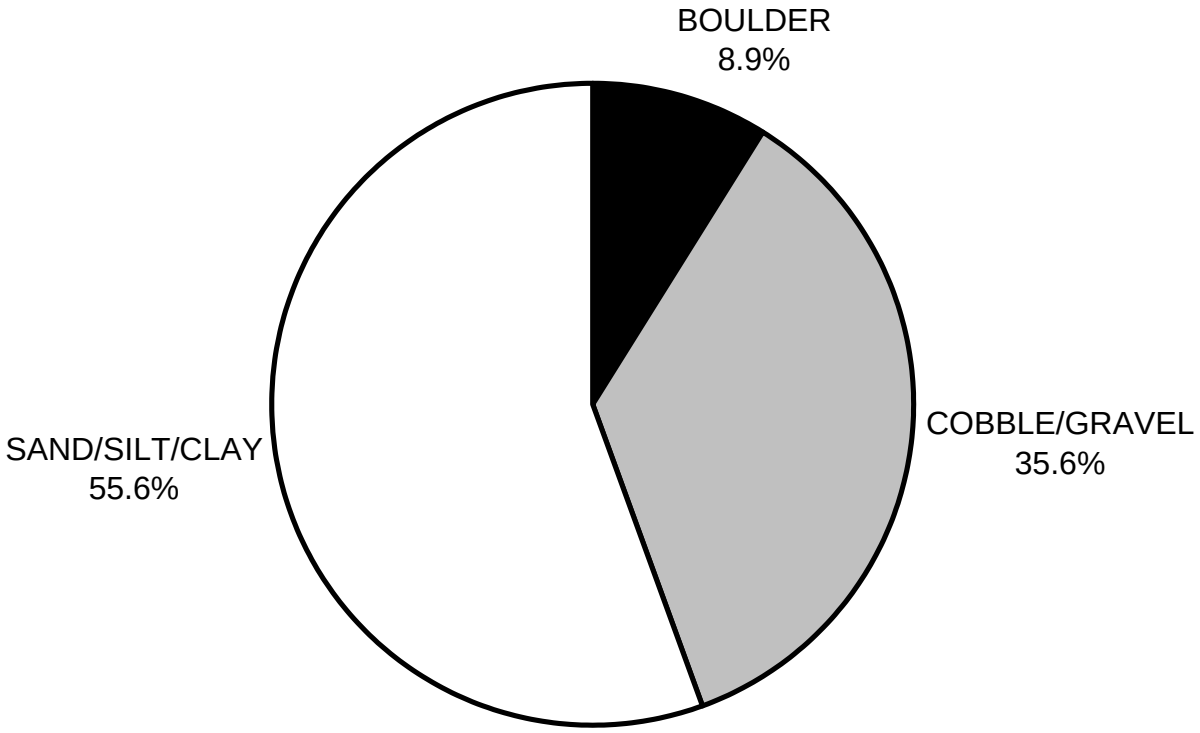
GRAPH 8

STOCKHOFF CREEK 2008
MEAN PERCENT CANOPY



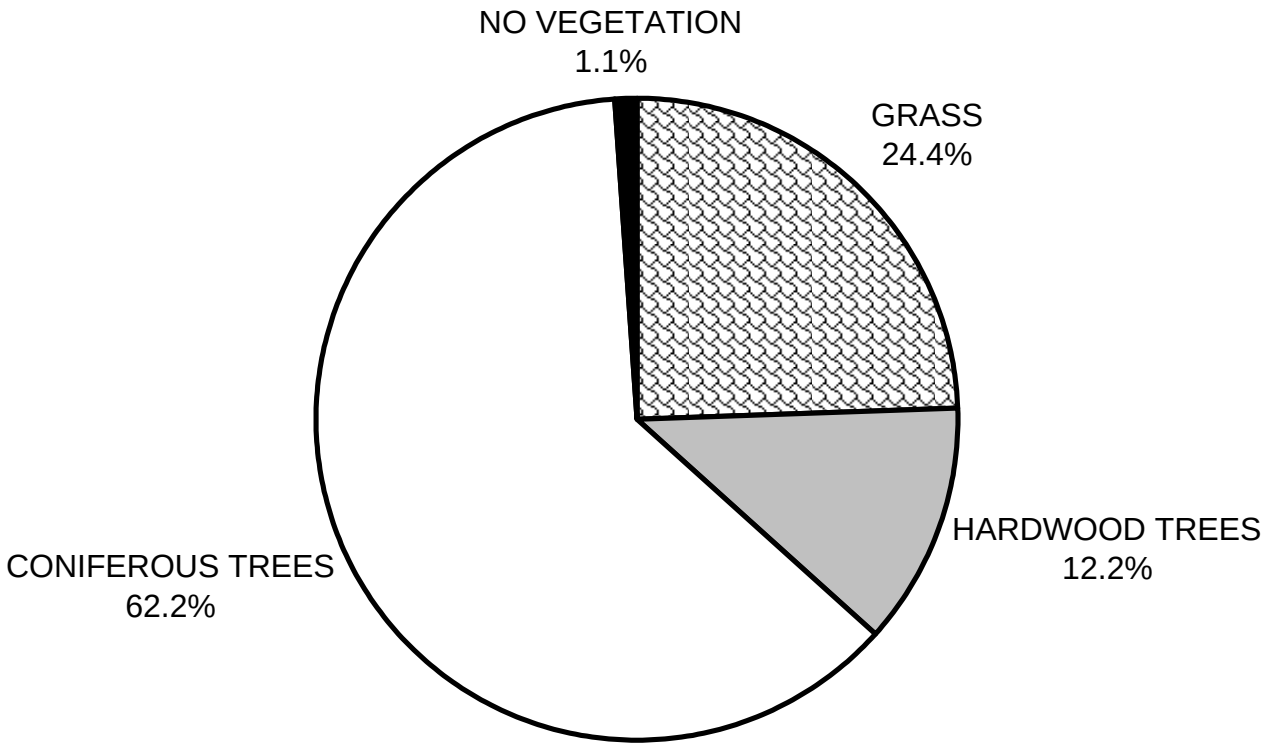
GRAPH 9

STOCKHOFF CREEK 2008
DOMINANT BANK COMPOSITION IN SURVEY REACH

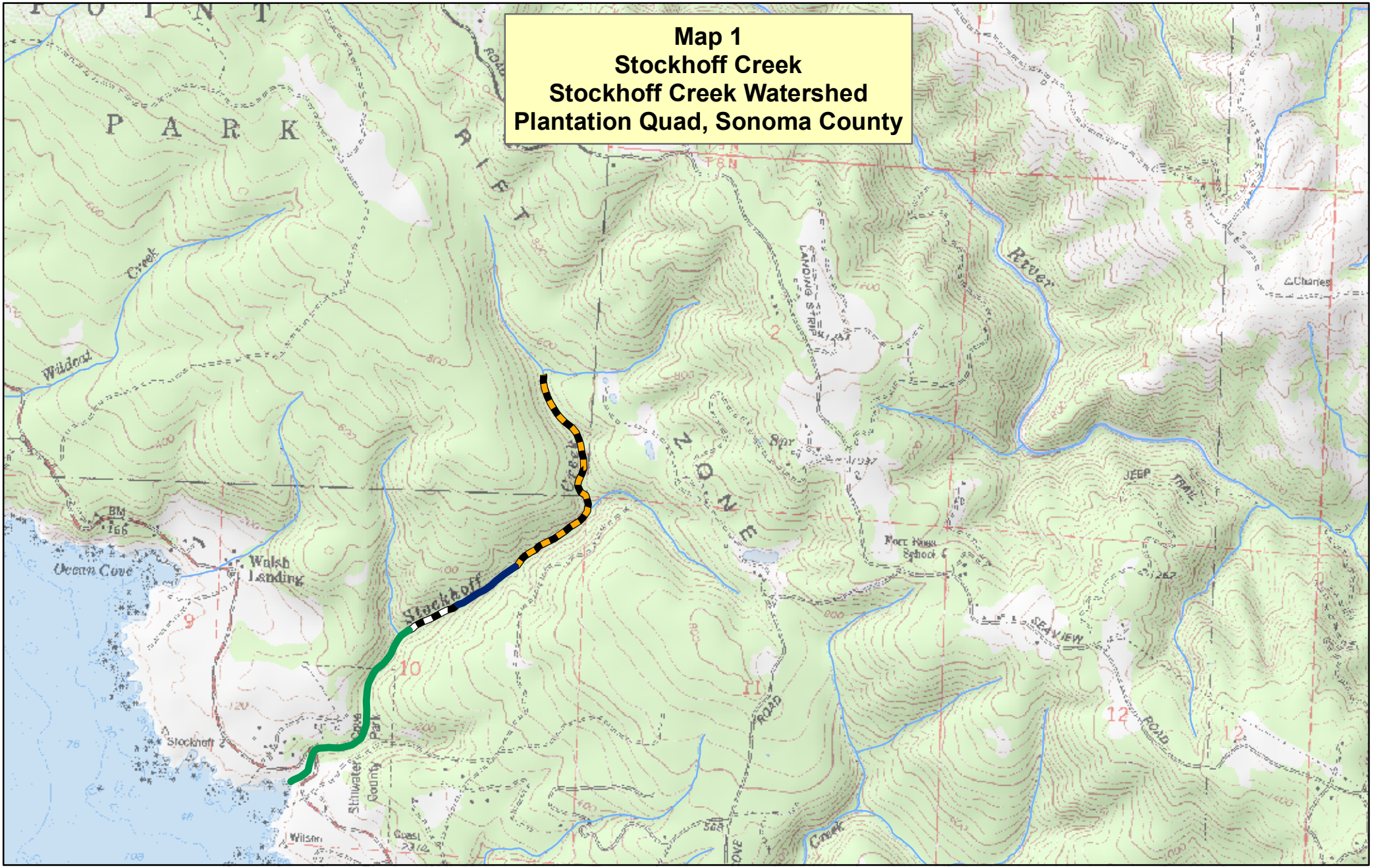


GRAPH 10

STOCKHOFF CREEK 2008
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11


Map 1
Stockhoff Creek
Stockhoff Creek Watershed
Plantation Quad, Sonoma County
P A R K
Wildcat Creek
Ocean Cove
Walsh Landing
Stockhoff
Stockhoff Cove
Stockhoff Creek
Schoolhouse Creek
Fort Ross School
JEEP TRAIL
SEAVIEW ROAD
Russian River
Wilson Grade
Stillwater Cove Park
Legend
Reach 1, F6 Channel Type
Reach 2, C2 Channel Type
Reach 3, A2 Channel Type
Reach 4, C2 Channel Type
N
S
E
W
0
1,500
3,000 Feet
RESOURCES AGENCY
CALIFORNIA
DEPARTMENT
FISH & GAME