

STREAM INVENTORY REPORT

China Creek

INTRODUCTION

A stream inventory was conducted from June 15 to June 23, 2009 on China Creek. The survey began at the confluence with Redwood Creek and extended upstream 2.2 miles.

The China 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 China 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 Chinook salmon, 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

China Creek is a tributary to Redwood Creek, tributary to the South Fork Eel River, tributary to the Eel River, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). China Creek's legal description at the confluence with Redwood Creek is T04S R02E S24. Its location is 40.0975 degrees north latitude and 123.9092 degrees west longitude, LLID number 1239093400975. China Creek is a second order stream and has approximately 4.2 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. China Creek drains a watershed of approximately 3.9 square miles. Elevations range from about 600 feet at the mouth of the creek to 1,100 feet in the headwater areas. Mixed hardwood forest and mixed conifer forest dominate the watershed. The watershed is entirely privately owned and is managed as a rural subdivision. Vehicle access exists via Briceland Thorn Road.

METHODS

The habitat inventory conducted in China 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

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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 China 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". China 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 China Creek, embeddedness was

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ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed 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 China 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 China 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 China 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.

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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 China Creek. In addition, underwater observations were made at three 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 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

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for China 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 June 15 to June 23, 2009 was conducted by T. Fleming and N. Talkington (WSP), and S. McSmith and I. Mikus (DFG). The total length of the stream surveyed was 11,635 feet with an additional 72 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.93 cfs on June 23, 2009.

China Creek is a F4 channel type for 11,635 feet of the stream surveyed (Reach 1). 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 52 to 58 degrees Fahrenheit. Air temperatures ranged from 53 to 76 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 50% pool units, 27% flatwater units, and 22% riffle units (Graph 1). Based on total length of Level II habitat types there were 52% pool units, 34% flatwater units, and 15% riffle units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 36%; low gradient riffle units, 22%; and run units, 21% (Graph 3). Based on percent total length, mid-channel pool units made up 37%, run units 21%, and low gradient riffle units 14%.

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A total of 116 pools were identified (Table 3). Main channel pools were the most frequently encountered at 72% (Graph 4), and comprised 73% 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-nine of the 116 pools (42%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 116 pool tail-outs measured, 41 had a value of 1 (35.3%); 53 had a value of 2 (45.7%); 20 had a value of 3 (17.2%); 2 had a value of 4 (1.7%); (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.

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 1, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 30 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 38. Main channel pools had a mean shelter rating of 27 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in China Creek. Graph 7 describes the pool cover in China 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 79% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 16% of the pool tail-outs.

The mean percent canopy density for the surveyed length of China Creek was 93%. Seven percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 89% and 11%, respectively. Graph 9 describes the mean percent canopy in China Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 89%. The mean percent left bank vegetated was 89%. The dominant elements composing the structure of the stream banks consisted of 42% sand/silt/clay, 40% cobble/gravel, 17% bedrock, and 1% boulder (Graph 10). Deciduous trees were the dominant vegetation type observed in 88% of the units surveyed. Additionally, 5% of the units surveyed had brush as the dominant vegetation type, and 4% had coniferous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at three sites for species composition and distribution in China Creek on June 23, 2009. Water temperatures taken during the survey period 0900 to

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0930 ranged from 53 to 54 degrees Fahrenheit. Air temperatures ranged from 54 to 60 degrees Fahrenheit. The sites were sampled by Isaac Mikus (DFG).

In reach 1, which comprised the first 11,635 feet of stream, three sites were sampled. The reach sites yielded 14 young-of-the-year steelhead/rainbow trout (SH/RT), one age 1+ SH/RT, and 58 coho.

The following chart displays the information yielded from these sites:

2009 China 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									
06/23/09	1	071	4.2	4,302	14	1	0	31	0
	2	226	4.2	11,580	0	0	0	1	0
	3	--	4.2	11,885	0	0	0	26	0

DISCUSSION

China Creek is an F4 channel type for the entire 11,707 feet of the stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperatures recorded on the survey days June 15 to June 23, 2009, ranged from 52 to 58 degrees Fahrenheit. Air temperatures ranged from 53 to 76 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 34% of the total length of this survey, riffles 15%, and pools 52%. Forty-nine of the 116 (42%) 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.

Ninety-four of the 116 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-two of the pool tail-outs had embeddedness ratings of 3 or 4. None of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead.

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One hundred ten of the 116 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 30. The shelter rating in the flatwater habitats is 5. 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 China 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 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 93%. 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 89%, 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) China 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.
- 4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

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COMMENTS AND LANDMARKS

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

Position (ft):	Habitat Unit #:	Comment:
0	0001.00	Start of survey at the confluence with Upper Redwood a.k.a. Pollock Creek. The channel type is an F4.
486	0010.00	There is a 1.2" high plunge over large woody debris (LWD) upstream of "V" weir, in good condition.
604	0012.00	Upstream "V" weir, in good condition; tires present in structure.
2773	0047.00	There is a seep on the right bank.
3117	0052.00	There is a seep on the right bank.
3188	0054.00	Tributary #01 enters on the right bank. It contributes to 5% of the downstream flow to China Creek. The temperature downstream and upstream of the tributary is 53 degrees Fahrenheit; the temperature of the tributary is 56 degrees Fahrenheit. The slope of the tributary is 10%. It is most likely inaccessible to fish because of the nine foot high jump at the mouth with a 0.7' deep pool below it. No fish are present in the tributary.
3294	0056.00	Concrete slabs and rebar are present on the right bank.
3338	0057.00	Branscomb Road crosses the channel. The metal and concrete bridge measures 23' high x 25' wide x 100' long. There is erosion on the left bank measuring 50' long x 25' high. It is contributing sediment ranging in size from silt to gravel. There are concrete slabs in the channel and along the right bank.
3526	0060.00	There is erosion on the right bank measuring 15' high x 75' long. It is contributing sediment ranging in size from silt to gravel.
4093	0069.00	There is erosion on the left bank measuring 20' high x 15' long. It is contributing sediment ranging in size from silt to gravel.
4302	0072.00	There is erosion on the right bank measuring 207' long x 12' high. It is contributing sediment ranging in size from silt to small cobble.
4325	0073.00	There is a dump site on right bank.

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4722	0078.00	Wood is accumulating on left bank.
5782	0092.00	China Creek Road crosses the creek. The metal bridge measures 11' high x 10' wide x 51' long. Rip-rap on the right bank supports the structure. There is erosion on the left bank measuring 15' long x 20' high. It is contributing sediment ranging in size from silt to gravel.
5828	0093.00	There is erosion on the right bank measuring 40' long x 20' high. Boulders and concrete slabs are supporting the right bank.
6034	0098.00	There is erosion on the left bank measuring 154' long x 12' high. It is contributing sediment ranging in size from silt to gravel.
6102	0099.00	A slump on the right bank is contributing woody debris and fine sediment.
6102	0099.00	Log debris accumulation (LDA) #01 contains 10 pieces of LWD and measures 5.7' high x 28' wide x 41' long. Water flows through and there are visible gaps. No sediment is being retained. Fish are present above the LDA.
6353	0105.00	A bank failure on the right bank measuring 40' high x 20' long is contributing sediment ranging in size from silt to small cobble. It is also contributing woody debris to the channel.
6444	0108.00	LDA #02 contains five pieces of LWD and measures 6' high x 22' wide x 7' long. Water flows through and there are visible gaps. No sediment is being retained. Fish are present above the LDA. Erosion on the left bank measuring 50' high x 25' long is contributing fine sediment. There is no vegetation present on the bank.
6523	0109.00	LDA #03 contains four pieces of LWD and measures 3' high x 12' wide x 2' long. Water flows through and there are visible gaps. There is no sediment retention. Fish are present above the LDA. There is a slump on the left bank measuring 50' long x 150' high. It is contributing sediment ranging in size from silt to gravel. There is no vegetation present on the bank.
6594	0111.00	Tributary #02 enters on the left bank. The flow is low and becomes subterranean 25 feet upstream from the mouth. The temperature downstream and upstream of the confluence was 58 degrees Fahrenheit; the temperature of the tributary was 56 degrees Fahrenheit. The slope is estimated to be 10%. There is a culvert 100 feet up the tributary, with a 5 foot high jump. No fish are present in the tributary.

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6669	0113.00	There is an unvegetated slump on the right bank.
6890	0116.00	LDA #04 contains four pieces of LWD and measures 2.5' high x 15' wide x 12' long. Water flows through and there are visible gaps. No sediment is being retained. Fish are present above the LDA.
7151	0123.00	There is a slump on the right bank measuring 50' high x 25' long. It is contributing sediment ranging in size from silt to gravel.
7232	0125.00	There is a dry tributary on the right bank.
7637	0135.00	LDA #05 contains five pieces of LWD and measures 5' high x 26' wide x 1.5 ' long. Water flows through and there are visible gaps. No sediment is being retained. Fish are present above the LDA.
7709	0136.00	Tributary #03 enters from the left bank, and contributes 7% to the downstream flow. The temperature downstream of the confluence is 57 degrees Fahrenheit, and the temperature of the tributary is 58 degrees Fahrenheit, and the temperature upstream of the confluence is 58 degrees Fahrenheit. The slope of the tributary is 10%. No fish are present in the 50 feet surveyed.
8070	0144.00	A slump on the left bank measuring 30' high x 20' long is contributing sediment ranging in size from silt to gravel.
8236	0147.00	A slump on the right bank measuring 20' long x 15' high is contributing sediment ranging in size from silt to gravel.
8910	0159.00	Tributary #04 (Twin Creek) enters from the right bank, and contributes to 65% of the downstream flow. For more details see the 2009 Twin Creek Stream Habitat Inventory Report. No vegetation is present on the right bank.
9191	0163.00	There is erosion on the right bank measuring 15' high x 15' long. It is contributing sediment ranging in size from silt to gravel. The slope has no vegetation.
9449	0168.00	There is erosion on the right bank measuring 25' wide x 100' long. It is contributing sediment ranging in size from silt to gravel. There is a dry tributary on the right bank.
9583	0172.00	LDA #06 contains 12 pieces of LWD and measures 5' high x 25' wide x 45' long. Water flows through and there are visible gaps. Retained sediment ranges from silt to gravel and measures 7' wide x 85' long x 1.5' deep. There is a plunge height of 0.8'. The LDA would become a

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		barrier in high flows because of small woody debris (SWD) accumulation.
9713	0174.00	Boulder riprap armors the left bank measuring 80' high x 35' long. Three digger logs are present.
9818	0177.00	There is a slump present upslope, approximately 50' away from the wetted width, measuring 100' long x 50' high. It is contributing sediment ranging in size from silt to gravel.
9980	0182.00	There is erosion on right bank measuring 46' long x 10' high. It is contributing sediment ranging in size from silt to gravel.
10220	0186.00	There is erosion on the left bank measuring 10' high x 35' long. It is contributing sediment ranging in size from silt to gravel.
10274	0188.00	Two digger logs and boulder rip-rap (50' long and 8' high) are present on the right bank. Boulder rip-rap is also present on the left bank, measuring 50' long x 8' high.
10510	0192.00	There is active erosion on the left bank measuring 30' long x 15' high. It is contributing sediment ranging in size from silt to gravel.
10632	0197.00	Erosion on left bank measuring 30' long x 12' high is contributing sediment ranging in size from silt to gravel.
10733	0200.00	Erosion on right bank measuring 15' long x 10' high is contributing sediment ranging in size from silt to gravel.
10849	0204.00	There is erosion on the left bank measuring 15' long x 5' high. It is contributing sediment ranging in size from silt to gravel. Erosion on right bank measuring 8' high x 18' long is contributing sediment ranging in size from silt to gravel.
11022	0207.00	Erosion on left bank measuring 100' high x 75' long is contributing sediment ranging in size from silt to gravel.
11040	0208.00	There is erosion on the right bank measuring 20' long x 5' high. It is contributing sediment ranging in size from silt to gravel.
11199	0212.00	Erosion on the left bank measuring 75' high x 10' long is contributing sediment ranging in size from silt to gravel.
11214	0213.00	There is erosion on left bank measuring 60' long x 5' high. It is contributing sediment ranging in size from silt to gravel.

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11307	0217.00	LDA #07 contains two pieces of LWD and measures 7' high x 50' wide x 1.5' long. Water flows through and there are visible gaps. Retained sediment ranges from silt to gravel and measures 7' high x 50' long x 1.5' deep. The plunge height is 1.5'.
11362	0219.00	There is a slump on the left bank measuring 75' high x 100' long. It is contributing sediment ranging in size from silt to gravel.
11391	0220.00	There is erosion on the right bank that measures 30' high x 15' long. There are many downed trees.
11435	0221.00	LDA #08 contains eight pieces of LWD and measures 3' high x 25' wide x 12' long. Water flows through and there are visible gaps. Retained sediment ranges from silt to gravel and measures 6.5' wide x 38' long x 2' deep.
11448	0222.00	A slump on right bank measuring 30' long x 50' high is contributing fine sediment and woody debris.
11580	0227.00	End of survey due to lack of access. There is erosion on the right bank measuring 30' long x 75' high. It is contributing sediment ranging in size from silt to gravel.

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: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Confluence Location: Quad: BRICELAND

Legal Description: T04SR02ES24

Latitude: 40:05:51.0N

Longitude: 123:54:33.0

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
63	7	FLATWATER	27.4	63	3974	33.9	13.1	0.4	0.9	837	52743	361	22715		5
116	116	POOL	50.4	52	6034	51.5	13.5	0.8	1.9	709	82290	811	94095	617	30
51	9	RIFFLE	22.2	33	1699	14.5	11.4	0.3	0.7	333	16998	121	6156		1
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
230	132				11707					152032			122965		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Confluence Location: Quad: BRICELAND

Legal Description: T04SR02ES24

Latitude: 40:05:51.0N

Longitude: 123:54:33.0W

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 (%)
50	8	LGR	21.7	33	1672	14.3	12	0.3	1.1	363	18141	132	6607		0	95
1	1	HGR	0.4	27	27	0.2	6	0.3	0.6	97	97	29	29		10	89
1	1	GLD	0.4	105	105	0.9	21	0.5	1.4	2205	2205	1103	1103		0	97
48	4	RUN	20.9	50	2414	20.6	12	0.4	0.9	387	18564	134	6450		1	93
14	2	SRN	6.1	104	1455	12.4	12	0.4	1.2	1054	14758	442	6188		15	93
82	82	MCP	35.7	52	4281	36.6	14	0.8	4	747	61220	899	73695	702	27	92
2	2	STP	0.9	52	105	0.9	11	0.8	2.8	650	1299	833	1666	649	10	97
4	4	CRP	1.7	76	305	2.6	12	0.7	2.7	916	3665	942	3769	584	26	96
11	11	LSL	4.8	42	466	4.0	12	0.7	3.2	500	5496	584	6421	440	70	97
5	5	LSR	2.2	61	307	2.6	13	0.6	2.2	793	3965	669	3345	450	23	80
10	10	LSBk	4.3	52	524	4.5	13	0.5	1.8	625	6249	478	4784	293	20	92
1	1	LSBo	0.4	27	27	0.2	7	0.3	1	180	180	90	90	54	10	100
1	1	PLP	0.4	19	19	0.2	12	1.3	1.9	217	217	325	325	282	5	100

Total Units
230

Total Units Fully Measured
132

Total Length (ft.)
11707

Total Area (sq.ft.)
136055

Total Volume (cu.ft.)
114470

Stream Name:	China Creek	LLID:	1239093400975	Drainage:	Eel River - South Fork
Survey Dates:	6/15/2009 to 6/23/2009				
Confluence Location:	Quad: BRICELAND	Legal Description:	T04SR02ES24	Latitude:	40:05:51.0N
				Longitude:	123:54:33.0W

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
84	84	MAIN	72	52	4386	73	14.0	0.8	744	62520	701	58880	27
32	32	SCOUR	28	52	1648	27	12.1	0.6	618	19771	397	12697	38
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
116	116				6034					82290		71576	

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

Stream Name: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Confluence Location: Quad: BRICELAND

Legal Description: T04SR02ES24

Latitude: 40:05:51.0N

Longitude: 123:54:33.0W

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
82	MCP	71	5	6	37	45	27	33	12	15	1	1
2	STP	2	0	0	1	50	1	50	0	0	0	0
4	CRP	3	1	25	0	0	3	75	0	0	0	0
11	LSL	9	1	9	7	64	2	18	1	9	0	0
5	LSR	4	0	0	3	60	2	40	0	0	0	0
10	LSBk	9	2	20	8	80	0	0	0	0	0	0
1	LSBo	1	0	0	1	100	0	0	0	0	0	0
1	PLP	1	0	0	1	100	0	0	0	0	0	0
Total Units			Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
116			9	8	58	50	35	30	13	11	1	1

Mean Maximum Residual Pool Depth (ft.): 1.9

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Dry Units: 0

Confluence Location: Quad: BRICELAND

Legal Description: T04SR02ES24

Latitude: 40:05:51.0N

Longitude: 123:54:33.0W

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
50	8	LGR	0	0	0	0	0	0	0	0	0
1	1	HGR	0	10	0	0	0	0	0	90	0
51	9	TOTAL RIFFLE	0	10	0	0	0	0	0	90	0
1	1	GLD	0	0	0	0	0	0	0	0	0
48	4	RUN	0	0	0	0	0	0	0	100	0
14	2	SRN	5	15	25	5	0	0	0	50	0
63	7	TOTAL FLAT	3	7	12	3	0	0	0	75	0
82	82	MCP	17	25	20	16	6	1	0	14	3
2	2	STP	0	28	28	23	3	0	0	20	0
4	4	CRP	13	25	24	14	10	0	0	15	0
11	11	LSL	10	33	43	5	6	0	0	3	0
5	5	LSR	27	15	12	44	0	2	0	0	0
10	10	LSBk	11	20	29	16	7	1	0	6	10
1	1	LSBo	0	20	0	0	20	0	0	60	0
1	1	PLP	0	20	10	30	0	0	0	40	0
116	116	TOTAL POOL	15	25	22	16	6	1	0	12	3
230	132	TOTAL	15	24	22	16	6	1	0	14	3

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Dry Units: 0

Confluence Location: Quad: BRICELAND

Legal Description: T04SR02ES24

Latitude: 40:05:51.0N

Longitude: 123:54:33.0W

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
50	8	LGR	0	0	75	13	13	0	0
1	1	HGR	0	0	0	0	0	100	0
1	1	GLD	0	0	100	0	0	0	0
48	4	RUN	0	0	100	0	0	0	0
14	2	SRN	0	0	100	0	0	0	0
82	82	MCP	1	20	76	1	1	0	1
2	2	STP	0	0	100	0	0	0	0
4	4	CRP	0	25	75	0	0	0	0
11	11	LSL	0	9	91	0	0	0	0
5	5	LSR	0	0	100	0	0	0	0
10	10	LSBk	0	0	90	0	0	10	0
1	1	LSBo	0	0	100	0	0	0	0
1	1	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Confluence Location: Quad: BRICELAND

Legal Description: T04SR02ES24

Latitude: 40:05:51.0N

Longitude: 123:54:33.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
93	11	89	0	89	89

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.

Stream Name:	China Creek	LLID:	1239093400975	Drainage:	Eel River - South Fork		
Survey Dates:	6/15/2009 to 6/23/2009	Survey Length (ft.):	11707	Main Channel (ft.):	11635	Side Channel (ft.):	72
Confluence Location:	Quad: BRICELAND	Legal Description:	T04SR02ES24	Latitude:	40:05:51.0N	Longitude:	123:54:33.0W

STREAM REACH: 1									
Channel Type: F4			Canopy Density (%): 93.0				Pools by Stream Length (%): 51.5		
Reach Length (ft.): 11635			Coniferous Component (%): 10.9				Pool Frequency (%): 50.4		
Riffle/Flatwater Mean Width (ft.): 12.2			Hardwood Component (%): 89.1				Residual Pool Depth (%):		
BFW:			Dominant Bank Vegetation: Hardwood Trees				< 2 Feet Deep: 58		
Range (ft.): 14 to 34			Vegetative Cover (%): 88.7				2 to 2.9 Feet Deep: 30		
Mean (ft.): 23			Dominant Shelter: Small Woody Debris				3 to 3.9 Feet Deep: 11		
Std. Dev.: 5			Dominant Bank Substrate Type: Sand/Silt/Clay				>= 4 Feet Deep: 1		
Base Flow (cfs.): 0.9			Occurrence of LWD (%): 18				Mean Max Residual Pool Depth (ft.): 1.9		
Water (F): 52 - 58			Air (F): 53 - 76				Mean Pool Shelter Rating: 30		
Dry Channel (ft): 0			LWD per 100 ft.:						
			Riffles: 2						
			Pools: 5						
			Flat: 2						
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 79 Sm Cobble: 16 Lg Cobble: 3 Boulder: 2 Bedrock: 0									
Embeddedness Values (%): 1. 35.3 2. 45.7 3. 17.2 4. 1.7 5. 0.0									

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Confluence Location: Quad: BRICELAND

Legal Description: T04SR02ES24

Latitude: 40:05:51.0N

Longitude: 123:54:33.0W

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	24	21	17.0
Boulder	2	1	1.1
Cobble / Gravel	54	51	39.8
Sand / Silt / Clay	52	59	42.0

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	1	2	1.1
Brush	3	9	4.5
Hardwood Trees	118	115	88.3
Coniferous Trees	7	3	3.8
No Vegetation	3	3	2.3

Total Stream Cobble Embeddedness Values:

2

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

StreamName: China Creek

LLID: 1239093400975

Drainage: Eel River - South Fork

Survey Dates: 6/15/2009 to 6/23/2009

Confluence Location: Quad: BRICELAND

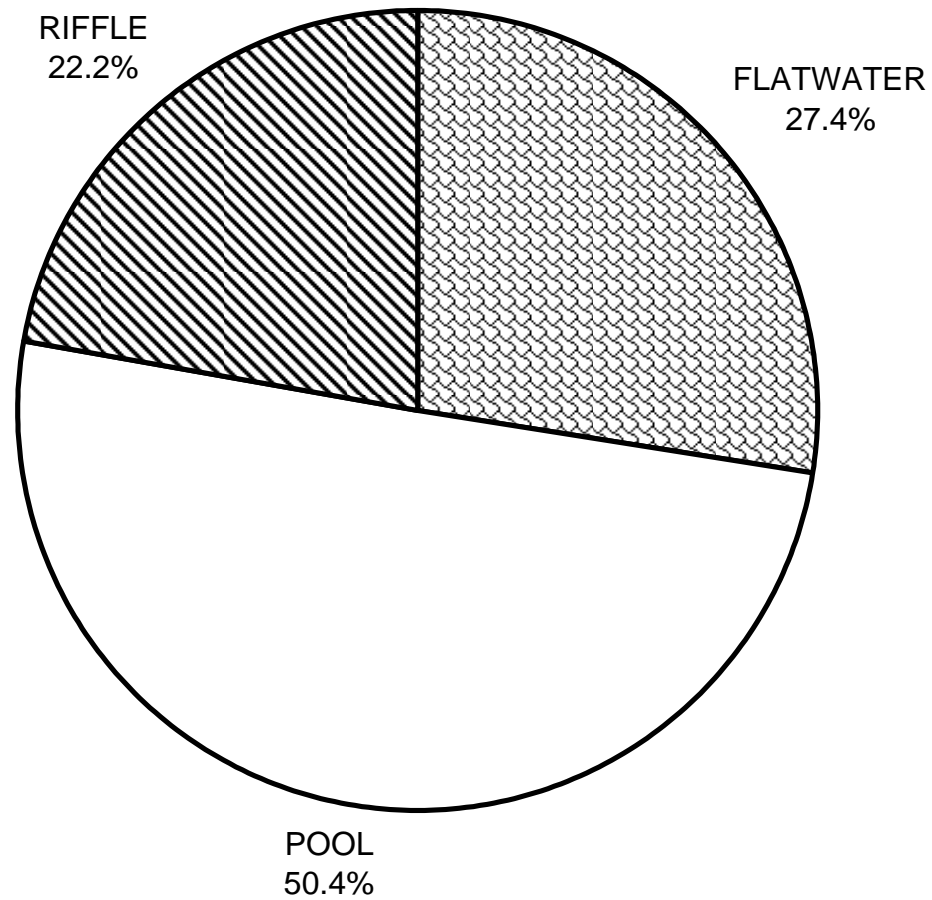
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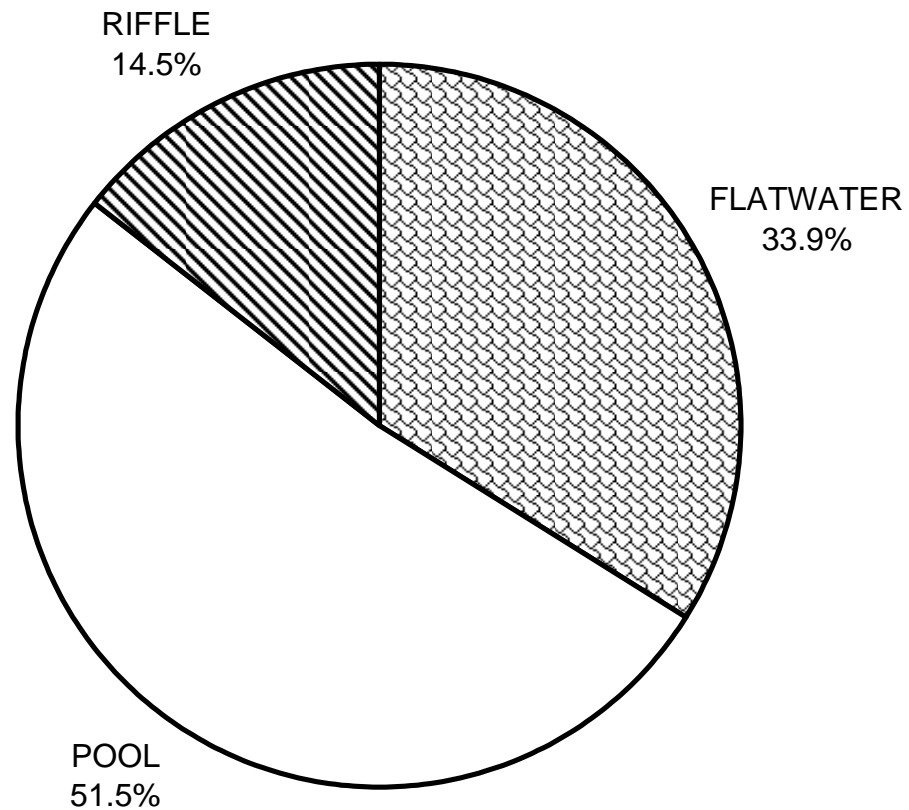
	Riffles	Flatwater	Pools
<hr/>			
UNDERCUT BANKS (%)	0	3	15
SMALL WOODY DEBRIS (%)	10	7	25
LARGE WOODY DEBRIS (%)	0	12	22
ROOT MASS (%)	0	3	16
TERRESTRIAL VEGETATION (%)	0	0	6
AQUATIC VEGETATION (%)	0	0	1
WHITEWATER (%)	0	0	0
BOULDERS (%)	90	75	12
BEDROCK LEDGES (%)	0	0	3

CHINA CREEK 2009
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

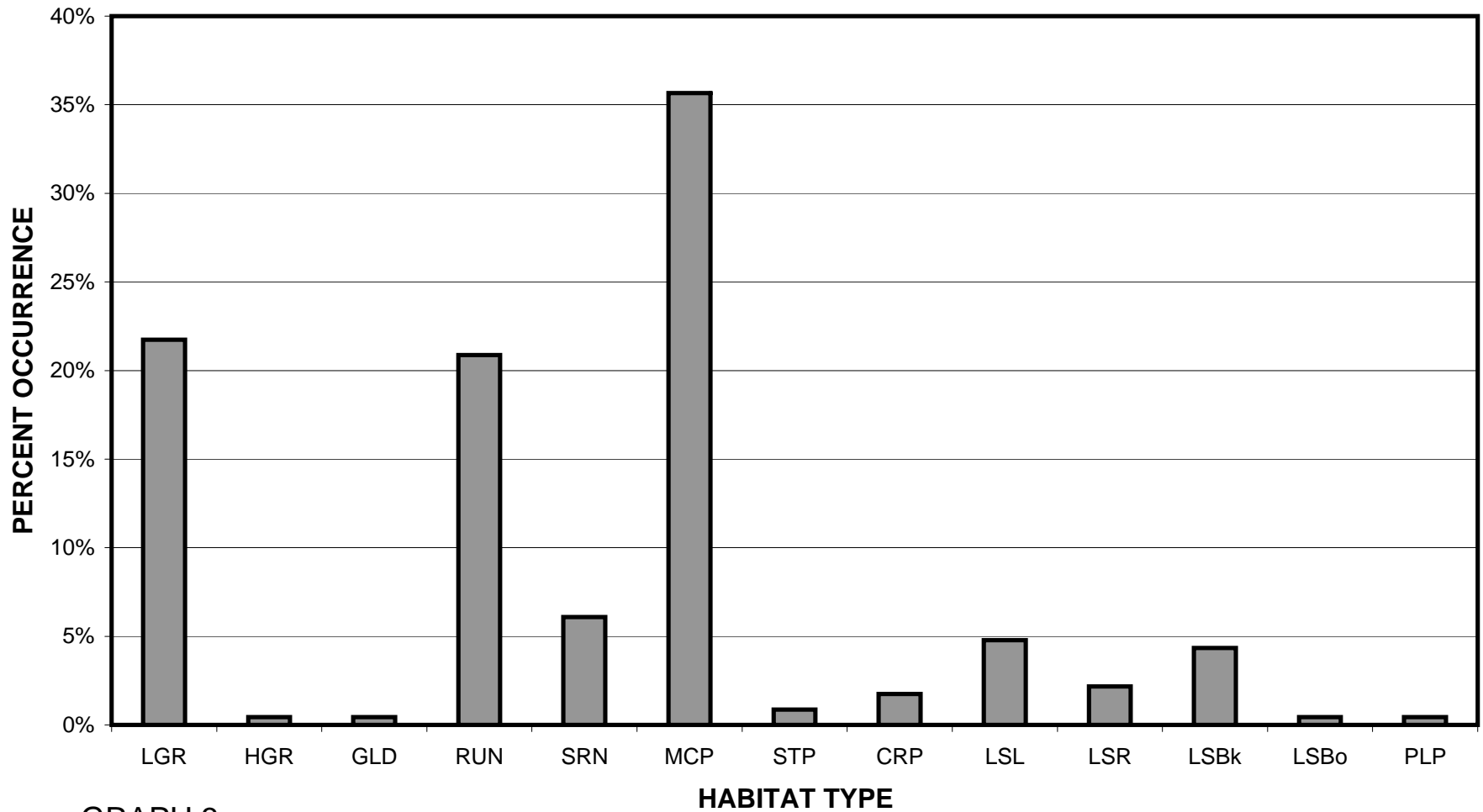
CHINA CREEK 2009
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

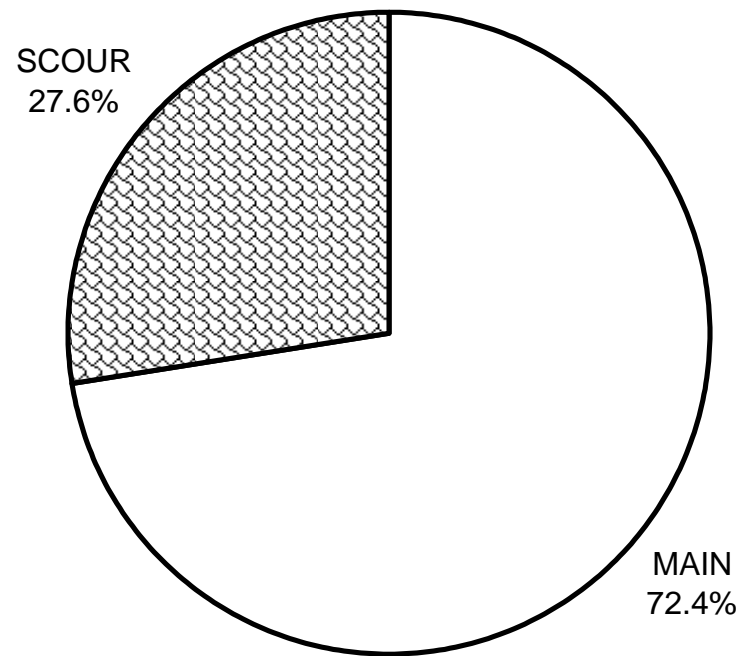
CHINA CREEK 2009

HABITAT TYPES BY PERCENT OCCURRENCE



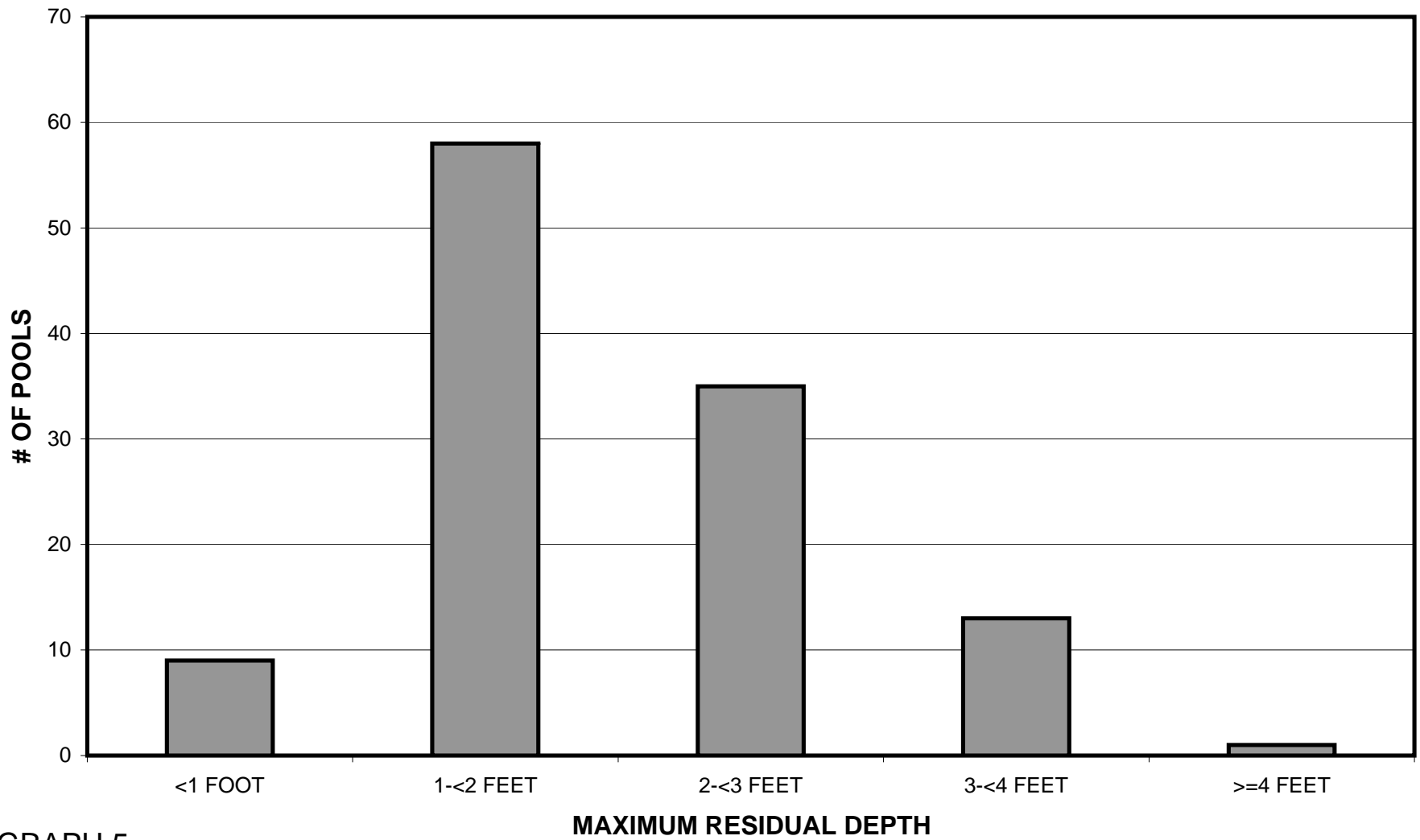
GRAPH 3

**CHINA CREEK 2009
POOL TYPES BY PERCENT OCCURRENCE**



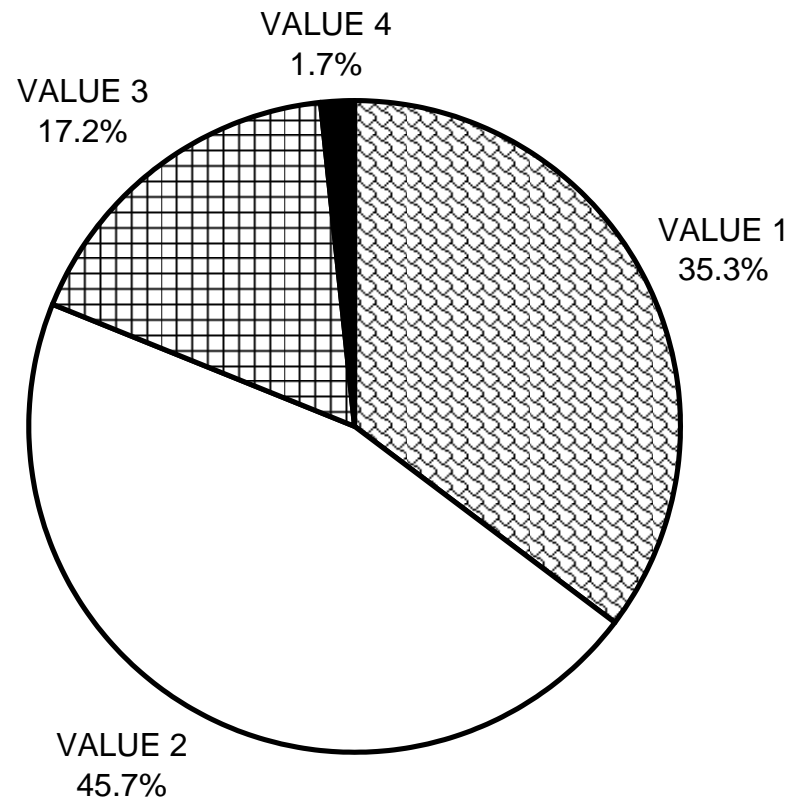
GRAPH 4

CHINA CREEK 2009 MAXIMUM DEPTH IN POOLS



GRAPH 5

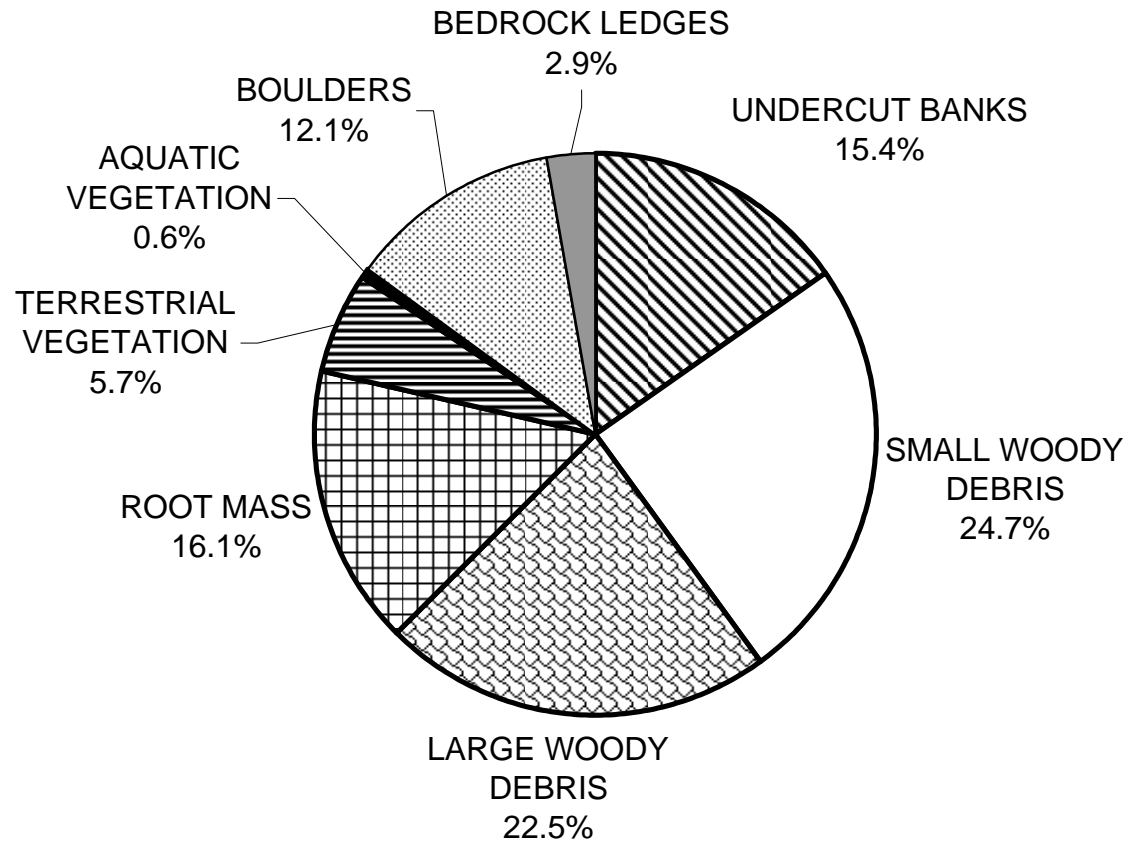
CHINA CREEK 2009 PERCENT EMBEDDEDNESS



GRAPH 6

CHINA CREEK 2009

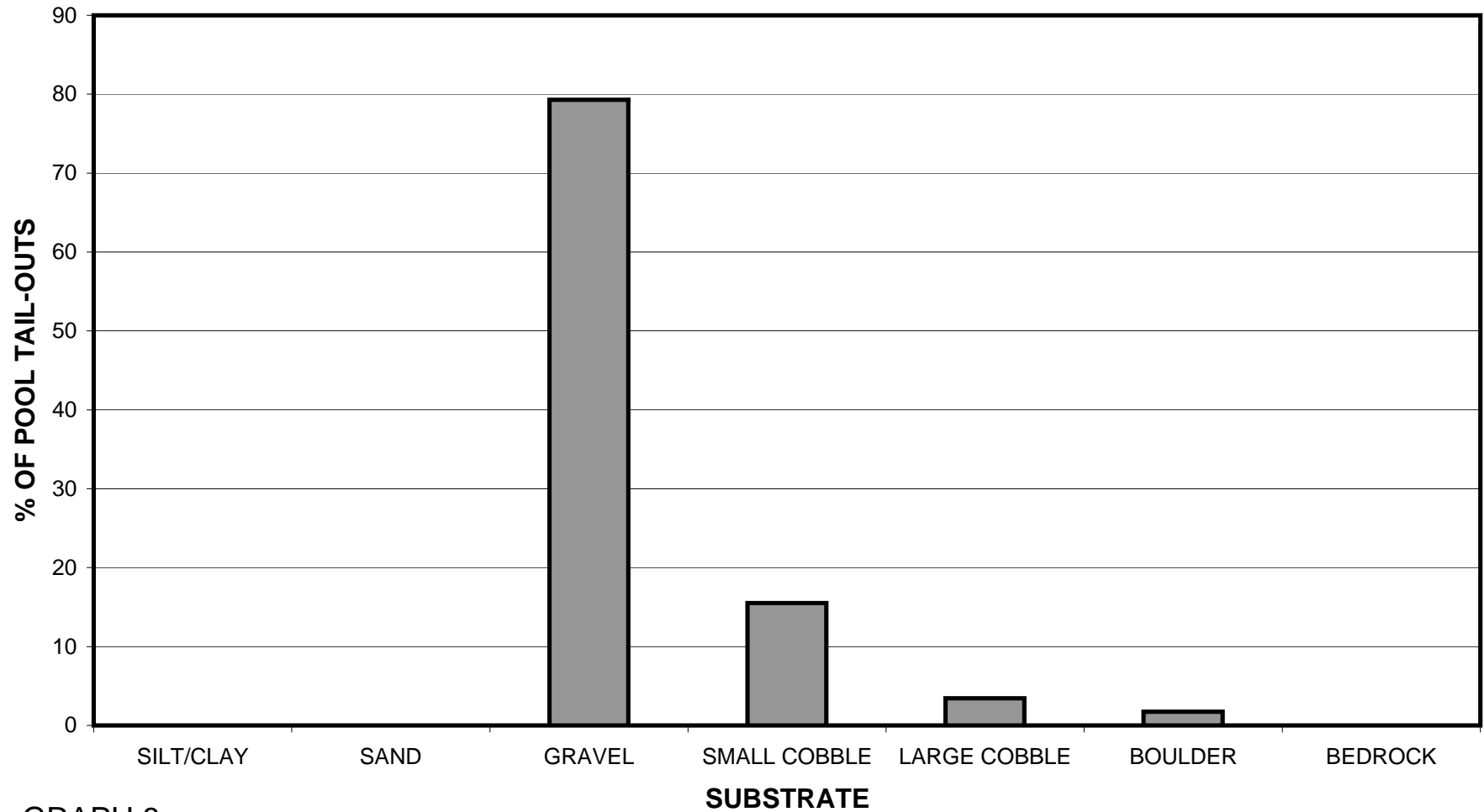
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

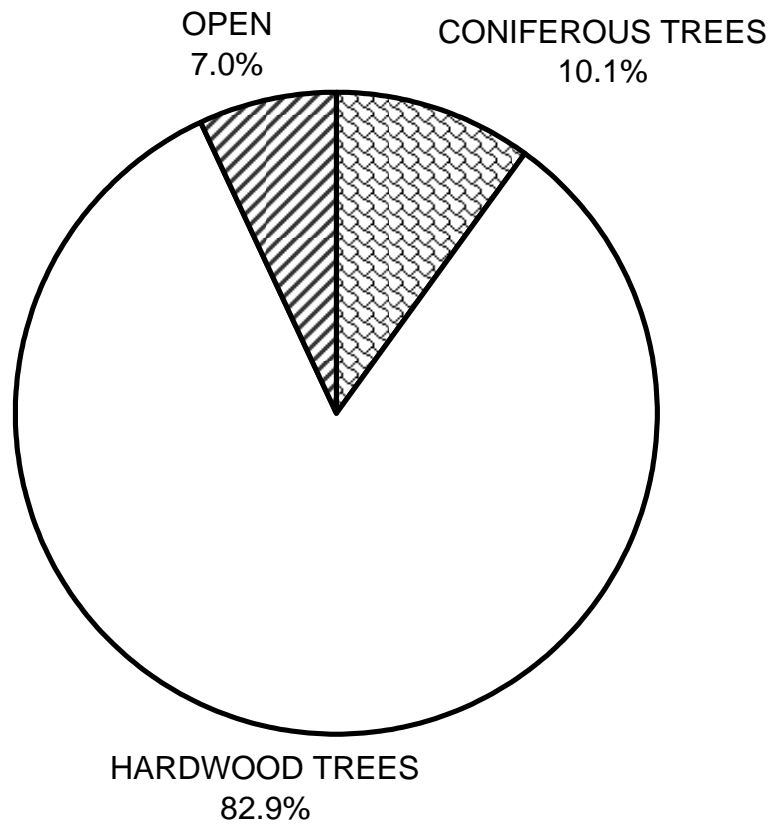
CHINA CREEK 2009

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



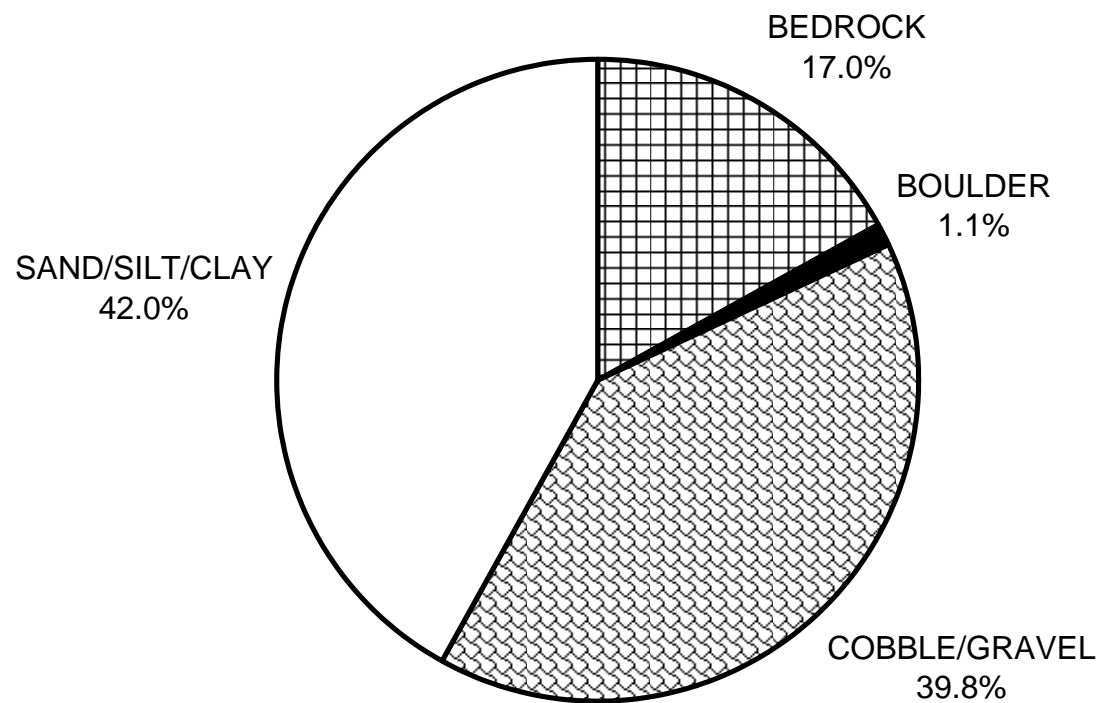
GRAPH 8

**CHINA CREEK 2009
MEAN PERCENT CANOPY**



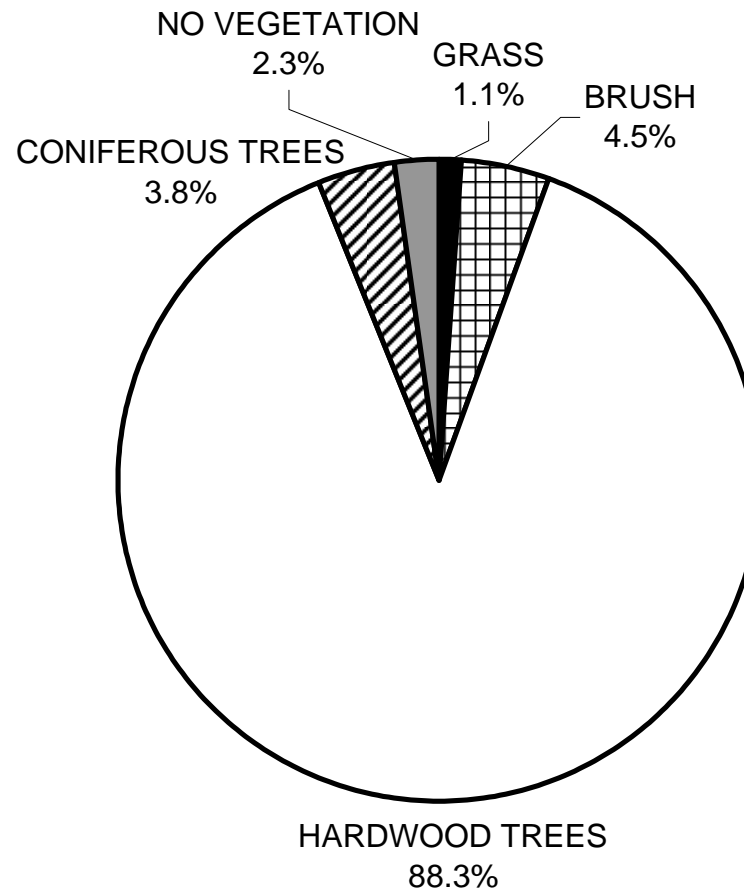
GRAPH 9

CHINA CREEK 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH



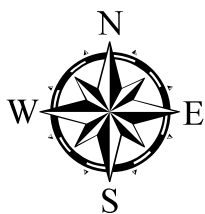
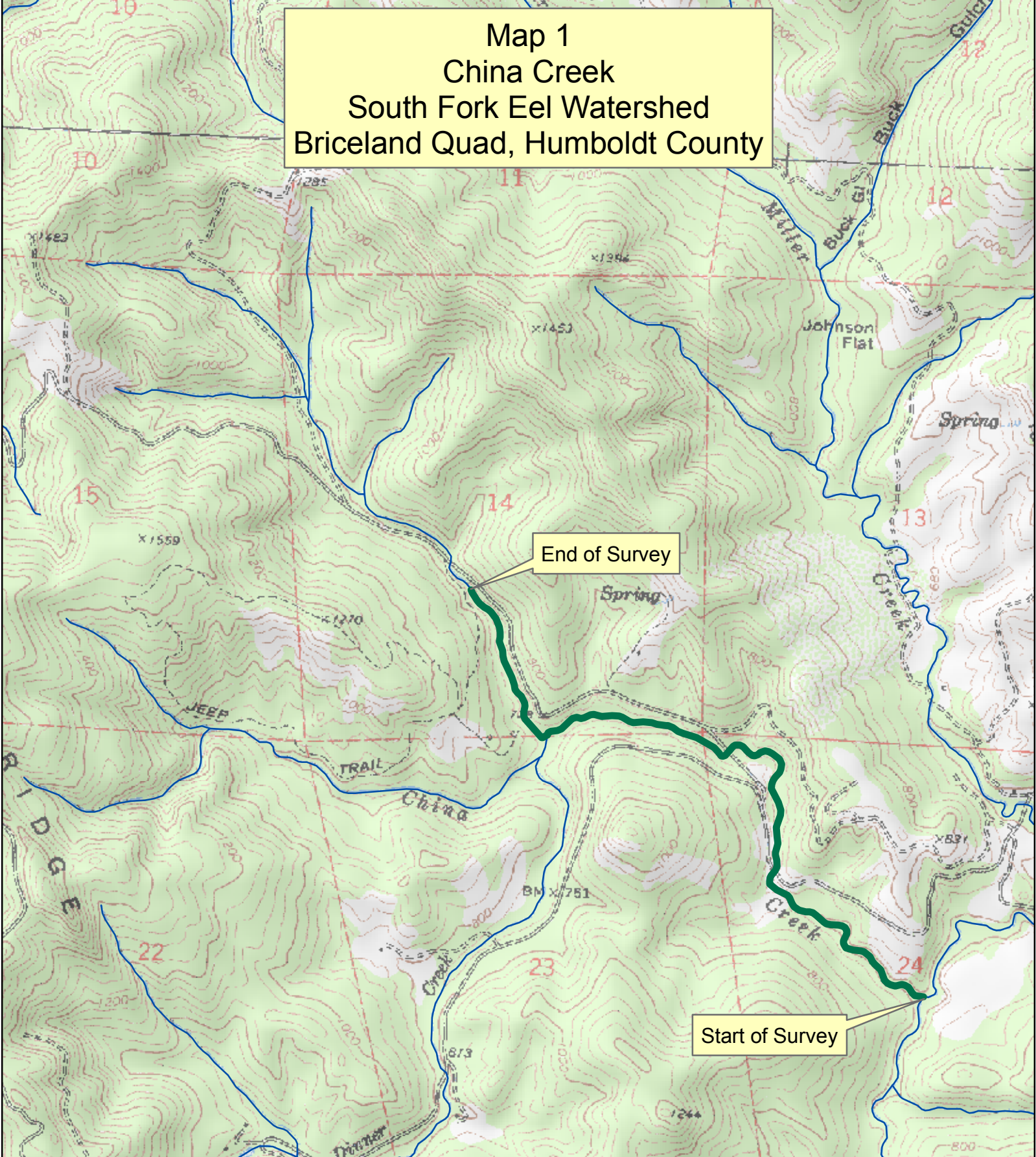
GRAPH 10

CHINA CREEK 2009
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Map 1
China Creek
South Fork Eel Watershed
Briceland Quad, Humboldt County



Legend

— Reach 1, F4 Channel Type

0 1,000 2,000 Feet

