STREAM INVENTORY REPORT

"Twin Creek"

INTRODUCTION

A stream inventory was conducted on June 24, 2009 on an unnamed tributary to Redwood Creek commonly know as and hereinafter referred to as Twin Creek. The survey began 140' upstream of the confluence with China Creek and extended upstream 0.5 miles.

The Twin 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 Twin 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

Twin Creek is a tributary to China Creek, tributary to Redwood Creek, tributary to South Fork Eel River, tributary to Eel River, which drains to the Pacific Ocean, located in Humboldt County, California (Map 1). Twin Creek's legal description at the confluence with China Creek is T04S R02E S23. Its location is 40.1055 north latitude and 123.9271 west longitude, LLID number 1239093400975. Twin Creek is a second order stream and has approximately 2.3 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Twin Creek drains a watershed of approximately 2.1 square miles. Elevations range from about 670 feet at the mouth of the creek to 1,100 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for rural subdivision. Vehicle access exists via Briceland Road to Twin Creeks Road.

METHODS

The habitat inventory conducted in Twin 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 Twin 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". Twin Creekhabitat 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 1239259401056, 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 1239259401056, 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 1239259401056, 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 1239259401056, 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.

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 Twin Creek. In addition, underwater observations were made at 2 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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Twin 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 24, 2009, was conducted by M. Groff (WSP) and S. McSmith (DFG). The total length of the stream surveyed was 2,826 feet with an additional 20 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.49 cfs on June 24, 2009.

Twin Creek is a F4 channel type for 2,846 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 53 to 57 degrees Fahrenheit. Air temperatures ranged from 57 to 78 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 38% riffle units, 33% flatwater units and 29% pool units (Graph 1). Based on total length of Level II habitat types there were 42% flatwater units, 36% riffle units and 22% pool units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were high gradient riffle units, 27%; mid-channel pool units, 21%; and run units, 20% (Graph 3). Based on percent total length, step run units made up 29%, high gradient riffle units 27%, and mid-channel pool units 17%.

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A total of 29 pools were identified (Table 3). Main channel pools were the most frequently encountered at 72% (Graph 4), and comprised 77% 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. Two of the 29 pools (7%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 29 pool tail-outs measured, 16 had a value of 1 (55.2%); 9 had a value of 2 (31%); 3 had a value of 3 (10.3%); 1 had a value of 4 (3.4%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst.

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 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 Twin Creek. Graph 7 describes the pool cover in Twin Creek. Small woody debris is the dominant pool cover type followed by undercut banks.

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 55% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 38% of pool tail-outs.

The mean percent canopy density for the surveyed length of Twin Creek was 97%. Three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 74% and 26%, respectively. Graph 9 describes the mean percent canopy in Twin Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 87%. The mean percent left bank vegetated was 96%. The dominant elements composing the structure of the stream banks consisted of 50% sand/silt/clay, 37% cobble/gravel, 12% bedrock and 1% boulder (Graph 10). Hardwood trees were the dominant vegetation type observed in 79.8% of the units surveyed. Additionally, 11.9% of the units surveyed had coniferous trees as the dominant vegetation type, and 8.3% had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at two sites for species composition and distribution in Twin Creek on June 25, 2009. Water temperature taken during the sampling period of 1035 to 1110 was 55 degrees Fahrenheit. Air temperatures ranged from 60 to 64 degrees Fahrenheit. The sites were sampled by S. McSmith (DFG), and M. Groff (WSP).

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In Reach 1, which comprised 2,826 feet of stream, 2 sites were sampled. The reach sites yielded 15 young-of-the-year steelhead/rainbow trout (SH/RT) and 50 coho.

The following chart displays the information yielded from these sites:

2009 Twin 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									
06/25/09	1	011	4.2	294	7	0	0	33	0
06/25/09	2	099	4.2	2,826	8	0	0	17	0

DISCUSSION

Twin Creek is a F4 channel type for 2,846 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 24, 2009, ranged from 53 to 57 degrees Fahrenheit. Air temperatures ranged from 57 to 78 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 42% of the total length of this survey, riffles 36%, and pools 22%. Two of the 29 (7%) 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.

Twenty-five of the 29 pool tail-outs measured had embeddedness ratings of 1 or 2. Four 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.

Twenty-seven of the 29 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

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The mean shelter rating for pools is 30. 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 Twin Creek. Small woody debris is the dominant cover type in pools followed by undercut banks. 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 97%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 87% and 96%, 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) Twin 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.

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 at the upstream end of culvert #01 (Twin Creeks Road). Culvert #01 has a 7'diameter and is 43' long. It is composed of a two corrugated metal pipes. The culvert has a plunge height is 0.6', and it has a maximum depth greater than 2.2' within 5' of the outlet. The

		slope is 2%, and its condition is fair. There is damage to the left culvert on the inlet end.
		Tributary #01, Dinner Creek, enters on the right bank. The (estimated) flow is 0.25 cfs, and it contributes to 50% of the flow to Twin Creek. The water temperature downstream of the tributary is 56 degrees Fahrenheit, the water temperature of the tributary is 58 degrees Fahrenheit, and the water temperature upstream of the confluence is 56 degrees Fahrenheit. The slope of the tributary is 2% and fish are observed in the 50 feet explored.
250	0011.00	There is erosion on right bank that is contributing fines.
696	0026.00	The right bank is eroding at the bottom of habitat unit. It measures approximately 25' long x 15' high and is contributing silt to gravel.
817	0032.00	The right bank is eroding. It measures approximately 50' long x 15' high and is contributing silt to gravel.
855	0034.00	The right bank is eroding at the top of the habitat unit. It measures approximately 50' long x 10' high and is contributing silt to gravel.
968	0035.00	The right bank is eroding approximately 100' upslope.
980	0036.00	The right bank is eroding at bottom of the habitat unit. It measures approximately 20' long x 20' high and is contributing silt to gravel.
1036	0038.00	The left bank is eroding and measures approximately 15' long x 5' high and is contributing fines.
1065	0039.00	There is a left bank seep at bottom of unit.
1212	0044.00	The left bank is eroding approximately 20' long x 10' high and is contributing fine sediment.
1248	0046.00	There is a landslide on right bank that measures approximately 100' long x 100' high and is contributing silt to small cobble.
1298	0047.00	Log debris accumulation (LDA) #01 contains 1 piece of large woody debris (LWD) and measures 2’ high x 19’ wide x 2’ long. Water flows through, though there are no visible gaps. Retained sediment ranges from fines to gravel and measures 10’ wide x 15’ long x 2’ deep. Fish are present above the LDA.
1351	0050.00	The right bank is eroding measuring approximately 30' long x 20' high and is contributing silt to gravel.

1953	0076.00	The left bank is eroding measuring approximately 30' upslope 20' long x 5' high and is contributing fine sediment.
1966	0077.00	There is a slump upslope on the left bank that measures approximately 150' high x 60' long.
1987	0078.00	There is a erosion on the right bank that measures approximately 80' long x 130' high and is contributing silt to gravel.
2,826	0099.00	End of survey due to lack of access.

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.

Twin 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: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	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
33	7	FLATWATER	33.0	37	1207	42.4	5.9	0.4	0.6	319	10533	107	3544		4
29	29	POOL	29.0	21	621	21.8	7.0	0.5	1.3	149	4308	102	2959	77	30
38	6	RIFFLE	38.0	27	1018	35.8	4.7	0.2	0.3	86	3263	18	669		4

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
100	42	2846	18104	7172

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

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 (%)
11	2	LGR	11.0	23	255	9.0	4	0.2	0.3	116	1273	23	255		5	97
27	4	HGR	27.0	28	763	26.8	5	0.2	0.5	71	1915	15	401		4	97
20	4	RUN	20.0	19	372	13.1	6	0.4	0.7	72	1449	25	500		3	98
13	3	SRN	13.0	64	835	29.3	6	0.4	0.9	648	8427	217	2824		5	97
21	21	MCP	21.0	23	480	16.9	7	0.6	3.1	160	3364	114	2392	86	27	97
1	1	LSL	1.0	16	16	0.6	9	0.2	0.9	144	144	58	58	29	60	98
3	3	LSR	3.0	19	56	2.0	5	0.4	1.3	100	300	56	169	40	55	97
1	1	LSBk	1.0	28	28	1.0	7	0.6	1.2	196	196	137	137	118	0	99
1	1	LSBo	1.0	16	16	0.6	8	0.4	1.3	128	128	77	77	51	20	98
2	2	PLP	2.0	12	25	0.9	7	0.6	1.3	88	176	63	126	49	30	98

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
100	42	2846	17371	6938

Table 3 - Summary of Pool Types

Stream Name: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

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
21	21	MAIN	72	23	480	77	7.0	0.6	160	3364	86	1813	27
8	8	SCOUR	28	18	141	23	6.8	0.4	118	944	52	416	38

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
29	29	621	4308	2229

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

Stream Name: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

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
21	MCP	72	3	14	16	76	1	5	1	5	0	0
1	LSL	3	1	100	0	0	0	0	0	0	0	0
3	LSR	10	0	0	3	100	0	0	0	0	0	0
1	LSBk	3	0	0	1	100	0	0	0	0	0	0
1	LSBo	3	0	0	1	100	0	0	0	0	0	0
2	PLP	7	0	0	2	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
29	4	14	23	79	1	3	1	3	0	0

Mean Maximum Residual Pool Depth (ft.): 1.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009 Dry Units: 0

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

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
11	2	LGR	80	0	0	20	0	0	0	0	0
27	4	HGR	0	60	0	0	0	0	10	30	0
38	6	TOTAL RIFFLE	27	40	0	7	0	0	7	20	0
20	4	RUN	55	23	0	23	0	0	0	0	0
13	3	SRN	0	67	0	0	0	0	0	33	0
33	7	TOTAL FLAT	22	49	0	9	0	0	0	20	0
21	21	MCP	28	32	16	13	3	0	0	7	1
1	1	LSL	20	60	10	10	0	0	0	0	0
3	3	LSR	47	10	0	43	0	0	0	0	0
1	1	LSBk	0	0	0	0	0	0	0	0	0
1	1	LSBo	0	50	15	0	0	0	0	35	0
2	2	PLP	0	85	0	10	0	0	0	0	5
29	29	TOTAL POOL	27	35	13	16	2	0	0	6	1
100	42	TOTAL	26	37	10	14	2	0	1	9	1

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009 Dry Units: 0

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

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
11	2	LGR	0	0	100	0	0	0	0
27	4	HGR	0	0	50	50	0	0	0
20	4	RUN	0	0	75	25	0	0	0
13	3	SRN	0	0	100	0	0	0	0
21	21	MCP	0	0	100	0	0	0	0
1	1	LSL	0	0	100	0	0	0	0
3	3	LSR	0	0	100	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
1	1	LSBo	0	0	100	0	0	0	0
2	2	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	26	74	0	87	96

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: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009 Survey Length (ft.): 2846 Main Channel (ft.): 2826 Side Channel (ft.): 20

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4
Reach Length (ft.): 2826
Riffle/Flatwater Mean Width (ft.): 5.3
BFW:
Range (ft.): 9 to 17
Mean (ft.): 13
Std. Dev.: 2
Base Flow (cfs.): 0.5
Water (F): 53 - 57 Air (F): 57 - 78
Dry Channel (ft): 0

Canopy Density (%): 97.4
Coniferous Component (%): 26.2
Hardwood Component (%): 73.8
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 91.4
Dominant Shelter: Small Woody Debris
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 9
LWD per 100 ft.:
Riffles: 1
Pools: 1
Flat: 1

Pools by Stream Length (%): 21.8
Pool Frequency (%): 29.0
Residual Pool Depth (%):
< 2 Feet Deep: 93
2 to 2.9 Feet Deep: 3
3 to 3.9 Feet Deep: 3
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 1.3
Mean Pool Shelter Rating: 30

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 55 Sm Cobble: 38 Lg Cobble: 3 Boulder: 3 Bedrock: 0

Embeddedness Values (%): 1. 55.2 2. 31.0 3. 10.3 4. 3.4 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

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	5	5	11.9
Boulder	1	0	1.2
Cobble / Gravel	15	16	36.9
Sand / Silt / Clay	21	21	50.0

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	0	0	0.0
Brush	3	4	8.3
Hardwood Trees	34	33	79.8
Coniferous Trees	5	5	11.9
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

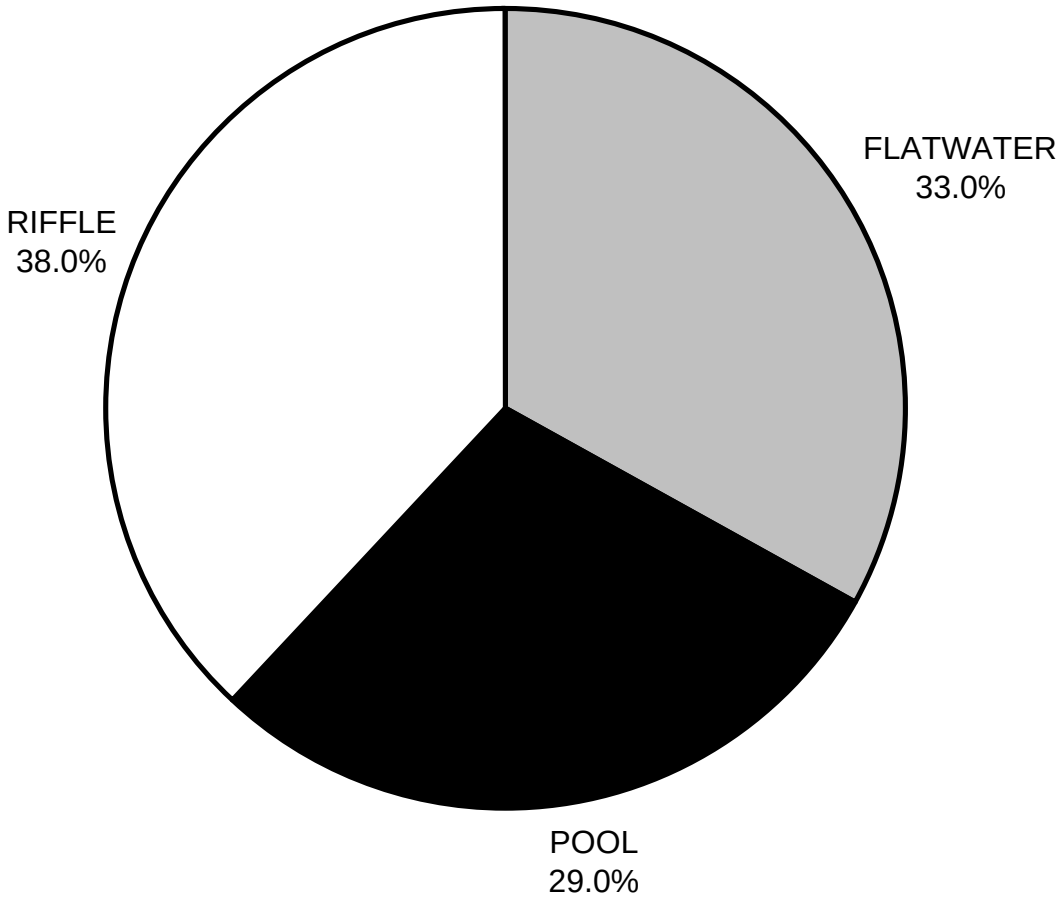
StreamName: Twin Creek LLID: 1239093400975 Drainage: Eel River - South Fork

Survey Dates: 6/24/2009 to 6/24/2009

Confluence Location: Quad: BRICELAND Legal Description: T04SR02ES23 Latitude: 40:06:20.0N Longitude: 123:55:33.0W

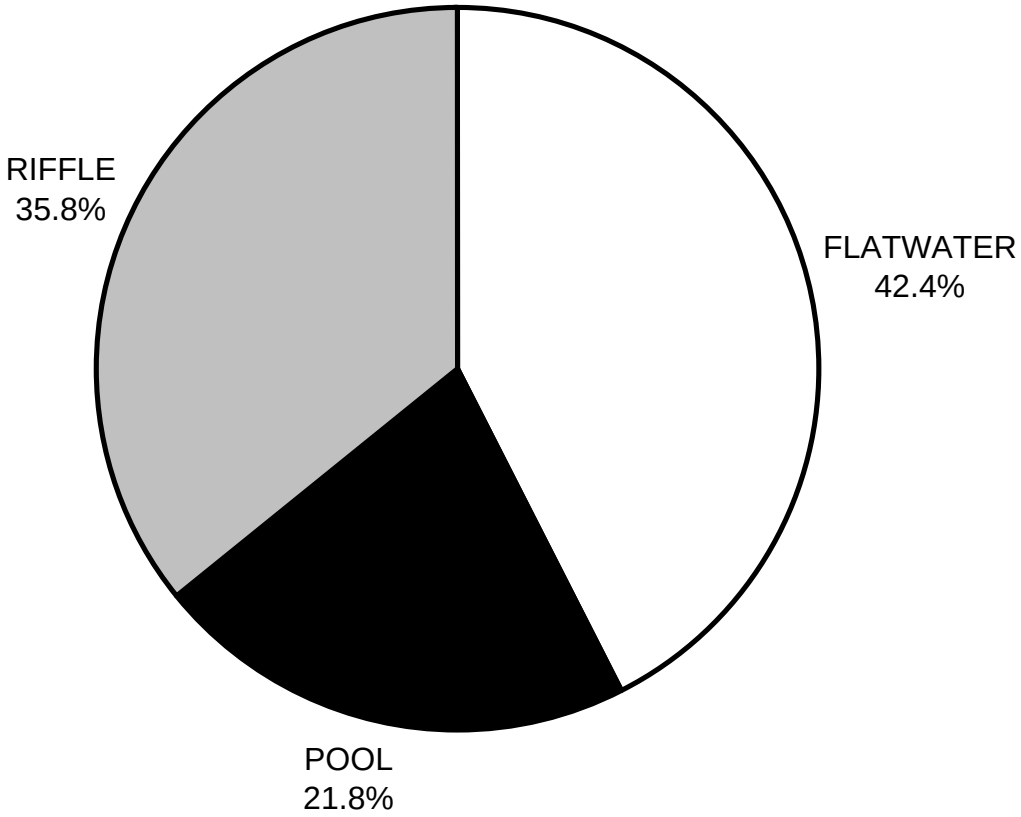
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	27	22	27
SMALL WOODY DEBRIS (%)	40	49	35
LARGE WOODY DEBRIS (%)	0	0	13
ROOT MASS (%)	7	9	16
TERRESTRIAL VEGETATION (%)	0	0	2
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	7	0	0
BOULDERS (%)	20	20	6
BEDROCK LEDGES (%)	0	0	1

"TWIN CREEK" 2009
HABITAT TYPES BY PERCENT OCCURRENCE



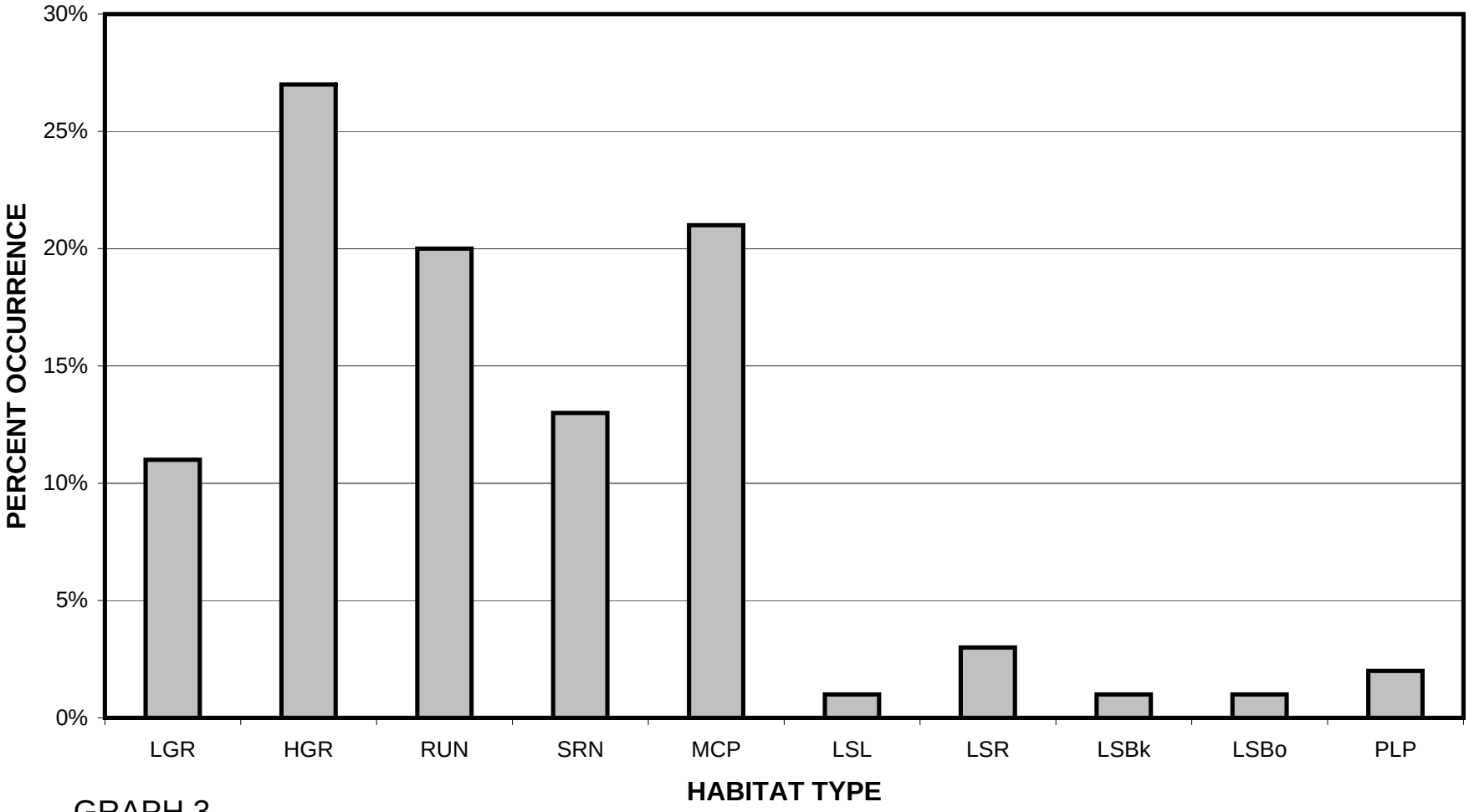
GRAPH 1

"TWIN CREEK" 2009
HABITAT TYPES BY PERCENT TOTAL LENGTH



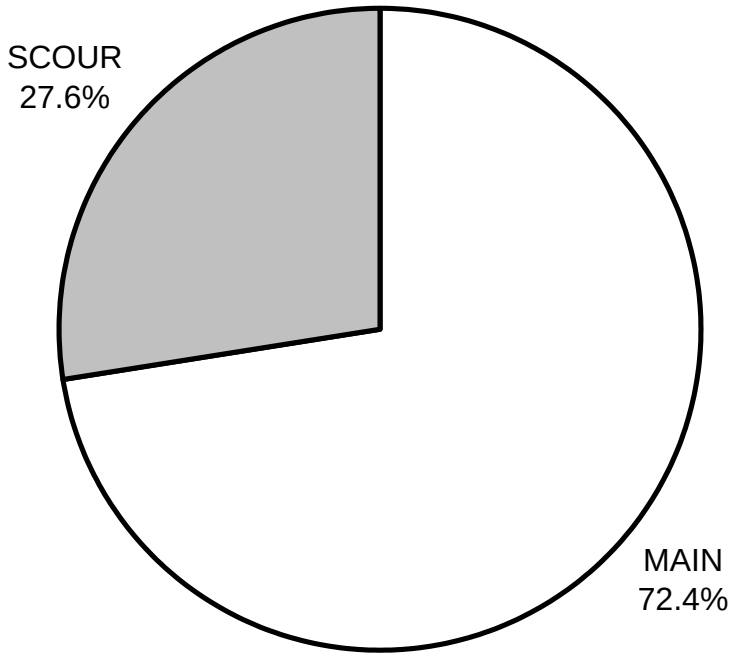
GRAPH 2

"TWIN CREEK" 2009
HABITAT TYPES BY PERCENT OCCURRENCE



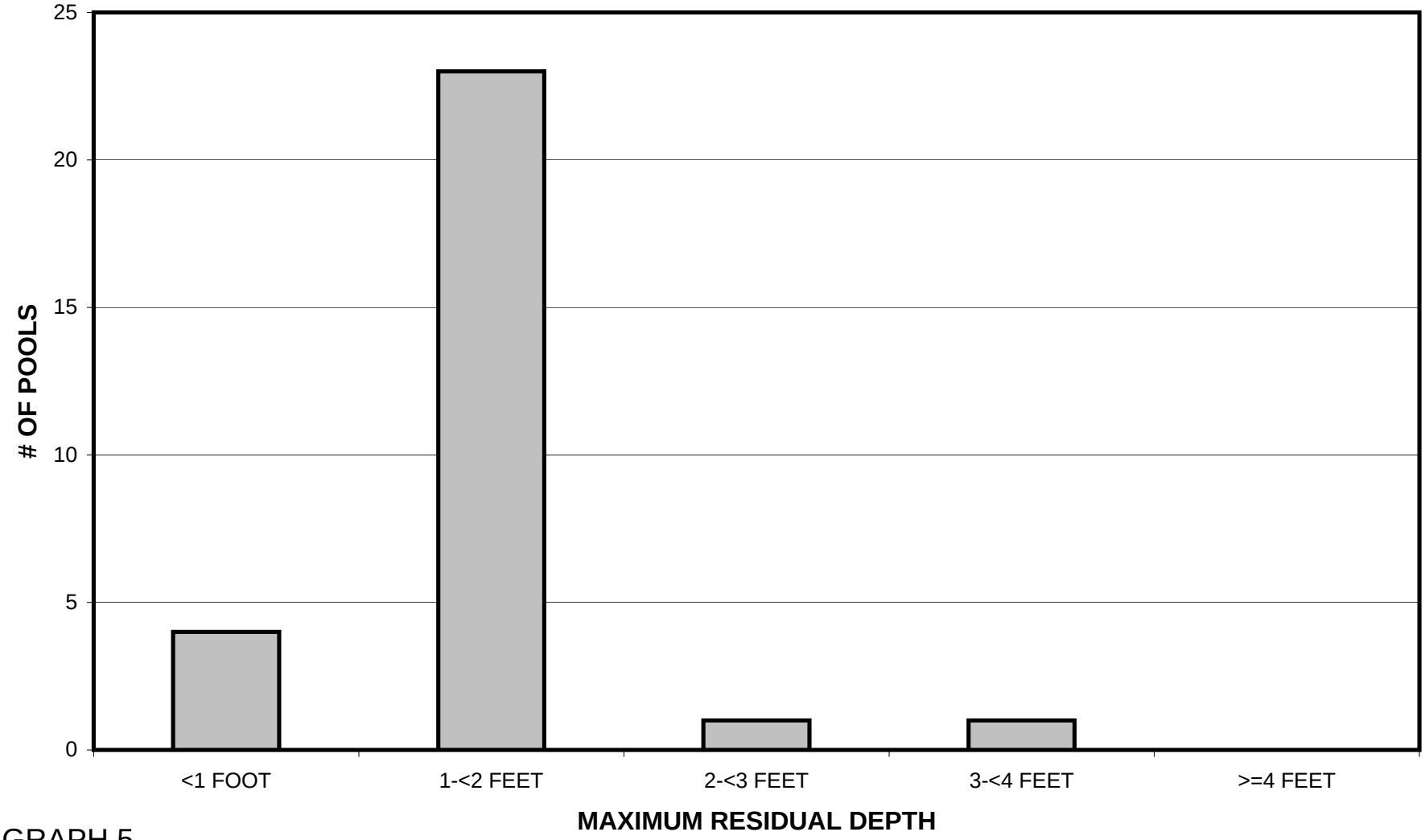
GRAPH 3

"TWIN CREEK" 2009
POOL TYPES BY PERCENT OCCURRENCE



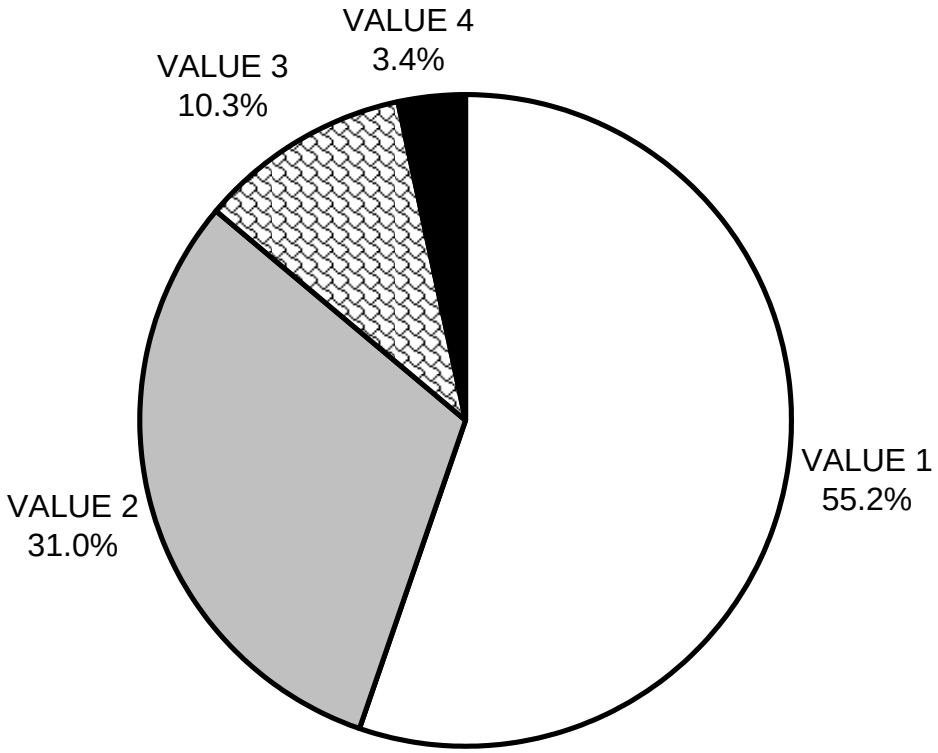
GRAPH 4

"TWIN CREEK" 2009
MAXIMUM DEPTH IN POOLS



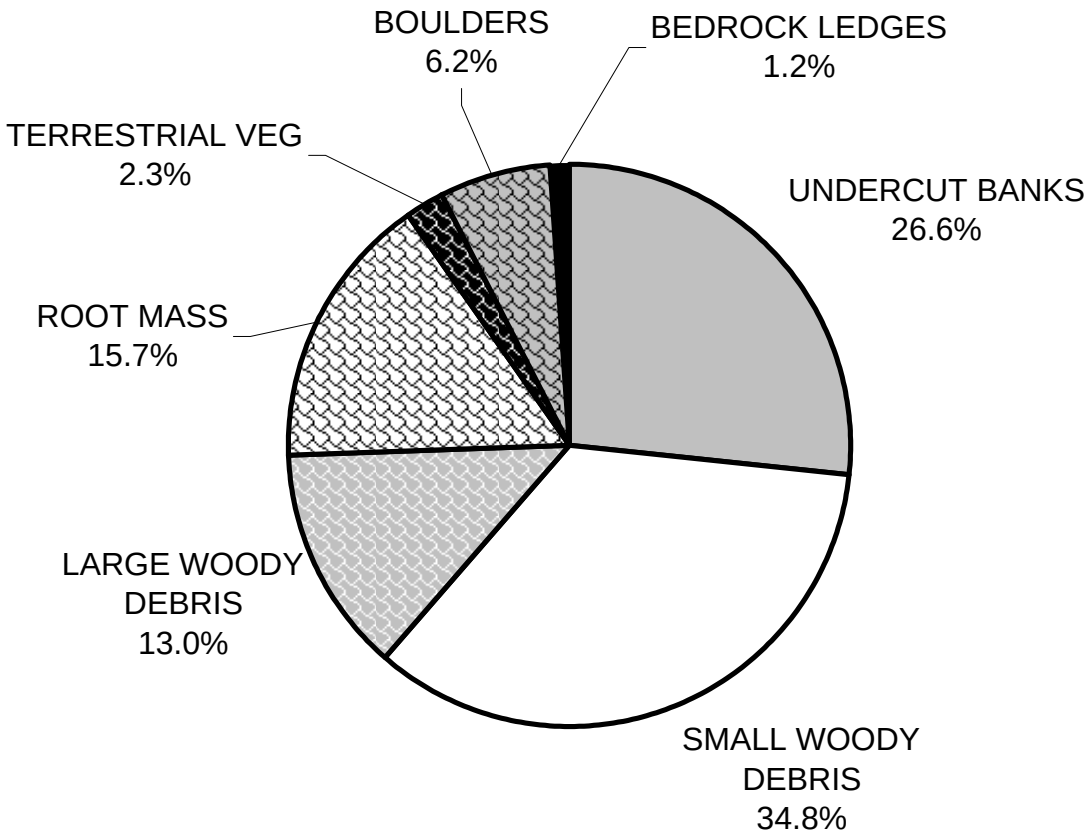
GRAPH 5

"TWIN CREEK" 2009
PERCENT EMBEDDEDNESS



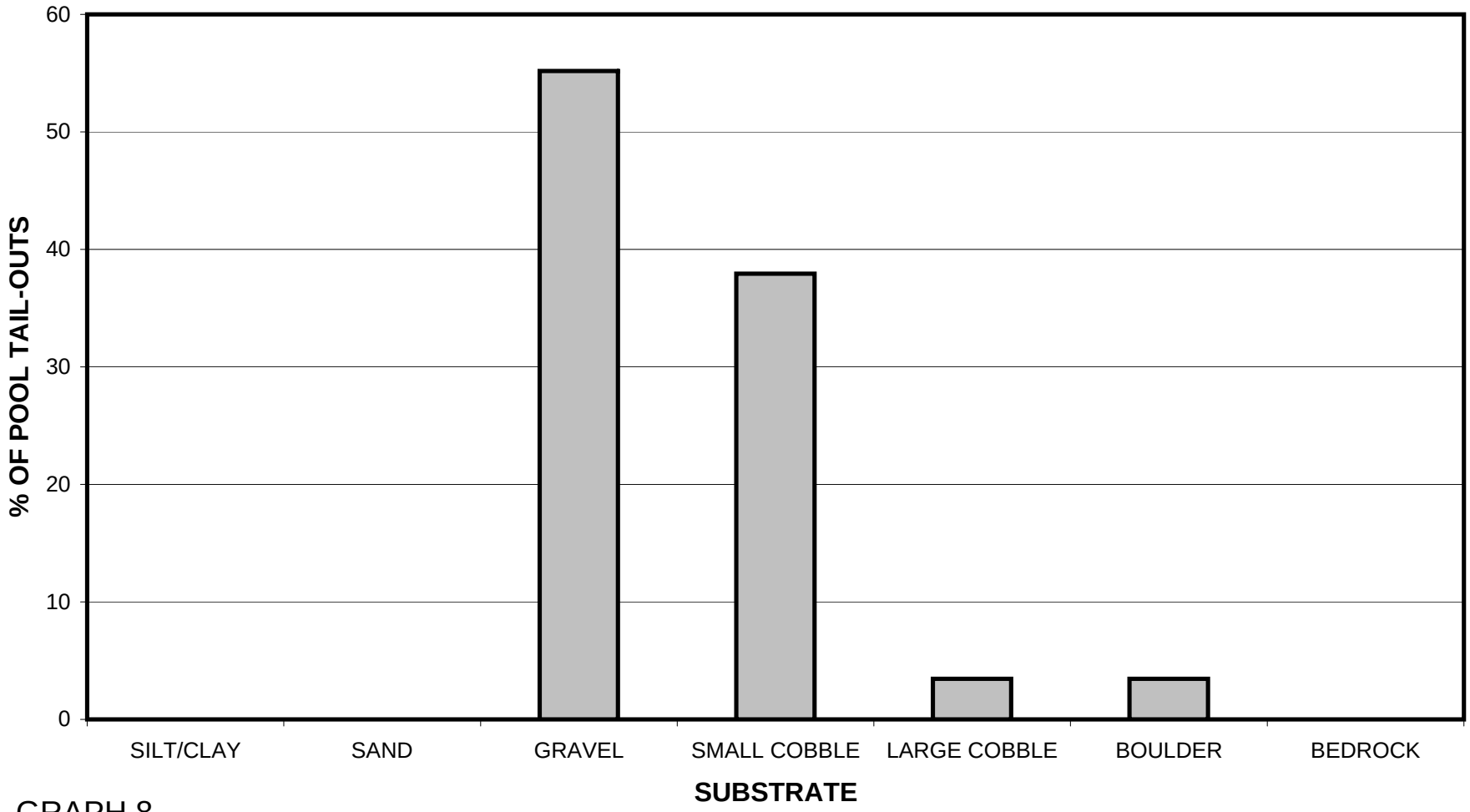
GRAPH 6

"TWIN CREEK" 2009
MEAN PERCENT COVER TYPES IN POOLS



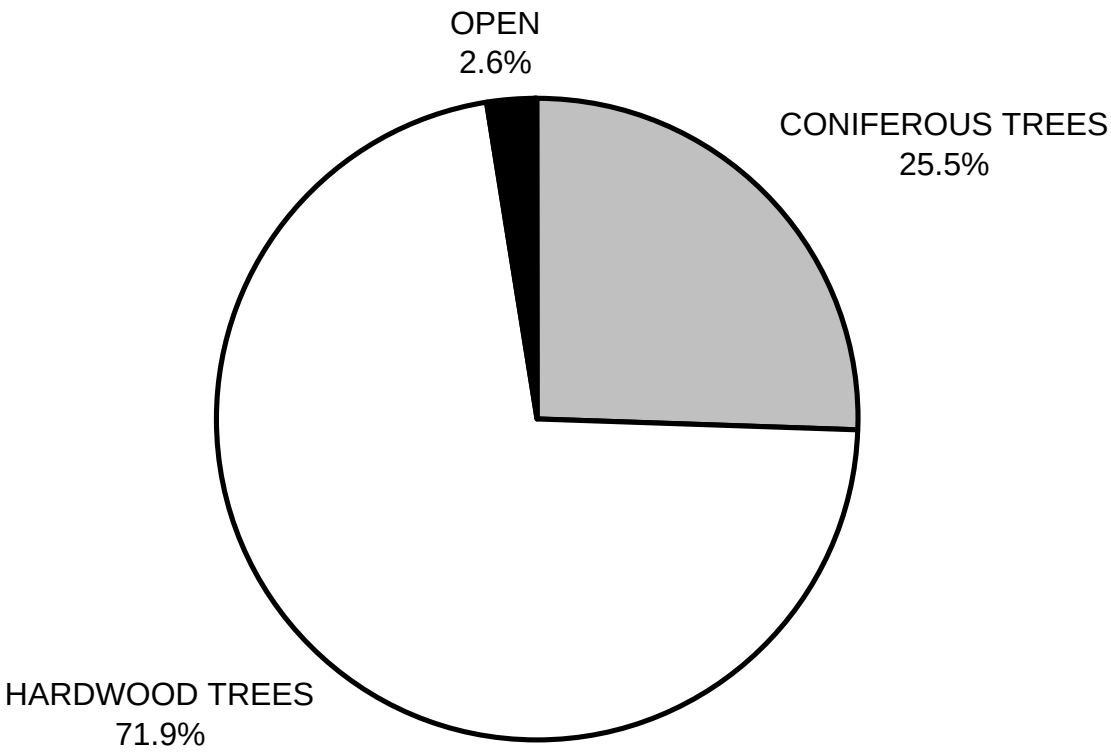
GRAPH 7

"TWIN CREEK" 2009
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



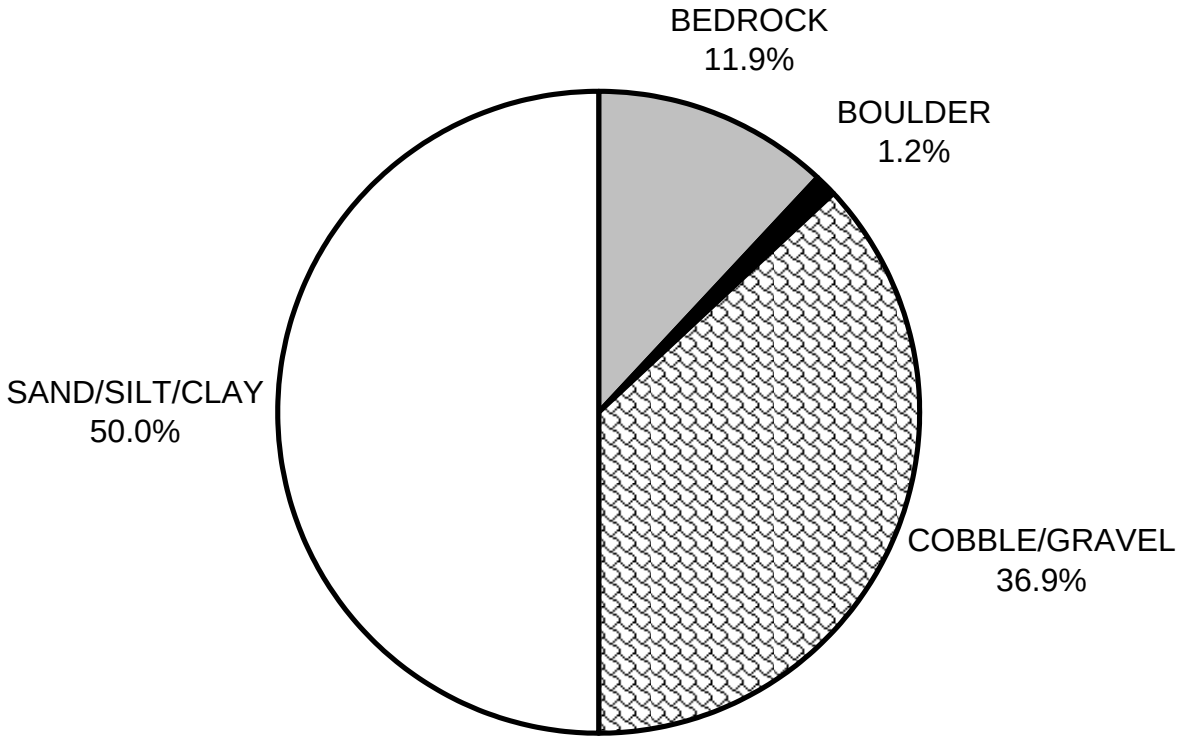
GRAPH 8

"TWIN CREEK" 2009
MEAN PERCENT CANOPY



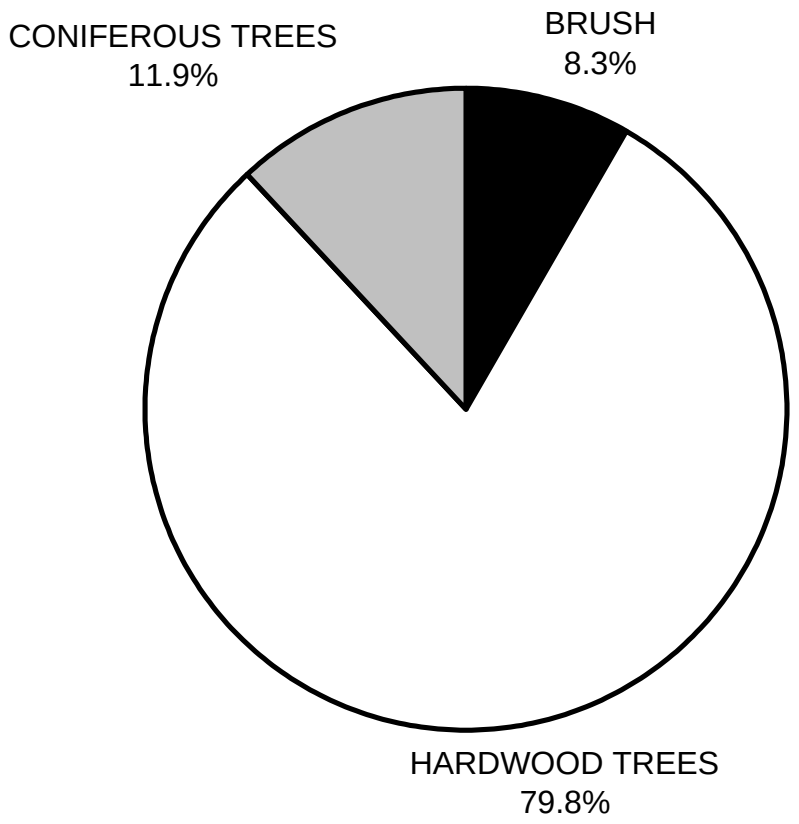
GRAPH 9

"TWIN CREEK" 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH

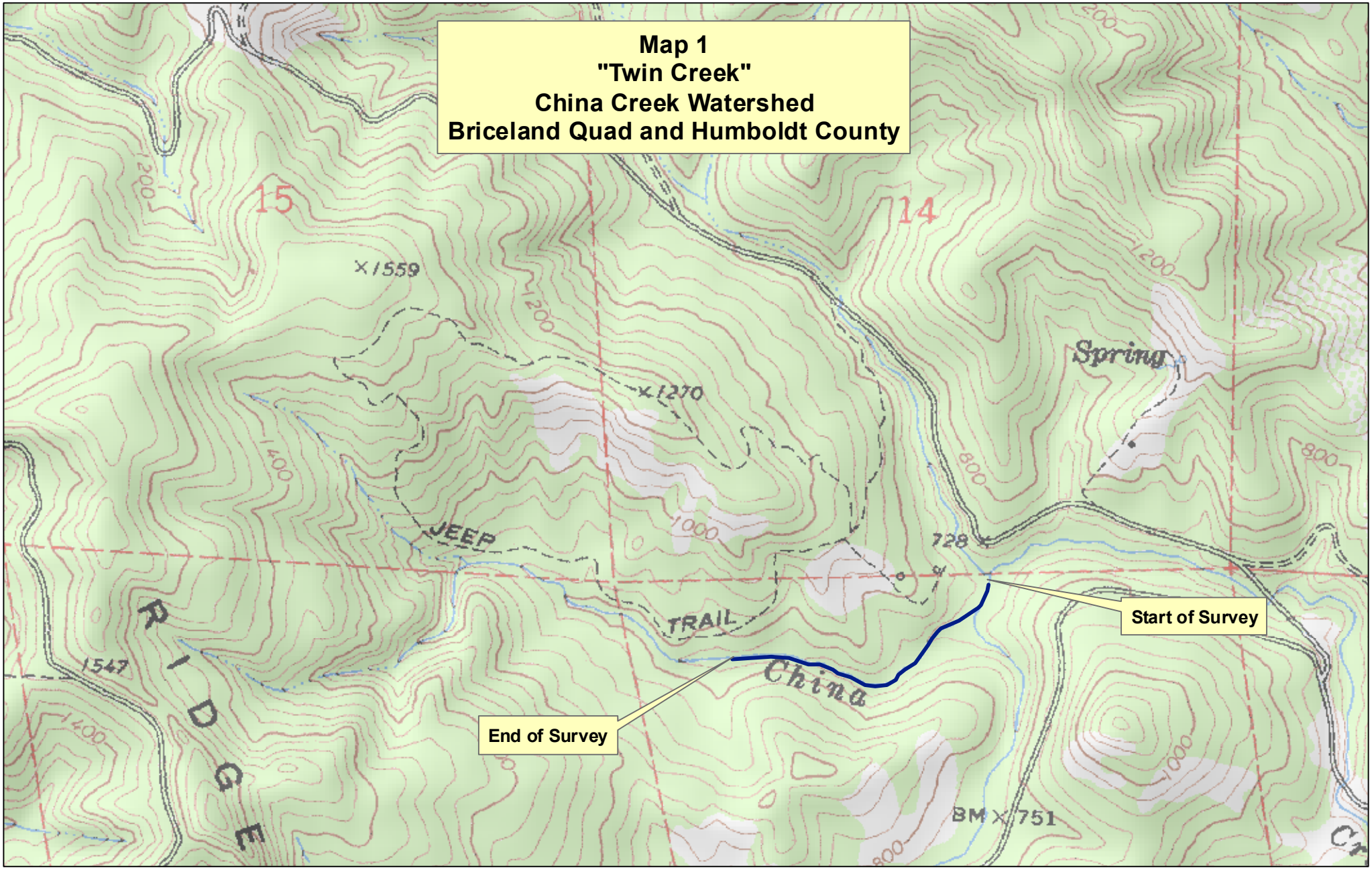


GRAPH 10

"TWIN CREEK" 2009
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11



N
W E
S

Legend

"Twin Creek", F4 Channel Type

0 1,400 2,800 Feet

RESOURCES AGENCY
CALIFORNIA
DEPARTMENT
FISH & GAME