STREAM INVENTORY REPORT

BULL CREEK

INTRODUCTION

A stream inventory was conducted during the spring of 2001 on Bull Creek to assess the habitat conditions related to instream projects completed in the spring of 2000. The survey began at the start of the restoration reach and extended upstream 1878 ft. approximately 65 ft above the confluence of Cuneo Creek. The Bull 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 Bull 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 determine if past restoration efforts have succeeded in creating habitat for rejuvenation of documented chinook salmon, coho salmon, and steelhead stocks. Further recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Bull Creek is a tributary to the South Fork Eel River, a tributary to the Eel River, located in Humboldt County, California (Map 1). Bull Creek legal description at the confluence with the South Fork Eel River is T01S R2E S34. Its location is 40°20′23″ north latitude and 123°56′15″ west longitude. Bull Creek is a fourth order stream and has approximately 21.2 miles of blue line stream according to the USGS Bull Creek and Weott 7.5 minute quadrangle. Bull Creek drains a watershed of approximately 38.1 square miles. Elevations range from about 160 feet at the mouth of the creek to 3000 feet in the headwater areas. Old-growth redwood forest dominates the watershed. The watershed is entirely owned by the state of California and is managed as a state park. Vehicle access exists via U.S. Highway 101, via the Honeydew exit. Approximately 5 miles down the Mattole Road is the start of the study site.

METHODS

The habitat inventory conducted in Bull Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Scientific Aides 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 Bull Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at 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 (1985 rev. 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 (1988). 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". Bull 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. Unit measurements included mean length, mean width, mean depth, and maximum depth. Depth of the pool tail crest at each pool habitat unit was measured at the thalweg.

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 Bull 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 particle size, bedrock, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide 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. 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 Bull 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 Bull 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 deciduous 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 Bull 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.

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 Bull Creek. In addition, three sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual.*

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Quattro Pro. Graphics developed for Bull Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of May 29-31, 2001, was conducted by Erin Springer and Susannah Ferson. The total length of the stream surveyed was 1,878 feet.

Stream flow was estimated to be 2-3 cfs during the survey period at the bottom of the survey reach using a Marsh-McBirney Model 2000 flowmeter.

Bull Creek is a B4 channel type for the entire 1,878 feet of the stream surveyed. B4 channels are moderately entrenched, moderate gradient (2-4% slope), riffle dominated channel with infrequently spaced pools; very stable plan and profile; stable banks; cobble dominated channel with sinuosity greater than 1.2 (Rosgen, 1994).

Water temperatures taken during the survey period ranged from 62 to 72 degrees Fahrenheit. Air temperatures ranged from 69 to 91 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 20% riffle units, 16% flatwater units, and 64% pool units (Graph 1). Based on total length of Level II habitat types there were 20% riffle units, 36% flatwater units, and 44% pool units (Graph 2).

Twenty five Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools (MCP), 40%; Low gradient Riffles (LGR), 20%; and Runs (RUN), 3.3% (Graph 3). Based on percent total length, MCP made up 30%, LGR 20%, and RUN 36%.

A total of 16 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 63% , and comprised 69% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth (Trush, W.J. 1989). Eleven of the 16 pools (68%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 16 pool tail-outs measured, none had a value of 1; 11 had a value of 2 (68.75%); 3 had a value of 3 (18.75%); 2 had a value of 4 (12.5%); and none had a value of 5 (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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 13, flatwater habitat types had a mean shelter rating of 10, and pool habitats had a mean shelter rating of 13 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 15. Scour pools had a mean shelter rating of 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders and large woody debris are the dominant cover types in Bull Creek. Graph 7 describes the pool cover in Bull Creek. Boulder substrate 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 70% of pool tail-outs (an average between low gradient riffles and runs) while small cobble was the next most frequently observed substrate type, at 30%.

The mean percent canopy density for the surveyed length of Bull Creek was 5.0%. The mean percentages of deciduous and coniferous trees were 88% and 12%, respectively. Graph 9 describes the mean percent canopy in Bull Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 49.8%. The mean percent left bank vegetated was 46.4%. The dominant elements composing the structure of the stream banks consisted of 64.0% cobble/gravel, 30.0% boulders and 6.0% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation observed in 62.0% of the units surveyed. Additionally, 36.0% of the units surveyed had brush and grass as the dominant vegetation type, and 2.0% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished for species composition and distribution in Bull Creek on July 20, 1998. Water temperatures taken during the electrofishing period ranged from 60

to 62 degrees Fahrenheit. Air temperatures ranged from 61 to 68 degrees Fahrenheit. The sites were sampled by Barry Collins and Gary Larson (DFG). Each site was conducted by doing three passes with the electrofishing device to calculate population by depletion.

The first site sampled was conducted 400 ft above the Bull Creek confluence with the South Fork Eel River. The site yielded 4 steelhead (SH).

The second site was 2000 ft. upstream from the mouth of Bull Creek and included habitat units 0001-0005. The site yielded 17 steelhead (SH) and numerous species of freshwater fish and amphibians.

The third site sampled was approximately 2500 ft. upstream from the SF Eel River confluence and included habitat units 0024-0025. The site yielded 47 steelhead (SH).

The following chart displays the information yielded from these sites:

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead YOY	1+	2+
07/30/98	1	400		4.2	1	B4	3	1	
07/31/98	2	2000	001	3.3	1	B4	5	9	3
08/04/98	3	2500	0024	4.2	1	B4	30	17	3

DISCUSSION

Bull Creek is a B4 channel type for the entire 1,878 feet of stream surveyed. The suitability of B4 channel types for fish habitat improvement structures is as follows:

The water temperatures recorded on the survey days May 29-31, 2001, ranged from 62 to 72 degrees Fahrenheit. Air temperatures ranged from 69 to 91 degrees Fahrenheit. This is a less than optimum water temperature range for salmonids. However, 60° F, if sustained, is near the threshold stress level for salmonids. The extreme temperatures are due to the drought and low water levels where temperatures were taken. To make any further

The percentage of right and left bank covered with vegetation was moderate at 49.8% and 46.4%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels alder and willow have been extensively planted over the last three seasons.

RECOMMENDATIONS

1) Bull Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within/above 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) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable.

5) 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.

6) 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.

7) Increase the canopy on Bull Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

8) Suitable size spawning substrate on Bull Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

9) There are several log debris accumulations present on Bull Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is

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 36.0% of the total length of this survey, riffles 20.0%, and pools 44.0%. The pools are relatively deep, with only 5 of the 16 (31.25%) pools having a maximum depth less 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 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 structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

Eleven of the sixteen pool tail-outs measured had embeddedness ratings of 1 or 2. The rest 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 Bull Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

All sixteen of the 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 was low with a rating of 13. The shelter rating in the flatwater habitats was slightly lower at 10. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, large woody debris contribute a small amount. 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 5.0%. This is a relatively low percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%. For this reason in the fall of this year September 2002 willow baffles were planted to add to canopy cover and retain sediment.

Bull Creek

1600' Right bank digger log with boulder armoring and opposing boulder wing deflector.

1700' Boulder cluster.

1878' End of survey. This survey ended here to document if any change has taken place upstream as well as downstream from the project site due to the instream structures.

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. This resource contains the following references used in this paper:

desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

10) There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives should be explored with the grazier and developed if possible.

11) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

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.

0' Begin survey at downstream end of project reach. Channel type is F4.

843' Boulder weir

908' Right bank digger log creating a pool.

1083' Right bank digger log creating a pool.

1108' Boulder cluster.

1158' Right bank digger log with boulder reinforcement.

1203' Upstream boulder vortex weir.

1278' Upstream boulder vortex weir with rootwad.

1318' Opposing boulder constrictors.

1348' Opposing boulder constrictors.

1448' Opposing boulder constrictors.

1508' Opposing boulder constrictors.

1528' Cuneo Creek confluence with Bull 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]	

BULL CREEK

Drainage: SOUTH FORK EEL RIVER

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES

Survey Dates: 05/29/01 to 05/31/01

Confluence Location: QUAD: BULL CREEK LEGAL DESCRIPTION: T01SR02ES34 LATITUDE:40°20'23" LONGITUDE:123°56'15"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN 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
5	5	RIFFLE	20	76	378	20	32.2	0.7	2004	10018	1489	7443	0	13
4	4	FLATWATER	16	168	672	36	33.8	0.8	4138	16552	3298	13190	0	10
16	16	POOL	64	52	828	44	36.1	1.5	1437	22997	2064	33022	990	11

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
25	25	1878	49567	53655

BULL CREEK

Drainage: SOUTH FORK EEL RIVER

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 05/29/01 to 05/31/01

Confluence Location: QUAD: BULL CREEK LEGAL DESCRIPTION: T01SR02ES34 LATITUDE:40°20'23" LONGITUDE:123°56'15"

HABITAT UNITS #	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft.	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MAXIMUM DEPTH ft.	MEAN AREA sq.ft.	TOTAL AREA EST. sq.ft.	MEAN VOLUME cu.ft.	TOTAL VOLUME EST. cu.ft.	MEAN RESIDUAL POOL VOL cu.ft.	MEAN SHELTER RATING	MEAN CANOPY %
5	5	LGR	20	76	378	20	32	0.7	1.5	2004	10018	1489	7443	0	13	7
4	4	RUN	16	168	672	36	34	0.8	1.7	4138	16552	3298	13190	0	10	2
10	10	MCP	40	57	570	30	30	1.6	3.9	1598	15980	2363	23631	1131	12	5
3	3	LSL	12	59	178	9	49	1.4	2.9	1605	4815	2362	7087	1239	12	12
3	3	LSBo	12	27	80	4	45	1.1	2.0	734	2202	768	2304	268	8	1

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
25	25	1878	49567	53655

BULL CREEK

Drainage: SOUTH FORK EEL RIVER

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 05/29/01 to 05/31/01

Confluence Location: QUAD: BULL CREEK LEGAL DESCRIPTION: T01SR02ES34 LATITUDE:40°20'23" LONGITUDE:123°56'15"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA EST. (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME EST. (cu.ft.)	MEAN RESIDUAL POOL VOL. (cu.ft.)	MEAN SHELTER RATING
10	10	MAIN	63	57	570	69	29.5	1.6	1598	15980	2363	23631	1131	12
6	6	SCOUR	38	43	258	31	47.2	1.3	1170	7017	1565	9391	753	10

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
16	16	828	22997	33022

BULL CREEK

Drainage: SOUTH FORK EEL RIVER

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES

Survey Dates: 05/29/01 to 05/31/01

Confluence Location: QUAD: BULL CREEK LEGAL DESCRIPTION: T01SR02ES34 LATITUDE:40°20'23" LONGITUDE:123°56'15"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
10	MCP	63	0	0	4	40	2	20	4	40	0	0
3	LSL	19	0	0	0	0	3	100	0	0	0	0
3	LSBo	19	0	0	2	67	1	33	0	0	0	0

TOTAL UNITS
16

BULL CREEK

Drainage: SOUTH FORK EEL RIVER

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE

Survey Dates: 05/29/01 to 05/31/01

Confluence Location: QUAD: BULL CREEK LEGAL DESCRIPTION: T01SR02ES34 LATITUDE:40°20'23" LONGITUDE:123°56'15"

UNITS MEASURED	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
5	5	LGR	0	0	0	0	0	0	0	100	0
4	4	RUN	0	0	0	5	0	0	0	95	0
10	10	MCP	1	0	11	13	0	0	0	76	0
3	3	LSL	0	0	75	0	0	0	0	25	0
3	3	LSBo	0	0	0	0	0	0	0	100	0

BULL CREEK

Drainage: SOUTH FORK EEL RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 05/29/01 to 05/31/01

Confluence Location: QUAD: BULL CREEK LEGAL DESCRIPTION: T01SR02ES34 LATITUDE:40°20'23" LONGITUDE:123°56'15"

TOTAL HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
5	5	LGR	0	0	40	40	20	0	0
4	4	RUN	0	0	100	0	0	0	0
10	10	MCP	0	30	20	40	10	0	0
3	3	LSL	0	0	100	0	0	0	0
3	3	LSBo	0	33	33	33	0	0	0

Summary of Mean Percent Vegetative Cover for Entire Stream

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Deciduous	Mean Percent Open units	Mean Right bank % Cover	Mean Left Bank % Cover
5	12	88	43	49.8	46.4

Note: Mean percent conifer and deciduous 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: BULL CREEK
SAMPLE DATES: 05/29/01 to 05/31/01
STREAM LENGTH: 1878 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: BULL CREEK — Latitude: 40°20'23"
Legal Description: T01SR02ES34 — Longitude: 123°56'15"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

Channel Type: B4
Channel Length: 1878 ft.
Riffle/flatwater Mean Width: 33 ft.
Total Pool Mean Depth: 1.5 ft.
Base Flow: 2.0 cfs
Water: 62 - 72 °F Air: 69 -91 °F
Dom. Bank Veg.: Deciduous Trees
Vegetative Cover: 48%
Dom. Bank Substrate: Cobble/Gravel

Canopy Density: 5%
Coniferous Component: 12%
Deciduous Component: 88%
Pools by Stream Length: 44%
Pools >=3 ft.deep: 25%
Mean Pool Shelter Rtn: 11
Dom. Shelter: Boulders
Occurrence of LOD: 13%
Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2.69% 3. 19% 4. 13% 5. 0%

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Bedrock	0	0	0
Boulder	9	6	30
Cobble/Gravel	15	17	64
Silt/clay	1	2	6

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Grass	8	4	24
Brush	2	4	12
Decid. Trees	15	16	62
Conif. Trees	0	1	2
No Vegetation	0	0	0

Total stream average embeddedness value for pool 2.44

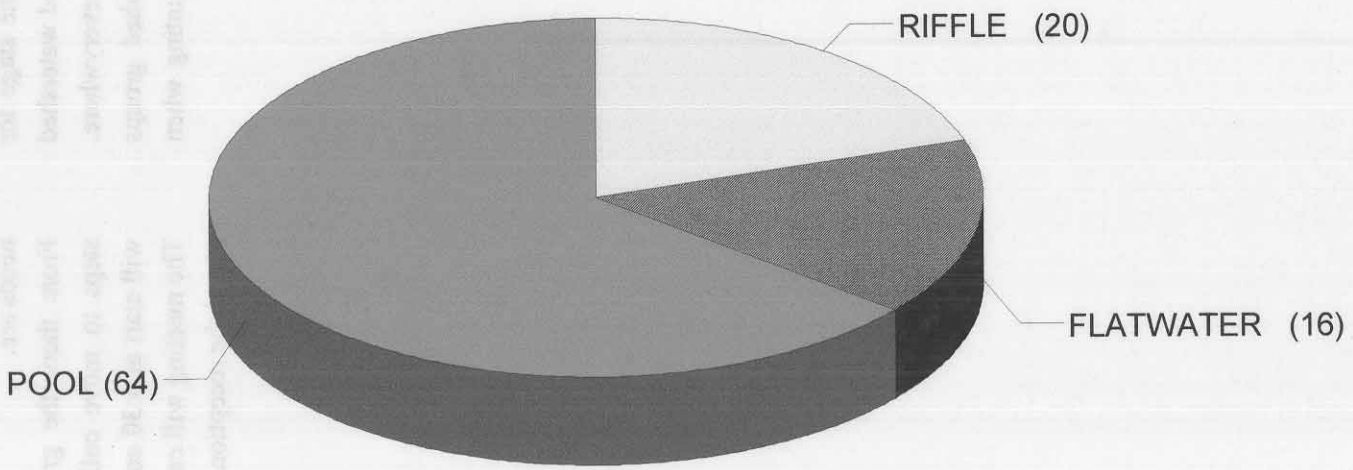
TABLE 10. MEAN PERCENT OF SHELTER COVER TYPES FOR ENTIRE STREAM

Stream: BULL CREEK Drainage: SOUTH FORK EEL RIVER

Survey Date: 05/29/01 to 05/31/01

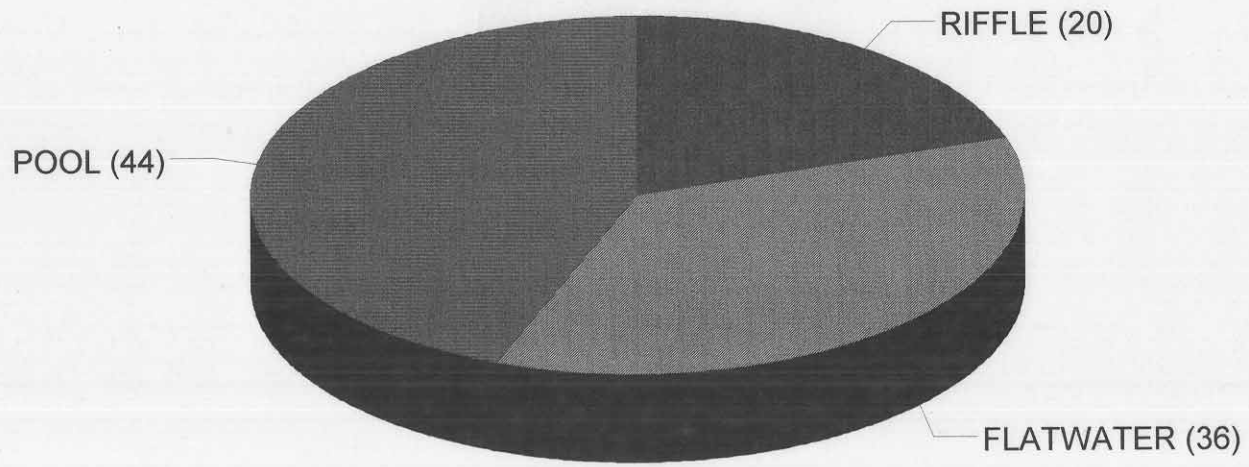
	RIFFLES	FLATWATER	POOLS
UNDERCUT BANKS	0.20	0	0.31
SMALL WOODY DEBRIS	0	0	0
LARGE WOODY DEBRIS	13.40	0	20.94
ROOTS	6	5	8.13
TERRESTRIAL VEG	0	0	0
AQUATIC VEG	0	0	0
WHITEWATER	0	0	0
BOULDERS	80.60	95	70.94
BEDROCK LEDGES	0	0	0

Bull Creek, Humboldt County
HABITAT TYPES BY PERCENT OCCURRENCE



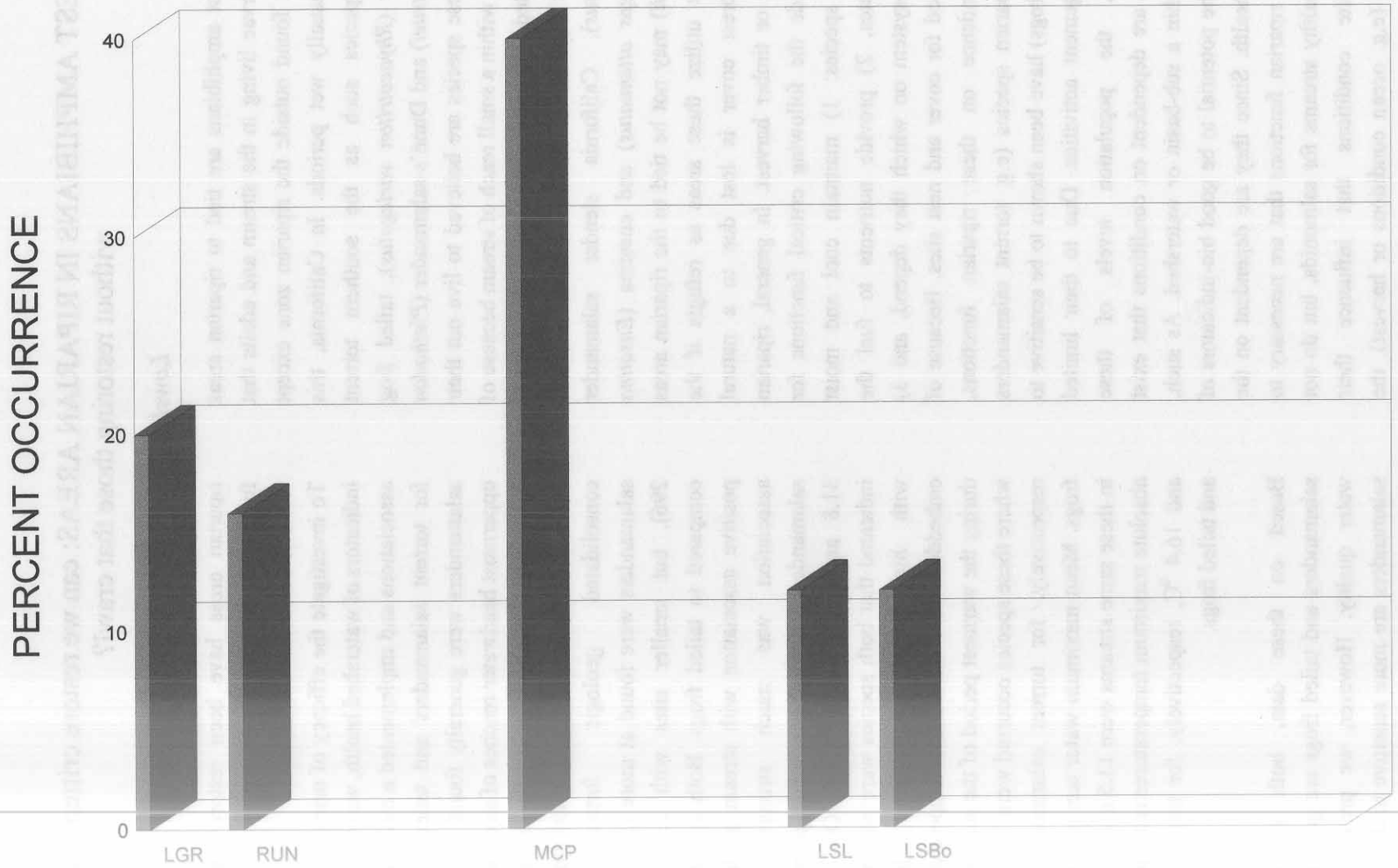
GRAPH 1

Bull Creek, Humboldt County
HABITAT TYPES BY PERCENT TOTAL LENGTH



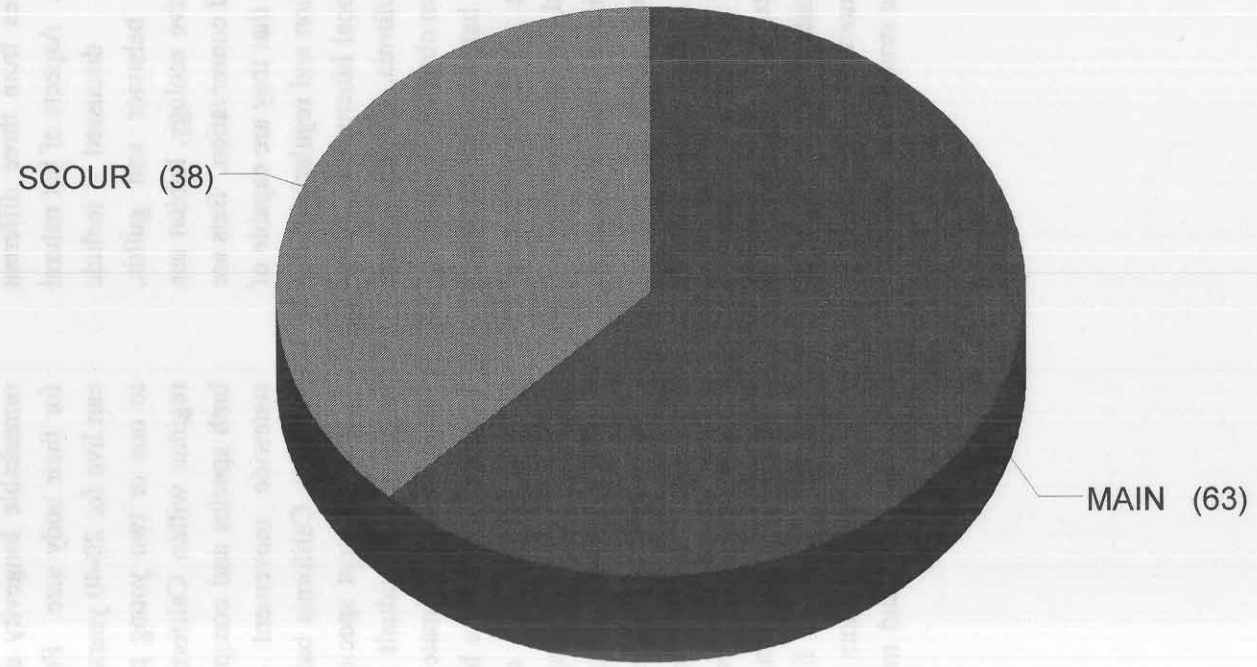
GRAPH 2

Bull Creek, Humboldt County
HABITAT TYPES BY PERCENT OCCURRENCE



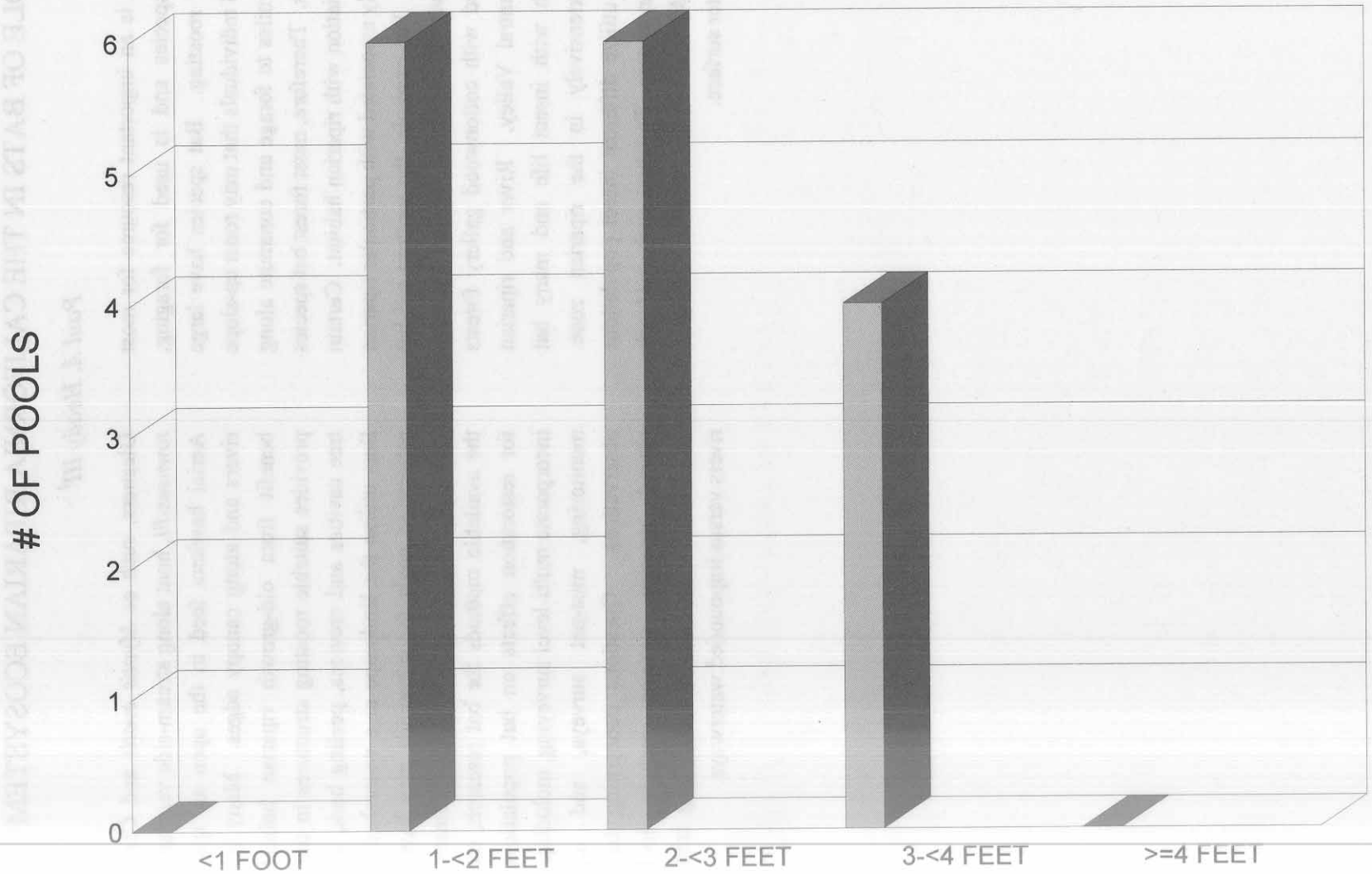
GRAPH 3

Bull Creek, Humboldt County
POOL HABITAT TYPES BY PERCENT OCCURRENCE



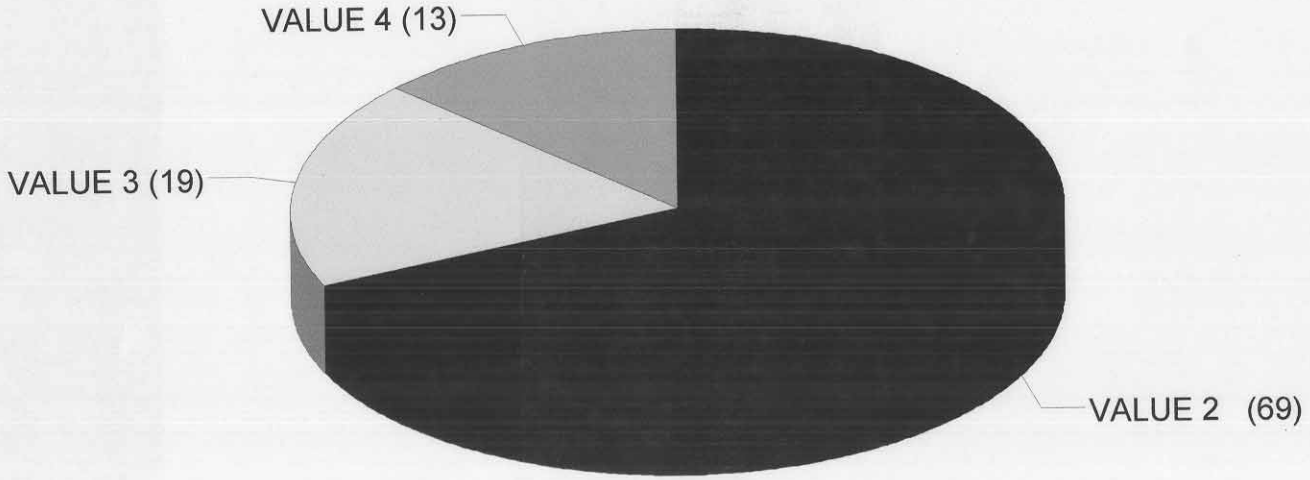
GRAPH 4

Bull Creek, Humboldt County
MAXIMUM POOL DEPTHS



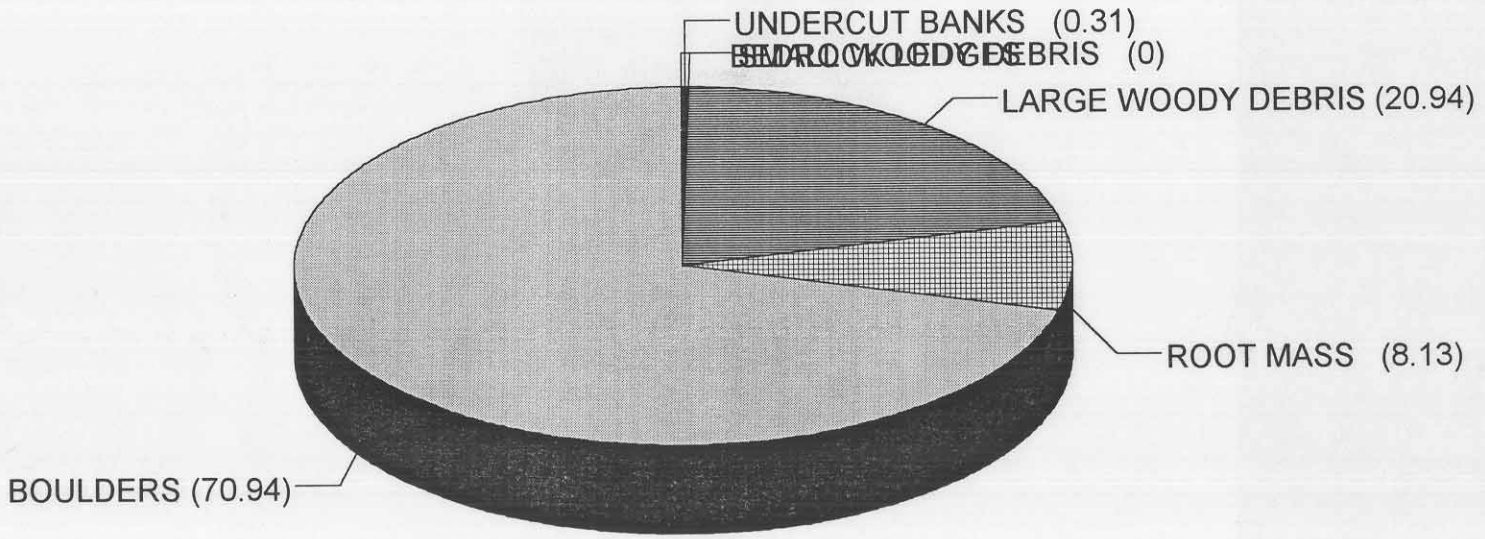
GRAPH 5

Bull Creek, Humboldt County
PERCENT EMBEDDEDNESS



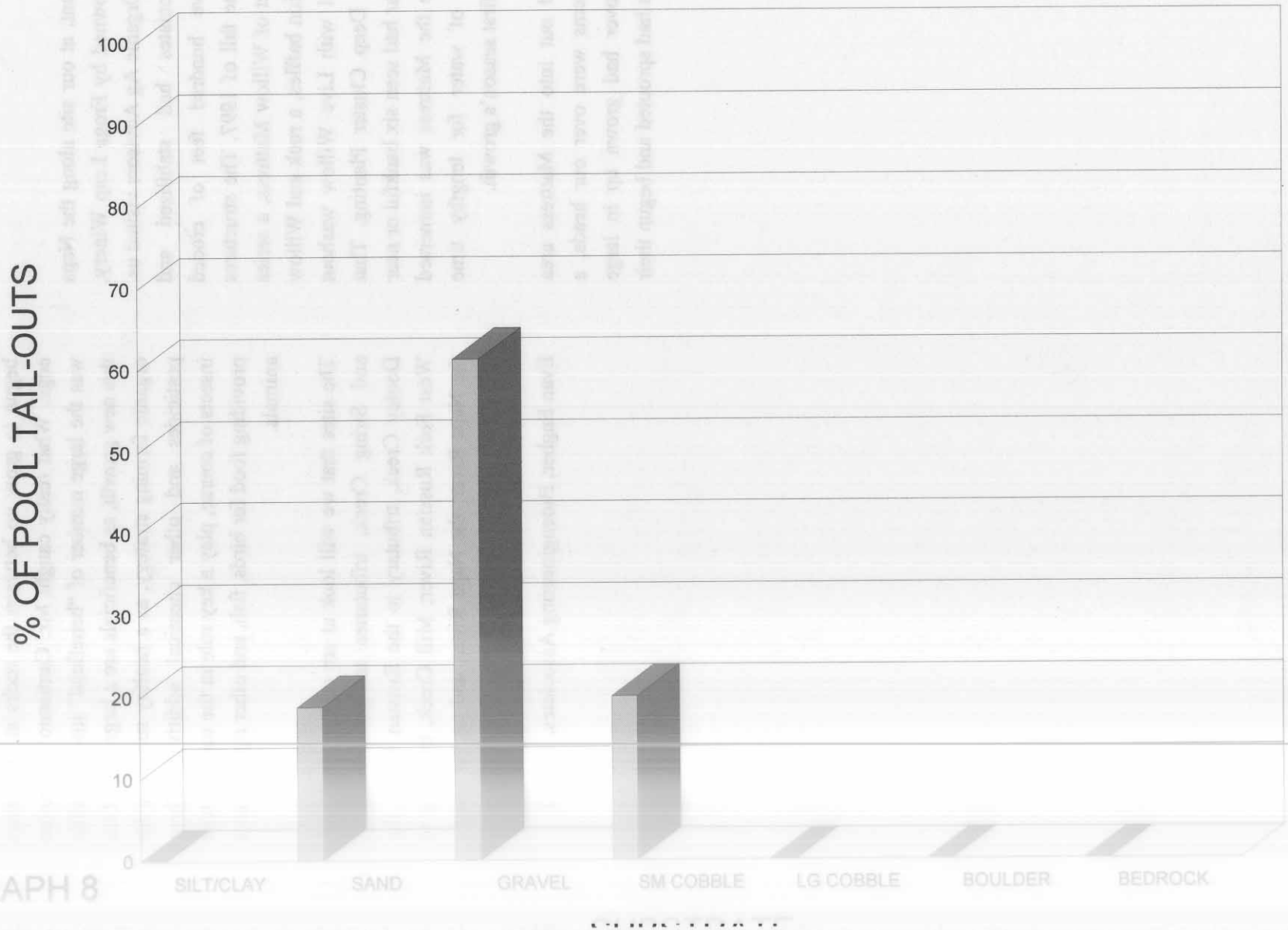
GRAPH 6

MEAN PERCENT COVER TYPES IN POOLS



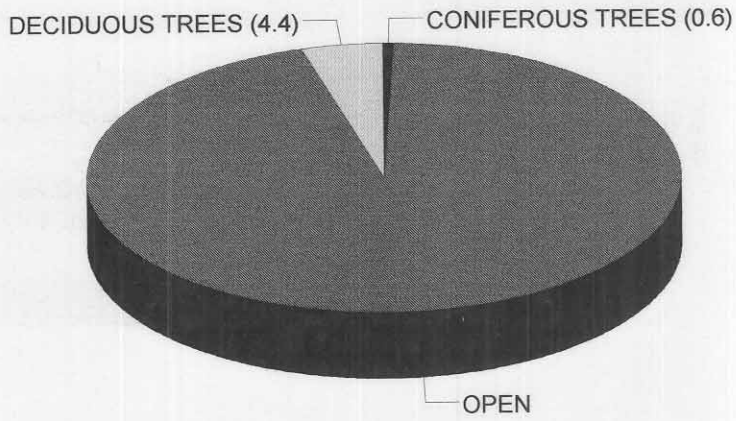
GRAPH 7

Bull Creek, Humboldt County
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

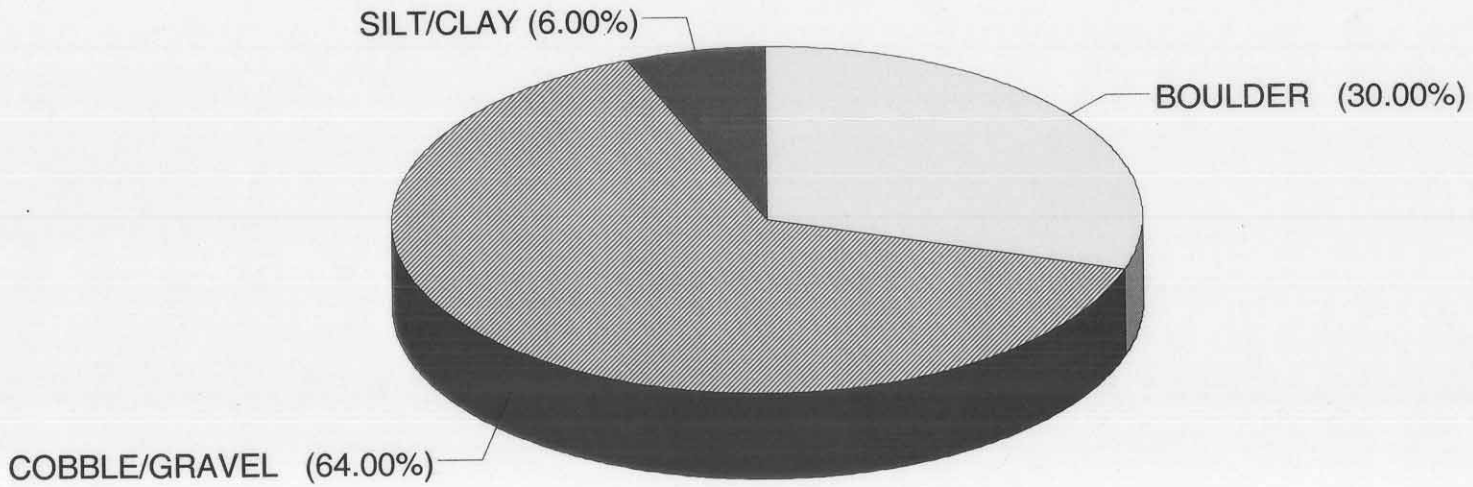
Bull Creek, Humboldt County
PERCENT CANOPY



5 (95)

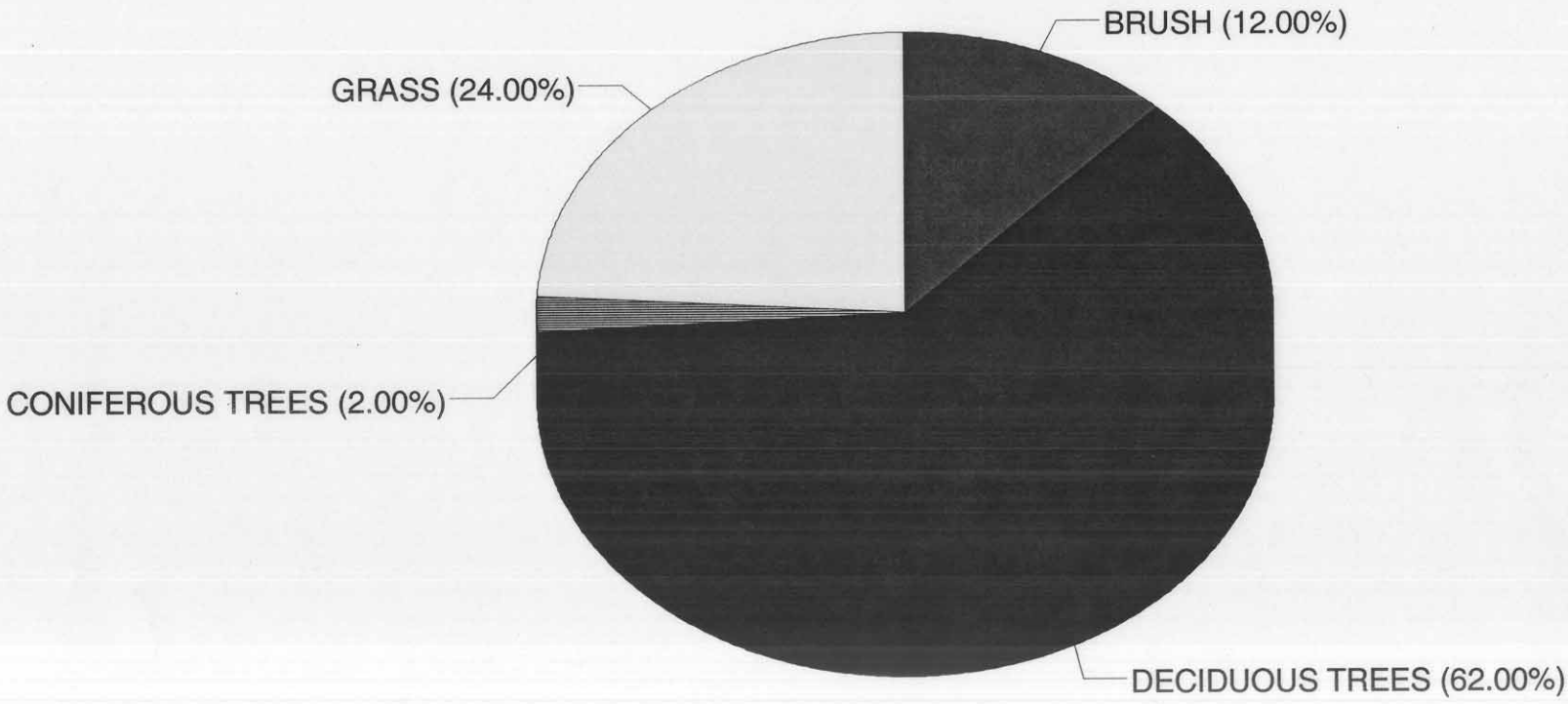
GRAPH 9

Bull Creek, Humboldt County
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

Bull Creek, Humboldt County
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11