CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Humbug Creek
Report Revised April 14, 2006
Report Completed 2000
Assessment Completed 1996

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Humbug Creek . The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in Humbug Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

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

Humbug Creek is a tributary to Mark West Creek, a tributary of the Russian River, located in Sonoma County, California (see Humbug Creek map, page 2). The legal description at the confluence with Mark West Creek is T8N, R7W, S20. Its location is 38°31'12" N. latitude and 122°39'33" W. longitude.

Humbug Creek and its tributaries drain a basin of approximately 2.75 square miles. Humbug Creek is a second order stream and has approximately 3.25 miles of blue line stream, according to the USGS Mark West 7.5 minute quadrangle. Summer flow was measured as approximately 2.4 cfs. Elevations range from about 640 feet at the mouth of the creek to 1600 feet in the headwaters. Grassland and chaparral dominate the watershed, but there are zones of oak-woodland near the mouth. The watershed is privately owned.

METHODS

The habitat inventory conducted in Mark West Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi, et al. 1998). The Sonoma county Water Agency personnel 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 with technical oversight by Bob Coey, Russian River Basin Planner (DFG).

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 Humbug Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows were also measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1996). 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.

3. Temperatures:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed. Temperatures are measured in Fahrenheit at the middle of the habitat unit and within one foot of the water surface. Temperatures are also recorded using remote Temperature recorders which log temperature every two hours, 24 hours/day.

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". Humbug 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 unit lengths were measured, additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were completely sampled (length, mean width, mean depth, maximum depth and pool tail crest depth). All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Humbug Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a rating of "not suitable" (NS)was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, 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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Humbug Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. 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 measured habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the California Salmonid Stream Habitat Restoration Manual, 1994. Canopy density relates to the amount of stream shaded from the sun. In Humbug 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 visually into percentages of evergreen or deciduous trees.

9. Bank Composition:

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 Humbug Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully measured unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. 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 IV 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 tables and appendices:

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

- Vegetative cover and dominant bank composition
- Fish habitat elements by stream reach

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Humbug Creek include:

- Level II Habitat Types by % Occurrence and % Total Length
- Level IV Habitat Types by % Occurrence
- Pool Habitat Types by % Occurrence
- Maximum Depth in Pools
- Pool Shelter Types by % Area
- Substrate Composition in Low Gradient Riffles
- Percent Cobble Embeddedness by Reach
- Mean Percent Canopy
- Mean Percent Canopy by Reach
- Percent Bank Composition and Bank Vegetation

HABITAT INVENTORY RESULTS

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

The habitat inventory of June 4-6, 1996 was conducted by Sean White and Pamela Higgins, Sonoma County Water Agency personnel. The survey began at the confluence with Mark West Creek and extended up Humbug Creek to the end of landowner access permission. The total length of the stream surveyed was 7,052 feet, with an additional 92 feet of side channel. Flow was estimated to be 2.4 cfs during the survey period.

This section of Humbug Creek has four reaches of three different channel types: from the mouth to 2,527 feet an F3; next 1,091 feet an F1; next 1,580 feet an F3 and the upper 1,854 feet an F2. F3 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly cobble substrate. F1 and F2 channel types are similar, but with bedrock and boulder substrates, respectively.

Water temperatures ranged from 62°F to 66°F, and air temperatures ranged from 68°F to 82°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 49% pool units, 35% riffle units, and 16% flatwater units. Based on total length there were 46% pool units, 35% riffle units, and 19% flatwater units (Graph 1).

There were 128 habitat units measured and 19% were completely sampled. Sixteen Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent occurrence were mid-channel pools at 20%, high gradient riffles 16%, low gradient riffles 14% and step pools 7% (Graph 2). By percent total length, mid-channel pools made up 17%, high gradient riffles 17%, low gradient riffles 14%, and step pools 11%.

Sixty-three pools were identified (Table 3). Main Channel pools were most often encountered at 59%, and comprised 70% of the total length of pools (Graph 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty-one of the 63 pools (65%) had a depth of two feet or greater (Graph 4). These deeper pools comprised 32% of the total length of stream habitat.

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. Pool types in general had a mean shelter rating of 28. Of the pool types, the main channel pools had the highest mean shelter rating at 32, scour pools rated 26, and backwater pools rated 5 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were undercut banks at 37%, boulders 30%, and bedrock ledges 22%. Graph 5 describes the pool shelter in Humbug Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was a dominant substrate in none of the two low gradient riffles measured. Small cobble was dominant in both of the low gradient riffles (Graph 6).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 58 pool tail-outs measured, six had a value of 1 (10%); 38 had a value of 2 (66%); two had a value of 3 (3%); and twelve had a value of 4 (21%). On this scale, a value of one is best for fisheries.

The mean percent canopy density for the stream reach surveyed was 79%. The mean percentages of deciduous and evergreen trees were 94% and 6%, respectively. Graph 8 describes the canopy for the entire survey.

For the entire stream reach surveyed, the mean percent right bank

vegetated was 96% and the mean percent left bank vegetated was 96%. For the habitat units measured, the dominant vegetation types for the stream banks were: 91% deciduous trees, and 9% evergreen trees. The dominant substrate for the stream banks were: 66% bedrock, 17% silt/clay/sand, 13% cobble/gravel and 4% boulder (Graph 10).

Biological surveys were not conducted in Humbug Creek in 1996 or 1997 due to inadequate staffing levels.

During the summer of 1997, summer water temperatures were measured using a remote temperature recorder placed in a pool (see Temperature Summary graph at end of report). A temperature recorder was placed in Reach 1 and logged temperatures every two hours from May 15 to September 9, 1997. The highest temperature recorded was 72°F in August and the lowest temperature was 54°F in May.

DISCUSSION

Humbug Creek has three channel types: F3, F1, and F3. There are 4,107 feet of F3 channel type in Reaches 1 and 3. According to the California Salmonid Stream Habitat Restoration Manual, F3 channel types are good for bank-placed boulders as well as single and opposing wing-deflectors. They are fair for low-stage weirs, boulder clusters, channel constrictors and log cover. There are 1,091 feet of F1 channel type in Reach 2. F1 channel types are good for bank-placed boulders and fair for single wing-deflectors and log cover. There are 1,854 feet of F2 channel type in Reach 4. F2 channel types are fair for low-stage weirs, single and opposing wing-deflectors and log cover.

The water temperatures recorded on the survey days June 4-6, 1996 ranged from 62°F to 66°F, and air temperatures ranged from 68°F to 82°F. These higher temperatures are at the threshold stress level (65°F) for salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling conducted.

Pools comprised 46% of the total length of this survey. 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. In Humbug Creek, the pools are relatively deep with 65% having a maximum depth of at least 2 feet. These pools comprised 32% of the total length of stream habitat. In

coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 28. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by undercut banks, boulders, and bedrock ledges. More log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.
Both of the low gradient riffles measured had small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Sixty-six percent of the pool tail-outs measured had embeddedness ratings of 2. Only 10% had a rating of 1. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In a reach comparison, Reaches 1 and 3 had the best ratings. In Humbug Creek, the amount of fine sediment in potential spawning habitat seems to be minimal.

The mean percent canopy for the survey was 79%. This is a good percentage of canopy, since 80 percent is generally considered desirable.

GENERAL RECOMMENDATIONS

Humbug Creek should be managed as an anadromous, natural production stream.

Recent storms brought down many large trees and other woody debris into the stream, which increased the number and quality of pools since the drought years. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Many signs of recent and historic tree and log removal were evident in the active channel during our survey. Efforts to increase flood protection or improve fish access in the short run, have led to long term problems in the system. Landowners should be encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

SPECIFIC FISHERY ENHANCEMENT RECOMMENDATIONS

1) Access for migrating salmonids is an ongoing potential

problem at existing flashboard dams, therefore, fish passage should be monitored, and improved where possible.

2) Increase the canopy on Humbug Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reach above the survey section should be assessed for planting and treated as well, since water temperatures throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

3) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations. This must be in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

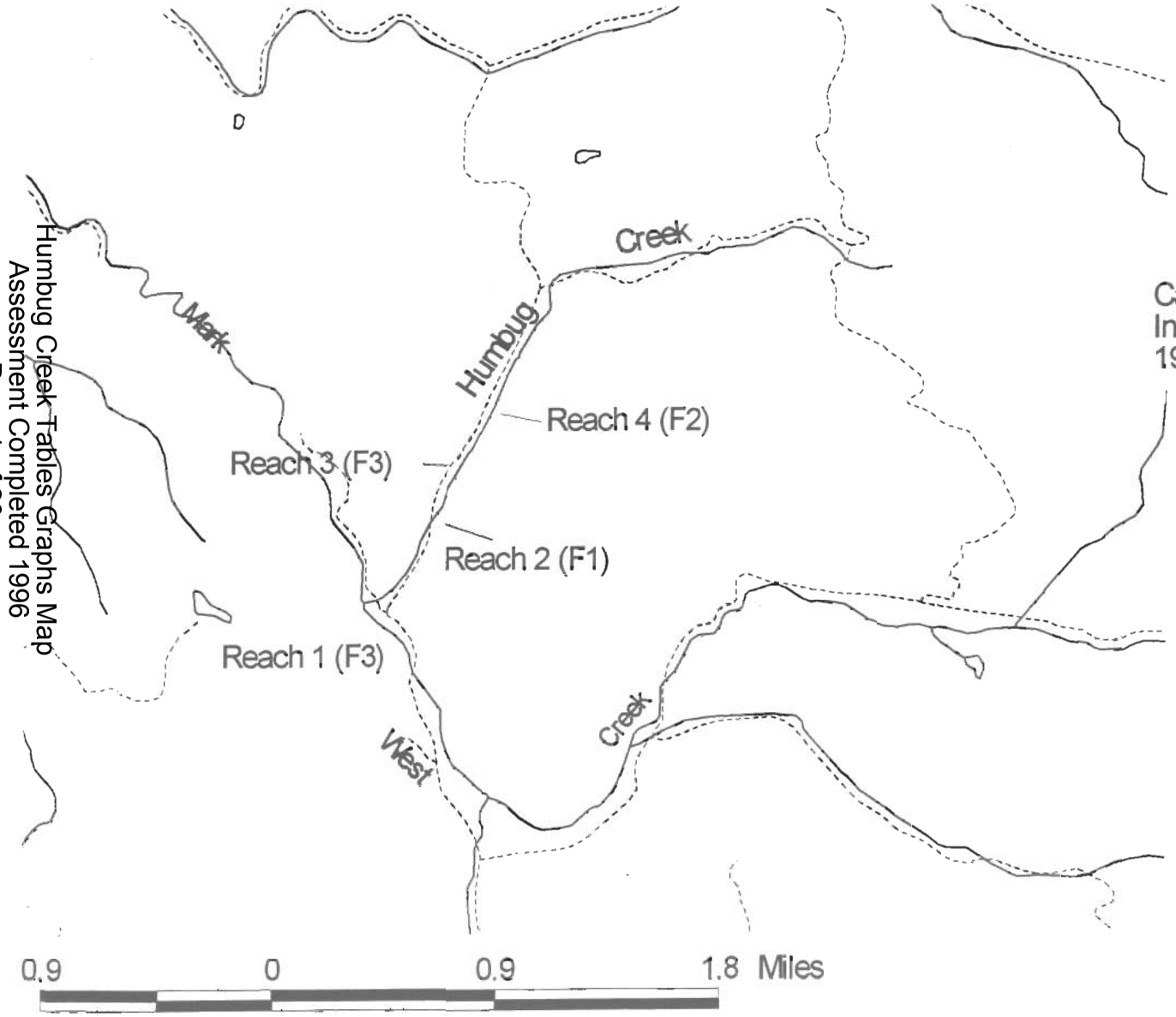
PROBLEM SITES AND LANDMARKS - HUMBUG CREEK SURVEY COMMENTS

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

HABITAT UNIT #	STREAM LEN (FT.)	COMMENTS
8	379	Cement bridge #1 (16.1w x 5.5h x 25.8L)
46	2465	Bridge #2, cement (21.2w x 7.7h x 51.0L); Pacific giant salamander and yellow-legged frog
48	2527	Channel change
58	3012	Last unit before Grijalva property.
59	3036	Begin after skipping Grilalva property. Bridge #3 (7.5h x 16.7w x 16.5L)
60	3082	right bank cmp gabions
64	3423	Resident (Manley) noted disappearance of crawdads in lst 2 years; coho seen 20 years ago.
67	3576	Bridge #4 (wood rail car, 16.0w x 7.2h x 22.0L)
69	3700	Channel change, back to downstream channel type
70	3827	Redwood bridge w/2 cmp piers in channel.

74	4108	Pacific giant salamander (PGS) present.
75	4149	crawfish present
76	4257	Dry trib. left bank.
77	4331	Flashboard dam
80	4625	Bridge #5 (Henke property) wooden (7.0h x 12.5w x 11.0L)
84	4860	Bridge #6 cement/wood (5.5h x 14.5w.x.13.0L)
89	5073	Redwood flashboard dam
90	5151	End downstream of Bridge #7.
91	5198	3168 Calistoga (Blair) begin again here. Skipped Upp property.
92	5240	Channel change.
95	5378	Bridge #8 wood (14.0L x 11.6h x 17.0w)
100	5561	Lieberman property (upstream end)
106	5777	concrete check dam
107	5833	Bridge #9 wooden
108	5956	Concrete check dam at downstream end of unit
109	6001	Side channel begins and ends.
110	6039	Bridge #9 wood (10.0L x 15.0w x 4.2h)
113	6346	Rootwad, lwd (1st seen in creek)
126	7027	Gradient getting steeper, habitat not good.
127	7052	End survey Holman property; Moir property--large plunge pool (6' deep, 6' drop to pool)

Humbug Creek



California Department of Fish and Game
Inland Fisheries Division
1997

Roads
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Humbug Creek Tables Graphs Map
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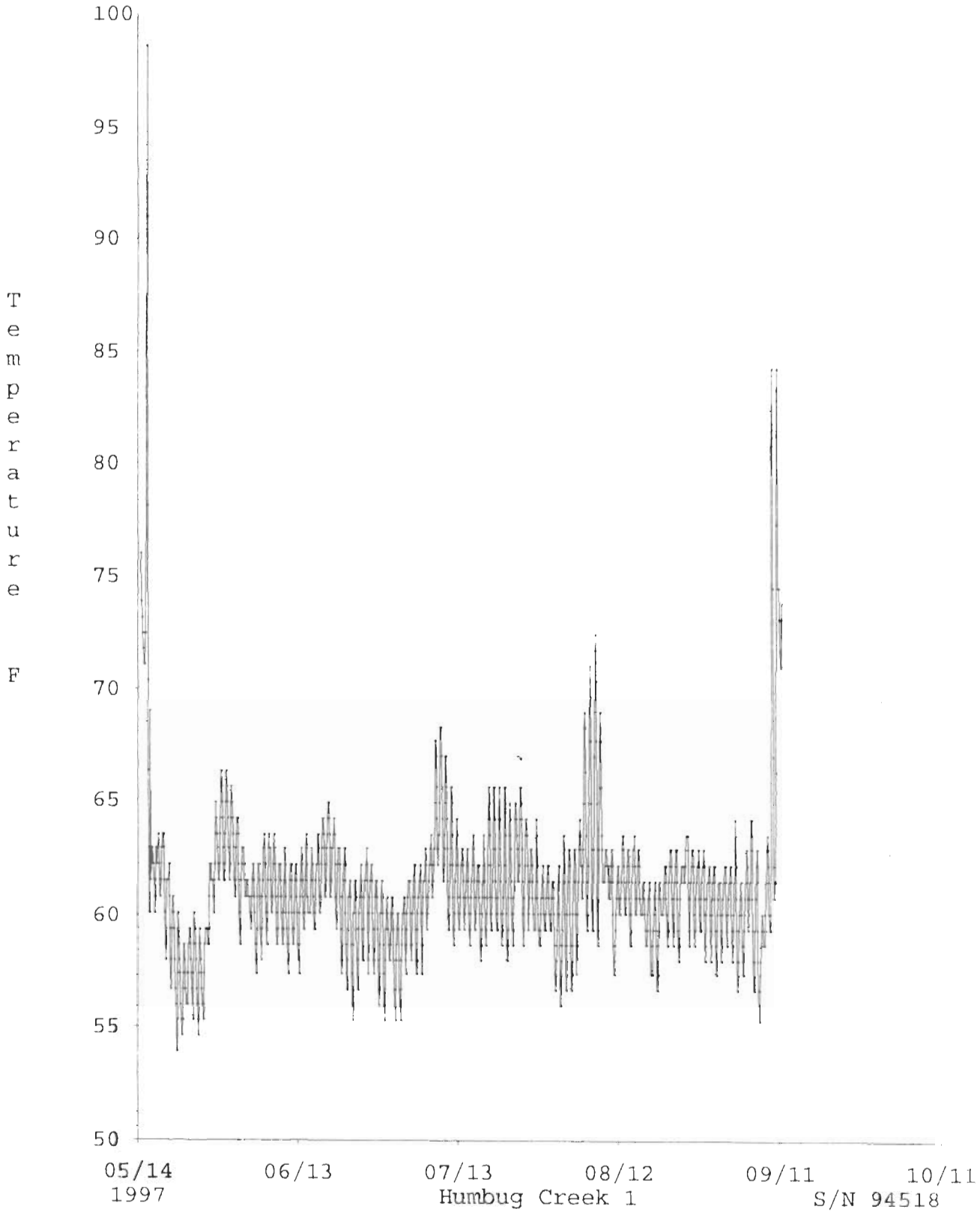
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Humbug Creek 1
S/N 94518

Humbug Creek

Drainage: Mark West Creek, Russian River

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

Survey Dates: 06/04/96 to 06/06/96

Confluence Location: QUAD: MARK WEST LEGAL DESCRIPTION: T8NR7WS20 LATITUDE: 38°31'12" LONGITUDE: 122°39'33"

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
45	2	RIFFLE	35	56	2505	35	8.2	0.5	444	19999	208	9376	0	1
20	2	FLATWATER	16	67	1345	19	8.3	0.6	523	10462	330	6605	0	0
63	20	POOL	49	52	3294	46	9.6	1.6	499	31441	836	52669	708	28

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
128	24	7144	61902	68650

Humbug Creek

Drainage: Mark West Creek, Russian River

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 06/04/96 to 06/06/96

Confluence Location: QUAD: MARK WEST LEGAL DESCRIPTION: T8NR7WS20 LATITUDE: 38°31'12" LONGITUDE: 122°39'33"

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 %
18	1	LGR	14	56	1013	14	10	0.4	1.1	528	9497	219	3950	0	0	77
20	0	HGR	16	59	1180	17	8	0.5	1.1	452	9044	238	4758	0	0	81
4	1	CAS	3	47	187	3	5	0.6	2.1	230	920	136	545	0	10	66
3	0	BRS	2	42	126	2	4	0.2	0.6	179	538	41	124	0	0	75
1	0	POW	1	65	65	1	9	0.9	1.8	605	605	544	544	0	0	85
5	1	GLD	4	45	224	3	9	0.7	1.8	424	2119	311	1555	0	0	82
7	0	RUN	5	63	444	6	9	0.6	1.1	585	4097	346	2420	0	0	79
7	1	SRN	5	87	612	9	7	0.6	1.2	520	3641	298	2085	0	0	85
3	2	TRP	2	90	271	4	5	2.1	3.6	470	1409	1132	3395	1060	20	88
25	9	MCP	20	49	1228	17	10	1.8	6.0	515	12878	952	23795	775	27	81
9	3	STP	7	89	801	11	8	1.2	5.2	727	6544	920	8276	974	73	80
8	2	LSR	6	36	286	4	10	1.1	2.6	350	2798	388	3105	242	23	80
7	1	LSBk	5	44	311	4	10	1.5	2.2	444	3106	680	4762	508	12	75
1	1	LSBo	1	37	37	1	7	1.2	1.8	260	260	312	312	260	100	70
8	2	PLP	6	29	235	3	9	1.5	3.2	261	2091	458	3663	392	31	82
2	0	DPL	2	63	126	2	17	2.4	3.6	1103	2205	2456	4913	2346	5	80

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
128	24	7144	61752	68202

Humbug Creek

Drainage: Mark West Creek, Russian River

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 06/04/96 to 06/06/96

Confluence Location: QUAD: MARK WEST LEGAL DESCRIPTION: T8NR7WS20 LATITUDE: 38°31'12" LONGITUDE: 122°39'33"

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
37	14	MAIN	59	62	2300	70	9.3	1.7	563	20831	959	35466	831	32
24	6	SCOUR	38	36	867	26	9.5	1.4	344	8249	498	11951	375	26
2	0	BACKWATER	3	63	126	4	16.8	2.4	1103	2205	2456	4913	2346	5

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
63	20	3294	31286	52330

Humbug Creek — Drainage: Mark West Creek, Russian River

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES — Survey Dates: 06/04/96 to 06/06/96

Confluence Location: QUAD: MARK WEST LEGAL DESCRIPTION: T8NR7WS20 — LATITUDE: 38°31'12" LONGITUDE: 122°39'33"

UNITS MAX DPTH 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
3	TRP	5	0	0	0	0	2	67	1	33	0	0
25	MCP	40	0	0	5	20	15	60	3	12	2	8
9	STP	14	0	0	4	44	3	33	1	11	1	11
8	LSR	13	0	0	6	75	2	25	0	0	0	0
7	LSBk	11	0	0	2	29	5	71	0	0	0	0
1	LSBo	2	0	0	1	100	0	0	0	0	0	0
8	PLP	13	0	0	4	50	2	25	2	25	0	0
2	DPL	3	0	0	0	0	1	50	1	50	0	0

TOTAL UNITS 63

Humbug Creek — Drainage: Mark West Creek, Russian River

Table 5 - Summary of Shelter by Habitat Type — Survey Dates: 06/04/96 to 06/06/96

Confluence Location: QUAD: MARK WEST LEGAL DESCRIPTION: T8NR7WS20 LATITUDE: 38°31'12" LONGITUDE: 122°39'33"

UNITS MEASURED	UNITS SHELTER MEASURED	HABITAT TYPE	% TOTAL UNDERCUT BANKS	% TOTAL SWD	% TOTAL LWD	% TOTAL ROOT MASS	% TOTAL TERR. VEGETATION	% TOTAL AQUATIC VEGETATION	% TOTAL WHITE WATER	% TOTAL BOULDERS	% TOTAL BEDROCK LEDGES
18	5	LGR	0	0	0	0	0	0	0	0	0
20	1	HGR	0	0	0	0	0	0	0	0	0
4	1	CAS	95	0	0	0	0	0	5	0	0
3	1	BRS	0	0	0	0	0	0	0	0	0
1	0	POW	0	0	0	0	0	0	0	0	0
5	1	GLD	0	0	0	0	0	0	0	0	0
7	2	RUN	0	0	0	0	0	0	0	0	0
7	1	SRN	0	0	0	0	0	0	0	0	0
3	3	TRP	0	0	0	0	0	0	0	4	96
25	23	MCP	58	0	0	6	8	0	0	13	15
9	4	STP	34	0	0	3	0	0	1	62	0
8	8	LSR	18	0	0	33	15	0	0	33	0
7	7	LSBk	33	0	0	20	0	0	0	25	22
1	1	LSBo	0	0	0	0	0	0	0	100	0
8	8	PLP	32	0	0	0	0	0	2	24	42
2	2	DPL	0	0	0	0	0	0	0	86	14
128	68	ALL HABITAT TYPES	38	0	0	6	4	0	1	30	22
63	56	POOLS ONLY	37	0	0	6	4	0	1	30	22

Humbug Creek | Drainage: Mark West Creek, Russian River

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE | Survey Dates: 06/04/96 to 06/06/96

Confluence Location: QUAD: MARK WEST LEGAL DESCRIPTION: T8NR7WS20 LATITUDE: 38°31'12" LONGITUDE: 122°39'33"

TOTAL HABITAT UNITS	UNITS SUBSTRATE 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
18	2	LGR	0	0	0	100	0	0	0
1	1	HGR	0	0	0	0	100	0	0
3	3	CAS	0	0	0	0	0	33	67
2	2	BRS	0	0	0	0	0	0	100
1	1	POW	0	0	0	0	0	0	100
2	2	GLD	0	0	0	50	0	0	50
1	1	RUN	0	0	0	0	0	0	100
2	2	SRN	0	0	0	0	100	0	0
2	2	TRP	0	0	0	0	0	0	100
9	9	MCP	0	78	11	0	0	0	11
3	3	STP	0	33	0	0	33	0	33
2	2	LSR	0	0	0	0	50	50	0
1	1	LSBk	0	100	0	0	0	0	0
1	1	LSBo	0	0	0	0	0	100	0
2	2	PLP	0	0	0	0	0	0	100
0	0	DPL	0	0	0	0	0	0	0

Humbug Creek

APPENDIX A. Summary of Mean Percent Vegetative Cover for Entire Stream

Mean Percent Canopy	Mean Percent Evergreen	Mean Percent Deciduous	Mean Right bank % Cover	Mean Left Bank % Cover
79.11	6.43	93.57	96.05	96.45

APPENDIX B.

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Bedrock	26	24	65.79
Boulder	2	1	3.95
Cobble/Gravel	6	4	13.16
Silt/clay	4	9	17.11

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Grass	0	0	0
Brush	0	0	0
Deciduous Trees	34	35	90.79
Evergreen Trees	4	3	9.21
No Vegetation	0	0	0

APPENDIX C. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Humbug Creek
SAMPLE DATES: 06/04/96 to 06/06/96
STREAM LENGTH: 7052 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: MARK WEST — Latitude: 38°31'12"
Legal Description: T8NR7WS20 — Longitude: 122°39'33"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 1 (Units 1-48)

Channel Type: F3	Mean Canopy Density: 80%
Channel Length: 2527 ft.	Evergreen Component: 5%
Riffle/Flatwater Mean Width: 10 ft.	Deciduous Component: 95%
Total Pool Mean Depth: 1.6 ft.	Pools by Stream Length: 45%
Base Flow: 2.4 cfs	Pools >=3 ft. deep: 14%
Water: 62-66°F Air: 75-82°F	Mean Pool Shelter Rtn: 22
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Undercut Banks
Bank Vegetative Cover: 96%	Occurrence of LOD: 0%
Dom. Bank Substrate: Bedrock	Dry Channel: 0 ft.

Embeddness Value: 1. 27% 2. 64% 3. 9% 4. 0%

STREAM REACH 2 (Units 49-68)

Channel Type: F1	Mean Canopy Density: 82%
Channel Length: 1091 ft.	Evergreen Component: 5%
Riffle/Flatwater Mean Width: 7 ft.	Deciduous Component: 95%
Total Pool Mean Depth: 1.7 ft.	Pools by Stream Length: 55%
Base Flow: 2.4 cfs	Pools >=3 ft. deep: 18%
Water: 62-64°F Air: 78-78°F	Mean Pool Shelter Rtn: 25
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Bedrock Ledges
Bank Vegetative Cover: 98%	Occurrence of LOD: 0%
Dom. Bank Substrate: Bedrock	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 60% 3. 0% 4. 40%

STREAM REACH 3 (Units 69-91)

Channel Type: F3	Mean Canopy Density: 81%
Channel Length: 1580 ft.	Evergreen Component: 1%
Riffle/Flatwater Mean Width: 8 ft.	Deciduous Component: 99%
Total Pool Mean Depth: 1.6 ft.	Pools by Stream Length: 39%
Base Flow: 2.4 cfs	Pools >=3 ft. deep: 17%
Water: 62-64°F Air: 70-78°F	Mean Pool Shelter Rtn: 30
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Bedrock Ledges
Bank Vegetative Cover: 97%	Occurrence of LOD: 0%
Dom. Bank Substrate: Bedrock	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 91% 3. 0% 4. 9%

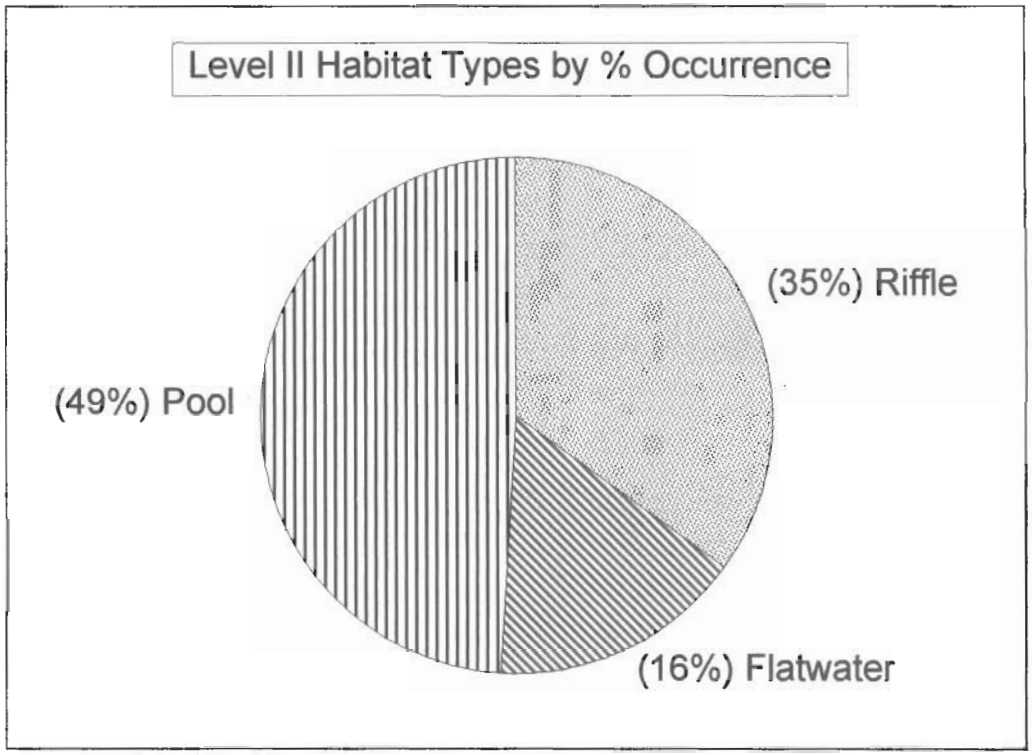
STREAM REACH 4 (Units 92-127)

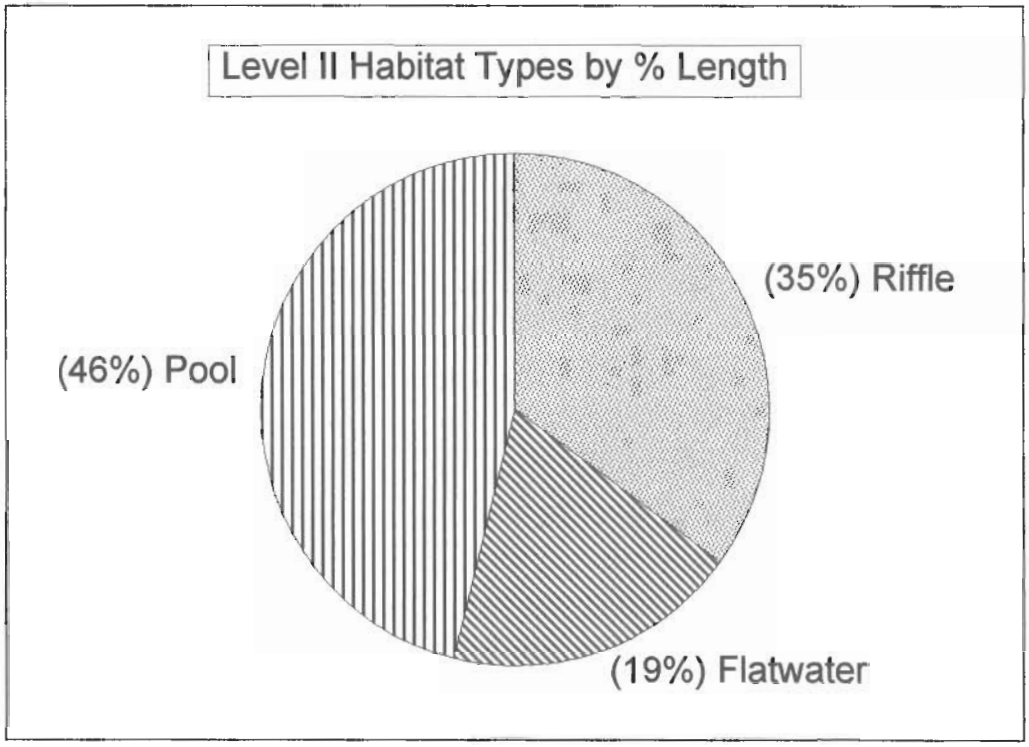
Channel Type: F2	Mean Canopy Density: 76%
Channel Length: 1854 ft.	Evergreen Component: 12%
Riffle/Flatwater Mean Width: 7 ft.	Deciduous Component: 88%
Total Pool Mean Depth: 1.6 ft.	Pools by Stream Length: 50%
Base Flow: 2.4 cfs	Pools >=3 ft. deep: 22%
Water: 62-62°F Air: 68-80°F	Mean Pool Shelter Rtn: 40
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Bank Vegetative Cover: 65%	Occurrence of LOD: 0%
Dom. Bank Substrate: Bedrock	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 53% 3. 0% 4. 47%

Humbug Creek

Level II Habitat Types

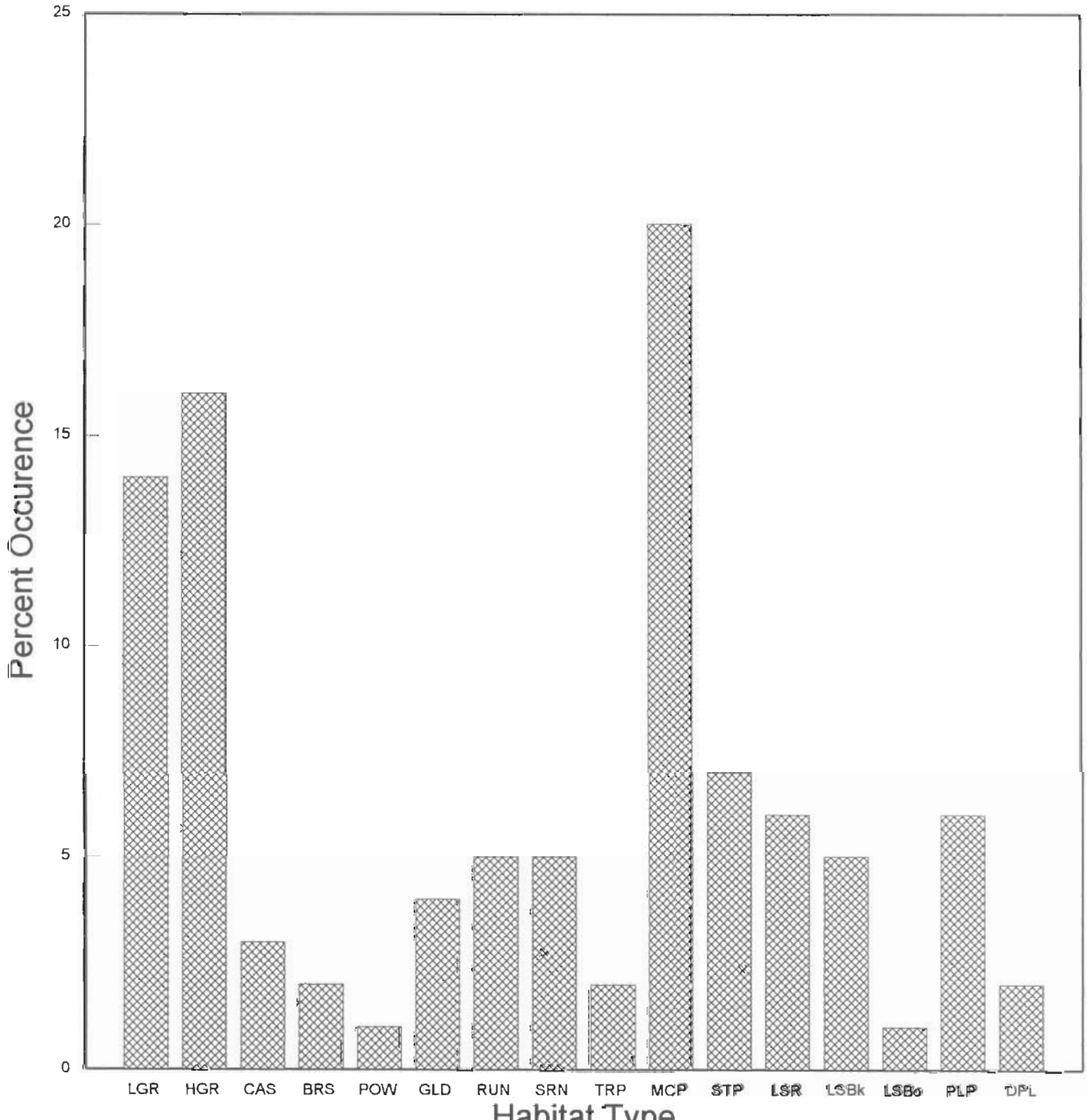




Graph 1

Humbug Creek

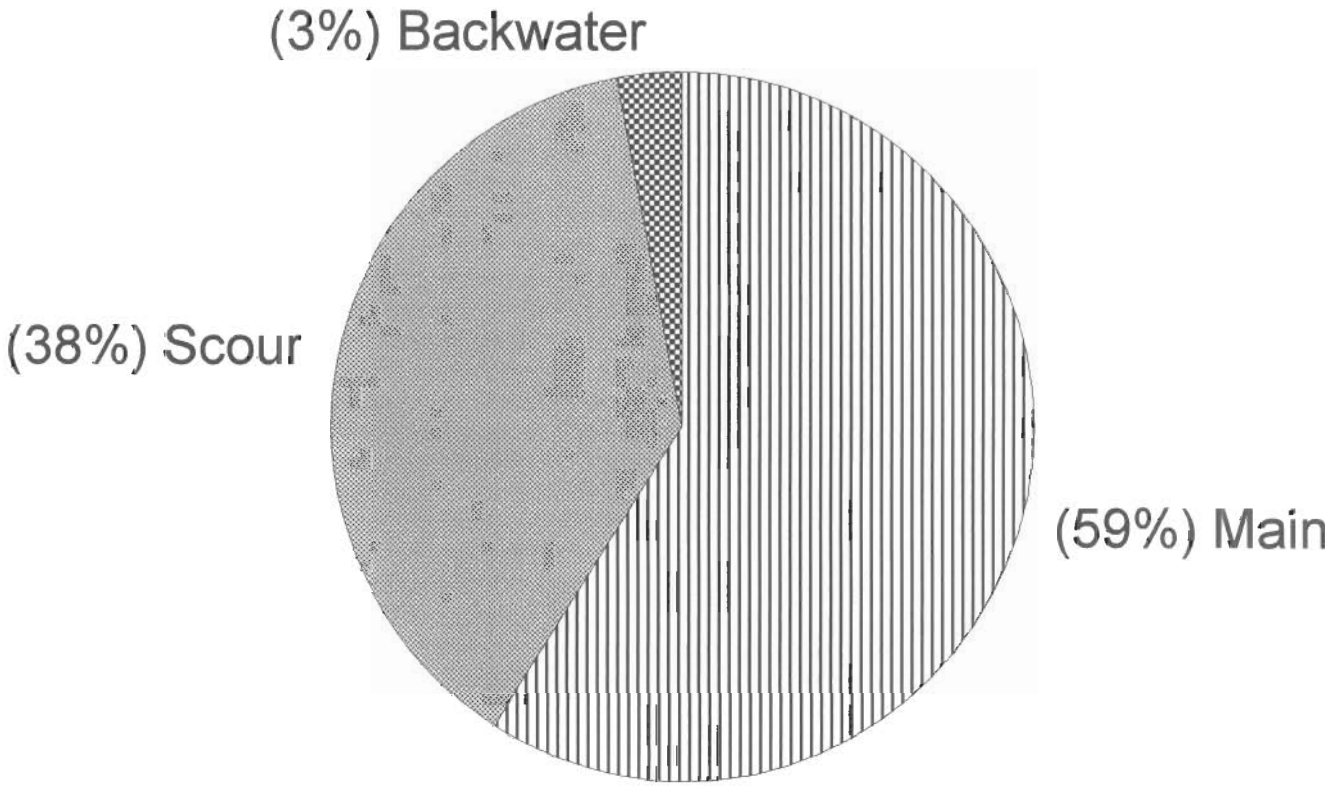
Level IV Habitat Types by % Occurrence



Graph 2

Humbug Creek

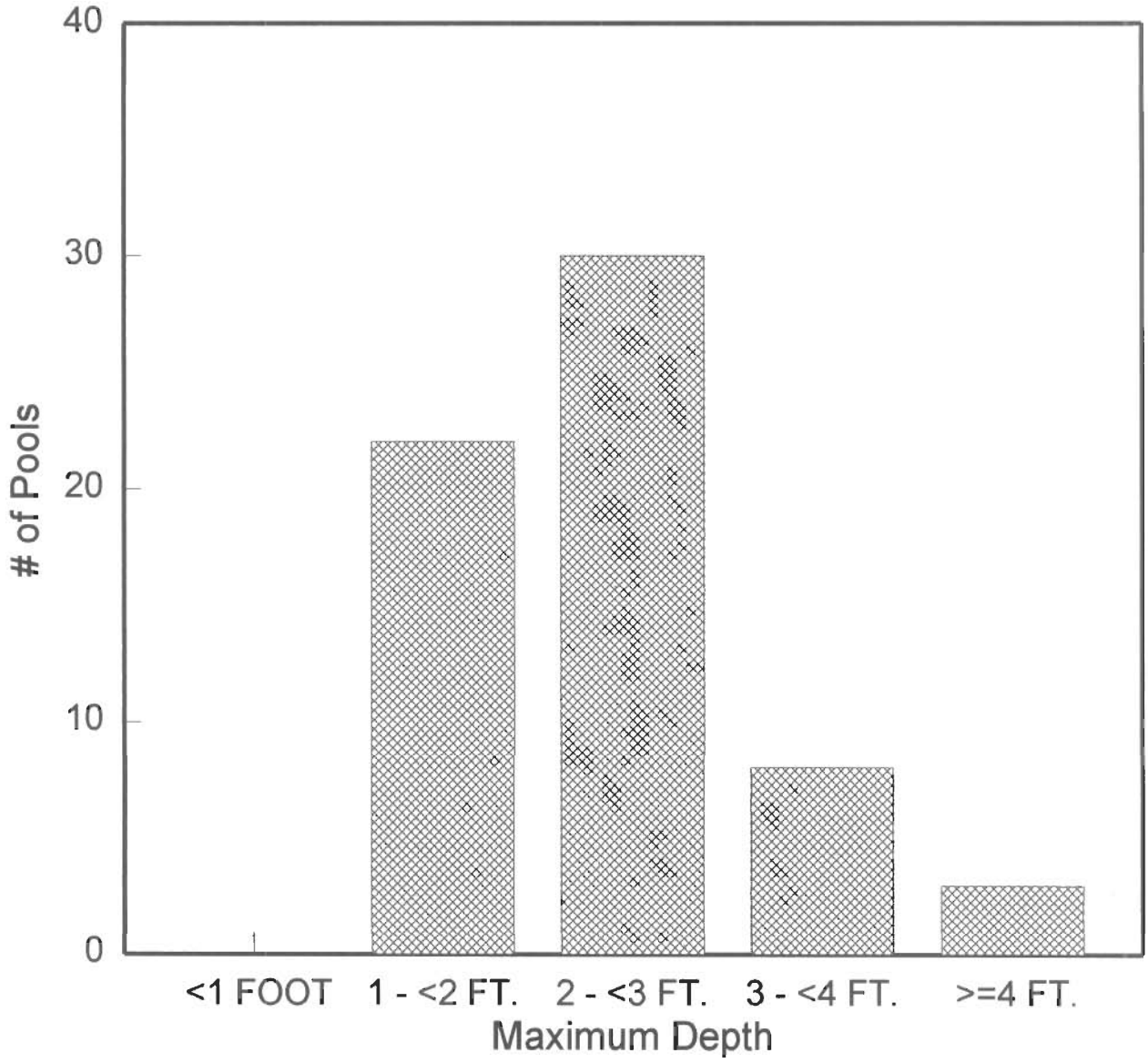
Pool Habitat Types by % Occurrence



Graph 3

Humbug Creek

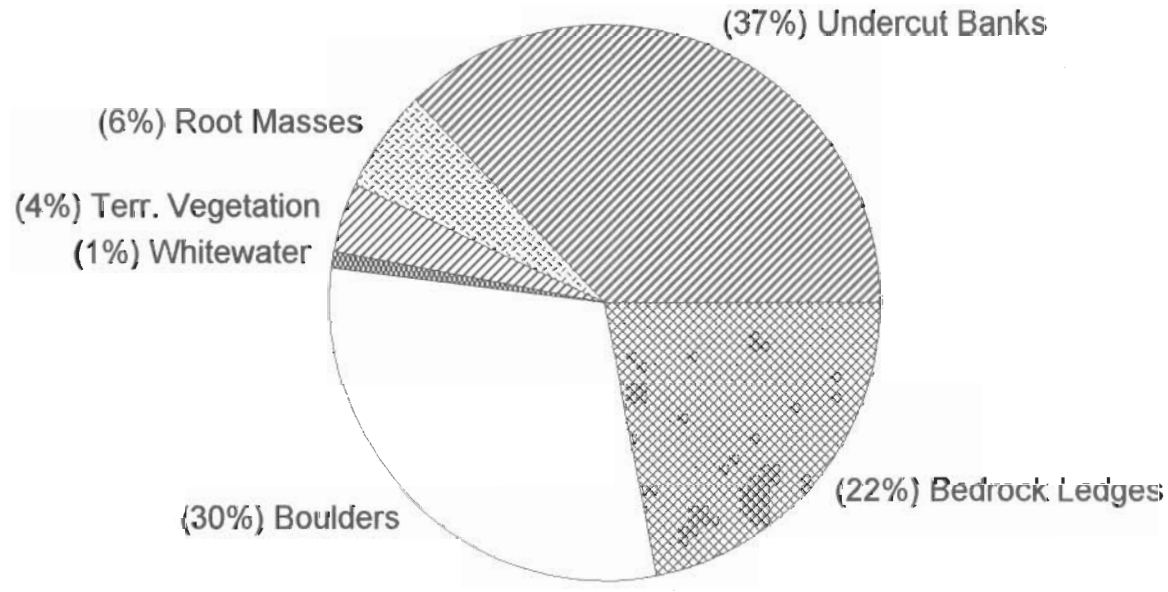
Maximum Depth in Pools



Graph 4

Humbug Creek

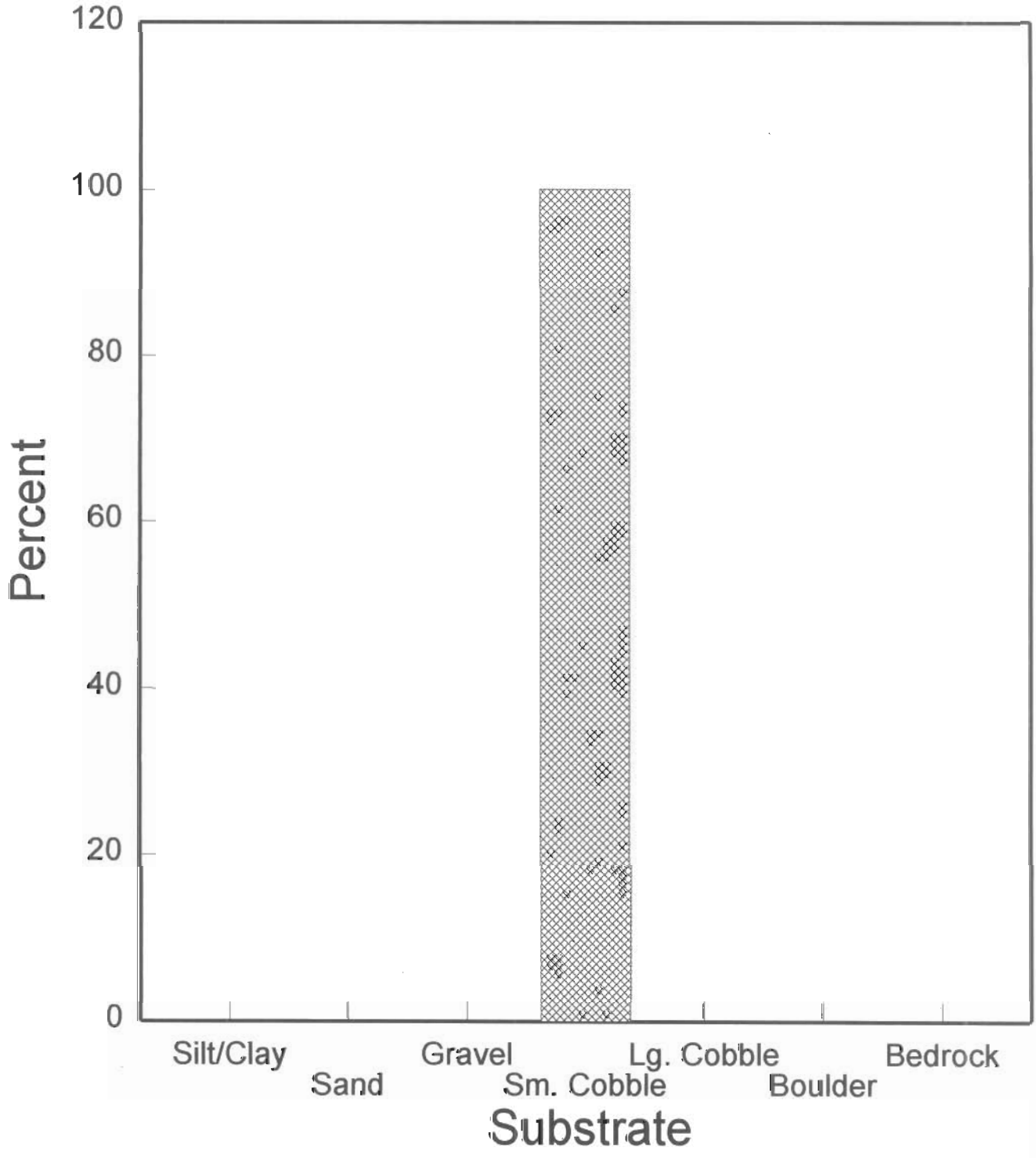
Pool Shelter Types by % Area



Graph 5

Humbug Creek

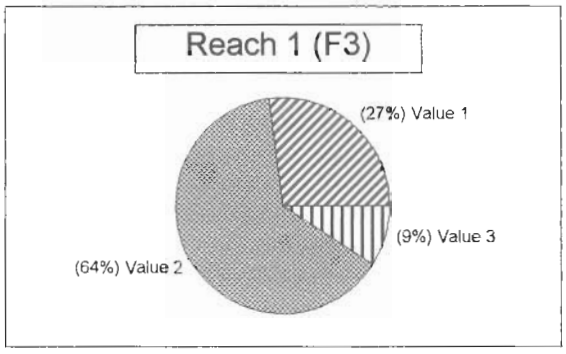
Substrate Composition in Low Gradient Riffles

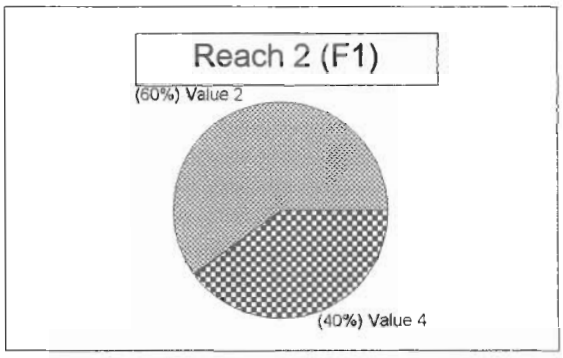


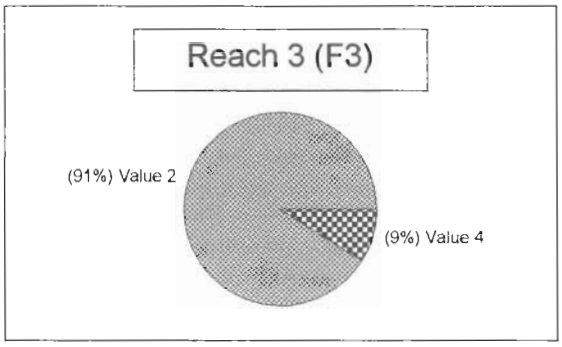
Graph 6

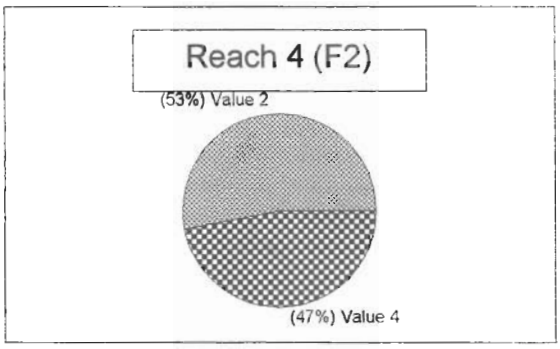
Humbug Creek

Percent Cobble Embeddedness by Reach







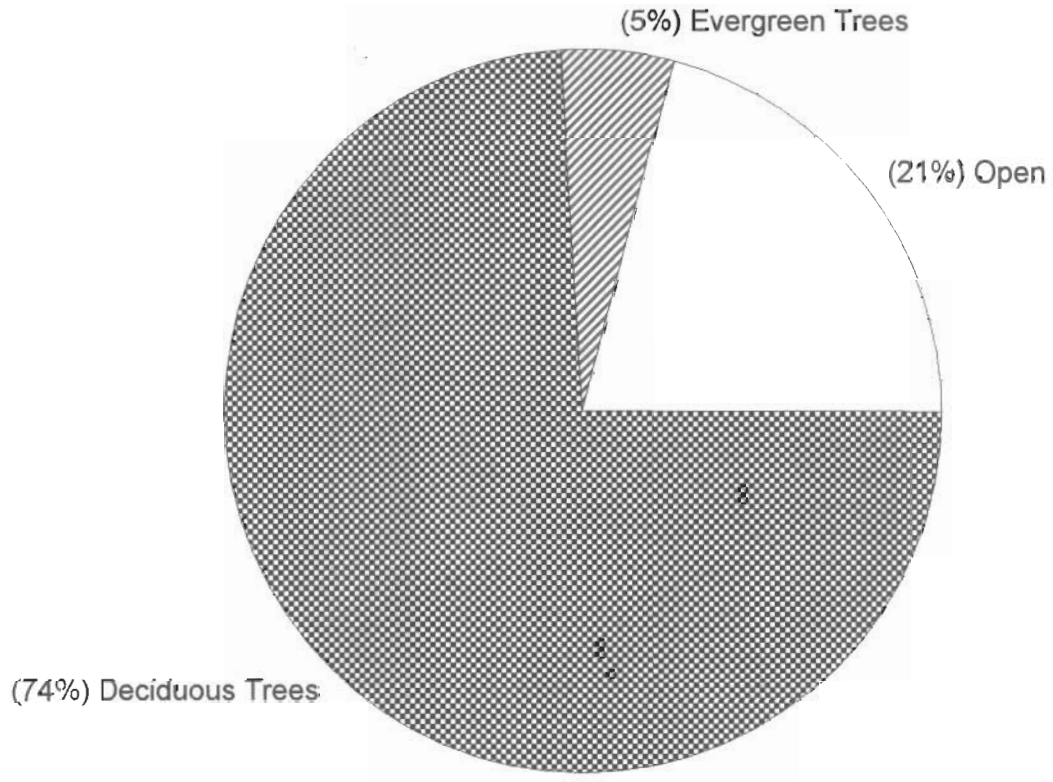


Value 1 = <25% Value 2 = 25-50% Value 3 = 51-75% Value 4 = >76%

Graph 7

Humbug Creek

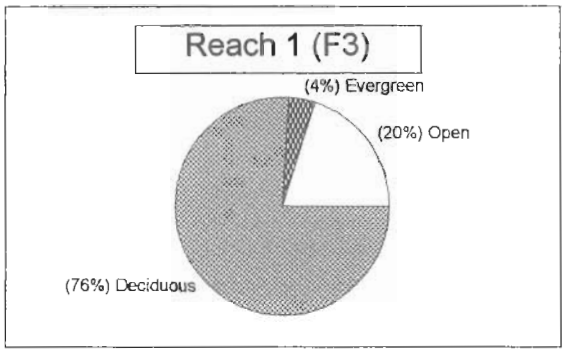
Mean Percent Canopy

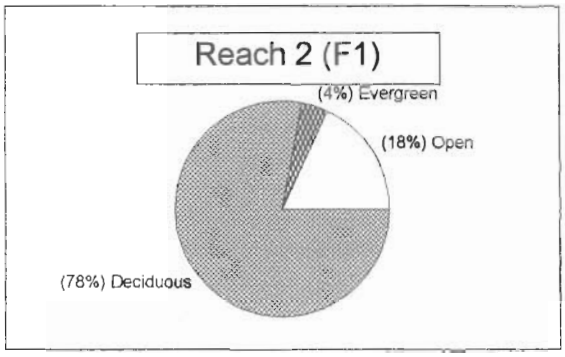


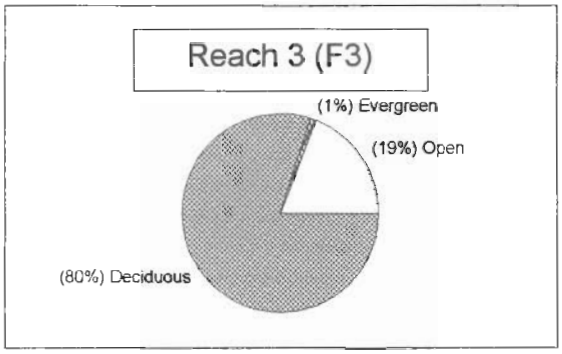
Graph 8

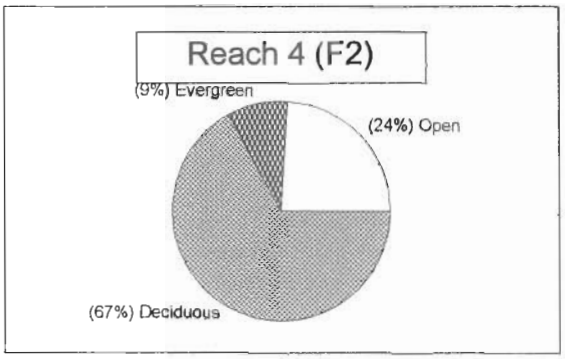
Humbug Creek

Percent Canopy By Reach





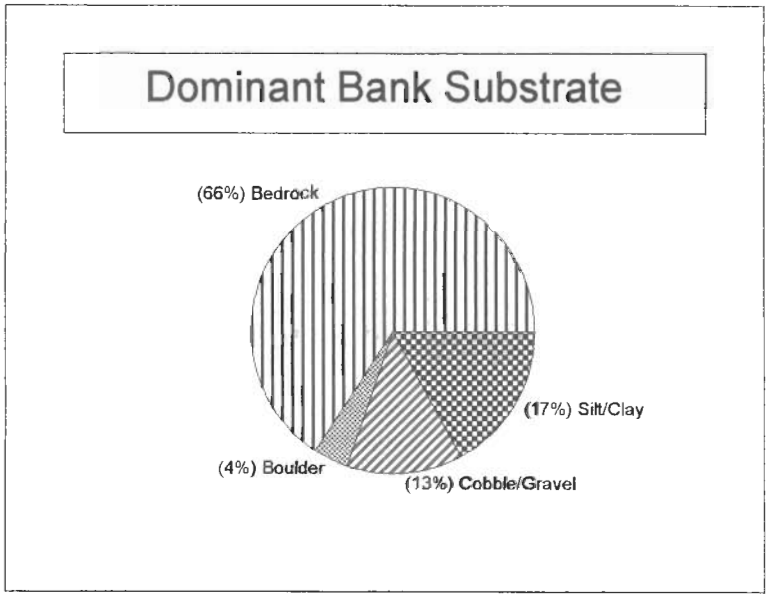


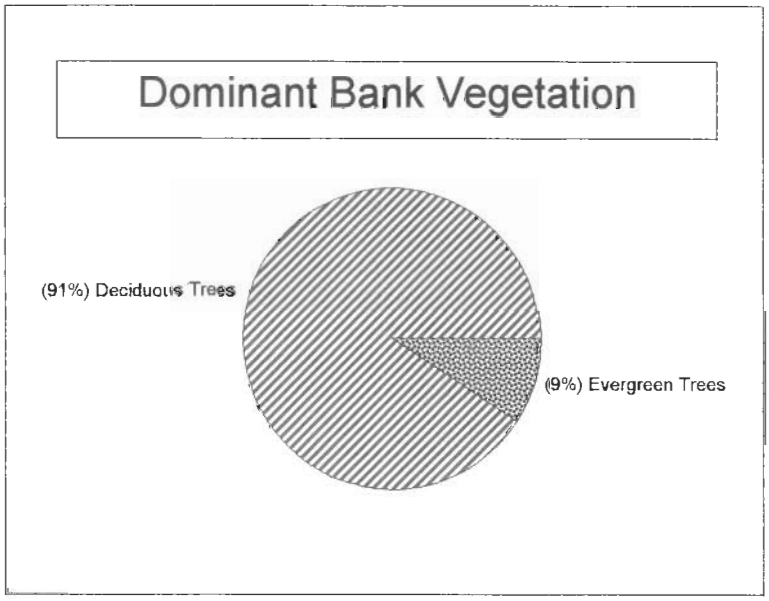


Graph 9

Humbug Creek

Percent Bank Composition





Graph 10