CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Mission Creek
Report Revised April 14, 2006
Report Completed 1998
Assessment Completed 1997

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Mission 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 Mission 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

Mission Creek is a tributary to Hulbert Creek, a tributary of the Russian River, located in Sonoma County, California (see Mission Creek map, page 2). The legal description at the confluence with Hulbert Creek is T8N, R11W, S25. Its location is 38°30'14" N. latitude and 123°01'37" W. longitude. Year round vehicle access exists from Highway 101 near Monte Rosa, via Old Cazadero Road.

Mission Creek and its tributaries drain a basin of approximately 1.6 square miles. Mission Creek is a first order stream and has approximately 1.7 miles of blue line stream, according to the USGS Cazadero 7.5 minute quadrangles. Summer flow was estimated as approximately 0.3 cfs. Elevations range from about 196 feet at the mouth of the creek to 1000 feet in the headwaters. The watershed is dominated by Redwood forest, along with some mixed conifer and Oak Woodlands in the upper reaches.

METHODS

The habitat inventory conducted in Mission Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1997). The Americorps Volunteers 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 and was supervised 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 Mission 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 (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 were 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". Mission 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 Mission 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). A rating of "not suitable" (5) 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 Mission 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, 1997. Canopy density relates to the amount of stream shaded from the sun. In Mission 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 Mission 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 Mission 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 09/03/97 to 09/04/97 was conducted by Edward Sanchez and Marc Miller (AmeriCorps). The survey began at the confluence with the Russian River and extended up Mission Creek to the end of the survey. The total length of the stream surveyed was 6086 feet, with no side channels.

Flows were not measured on Mission Creek, but when compared to Hulbert Creek, the flow was estimated to be .3 cfs.

Mission Creek has one channel type: an F4 from the mouth to 6086 feet. F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate.

Water temperatures ranged from 60°F to 61°F. Air temperatures ranged from 71°F to 79°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 47% riffle units, 32% pool units, 15% dry streambed units, and 6% flatwater units. Based on total **length** there were 58% dry streambed units, 35% riffle units, 6% pool units, and 1% flatwater units (Graph 1).

Forty seven habitat units were measured and 19% were completely sampled. 9 Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles at 45%, dry streambed 15%, boulder scour pools 11% and root wad scour pools 9% (Graph 2). By percent total **length**, dry streambed made up 58%, low gradient riffles 35%, boulder scour pools 2%, and runs 1%.

Fifteen pools were identified (Table 3). Scour pools were most often encountered at 100%, and comprised 100% 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. Three of the 15 pools (20%) had a depth of two feet or greater (Graph 4). These deeper pools comprised only 1% 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 had the highest shelter rating at 14, and riffle types rated 2 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 14 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were undercut banks at 31%, boulders 28%, large woody debris 21%, and small woody debris 9%. Graph 5 describes the pool shelter in Mission Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in all of the low gradient riffles measured (Graph 6).

No mechanical gravel sampling was conducted in 1997 surveys due to inadequate staffing levels.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 15 pool tail-outs measured, six had a value of 1 (40%); seven had a value of 2 (47%); two had a value of 3 (13%); and none had a value of 4. On this scale, a value of one is best for fisheries.

The mean percent canopy density for the stream reach surveyed was 82%. The mean percentages of deciduous and evergreen trees were 20% and 80%, respectively. Graph 8 describes the canopy for the entire survey.

For the entire stream reach surveyed, the mean percent right bank vegetated was 83% and the mean percent left bank vegetated was 86%. For the habitat units measured, the dominant vegetation types for the stream banks were: 90% evergreen trees and 10% deciduous trees. The dominant substrate for the stream banks were: 75% silt/clay/sand and 25% bedrock (Graph 10).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In 1997 biological inventory was conducted in Mission Creek to document the fish species composition and distribution at several locations. Each site was single pass electrofished in Mission Creek using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, and returned to the stream. The 1997 fall survey counted 0+, 1+ and 2+ Steelhead in Mission Creek.

A summary of recent data collected appears in the table below.

Species Observed in Recent Surveys			
YEARS	**SPECIES**	**SOURCE**	**Native/Introduced**
1997	Steelhead	DFG	N
1997	Sculpin	DFG	N

1997	Pacific Giant Salamander	DFG	N

DISCUSSION

Mission Creek has one channel types F4 (6086 ft.). According to the DFG Salmonid Stream Habitat Restoration Manual, F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover.

Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter.

The water temperatures recorded on the survey days 09/03/97 to 09/04/97 ranged from 60°F to 61°F. Air temperatures ranged from 71°F to 79°F. This temperature regime is favorable to salmonids.

Pools comprised 6% 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 Mission Creek, the pools are relatively shallow with 20% having a maximum depth of at least 2 feet. These pools comprised only 1% 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 14. 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 (31%), boulders (28%), large woody debris (21%), and small woody debris (9%). Log and root wad cover in the pools and flatwater are needed to 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.

All of the low gradient riffles measured had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Of the pool tail-outs measured, 13% had embeddedness ratings of either 3 or 4, 47% were rated 2, and 40% 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.

The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because

of fine sediment capping the redd and preventing fry emergence. The amount of fine sediment in potential spawning habitat seems to be low.

The mean percent canopy for the entire survey was 82%. This is very good, since 80 percent is generally considered desirable. Vegetation removal within the riparian corridor leads to less stream canopy, and can cause channel incision, bank erosion, and higher water temperatures. Large trees required to contribute shade also provide a long term source of large woody debris needed for instream structure and bank stability.

SUMMARY

Biological surveys were conducted to document fish distribution and are not necessarily representative of population information. Steelhead were documented consistently during each past survey year and coho only intermittently. This is likely because physiological and environmental requirements for coho are more stringent than for steelhead, or coho were absent or present only in small numbers in some years. The 1997 fall surveys documented 0+ fish indicating successful spawning in Mission Creek. 1+ fish were observed, indicating good rearing conditions the year before.

In general, Mission Creek is good salmon and steelhead habitat. The few deep pools which occur may be used as rearing habitat. Riffle habitat does exist for producing fry, which may rear in pools downstream on Hulbert Creek. Any work considered in these reaches will require careful design, placement, and construction that must include protection for the unstable banks and high stream velocities. Log cover structures could be used to increase instream shelter and pool depth.

GENERAL RECOMMENDATIONS

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

The recent winter 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 sensitive about the natural and positive role woody debris plays in the system, and 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)Map sources of upslope and in-channel 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. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff.

2)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 in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

3) Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

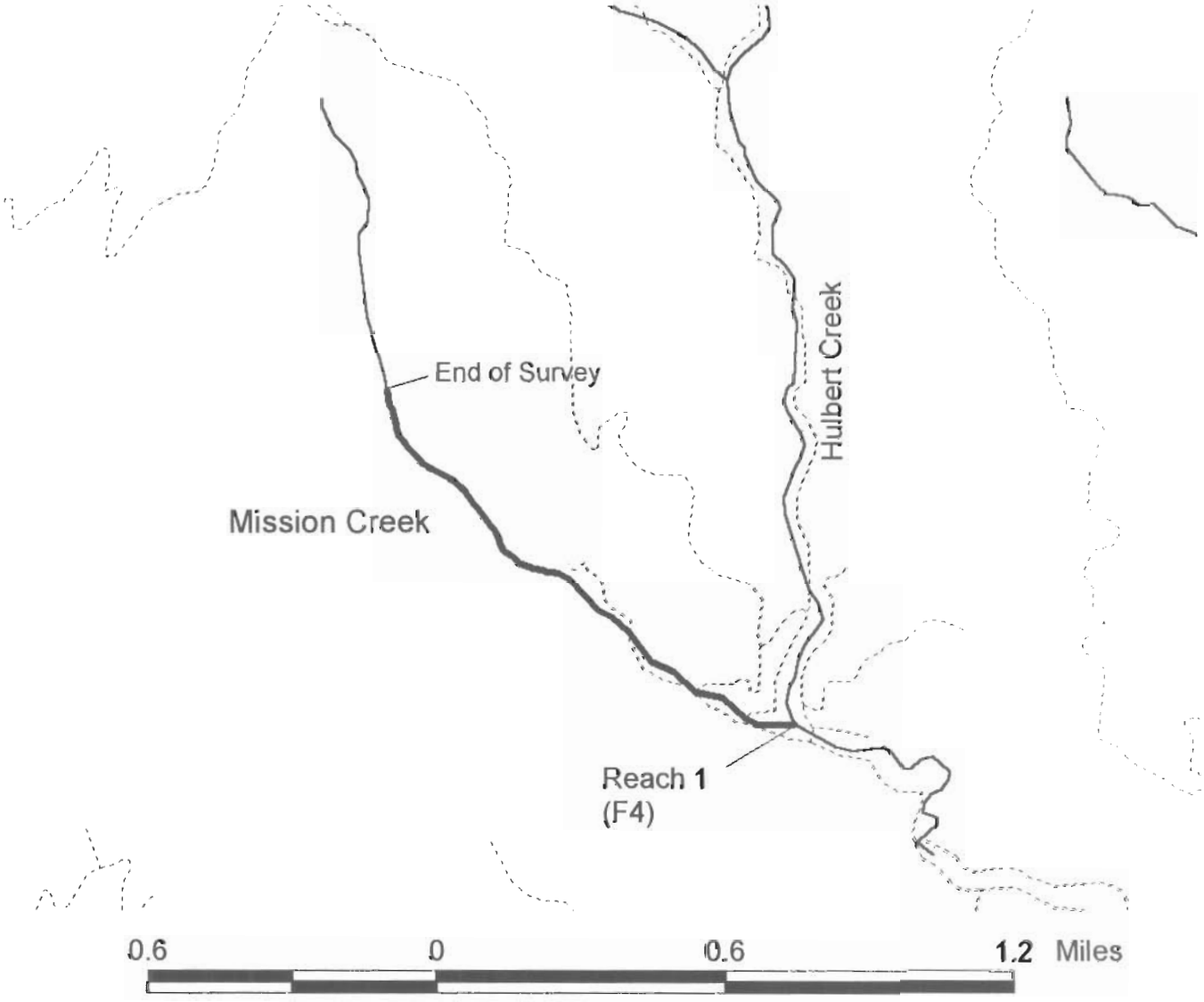
PROBLEM SITES AND LANDMARKS - Mission CREEK SURVEY COMMENTS

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
1.00	3235	major gravel build up, and small cobble approx. 5 feet high from top of gravel to bottom of hulbert creek bed
2.00	3328	cement retaining wall 100ft. by 6 by 3 at left bank; rip rap 131 feet into unit extends 140 feet.
3.00	3357	double culverts at 524 feet; dry trib at RB, 655 feet; footbridge at 1070 ft.; Old Cazadero Rd.
4.00	3386	box culvert at1217 ft.; erosion at LB, 50ft. high by 50 ft.long box culvert at 1217 ft.; ersion at LB, 50ft. high by 50 ft. long by 20 ft. deep at 242' up from Old Cazadero Rd.

5.00	3406	erosion at LB, 75 ft. (height) x 70' (length) x 50' (depth) to 1230' up from Old Cazadero Rd.
6.00	3418	rip rap extending 90ft. on LB, easement road paralleling; culvert at RB 1900ft.; well at 1900 LB
7.00	3663	0+ steelhead
13.00	3949	dry trib at RB
14.00	3961	erosion at LB; 5H x 5ft.D x 10ft.L
15.00	3972	0+ S.H.
21.00	4426	dry trib at LB.
23.00	4461	0+ S.H., 1+ S.H.
31.00	5048	0+ S.H.
32.00	5108	2+ S.H. dry trib at LB
38.00	5398	2+ S.H.
39.00	5479	0+ S.H.
47.00	6086	main stem- DRY; turns to an "A" channel. wet trib at RB; only wet trib for 100 feet;

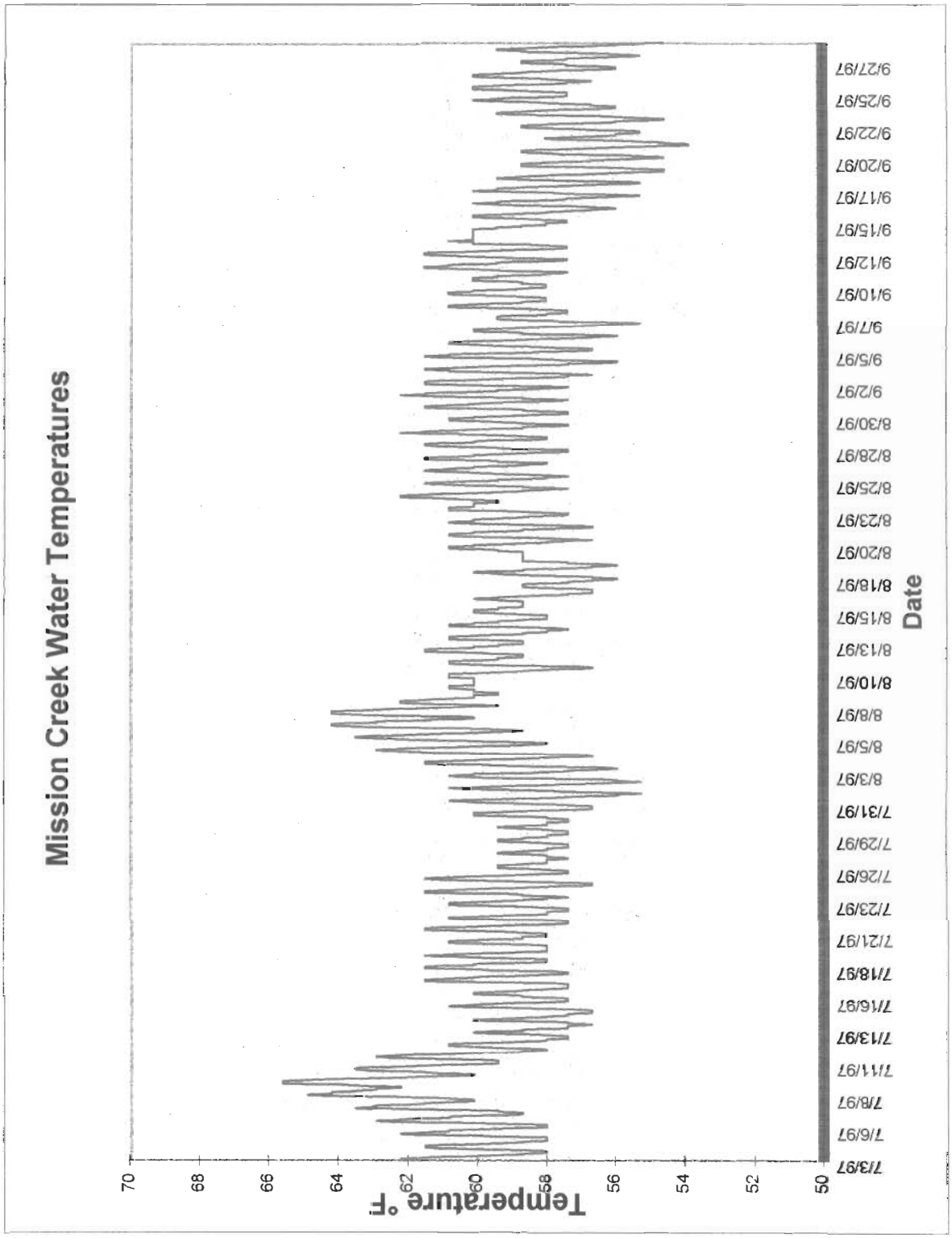
Mission Creek



Mission Creek Survey
Roads
Streams

N
W
E
S

Inland Fisheries Division
Department of Fish and Game
1997


Mission Creek Water Temperatures
Temperature °F
70
68
66
64
62
60
58
56
54
52
50
Date
7/3/97
7/6/97
7/8/97
7/11/97
7/13/97
7/16/97
7/18/97
7/21/97
7/23/97
7/26/97
7/29/97
7/31/97
8/3/97
8/5/97
8/8/97
8/10/97
8/13/97
8/15/97
8/18/97
8/20/97
8/23/97
8/25/97
8/28/97
8/30/97
9/2/97
9/5/97
9/7/97
9/10/97
9/12/97
9/15/97
9/17/97
9/20/97
9/22/97
9/25/97
9/27/97

Mission Creek

Drainage: Hulbert Creek

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

Survey Dates: 09/03/97 to 09/04/97

Confluence Location: QUAD: LEGAL DESCRIPTION: LATITUDE: 0°0'0" LONGITUDE: 0°0'0"

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
22	2	RIFFLE	47	98	2156	35	4.5	0.4	120	2633	57	1252	0	2
3	1	FLATWATER	6	30	89	1	4.0	0.2	110	331	22	66	0	0
15	6	POOL	32	22	336	6	6.0	0.7	118	1772	85	1281	73	14
7	0	DRY	15	501	3505	58	0.0	0.0	0	0	0	0	0	0

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
47	9	6086	4736	2599

Mission Creek | Drainage: Hulbert Creek

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS | Survey Dates: 09/03/97 to 09/04/97

Confluence Location: QUAD: | LEGAL DESCRIPTION: | LATITUDE: 0°0'0" LONGITUDE: 0°0'0"

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 %
21	1	LGR	45	102	2145	35	6	0.6	1.4	170	3563	84	1771	0	3	76
1	1	BRS	2	11	11	0	2	0.1	0.4	20	20	2	2	0	0	100
3	1	RUN	6	30	89	1	4	0.2	0.5	110	331	22	66	0	0	93
1	1	CRP	2	17	17	0	3	0.8	2.1	51	51	41	41	0	5	90
4	2	LSR	9	20	79	1	5	0.7	1.2	102	410	73	293	62	23	94
4	1	LSBk	9	21	82	1	8	0.9	2.7	120	481	94	376	94	3	78
5	1	LSBo	11	29	144	2	5	0.6	1.6	144	719	92	459	64	12	100
1	1	PLP	2	14	14	0	8	1.0	2.0	112	112	112	112	90	50	40
7	0	DRY	15	501	3505	58	0	0.0	0.0	0	0	0	0	0	0	83

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
47	9	6086	5685	3120

Mission Creek

Drainage: Hulbert Creek

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 09/03/97 to 09/04/97

Confluence Location: QUAD: LEGAL DESCRIPTION: LATITUDE: 0°0'0" LONGITUDE: 0°0'0"

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
15	6	SCOUR	100	22	336	100	6.0	0.7	118	1772	85	1281	73	14

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
15	6	336	1772	1281

Mission Creek | Drainage: Hulbert Creek

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES | Survey Dates: 09/03/97 to 09/04/97

Confluence Location: QUAD: | LEGAL DESCRIPTION: | LATITUDE: 0°0'0" LONGITUDE: 0°0'0"

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
1	CRP	7	0	0	0	0	1	100	0	0	0	0
4	LSR	27	2	50	2	50	0	0	0	0	0	0
4	LSBk	27	0	0	3	75	1	25	0	0	0	0
5	LSBo	33	1	20	4	80	0	0	0	0	0	0
1	PLP	7	0	0	0	0	1	100	0	0	0	0

TOTAL UNITS
15

Mission Creek | Drainage: Hulbert Creek

Table 5 - Summary of Shelter by Habitat Type | Survey Dates: 09/03/97 to 09/04/97

Confluence Location: QUAD: | LEGAL DESCRIPTION: | LATITUDE: 0°0'0" | LONGITUDE: 0°0'0"

	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
	21	2	LGR	0	0	0	100	0	0	0	0	0
	1	1	BRS	0	0	0	0	0	0	0	0	0
	3	1	RUN	0	0	0	0	0	0	0	0	0
	1	1	CRP	0	0	0	0	100	0	0	0	0
	4	4	LSR	43	5	24	20	0	0	0	8	0
	4	4	LSBk	0	0	0	0	0	50	0	50	0
	5	5	LSBo	41	0	0	0	0	0	0	59	0
	1	1	PLP	0	35	65	0	0	0	0	0	0
	7	0	DRY	0	0	0	0	0	0	0	0	0
ALL HABITAT TYPES	47	19		29	8	20	12	2	3	0	27	0
POOLS ONLY	15	15		31	9	21	7	2	3	0	28	0

Mission Creek

Drainage: Hulbert Creek

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 09/03/97 to 09/04/97

Confluence Location: QUAD: LEGAL DESCRIPTION: LATITUDE: 0°0'0" LONGITUDE: 0°0'0"

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
21	1	LGR	0	0	100	0	0	0	0
1	1	BRS	0	0	0	0	0	0	100
3	1	RUN	0	0	100	0	0	0	0
1	1	CRP	0	100	0	0	0	0	0
4	2	LSR	0	0	100	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
5	2	LSBo	0	100	0	0	0	0	0
1	1	PLP	0	100	0	0	0	0	0
1	0	DRY	0	0	0	0	0	0	0

Mission 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
81.92	80.38	19.62	82.50	86.00

APPENDIX B.

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Bedrock	2	3	25
Boulder	0	0	0
Cobble/Gravel	0	0	0
Silt/clay	8	7	75

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	2	0	10
Evergreen Trees	8	10	90
No Vegetation	0	0	0

APPENDIX C. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Mission Creek
SAMPLE DATES: 09/03/97 to 09/04/97
SURVEY LENGTH:
MAIN CHANNEL: 6086 ft. SIDE CHANNEL: 0 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: Latitude: 0°0'0"
Legal Description: Longitude: 0°0'0"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

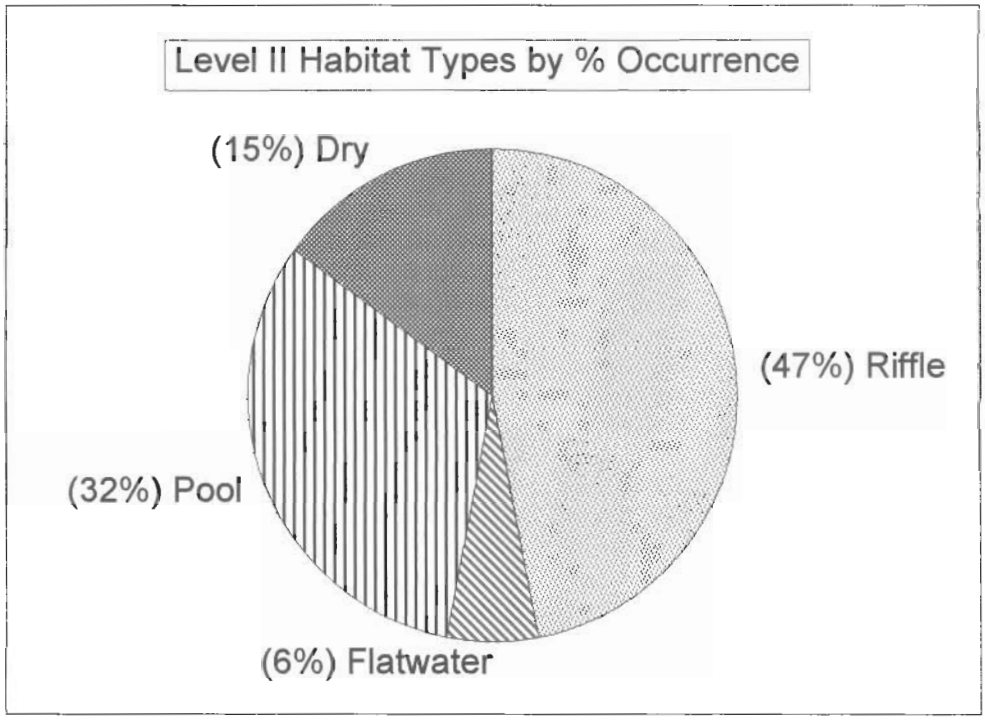
STREAM REACH 1 (Units 1-47)

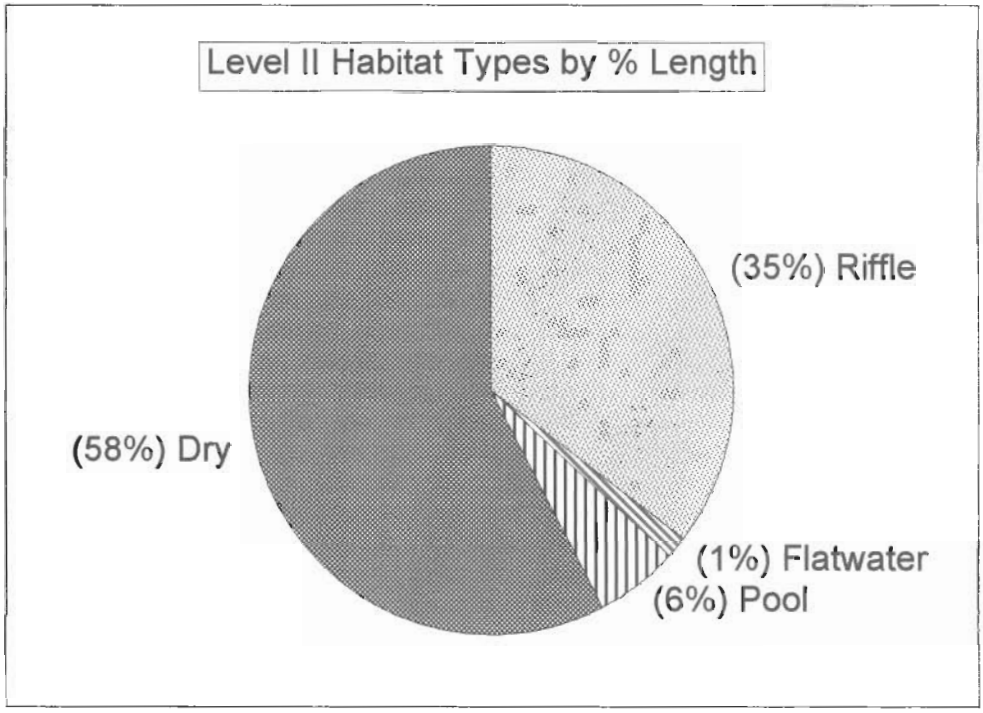
Channel Type: F4	Mean Canopy Density: 82%
Main Channel Length: 6086 ft.	Evergreen Component: 80%
Side Channel Length: 0 ft.	Deciduous Component: 20%
Riffle/Flatwater Mean Width: 4.4 ft.	Pools by Stream Length: 6%
Pool Mean Depth: 0.7 ft.	Pools >=2 ft. Deep: 20%
Base Flow: 0.0 cfs	Pools >=3 ft. Deep: 0%
Water: 60-61°F Air: 71-79°F	Mean Pool Shelter Rtn: 14
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Boulders
Bank Vegetative Cover: 84%	Occurrence of LOD: 58%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 3505 ft.

Embeddedness Value: 1. 40% 2. 47% 3. 13% 4. 0%

Mission Creek

Level II Habitat Types

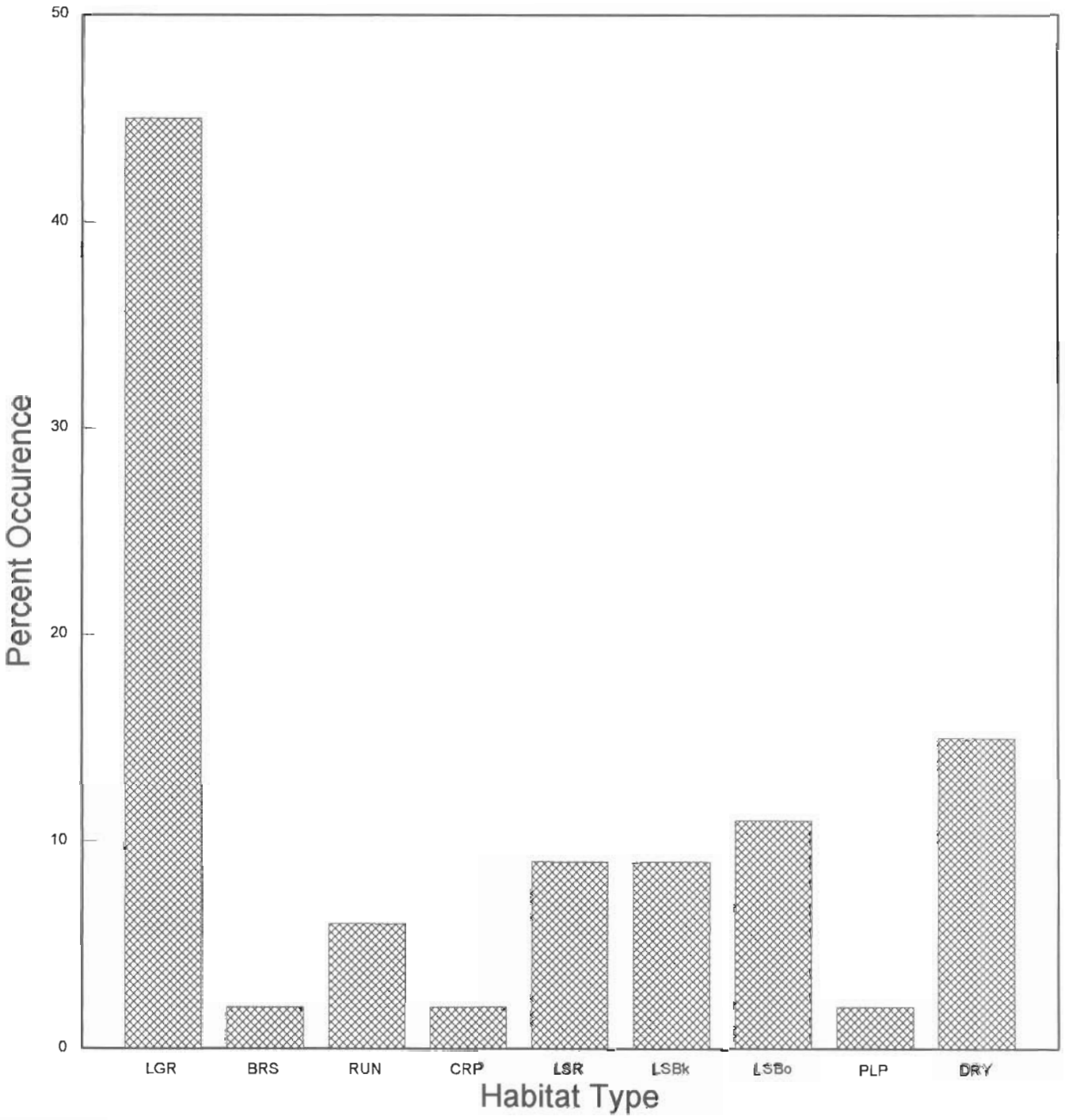




Graph 1

Mission Creek

Level IV Habitat Types by % Occurrence

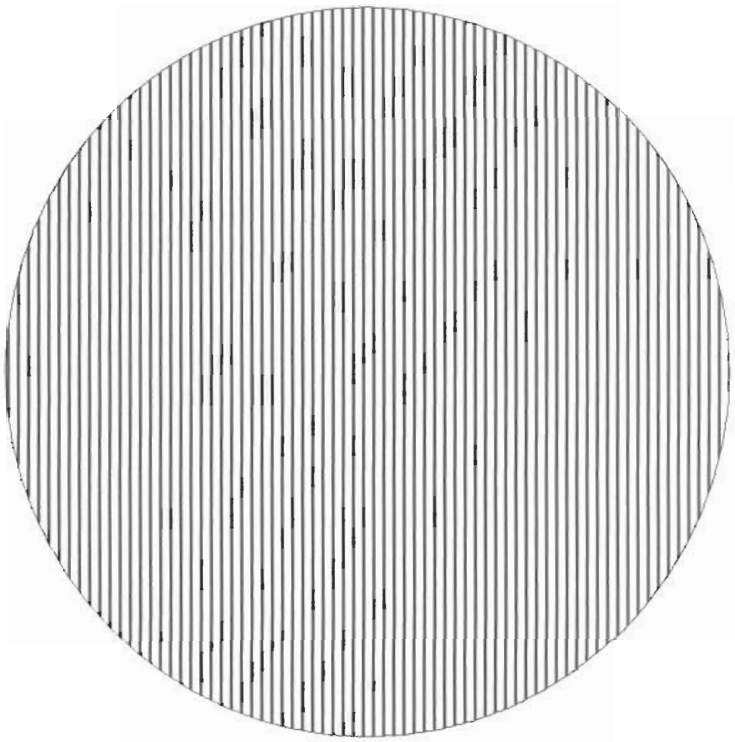


Graph 2

Mission Creek

Pool Habitat Types by % Occurrence

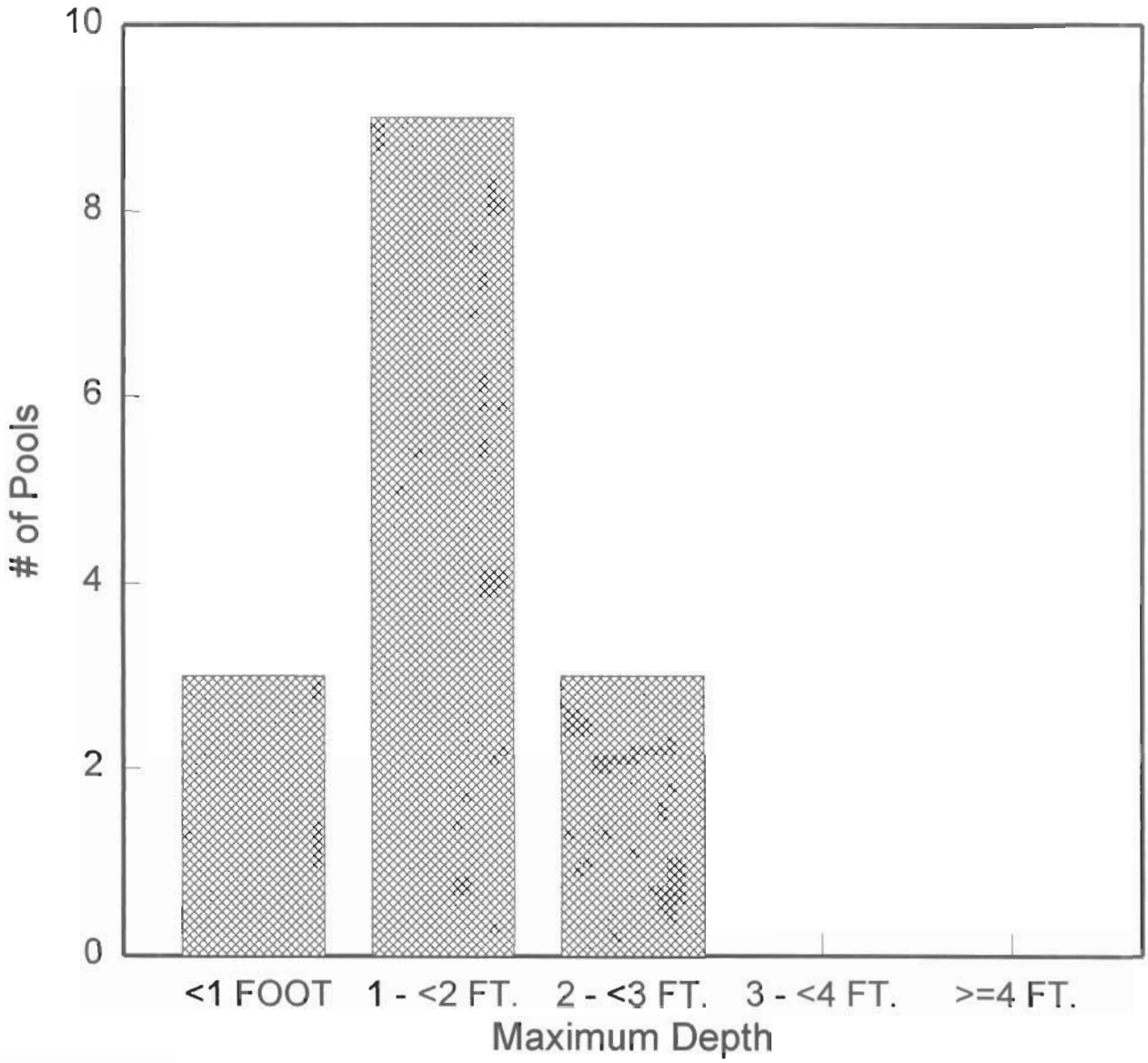
(100%) Scour



Graph 3

Mission Creek

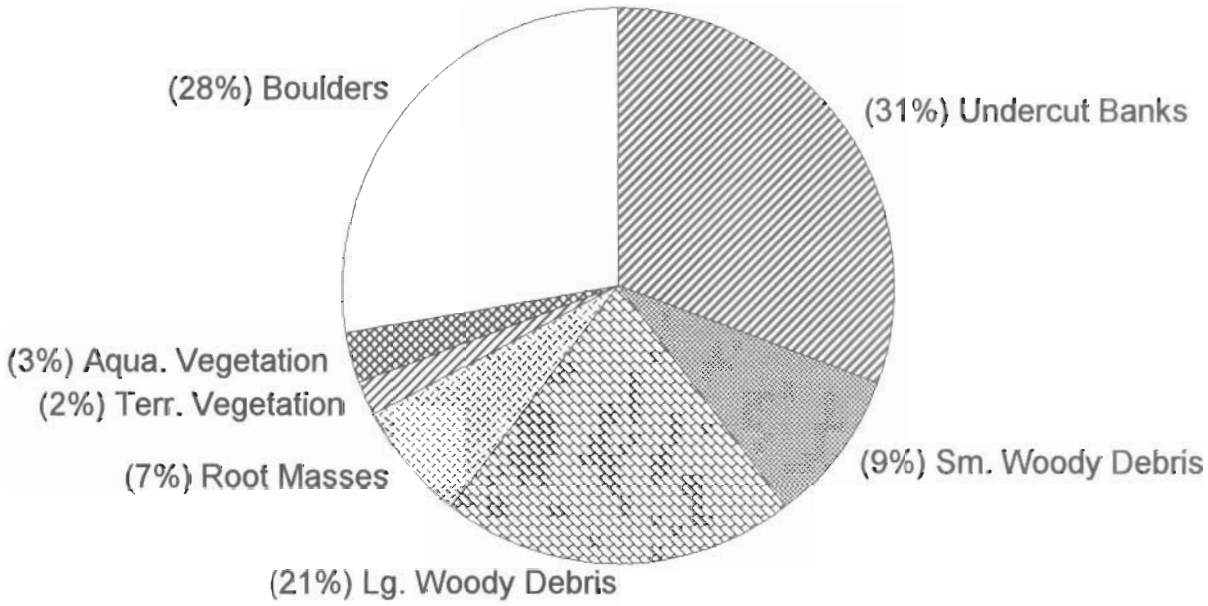
Maximum Depth in Pools



Graph 4

Mission Creek

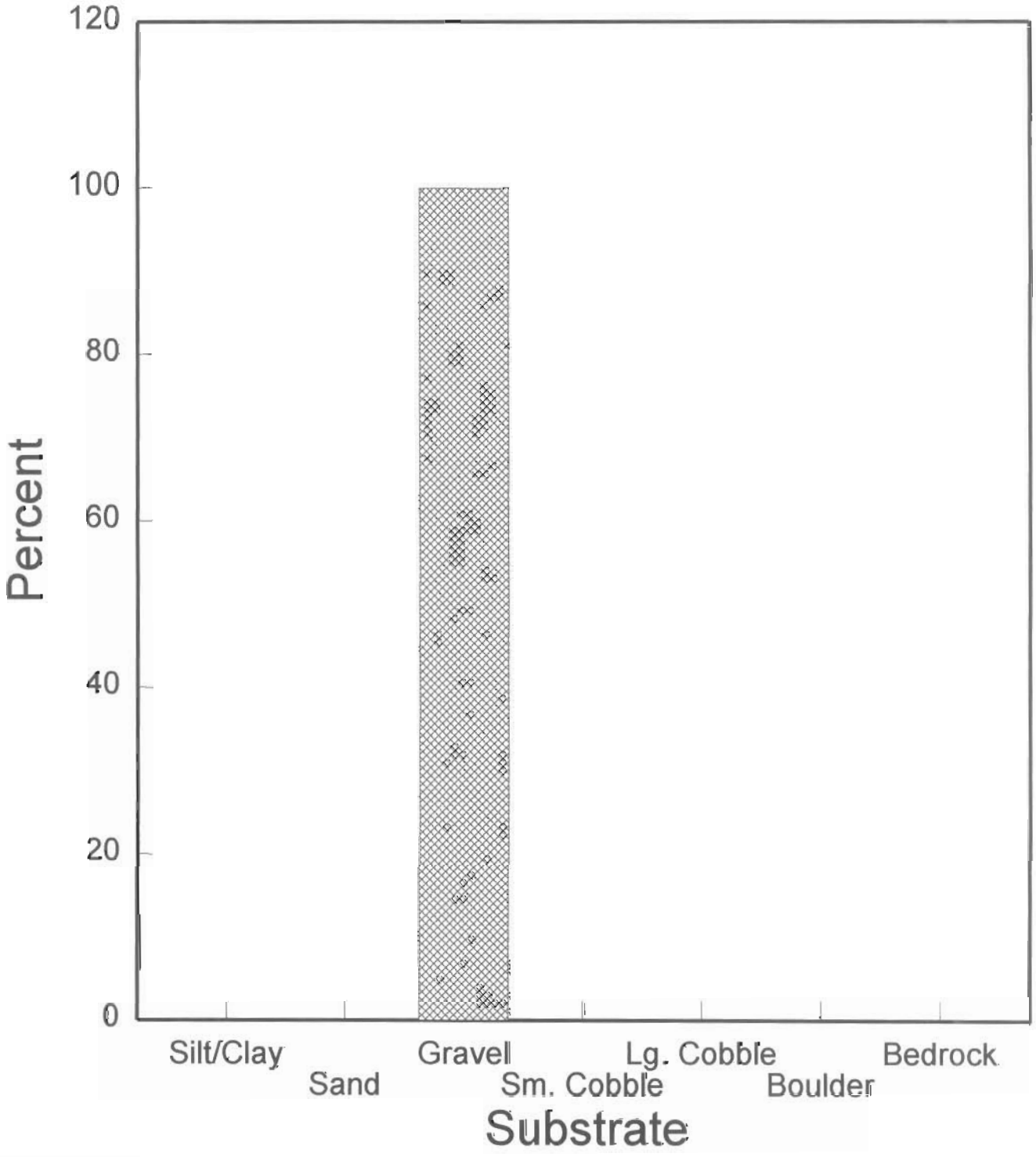
Pool Shelter Types by % Area



Graph 5

Mission Creek

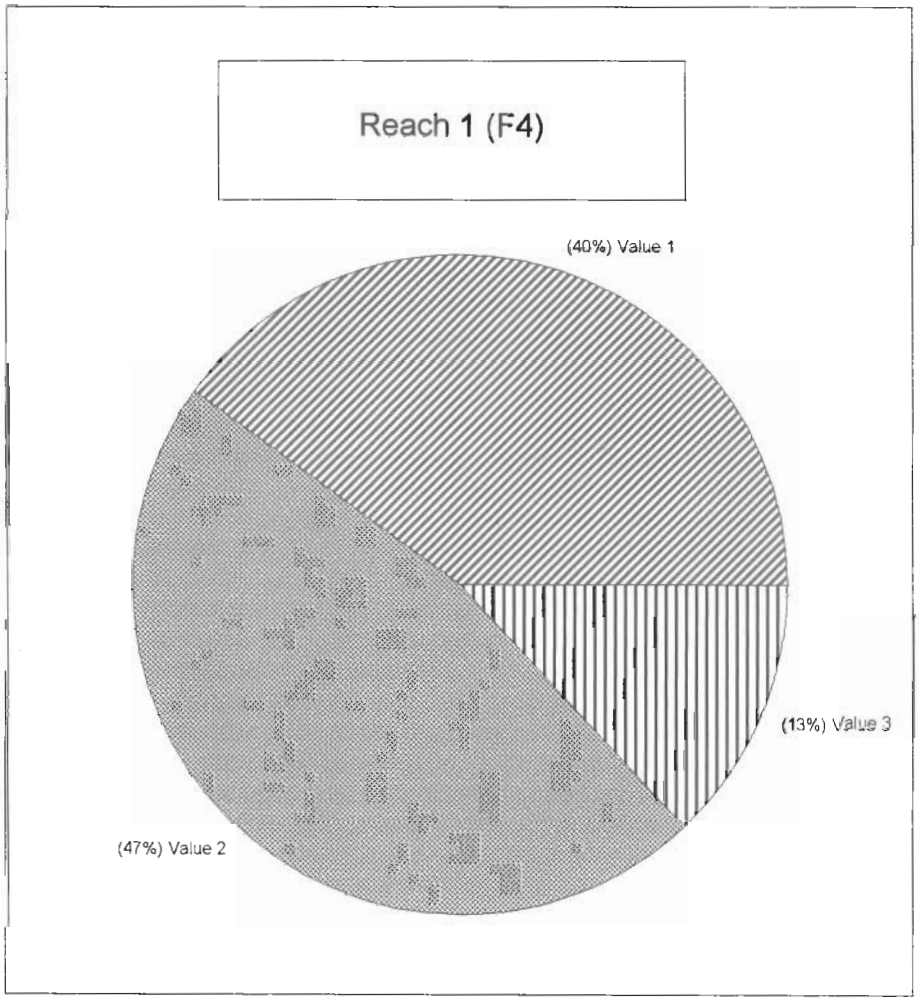
Substrate Composition in Low Gradient Riffles



Graph 6

Mission Creek

Percent Cobble Embeddedness by Reach

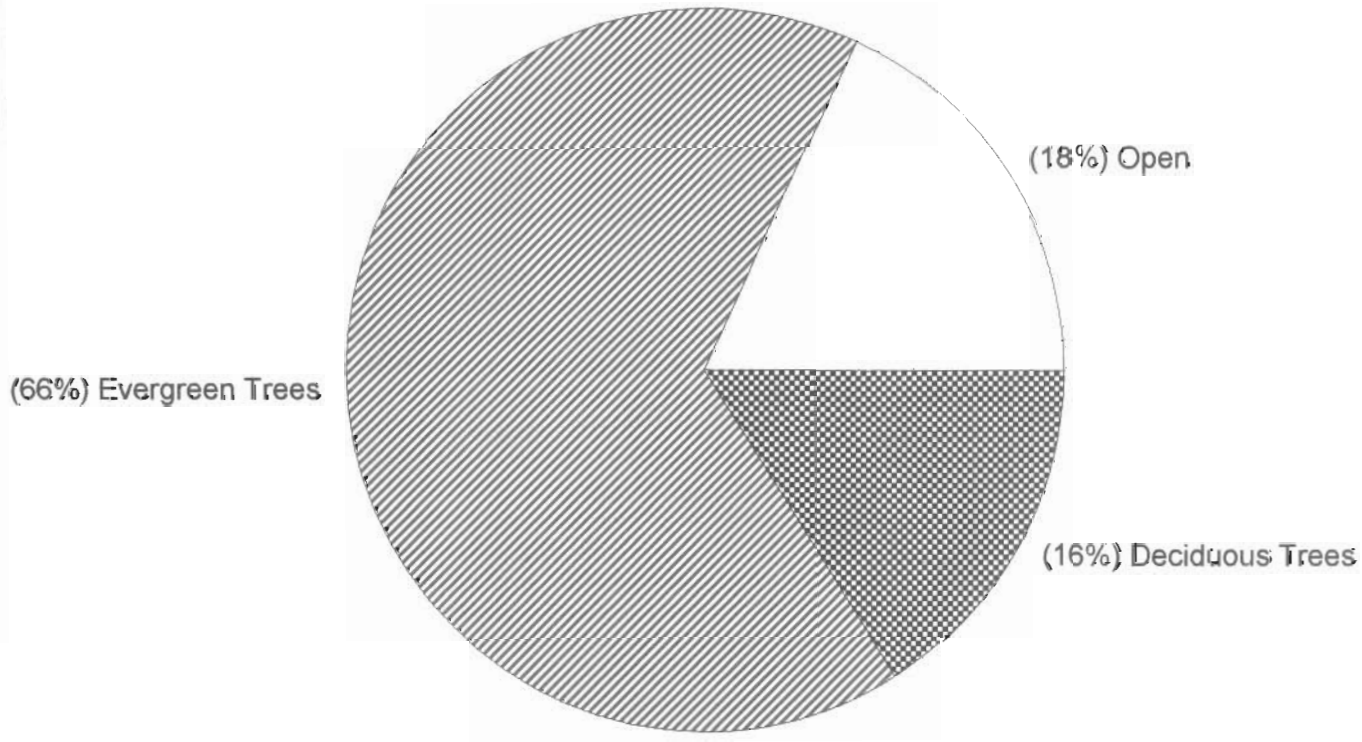


Value 1 = <25% Value 2 = 25-50% Value 3 = 51-75% Value 4 = >76%

Graph 7

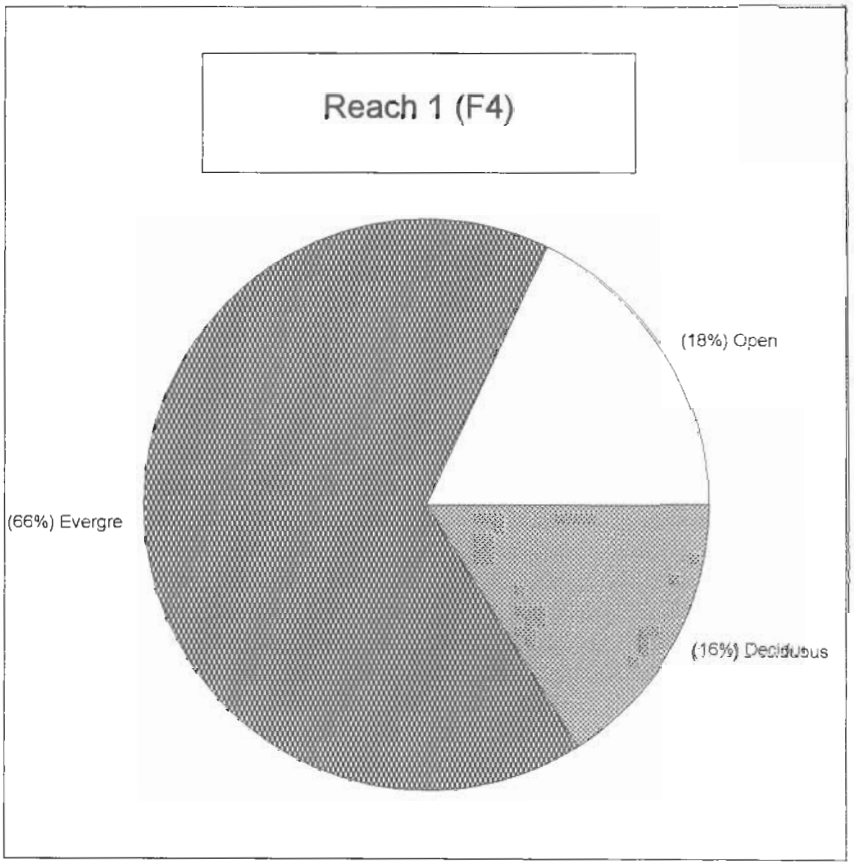
Mission Creek

Mean Percent Canopy



Graph 8

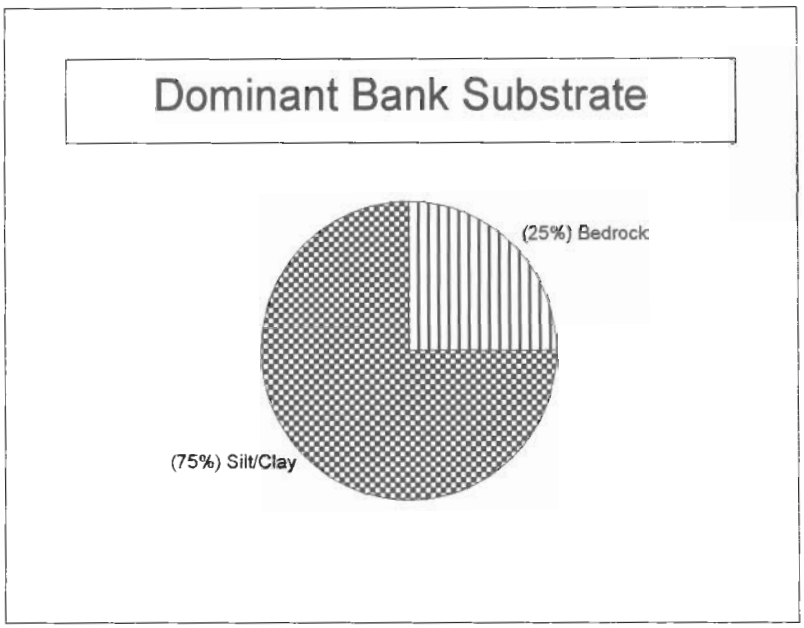
Mission Creek
Percent Canopy By Reach

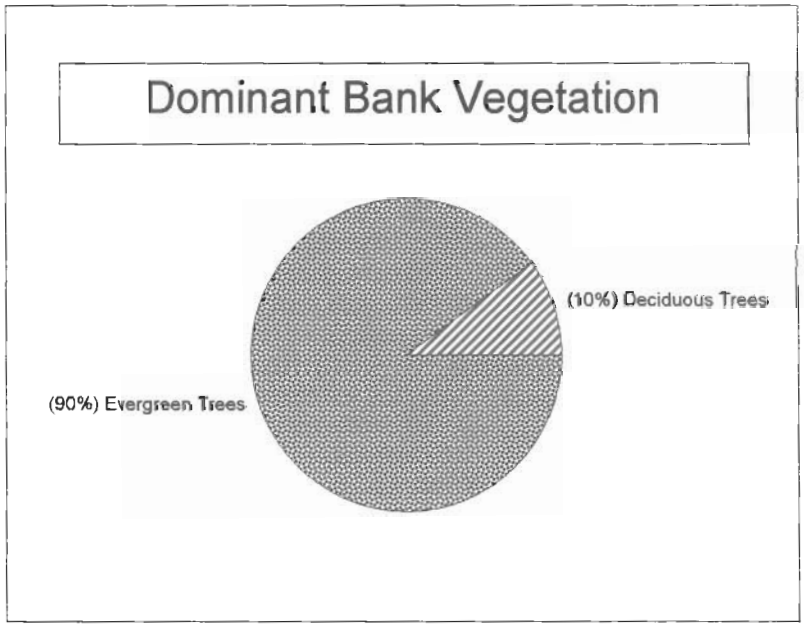


Graph 9

Mission Creek

Percent Bank Composition





Graph 10