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

INTRODUCTION

A stream inventory was conducted during the summer of 1996 on Bidwell 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 Bidwell 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

Bidwell Creek is a tributary to Franz Creek which flows into Maacama Creek, a tributary of the Russian River, located in Sonoma County, California (see Bidwell Creek map, page 2). (get following from watershed overview) The legal description at the confluence with the Franz Creek is T6N, R4W, S26. Its location is 38°22'23" N. latitude and 122°18'17" W. longitude. Year round vehicle access exists from Highway 101 at Lytton Springs Rd, exit east on Alexander Valley Rd, east on Hwy 128, and south on Franz Valley Rd.

Bidwell Creek drains a basin of approximately 4.9 square miles. Bidwell Creek is a second order stream and has approximately 6.5 miles of blue line stream, according to the USGS Mark West Springs 7.5 minute quadrangle. Elevations range from about 365 feet at the mouth of the creek to 1180 feet in the headwaters. Bidwell Creek headwaters begin in the moderately steep Maacama Mountains and flows in a southerly direction for 1.5 miles, changing flow towards the east through Knights Valley to its mouth. Most of the 4.9 square miles of drainage basin lies within the grassy-woodland and vineyards of Knights Valley, while oak savannah is predominate in the headwaters. Other tree species observed were oaks, bay, and alders. The entire drainage lies within privately owned lands.

METHODS

The habitat inventory conducted in Bidwell Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi et al, 1997). The AmeriCorps Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two person team 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 Bidwell 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. 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.

2. 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.

3. 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". Bidwell 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.

4. 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 Bidwell 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.

5. 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 Bidwell 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.

6. 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.

7. 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 Bidwell 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.

8. 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 Bidwell, 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.

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 Bidwell 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 Bidwell 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
- Percent Bank Composition and Bank Vegetation

HISTORICAL STREAM SURVEYS:

The Department of Fish & Game conducted a survey of Bidwell Creek in 1964, August 1976 and January 1983. The 1964 survey found that most streams in this area have a substrate composed of 15% fines (particles less than .85mm).

The 1976 survey extended from the mouth to the headwaters with a total length of 5 miles. The flow was measured to be 0.32 cfs. The air temperature was 80° F and the water temperature was 64° F. The substrate in the headwaters above Foss Hill Road averaged 50% boulder, 40% rubble, 5% gravel, and 5% silt. The remaining 3½ miles of stream was 25% boulder, 35% rubble, 15% gravel and sand, and 25% silt. A 12 " bedrock falls steelhead barrier was found 4½ miles upstream from the mouth. A 3½ " concrete dam considered to be a partial barrier was found 4 miles above the mouth. Three dams and reservoirs (used for vineyard frost protection) were found in the headwaters of the unnamed tributaries.

The 1983 survey extended 300 yds. long in an east-west direction and varying from about 50 yds. wide at the west end to about 100 yds. wide at the east end. The northern boundary of the parcel is Bidwell Creek, the southern boundary is Kelly Creek. These two streams join at the west end of the parcel. The land has been plowed within the past several months with virtually all of the riparian vegetation destroyed as much of it was pushed directly into the creek. The banks are steep and unstable with many tension cracks visible.

HABITAT INVENTORY RESULTS

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

The habitat inventory of Bidwell Creek was conducted from 10/01/97 to 10/15/97, and was conducted by T. Parlato, M.Miller, J. Campo, and E. Sanchez (AmeriCorps). The survey began at the confluence with the Russian River and extended up Bidwell Creek to the end of the survey, dry streambed conditions. The total length of the stream surveyed was 10083 feet, with an additional 595 feet of side channel.

Flows were not measured on Bidwell Creek.

This section of Bidwell Creek has two channel types: from the mouth to 4916 feet a B3 and the upper 5167 feet a B4.

B3 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly cobble substrate.

B4 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly gravel substrate.

Water temperatures ranged from 54°F to 61°F. Air temperatures ranged from 56°F to 88°F. Summer temperatures were also measured using remote temperature recorders placed in pools (see Temperature Summary graphs at end of report). A recorder placed near the only vehicle crossing on the Laufenburg Property logged temperatures every 2 hours from June 30 - September 28,1997. The highest temperature recorded was 66°F in July and the lowest was 58°F in September. The mean of the daily highs was 62°F for the month of July, 63°F for August and 61°F for September.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 41% pool units, 25% flatwater units, 18% dry streambed units, and 15% riffle units. Based on total **length** there were 44% pool units, 27% flatwater units, 21% dry streambed units, and 9% riffle units (Graph 1).

One hundred fifty habitat units were measured and 21% were completely sampled. Eleven 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 23%, runs 19%, dry streambed 18% and low gradient riffles 15% (Graph 2). By percent total **length**, mid-channel pools made up 29%, dry streambed 21%, runs 20%, and root wad scour pools 10%.

Sixty two pools were identified (Table 3). Main Channel pools were most often encountered at 56%, and comprised 66% 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 of the 62 pools (65%) had a depth of two feet or greater (Graph 4). These deeper pools comprised 33% 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 17. Riffle had the lowest rating with 4 and flatwater rated 11 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 17, and main channel pools rated 17 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were root masses at 30%, undercut banks 23%, terr. vegetation 19%, and small woody debris 13%. Graph 5 describes the pool shelter in Bidwell Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 1 of the 7 low gradient riffles measured. Small cobble was dominant in one of the low gradient riffles (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 61 pool tail-outs measured, 8 had a value of 1 (13%); 26 had a value of 2 (43%); 13 had a value of 3 (21%); and 14 had a value of 4 (23%). On this scale, a value of one is best for fisheries.

The mean percent canopy density for the stream reach surveyed was 83%. The mean percentages of deciduous and evergreen trees were 79% and 21%, respectively. Graph 8 describes the canopy for the entire survey and graph 9 describes the canopy by reach.

For the entire stream reach surveyed, the mean percent right bank vegetated was 82% and the mean percent left bank vegetated was 72%. For the habitat units measured, the dominant vegetation types for the stream banks were: 76% deciduous trees, 16% evergreen trees, 7%

brush, 1% bare soil and 0% grass (Graph 11). The dominant substrate for the stream banks were: 81% silt/clay/sand, 9% cobble/gravel, 8% boulder and 1% bedrock (Graph 10).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In the 1976 survey no steelhead were observed in the creek, but local residents had seen and photographed steelhead in the past as evidence that steelhead populations once thrived. Green Sunfish were observed at a rate of 75/100'. California Roach were observed at a rate of 200/100'. Cattle, deer, turtles, Western Fence lizards, newts and frogs were also observed.

On 10/22/'97 a biological inventory was conducted in two sites of Bidwell Creek to document fish species composition and distribution. Each site was single pass electrofished using one Smith Root Model 12 electrofisher. Fish from each site were counted by species, and returned to the stream. The air temperature was 17°C and the water temperature was 13°C. The observers were Marc Miller, Paul Campo, and April Richards.

The inventory of Reach 1 started in habitat unit #46 and ended approximately 1039 feet up in habitat unit #63. In riffle and pool habitat types no steelhead were observed along with three California Roach, one unidentified frog and three sunfish.

The inventory of Reach 1 was continued starting at Dam #1 (unit# 63) and ending approximately 1964 feet upstream. In riffle and pool habitat types two 1+ steelhead were observed along with three sculpin, eight California roach, one unidentified frog, one L.M. Bass, and 41 Sacramento squawfish.

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

Species Observed in Historical and Recent Surveys

YEARS	SPECIES	SOURCE	Native/Introduced
1997	Steelhead	DFG	N
1997	Sculpin (Cottus sp.)	DFG	N
1976,1997	Roach	DFG	N

Species Observed in Historical and Recent Surveys			
YEARS	**SPECIES**	**SOURCE**	**Native/Introduced**
1997	Largemouth Bass	DFG	I
1997	Sacramento Squawfish	DFG	N
1976,1997	Green Sunfish	DFG	I

Historical records indicate no hatchery stocking, transfers or known rescues have occurred in Bidwell Creek watershed.

ADULT SURVEYS:

A spawning survey was conducted in Bidwell Creek on 3/4/1998, beginning at habitat unit #175 and extending upstream to habitat unit # 187. In habitat unit #175, four steelhead were observed. A redd was observed in habitat unit #175 and gravel quality there appeared to be good. In habitat unit #187 a spawning pair of steelhead were observed creating a redd. Three possible redds were observed in habitat unit #187.

DISCUSSION

Bidwell Creek has two channel types: B3 (4916 ft.) and B4 (5167 ft.).

There are 4916 feet of B3 channel type in Reach 1 and 5167' of B4 channel type in Reach 2. According to the DFG Salmonid Stream Habitat Restoration Manual,

B3/4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. They are also good for medium-stage plunge weirs. Any work considered will require careful design, and placement. These channel types have suitable gradients and the stable stream banks that are necessary for the installation of instream structures designed to increase pool habitat, trap spawning gravels, and provide protective shelter for fish.

The water temperatures recorded on the survey days 10/06/97 to 10/15/97 ranged from 54°F to 61°F. Air temperatures ranged from 56°F to 88°F. The warmer water temperatures were recorded in Reach 1. This temperature regime is favorable to salmonids.

Summer temperatures measured using a remote temperature recorder placed in a pool ranged from 54° to 61°F. The Temperature Summary graph shows that for much of the summer (July through August) the lower watershed exhibited temperatures above the optimal for salmonids. In July the extreme temperatures were above optimal.

It is unknown if this thermal regime is typical, but our electrofishing samples found steelhead more frequently in the upper, cooler sample sites. 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 44% 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 Bidwell Creek, the pools are relatively deep with 65% having a maximum depth of at least 2 feet. These pools comprised 33% of the total length of stream habitat. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length. Therefore, installing structures that will increase pool habitat is recommended for locations where their installation will not jeopardize any unstable stream banks, or subject the structures to high stream energy.

The mean shelter rating for pools was 17. 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 root masses (30%), undercut banks (23%), terrestrial vegetation (19%), and small woody debris (13%). Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

Two of the seven low gradient riffles measured (29%) had either gravel or small cobble as the dominant substrate. This is generally considered poor for spawning salmonids.

Forty four of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 13% 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, Reach 2 had the best ratings and Reach 1 had the poorest ratings.

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. In Bidwell Creek Reach 1 and Reach 2 sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the entire survey was 83%. This is good, since 80 percent is generally considered desirable. However, the riparian buffer is thin or nearly absent in areas with livestock or agriculture. Riparian removal, increased grazing or vineyard development within the riparian corridor could all lead to less stream canopy, channel incision causing 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. Overall, very few fish were observed during the 1997 surveys. The 1997 fall surveys documented no 0+ fish indicating relatively unsuccessful spawning in the all reaches of Bidwell Creek. However, very few 1+ fish were observed indicating poor rearing conditions the year before or poor holding-over conditions in general. Spawning steelhead were observed in the winter, 1998 spawning/carcass survey indicating that Bidwell supports spawning grounds and adult steelhead. Habitat conditions upstream of our survey reach are extremely poor. Overall, habitat conditions for both steelhead and coho have declined over time.

In general, Reaches 1-2 of Bidwell Creek are marginal for salmon and steelhead habitat. Some long, deep sections of the stream occur which may be used as rearing habitat, however, shelter is lacking and stream temperatures are high. Little riffle habitat exists for spawning, and what does exist is poor for spawning due to high gravel embeddedness. The unstable banks and effects of channelization in these reaches limits instream habitat improvement alternatives, although some opportunity exists. 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. In Reaches 1 and 2 bank

protection, and riparian planting is recommended. Reaches 1 and 2 are good for bank-placed boulders and single and opposing wing-deflectors. They are good for low-stage (low profile) weirs, boulder clusters and channel constrictors. Log cover structures can be used to increase instream shelter.

Instream shelter is lacking and stream bank erosion is prevalent due to channel down-cutting. However, many opportunities and alternatives exist for habitat improvement due to the more stable channel type. Reaches 1 and 2 are excellent for many types of low and medium stage instream enhancement structures. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter.

The best spawning gravel and habitat in the watershed exists within the upper portion of Bidwell Creek. Sediment transported downstream from the upper reaches in the winter also impacts the source of spawning gravel. Stream bank protection and riparian planting is recommended, as well as structures to offset channel down-cutting and recruit gravel for spawning.

GENERAL RECOMMENDATIONS

Bidwell 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 date of this survey. 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 educated 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) Increase the canopy on Bidwell Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels (portions of Reach 1). In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

2) Spawning gravels on Bidwell Creek are limited to relatively few areas (only portions of Reach 2 are suitable for spawning). Structures to decrease channel incision and recruit spawning gravel (using gravel retention structures), should be installed to trap, sort and expand redd distribution in the stream (particularly in Reach 1).

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 in the lower and upper reaches. In some areas the material is at hand.

4) Where feasible, design and engineer pool enhancement structures to increase the number of pools in the lower and upper reaches.

5) In Bidwell Creek, active and potential sediment sources related to the road system need to be mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

PROBLEM SITES AND LANDMARKS - BIDWELL 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.

The Bidwell Creek habitat survey started at the mouth of Bidwell and the confluence with Franz Creek.

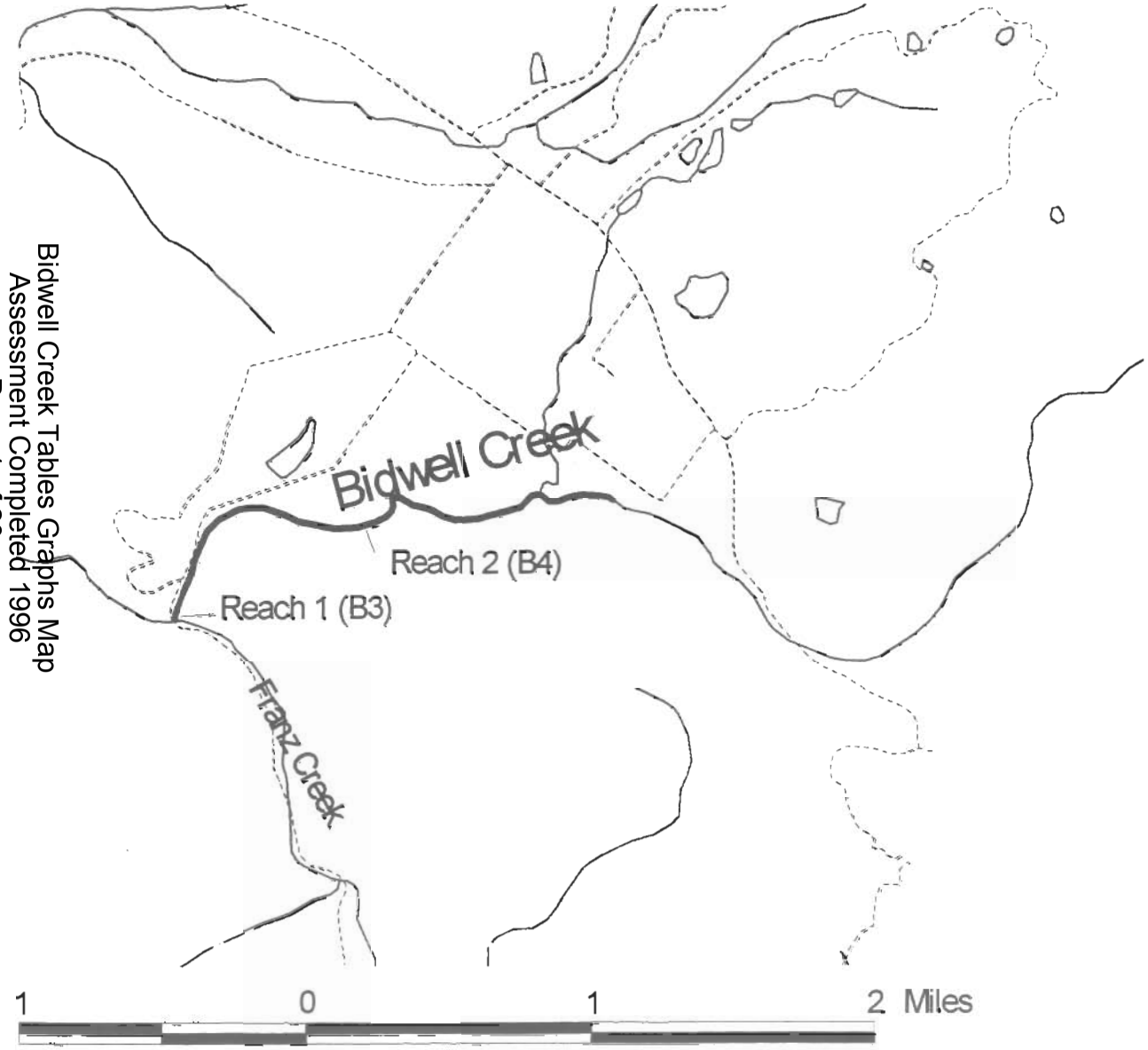
HABITAT UNIT#	STREAM LEN(FT.)	COMMENTS
1.00	75	Large RB flood damage present
5.00	397	Bridge #1
6.00	621	10'x10' debris jam in center of creek causing RB erosion(30'lx8'hx4'd). Both banks have sm. erosions.
7.00	740	Bridge #2(not in use).
9.00	889	Creek access LB(abandoned wet crossing).
11.00	1151	Continue erosion problems/Both banks.

14.00	1492	LB rip-rap & weed matted. Work is new this year. Planned vegetation planting. 1' culvert drainage from new/improved road on LB.
15.00	1567	2' culvert on LB from new road.
20.10	1903	second side channel
20.20	1903	Left bank up to new road-way (private). Rip-rap and filter cloth. 1'6" culvert.
20.30	1903	Left bank 1'6" culvert. Drainage from new road. Rip-rap and filter cloth.
20.40	1903	Rip-rap and filter cloth left bank.
20.60	1903	1st. side channel
21.00	1980	1'0" culvert right bank
24.00	2155	Right bank culvert from dry tributary across road
25.00	2420	Left bank culvert from private road.
26.00	2609	Rip-rap
27.00	2644	2'0" culvert left bank.
31.00	2903	Begins at confluence of spillway tributary. Boulder rip-rap left bank. Opaque water (alder leaf tea).
38.00	3283	2'0" DIA culvert left bank (new as of this year).
40.00	3396	Not a flagged unit due to questionable access.
45.00	3877	2'0" culvert left bank (new).
46.00	3931	3' culvert left bank (new).
50.00	4108	Unit not flagged due to questionable access.
57.00	4620	This pool may be human-made.
63.00	4954	Well, Pump, and Dam-See form #1. Channel change, Reach 2.
66.00	5075	Dry tributary left bank.
70.00	5365	Channel type B4
83.00	5955	Road through creek.
84.00	6011	Corner erosion left bank.
85.00	6072	Dry tributary right bank.
91.00	6292	Begin unit 151 after 90: due to delayed access at mouth of creek, units 091 to 151 DO NOT EXIST. Thus continuous survey after unit # 090 at unit 151 and flagged on creek accordingly.

98.00	6858	Many squaw fish, dry tributary right bank.
108.00	7352	This unit is a wet crossing with gate on left bank.
112.00	7711	River otter scat. Dry tributary right and left bank. Squawfish. Another tributary right bank.
121.00	8398	Dry tributary right bank.
124.00	8632	Dry tributary right bank.
127.00	8775	Squawfish.
131.00	9134	Wet tributary right bank.

END SURVEY
The Bidwell Creek habitat survey ended because the streambed was dry

Bidwell Creek



Bidwell Creek Tables Graphs Map
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Inland Fisheries Division
Department of Fish and Game
1997

Bidwell Creek Survey
Roads
Streams

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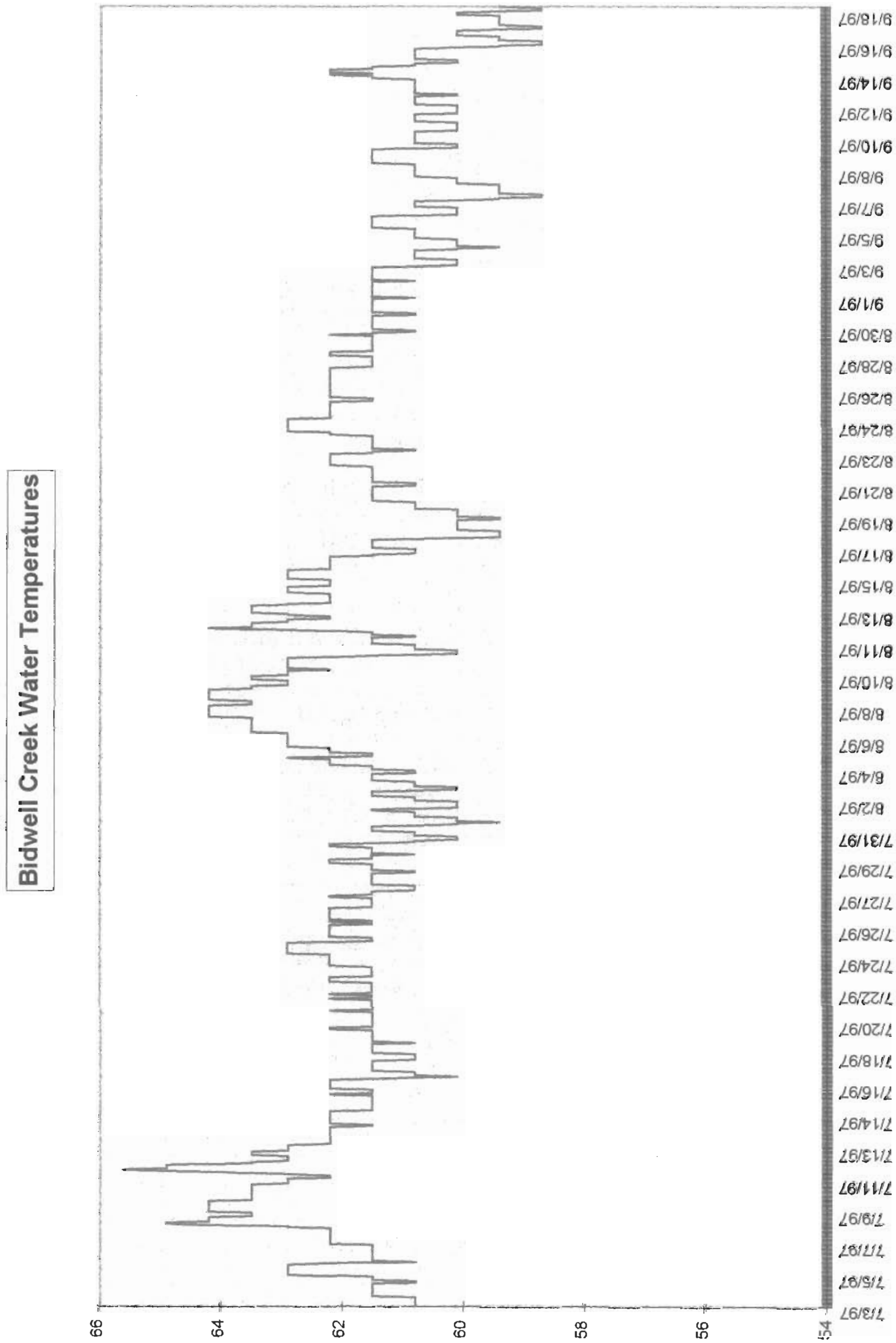
W
E
S


Bidwell Creek Water Temperatures
66
64
62
60
58
56
54
7/3/97
7/5/97
7/7/97
7/9/97
7/11/97
7/13/97
7/14/97
7/16/97
7/18/97
7/20/97
7/22/97
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8/23/97
8/24/97
8/26/97
8/28/97
8/30/97
9/1/97
9/3/97
9/5/97
9/7/97
9/8/97
9/10/97
9/12/97
9/14/97
9/16/97
9/18/97
Date

Bidwell Creek — Drainage: RUSSIAN RIVER

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 10/15/97 to 10/06/97

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
23	5	RIFFLE	15	39	893	8	5.3	0.3	265	6087	113	2604	0	4
38	6	FLATWATER	25	73	2771	26	30.7	0.6	3171	120487	370	14051	0	11
62	19	POOL	41	77	4779	45	11.5	1.3	934	57893	1345	83401	1370	17
27	2	DRY	18	83	2235	21	0.5	0.2	30	799	6	159	0	1

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
150	32	10678	185265	100215

Bidwell Creek

Drainage: RUSSIAN RIVER

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 10/15/97 to 10/06/97

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 %
23	5	LGR	15	39	893	8	5	0.3	0.9	265	6087	113	2604	0	4	81
4	1	GLD	3	53	213	2	11	0.7	0.9	748	2992	524	2094	0	5	90
28	3	RUN	19	74	2064	19	8	0.6	1.2	656	18364	421	11792	0	16	92
6	2	SRN	4	82	494	5	59	0.6	1.1	6291	37747	190	1141	0	5	90
35	9	MCP	23	88	3097	29	12	1.4	4.2	1065	37284	1648	57664	1609	17	82
1	1	CRP	1	53	53	0	13	1.4	2.8	689	689	965	965	827	10	95
2	2	LSL	1	66	131	1	13	0.9	1.7	971	1941	802	1605	673	18	83
17	3	LSR	11	67	1144	11	11	1.1	3.8	793	13474	994	16893	1194	17	85
4	3	LSBk	3	65	260	2	11	1.2	2.8	817	3267	1129	4516	995	11	89
3	1	LSBo	2	31	94	1	11	1.2	2.3	365	1096	469	1406	449	27	80
27	2	DRY	18	83	2235	21	1	0.2	0.5	30	799	6	159	0	1	64

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
150	32	10678	123740	100839

Bidwell Creek

Drainage: RUSSIAN RIVER

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 10/15/97 to 10/06/97

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
35	9	MAIN	56	88	3097	65	11.5	1.4	1065	37284	1648	57664	1609	17
27	10	SCOUR	44	62	1682	35	11.4	1.1	757	20432	938	25330	995	17

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
62	19	4779	57716	82994

Bidwell Creek | Drainage: RUSSIAN RIVER

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES | Survey Dates: 10/15/97 to 10/06/97

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
35	MCP	56	0	0	11	31	17	49	6	17	1	3
1	CRP	2	0	0	0	0	1	100	0	0	0	0
2	LSL	3	0	0	2	100	0	0	0	0	0	0
16	LSR	26	0	0	6	38	8	50	2	13	0	0
4	LSBk	6	0	0	2	50	2	50	0	0	0	0
3	LSBo	5	0	0	0	0	3	100	0	0	0	0

TOTAL UNITS 61

Bidwell Creek | Drainage: RUSSIAN RIVER

Table 5 - Summary of Shelter by Habitat Type | Survey Dates: 10/15/97 to 10/06/97

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
23	4	LGR	0	0	0	0	30	0	0	70	0
4	1	GLD	40	40	0	0	0	20	0	0	0
28	4	RUN	6	43	0	17	16	2	0	16	0
6	2	SRN	0	17	0	7	50	0	0	27	0
35	33	MCP	25	13	1	29	21	3	0	8	0
1	1	CRP	0	90	0	0	10	0	0	0	0
2	2	LSL	0	0	85	5	9	0	0	0	0
17	15	LSR	22	12	2	46	14	1	0	4	0
4	4	LSBk	25	13	0	11	36	0	0	14	0
3	3	LSBo	26	0	0	33	0	0	0	41	0
27	4	DRY	0	100	0	0	0	0	0	0	0
150	73	ALL HABITAT TYPES	21	15	5	28	19	2	0	10	0
62	58	POOLS ONLY	23	13	5	30	19	2	0	8	0

Bidwell Creek — Drainage: RUSSIAN RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE — Survey Dates: 10/15/97 to 10/06/97

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
23	6	LGR	0	0	17	17	33	33	0
1	1	GLD	0	100	0	0	0	0	0
3	3	RUN	0	0	33	33	0	33	0
2	2	SRN	0	0	0	0	50	0	50
9	9	MCP	22	22	33	0	0	11	11
1	1	CRP	0	0	100	0	0	0	0
2	2	LSL	0	50	50	0	0	0	0
3	3	LSR	67	0	0	0	33	0	0
3	3	LSBk	0	0	33	33	0	0	33
1	1	LSBo	0	0	0	0	0	100	0
4	4	DRY	25	0	25	0	0	50	0

Bidwell 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
82.64	21.01	78.99	82.43	71.89

APPENDIX B.

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Percent Total Units
Bedrock	1	0	1.35
Boulder	3	3	8.11
Cobble/Gravel	2	5	9.46
Silt/clay	31	29	81.08

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	2	3	6.76
Deciduous Trees	30	26	75.68
Evergreen Trees	5	7	16.22
No Vegetation	0	1	1.35

APPENDIX C. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Bidwell Creek
SAMPLE DATES: 10/15/97 to 10/06/97
SURVEY LENGTH:
MAIN CHANNEL: 10083 ft. SIDE CHANNEL: 595 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 1-62)

Channel Type: B3	Mean Canopy Density: 84%
Main Channel Length: 4916 ft.	Evergreen Component: 19%
Side Channel Length: 415 ft.	Deciduous Component: 81%
Riffle/Flatwater Mean Width: 29.8 ft.	Pools by Stream Length: 35%
Pool Mean Depth: 1.2 ft.	Pools >=2 ft. Deep: 64%
Base Flow: 0.0 cfs	Pools >=3 ft. Deep: 9%
Water: 54-61°F Air: 57-88°F	Mean Pool Shelter Rtn: 17
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Bank Vegetative Cover: 67%	Occurrence of LOD: 12%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 898 ft.

Embeddness Value: 1. 0% 2. 18% 3. 36% 4. 45%

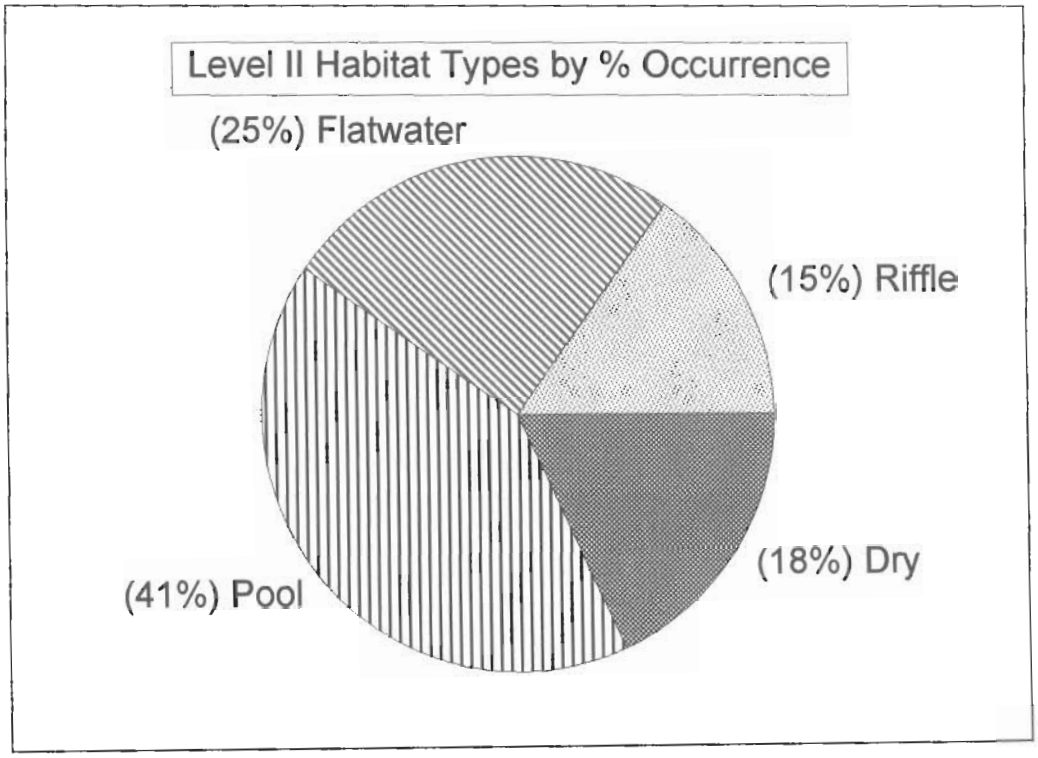
STREAM REACH 2 (Units 63-140)

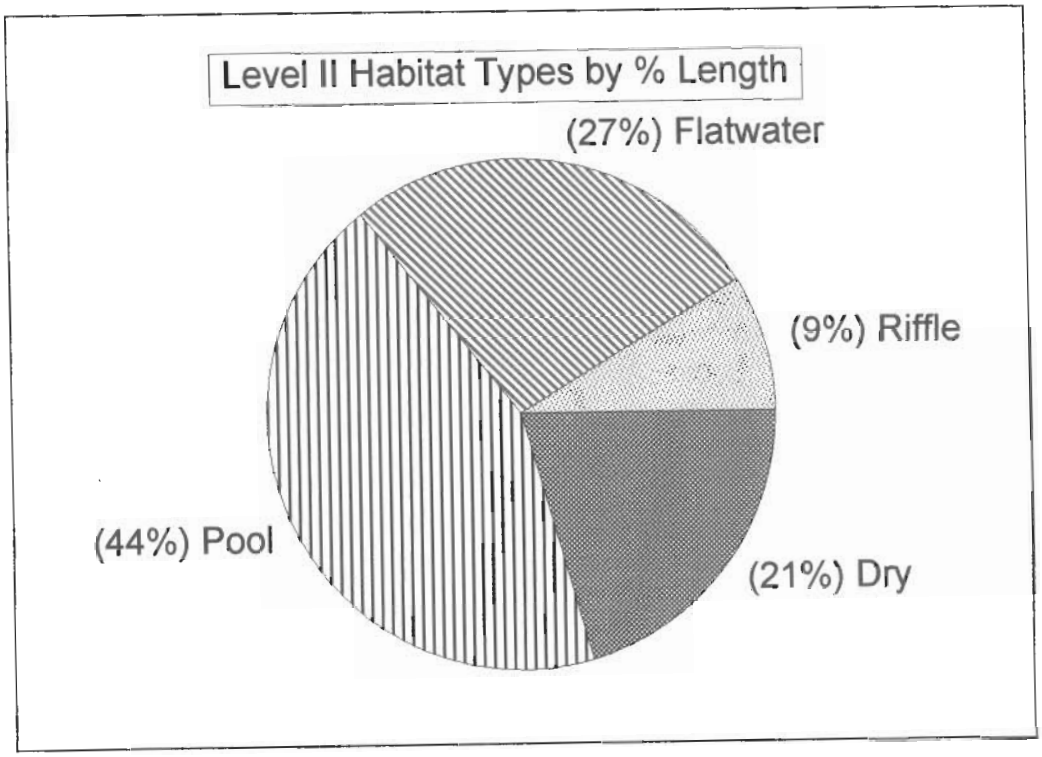
Channel Type: B4	Mean Canopy Density: 82%
Main Channel Length: 5167 ft.	Evergreen Component: 23%
Side Channel Length: 180 ft.	Deciduous Component: 77%
Riffle/Flatwater Mean Width: 7.3 ft.	Pools by Stream Length: 55%
Pool Mean Depth: 1.3 ft.	Pools >=2 ft. Deep: 70%
Base Flow: 0.0 cfs	Pools >=3 ft. Deep: 19%
Water: 54-61°F Air: 56-68°F	Mean Pool Shelter Rtn: 17
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Root masses
Bank Vegetative Cover: 88%	Occurrence of LOD: 55%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 1101 ft.

Embeddness Value: 1. 21% 2. 56% 3. 13% 4. 10%

Bidwell Creek

Level II Habitat Types

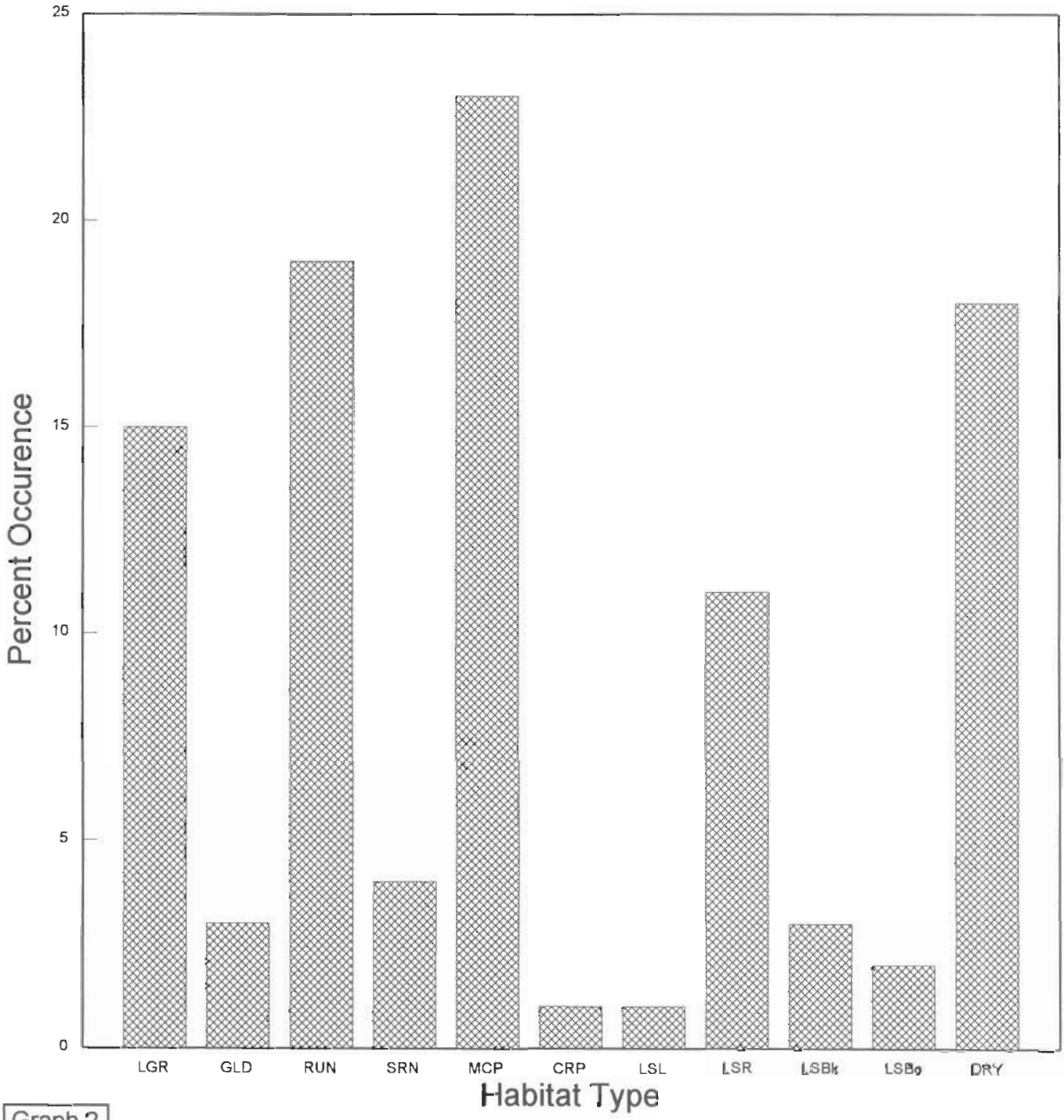




Graph 1

Bidwell Creek

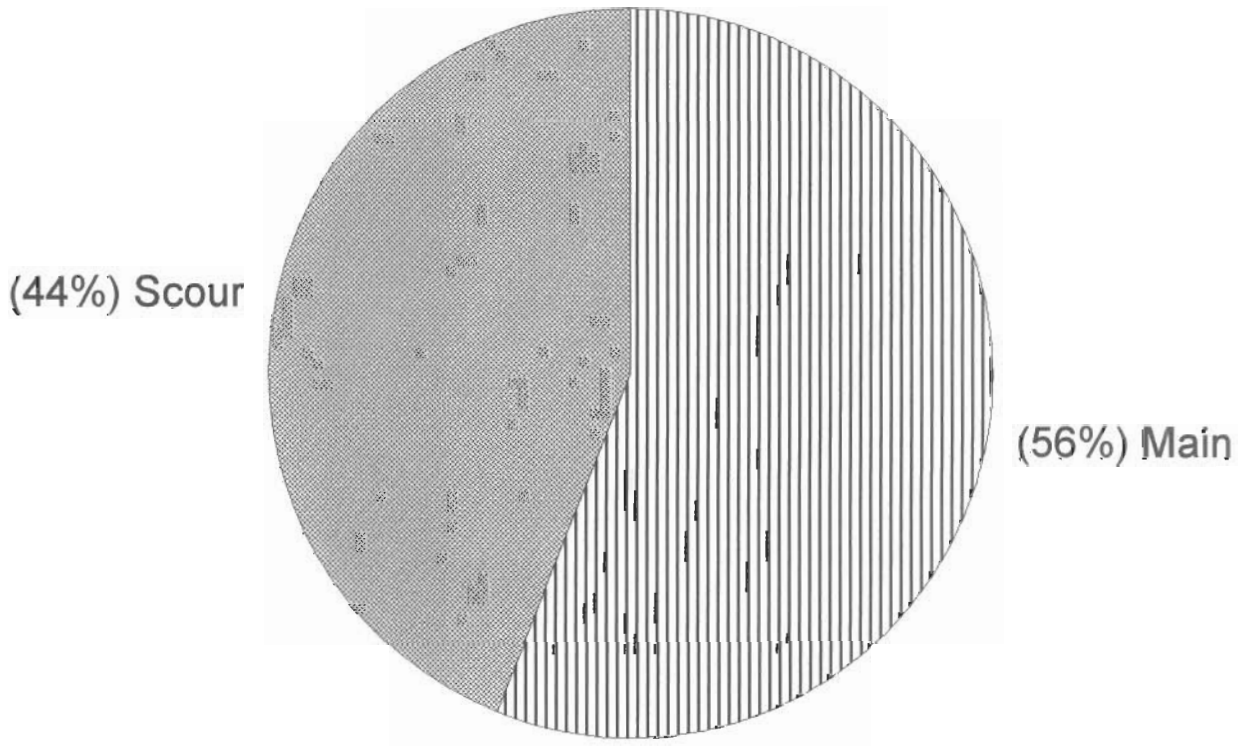
Level IV Habitat Types by % Occurrence



Graph 2

Bidwell Creek

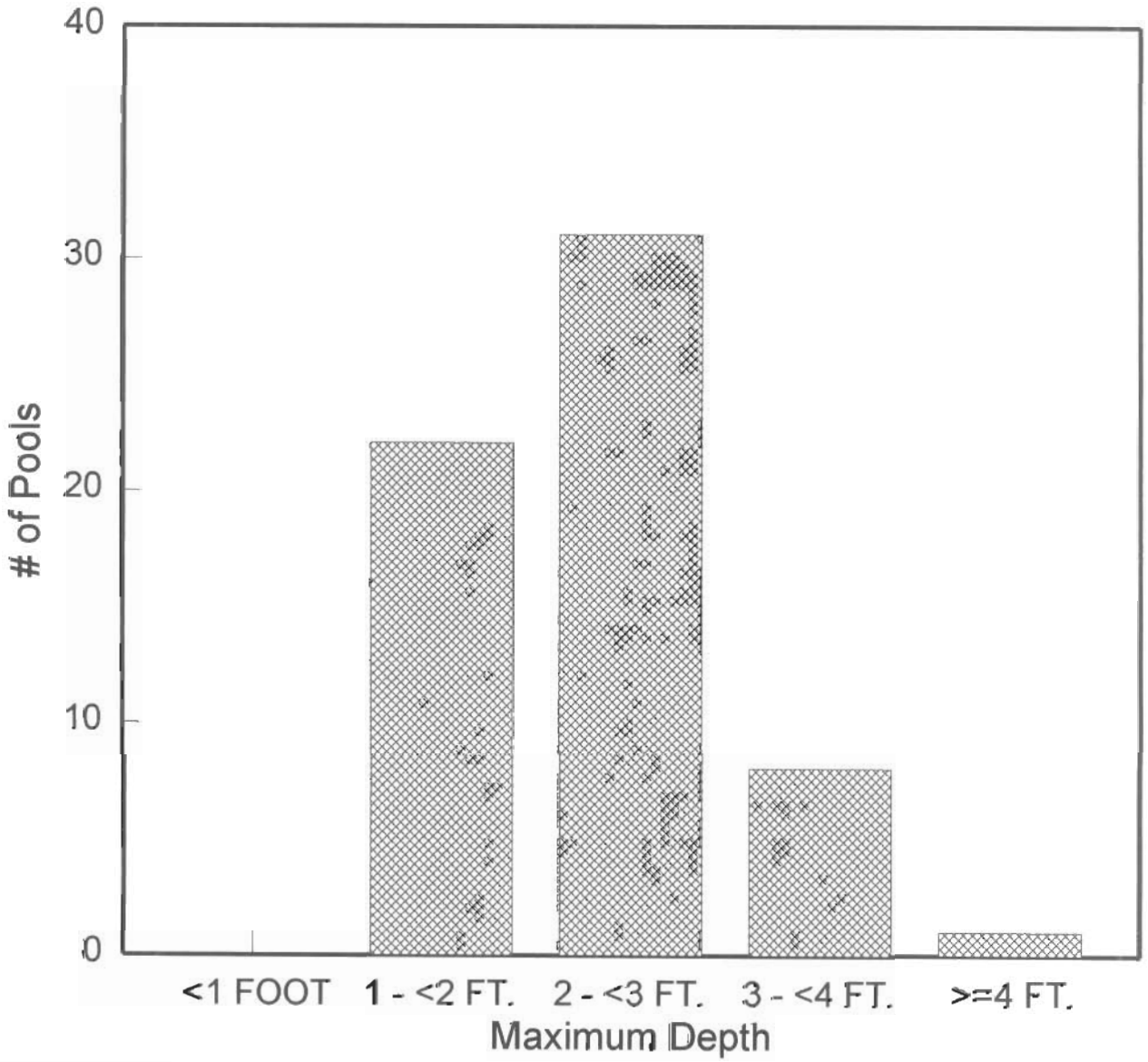
Pool Habitat Types by % Occurrence



Graph 3

Bidwell Creek

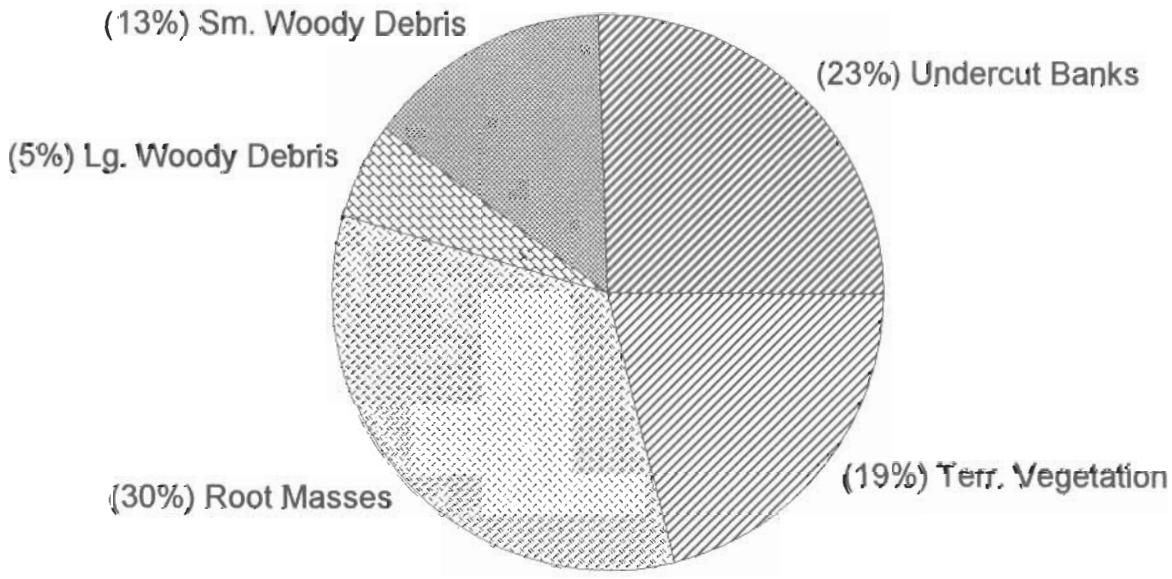
Maximum Depth in Pools



Graph 4

Bidwell Creek

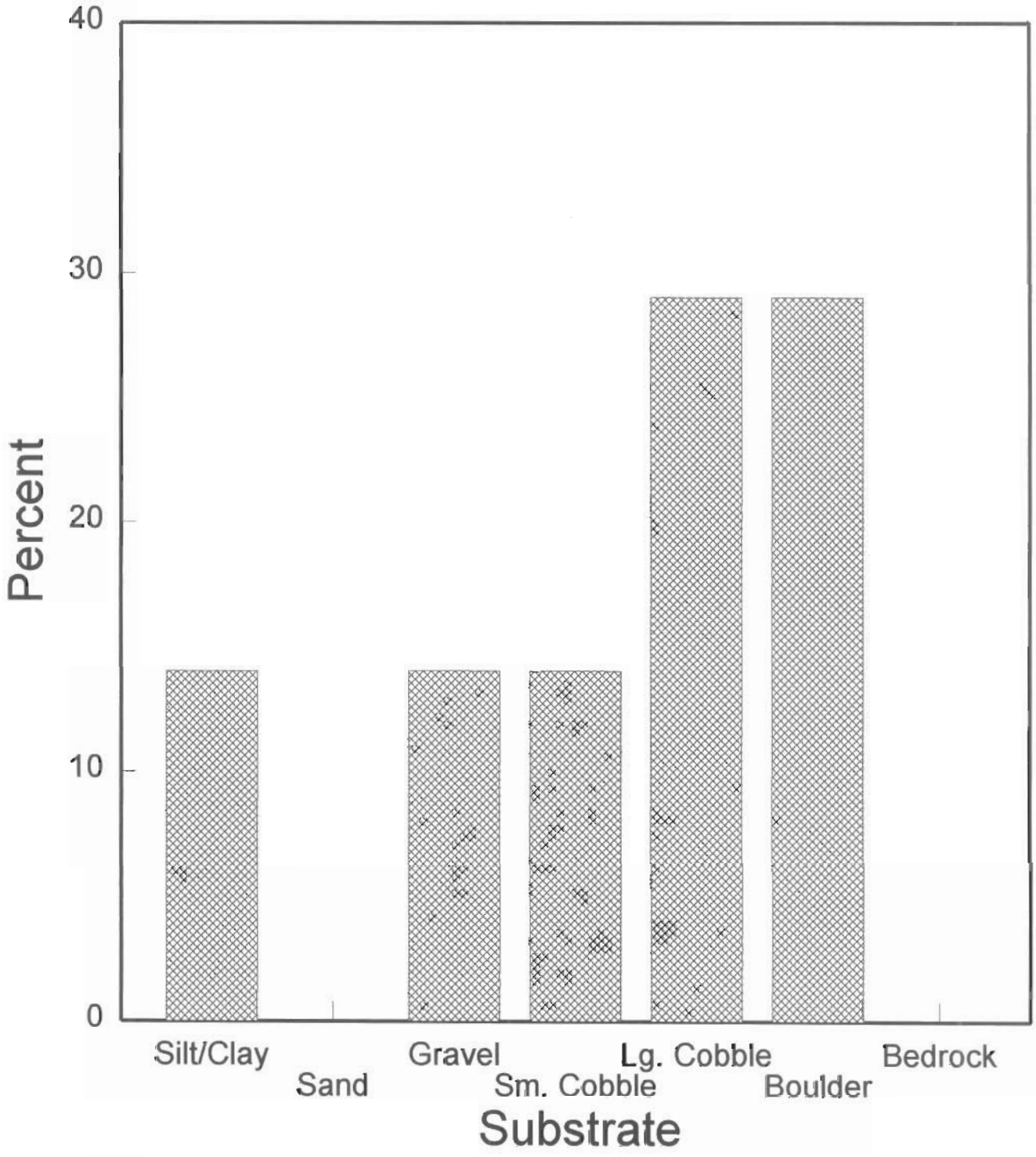
Pool Shelter Types by % Area



Graph 5

Bidwell Creek

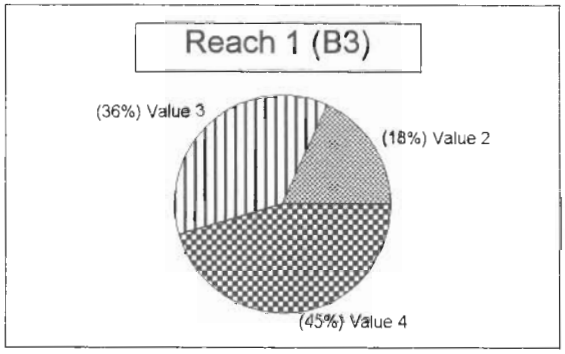
Substrate Composition in Low Gradient Riffles

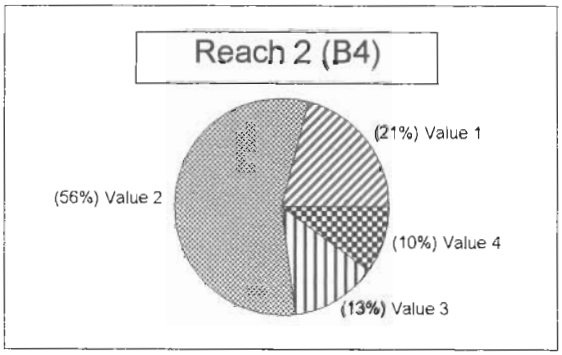


Graph 6

Bidwell Creek

Percent Cobble Embeddedness by Reach



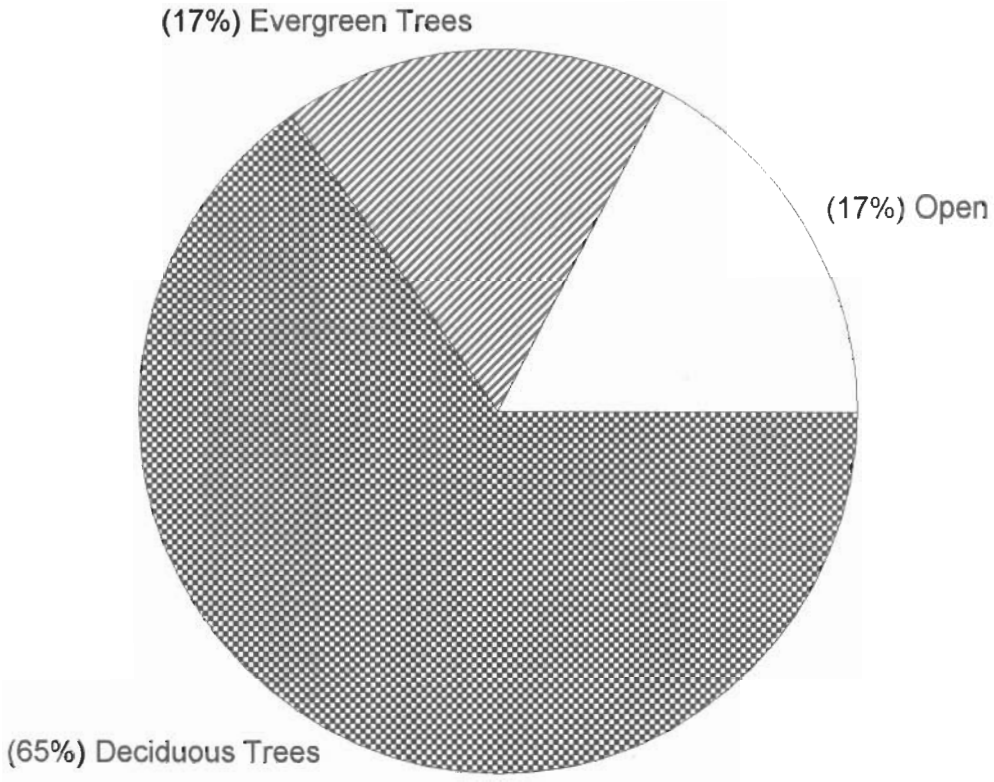


Value 1 = <25% Value 2 = 25-50% Value 3 = 51-75% Value 4 = >76%

Graph 7

Bidwell Creek

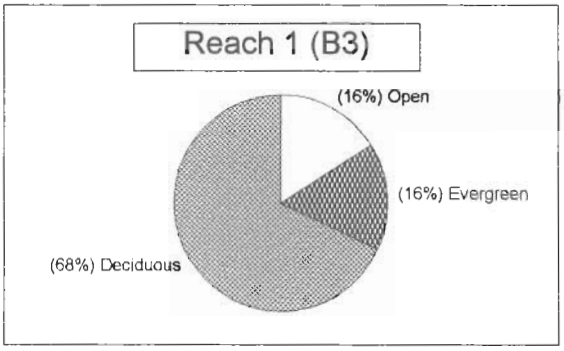
Mean Percent Canopy

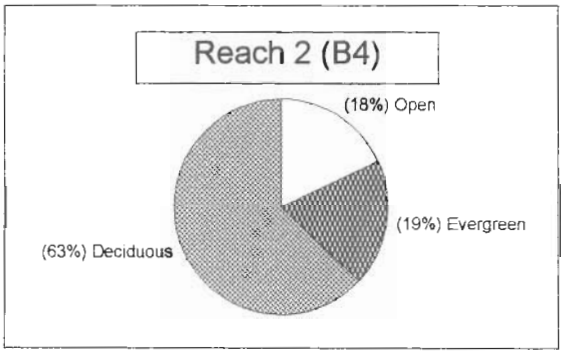


Graph 8

Bidwell Creek

Percent Canopy By Reach

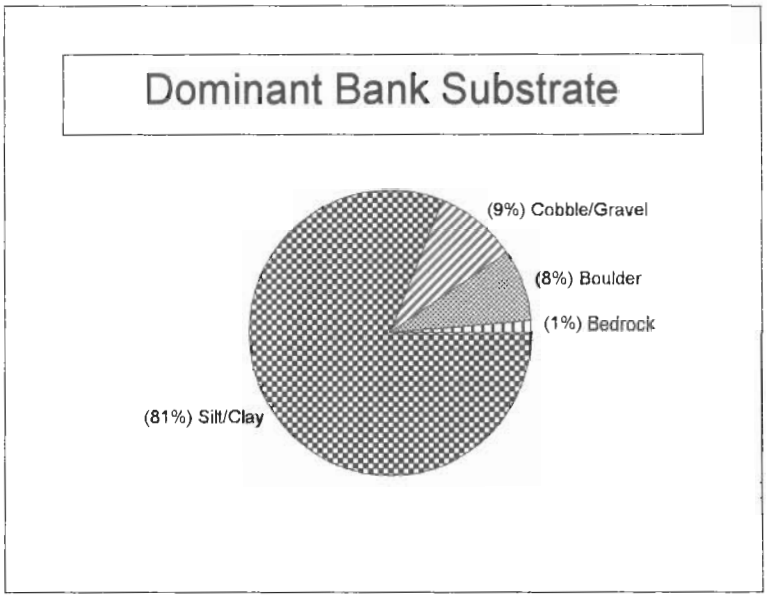


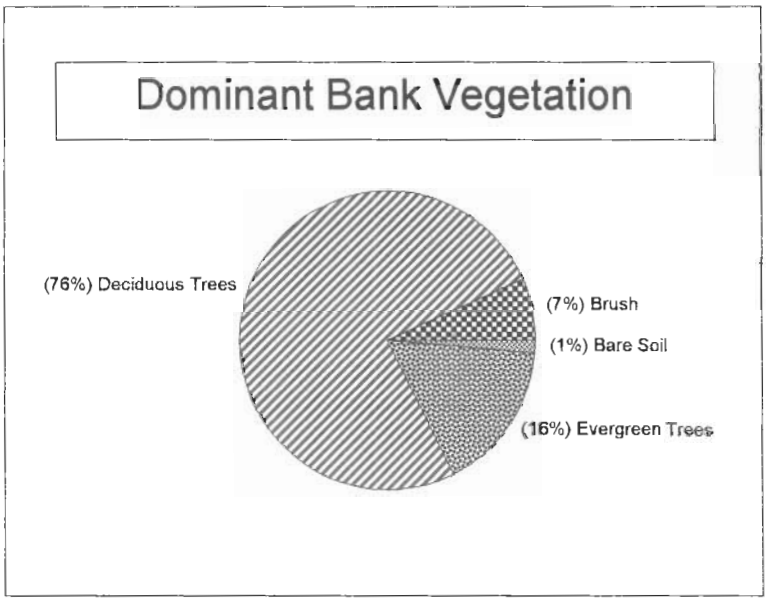


Graph 9

Bidwell Creek

Percent Bank Composition





Graph 10