**CALIFORNIA DEPARTMENT OF FISH AND GAME**
**STREAM INVENTORY REPORT**
Big Austin Creek
*Report Revised April 14, 2006*
*Report Completed 2000*
*Assessment Completed 1995*

## INTRODUCTION

Stream inventories were conducted during the summers of 1995 and 1996 on Big Austin Creek. The inventories were 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 Big Austin 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

Big Austin Creek is a tributary of the Russian River, located in Sonoma County, California (see Big Austin Creek map, page 2). The legal description at the confluence with the Russian River is T7N, R11W. Its location is 38°27'58" N. latitude and 123°2'57" W. longitude. Year round vehicle access exists from Austin Creek Road via Highway 116 near Cazadero. The upper road was only accessible through private locked gates.

Big Austin Creek and its tributaries drain a basin of approximately 68.7 square miles. Big Austin Creek is a fourth order stream and has approximately 13 miles of blue line stream, according to the USGS Guerneville, Duncans Mills, Fort Ross, and Cazadero 7.5 minute quadrangles. Major tributaries including East Austin Creek and Ward Creek are described in separate stream reports. Elevations range from about 20 feet at the mouth of the creek to 2,111 feet in the headwaters. Coniferous forest dominates the watershed, but there are zones of grassland and oak-woodland in the upper areas. The watershed is primarily privately owned, except for a portion in Austin Creek State Recreation Area. Major land uses include timber production, quarry mining (historical), gravel mining and urban development. Historically many residences were only occupied

seasonally, today most are year-round.

## METHODS

The habitat inventory conducted in Big Austin Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). The Neap crew 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 Big Austin 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. 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.

### 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.

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". Big Austin 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 Big Austin 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 Big Austin 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, 1998. Canopy density relates to the amount of stream shaded from the sun. In Big Austin 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 Big Austin 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 Big Austin 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

## HISTORICAL STREAM SURVEYS:

The Department of Fish and Game conducted two partial surveys of Big Austin Creek in 1977. The partial survey from the mouth to Ward Creek was conducted in April 1977 and the partial survey from Ward Creek to the headwaters was conducted in July 1977. In addition, biological inventories were conducted in June 1954, August 1956, and October 1968. A brief summary of each survey follows. In the 1977 survey, between Highway 116 and the mouth, the stream was intermittent. Fifty yards south of Ward Creek, a flow of 1.6 cfs was measured with a pygmy meter. Seventy yards upstream of Ward Creek, the flow was estimated to be 2.6 cfs. A 1 mile section near Red Slide Creek and a 1 mile section in the headwaters were intermittent. The wetted width ranged from 3" to 40' below Ward Creek and less than 1' to approximately 60' in areas with seasonal dams above Ward Creek. The depth ranged from less than 1" to 4' below Ward Creek and less than 1" to approximately 15' above Ward Creek.

Above Ward Creek, natural pools were most common in the upper 2 miles and artificial dammed pools occurred in the lower 3 miles. Shelter was provided by undercut banks and boulders. Below Ward Creek, pools were most common in the lower half of the survey. Shelter was provided by terrestrial vegetation, aquatic vegetation and deep pools.

Below Ward Creek, the substrate was 60% gravel, 15% small cobble and 25% sand. Forty-one steelhead redds and three lamprey redds were observed. Between Ward Creek and Red Slide Creek, the substrate consisted of 10% boulders, 30% cobble, 50% gravel, 5%

sand, and 5% organic debris/silt with many areas containing usable spawning gravel. One mile upstream of Red Slide Creek, the substrate was predominantly gravel. In the headwaters, the streambed was approximately 60% boulders, 35% cobble and 5% gravel with few areas available for spawning.

Partial barriers below Ward Creek included a temporary road crossing with a 36" culvert below the town of Cazadero, streambed alterations in an area opposite a gravel plant located north of the old Austin Creek Bridge, and remnants of some of the summer dams. Above Ward Creek, the only barriers were those created by gravel dams located downstream of the Arroyo Gun Club.

No pollution was observed, although septic tank leakage from homes along the creek was suspected. Two diversions were noted. Water Temperatures ranged from 53-73°F and air temperatures ranged from 56-84°F.

## HABITAT INVENTORY RESULTS

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

Habitat inventories of Big Austin Creek were conducted on August 8-31, 1995 and September 16-25, 1996. The 1995 inventory was conducted by Pamela Higgins, Kurt Gregory, and Julie Maggi (AmeriCorps). The 1996 inventory was conducted by Nancy and Bob Barney (NEAP). The data for both years was combined into one database and analyzed by Ken Bunzel (DFG). The stream was not inventoried from its mouth to the confluence with Ward Creek, because of its large size. The 1996 survey began at the confluence with Ward Creek and ended at the confluence with Bearpen Creek. The 1995 survey began at the confluence with Bearpen Creek, and extended to a point 500 feet past the end of anadromous fish passage at a 14 foot waterfall. The total length of the stream surveyed was 47,300 feet, with an additional 2,257 feet of side channel.

On July 21, 1995 summer flows were measured as approximately 2.45 cfs just above the confluence of Bearpen Creek and 5.72 cfs at the crossing of Old Cazadero Road and Cazadero Highway. On September 7, 1995 flows were measured as 0.984 near the confluence of Bearpen Creek, below the bridge. On May 25, 1996 flows were measured as 16.59 cfs at 150 yards north of the confluence with Ward Creek.

This section of Big Austin Creek has seven channel types in nine separate reaches: from the mouth to 18,874 feet an F3; next 1,563 feet an F2; next 2,220 feet an F3; next 3,523 feet an F4; next

3,403 feet a D4; next 6,257 feet a D3; next 1,153 feet an F3; next 4,536 feet an F1 and the upper 5,772 feet a B1.

F1 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly bedrock substrate. F2, F3 and F4 channels are similar with boulder, cobble and gravel substrates, respectively.

B1 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 bedrock substrate.

D3 channel types are multiple channels with longitudinal and transverse bars. They have a very wide low gradient (<2%) channel with eroding banks and a predominantly cobble substrate. D4 channels are similar except with a gravel substrate.

The un-surveyed section from the mouth to the confluence with Ward Creek can generally be described as a D4 channel type. It is characterized by long riffle/flatwater units with intermittent flow with few pools, except bedrock or boulder outcroppings and little shelter except where terrestrial vegetation exists.

Water temperatures ranged from 59-76°F. Air temperatures ranged from 54-91°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 44% pool units, 29% flatwater units, and 27% riffle units. Based on total **length** there were 36% pool units, 36% flatwater units, and 28% riffle units (Graph 1).

Eight hundred, ten habitat units were measured and 13% were completely sampled. Twenty-four 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 21%, runs 11%, and bedrock scour pools 9% (Graph 2). By percent total **length**, low gradient riffles made up 24%, runs 14%, and glides 9%.

Three hundred, fifty-nine pools were identified (Table 3). Scour pools were most often encountered at 54%, and comprised 48% 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. Eighty-three of

the 359 pools (23%) had a depth of three feet or greater (Graph 4). These deeper pools comprised 12% 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. Riffle types had the highest shelter rating at 28. Flatwater had the lowest rating with 17 and pools rated 20 (Table 1). Of the pool types, scour pools rated 24, backwater pools 21, and main channel pools 15 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were boulders at 53%, bedrock ledges at 21%, and root masses at 10%. Graph 5 describes the pool shelter in Big Austin Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in seven of the fifteen low gradient riffles measured. Small cobble was dominant in four of the low gradient riffles (Graph 6).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 352 pool tail-outs measured, 73 had a value of 1 (21%); 79 had a value of 2 (22%); 93 had a value of 3 (26%); and 107 had a value of 4 (30%). On this scale, a value of one is best for fisheries. Graph 7 describes percent embeddedness by reach.

The mean percent canopy density for the stream reach surveyed was 51%. The mean percentages of deciduous and evergreen trees were 36% and 64%, 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 61% and the mean percent left bank vegetated was 63%. For the habitat units measured, the dominant vegetation types for the stream banks were: 48% evergreen trees, 30% deciduous trees, 8% brush, 7% bare soil and 6% grass. The dominant substrate for the stream banks were: 33% cobble/gravel, 28% silt/clay/sand, 20% bedrock and 19% boulder (Graph 10).

*HABITAT INVENTORY RESULTS FOR UNNAMED TRIBUTARY*

*The habitat inventory of August 25-31, 1995 was conducted by Pamela Higgins and Kurt Gregory (Americorps) and data analyzed by Ken Bunzel (DFG). The survey began at the confluence with Big Austin Creek and ended 2,970 feet upstream were fish were no longer observed.*

*The surveyed section of this tributary is an F1 channel type. These channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly bedrock substrate.*

*Water temperatures ranged from 68°-72°F. Air temperatures ranged from 73-81°F. Based on total* ***length*** *there were 38% pool units, 33% flatwater units, and 29% riffle units. Forty-five habitat units were measured and 7% were completely sampled. By percent total* ***length****, high gradient riffles made up 28%, step pools 28%, step runs 25%, and runs 8%.*

*Twenty-four pools were identified. Main Channel pools were most often encountered at 54%, and comprised 80% of the total length of pools. Half of the pools had a depth of two feet or greater. These deeper pools comprised 18% of the total length of stream habitat. Pool types in general had a mean shelter rating at 21, with shelter consisting of 78% boulders and 22% bedrock ledges.*

*The mean percent canopy density for the stream reach surveyed was 36%. The mean percentages of deciduous and evergreen trees were 10% and 90%, respectively. Both right and left banks were 100% vegetated, with vegetation consisting of 83% evergreen trees and 17% brush. The stream banks were 83% bedrock and 17% cobble/gravel.*

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In July 1954, two sites were electroshocked using a 230 volt D.C. shocker. The first site was located 3 miles above the mouth at the Dic-A-Dero Rancho Resort. The water temperature was 65°F and the air temperature was 73°F. The flow was estimated at approximately 5 cfs. For 200 feet in pools and riffles 21 0+ and six 1+ steelhead were observed along with 1 juvenile Coho Salmon, 10 California Roach, 9 Sacramento Suckers, 1 Threespine Stickleback, 1 Sacramento Pikeminnow and 12 sculpin (Cottus Sp.). In addition, lamprey ammocoetes and crayfish were abundant.

The second site was located .5 miles above Austin Creek School. For 200 feet in pools and riffles 341 0+, 27 1+, and two 2+ steelhead were observed. Both of the 2+ steelhead had been feeding almost exclusively on caddis fly larvae. In addition, 56 California Roach, 5 Sacramento Suckers, and 2 sculpin were observed. No crayfish or lamprey were found at this site.

In August 1956, two sites were electroshocked for evaluation of the Russian River rough fish control project. The first site, located just above the mouth of Bearpen Creek, was nearly dry. A 4' deep pool still existed at the base of a large rock. Only 4 large Sacramento Suckers 10-11" long were seen.

The second site was located near the lower end of Ohmens Resort Campground. The water was fairly low in this area, with a flow of less than 0.5 cfs, which was lower than observed in previous years at this time. Three 0+ steelhead, 5 Sacramento Suckers and 1 Sacramento Pikeminnow were observed.

In 1968, nineteen tributaries of the Russian River were checked for the presence of Juvenile coho Salmon. Capture and identification was done by the use of a brail net. No coho were found in Austin Creek, although it was noted that a period of low rainfall occurred during the previous spawning season. Species present during this survey included steelhead, California Roach, large (adult) Sacramento Pikeminnow and Sacramento Suckers.

In the April 1977 survey below Ward Creek, young of the year Steelhead and California Roach were abundant, averaging 100/100' for each species. In addition, 13 adult steelhead, numerous Threespine Sticklebacks, 10 Sacramento Suckers, and 5 Sacramento Pikeminnow were observed.

In the July 1977 survey above Ward Creek, Young of the year steelhead were observed at 15-25/100' upstream to the Ohmen Resort area. It was noted that low winter flows during the past two years had probably limited both the range and number of steelhead in the stream. California Roach were observed up to Laton Mine in the headwaters and were the most abundant species found in this section. Approximately 80 Sacramento Suckers ranging in size from 3-10" were observed from 0.1 miles downstream of the headwaters to Ward Creek, with many observed in the pools downstream of Red Slide Creek. Three sculpin (Cottus sp.) were observed approximately 0.75 miles downstream of the headwaters.

On September 7, 1995 a biological inventory was conducted in four sites of Big Austin 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 ranged from 86-88°F and the water temperature ranged from 68-73°F. The observers were Higgins and Gregory (AmeriCorps).

The inventory of Reach 4 started in habitat unit 28 and ended 394

feet upstream in habitat unit 45. In two lateral scour pools 28 0+ and 4 1+ steelhead (8/100') and 1 coho were observed along with 10 California Roach, 1 sculpin (Cottus sp.) and 1 Threespine Stickleback.

The inventory of Reach 7 started in habitat unit 262 and ended 233 feet upstream in habitat unit 268. In two lateral scour pools 30 0+ and 7 1+ steelhead (18/100') were observed along with 14 California Roach and 6 sculpin. Five 0+ steelhead were also observed in a run habitat type.

The inventory of Reach 8 started in habitat unit 348 and ended 620 feet upstream in habitat unit 356. In pool and run habitat types 39 0+ and 2 1+ steelhead (7/100') were observed along with 18 sculpin, 7 California Roach and 3 unidentified salamanders.

The inventory of Reach 9 started in habitat unit 462 and ended 330 feet upstream in habitat unit 470. Eight 0+ steelhead (2/100') were observed in pool habitats and one California Roach and six sculpin were observed in pool, run and riffle habitats.

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 |
|---|---|---|---|
| 1954, 1956, 1968, 1977, 1995 | Steelhead Trout | DFG | N |
| 1954, 1995 | Coho Salmon | DFG | N |
| 1954, 1956, 1968, 1977 | Sacramento Pikeminnow | DFG | N |
| 1954, 1956, 1968, 1977 | Sacramento Sucker | DFG | N |
| 1954, 1968, 1977, 1995 | California Roach | DFG | N |
| 1954, 1977, 1995 | Sculpin | DFG | N |
| 1954, 1977, 1995 | Threespine Stickleback | DFG | N |
| 1954 | Lamprey Ammocoetes | DFG | N |

No introduced fish species were found in any of the surveys. The following table summarizes fish hatchery stocking, transfers or rescues for Big Austin Creek.

**Summary of hatchery stocking, transfers or rescues**

| YEAR | SPECIES | SOURCE | # | SIZE |
|---|---|---|---|---|
| 1956 | SH | AUSTIN CREEK* | 4335 | FING |
| 1957 | SH | AUSTIN CREEK* | 18069 | FING |
| 1958 | SH | AUSTIN CREEK* | 15824 | FING |
| 1958 | SH | DUTCH BILL CREEK* | 6694 | FING |
| 1959 | SH | AUSTIN CREEK* | 7718 | FING |
| 1959 | SH | BEAR PEN* | 5625 | FING |
| 1959 | SH | DUTCH BILL CREEK* | 41494 | FING |
| 1959 | SH | HULBERT CREEK* | 5000 | FING |
| 1960 | SH | AUSTIN CREEK* | 21423 | FING |
| 1960 | SH | BEAR PEN CREEK* | 12791 | FING |
| 1960 | SH | DUTCH BILL CREEK* | 7690 | FING |
| 1961 | SH | AUSTIN CREEK* | 24926 | FING |
| 1961 | SH | BEAR PEN CREEK* | 12680 | FING |
| 1961 | SH | DUTCH BILL CREEK* | 18527 | FING |
| 1962 | SH | AUSTIN CREEK* | 21448 | FING |
| 1962 | SH | BEAR PEN CREEK* | 18906 | FING |
| 1962 | SH | DUTCH BILL CREEK* | 5651 | FING |
| 1963 | SH | AUSTIN CREEK* | 13440 | FING |
| 1963 | SH | BEAR PEN CREEK* | 2120 | FING |
| 1963 | SH | DUTCH BILL CREEK* | 2624 | FING |
| 1964 | SH | AUSTIN CREEK* | 131007 | FING |
| 1964 | SH | BEAR PEN CREEK* | 7787 | FING |

| Summary of hatchery stocking, transfers or rescues | | | | |
|---|---|---|---|---|
| 1964 | SH | DUTCH BILL CREEK* | 13520 | FING |
| 1965 | SH | AUSTIN CREEK* | 8656 | FING |
| 1966 | SH | AUSTIN CREEK* | 63970 | FING |
| 1966 | SH | BEAR PEN CREEK* | 11400 | FING |
| 1967 | SH | AUSTIN CREEK* | 15717 | FING |
| 1967 | SH | BEAR PEN CREEK* | 2088 | FING |
| 1967 | SH | SONOMA CREEK* | 5556 | FING |
| 1968 | SH | AUSTIN CREEK* | 86499 | FING |
| 1968 | SS | DUTCH BILL CREEK* | 30032 | FING |
| 1969 | SH | AUSTIN CREEK* | 27100 | FING |
| 1969 | SS | DARRAH **Hatchery t** | 10000 | YEAR |
| 1969 | SS | DUTCH BILL CREEK* | 29684 | FING |
| 1969 | SH | RUSSIAN RIVER* | 2460 | FING |
| 1970 | SH | AUSTIN CREEK* | 56436 | FING |
| 1970 | SH | BEAR PEN CREEK* | 4305 | FING |
| 1970 | SS | DARRAH **Hatchery t** | 15015 | YEAR |
| 1970 | SS | DUTCH BILL CREEK* | 4277 | FING |
| 1972 | SH | AUSTIN CREEK* | 5965 | FING |
| 1978 | SS | GARCIA POND #1 **t** | 4455 | YEAR |
| 1978 | SS | GARCIA POND #2 **t** | 3965 | YEAR |
| 1983 | SH | WARM SPRINGS HATCHERY | 24800 | FING |
| 1984 | SH | WARM SPRINGS HATCHERY | 13770 | FING |
| 1986 | SH | WARM SPRINGS HATCHERY | 13500 | FING |

SH = steelhead

SS = coho (silver) salmon
***** = rescue actively
**t** = transfer

DISCUSSION

Big Austin Creek has seven channel types: F3, F2, F4, D4, D3, F1, and B1. There are 22,247 feet of F3 channel type in Reaches 1, 3 and 7. According to the DFG 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 1563 feet of F2 channel type in Reach 2. These channel types are fair for low-stage weirs, single and opposing wing-deflectors and log cover.

There are 3523 feet of F4 channel type in Reach 4. These channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover.

There are 3403 feet of D4 channel type in Reach 5. D4 channel types are fair for bank-placed boulders, single and opposing wing-deflectors and channel constrictors.

There are 6257 feet of D3 channel type in Reach 6. D3 channel types are fair for bank-placed boulders, single and opposing wing-deflectors and channel constrictors. They are poor for low and medium-stage weirs, boulder clusters and log cover.

There are 4536 feet of F1 channel type in Reach 8. These channel types are good for bank-placed boulders and fair for single wing-deflectors and log cover.

There are 5772 feet of B1 channel type in Reach 9. These channel types are excellent for bank-placed boulders and bank cover and good for log cover.

Any work considered in the D channel type areas must take into consideration the meandering stream channel created by the low gradient and excess gravel supply from the headwaters. Bioengineering erosion control techniques could be suitable in some areas to decrease channel width thereby increasing riparian and sediment scour.

The F and B 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. However, any work considered will require careful design, placement, and construction, due to high stream energies, and must include protection for any unstable banks.

The water temperatures recorded on the survey days August 8-31, 1995 and September 16-25, 1996 ranged from 59-76°F. Air temperatures ranged from 54-91°F. Water temperatures above the threshold stress level (65°F) for salmonids were recorded in all reaches. 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 36% of the total **length** of this survey. In third and fourth order streams a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Big Austin Creek, the pools are relatively shallow with only 23% having a maximum depth of at least 3 feet. These pools comprised 12% of the total length of stream habitat. Landowners indicate historically Austin Creek had many large deep pools. These pools have now filled with gravel due to historic quarry mining activities, sedimentation from road building, urban development and a recent major fire. Seasonal dams built may have also led to instream erosion through bank saturation and slumping.

The mean shelter rating for pools was 20. 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 boulders and bedrock ledges. Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Landowners indicate that many large logs have been removed from the channel over time for lumber, firewood and to reduce the threat of erosion and flooding. However, this practice has lead to diminished fish habitat quality and likely increased stream velocities leading to increased erosion and flooding in downstream areas. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Seventy-three percent of the low gradient riffles measured had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids. Fifty-seven percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 21% 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 1-5, and 7 had fair ratings while Reaches 6, 8 and 9 had poor 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 Reaches 6-9, stream bank erosion adjacent to road areas is prevalent. These sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the survey was only 51%. Although 80 percent is generally considered desirable, canopy could only be improved in this wide alluvial stream with large native conifers. Cooler water temperatures are desirable in Big Austin Creek. Elevated water temperatures could be reduced by increasing stream canopy, particularly in the lower un-surveyed areas. The large trees required for adequate stream canopy would also eventually provide a long term source of large woody debris needed for instream structure and bank stability.

The headwater area of Big Austin Creek is geologically made up of highly erodible materials. This natural instability has been exacerbated by historic mining activities and a more recent devastating fire. Although much of the quarry mining activity has healed over, the effects of the fire in reducing riparian vegetation are still evident, and several large landslides exist which will be active for some time.

*DISCUSSION FOR UNNAMED TRIBUTARY*

*There are 2970 feet of F1 channel type in this tributary. These channel types are good for bank-placed boulders and fair for single wing-deflectors and log cover.*

*The water temperatures were high (68-72°F) and the canopy density was very low (36%) in this creek. In addition, the amount and quality of pool shelter is inadequate. Large woody debris would increase pool habitat with protective shelter for juvenile salmonids. Increasing the shade canopy by planting native trees would keep water temperatures cool and provide a long term source of woody debris for instream structure and shelter.*

*Road related erosion is prevalent in some areas, particularly downstream in the un-surveyed section. Eleven diversions were noted*

*in this section. Downstream where seasonal vacation residences have been converted to year round homes, water diversion is likely reducing flows.*

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 in the 1954 and 1995 surveys. 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 survey documented few 0+ fish indicating unsuccessful spawning or poor rearing conditions. Fewer 1+ fish were noted indicating poor holding-over conditions in general.

In general, Big Austin Creek is inadequate for salmonid rearing habitat. Stream shade canopy is very low and water temperatures are high. The #'s and presence of species such as Sacramento Pikeminnow and Sacramento Suckers indicate temperature levels favor warm water species and are marginal for salmonids.

There are adequate quantities of spawning gravel throughout the surveyed section; however, Reaches 6-9 have high levels of fine sediment. The stream for its entire length is severely aggraded. This can be attributed mainly to the natural geologic instability of the region which has been exasperated by historic quarry mining and wildfire, road building and urban development. Relatively few pools of adequate depth exist for salmonid rearing habitat and there is a lack of large woody debris shelter. Downstream of the surveyed section, habitat for salmonids is almost nonexistent and largely serves as a migration corridor.

## GENERAL RECOMMENDATIONS

Big Austin 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. 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) Numerous roads with inadequate erosion protection were observed in the headwaters of Big Austin 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.

2) A geological/hydrological assessment of the headwater area, and adjoining historic mine should be conducted to develop a restoration plan for the aggraded channel. This should include a sediment-budget analysis and the possibility of increased gravel mining in the lower and uppermost reaches.

3) There is a bank culvert in habitat unit 114 (Reach 1) in need of maintenance. This culvert has rusted and is causing erosion. There are also major bank erosion problems in habitat units 232 (Reach 2, below Bearpen Creek), 204 and 210 (both Reach 6, above Bearpen Creek). These sites should be treated with bank stabilization structures and/or revegetation techniques to reduce the amount of fine sediment entering the stream.

4) Increase the canopy on Big Austin Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

PROBLEM SITES AND LANDMARKS - BIG AUSTIN 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 | 48 | START AT WARD CREEK |
| 2.00 | 124 | FEW FISH |
| 15.00 | 957 | MAN MADE DAM |
| 16.00 | 1033 | 2" WATER INTAKE |
| 17.00 | 1090 | DRY TRIB LF BANK |
| 23.00 | 1432 | SM. MAN MADE ROCK DAM , NO FORM |
| 25.00 | 1735 | WELL CASING RT & LF BANKS |
| 26.00 | 1841 | SM. CULVERT LF BANK |
| 27.00 | 2023 | MAN MADE SM. ROCK DAM W/ VISQUENE 45' X 2' X 25' |
| 29.00 | 2290 | SM. MANMADE ROCK DAM |
| 31.00 | 2331 | PUMP CASING LF BANK |
| 36.00 | 2597 | CONCRETE WALL CASING RT BANK |
| 40.00 | 2805 | FISH |
| 44.00 | 2974 | UNSTABLE RT BANK |
| 46.00 | 3035 | SUCKER FISH |
| 69.00 | 4329 | YELLOW-LEGGED FROGS |
| 71.00 | 4499 | FROGS |
| 73.00 | 4594 | CULVERT LF BANK |
| 74.00 | 4732 | DRY TRIB RT BANK |
| 78.00 | 4988 | CONCRETE CULVERT LF BANK 4'X4'X30' DOWN CUTTING SLIGHTLY. HAS A SILL. NO PROBLEMS |
| 84.00 | 5634 | DRY TRIB RT BANK |
| 86.00 | 5902 | SAW NUMEROUS 0+ FISH |
| 90.10 | 6216 | FROGS |
| 91.00 | 6374 | SM. FROGS |
| 92.00 | 6492 | MAN MADE SM. ROCK DAM |
| 96.00 | 6783 | FROGS |
| 99.00 | 7114 | FROGS & FISH |
| 103.00 | 7473 | BRIDGE 10.5'H X 13.5'W X 45'L |
| 105.00 | 7940 | SM. CULVERT LF BANK 12X12 NO PROBLEMS |
| 110.00 | 8371 | DRY TRIB RT BANK |
| 114.00 | 8543 | CULVERT |
| 117.00 | 9087 | DRY TRIB RT BANK |
| 123.00 | 9767 | NUMEROUS FISH |
| 125.00 | 9931 | TEMP. INSTREAM CULVERT DUE TO LOGGING |
| 135.00 | 10914 | BRIDGE |
| 138.00 | 11162 | WELL CASING LF BANK |

| | | |
|---|---|---|
| 157.00 | 12632 | MAN MADE VERY LOW ROCK DAM |
| 162.00 | 12972 | PIC #14 TRIB RT BANK HOLMES CANYON |
| 171.00 | 14282 | DAMMED POOL FLASH BOARD |
| 176.00 | 14908 | MANY 0+ FISH |
| 188.00 | 15742 | MANY FISH |
| 190.00 | 16007 | UNSTABLE RT BANK |
| 191.00 | 16073 | PUMP CASING RT BANK |
| 196.00 | 16550 | 1+, 2+ FISH |
| 200.00 | 17619 | MAN MADE DAM POOL; DRY TRIB LF BANK |
| 209.00 | 18697 | EROSION PROBLEM RT BANK |
| 214.00 | 19107 | SEVERAL 0+ FISH |
| 215.00 | 19141 | EROSION LF BANK |
| 218.00 | 19337 | UNSTABLE RT BANK |
| 220.00 | 19426 | UNSTABLE RT & LF BANKS |
| 221.00 | 19464 | SEVERAL 1+, ONE 2+ |
| 227.00 | 19789 | 50 - 70 0+ FISH THIS POOL |
| 231.00 | 20092 | UNSTABLE BANK |
| 232.00 | 20127 | BLOW OUT RT BANK |
| 251.00 | 22409 | IN BANK CULVERT RT BANK |
| 257.00 | 22697 | BEAR PEN CREEK RT BANK |
| 1.00 | 22728 | FISH PRESENT; ROACH?/STEELHEAD |
| 43.00 | 24430 | SH/ROACH? |
| 46.00 | 24761 | MANY FISH CUT OFF FROM CHANNEL |
| 58.00 | 25516 | A FEW 1+ SH; MANY 0+ SH AND ROACH |
| 68.00 | 26123 | STEELHEAD OBSERVED |
| 90.00 | 27430 | EROSION LF BK |
| 98.00 | 27985 | DIRT CROSSING |
| 107.00 | 28640 | MANY FISH |
| 124.00 | 29858 | SUMMER CROSSING |
| 127.00 | 29967 | EROSION RT BK |
| 130.00 | 30144 | SUMMER CROSSING |
| 137.00 | 30550 | LARGE FISH |
| 167.00 | 32080 | TRIB LF BK STEEP, BOULDERS (61°F) |
| 176.00 | 32444 | MANY FISH (ROACH/SH) |
| 189.00 | 32964 | DRY TRIB LF BK (LG. BOULDERS) |
| 190.00 | 32990 | MANY 0+ SALMONIDS |
| 194.00 | 33140 | WET TRIB LF BK (60°F) |
| 195.00 | 33200 | EROSION OF FINE SEDIMENT ON RT BK |
| 204.00 | 33623 | BLOWOUT LF BK |
| 206.00 | 33671 | OLD BLOWOUT/EROSION RT BK |
| 207.00 | 33685 | NEW BLOWOUT, SMALLER RT BK |
| 211.00 | 33776 | MASSIVE LOG ACCUMULATION |
| 219.00 | 34158 | RESUMED TYPING OF BIG AUSTIN AT TRIB CONFLUENCE |
| 236.00 | 34615 | EROSION RT BK |
| 237.00 | 34645 | EROSION RT BK |
| 239.00 | 34776 | TRIB OR GULLY (DRY) RT BANK |

| | | |
|---|---|---|
| 249.00 | 35436 | BRIDGE XING |
| 256.00 | 35710 | SUMMER XING |
| 260.00 | 35896 | "GRAVELY SPRING" TRIB ON LF BK, TOP OF UNIT (63°F) |
| 274.00 | 36397 | E.F. SPOT/SNORKEL; 1+/2+? SALMONIDS |
| 276.00 | 36449 | DRY TRIB/GULLY LF BANK |
| 302.00 | 37452 | POSS. DRY TRIB ON RT BK, LARGE LOGS |
| 304.00 | 37555 | EROSION LF BK |
| 307.00 | 37643 | EROSION RT BK |
| 335.00 | 38742 | CULVERT FOR ROAD (6.5' X 16'L) RT BK, TRIB (66°F) |
| 337.00 | 38806 | LARGE 2+ SH |
| 348.00 | 39138 | SUMMER ROAD XING |
| 367.00 | 40197 | TRIB LF BK 61°F (FISH) 3'W, .5' AVG. DEPTH. |
| 375.00 | 40487 | EROSION RT BANK |
| 378.00 | 40532 | TRIB RT BK STEEP/NARROW 1'W, 66°F |
| 387.00 | 40789 | 1+/2+ FISH OBSERVED |
| 395.00 | 41090 | EROSION/BLOWOUT RT BK |
| 398.00 | 41206 | TRIB RT BK (62°F) SHALLOW, AVG. DPTH .5, FISH PRESENT |
| 402.00 | 41370 | TRIB LF BK (64°F) STEEP/BOULDERS/VERY SHALLOW TRICKLE |
| 426.00 | 42446 | 2" PIPE LF BK PUTTING TRICKLE INTO CREEK |
| 427.00 | 42578 | DRY TRIB LF BK |
| 432.00 | 42866 | TRIB LF BK (TRICKLE, VERY STEEP) |
| 434.00 | 43017 | SUMMER ROAD XING |
| 444.00 | 43324 | SUMMER XING |
| 460.00 | 43876 | SPRING LF BK |
| 479.00 | 44688 | LF BK SPRING |
| 481.00 | 44750 | TINY TRIB LF BK, STEEP, 63°F |
| 485.00 | 44943 | SPRING LF BK INTO POOL |
| 492.00 | 45377 | BEDROCK SUBSTRATE |
| 494.00 | 45481 | 1+ OR 2+ SALMONID |
| 495.00 | 45502 | BEDROCK SUBSTRATE |
| 497.00 | 45666 | WHITE SUBSTANCE COVERING POOL BOTTOM |
| 499.00 | 45733 | WHITE SUBSTANCE COVERING POOL BOTTOM (FISH OBSERVED, SP.?) |
| 500.00 | 45770 | ALL BEDROCK SUBSTRATE |
| 502.00 | 45851 | BEDROCK SHEET? |
| 503.00 | 45879 | CREEK BECOMING NARROW/SHALLOW |
| 506.00 | 46226 | DRY TRIB LF BK |
| 510.00 | 46433 | DRY ABOVE HERE SOME DISTANCE |
| 512.00 | 46503 | FISH OBSERVED |

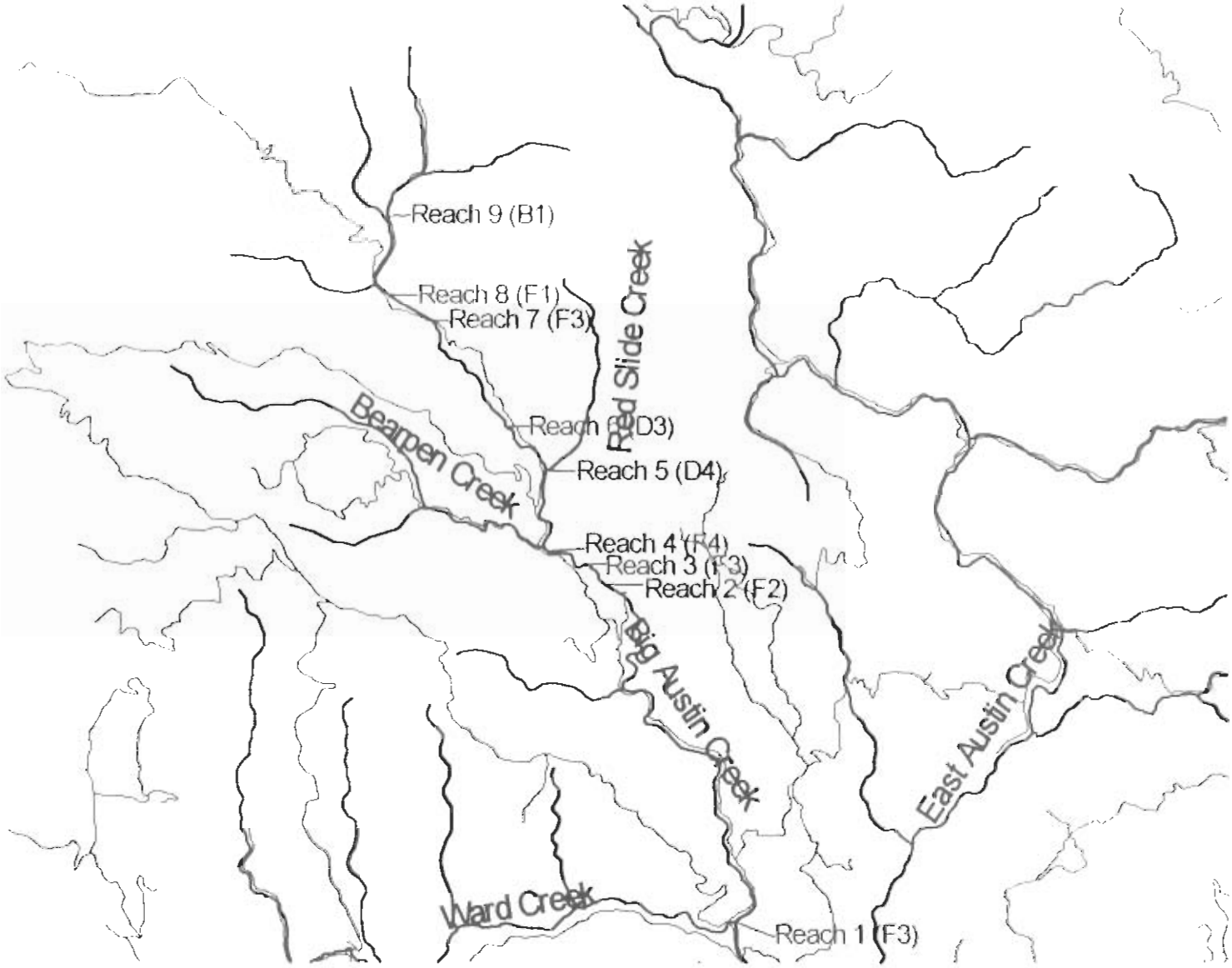
| | | |
|---|---|---|
| 517.00 | 46837 | 2" METAL PIPE RT BK, LARGE VOLUME WATER COMING INTO CREEK |
| 518.00 | 46868 | 14' FROM POOL SURFACE TO TOP OF PLUNGE. FISH PRESENT IN POOL |
| 520.00 | 47026 | TRIB RT BK (FORK, 71°F) ONLY A TRICKLE, VERY SHALLOW/STEEP/BOULDERS, VARIED BEDROCK SUBSTRATE |
| 521.00 | 47336 | NO FISH OBSERVED ABOVE UNIT #518 |
| 522.00 | 47367 | CREEK GOES DRY HERE, NO FISH OBSERVED |

*PROBLEM SITES AND LANDMARKS - UNNAMED TRIBUTARY SURVEY COMMENTS*

| *HABITAT UNIT #* | *STREAM LEN (FT.)* | *COMMENTS* |
|---|---|---|
| *18.00* | *794* | *FISH FRY OBSERVED* |
| *22.00* | *1003* | *9' FROM POOL SURFACE TO TOP OF PLUNGE* |
| *25.00* | *1134* | *FISH PRESENT* |
| *30.00* | *1370* | *NO FISH* |
| *33.00* | *1522* | *NO FISH* |
| *35.00* | *1747* | *TRIB LF BK (STEEP/BEDROCK) FRY PRESENT 63°F* |
| *45.00* | *2973* | *ENDED SURVEY HERE. NEXT 1000' WAS VERY NARROW, BOULDER AND BEDROCK STEP RUN WITH SOME INFREQUENT SHALLOW POOLS. ONLY A COUPLE 1/2" FRY. WATER 73°F, ALMOST ZERO CANOPY. ROCKY/BEDROCK TERRAIN.* |

# Big Austin Creek

## Channel Typing Reaches




Roads

Streams

Inland Fisheries Division
Dept. of Fish and Game
April 16, 1997

2 0 2 Miles

Big Austin Creek

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

| Mean Percent Canopy | Mean Percent Evergreen | Mean Percent Decidous | Mean Right bank % Cover | Mean Left Bank % Cover |
|---|---|---|---|---|
| 51.26 | 63.86 | 35.70 | 61.39 | 63.26 |

APPENDIX B.

Mean Percentage of Dominant Substrate

| Dominant Class of Substrate | Number Units Right Bank | Number Units Left Bank | Total Mean Percent |
|---|---|---|---|
| Bedrock | 25 | 37 | 20.26 |
| Boulder | 33 | 24 | 18.63 |
| Cobble/Gravel | 49 | 52 | 33.01 |
| Silt/clay | 46 | 40 | 28.10 |

Mean Percentage of Dominant Vegetation

| Dominant Class of Vegetation | Number Units Right Bank | Number Units Left Bank | Total Mean Percent |
|---|---|---|---|
| Grass | 5 | 13 | 5.88 |
| Brush | 14 | 12 | 8.50 |
| Deciduous Trees | 51 | 42 | 30.39 |
| Evergreen Trees | 74 | 74 | 48.37 |
| No Vegetation | 9 | 12 | 6.86 |

# APPENDIX C. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Big Austin Creek
SAMPLE DATES: 09/16/96 to 08/31/95
STREAM LENGTH: 47300 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: Fort Ross — Latitude: 38°27'58"
Legal Description: T7NR11W — Longitude: 123°2'57"

## SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

### STREAM REACH 1

Channel Type: F3
Channel Length: 18874 ft.
Riffle/Flatwater Mean Width: 16 ft.
Total Pool Mean Depth: 1.4 ft.
Base Flow: 0.0 cfs
Water: 59 - 67 °F Air: 54 - 84 °F
Dom. Bank Veg.: Evergreen Trees
Vegetative Cover: 24%
Dom. Bank Substrate: Cobble/Gravel
Embeddness Value: 1. 64% 2. 13% 3. 14% 4. 9%

Canopy Density: 55%
Evergreen Component: 65%
Deciduous Component: 35%
Pools by Stream Length: 30%
Pools >=3 ft. deep: 49%
Mean Pool Shelter Rtn: 27
Dom. Shelter: Boulders
Occurrence of LOD: 13%
Dry Channel: 0 ft.

### STREAM REACH 2

Channel Type: F2
Channel Length: 1563 ft.
Riffle/Flatwater Mean Width: 18 ft.
Total Pool Mean Depth: 1.3 ft.
Base Flow: 0.0 cfs
Water: 63 - 66 °F Air: 67 - 79 °F
Dom. Bank Veg.: Evergreen Trees
Vegetative Cover: 12%
Dom. Bank Substrate: Cobble/Gravel
Embeddness Value: 1. 83% 2. 0% 3. 0% 4. 17%

Canopy Density: 36%
Evergreen Component: 56%
Deciduous Component: 44%
Pools by Stream Length: 21%
Pools >=3 ft. deep: 38%
Mean Pool Shelter Rtn: 35
Dom. Shelter: Boulders
Occurrence of LOD: 7%
Dry Channel: 0 ft.

### STREAM REACH 3

Channel Type: F3
Channel Length: 2220 ft.
Riffle/Flatwater Mean Width: 31 ft.
Total Pool Mean Depth: 1.3 ft.
Base Flow: 0.0 cfs
Water: 65 - 67 °F Air: 70 - 75 °F
Dom. Bank Veg.: Evergreen Trees
Vegetative Cover: 25%
Dom. Bank Substrate: Cobble/Gravel
Embeddness Value: 1. 86% 2. 14% 3. 0% 4. 0%

Canopy Density: 61%
Evergreen Component: 61%
Deciduous Component: 39%
Pools by Stream Length: 12%
Pools >=3 ft. deep: 17%
Mean Pool Shelter Rtn: 41
Dom. Shelter: Boulders
Occurrence of LOD: 40%
Dry Channel: 0 ft.

### STREAM REACH 4

Channel Type: F4
Channel Length: 3523 ft.
Riffle/Flatwater Mean Width: 13 ft.
Total Pool Mean Depth: 0.9 ft.
Base Flow: 0.0 cfs
Water: 66 - 72 °F Air: 64 - 87 °F
Dom. Bank Veg.: Evergreen Trees
Vegetative Cover: 79%
Dom. Bank Substrate: Cobble/Gravel
Embeddness Value: 1. 31% 2. 28% 3. 22% 4. 19%

Canopy Density: 59%
Evergreen Component: 17%
Deciduous Component: 83%
Pools by Stream Length: 38%
Pools >=3 ft. deep: 18%
Mean Pool Shelter Rtn: 16
Dom. Shelter: Root masses
Occurrence of LOD: 57%
Dry Channel: 20 ft.

STREAM REACH 5

| | |
|---|---|
| Channel Type: D4 | Canopy Density: 30% |
| Channel Length: 3403 ft. | Evergreen Component: 48% |
| Riffle/Flatwater Mean Width: 16 ft. | Deciduous Component: 53% |
| Total Pool Mean Depth: 1.2 ft. | Pools by Stream Length: 32% |
| Base Flow: 0.0 cfs | Pools >=3 ft. deep: 28% |
| Water: 72 - 75 °F Air: 82 - 91 °F | Mean Pool Shelter Rtn: 39 |
| Dom. Bank Veg.: Evergreen Trees | Dom. Shelter: Root masses |
| Vegetative Cover: 85% | Occurrence of LOD: 20% |
| Dom. Bank Substrate: Cobble/Gravel | Dry Channel: 0 ft. |
| Embeddness Value: 1. 0% 2. 61% 3. 28% 4. 11% | |

STREAM REACH 6

| | |
|---|---|
| Channel Type: D3 | Canopy Density: 47% |
| Channel Length: 6257 ft. | Evergreen Component: 69% |
| Riffle/Flatwater Mean Width: 11 ft. | Deciduous Component: 31% |
| Total Pool Mean Depth: 1.2 ft. | Pools by Stream Length: 50% |
| Base Flow: 0.0 cfs | Pools >=3 ft. deep: 11% |
| Water: 62 - 74 °F Air: 66 - 91 °F | Mean Pool Shelter Rtn: 22 |
| Dom. Bank Veg.: Evergreen Trees | Dom. Shelter: Boulders |
| Vegetative Cover: 81% | Occurrence of LOD: 23% |
| Dom. Bank Substrate: Cobble/Gravel | Dry Channel: 51 ft. |
| Embeddness Value: 1. 3% 2. 30% 3. 34% 4. 34% | |

STREAM REACH 7

| | |
|---|---|
| Channel Type: F3 | Canopy Density: 54% |
| Channel Length: 1153 ft. | Evergreen Component: 62% |
| Riffle/Flatwater Mean Width: 11 ft. | Deciduous Component: 18% |
| Total Pool Mean Depth: 1.0 ft. | Pools by Stream Length: 58% |
| Base Flow: 0.0 cfs | Pools >=3 ft. deep: 18% |
| Water: 65 - 68 °F Air: 70 - 74 °F | Mean Pool Shelter Rtn: 16 |
| Dom. Bank Veg.: Evergreen Trees | Dom. Shelter: Boulders |
| Vegetative Cover: 91% | Occurrence of LOD: 100% |
| Dom. Bank Substrate: Cobble/Gravel | Dry Channel: 0 ft. |
| Embeddness Value: 1. 18% 2. 47% 3. 18% 4. 18% | |

STREAM REACH 8

| | |
|---|---|
| Channel Type: F1 | Canopy Density: 69% |
| Channel Length: 4536 ft. | Evergreen Component: 78% |
| Riffle/Flatwater Mean Width: 9 ft. | Deciduous Component: 22% |
| Total Pool Mean Depth: 1.2 ft. | Pools by Stream Length: 52% |
| Base Flow: 0.0 cfs | Pools >=3 ft. deep: 16% |
| Water: 62 - 69 °F Air: 65 - 78 °F | Mean Pool Shelter Rtn: 18 |
| Dom. Bank Veg.: Evergreen Trees | Dom. Shelter: Boulders |
| Vegetative Cover: 86% | Occurrence of LOD: 21% |
| Dom. Bank Substrate: Cobble/Gravel | Dry Channel: 0 ft. |
| Embeddness Value: 1. 3% 2. 19% 3. 44% 4. 34% | |

STREAM REACH 9

| | |
|---|---|
| Channel Type: B1 | Canopy Density: 35% |
| Channel Length: 5772 ft. | Evergreen Component: 82% |
| Riffle/Flatwater Mean Width: 9 ft. | Deciduous Component: 18% |
| Total Pool Mean Depth: 1.8 ft. | Pools by Stream Length: 48% |
| Base Flow: 0.0 cfs | Pools >=3 ft. deep: 23% |
| Water: 63 - 76 °F Air: 70 - 82 °F | Mean Pool Shelter Rtn: 11 |
| Dom. Bank Veg.: Evergreen Trees | Dom. Shelter: Boulders |
| Vegetative Cover: 85% | Occurrence of LOD: 37% |
| Dom. Bank Substrate: Cobble/Gravel | Dry Channel: 40 ft. |
| Embeddness Value: 1. 0% 2. 1% 3. 32% 4. 67% | |

Big Austin Creek

Drainage: Russian River

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

Survey Dates: 09/16/96 to 08/31/95

Confluence Location: QUAD: Fort Ross LEGAL DESCRIPTION: T7NR11W

LATITUDE: 38°27'58" LONGITUDE: 123°2'57"

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 217 | 8 | RIFFLE | 27 | 63 | 13668 | 28 | 12.8 | 1.5 | 481 | 104313 | 3202 | 694747 | 0 | 28 |
| 231 | 26 | FLATWATER | 29 | 77 | 17809 | 36 | 13.0 | 0.6 | 777 | 179549 | 493 | 113942 | 218 | 17 |
| 359 | 75 | POOL | 44 | 50 | 17970 | 36 | 15.3 | 1.3 | 1058 | 379776 | 1544 | 554147 | 1251 | 20 |
| 3 | 0 | DRY | 0 | 37 | 111 | 0 | 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.) |
|---|---|---|---|---|
| 810 | 109 | 49557 | 663638 | 1362836 |

Big Austin Creek — Drainage: Russian River

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 09/16/96 to 08/31/95

Confluence Location: QUAD: Fort Ross LEGAL DESCRIPTION: T7NR11W — LATITUDE: 38°27'58" LONGITUDE: 123°2'57"

| 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 % |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 172 | 3 | LGR | 21 | 68 | 11653 | 24 | 16 | 2.3 | 1.1 | 643 | 110639 | 5663 | 974028 | 0 | 15 | 47 |
| 40 | 1 | HGR | 5 | 46 | 1830 | 4 | 10 | 0.6 | 1.1 | 305 | 12207 | 174 | 6941 | 0 | 30 | 37 |
| 5 | 4 | CAS | 1 | 37 | 184 | 0 | 9 | 0.7 | 1.4 | 241 | 1207 | 170 | 851 | 0 | 47 | 68 |
| 43 | 9 | POW | 5 | 79 | 3384 | 7 | 17 | 0.8 | 2.7 | 616 | 26468 | 503 | 21642 | 218 | 17 | 58 |
| 64 | 3 | GLD | 8 | 71 | 4546 | 9 | 15 | 0.5 | 1.2 | 874 | 55911 | 442 | 28318 | 0 | 5 | 54 |
| 93 | 6 | RUN | 11 | 77 | 7115 | 14 | 13 | 0.6 | 2.1 | 958 | 89092 | 605 | 56249 | 0 | 28 | 50 |
| 27 | 5 | SRN | 3 | 91 | 2454 | 5 | 9 | 0.7 | 1.8 | 606 | 16351 | 441 | 11907 | 0 | 9 | 38 |
| 4 | 3 | EDW | 0 | 77 | 310 | 1 | 11 | 0.5 | 1.5 | 712 | 2848 | 290 | 1162 | 0 | 23 | 68 |
| 1 | 1 | TRP | 0 | 46 | 46 | 0 | 8 | 2.0 | 3.7 | 366 | 366 | 731 | 731 | 548 | 0 | 70 |
| 66 | 12 | MCP | 8 | 39 | 2604 | 5 | 16 | 1.3 | 6.0 | 681 | 44928 | 1010 | 66671 | 813 | 21 | 52 |
| 6 | 2 | CCP | 1 | 28 | 165 | 0 | 16 | 1.2 | 2.6 | 420 | 2522 | 523 | 3136 | 365 | 3 | 52 |
| 56 | 7 | STP | 7 | 65 | 3658 | 7 | 12 | 1.0 | 3.1 | 799 | 44737 | 828 | 46387 | 574 | 10 | 40 |
| 3 | 3 | CRP | 0 | 78 | 235 | 0 | 13 | 1.2 | 4.2 | 931 | 2792 | 1135 | 3405 | 780 | 30 | 42 |
| 4 | 1 | LSL | 0 | 34 | 135 | 0 | 16 | 1.2 | 2.8 | 799 | 3197 | 896 | 3584 | 702 | 25 | 60 |
| 42 | 9 | LSR | 5 | 42 | 1760 | 4 | 14 | 1.1 | 4.9 | 695 | 29205 | 867 | 36426 | 673 | 37 | 64 |
| 70 | 8 | LSBk | 9 | 52 | 3614 | 7 | 16 | 1.4 | 5.2 | 1132 | 79274 | 1645 | 115151 | 1328 | 14 | 60 |
| 44 | 9 | LSBo | 5 | 47 | 2059 | 4 | 18 | 1.4 | 5.9 | 1247 | 54872 | 1898 | 83506 | 1502 | 19 | 58 |
| 30 | 9 | PLP | 4 | 25 | 757 | 2 | 12 | 1.6 | 10.5 | 293 | 8799 | 552 | 16575 | 428 | 33 | 57 |
| 2 | 2 | SCP | 0 | 21 | 42 | 0 | 10 | 1.3 | 2.2 | 192 | 384 | 230 | 459 | 151 | 8 | 22 |
| 19 | 4 | BPB | 2 | 29 | 558 | 1 | 10 | 0.9 | 3.1 | 372 | 7068 | 356 | 6767 | 246 | 15 | 46 |
| 3 | 0 | BPR | 0 | 61 | 183 | 0 | 7 | 0.5 | 2.0 | 224 | 672 | 112 | 336 | 67 | 43 | 90 |
| 4 | 3 | BPL | 0 | 41 | 164 | 0 | 7 | 1.1 | 3.1 | 311 | 1244 | 375 | 1500 | 252 | 41 | 50 |
| 9 | 5 | DPL | 1 | 221 | 1991 | 4 | 29 | 1.5 | 5.5 | 5606 | 50450 | 8956 | 80605 | 8433 | 21 | 53 |
| 3 | 0 | DRY | 0 | 37 | 111 | 0 | 0 | 0.0 | 0.0 | 0 | 0 | 0 | 0 | 0 | 0 | 23 |

| TOTAL UNITS | TOTAL UNITS | LENGTH (ft.) | AREA (sq.ft) | TOTAL VOL. (cu.ft) |
|---|---|---|---|---|
| 810 | 109 | 49557 | 645233 | 1566338 |

Big Austin Creek Tables Graphs Map
Assessment Completed 1995
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Big Austin Creek | Drainage: Russian River

Table 3 - SUMMARY OF POOL TYPES | Survey Dates: 09/16/96 to 08/31/95

Confluence Location: QUAD: Fort Ross LEGAL DESCRIPTION: T7NR11W | LATITUDE: 38°27'58" LONGITUDE: 123°2'57"

| 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 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 129 | 22 | MAIN | 36 | 50 | 6473 | 36 | 14.7 | 1.2 | 670 | 86451 | 916 | 118128 | 706 | 15 |
| 193 | 39 | SCOUR | 54 | 44 | 8559 | 48 | 15.7 | 1.3 | 962 | 185668 | 1392 | 268639 | 1099 | 24 |
| 37 | 14 | BACKWATER | 10 | 79 | 2938 | 16 | 15.1 | 1.1 | 1895 | 70108 | 2889 | 106881 | 2525 | 21 |

| TOTAL UNITS | TOTAL UNITS | TOTAL LENGTH (ft.) | TOTAL AREA (sq.ft.) | TOTAL VOL. (cu.ft.) |
|---|---|---|---|---|
| 359 | 75 | 17970 | 342228 | 493648 |

Big Austin Creek — Drainage: Russian River

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES — Survey Dates: 09/16/96 to 08/31/95

Confluence Location: QUAD: Fort Ross LEGAL DESCRIPTION: T7NR11W — LATITUDE: 38°27'58" LONGITUDE: 123°2'57"

| UNITS MEASURED | HABITAT TYPE | HABITAT PERCENT OCCURRENCE | <1 FOOT MAXIMUM DEPTH | <1 FOOT PERCENT OCCURRENCE | 1-<2 FT. MAXIMUM DEPTH | 1-<2 FOOT PERCENT OCCURRENCE | 2-<3 FT. MAXIMUM DEPTH | 2-<3 FOOT PERCENT OCCURRENCE | 3-<4 FT. MAXIMUM DEPTH | 3-<4 FOOT PERCENT OCCURRENCE | >=4 FEET MAXIMUM DEPTH | >=4 FEET PERCENT OCCURRENCE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | TRP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 100 | 0 | 0 |
| 66 | MCP | 18 | 0 | 0 | 21 | 32 | 30 | 45 | 5 | 8 | 10 | 15 |
| 6 | CCP | 2 | 0 | 0 | 4 | 67 | 2 | 33 | 0 | 0 | 0 | 0 |
| 56 | STP | 16 | 0 | 0 | 40 | 71 | 14 | 25 | 2 | 4 | 0 | 0 |
| 3 | CRP | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 2 | 67 | 1 | 33 |
| 4 | LSL | 1 | 0 | 0 | 3 | 75 | 1 | 25 | 0 | 0 | 0 | 0 |
| 42 | LSR | 12 | 0 | 0 | 16 | 38 | 17 | 40 | 6 | 14 | 3 | 7 |
| 70 | LSBk | 19 | 1 | 1 | 17 | 24 | 24 | 34 | 14 | 20 | 14 | 20 |
| 44 | LSBo | 12 | 0 | 0 | 16 | 36 | 16 | 36 | 5 | 11 | 7 | 16 |
| 30 | PLP | 8 | 0 | 0 | 13 | 43 | 10 | 33 | 2 | 7 | 5 | 17 |
| 2 | SCP | 1 | 0 | 0 | 1 | 50 | 1 | 50 | 0 | 0 | 0 | 0 |
| 19 | BPB | 5 | 0 | 0 | 13 | 68 | 5 | 26 | 1 | 5 | 0 | 0 |
| 3 | BPR | 1 | 0 | 0 | 2 | 67 | 1 | 33 | 0 | 0 | 0 | 0 |
| 4 | BPL | 1 | 0 | 0 | 1 | 25 | 2 | 50 | 1 | 25 | 0 | 0 |
| 9 | DPL | 3 | 1 | 11 | 1 | 11 | 3 | 33 | 2 | 22 | 2 | 22 |

TOTAL UNITS 359

Big Austin Creek | Drainage: Russian River

Table 5 - Summary of Shelter by Habitat Type | Survey Dates: 09/16/96 to 08/31/95

Confluence Location: QUAD: Fort Ross LEGAL DESCRIPTION: T7NR11W | LATITUDE: 38°27'58" LONGITUDE: 123°2'57"

| UNITS MEASURED | UNITS SHELTER MEASURED | HABITAT TYPE | SQ. FT. UNDERCUT BANKS | SQ. FT. SWD | SQ. FT. LWD | SQ. FT. ROOT MASS | SQ. FT. TERR. VEGETATION | SQ. FT. AQUATIC VEGETATION | SQ. FT. WHITE WATER | SQ. FT. BOULDERS | SQ. FT. BEDROCK LEDGES |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 172 | 5 | LGR | 0 | 69 | 0 | 0 | 0 | 0 | 0 | 745 | 0 |
| 40 | 2 | HGR | 0 | 15 | 7 | 0 | 0 | 0 | 30 | 97 | 0 |
| 5 | 4 | CAS | 0 | 0 | 0 | 0 | 12 | 0 | 28 | 211 | 0 |
| 43 | 17 | POW | 43 | 0 | 0 | 0 | 15 | 0 | 0 | 839 | 0 |
| 64 | 3 | GLD | 0 | 0 | 32 | 0 | 0 | 0 | 0 | 184 | 0 |
| 93 | 6 | RUN | 142 | 169 | 0 | 30 | 30 | 110 | 0 | 329 | 0 |
| 27 | 5 | SRN | 0 | 0 | 0 | 0 | 0 | 103 | 0 | 192 | 0 |
| 4 | 3 | EDW | 0 | 73 | 0 | 0 | 0 | 29 | 0 | 95 | 0 |
| 1 | 1 | TRP | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 66 | 64 | MCP | 0 | 29 | 4 | 57 | 5 | 9 | 47 | 1232 | 91 |
| 6 | 5 | CCP | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 6 | 0 |
| 56 | 56 | STP | 0 | 8 | 0 | 7 | 0 | 9 | 25 | 117 | 9 |
| 3 | 3 | CRP | 13 | 26 | 13 | 77 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | LSL | 0 | 132 | 112 | 0 | 0 | 0 | 0 | 168 | 0 |
| 42 | 42 | LSR | 209 | 350 | 142 | 1182 | 32 | 32 | 0 | 99 | 0 |
| 70 | 67 | LSBk | 0 | 42 | 16 | 0 | 31 | 312 | 0 | 908 | 2170 |
| 44 | 43 | LSBo | 52 | 48 | 76 | 129 | 40 | 30 | 0 | 3220 | 75 |
| 30 | 30 | PLP | 0 | 5 | 0 | 0 | 0 | 0 | 82 | 409 | 23 |
| 2 | 2 | SCP | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 27 | 0 |
| 19 | 17 | BPB | 65 | 95 | 15 | 16 | 0 | 0 | 0 | 264 | 51 |
| 3 | 3 | BPR | 0 | 0 | 0 | 11 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | BPL | 0 | 9 | 99 | 22 | 0 | 22 | 0 | 43 | 0 |
| 9 | 8 | DPL | 0 | 138 | 20 | 204 | 114 | 97 | 0 | 2241 | 960 |
| 3 | 0 | DRY | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| TOTAL 810 | 394 | | 525 | 1209 | 536 | 1735 | 279 | 753 | 212 | 11426 | 3379 |
| | | | 3% | 6% | 3% | 9% | 1% | 4% | 1% | 57% | 17% |
| TOTAL FOR POOLS 359 | 349 | | 340 | 883 | 497 | 1705 | 222 | 511 | 154 | 8734 | 3379 |
| | | | 2% | 5% | 3% | 10% | 1% | 3% | 1% | 53% | 21% |

Big Austin Creek | Drainage: Russian River

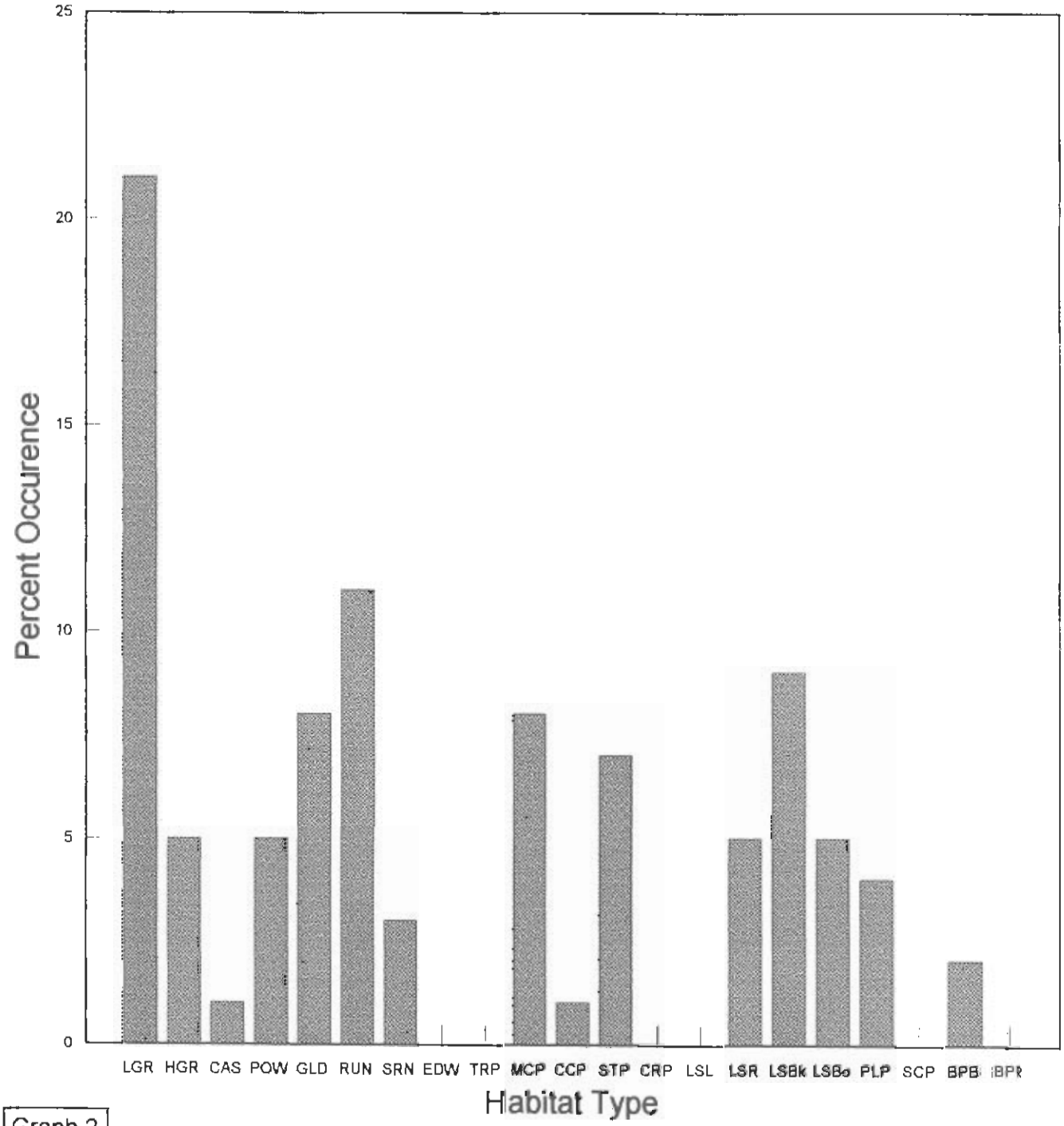
Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE | Survey Dates: 09/16/96 to 08/31/95

Confluence Location: QUAD: Fort Ross LEGAL DESCRIPTION: T7NR11W | LATITUDE: 38°27'58" LONGITUDE: 123°2'57"

| 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 |
|---|---|---|---|---|---|---|---|---|---|
| 172 | 15 | LGR | 0 | 0 | 47 | 27 | 20 | 7 | 7 |
| 10 | 8 | HGR | 0 | 0 | 0 | 50 | 25 | 25 | 0 |
| 5 | 5 | CAS | 0 | 0 | 20 | 20 | 60 | 0 | 0 |
| 3 | 9 | POW | 0 | 0 | 67 | 33 | 0 | 0 | 0 |
| 6 | 6 | GLD | 0 | 0 | 67 | 17 | 17 | 0 | 0 |
| 3 | 12 | RUN | 0 | 8 | 50 | 33 | 8 | 0 | 0 |
| 7 | 6 | SRN | 0 | 0 | 17 | 67 | 0 | 0 | 17 |
| 4 | 4 | EDW | 0 | 0 | 25 | 75 | 0 | 0 | 0 |
| 1 | 1 | TRP | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 8 | 13 | MCP | 0 | 31 | 46 | 23 | 0 | 0 | 0 |
| 3 | 3 | CCP | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 6 | 7 | STP | 0 | 0 | 29 | 43 | 14 | 0 | 14 |
| 3 | 3 | CRP | 0 | 67 | 33 | 0 | 0 | 0 | 0 |
| 4 | 2 | LSL | 0 | 0 | 100 | 0 | 0 | 0 | 0 |
| 2 | 10 | LSR | 0 | 40 | 40 | 20 | 0 | 0 | 0 |
| 0 | 9 | LSBk | 0 | 33 | 56 | 11 | 0 | 0 | 0 |
| 1 | 9 | LSBo | 0 | 11 | 78 | 11 | 0 | 0 | 0 |
| 30 | 9 | PLP | 0 | 11 | 56 | 0 | 11 | 11 | 11 |
| 2 | 2 | SCP | 0 | 50 | 0 | 50 | 0 | 0 | 0 |
| 19 | 8 | BPB | 0 | 38 | 63 | 0 | 0 | 0 | 0 |
| 3 | 1 | BPR | 0 | 100 | 0 | 0 | 0 | 0 | 0 |
| 4 | 4 | BPL | 0 | 75 | 25 | 0 | 0 | 0 | 0 |
| 9 | 5 | DPL | 0 | 0 | 40 | 20 | 40 | 0 | 0 |
| 3 | 0 | DRY | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

# Big Austin Creek

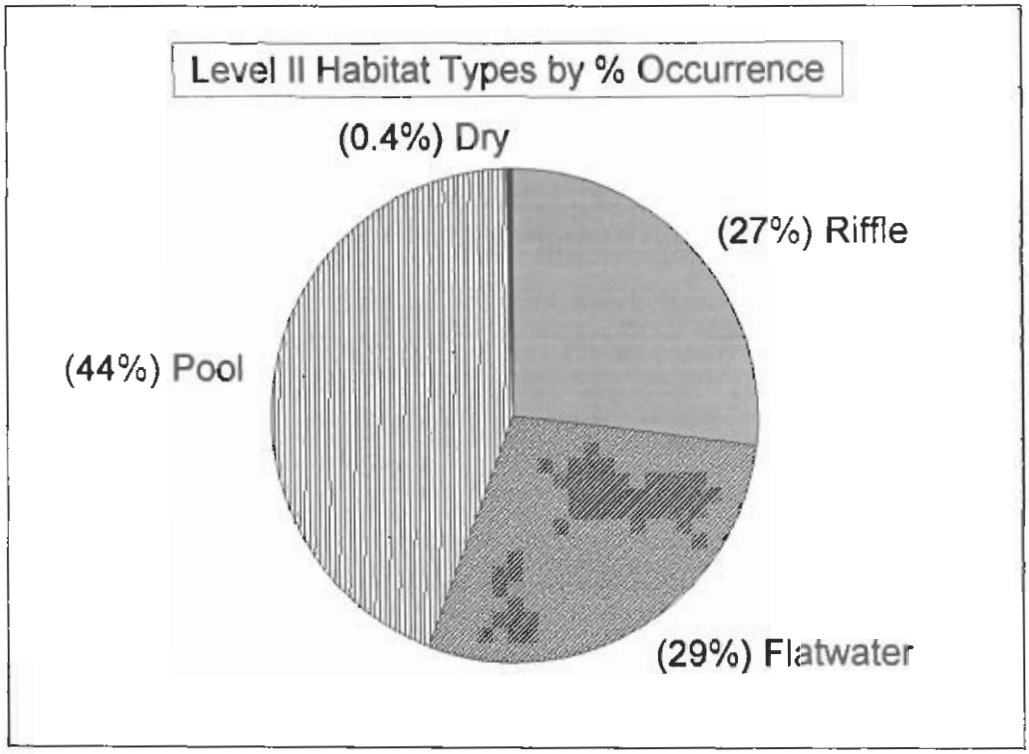
## Level IV Habitat Types by % Occurrence

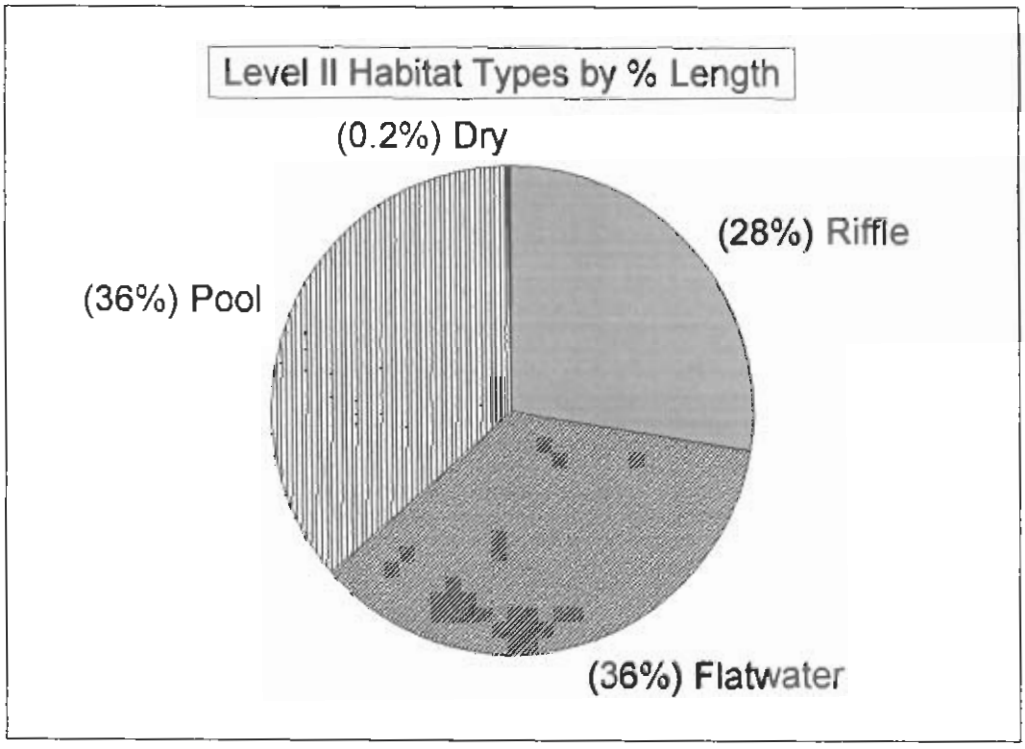



Graph 2

# Big Austin Creek

## Level II Habitat Types

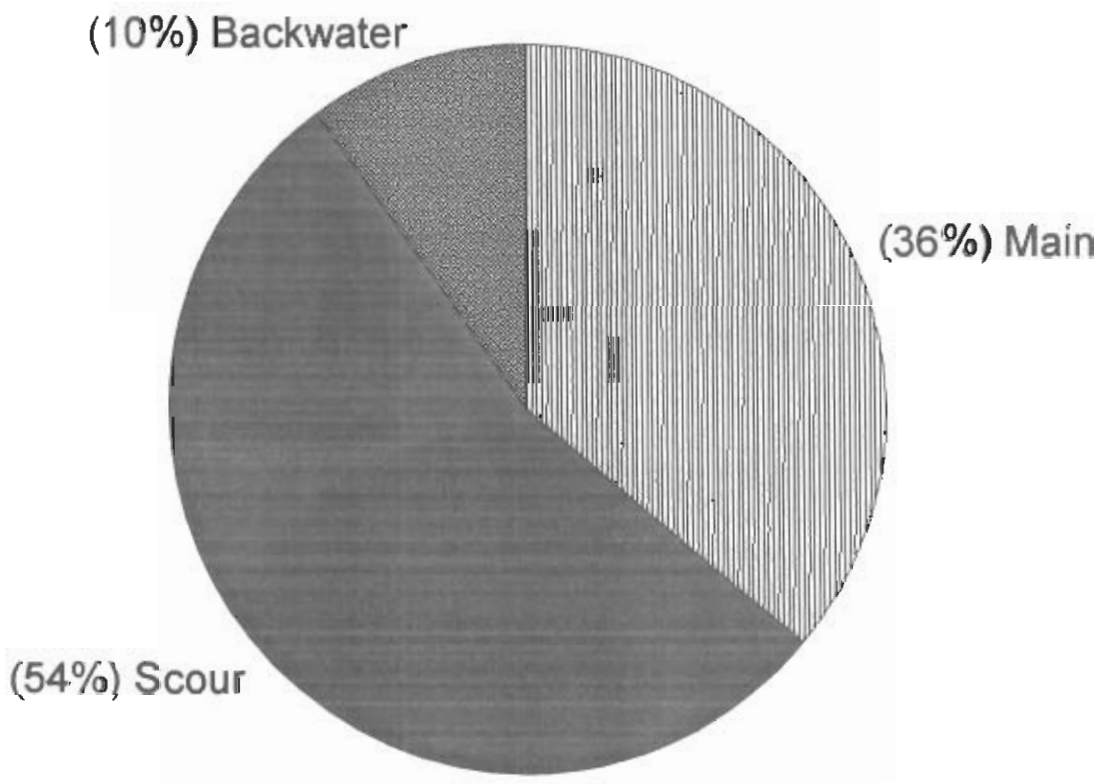



Graph 1

# Big Austin Creek

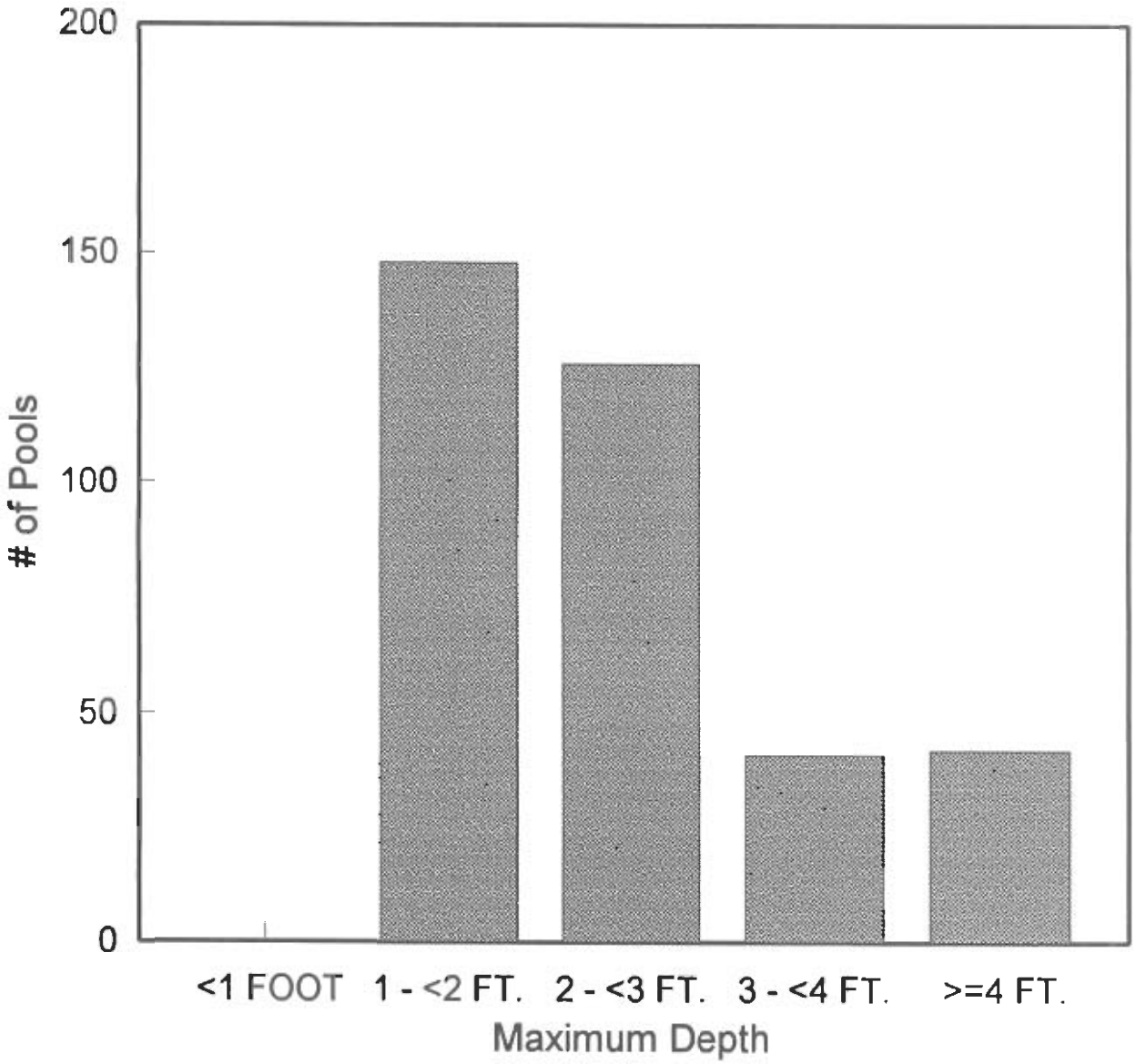
## Pool Habitat Types by % Occurrence




Graph 3

# Big Austin Creek

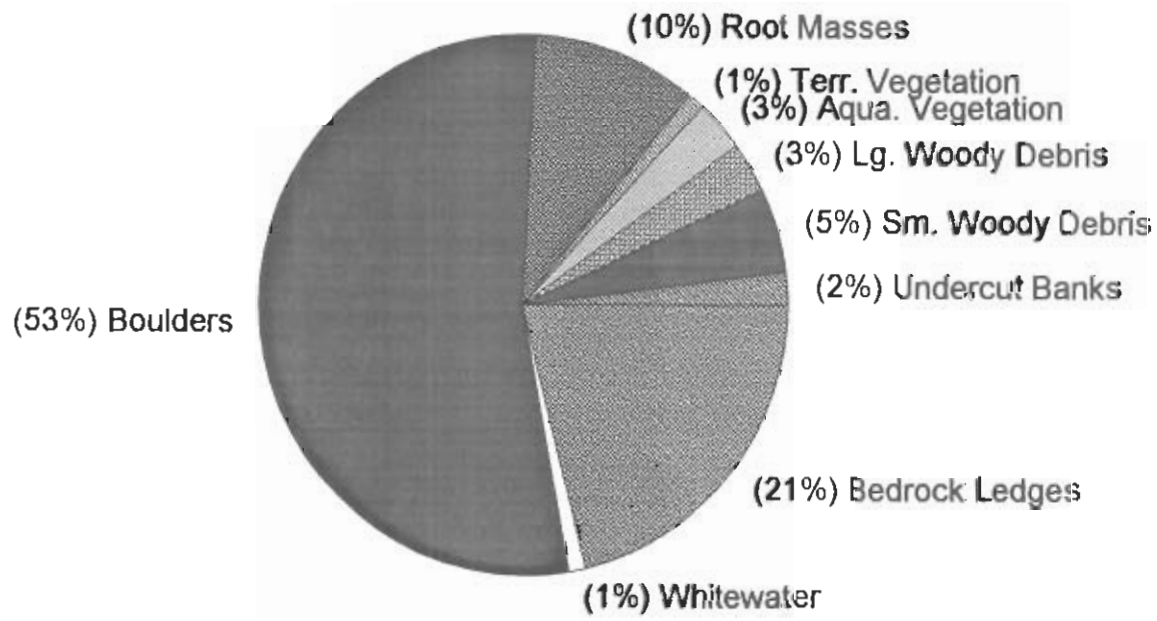
Maximum Depth in Pools




Graph 4

# Big Austin Creek

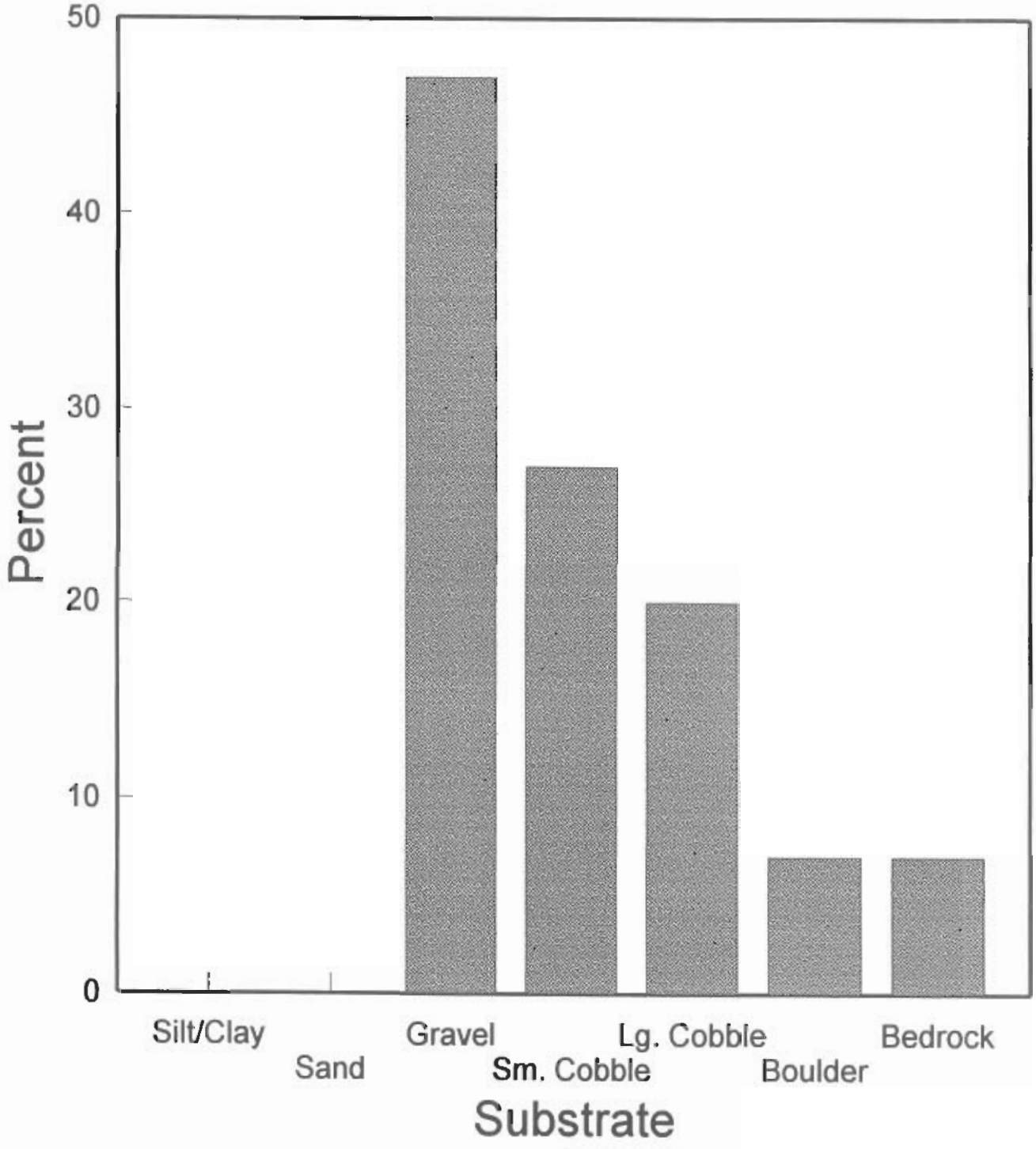
## Pool Shelter Types by % Area




Graph 5

# Big Austin Creek

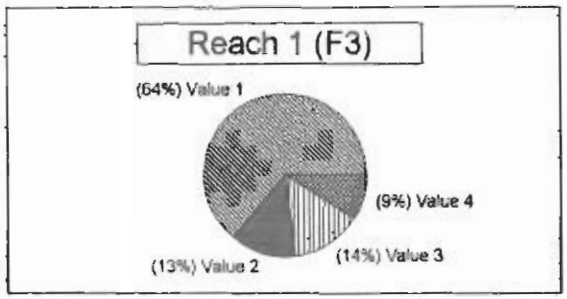
## Substrate Composition in Low Gradient Riffles

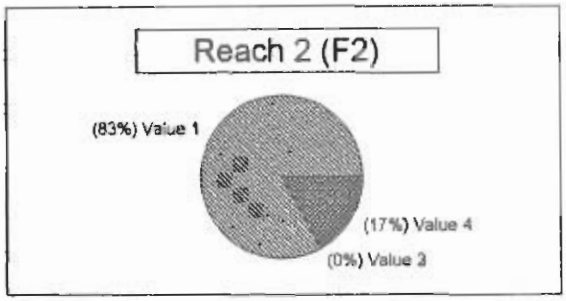


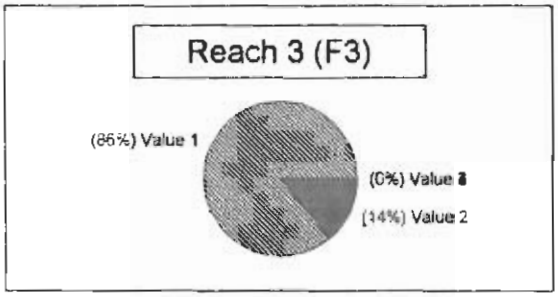

Graph 6

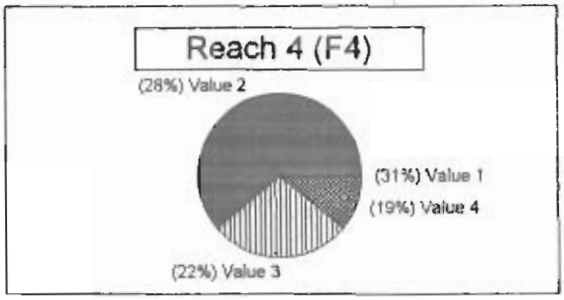
# Big Austin Creek

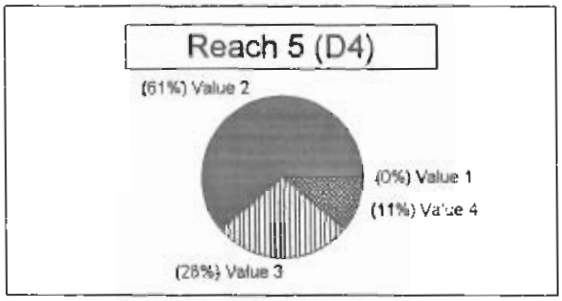
## Percent Cobble Embeddedness by Reach

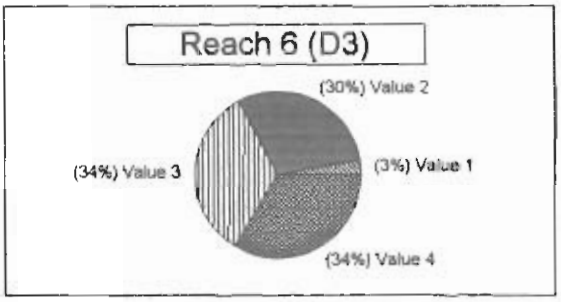


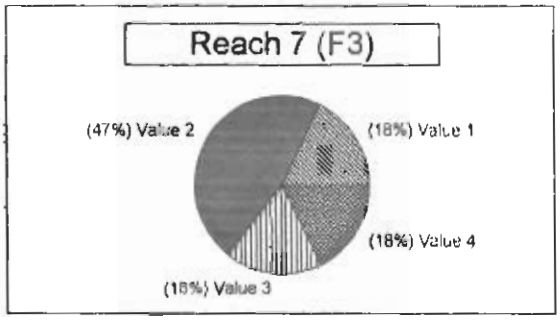



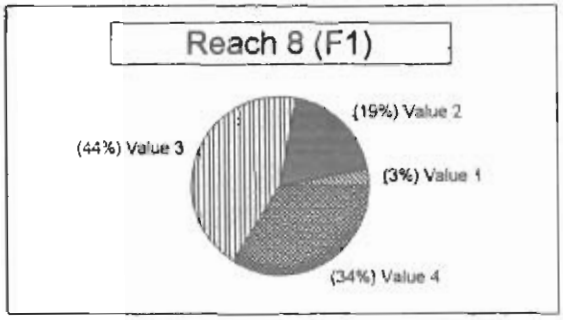



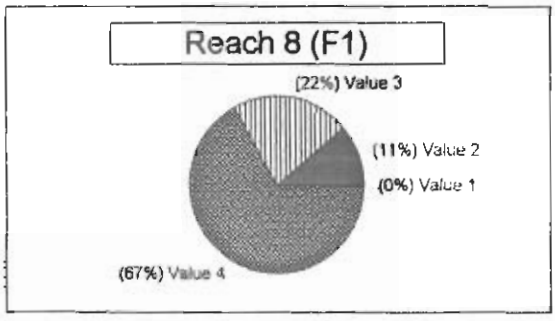



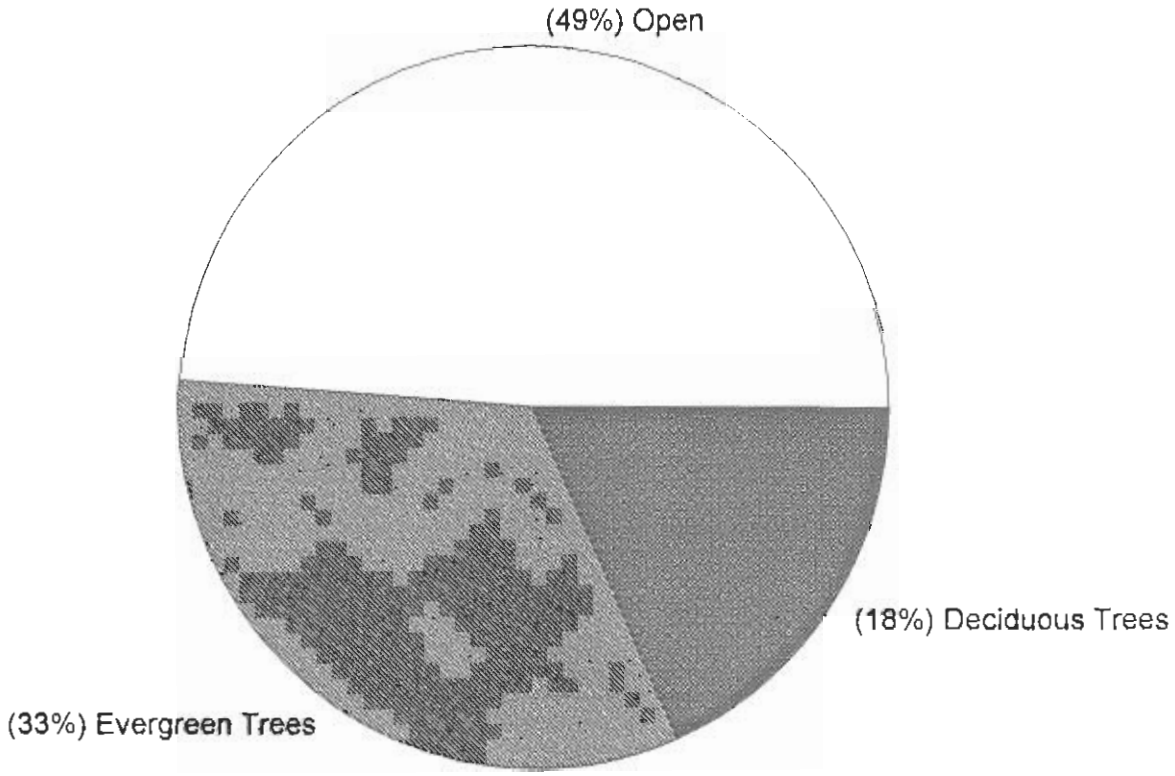




Graph 7

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

# Big Austin Creek

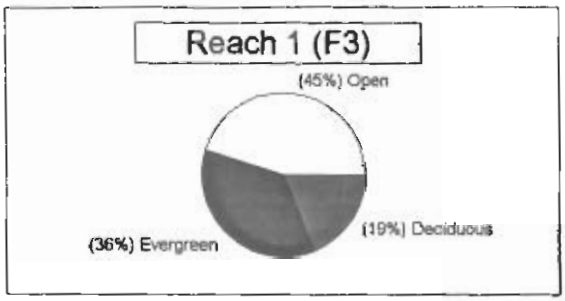
## Mean Percent Canopy

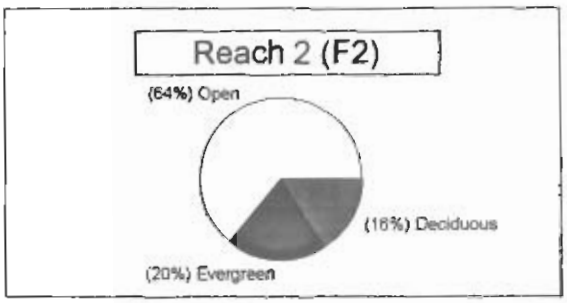


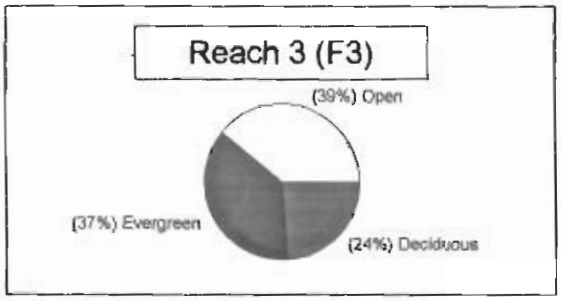

Graph 8

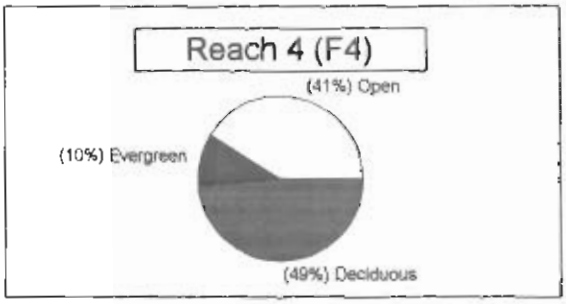
# Big Austin Creek

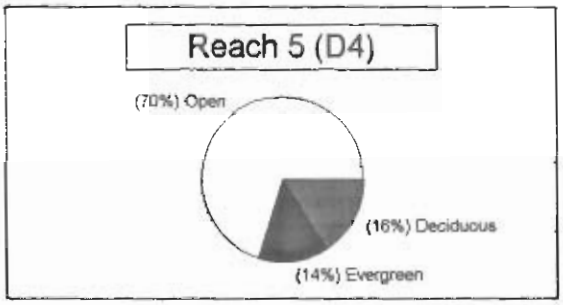
## Percent Canopy By Reach

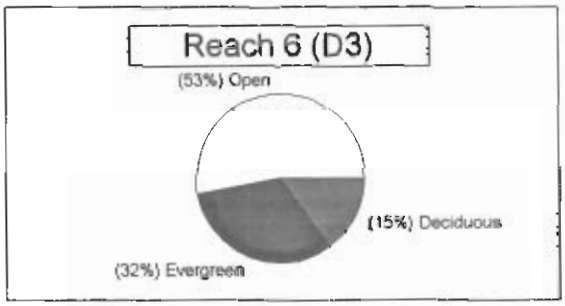


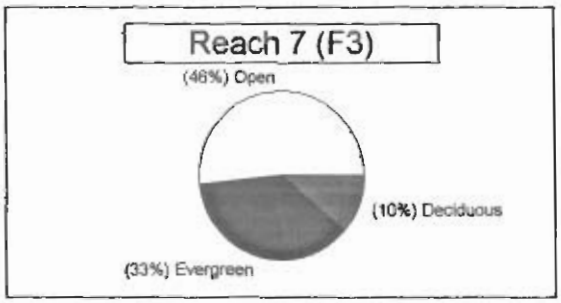



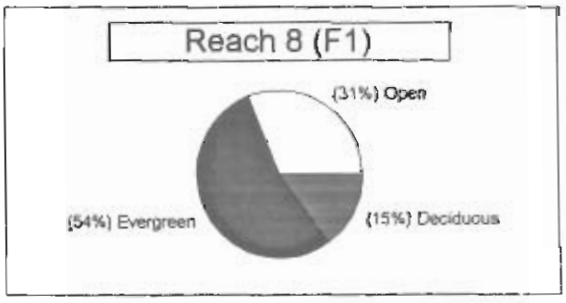



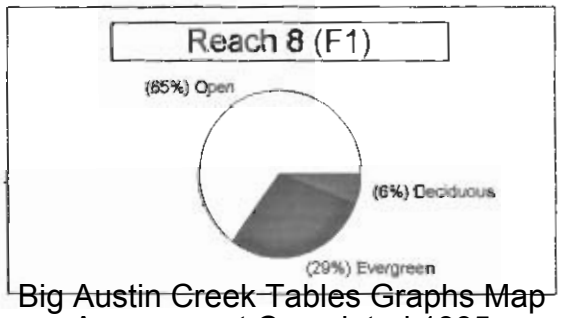



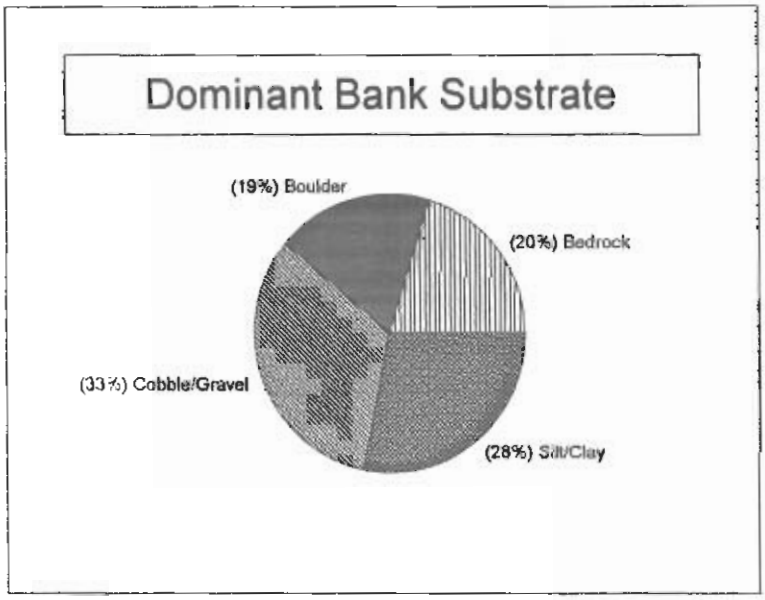



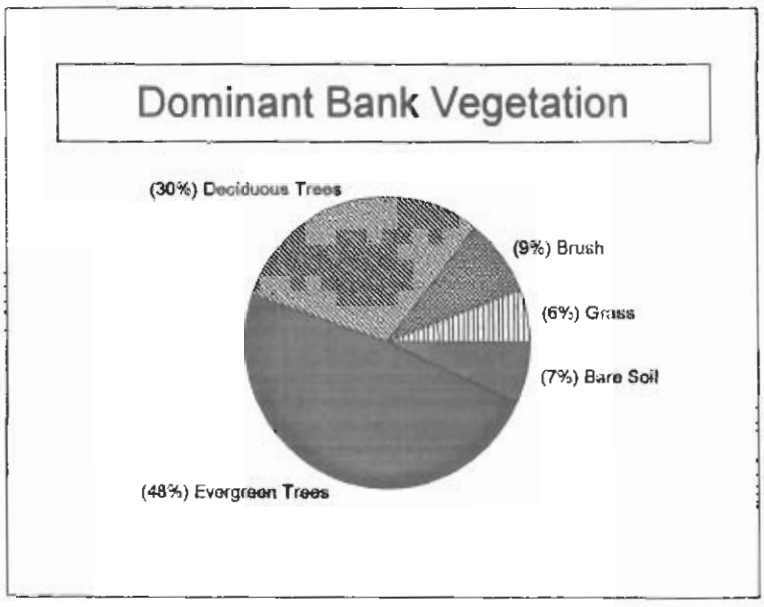




Graph 9

# Big Austin Creek

## Percent Bank Composition




Graph 10