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

INTRODUCTION

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

Gilliam Creek is tributary to East Austin Creek, which flows into Big Austin Creek, a tributary of the Russian River, located in Sonoma County, California (see Gilliam Creek map, page 2). The legal description at the confluence with the East Austin Creek is T8N, R11W, S2. Its location is 38°33'39" N. latitude and 123°3'53" W. longitude. Restricted seasonal vehicle access exists from Austin Creek State Recreation Area roads via Armstrong Redwoods Road via Hwy 116 in Guerneville. A foot trail also exists within the park.

Gilliam Creek and its tributaries drain a basin of approximately 3.3 square miles. Gilliam Creek is a second order stream and has approximately 3 miles of blue line stream, according to the USGS Cazadero 7.5 minute quadrangles. An unnamed tributary and Schoolhouse Creek were also surveyed and the results are included in this report. Gilliam Creek flows through a steep mountainous canyon. Elevations range from about 200 feet at the mouth of the creek to 1240 feet in the headwaters. The watershed is dominated by oaks, annual grasses and Douglas-fir with small stands of redwood in the upper section. The Foothill Yellow-legged Frog (*Rana boylii*) was listed in DFG's Natural Diversity Database for Gilliam Creek Watershed. The watershed is entirely within Austin

Creek State Recreation Area.

METHODS

The habitat inventory conducted in Gilliam Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1994). 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 Gilliam 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 a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Gilliam Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Gilliam 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) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, bedrock, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Gilliam Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Gilliam 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 and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Gilliam Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during 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 Gilliam 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 surveys of Gilliam Creek in April and May 1962 and August 1977. The 1962 surveys both started at the mouth and continued for 3 miles upstream. Flows were estimated to be 4.5 cfs in the lower section on April 11 and 2.4 cfs in the headwater section on May 11. The wetted width averaged 6' and ranged from 4-12'. The depth averaged 5" and ranged from 2-8". No pollution or diversions were observed and spring development appeared to be very good.

Pool development was considered very good with some pools in the mid-section averaging 10' x 20' x 5'. Shelter was noted as very satisfactory for small salmonids and was mainly in the form of overhanging vegetation, rocks and roots. The air temperature was 77°F on April 11 and 70°F on May 11. The water temperature was 56°F on April 11 and 54°F on May 11.

The substrate consisted predominantly of gravel and cobble with boulders scattered throughout the entire section. Spawning was considered to be excellent throughout. In general, this stream was considered one of the most important spawning areas for steelhead and coho salmon in the upper East Austin Creek drainage. This was the only tributary in which juvenile coho were documented during the 1962 East Austin Creek survey.

The 1977 survey started at the mouth and continued upstream for 2.7 miles. Flows were less than .1 cfs in the upper 1 mile of the survey with several short intermittent sections. The wetted width averaged 8' and ranged from 3-40'. The depth averaged several inches and ranged from less than 1" to 5'. The lower 1.7 miles were dry with the exception of several small stagnant pools. It was noted that lack of flow in the lower section was due to the extremely low rainfall since 1975 and the creek in previous years had provided year-round flow to East Austin Creek. Several springs were observed in the upper .6 miles surveyed.

Pools formed by bedrock, boulders, and undercut banks were common with the average size being 8' x 15' x 2'. The pool to riffle ratio was 7 to 3 in the upper 1 mile section surveyed. Shelter consisted of roots, boulders and undercut banks with a canopy providing an average of 50% cover. Air temperatures ranged from 68-81°F and water temperatures ranged from 63-64°F.

The substrate in the lower 1.9 miles consisted of 2% bedrock, 13% boulder, 25% cobble, 45% gravel, and 15% silt, sand and detritus. The upper .8 miles consisted of 5% bedrock, 30% boulder, 35% cobble, 15% gravel, and 15% silt, sand and detritus. Approximately 40% of the creek was considered to have good spawning gravel. The

gravel appeared moderately loose with some silt present in all areas.

HABITAT INVENTORY RESULTS

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

The habitat inventory of August 6-20, 1996 was conducted by Mark Bolin and Mark Kipp (NEAP) and data analyzed by Ken Bunzel (DFG). The survey began at the confluence with East Austin Creek and extended up Gilliam Creek to the confluence with an unnamed tributary in the headwaters, where habitat conditions became minimal. The total length of the stream surveyed was 17,846 feet (3.4 miles), with an additional 34 feet of side channel.

This section of Gilliam Creek has 3 channel types: from the mouth to 8,273 feet an F3; next 1,989 feet a G1 and the upper 7,584 feet a B2. F3 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly cobble substrate.

G1 channel types are characterized as well entrenched "gully" step-pool channels with a low width/depth ratio, a moderate gradient (2-4%) and a predominantly bedrock substrate.

B2 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 boulder substrate.

Water temperatures ranged from 58°F to 72°F. Air temperatures ranged from 62°F to 94°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 39% pool units, 32% flatwater units, and 29% riffle units. Based on total **length** there were 45% flatwater units, 28% riffle units, and 27% pool units (Graph 1).

Two hundred, Fifty-four habitat units were measured and 20% were completely sampled. Twelve Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent **occurrence** were high gradient riffles at 15%, step runs 15%, runs 14% and bedrock scour pools 13% (Graph 2). By percent total **length**, step runs made up 26%, runs 16%, high gradient riffles 15%, and step pools 10%.

Ninety-eight pools were identified (Table 3). Scour pools were most often encountered at 65%, and comprised 50% of the total length of pools (Graph 3). No backwater pools were identified.

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Seventy-three of the 98 pools (74%) had a depth of two feet or greater (Graph 4). These deeper pools comprised 21% 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 137. Flatwater had the lowest rating with 73 and pools rated 113 (Table 1). Of the pool types, the main channel pools rated 142 and scour pools rated 97 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were boulders at 50%, bedrock ledges 11%, and undercut banks 9%. Graph 5 describes the pool shelter in Gilliam Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed the low gradient riffles measured, and Small cobble was co-dominant (Graph 6).

The depth of cobble embeddedness was estimated at pool tail-outs. All of the 98 pool tail-outs measured had a value of 2. On this scale, a value of one (<25% embedded) is best for fisheries.

The mean percent canopy density for the stream reach surveyed was 82%. The mean percentages of deciduous and evergreen trees were 41% and 59%, respectively. Graph 8 describes the canopy for the entire survey and graph 9 describes the canopy by reach.

For the stream reach surveyed, the mean percent right bank vegetated was 68% and the mean percent left bank vegetated was 70%. For the habitat units measured, the dominant vegetation types for the stream banks were: 49% evergreen trees, 32% deciduous trees, 13% brush, and 6% grass. The dominant substrate for the stream banks were: 39% bedrock, 27% boulder, 18% cobble/gravel and 16% silt/clay/sand (Graph 10).

HABITAT INVENTORY RESULTS FOR UNNAMED TRIBUTARY (Bea Creek) TO GILLIAM CREEK

The habitat inventory of August 21, 1996 was conducted by Mark

Bolin and Mark Kipp (NEAP) and data analyzed by Ken Bunzel (DFG). The survey began at the mouth and continued upstream for 4,229 feet (see map). A log jam fish barrier was located approximately 2,349 feet (0.4 miles) from the mouth.

This fork of Gilliam Creek has a B2 channel type. These channels 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 boulder substrate.

Water temperatures ranged from 60°F to 63°F. Air temperatures ranged from 69°F to 76°F.

*Based on frequency of **occurrence** there were 38% flatwater units, 35% pool units, and 28% riffle units. Based on total **length** there were 66% flatwater units, 24% riffle units, and 10% pool units.*

*Forty habitat units were measured and 28% were completely sampled. Nine Level IV habitat types were identified. The most frequent habitat types by percent **occurrence** were step runs at 30%, high gradient riffles 18%, bedrock scour pools 13% and low gradient riffles 10%. By percent total **length**, step runs made up 60%, high gradient riffles 15%, low gradient riffles 9%, and runs 7%.*

Fourteen pools were identified. Scour pools were most often encountered at 86%, and comprised 66% of the total length of pools.

Pool quality for salmonids increases with depth. Six of the 14 pools (43%) had a depth of two feet or greater (Graph 4). These deeper pools comprised 6% of the total length of stream habitat.

Pool types had the highest shelter rating at 83. Riffles had the lowest rating with 60 and flatwater rated 63. Of the pool types, the main channel pools had the highest mean shelter rating at 110, and scour pools rated 79.

By percent area, the dominant pool shelter types were boulders at 44%, undercut banks 17%, and small woody debris 16%.

Neither gravel or small cobble were the dominant substrate observed the 2 low gradient riffles measured. However, gravel and small cobble were observed as dominant in other habitat types. The depth of cobble embeddedness was estimated at pool tail-outs. Of the 13 pool tail-outs measured, all had a value of 2.

The mean percent canopy density for the stream reach surveyed was

92%. The mean percentages of deciduous and evergreen trees were 42% and 58%, respectively. For the entire stream reach surveyed, the mean percent right bank vegetated was 84% and the mean percent left bank vegetated was 68%. For the habitat units measured, the dominant vegetation types for the stream banks were: 55% deciduous trees, 41% evergreen trees, and 5% grass. The dominant substrate for the stream banks were: 36% cobble/gravel, 32% silt/clay/sand, 18% bedrock and 14% boulder.

HABITAT INVENTORY RESULTS FOR SCHOOLHOUSE CREEK

The habitat inventory of this tributary of Gilliam Creek was conducted on August 22, 1996 by Mark Bolin and Mark Kipp (NEAP) and data analyzed by Ken Bunzel (DFG). The survey began at the mouth and extended up Schoolhouse Creek for 1,629 feet. This tributary was dry at the mouth and intermittent for the entire surveyed reach. Salmonids were observed in isolated shallow pools up to and including the last unit. The pools were almost all completely dry by late September

Water temperatures were recorded at 58°. Air temperatures were recorded at 61°.

Schoolhouse Creek has an F3 channel type. These channel types are described as entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly cobble substrate.

*Nine habitat units were measured and 6 Level IV habitat types were identified. By percent total **length**, low gradient riffles made up 81%, runs 9%, bedrock scour pools 3%, and glides 3%.*

Three scour pools all less than 2 feet deep, with a mean shelter rating of 102 where observed harboring 0+ and 2+ salmonids. Although substrate composition was not measured in low gradient riffles, gravel and small cobble were found in other habitat types. All 3 pools had embeddedness ratings of 2.

The mean percent canopy density for the stream reach surveyed was 83%. The mean percent right and left bank vegetated were both 84%.

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

In the 1962 April and May surveys, 3 juvenile coho were observed in the lower 100 yards of the stream. Numerous 0+, 50 1+ and 50 2+ steelhead were observed. Barriers included a 6' high rock and log falls located approximately 2.5 miles from the mouth. No steelhead young of the year were observed upstream from this barrier. Another rock and log falls, 12' high, was located about 50 yards upstream from the first falls. In addition, there was a partial barrier created by a log jam approximately 300 yards from the mouth. Upstream of the natural falls barrier, a small population of resident Rainbow Trout existed. Pacific Giant Salamanders and newts (Taricha sp.) were also observed.

In the August 1977 survey, California Roach were observed in the stagnant pools of the lower dry section. In the upper section, steelhead young of the year were observed at a rate of 5/100', however, no coho were observed. A complete barrier to fish passage was created by the steep gradient and large boulders in the upper .4 miles surveyed. In addition, Yellow-legged Frogs and newts were noted.

On October 28, 1996 a biological inventory was conducted in three sites of Gilliam 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 58°-66°F and the water temperature 51°F. The observers were Bolin, Kipp (NEAP) Campo, Nossaman and Carey (Americorps).

The inventory of Reach 1 started in habitat unit 81 (1.2 miles from the mouth) and ended approximately 800 feet upstream in habitat unit 91. In riffle and pool habitat types 172 0+, 30 1+ and 6 2+ steelhead were observed (26/100') along with 10 Sacramento Squawfish, 11 sculpin, 37 California Roach, 1 Sacramento Sucker and 2 unidentified frogs.

The inventory of Reach 2 started approximately 500 feet upstream of a fire road bridge in habitat unit 111 and ended 690 feet upstream in habitat unit 121. In pool and riffle habitat types 46 0+, 20 1+ and 2 2+ steelhead were observed (10/100') along with 1 sculpin (cottus sp.), 1 Rough-skinned Newt and 1 Yellow-legged Frog.

The inventory of Reach 3 started where an old skid road meets the left bank in habitat unit 129 and ended 993 feet upstream in habitat unit 142. In pool and riffle habitat types 110 0+, 13 1+ and 2 2+ steelhead were observed (13/100') along with 5 Yellow-legged Frogs and 3 Rough-skinned Newts.

During the 1996 habitat inventories, salmonids were observed throughout the surveyed section of Gilliam Creek. In the unnamed tributary, a log jam located approximately .4 miles from the mouth, is believed to block salmonid migration. No salmonids were observed above this jam. In Schoolhouse Creek, salmonids were observed in isolated shallow pools up to and including the last unit. A lack of adequate flow limited salmonids in this tributary. 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**
1962, 1977, 1996	Steelhead Trout	DFG	N
1962	Coho Salmon	DFG	N
1996	Sculpin	DFG	N
1977, 1996	California Roach	DFG	N
1996	Sacramento Pikeminnow	DFG	N
1996	Sacramento Sucker	DFG	N
1962, 1977, 1996	Rough-skinned Newt	DFG	N
1962	Pacific Giant Salamander	DFG	N
1977, 1996	Yellow-legged Frog	DFG	N

No introduced fish species were found in the surveys and historical records indicate no hatchery stocking, transfers or rescues have occurred in the watershed.

DISCUSSION

Gilliam Creek has 3 channel types: F3, G1 and B2. There are 8,273 feet of F3 channel type in Reach 1. 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. 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.

There are 1,989 feet of G1 channel type in Reach 2. G1 channel types are fair for log cover.

There are 7,584 feet of B2 channel type in Reach 3. B2 channel types are excellent for low and medium-stage plunge weirs, single and opposing wing deflectors and bank cover. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

The water temperatures recorded on the survey days August 6-20, 1996 ranged from 58°F to 72°F. Air temperatures ranged from 62°F to 94°F. The warmer water temperatures were recorded in all three reaches. These temperatures, if sustained, are above the threshold stress level (65°F) for salmonids. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and more extensive biological sampling conducted.

Pools comprised 27% 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 Gilliam Creek, the pools are relatively deep with 74% having a maximum depth of at least 2 feet. These pools comprised 21% 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. The mean shelter rating for pools was 113. Shelter ratings in this stream were measured in regard to 0+ fish. Shelter for 1+ fish is scarce. The relatively small amount of pool shelter that now exists is being provided primarily by boulders (50%), bedrock ledges (11%), and undercut banks (9%). Large woody debris in the pools and flatwater habitats would improve both summer and winter salmonid habitat. Log cover structures increase scour for pool development, provide rearing fry with protection from predation, adults with rest from water velocity, and also divide territorial units to reduce density related competition.

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

All of the pool tail-outs measured had embeddedness ratings of 2. This is fair, since cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and

steelhead.

The mean percent canopy for the survey was 82%. This is good, since 80 percent is generally considered desirable.

DISCUSSION FOR UNNAMED TRIBUTARY (Bea Creek) TO GILLIAM CREEK

The surveyed section of this unnamed tributary has a B2 channel type. These channel types are excellent for low and medium-stage plunge weirs, single and opposing wing deflectors and bank cover.

Although fish shelter was fair, with a mean shelter rating of 83, primary pools comprised only 6% of the total surveyed length. The shelter was predominantly boulders, undercut banks and small woody debris. Installing log and root wad scour structures would increase both pool habitat depth and length.

The amount and quality of spawning gravels is adequate and salmonids were observed up to the log jam barrier. There are an additional 2000' of suitable habitat above fish barrier/bow out around unit 030. Shade canopy was 92% for this tributary and the water temperatures recorded, ranging from 60-63°F, are favorable to salmonids.

DISCUSSION FOR SCHOOLHOUSE CREEK

In Schoolhouse Creek, the quantity and condition of spawning gravels, and the presence of salmonid juveniles all indicate spawning habitat is adequate. The pools are shallow and shelter is scarce for juvenile salmonids. In addition, water temperatures and riparian canopy are good. A lack of adequate flow is the main limiting factor for salmonid production in this creek. It is not known whether this creek historically had year-round flow, although USGS maps indicate that is the case.

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 1962 survey. 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 1996 summer surveys documented

many 0+ fish indicating successful spawning in all reaches of Gilliam Creek. In addition, salmonids were documented in Schoolhouse Creek and the unnamed tributary.

In all reaches, stream shade canopy was good, but water temperatures were high. Adequate spawning gravel of good quality exists throughout the survey reach. Shelter ratings were poor for pools in all reaches, and the quantity of pool habitat was low. There is also lack of large woody debris and root mass shelter.

Reach 1 is good for bank-placed boulders as well as single and opposing wing-deflectors. Low-stage weirs, boulder clusters and channel constrictors are also appropriate. In Reach 2, only log cover is appropriate. Reach 3 is excellent for low and medium-stage plunge weirs, single and opposing wing deflectors and bank cover. Log cover structures can be used to increase instream shelter in all reaches.

In the unnamed tributary, a log jam is blocking anadromous fish passage .4 miles from the mouth. Spawning habitat, stream shade canopy and water temperatures were all good.

GENERAL RECOMMENDATIONS

Gilliam Creek and its tributaries should be managed as anadromous, natural production streams.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. 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) There are six bank erosion problems in Reach 1, four in Reach 3 and two in the unnamed tributary. Numerous old crossings exist and untreated haul road failures which are generating sediment. Bank stabilization structures followed up with revegetation using native species is recommended.

2) A major road related landslide has caused a fish barrier at habitat unit 030 of the unnamed tributary (Bea Creek). This

feature is also a source of sediment in the system. To restore this site heavy equipment would be needed to clear the channel, remove the unstable material from the slide, stabilize the hillslope and de-commission the old and failing section of the road on the way out. The log jams downstream at habitat units 023 and 026 could be modified concurrently.

3) There are 4 log debris accumulations present on Gilliam Creek and a few on the unnamed tributary that have the potential for causing bank erosion. These were caused by slides, likely during the high water events of 1995/96. The modification of these debris accumulations may be necessary, and they should be monitored. **If modification becomes necessary, it must be done carefully to preserve existing habitat.**

4) Increasing woody structure in the pool and flatwater habitat units along the stream, with high quality complexity would increase the number of pools for rearing juvenile salmonids. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations. This must only be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

RESTORATION IMPLEMENTED

1) Access for migrating salmonids is a potential problem in the unnamed tributary at several log jams, and in Gilliam Creek at unit #234 approximately 3.1 miles upstream. **Modification of these barriers to allow upstream migration must be done carefully to preserve existing habitat provided by the woody debris.**

2) The unimproved park access road into Gilliam Creek has erosive gullies and culverts which need maintenance. These road problems need to be inventoried, prioritized and treated to decrease sedimentation to the stream.

PROBLEM SITES AND LANDMARKS - GILLIAM 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	100	AT CONFLUENCE OF EAST AUSTIN
3.00	202	CLASS 3 STREAM AT TOP OF UNIT LF BANK (WET) 60°F; SAW NO FISH
5.00	561	SALMONIDS 0+, 1+
6.00	599	SALMONIDS, GOOD POOL
15.00	1178	FEEDER STREAM LF BANK 56°F, WET 8' HEAD CUT AT CONFLUENCE.
18.00	1506	SIDE TRIB LF BANK, DRY
23.00	1720	BLOWOUT RT BANK LOGS IN STREAM
53.00	3897	DRY TRIB RT BANK
55.00	4025	DRY TRIB RT BANK
62.00	4536	BLOW OUT
63.00	4591	TRAIL XING STREAM; SALMONIDS
64.00	4633	SMALL BLOW OUT 20 X 30 BELOW TRAIL
65.00	4701	DEEP POOL
71.00	5045	LF BANK FEEDER STREAM TOP OF UNIT 56°F; WET
78.00	5958	BIG MADRONE ACROSS UNIT, DRY TRIB LF BANK
80.00	6057	TRAIL
81.00	6139	DRY RAVINE TOP OF UNIT LF BANK,
82.00	6221	PIKEMINNOW & SALMONIDS
85.00	6475	STEEP GULLY RT BANK, SALMONIDS
89.00	6653	DRY RAVINE LF BANK
95.00	7147	DRY RAVINE LF BANK
100.00	7554	SCHOOL HOUSE
101.00	7651	CONFLUENCE W/ SCHOOL HOUSE CREEK
107.00	7956	GILLIAM CREEK BRIDGE
113.00	8447	DRY TRIB LF BANK
118.00	8707	DRY RAVINE TOP OF UNIT
120.00	8808	0+,1+, 2+ (TWO 6-7" FISH)
122.00	9223	DRY TRIB RT BANK, SALMONIDS
123.00	9295	BLOWOUT LF BANK
125.00	9404	YOUNG RATTLESNAKE
127.00	9472	DRY RAVINE LF BANK, PIECE OF CONCRETE CULVERT IN STREAM
128.00	9502	SALMONIDS

129.00	9608	STEP POOL W/SALMONIDS
133.00	9850	SALMONIDS
135.00	9905	BRUSH PILE OVER CREEK
137.00	10182	3 POOLS
141.00	10462	LF BANK DRY RAVINE, OLD HAUL RD
145.00	10771	DRY RAVINE LF BANK, TOP OF UNIT
146.00	10867	2 POOLS W/ SALMONIDS, SPAWNING BEDS?
147.00	10871	BLOWOUT RT BANK
148.00	10907	BLOW OUT, NICE POOL
152.00	11173	RAVINE STEEP DRY LF BANK, 4 SHALLOW POOLS, STATE PARK SIGN LF BANK
153.00	11200	SMALL STEEP DRY RAVINE LF BANK,
154.00	11240	WELL DEVELOPED BEDROCK LEDGE RT BANK
159.00	11580	SPRING RT BANK 65°F
162.00	11777	FEEDER STREAM (DAMP) LF BANK
163.00	11852	SALMONIDS THROUGHOUT THESE UNITS
166.00	12049	FEEDER STREAM 63°F LF BANK
169.00	12253	LEANER REDWOOD ACROSS UNIT
170.00	12276	DRY RAVINE RT BANK
173.00	12476	2 NICE POOLS THROUGH CASCADE
174.00	12593	SHALLOW POOLS, SMALL CASCADES
175.00	12651	2 NICE POOLS THROUGH CASCADE
176.00	12789	CLASS 3 LF BANK 85' UP 60°F SHALLOW POOLS IN THIS UNIT
177.00	12841	3 SHALLOW POOLS, DRY RAVINE LF BANK, SEEPING SPRING
178.00	12854	5' WATERFALL, SALMONIDS IN POOL
179.00	12960	3 POOLS W/ SALMONIDS
184.00	13210	BLOW OUT RT BANK
187.00	13367	6 SHALLOW POOLS
196.00	13767	2 POOLS, BRUSH PILES IN STREAM
197.00	13833	SPRING LF BANK, BLOW OUT RT BANK 70 X 50 X 3; 2 TREES ACROSS STREAM
200.00	14003	LOG JAM OVER CREEK, 2 POOLS
202.00	14101	LOG JAM, 2 POOLS
212.00	15014	CLASS 3 STREAM LF BANK, RUSHING W/ WATER. 62°F; NO FISH OBSERVED
215.00	15431	SEVERAL 3-4' REDWOODS ALONG THESE UNITS (214-223); BOTH BANKS
218.00	15578	SMALL SHALLOW POOL
226.00	15939	UNDERCUT 4' BEDROCK
227.00	16038	CLASS 3 (NOT RUNNING) 61°F 110' UPSTREAM, GRAVEL BED AT CONFL.
228.00	16163	DRY RAVINE RT BANK
231.00	16472	6 SMALL POOLS
232.00	16552	LG DOUBLE REDWOOD W/ PRIVATE PROPERTY SIGN

233.00	16624	LOG JAM TOP OF UNIT
238.00	16903	IRON WHEEL W/ SPOKES ON RT BANK GRAVEL BED
242.00	17116	6' LIVING MAPLE ACROSS UNIT
244.00	17317	CLASS 3 TOP OF UNIT
249.00	17698	WASHED OUT OLD BRIDGE CROSSING
252.00	17828	SULPHUR SPRING LF BANK
253.00	17846	SWEET SPRING RT BANK, BOTTOM UNIT

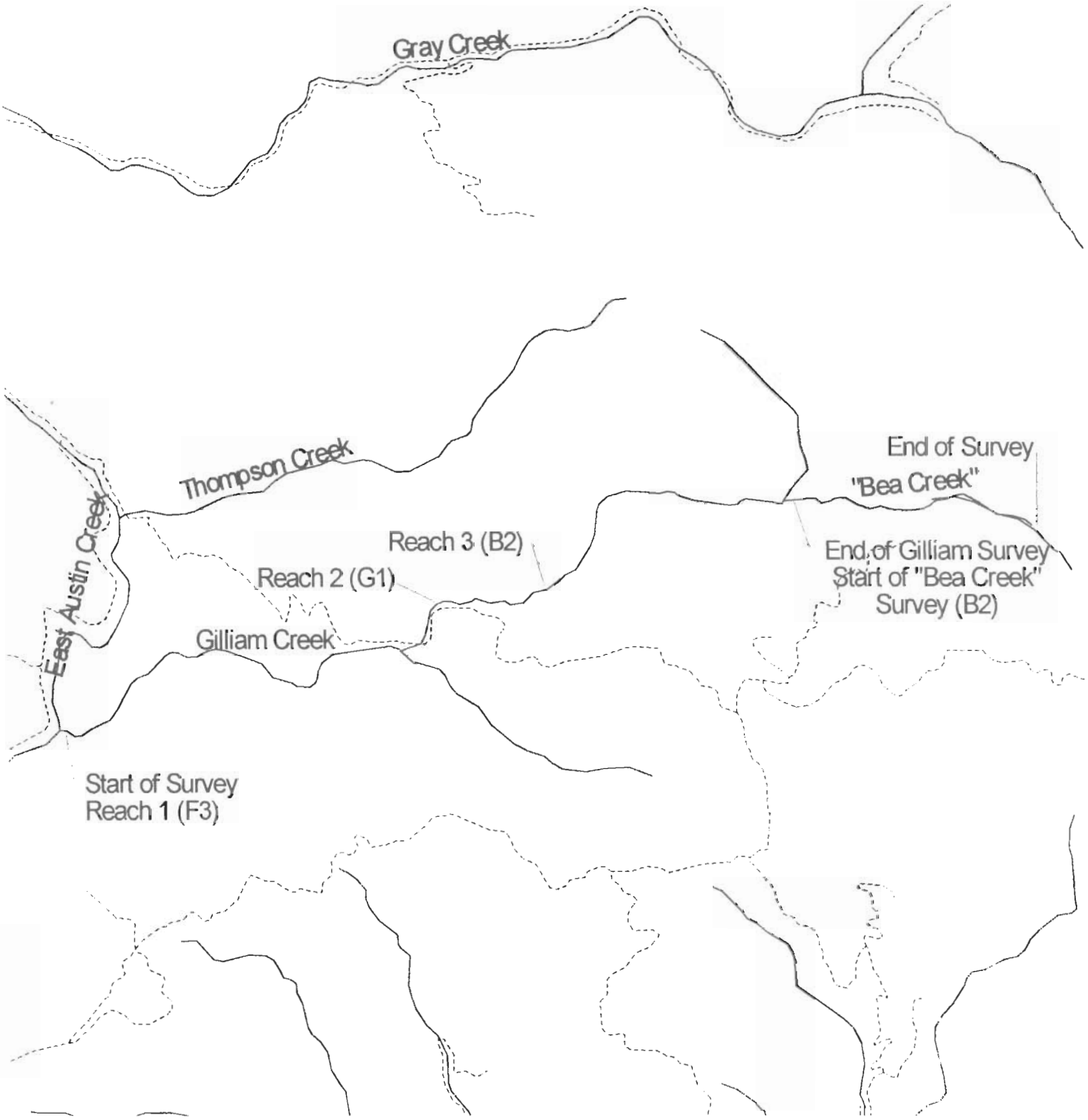
PROBLEM SITES AND LANDMARKS - UNNAMED TRIBUTARY SURVEY COMMENTS

HABITAT UNIT #	*STREAM LEN (FT.)*	*COMMENTS*
1.00	*42*	*CONFLUENCE WITH GILLIAM*
4.00	*121*	*SALMONIDS OBSERVED*
6.00	*192*	*SPAWNING AREA? FAST MOVERS; GRAVEL*
7.00	*576*	*2+ SALMONIDS, OLD BRIDGE REMAINS 200 FT UP UNIT*
8.00	*611*	*LF BANK SMALL DRY RAVINE*
9.00	*729*	*REMNANT OLD BRIDGE MID UNIT*
10.00	*784*	*SALMONIDS; GOOD GRAVEL STEEP RAVINE RT BANK*
17.00	*1181*	*3 POOLS DRY RAVINE RT BANK*
18.00	*1244*	*DRY TRIB RT BANK, BEAR DEN LF BANK*
20.00	*1611*	*DRY TRIB LF BANK, SHALLOW POOLS W/ GRAVEL*
22.00	*1866*	*SALMONIDS, SHALLOW POOL W/ GRAVEL*
23.00	*1883*	*LOG LAM RETAINING MUCH GRAVEL, 90 FT TO NEXT UNIT*
24.00	*1971*	*SPRING LF BANK W/ GULLY, GRAVEL BED FROM LOG JAM*
25.00	*1979*	*PLUNGE POOL AT BASE OF LOG JAM*
26.00	*2024*	*LOG JAM*
27.00	*2274*	*UNDER + THROUGH DEBRIS PILE FROM BLOWOUT*
28.00	*2449*	*DRY GRAVEL BED FROM BLOWOUT JAM, SUBTERRANEAN W/ WATER FLOW, NO SALMONIDS OBSERVED ABOVE THIS*
29.00	*2649*	*FEEDER STREAM LF BANK RUNNING, BOTTOM OF UNIT-60°F*
30.00	*2772*	*BLOWOUT 44'L X 90'W X 4'H RT BANK*
34.00	*3309*	*DRY RAVINE RT BK*
37.00	*3456*	*LOG JAM TOP OF UNIT*
40.00	*4229*	*TOP OF UNIT AT RD XING, CLASS 3 STREAM LF BK, RUNNING-61°F*

PROBLEM SITES AND LANDMARKS - SCHOOLHOUSE CREEK SURVEY COMMENTS

HABITAT UNIT #	STREAM LEN (FT.)	COMMENTS
1.00	39	DRY UNIT AT CONFLUENCE WITH GILLIAM
2.00	59	SALMONIDS OBSERVED
3.00	157	INTERMITTENT WATER MOSTLY DRY
4.00	186	TRAIL- BOTTOM OF UNIT, SALMONIDS 0+, 2+
5.00	338	INTERMITTENT WATER, SMALL SALMONIDS PRESENT
6.00	354	SALMONIDS IN POOL
7.00	581	INTERMITTENT-MOSTLY DRY W/ SALMONIDS IN SHALLOW WATER.
8.00	629	SALMONIDS
9.00	1629	TRAIL XING 850' UP + RECROSS, DRY TRIB RT BANK APPROX 1110' UP UNIT, MOSTLY DRY, SMALL TRICKLES, ISOLATED SHALLOW "POOLS" W/ SALMONIDS, STEEP RAVINES LF AND RT BANKS 400' UP UNIT 11 FISH

Gilliam Creek



Gilliam Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

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

Survey Dates: 08/06/96 to 08/20/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8NR11WS2 LATITUDE: 38°33'39" LONGITUDE: 123°3'53"

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
74	16	RIFFLE	29	68	5034	28	8.1	0.6	268	19854	195	14415	1114	137
82	16	FLATWATER	32	99	8105	45	9.7	0.7	670	54977	474	38863	0	73
98	18	POOL	39	48	4741	27	10.5	1.3	516	50554	679	66531	523	113

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
254	50	17880	125386	119809

Gilliam Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 08/06/96 to 08/20/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8NR11WS2 LATITUDE: 38°33'39" LONGITUDE: 123°3'53"

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 %
22	5	LGR	9	61	1349	8	7	0.4	1.0	288	6340	114	2512	0	76	83
39	7	HGR	15	68	2666	15	7	0.6	3.3	254	9907	240	9365	1114	159	79
13	4	CAS	5	78	1019	6	11	0.8	1.9	272	3535	205	2664	0	175	54
8	3	GLD	3	70	557	3	12	0.9	2.1	846	6767	689	5514	0	7	83
36	7	RUN	14	80	2881	16	10	0.7	2.2	467	16799	311	11178	0	54	86
38	6	SRN	15	123	4667	26	9	0.7	2.6	828	31472	568	21601	0	124	83
12	3	MCP	5	53	639	4	12	1.2	4.3	626	7509	798	9575	573	102	86
22	3	STP	9	79	1744	10	10	1.2	5.2	765	16820	887	19506	641	162	83
7	2	LSR	3	43	301	2	12	1.6	5.6	584	4086	1163	8143	952	109	100
32	4	LSBk	13	41	1300	7	10	1.2	4.2	436	13965	543	17391	419	81	84
20	4	LSBo	8	32	648	4	12	1.3	4.2	370	7390	523	10458	447	100	83
5	2	PLP	2	22	109	1	7	1.9	6.2	157	784	292	1459	242	171	98

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
254	50	17880	125375	119365

Gilliam Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 08/06/96 to 08/20/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8NR11WS2 LATITUDE: 38°33'39" LONGITUDE: 123°3'53"

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
34	6	MAIN	35	70	2383	50	10.4	1.2	716	24329	855	29081	617	142
64	12	SCOUR	65	37	2358	50	10.6	1.3	410	26225	585	37450	473	97

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
98	18	4741	50554	66531

Gilliam Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

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

Survey Dates: 08/06/96 to 08/20/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8NR11WS2 LATITUDE: 38°33'39" LONGITUDE: 123°3'53"

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
12	MCP	12	0	0	1	8	7	58	3	25	1	8
22	STP	22	0	0	7	32	10	45	2	9	3	14
7	LSR	7	0	0	2	29	3	43	1	14	1	14
32	LSBk	33	0	0	7	22	18	56	6	19	1	3
20	LSBo	20	0	0	7	35	9	45	3	15	1	5
5	PLP	5	0	0	1	20	3	60	0	0	1	20

TOTAL UNITS
98

Gilliam Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 5 - Summary of Shelter by Habitat Type

Survey Dates: 08/06/96 to 08/20/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8NR11WS2 LATITUDE: 38°33'39" LONGITUDE: 123°3'53"

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
22	5	LGR	0	37	0	0	118	0	147	662	0
39	8	HGR	0	142	82	31	57	0	330	1321	125
13	4	CAS	33	0	0	0	34	0	268	1312	33
8	3	GLD	0	0	0	0	0	0	0	130	0
36	8	RUN	44	10	0	0	14	0	228	1333	64
38	7	SRN	153	210	47	0	281	0	603	2504	0
12	12	MCP	264	235	281	270	59	0	29	686	86
22	22	STP	514	521	257	165	138	0	1278	5439	852
7	7	LSR	430	278	292	448	68	0	14	189	0
32	32	LSBk	186	348	197	140	199	32	200	1676	896
20	20	LSBo	386	254	113	200	52	0	84	1824	134
5	5	PLP	13	6	2	0	6	12	77	164	148
TOTAL 254	133		2023	2041	1271	1254	1026	44	3258	17240	2338
			7%	7%	4%	4%	3%	0%	11%	57%	8%
TOTAL OTHER POOLS 98	98		1793	1642	1142	1223	522	44	1682	9978	2116
			9%	8%	6%	6%	3%	0%	8%	50%	11%

Gilliam Creek

Drainage: East Austin Creek, Big Austin Creek, Russian River

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 08/06/96 to 08/20/96

Confluence Location: QUAD: CAZADERO LEGAL DESCRIPTION: T8NR11WS2 LATITUDE: 38°33'39" LONGITUDE: 123°3'53"

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
22	5	LGR	0	0	0	20	60	20	0
7	7	HGR	0	0	0	29	29	43	0
4	4	CAS	0	0	0	0	0	100	0
3	3	GLD	0	0	33	33	0	0	33
7	7	RUN	0	0	43	14	29	14	0
6	6	SRN	0	0	17	33	17	33	0
3	3	MCP	0	0	67	0	0	33	0
3	3	STP	0	0	67	0	0	0	33
2	2	LSR	0	100	0	0	0	0	0
4	4	LSBk	0	0	50	0	0	50	0
4	4	LSBo	0	25	0	25	0	50	0
2	2	PLP	0	50	50	0	0	0	0

Gilliam 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
82.48	59.11	40.89	68.04	69.61

APPENDIX B.

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Bedrock	15	25	39.22
Boulder	16	12	27.45
Cobble/Gravel	12	6	17.65
Silt/clay	8	8	15.69

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Grass	4	2	5.88
Brush	10	3	12.75
Deciduous Trees	14	19	32.35
Evergreen Trees	23	27	49.02
No Vegetation	0	0	0

APPENDIX C. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Gilliam Creek
SAMPLE DATES: 08/06/96 to 08/20/96
STREAM LENGTH: 17846 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: CAZADERO — Latitude: 38°33'39"
Legal Description: T8NR11WS2 — Longitude: 123°3'53"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

Channel Type: F3	Canopy Density: 86%
Channel Length: 8273 ft.	Evergreen Component: 45%
Riffle/Flatwater Mean Width: 10 ft.	Deciduous Component: 55%
Total Pool Mean Depth: 1.3 ft.	Pools by Stream Length: 26%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 30%
Water: 60 - 71 °F Air: 62 - 94 °F	Mean Pool Shelter Rtn: 79
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Boulders
Vegetative Cover: 67%	Occurrence of LOD: 34%
Dom. Bank Substrate: Bedrock	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 100% 3. 0% 4. 0%

STREAM REACH 02

Channel Type: G1	Canopy Density: 79%
Channel Length: 1989 ft.	Evergreen Component: 42%
Riffle/Flatwater Mean Width: 8 ft.	Deciduous Component: 58%
Total Pool Mean Depth: 1.2 ft.	Pools by Stream Length: 29%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 27%
Water: 64 - 72 °F Air: 73 - 89 °F	Mean Pool Shelter Rtn: 131
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Boulders
Vegetative Cover: 74%	Occurrence of LOD: 18%
Dom. Bank Substrate: Bedrock	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 100% 3. 0% 4. 0%

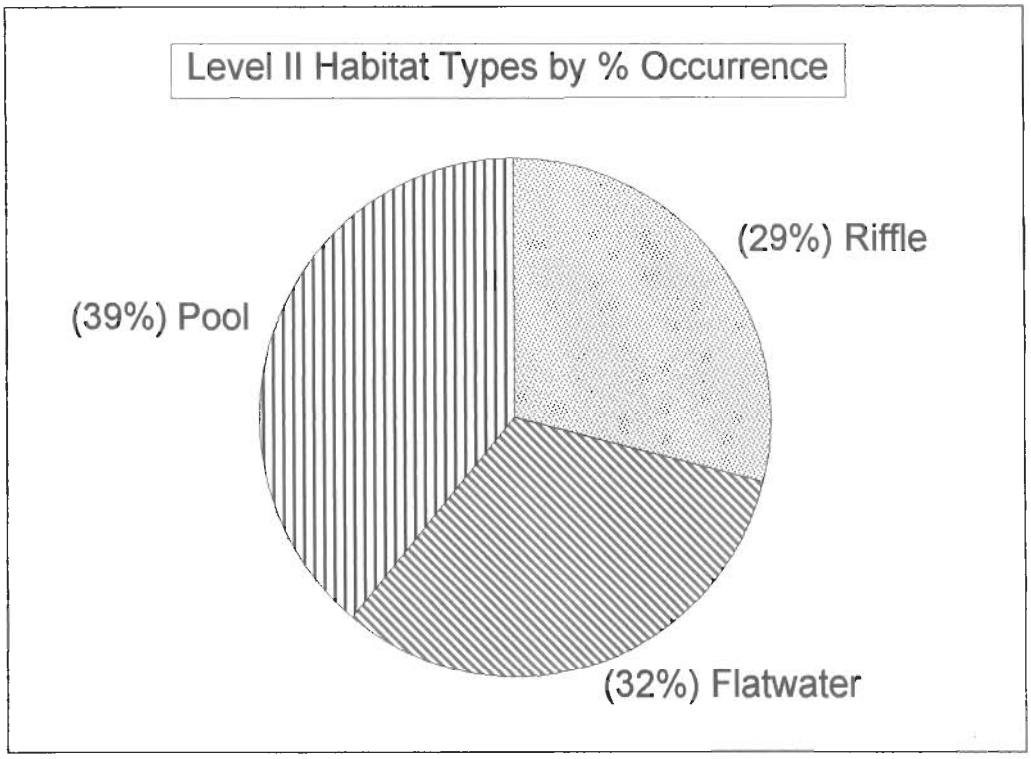
STREAM REACH 03

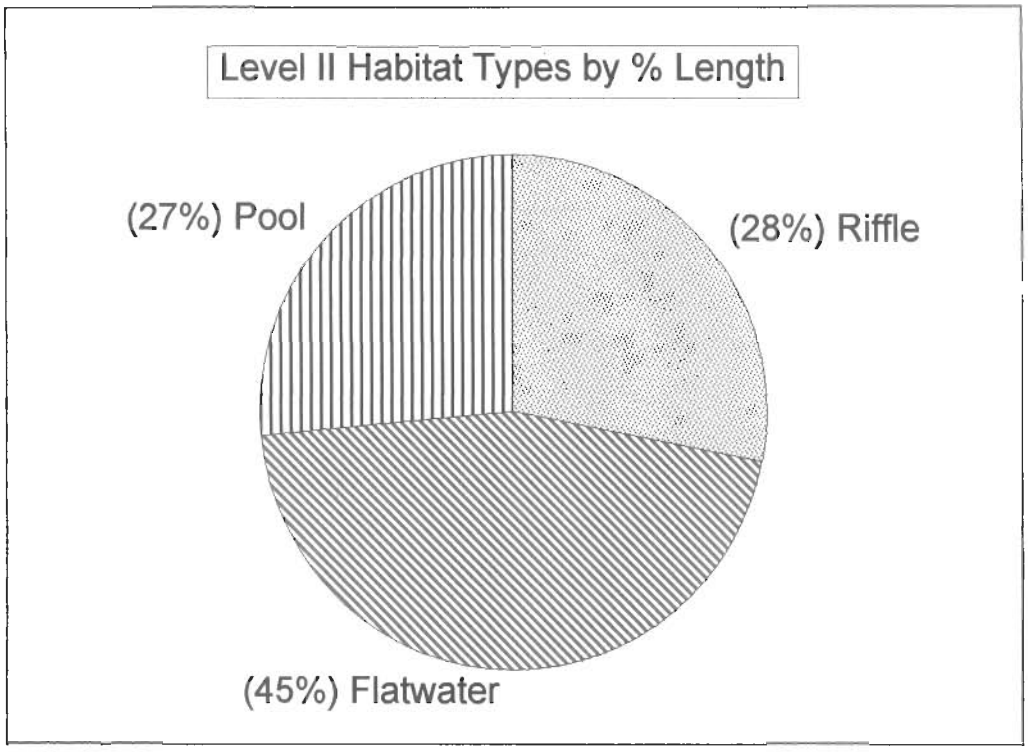
Channel Type: B2	Canopy Density: 81%
Channel Length: 7584 ft.	Evergreen Component: 79%
Riffle/Flatwater Mean Width: 8 ft.	Deciduous Component: 21%
Total Pool Mean Depth: 1.3 ft.	Pools by Stream Length: 27%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 17%
Water: 58 - 72 °F Air: 64 - 87 °F	Mean Pool Shelter Rtn: 134
Dom. Bank Veg.: Evergreen Trees	Dom. Shelter: Boulders
Vegetative Cover: 68%	Occurrence of LOD: 18%
Dom. Bank Substrate: Bedrock	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 100% 3. 0% 4. 0%

Gilliam Creek

Level II Habitat Types

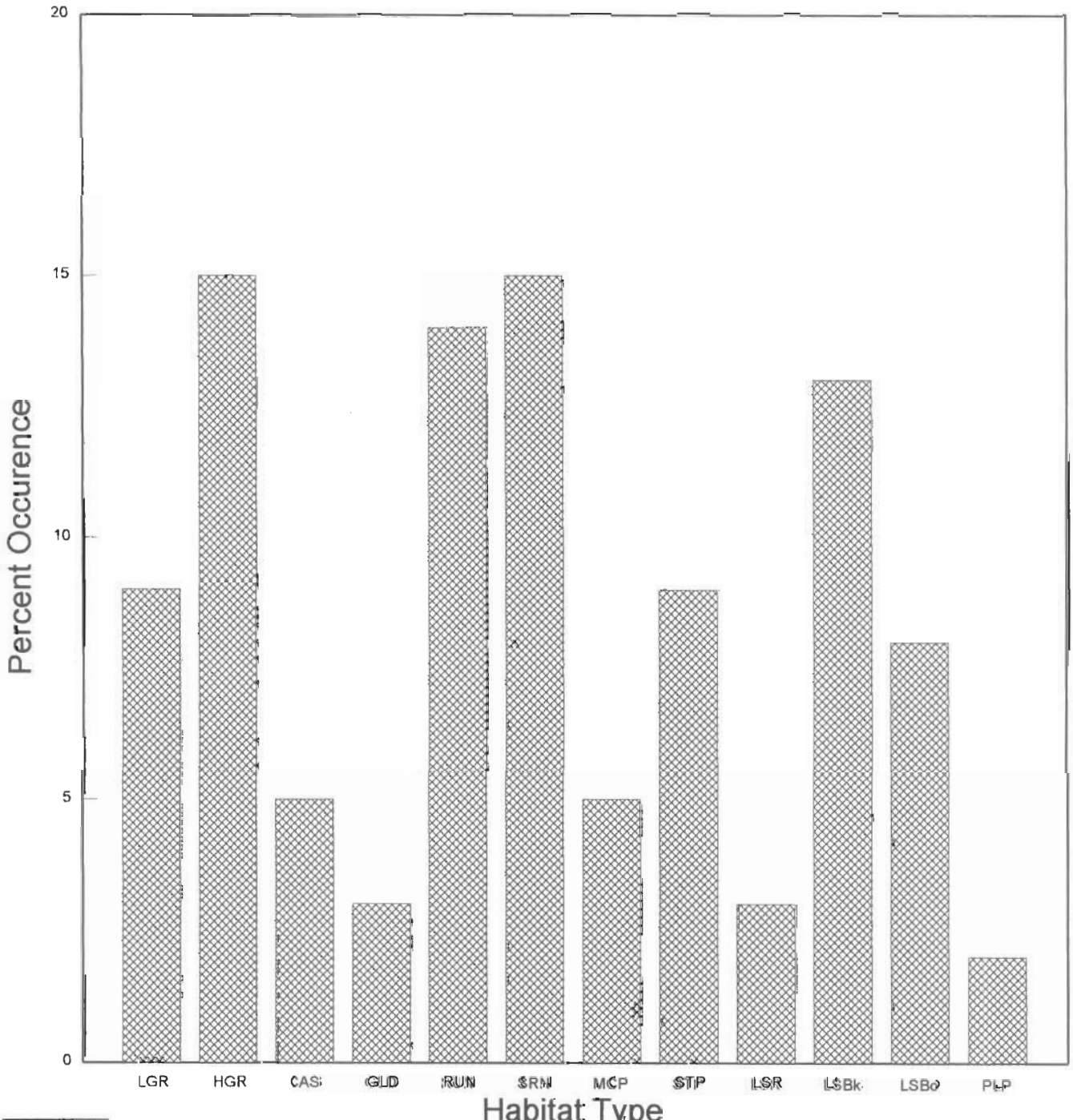




Graph 1

Gilliam Creek

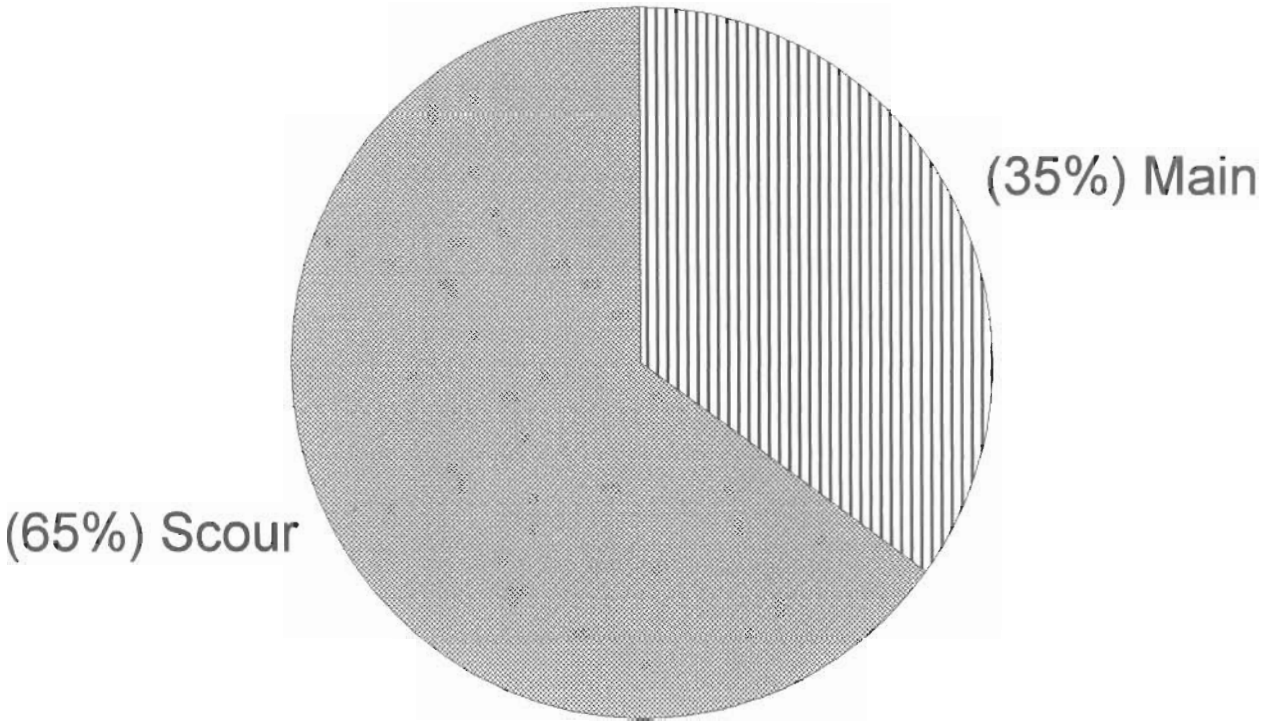
Level IV Habitat Types by % Occurrence



Graph 2

CreekName

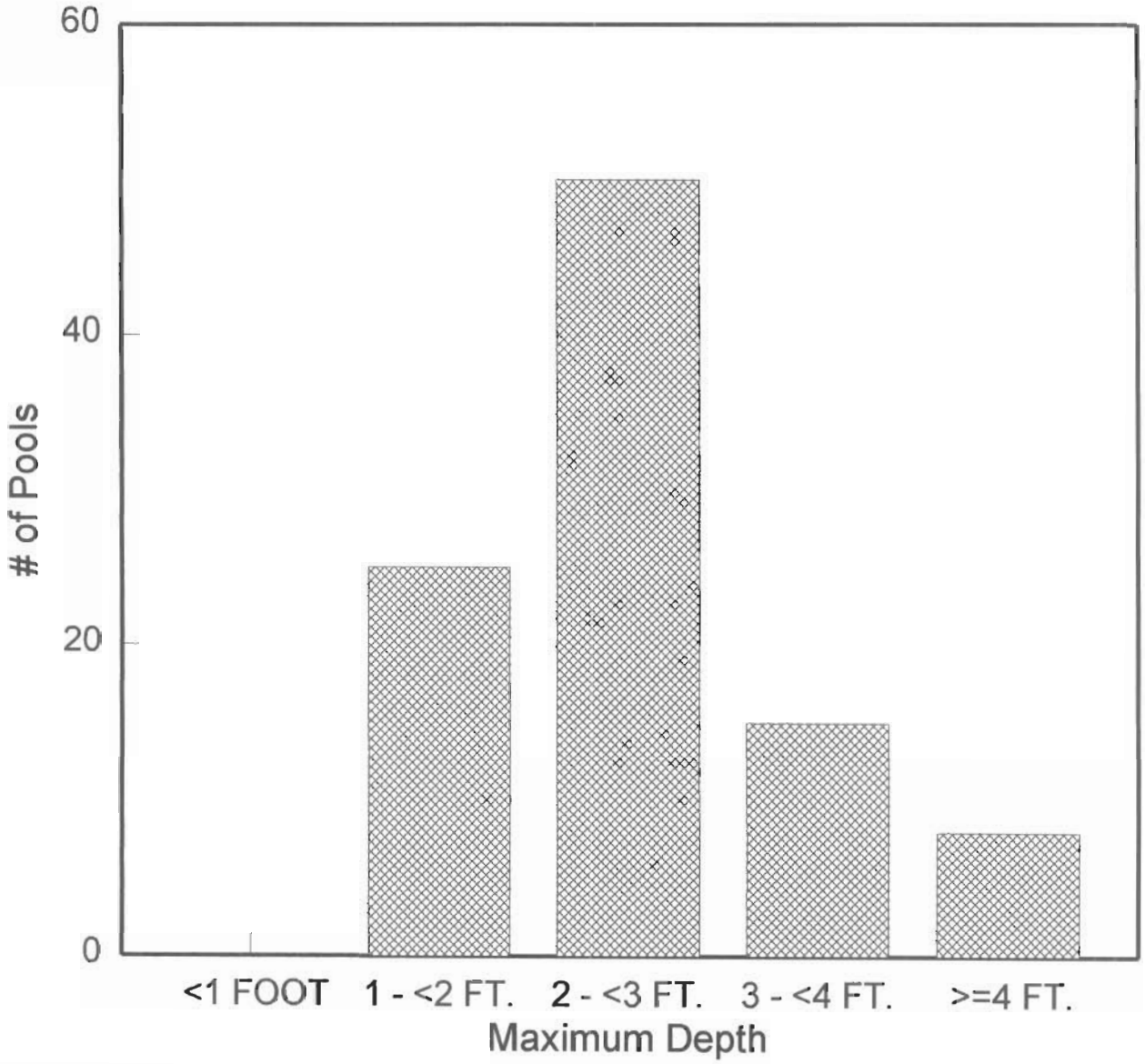
Pool Habitat Types by % Occurrence



Graph 3

Gilliam Creek

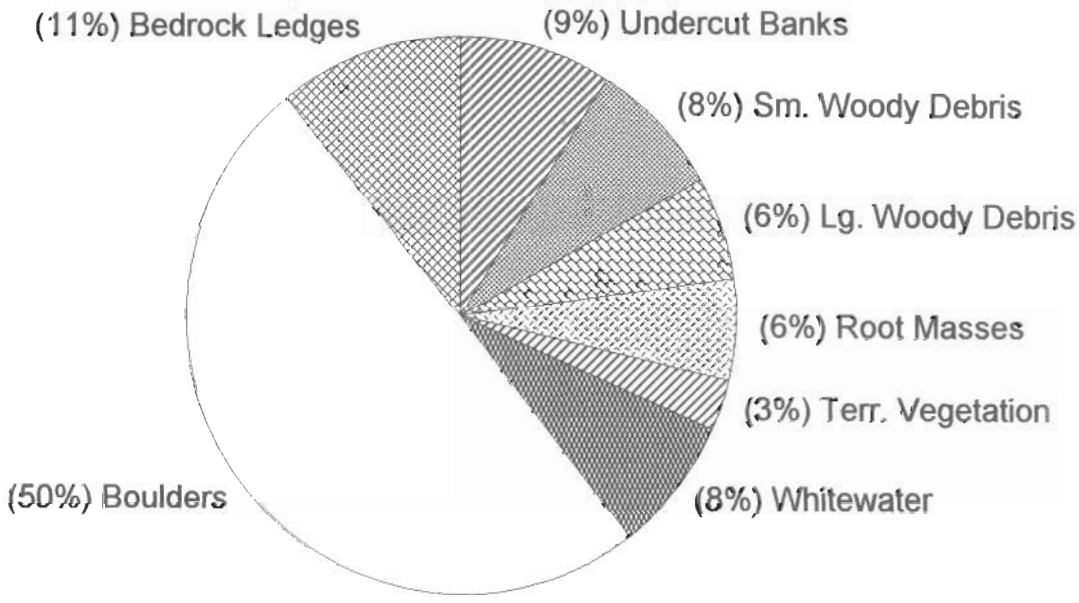
Maximum Depth in Pools



Graph 4

Gilliam Creek

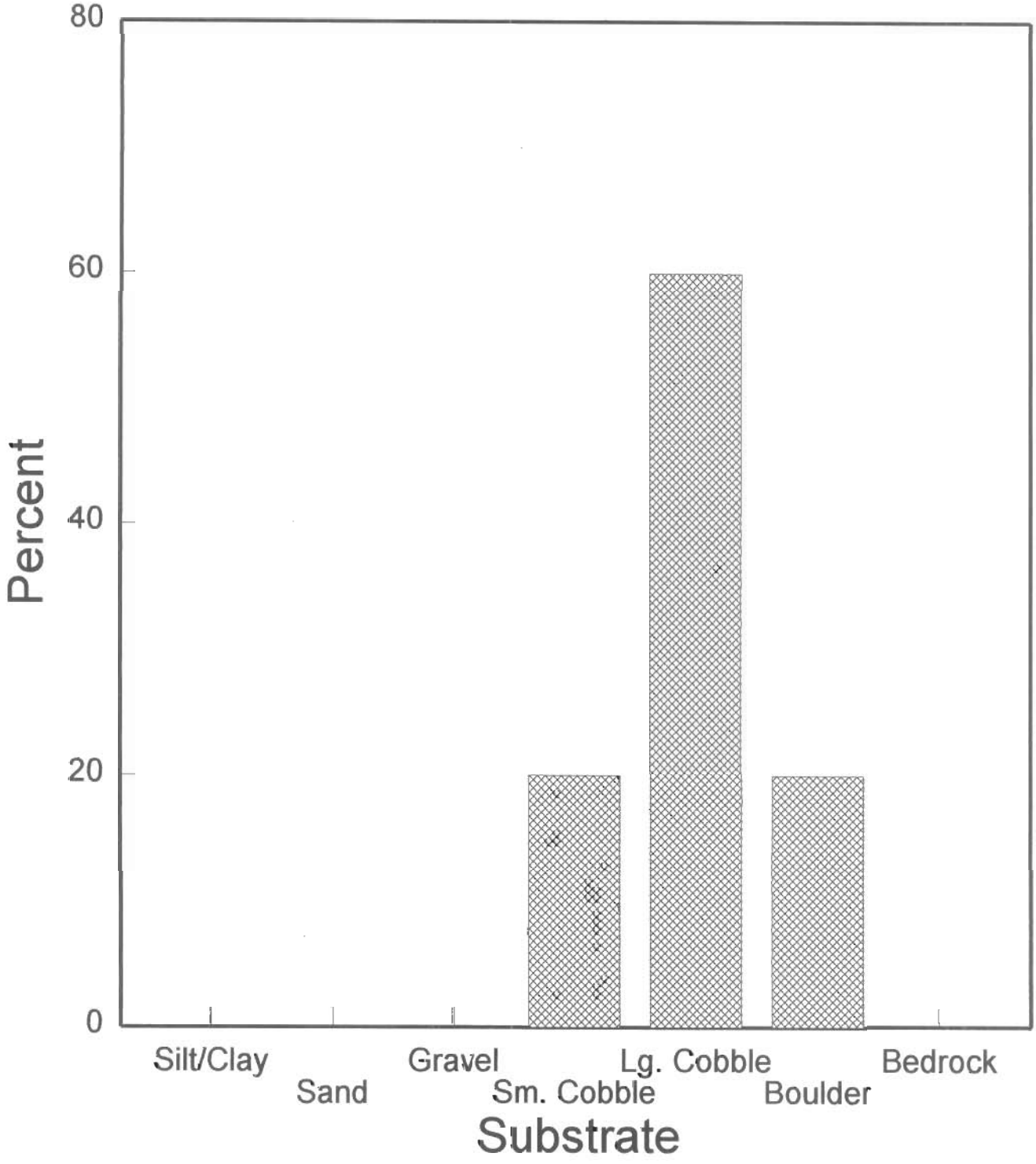
Pool Shelter Types by % Area



Graph 5

Gilliam Creek

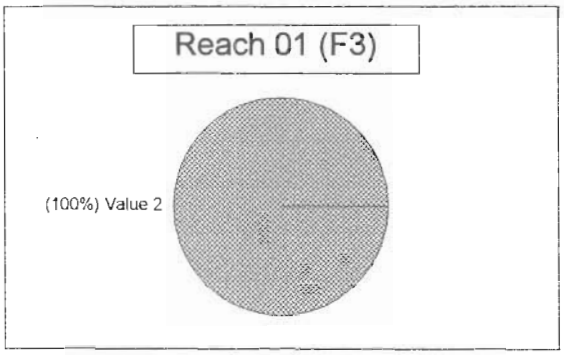
Substrate Composition in Low Gradient Riffles

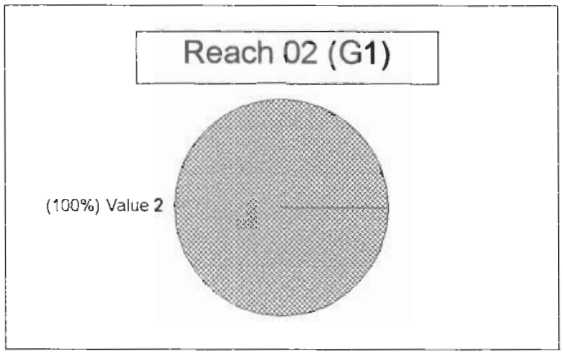


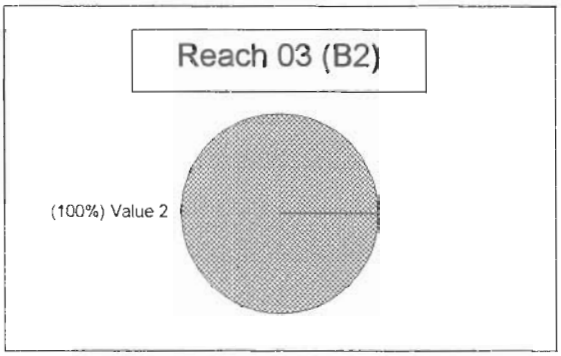
Graph 6

Gilliam Creek

Percent Cobble Embeddedness by Reach





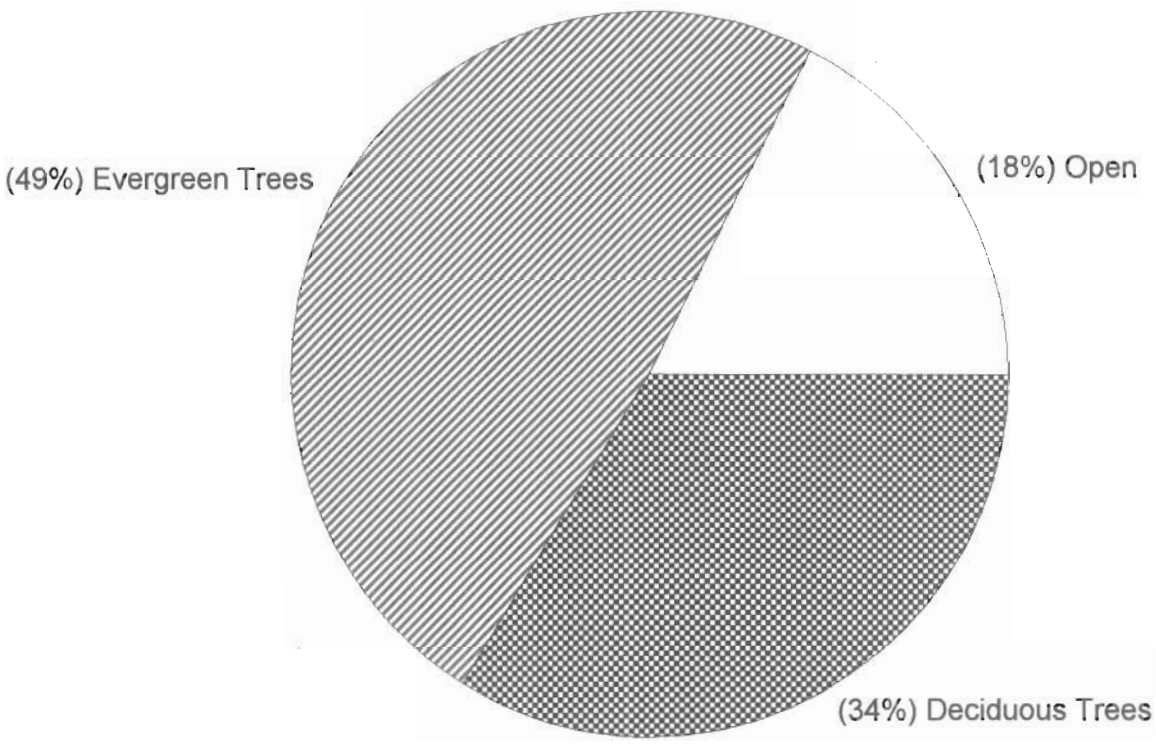


Value 1 = <25% Value 2 = 25-50% Value 3 = 51-75% Value 4 = >76%

Graph 7

Gilliam Creek

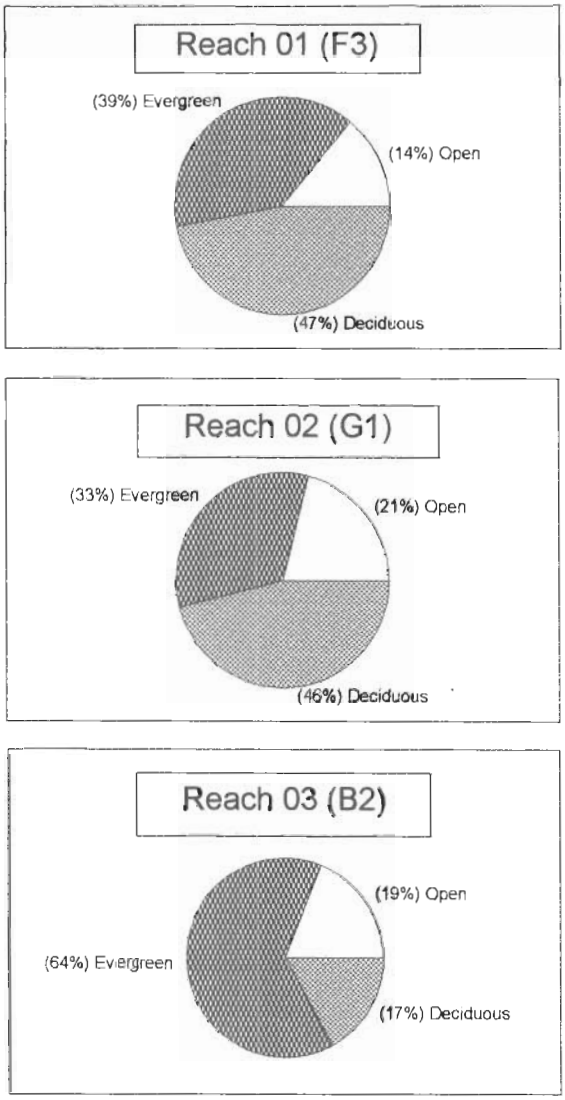
Mean Percent Canopy



Graph 8

Gilliam Creek

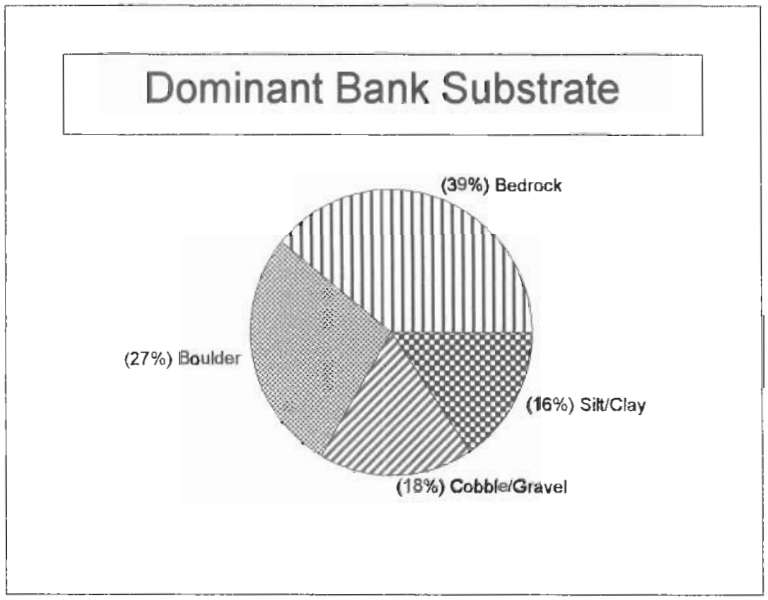
Percent Canopy By Reach

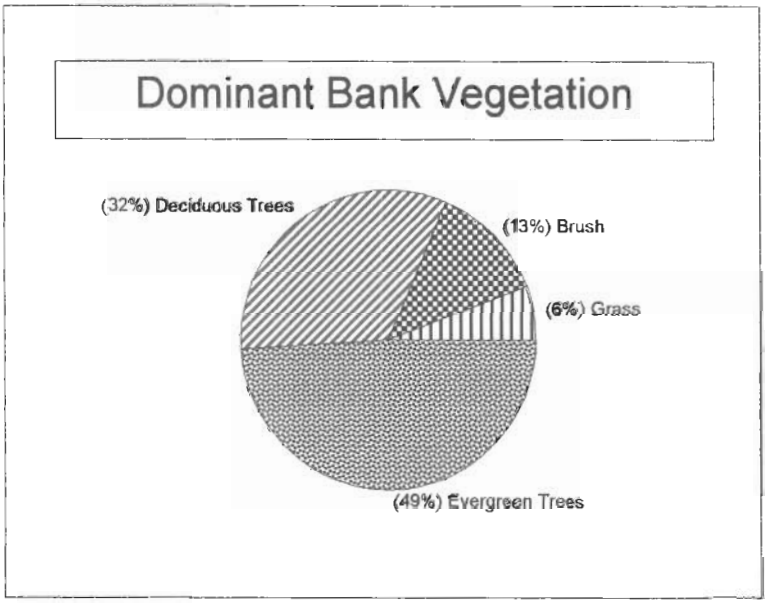


Graph 9

Gilliam Creek

Percent Bank Composition





Graph 10