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

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on Felta Creek to assess habitat conditions for anadromous salmonids. 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 Felta Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution. After analysis of historical information and data gathered recently, stream restoration and enhancement recommendations are presented.

WATERSHED OVERVIEW

Felta Creek is a tributary to Mill Creek, which is a tributary to Dry Creek which empties into the Russian River, located in Sonoma County, California (see Felta Creek Watershed map, page 2). The legal description at the confluence with Mill Creek is T09N, R09W, S32. It's location is 38°34'52" N. latitude and 122°52'56" W. longitude. Year round vehicle access exists from Felta Lane in Healdsburg, via Westside Road.

Felta Creek is a second order stream and has approximately 5 miles of blue line stream, according to the USGS Guerneville 7.5 minute quadrangle. A first order un-named tributary (Salt Creek) is the only major tributary and is included in this report. Felta Creek and its tributaries drain a basin of approximately 3.7 square miles, and the system has a total of 5 miles of blue line stream. Summer base flow was measured at approximately 1.8 cfs at Felta Road in July, 1985. Elevations range from about 100 feet at the mouth of the creek to 800 feet in the headwaters. Felta Creek flows in an easterly direction and is all privately owned. Tan-oak, live oak, valley oak, alder, bay and redwood trees forest the drainage. Land use is characterized by rural residential, timber production and agriculture.

The Northern Spotted Owl (Strix occidentalis caurina) is listed in DFG's Natural Diversity Database for Felta Creek watershed. No sensitive plants were listed.

Stream Surveys:

CDFG stream surveys were conducted on Felta Creek in October 1968 and July 1985 to assess and improve habitat conditions for anadromous salmonids. Site visits in the fall of 1958 and 1968 were also conducted.

A site visit in October 1958, .3 miles west on Felta Road, found Felta Creek to be dry.

The August 1963 survey found the creek to be completely dry from the mouth to Felta School.

The 1963 survey was conducted to determine the presence of juvenile salmonids in tributaries to the Russian River. Steelhead and roach were present.

The July 1985 survey was conducted to determine the need for instream enhancement work. This survey was initiated in response to a landowner's reports of a potential problem with steelhead passage approximately 1 mile from the confluence with Mill Creek. An abandoned summer dam had accumulated several large boulders at its base. This eliminated the jump pool needed for the steelhead to clear the summer dam obstruction. The boulders were removed, using a grip hoist and silent explosives. Removal of the boulders made approximately two miles of spawning habitat upstream from the dam accessible.

References:

C.D.F.& G. Stream Flow Measurement; August 1963; G.K.B.

C.D.F.& G. Stream Surveys - Russian River, Sonoma County; October 1968; Holman, Gerald, Asst. Fisheries Biologist Region 3.

Stream Enhancement Contract #C - 1245; November 1986; Circuit Rider Productions, Windsor, CA.

METHODS

The habitat inventory conducted in Felta Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi and Reynolds, 1991). The Americorps members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG) under the supervision of DFG's Russian River Basin

Planner, Robert Coey in May 1995. This inventory was conducted by a two person team.

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 Felta Creek to record measurements and observations. There are nine components to the inventory form.

HABITAT INVENTORY COMPONENTS

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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 by David Rosgen (1985). 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 four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

3. Temperatures:

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

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Felta 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. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. Unit measurements included mean length, mean width, mean depth, and maximum depth. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken 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 Felta 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).

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 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 Felta 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 habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes. Mechanical substrate sampling was also conducted to quantify the percentage of fine sediment within spawning gravels.

8. Canopy:

Stream canopy is estimated using handheld spherical densiometers and is a measure of the water surface shaded during periods of high sun. In Felta Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results recorded.

9. Bank Composition:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Felta Creek, the dominant composition type in both the right and left banks was selected from a list of eight options on the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

SUBSTRATE SAMPLING

Gravel sampling is conducted to determine the percentage of fine sediment present in probable fish spawning areas. These areas are generally found in low gradient riffles at the tail-outs of pools. Three substrate samples were taken in potential spawning riffles in Felta Creek on December 4, 1995. One sample was taken for each of the first three reaches. Each sample consisted of one 12" McNeil sample to characterize each reach.

The samples were placed through a series of sieves with diameters of .85mm, 2.37mm, 4.7mm, 12.5mm, 25.4mm, 50.8mm, 76.2mm and 150mm. Displacement volumes were measured for particles in each size classification. Finally, the remaining sample <0.85mm was placed in Imhoff cones for 1 hour with the volume of fines settled out and measured.

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 the Habitat Program, a dBASE 4.1 data entry program developed by the California Department of Fish and Game (DFG). This program also processes and summarizes the data.

The Habitat Runtime program produces the following tables:

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

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

- Riffle, flatwater, pool habitats by percent occurrence
- Total habitat types by percent occurrence
- Pool types by percent occurrence

HABITAT INVENTORY RESULTS

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

The habitat inventory of June 6 through July 19, 1995 was conducted by Ken Mogan and John Fort (Americorps). The survey began at the confluence with Mill Creek and extended up Felta Creek to the end of survey. The total length of the stream surveyed was 22,866 feet, with an additional 36 feet of side channel.

A flow of 1.8 cfs was measured on July 28, 1995 at Felta Creek Road with a Marsh-McBirney Model 2000 flowmeter.

This section of Felta Creek has four channel types, with one type occurring in two separate reaches: from the mouth to 1,863 feet (to Pearl's flash board dam) an F4; the next 2,246 feet (to the end of the boulder section) a G2; the next 10,056 feet (to the confluence of Salt Creek) an F4; the next 5,897 feet a B4 and the upper 2,841 feet an A2 (Felta Creek Watershed map and Appendix B).

F4 streams have confined, meandering riffle/pool gravel channels on low gradients (less than 2%).

G2 channels are entrenched "gully" step-pools on a moderate (2-4%) gradient, with boulders as the dominant substrate.

B4 channels are moderately entrenched, moderate gradient, riffle

dominated channels with infrequently spaced pools. They are predominantly gravel channels with stable banks.

A2 streams are steep, narrow, cascading, step-pool streams with boulder substrate and high energy/debris transport associated with depositional soils.

Water temperatures ranged from 60°F to 70°F. Air temperatures ranged from 56°F to 86°F. A Ryan tempmentor was placed in a pool and recorded temperatures from June 30 - October 17, 1995 (see Tempmentor Summary graph at end of report). The highest temperature recorded was 69°F and the lowest was 54°F. The mean of the daily highs for the month of July was 65°F, August, 64°F, September, 62°F and October, 58°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 41%, flatwater 32%, and riffles 25% (Graph 1). Flatwater habitat types made up 35% of the total survey **length**, pools 34%, and riffles 25% .

Twenty-two Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent **occurrence** were low gradient riffles 24%, glides 17%, runs 14% and root wad scours 13% (Graph 2). By percent total **length**, low gradient riffles made up 23%, glides 16%, runs 17%, and root wad scours 11%.

Two hundred eighty-six pools were identified (Table 3). Scour pools were most often encountered at 72%, and comprised 70% of the total length of pools (Graph 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. The pools are relatively shallow with only 87 of the 286 pools (30%) having a maximum depth greater than 2 feet (Graph 4).

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. Flatwater types had the lowest shelter rating at 18 (Table 1). Pool types had the highest shelter rating at 43. Of the pool types, the main channel pools had the highest mean shelter rating at 45. Scour pools rated 43 and backwater pools rated 40 (Table 3). Pool shelter ratings were highest in reach 2 and lowest in reach 1. (Appendix B).

Table 5 summarizes mean percent cover by habitat type. Table 10 summarizes cover areas by habitat type. Undercut banks are the

dominant cover type for pools in Felta Creek. Root masses and large woody debris are the next most common pool cover types (Graphs 5 and 10).

Nearly 17% of Felta Creek lacked shade canopy. Of the 83% of the stream that was covered with canopy, 27% was composed of deciduous trees, and 73% was composed of coniferous trees (Graph 8). Shade canopy was also analyzed by reach (Appendix B and Graph 11)

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 72% and percent left bank vegetated was 73%. The dominant vegetation types for the stream banks were: 60% coniferous trees, 17% deciduous trees, 16% brush, 6% grass and 2% bare soil. The dominant substrate for the stream banks were: 80% silt/clay/sand, 9% cobble/gravel, 8% bedrock and 3% boulders (Appendix C and Graph 9).

SUBSTRATE SAMPLING

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 163 of the 165 (99%) low gradient riffles (Graph 7).

The depth of cobble embeddedness was estimated at pool tail-outs in Felta Creek. Of the 287 pool tail-outs measured, 78 had a value of one (27%); 107 had a value of two (37%); 56 had a value of three (20%); and 46 had a value of four (16%). On this scale, a value of one is best for fisheries. On a reach by reach comparison, reach 1 had the poorest embeddedness values with 64% of the pools having a value of either 3 or 4. Reach 3 had the best values with 74% having either a 1 or 2. Reach 2 had 34%, reach 4 42% and reach 5 53% with a value of 3 or 4 (Appendix B and Graph 5).

Gravel samples were taken in the field by Mogan, Fort, Huber and Gregory (Americorps). Laboratory analysis was done by Fort, Huber, Nossaman, Sanchez (Americorps), Wilson and Hards (Interns) in May of 1996. The data was then summarized and analyzed with a computer program written by Dwain Goforth (National Park Service).

The analysis showed sample 1 (Reach 1) to be 23.8% fines (<0.85 mm). Sample 2 (Reach 2) was 8.2% fines and sample 3 (Reach 3) was 10.1% fines. The combined summary of all three samples averaged 12.8% fines. The combined summary showed 75% of the substrate to be less than 23mm, 50% to be less than 9mm and 25% to be less than 3mm (see Grain Size Distribution Plot). Reach 1 had a significantly higher percentage of fines than reaches 2 or 3.

HABITAT INVENTORY RESULTS FOR SALT CREEK

The habitat inventory of July 12-13, 1995 was conducted by John Fort and Ken Mogan (Americorps). The survey began at the confluence with Felta Creek and extended up Salt Creek to the end of survey. The total length of the stream surveyed was 2,681 feet.

Salt Creek was determined to be a G4 channel type: This type is described as an entrenched "gully" step-pool with a low width/depth ratio, moderate gradient (2-4%) and a gravel substrate.

Water temperatures ranged from 60°F to 62°F. Air temperatures ranged from 63°F to 68°F.

*By percent **occurrence**, riffles made up 42%, pool types 35%, and flatwater 20%. Eleven Level IV habitat types were identified. The most frequent habitat types by percent **occurrence** were low gradient riffles, 40%; glides, 16%; bedrock scours, 16%. Thirty-six pools were identified, with Scour pools most often encountered at 83%. Table 4 is a summary of maximum pool depths by pool habitat types. Three of the 36 pools (8%) had a maximum depth greater than 2 feet.*

Flatwater types had the highest shelter rating at 65. Riffles had the lowest rating with 8. Of the pool types, the main channel pools had the highest shelter rating at 90, scour pools rated 51.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 36 pool tail-outs measured, 5 percent had a value of 1, 54 percent had value of 2, 35 percent had a value of 3 and 5 percent had a value of 4.

Large woody debris and root masses are the two most common cover types for Salt Creek. Small woody debris and terrestrial vegetation are the next most common types. Gravel was the dominant substrate observed in ninety-five percent of the low gradient riffles measured.

Nearly 17% of Salt Creek lacked shade canopy. Of the 83% of the stream that was covered with canopy, 35% was composed of deciduous trees, and 65% was composed of coniferous trees.

For the stream reach surveyed, the mean percent right bank vegetated was 64% and the mean percent left bank vegetated was 68%. The dominant vegetation types for the stream banks were: 42%

brush, 25% coniferous tree, 24% grass. The dominant substrate for the stream banks were: 55% silt/clay/sand, 45% bedrock.

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

A biological inventory was taken on July 18, 20, and 26 of 1995 to document the fish species composition and distribution at several locations in Felta Creek. 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 range in air temperature was 64-81°F and the water temperatures ranged from 62-64°F. The observers were Ken Mogan, John Fort, Joyce Ambrosius, Bob Coey, and Bill Cox.

The inventory of reach one was conducted 200 feet upstream from the Felta School in habitat units 20-50. This reach was dry from the mouth to unit 20 and intermittent from there to the first flashboard dam. In pool, riffle, and run habitat types, 5 coho, 236 0+ steelhead, three 2+ steelhead, 2 sculpin, and 3 crayfish were observed.

The inventory of reach two was conducted from the beginning of the reach in habitat units 50-60. This reach was not intermittent. In pool and riffle habitat types 31 0+ and two 2+ steelhead were observed along with 29 sculpin.

An inventory of reach three was conducted 100' downstream from the Folger's bridge starting at habitat units 120. In pool, riffle, glide and run habitat types 89 0+, ten 1+ and three 2+ steelhead were observed. The inventory was continued 150 yds. downstream from Boring's bridge starting at habitat unit 200. In pool, riffle, run and glide habitat types 130 0+, two 1+ and one 2+ steelhead were observed along with 1 Yellow-legged Frog and 1 salamander. The inventory continued 20 yds from Boring's bridge starting at habitat unit 218. In pool, run, glide and riffle habitat types 129 0+, 5 1+ and 3 2+ steelhead were observed along with 5 newts and 1 salamander.

The inventory of reach four was conducted 1/8 mile downstream from the confluence with Salt Creek in habitat units 375-399. In pool, run and riffle habitat types 207 0+, four 1+ and one 2+ steelhead were observed along with 6 Yellow-legged Frog, some salamanders and newts.

The inventory of reach five was conducted 100' downstream from the

confluence with Salt Creek in habitat units 437-474. In pool, riffle and run habitat types 75 0+, ten 1+ and two 2+ steelhead were observed along with 2 frogs, 26 salamanders and 2 newts. Resident 1+ fish (7-8") were seen visually from above in 3' deep pools.

The inventory of Salt Creek was conducted on July 18, 1995. The air temperature was 68°F and the water temperature was 61°F. The inventory started at the confluence to Felta Creek in habitat units 1-51. In pool, run and riffle habitat types 87 0+ and 3 1+ steelhead were observed along with 6 Pacific Giant Salamanders and 2 frogs.

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

Summary of Salmonids found in Juvenile Surveys

YEAR	SPECIES	SOURCE
1968	SH	DFG
1995	SH,SS	DFG

SH= Steelhead SS= Coho (Silver) Salmon

No known hatchery releases or fish rescues have occurred in this watershed.

ADULT SURVEYS:

A spawning/carcass survey was conducted on December 22, 1995 on Felta Creek, beginning at the mouth and extending upstream to Folger's Dam. Near habitat unit 30, 2 possible redds were observed in gravel of fair quality. A live female chinook salmon on a redd was also seen at habitat unit 42 in good gravel. A possible redd was observed downstream of Folger's dam, with good gravel quality.

Another spawning/carcass survey was conducted on Felta Creek on February 7, 1996, beginning at the Felta School bridge and extending upstream to habitat unit 90. No live salmonids, redds or carcasses were observed on this survey.

Another spawning/carcass survey was conducted on February 9, 1996, beginning at the first Felta Creek bridge and extended upstream 1/4 mile past habitat unit 280. Several fish (6-12") were seen attempting to jump the falls above the summer dam at habitat unit 90. It appeared that they were unable to navigate past the falls

due to high flows. Two adult steelhead of undetermined sex were observed at habitat unit 110. One adult steelhead of undetermined sex was observed at habitat unit 280.

DISCUSSION

Felta Creek has four channel types: F4, G2, B4 and A2. F4 channel types are generally suitable for certain instream enhancement structures such as; bank placed boulders; low stage weirs; opposing wing-deflector; channel constrictors and cover logs.

The G2 channel type is generally unsuitable for instream enhancement structures, but log cover may be appropriate with careful design and placement.

The B4 channel type is excellent for many types of low and medium stage instream enhancement structures. There are 5,897 feet of this type of channel in Felta Creek, along with a plenitude of LOD either in or nearby the stream. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and cover. Specifically, low-stage plunge weirs; boulder clusters and bank placed boulders; single and opposing wing-deflectors; and log cover.

The high energy and steep gradient of the A2 channel type makes it generally unsuitable for instream enhancement structures.

The water temperatures recorded between June 6, 1995 and July 19, 1995 ranged from 60° F to 70° F. Air temperatures ranged from 56° F to 86° F. The warmer water temperatures were recorded in all reaches except reach 1. These warm water temperatures, if sustained, are above the threshold stress level for salmonids. A Ryan tempmentor was placed in a pool in reach two and recorded temperatures from June 30 - October 17, 1995 (Figure 2). The highest temperature recorded was 69°F in July and the lowest was 54°F in October. The mean of the daily highs for the month of July was 65°F, August, 64°F, September, 62°F and October, 58°F. The July and August high temperatures for this pool were at the threshold stress level for Salmonids. Restoration measures should be taken in the upper watershed to decrease temperatures.

Flatwater habitat types comprised 35% of the total **length** of this survey, pools comprised 34%, and riffles 25%. The pools are relatively shallow with only 98 of the 286 pools having a maximum depth greater than 2 feet (34%). In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise

approximately 50% of total habitat. In 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. Therefore, installing structures that will increase pool habitat is recommended for Reaches 1, 3 and 4 where their installation will not jeopardize unstable stream banks, or subject the structures to high stream energy.

The mean shelter rating for flatwater was the lowest with a rating of 18. The mean shelter rating in the riffle habitats was 26 and the shelter rating for pools rated highest at 46. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool cover that now exists is being provided primarily by undercut banks. Additionally, root masses and large woody debris contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Ninety-nine percent of the low gradient riffles had either gravel or small cobble as the dominant substrate. This is considered very good for spawning salmonids. However, 36% of the 286 pool tail-outs measured had embeddedness ratings of either three or four. Reaches 2 and 3 had the lowest embeddedness ratings with reach 1 being the highest. Cobble embeddedness measured to be 25% or less, a rating of one, is considered best for the needs of salmon and steelhead. The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence.

The Gravel program analyzed the substrate sample data for egg to emergence survival rates for steelhead and coho. The survival rates are based on a 95% confidence interval and used the FredleIndex. Based on this index and the data on Felta Creek, the mean egg to emergence survival rate would be 54% for steelhead and 34% for coho. In Felta Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the survey reach was 83%. This is an adequate percentage of canopy, since 80 percent is generally considered desirable.

Biological surveys were conducted to document fish distribution and are not necessarily representative of population information. The inventory on July 18-26, 1995 found young of the year (0+) steelhead to be especially common, indicating successful spawning conditions. Fewer coho were found and only in reach 1 in this inventory. This is likely because physiological and environmental requirements for coho are more stringent than for steelhead, and coho may be unable to negotiate the boulder section of reach two. Within this reach, a small coffer dam exists which may inhibit adult migration during low flows. Overall, very few fish more than one year old were observed, indicating poor rearing conditions the year before or poor holding-over conditions in general.

DISCUSSION FOR SALT CREEK

Salt Creek is a G4 channel type, which is considered good for bank-placed boulders and fair for low-stage weirs, opposing wing-deflectors and log cover.

The water temperatures recorded on the survey days July 12-17, 1995 ranged from 60° F to 62° F. Air temperatures ranged from 63° F to 68° F. These warmer temperatures, if sustained, are just above the threshold stress level 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.

Riffle habitat types comprised 40% of the total ***length*** *of this survey, pools 25%, and flatwater 18%, however, the pools are relatively shallow with zero pools having a maximum depth greater than 2 feet. Therefore, installing structures that will increase pool habitat is recommended for locations where their installation will not jeopardize unstable stream banks, or subject the structures to high stream energy.*

The mean shelter rating of pools was 60, flatwater 55 and riffles had a rating of 23. The relatively small amount of cover that now exists is being provided primarily by large woody debris and root masses. Additionally, small woody debris and terr. vegetation contribute a small amount. Enhancing the log and root wad cover structures in the pool and flatwater habitats is needed to improve both summer and winter salmonid habitat.

All of the low gradient riffles measured had either gravel or small cobble as a dominant substrate. This is considered excellent for spawning salmonids. However, 40% of the pool tail-outs measured

had embeddedness ratings of either 3 or 4. 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 reach was 83%. This is a good percentage, since 80 percent is generally considered desirable.

SUMMARY

Biological surveys were conducted to document fish distribution and are not representative of population information. Steelhead were documented consistently during each past survey year, and coho and chinook only recently. Landowners have stated that steelhead are present every year and coho less frequently. Overall, habitat conditions for both steelhead and coho have declined over time. However, of the Russian River tributaries surveyed so far since 1994, Felta Creek is in the best condition for Salmonid habitat.

In general, Reaches 2-4 of Felta Creek are fair for salmon and steelhead habitat. The many scour pools may be used as rearing habitat, however, shelter is lacking and stream temperatures are moderately high. Riffle habitat exists for spawning, but some reaches have high gravel embeddedness. The intermittent flow of reach 1 and boulder section of reach 2 limits instream habitat improvement alternatives, although some opportunity exists. Any work considered in reaches 1 and 2 will require careful design, placement, and construction that must include protection for the adjacent road and high stream velocities. Log cover structures could be used to increase instream shelter.

Upstream of the Boring's bridge conditions are better. In reaches 3 and 4, spawning and rearing habitat exists and canopy shading is high overall, although some areas have no canopy at all. However, instream shelter is still low, stream temperatures are higher and stream bank erosion is prevalent due to past logging roads. Opportunities for improvement with Reach 3 are minimal due to unstable banks. Reach 4 is excellent for many types of low and medium stage instream enhancement structures and many opportunities and alternatives exist for habitat improvement due to the more stable channel type. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter.

The best spawning habitat in the watershed exists within reaches 3 and 4, and within Salt Creek. Down-stream in Reach 1 and 2 spawning and rearing habitat quality diminishes due to the effects of eroding stream banks and high energy of the boulder section

respectively. Sediment transported downstream from stored sediments in reach 4 during high winter flows impact the spawning habitat in lower gradient reaches below. Erosion control riparian planting is recommended.

GENERAL RECOMMENDATIONS

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

Recent winter storms brought down many large trees and other woody debris into the stream, which increased the number and quality of pools since the drought years. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. 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) In reach 3, active and potential sediment sources related to the past skid road system need to be mapped, and treated according to their potential for sediment yield to the stream and its tributaries. Alternatives to control erosion and increase canopy, in reach 3 should be explored with the landowner, and developed if possible.

2) Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff. Upslope intermittent tributaries should be assessed for planting and erosion control treatment, since water temperatures and spawning habitat throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or biotechnical erosion control projects.
3) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable (reach 4) or in conjunction with stream bank armor to prevent erosion.

4) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing cover is from undercut banks. Adding high quality complexity

with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations. This must be done where the banks are stable (reach 4) or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

RESTORATION IMPLEMENTED

1) The winter 1995 and 1996 storms brought down many large trees and other woody debris into the stream. This woody debris, if left undisturbed, will provide fish cover and rearing habitat, and offset channel incision in reaches 1 and 3. Many signs of historic tree and log removal were evident in the active channel during our survey. Past efforts to increase flood protection or improve fish access in the short run, have led to long term problems in the system. Landowners should be educated about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

2) Access for migrating salmonids has been voiced by landowners as an ongoing potential problem in Reach 2, therefore, fish passage should be monitored, and improved where possible. The jump pool above the first summer dam should possibly be modified.

3) Spawning gravels on Felta Creek are limited to relatively few reaches (only reaches 3 and 4 are suitable for spawning). Structures to recruit spawning gravel should be installed to trap, sort and expand redd distribution in the stream (particularly in reach 3 below Folger's bridge and in reach 4 above the Salt Creek confluence).

4) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable (reaches 1 and 3) or in conjunction with stream bank armor to prevent erosion.

5) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing cover is from undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations. This must be done where the banks are stable (reaches 1 and 3) or in conjunction with stream bank armor to prevent erosion. In some

areas the material is at hand.

6) In reach 4, active and potential sediment sources related to the past skid road system need to be mapped, and treated according to their potential for sediment yield to the stream and its tributaries. Alternatives to control erosion and increase canopy, in reach 3 should be explored with the landowner, and developed if possible.

7) Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff (conifer planting in reaches 2 and 3).

PROBLEM SITES AND LANDMARKS - FELTA CREEK SURVEY COMMENTS

STREAM LENGTH (FT)	COMMENTS	HABITAT UNIT #
319	BLOW OUT ON RT. BANK	
460	FELTA RD. BRIDGE 43'L X 22'W X 11'H	
623	FIRST BUG SAMPLE TAKEN HERE, 6/9/95	UNIT 18
726	2ND BUG SAMPLE TAKEN HERE, 6/9/95	UNIT 21
762	POSSIBLE CHANNEL CHANGE	UNIT 24
831	3RD BUG SAMPLE TAKEN HERE, 6/9/95	
856	POSSIBLE ELECTROFISHING SPOT	
1022	RT. BANK DUMP SITE	
1197	POSSIBLE ELECTROFISHING SPOT	
1867	CHANNEL TYPE CHANGE	UNIT 45
2061	POSSIBLE ELECTROFISHING SPOT	
2189	BRIDGE #2 19'W X 17'L X 8'H	
2579	POSSIBLE ELECTROFISHING SPOT	
3117	9.4'H X 9.5'W X 40'L CONCRETE DAM	
3142	BRIDGE #3 16'W X 11'H X 17'L	UNIT 65
3470	HUMAN-MADE ROCK DAM 25'L X 5'H X 2'W	
3502	DRY TRIBUTARY. RT. BANK	
3774	POSSIBLE ELECTROFISHING SPOT; FLOATING FENCE PARTIALLY OVER CREEK	
3802	3' CASCADE DROP	
4090	LOG JAM HOLDING GRAVEL (4'H X 15'L)	UNIT 106
4141	ROAD CROSSING THROUGH CREEK	
4601	POSSIBLE ELECTROFISHING SPOT	
4927	CHANNEL TYPING DONE	
5003	POSSIBLE ELECTROFISHING SPOT	
5147	BRIDGE #4 28'W X 8'H X 12'L	UNIT 129
5478	LARGE LOG JAM 10'H X 25'W X 32'L	
5681	FLASH DAM 4'H X 12'W X 10'L	UNIT 149
5868	POSSIBLE ELECTROFISHING SPOT	

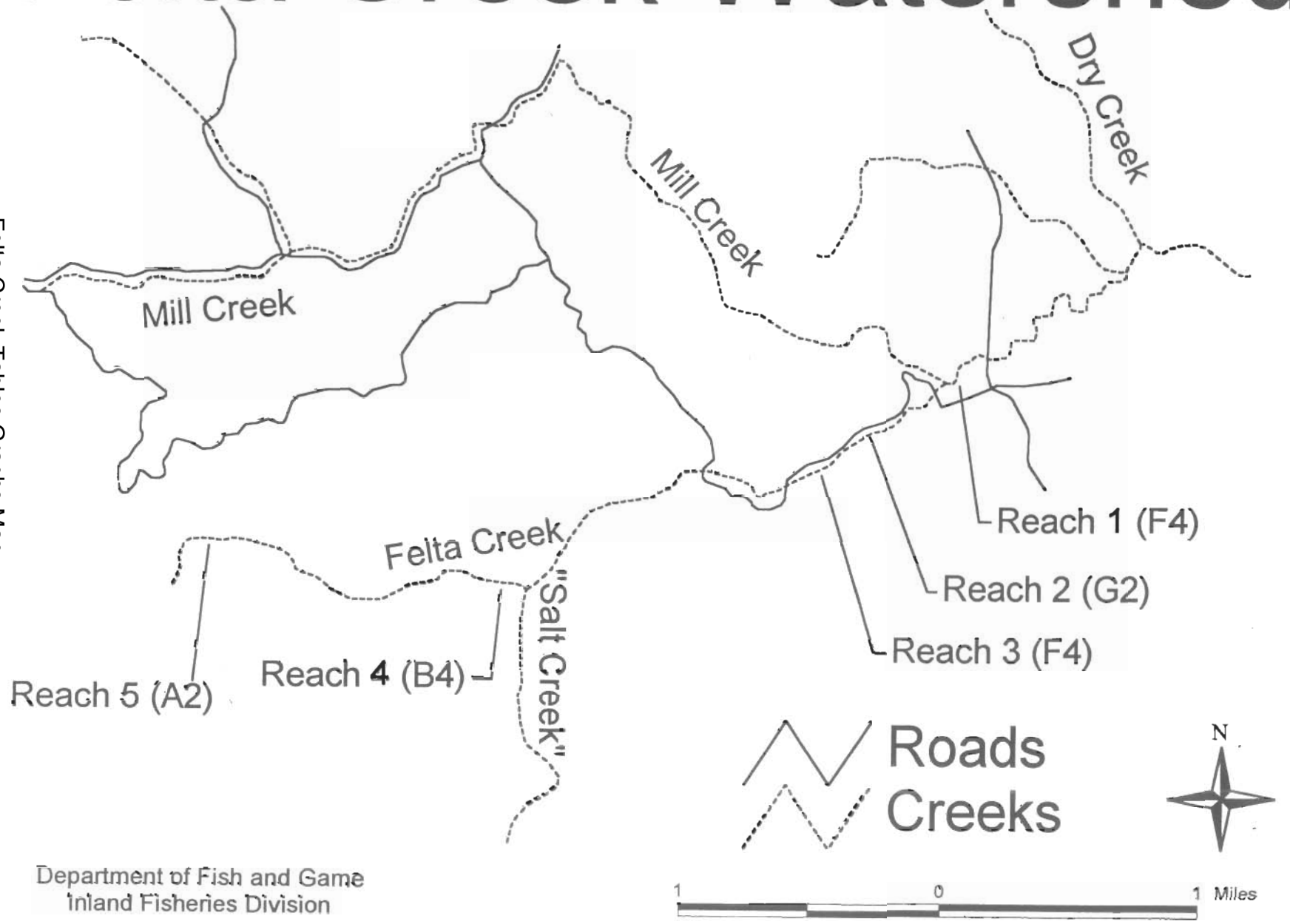
5954 RT. BANK SPRING
6139 TEMPERATURE METER PLACED HERE
6446 BLOW OUT LF. BANK
6730 SPRING ON LF. BANK, 60°F UNIT 188
7019 BRIDGE #5 9'H X 11'W X 13'L
7695 LOG JAM 5'H X 15'W X 11'L
7925 POSSIBLE ELECTROFISHING SPOT
8080 POSSIBLE ELECTROFISHING SPOT, 1+ FISH
8704 LG. GRAVEL BARS BUILT UP
9056 GRAVEL ROAD THROUGH STREAM - EROSION PROBLEM UNIT 275
9554 RT. BANK FAILURE
9622 BLOW OUT RT. BANK
9927 TRIBUTARY. ON LF. BANK 58°F UNIT 333
11486 PLUNGE POOL AT HIGHER FLOWS
11557 LG. REDWOOD LOGS, 3 AT 14'L X 32"D
11573 SPRING (TRIBUTARY?) LF. BANK, 60°F
12244 CORNER BLOWOUT RT. BANK
13131 POSSIBLE ELECTROFISHING SPOT
13206 BLOWOUT RT. BANK 12.5'H X 180'L
13419 BLOWOUT LF. BANK 18'W X 7'D X 25'H UNIT 407
13633 LOG JAM 7'H X 23'W X 10'L
14334 CONFLUENCE OF UNNAMED TRIBUTARY. (SALT CREEK)
14438 CORNER BLOWOUT 11'H X 30'L
14498 BRIDGE #6 OLD FLATCAR 7'H X 35'W X 11'L UNIT 446
14552 BLOWOUT RT. BANK 12'H X 40'L
14637 SPRING LF. BANK
14749 GULLY RT. BANK 3'D X 15'W X 20'H; SKID ROAD RT. BANK
14895 24" X 8' LOG RT. BANK
15187 1+ STEELHEAD UNIT 473
15420 RT. BANK BLOWOUT 15'H X 30'L; OLD SKID RD. ABOVE
15570 OSPREY NEST W/ YOUNG RT. BANK
16080 1+ FISH 7-8" UNIT 534
16657 TRIBUTARY. LF. BANK 59°F.
16726 1+ FISH 4-6"
16768 OLD SKID ROAD CROSSING
17429 ROAD ERODING ABOVE
17845 RT. BANK BLOWN OUT 7' X 50'
18085 OLD CROSSING BLOWN OUT
18155 LF. BANK BLOW OUT 15' X 35'
18227 18" CULVERT RT. BANK
18386 BRIDGE #7, 8'H X 35'W X 14'L
19287 TRIBUTARY. RT. BANK 60°F. UNIT 628
19370 LOG HOLDING BACK GRAVEL 5'H X 12'W.
20063 FLOW DISAPPEARS AT THIS POINT FOR 750'
20073 DRY TRIBUTARY. LF. BANK
21045 DRY TRIBUTARY. LF. BANK

22437 UNIT 689
A VISUAL SURVEY WAS DONE UP TO THE CONFLUENCE OF NORTH/SOUTH FORKS. FISH WERE SEEN 60 YDS. BELOW CONFLUENCE, PROBABLY DUE TO HIGH WATER IN RECENT PAST. BOTH FORKS 59°F.
22883 DRY TRIBUTARY. LF. BANK
22914 FISH PRESENT; EITHER STEELHEAD OR ROACH

PROBLEM SITES AND LANDMARKS - SALT CREEK SURVEY COMMENTS

STREAM LENGTH (FT)	COMMENTS	HABITAT UNIT #
89	LOG JAM (LG WOOD) 5'H X 12'W X 10'L HOLDING GRAVEL AND CAUSING SCOUR; 4" FISH	
111	3 OLD CEMENT CULVERTS IN CREEK BED, 6' DIAMETER, 9' LONG HOLDING BACK GRAVEL.	UNIT# 6
220	OLD SKID ROAD PARALLELS CREEK ON BOTH BANKS	
512	ROAD (OLD SKID) PARALLELS CREEK ON BOTH BANKS	
559	SPRING LEFT BANK 59°F	
598	3" FISH	
644	INTERMITTENT AT THIS POINT UPSTREAM; FISH STILL PRESENT	UNIT# 30
652	SKID ROADS RUN PARALLEL TO CREEK ON BOTH BANKS	
676	WATER RUNS SUBALLUVIAL	
942	DRY FOR 100' OF THE 145' LONG UNIT	
1296	DRY TRIBUTARY RIGHT BANK	
1589	OLD SKID ROAD PARALLELS BOTH BANKS	
1992	TRIBUTARY RIGHT BANK 60°F.	
2070	OLD ROAD CROSSING, LARGE WOODY DEBRIS	UNIT# 87
2406	FISH STILL FOUND	
2507	TRIBUTARY LEFT BANK 60°F.	
2689	LOG JAM HOLDING GRAVEL 5'H X 15'W X 10'L	

Felta Creek Watershed



Department of Fish and Game
Inland Fisheries Division

FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Felta Creek
SAMPLE DATES: 06/06/95 to 07/19/95
STREAM LENGTH: 22834 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: HEALD&GUER — Latitude: 38°34'52"
Legal Description: T09NR09WS32 — Longitude: 122°52'56"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 1

Channel Type: F4 — Canopy Density: 82%
Channel Length: 1863 ft. — Coniferous Component: 73%
Flowing Water Mean Width: 8 ft. — Deciduous Component: 27%
Flowing Water Mean Depth: 0.4 ft. — Pools by Stream Length: 37%
Base Flow: 0.0 cfs — Pools >=3 ft.deep: 16%
Water: 55 - 57 °F Air: 61 - 69 °F — Mean Pool Shelter Rtn: 21
Dom. Bank Veg.: Coniferous Trees — Dom. Shelter: Root masses
Vegetative Cover: 63% — Occurrence of LOD: 48%
Dom. Bank Substrate: Silt/Clay/Sand — Dry Channel: 0 ft.
Embeddness Value: 1. 32% 2. 5% 3. 53% 4. 11%

STREAM REACH 2

Channel Type: G2 — Canopy Density: 93%
Channel Length: 2246 ft. — Coniferous Component: 78%
Flowing Water Mean Width: 10 ft. — Deciduous Component: 22%
Flowing Water Mean Depth: 0.6 ft. — Pools by Stream Length: 36%
Base Flow: 0.0 cfs — Pools >=3 ft.deep: 8%
Water: 56 - 66 °F Air: 61 - 77 °F — Mean Pool Shelter Rtn: 43
Dom. Bank Veg.: Coniferous Trees — Dom. Shelter: Boulders
Vegetative Cover: 62% — Occurrence of LOD: 30%
Dom. Bank Substrate: Silt/Clay/Sand — Dry Channel: 0 ft.
Embeddness Value: 1. 42% 2. 25% 3. 13% 4. 21%

STREAM REACH 3

Channel Type: F4 — Canopy Density: 81%
Channel Length: 10020 ft. — Coniferous Component: 71%
Flowing Water Mean Width: 8 ft. — Deciduous Component: 29%
Flowing Water Mean Depth: 0.3 ft. — Pools by Stream Length: 40%
Base Flow: 0.0 cfs — Pools >=3 ft.deep: 12%
Water: 59 - 70 °F Air: 56 - 85 °F — Mean Pool Shelter Rtn: 45
Dom. Bank Veg.: Coniferous Trees — Dom. Shelter: Undercut Banks
Vegetative Cover: 76% — Occurrence of LOD: 43%
Dom. Bank Substrate: Silt/Clay/Sand — Dry Channel: 0 ft.
Embeddness Value: 1. 22% 2. 51% 3. 19% 4. 7%

STREAM REACH 4

Channel Type: B4 — Canopy Density: 82%
Channel Length: 5897 ft. — Coniferous Component: 74%
Flowing Water Mean Width: 6 ft. — Deciduous Component: 26%
Flowing Water Mean Depth: 0.4 ft. — Pools by Stream Length: 33%
Base Flow: 0.0 cfs — Pools >=3 ft.deep: 7%
Water: 60- 70 °F Air: 62 - 86 °F — Mean Pool Shelter Rtn: 55
Dom. Bank Veg.: Coniferous Trees — Dom. Shelter: Undercut Banks
Vegetative Cover: 74% — Occurrence of LOD: 46%
Dom. Bank Substrate: Silt/Clay/Sand — Dry Channel: 111 ft.
Embeddness Value: 1. 29% 2. 29% 3. 17% 4. 25%

STREAM REACH 5

Channel Type: A2	Canopy Density: 89%
Channel Length: 2810 ft.	Coniferous Component: 89%
Flowing Water Mean Width: 4 ft.	Deciduous Component: 11%
Flowing Water Mean Depth: 0.3 ft.	Pools by Stream Length: 12%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 6%
Water: 62 - 65 °F Air: 68 - 79 °F	Mean Pool Shelter Rtn: 40
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Boulders
Vegetative Cover: 65%	Occurrence of LOD: 40%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 1247 ft.
Embeddness Value: 1. 19% 2. 25% 3. 19% 4. 38%	

Summary of Mean Percent Vegetative Cover for Entire Stream

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Decidous	Mean Right bank % Cover	Mean Left Bank % Cover
83.19	73.43	26.57	72.29	73.45

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Bedrock	45	67	8
Boulder	22	22	3.14
Cobble/Gravel	68	59	9.07
Silt/clay	565	552	79.79

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Grass	44	35	5.64
Brush	92	127	15.64
Decid. Trees	122	112	16.71
Conif. Trees	427	413	60
No Vegetation	15	13	2

Felta Creek

Drainage: Mill Creek

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

Survey Dates: 06/06/95 to 07/19/95

Confluence Location: QUAD: HEALD&GUER LEGAL DESCRIPTION: T09NR09WS32 LATITUDE: 38°34'52" LONGITUDE: 122°52'56"

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
178	176	RIFFLE	25	32	5645	25	7.9	0.3	206	36616	75	13406	18	26
225	224	FLATWATER	32	36	8058	35	7.2	0.4	235	52828	108	24188	148	18
286	285	POOL	41	27	7810	34	9.4	1.1	270	77243	357	102159	301	46
11	0	DRY	2	123	1358	6	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.)
700	685	22870	166688	139753

Felta Creek — Drainage: Mill Creek

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 06/06/95 to 07/19/95

Confluence Location: QUAD: HEALD&GUER LEGAL DESCRIPTION: T09NR09WS32 LATITUDE: 38°34'52" LONGITUDE: 122°52'56"

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 %
166	164	LGR	24	31	5208	23	8	0.3	2.5	203	33643	69	11445	18	15	82
10	10	HGR	1	39	387	2	10	0.6	1.3	279	2791	184	1842	0	54	93
2	2	CAS	0	25	49	0	15	0.6	1.2	90	180	56	113	0	170	93
3	3	POW	0	60	179	1	13	0.7	1.6	555	1664	383	1149	0	47	93
116	116	GLD	17	31	3615	16	8	0.4	1.6	245	28466	109	12693	0	12	85
98	97	RUN	14	39	3818	17	6	0.4	1.5	207	20288	89	8752	0	22	81
8	8	SRN	1	56	447	2	8	0.6	1.5	298	2383	197	1576	148	43	94
49	49	MCP	7	22	1087	5	10	1.0	3.8	226	11091	228	11164	188	43	80
2	2	CCP	0	23	46	0	9	1.0	2.4	205	409	202	404	161	30	85
10	10	STP	1	53	533	2	9	0.8	4.1	258	2582	212	2119	113	70	96
6	6	CRP	1	31	184	1	8	1.0	3.4	249	1493	269	1613	223	23	68
27	27	LSL	4	22	607	3	8	1.2	9.0	191	5145	220	5932	178	62	81
92	92	LSR	13	28	2566	11	9	1.0	4.2	254	23385	281	25863	232	52	86
56	56	LSBk	8	28	1566	7	11	1.2	16.0	295	16539	378	21187	324	24	80
15	15	LSBo	2	24	360	2	8	0.9	2.2	195	2931	199	2992	152	23	88
11	11	PLP	2	15	166	1	14	1.4	5.3	233	2563	432	4750	354	60	91
9	9	SCP	1	18	165	1	4	0.8	2.5	69	622	65	589	53	64	83
2	2	BPB	0	13	25	0	5	0.7	1.1	70	139	43	86	21	0	93
2	2	BPR	0	17	33	0	6	0.9	2.5	98	197	99	198	86	0	83
3	2	BPL	0	15	46	0	5	0.7	2.8	78	234	59	177	43	15	68
2	2	DPL	0	213	425	2	23	2.5	4.8	4854	9707	12356	24711	11216	45	65
11	0	DRY	2	123	1358	6	0	0.0	0.0	0	0	0	0	0	0	91

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
700	685	22870	166449	139354

Felta Creek

Drainage: Mill Creek

Table 3 · SUMMARY OF POOL TYPES

Survey Dates: 06/06/95 to 07/19/95

Confluence Location: QUAD: HEALD&GUER LEGAL DESCRIPTION: T09NR09WS32 LATITUDE: 38°34'52" LONGITUDE: 122°52'56"

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
61	61	MAIN	21	27	1666	21	9.8	0.9	231	14082	224	13686	175	49
207	207	SCOUR	72	26	5450	70	9.6	1.1	251	52052	301	62358	250	45
18	17	BACKWATER	6	39	694	9	6.4	1.0	637	11457	1512	27214	1365	41

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
286	285	7810	77591	103258

Felta Creek

Drainage: Mill Creek

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

Survey Dates: 06/06/95 to 07/19/95

Confluence Location: QUAD: HEALD&GUER LEGAL DESCRIPTION: T09NR09WS32 LATITUDE: 38°34'52" LONGITUDE: 122°52'56"

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
49	MCP	17	5	10	31	63	9	18	4	8	0	0
2	CCP	1	1	50	0	0	1	50	0	0	0	0
10	STP	3	0	0	6	60	3	30	0	0	1	10
6	CRP	2	0	0	4	67	1	17	1	17	0	0
27	LSL	9	5	19	14	52	6	22	1	4	1	4
92	LSR	32	5	5	54	59	23	25	8	9	2	2
56	LSBk	20	5	9	30	54	15	27	5	9	1	2
15	LSBo	5	0	0	12	80	3	20	0	0	0	0
11	PLP	4	1	9	3	27	4	36	1	9	2	18
9	SCP	3	2	22	5	56	2	22	0	0	0	0
2	BPB	1	0	0	2	100	0	0	0	0	0	0
2	BPR	1	0	0	1	50	1	50	0	0	0	0
3	BPL	1	1	33	1	33	1	33	0	0	0	0
2	DPL	1	0	0	0	0	0	0	0	0	2	100

TOTAL UNITS 286

Felta Creek — Drainage: Mill Creek

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE — Survey Dates: 06/06/95 to 07/19/95

Confluence Location: QUAD: HEALD&GUER LEGAL DESCRIPTION: T09NR09WS32 LATITUDE: 38°34'52" LONGITUDE: 122°52'56"

UNITS MEASURED	UNITS FULLY MEASURED	HABITAT TYPE	MEAN % UNDERCUT BANKS	MEAN % SWD	MEAN % LWD	MEAN % ROOT MASS	MEAN % TERR. VEGETATION	MEAN % AQUATIC VEGETATION	MEAN % WHITE WATER	MEAN % BOULDERS	MEAN % BEDROCK LEDGES
166	164	LGR	39	4	6	8	6	2	1	30	5
10	10	HGR	0	0	1	0	0	0	33	66	0
2	2	CAS	0	5	5	0	0	0	49	42	0
3	3	POW	7	0	0	0	0	0	0	93	0
116	116	GLD	60	4	7	8	11	1	0	7	0
98	97	RUN	37	10	13	14	10	5	1	10	0
8	8	SRN	1	7	0	1	0	0	31	50	11
49	49	MCP	30	10	11	6	6	8	5	13	11
2	2	CCP	10	20	40	20	0	0	0	10	0
10	10	STP	2	4	7	5	0	1	26	55	1
6	6	CRP	69	8	0	5	6	12	0	0	0
27	27	LSL	18	22	44	10	2	0	0	4	0
92	92	LSR	34	11	14	31	6	3	0	0	0
56	56	LSBk	39	7	9	6	6	8	2	11	12
15	15	LSBo	25	10	0	3	0	0	0	55	8
11	11	PLP	32	5	31	7	0	0	7	16	3
9	9	SCP	38	13	8	14	12	6	0	3	6
2	2	SPB	0	0	0	0	0	0	0	0	0
2	2	SPR	0	0	0	0	0	0	0	0	0
3	2	SPL	65	0	35	0	0	0	0	0	0
2	2	DPL	8	5	0	43	45	0	0	0	0
11	2	DRY	0	0	0	0	0	0	0	0	0

Felta Creek | Drainage: Mill Creek

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE | Survey Dates: 06/06/95 to 07/19/95

Confluence Location: QUAD: HEALD&GUER LEGAL DESCRIPTION: T09NR09WS32 LATITUDE: 38°34'52" LONGITUDE: 122°52'56"

TOTAL HABITAT UNITS	UNITS FULLY 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
166	164	LGR	0	1	93	3	1	1	2
10	10	HGR	0	0	20	0	10	50	20
2	2	CAS	0	0	0	0	0	0	100
3	3	POW	0	33	67	0	0	0	0
116	116	GLD	0	20	73	3	1	0	3
97	97	RUN	0	12	82	1	1	0	4
8	8	SRN	0	0	50	13	0	25	13
49	49	MCP	2	49	35	0	0	2	12
2	2	CCP	0	50	50	0	0	0	0
10	10	STP	0	20	20	0	10	50	0
6	6	CRP	0	67	33	0	0	0	0
27	27	LSL	0	52	48	0	0	0	0
92	92	LSR	0	53	42	3	0	0	1
56	56	LSBk	0	57	30	2	2	4	7
15	15	LSBo	0	33	53	7	0	0	7
11	11	PLP	0	91	9	0	0	0	0
9	9	SCP	0	44	22	0	0	0	33
2	2	BPB	0	50	0	0	0	0	50
2	2	BPR	0	0	50	0	0	0	50
3	2	BPL	0	67	0	0	0	0	33
2	2	DPL	0	0	100	0	0	0	0
11	2	DRY	0	0	100	0	0	0	0

Felta Creek

Drainage: Mill Creek

Table 10 - Summary of Shelter Type Areas by Habitat Type

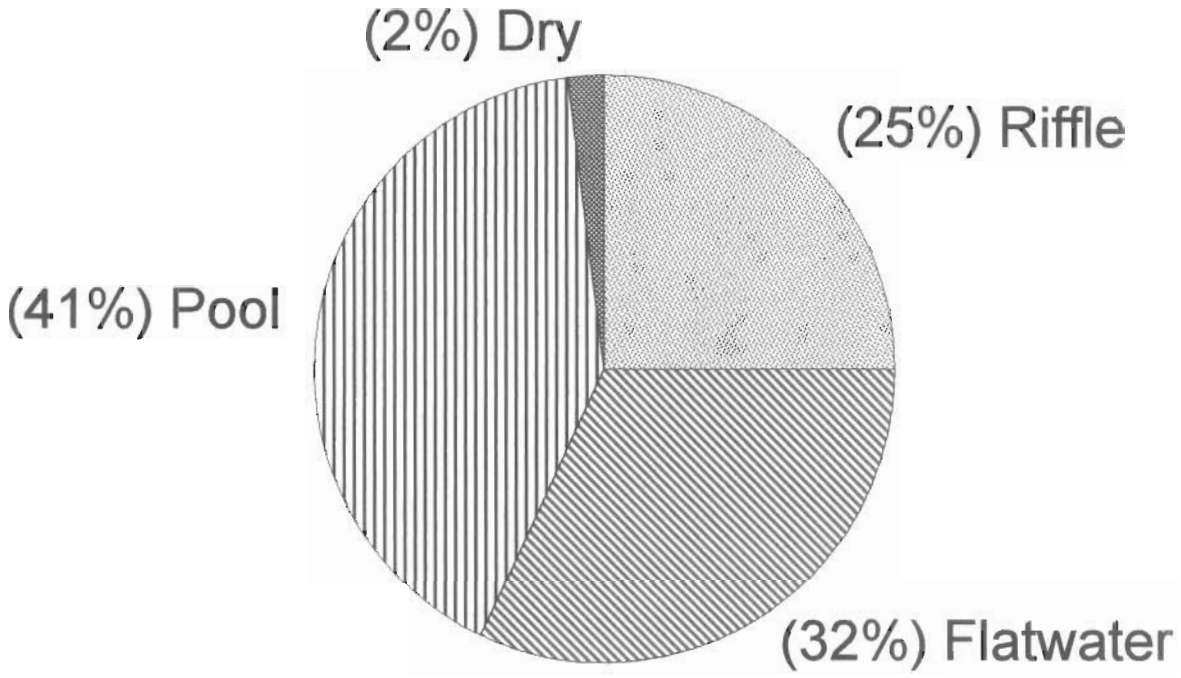
Survey Dates: 06/06/95 to 07/19/95

Confluence Location: QUAD: HEALD&GUER LEGAL DESCRIPTION: T09NR09WS32 LATITUDE: 38°34'52" LONGITUDE: 122°52'56"

UNITS MEASURED	UNITS FULLY 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
166	164	LGR	296	68	114	59	73	21	35	898	76
10	10	HGR	0	0	10	0	0	0	347	799	0
2	2	CAS	0	27	27	0	0	0	222	219	0
3	3	POW	19	0	0	0	0	0	0	526	0
116	116	GLD	812	118	89	150	345	7	0	117	2
98	97	RUN	610	150	177	201	89	18	17	165	0
8	8	SRN	15	31	0	15	0	0	197	514	122
49	49	MCP	385	173	202	99	128	116	58	84	127
2	2	CCP	4	8	16	8	0	0	0	4	0
10	10	STP	76	29	47	97	0	8	494	1139	3
6	6	CRP	124	18	0	11	12	27	0	0	0
27	27	LSL	195	320	659	169	48	0	0	16	0
92	92	LSR	1742	661	1118	1760	213	126	13	0	19
56	56	LSBk	1159	138	105	119	82	135	14	80	142
15	15	LSBo	44	40	0	15	0	0	0	212	103
11	11	PLP	120	33	141	21	0	0	27	27	12
9	9	SCP	71	37	38	15	30	13	0	0	4
2	2	BPB	0	0	0	0	0	0	0	0	0
2	2	BPR	0	0	0	0	0	0	0	0	0
3	2	BPL	13	0	7	0	0	0	0	0	0
2	2	DPL	42	165	0	238	1481	0	0	0	0
11	0	DRY	0	0	0	0	0	0	0	0	0
TOTAL 700	685		5727	2016	2750	2977	2501	471	1424	4800	610

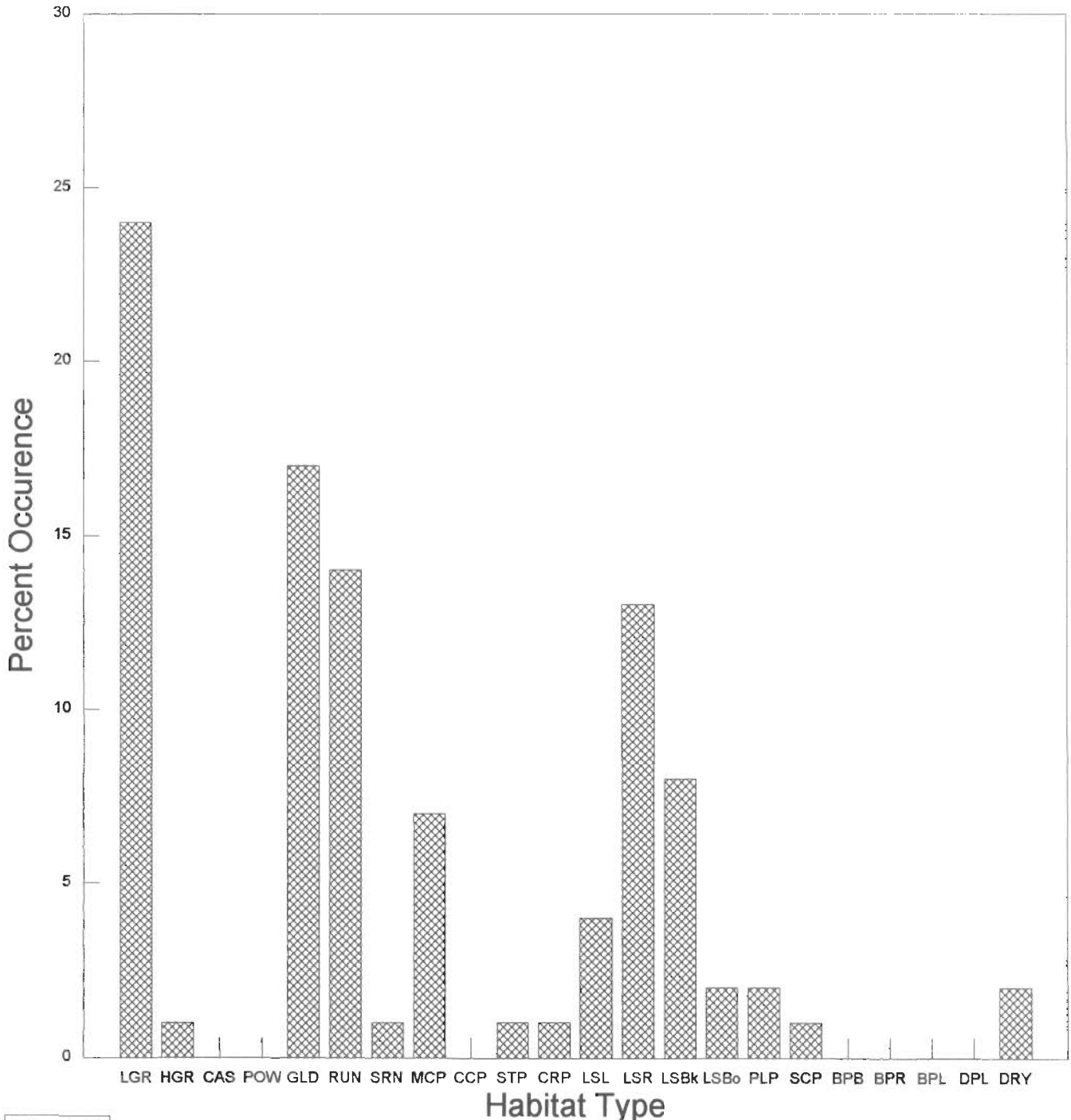
Felta Creek

Level II Habitat Types by % Occurrence



Graph 1

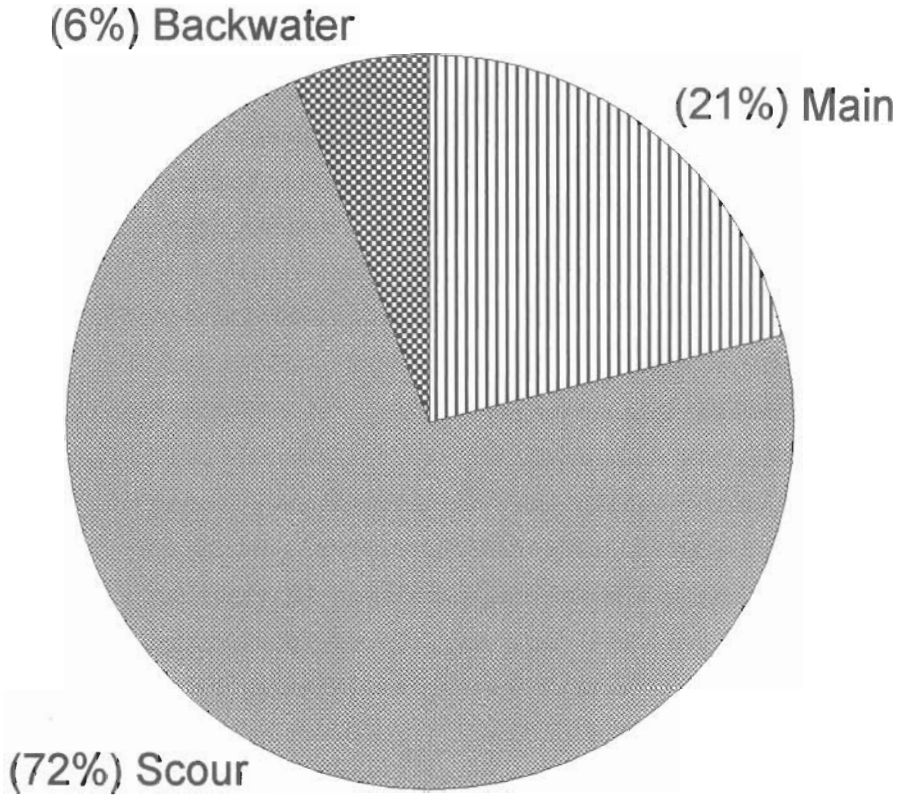
Felta Creek
Level IV Habitat Types by Percent Occurrence



Graph 2

Felta Creek

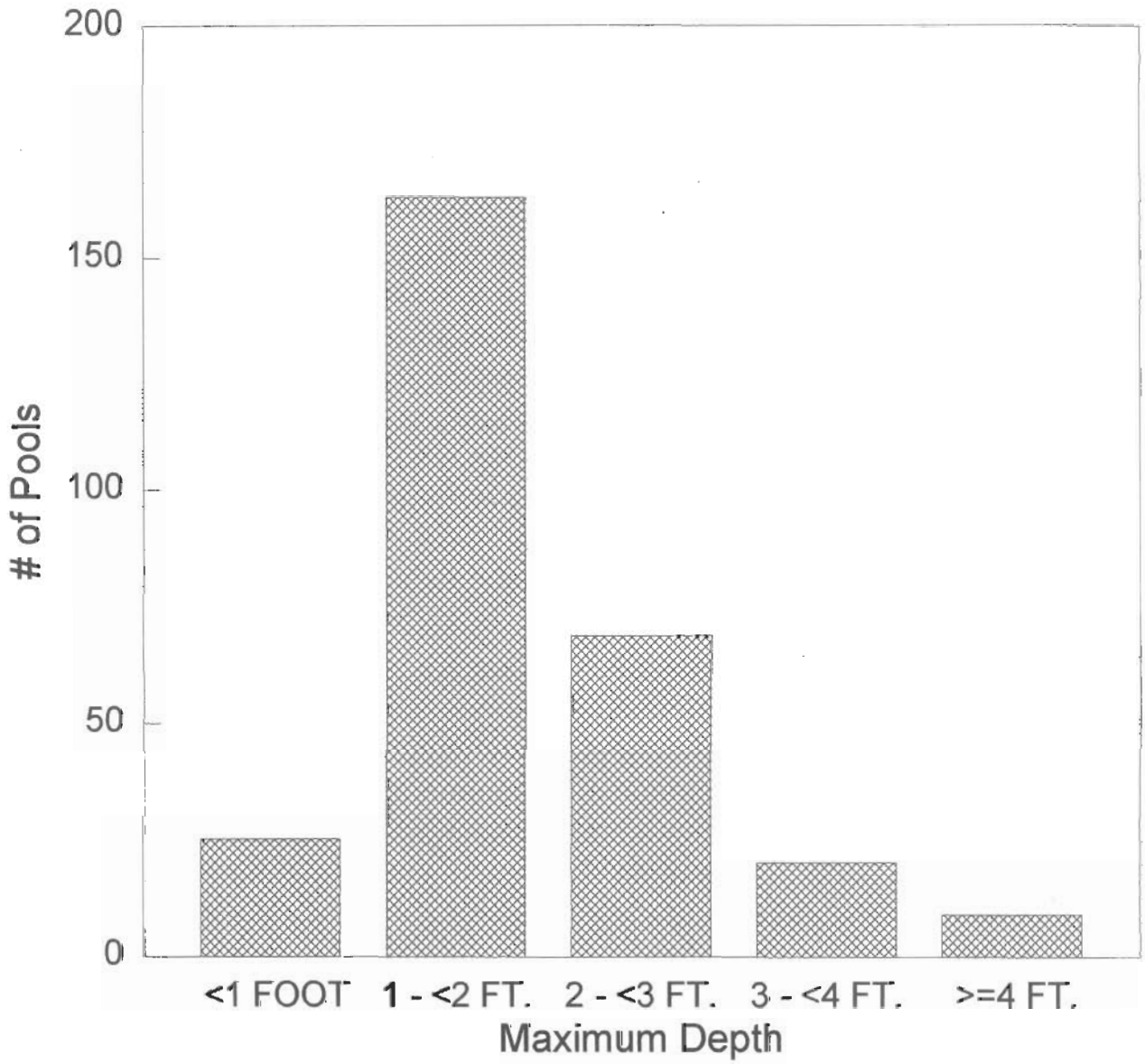
Pool Habitat Types by % Occurrence



Graph 3

Felta Creek

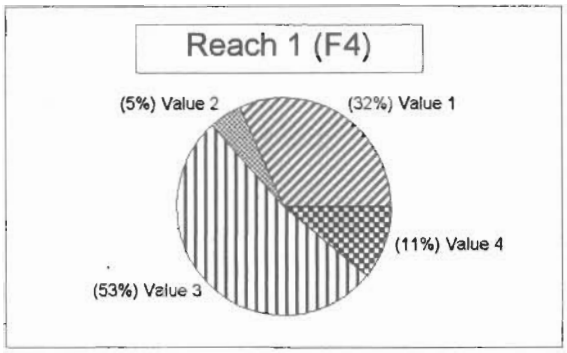
Maximum Depth in Pools

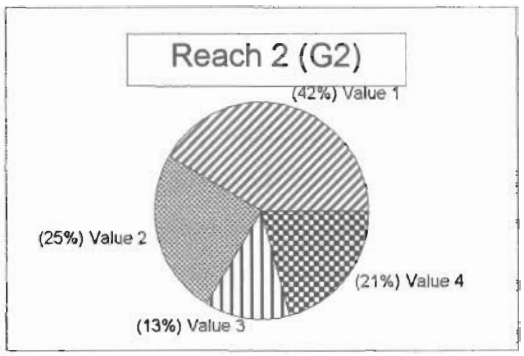


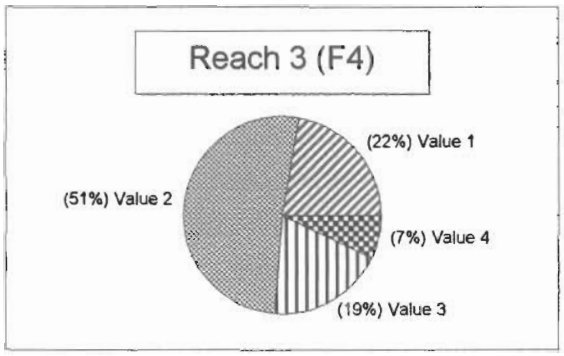
Graph 4

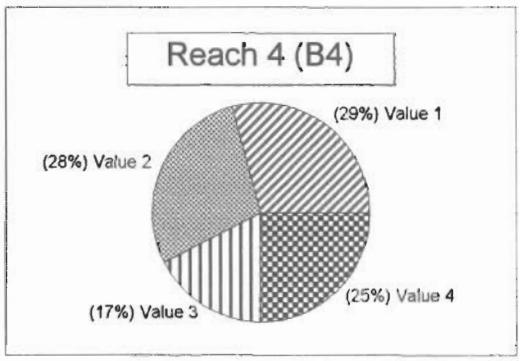
Felta Creek

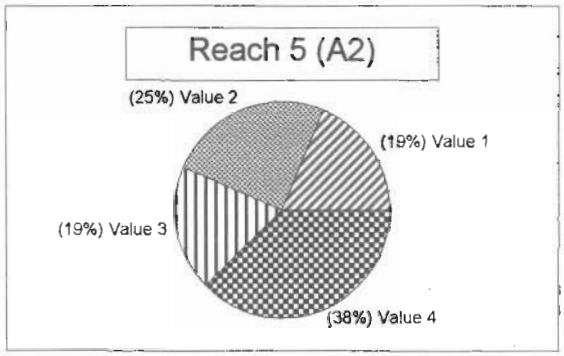
Percent Embeddedness by Reach









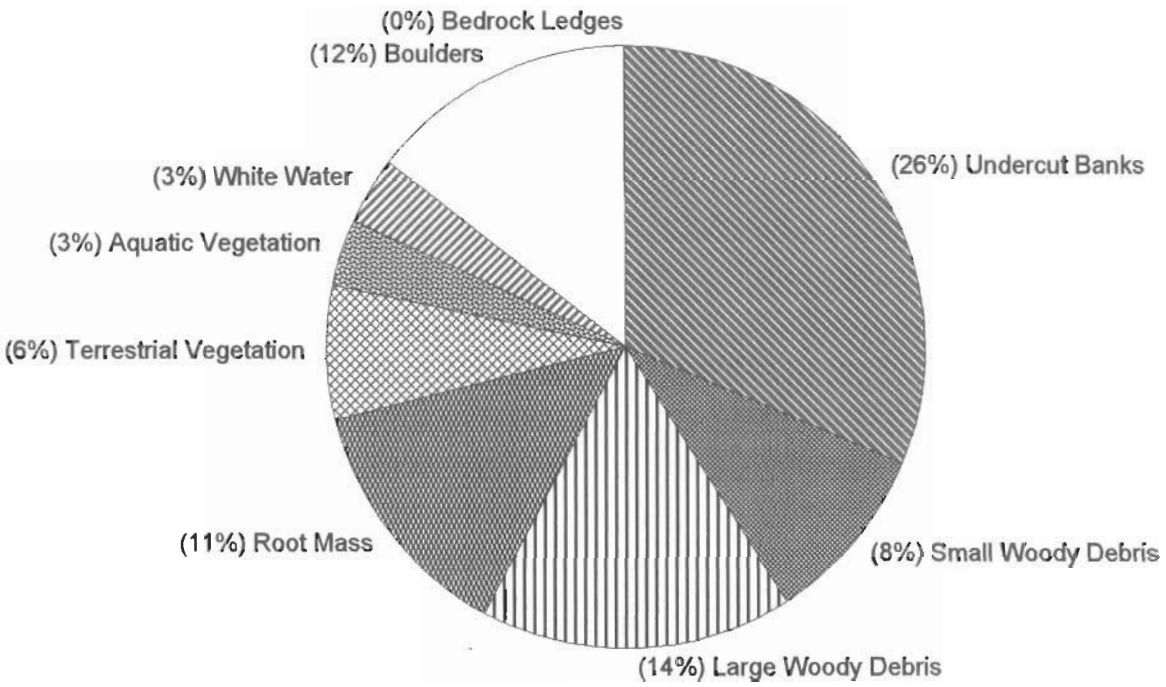


Value 1 = <25% Value 2 = 25-50% Value 3 = 51-75% Value 4 = >76%

Graph 5

Felta Creek

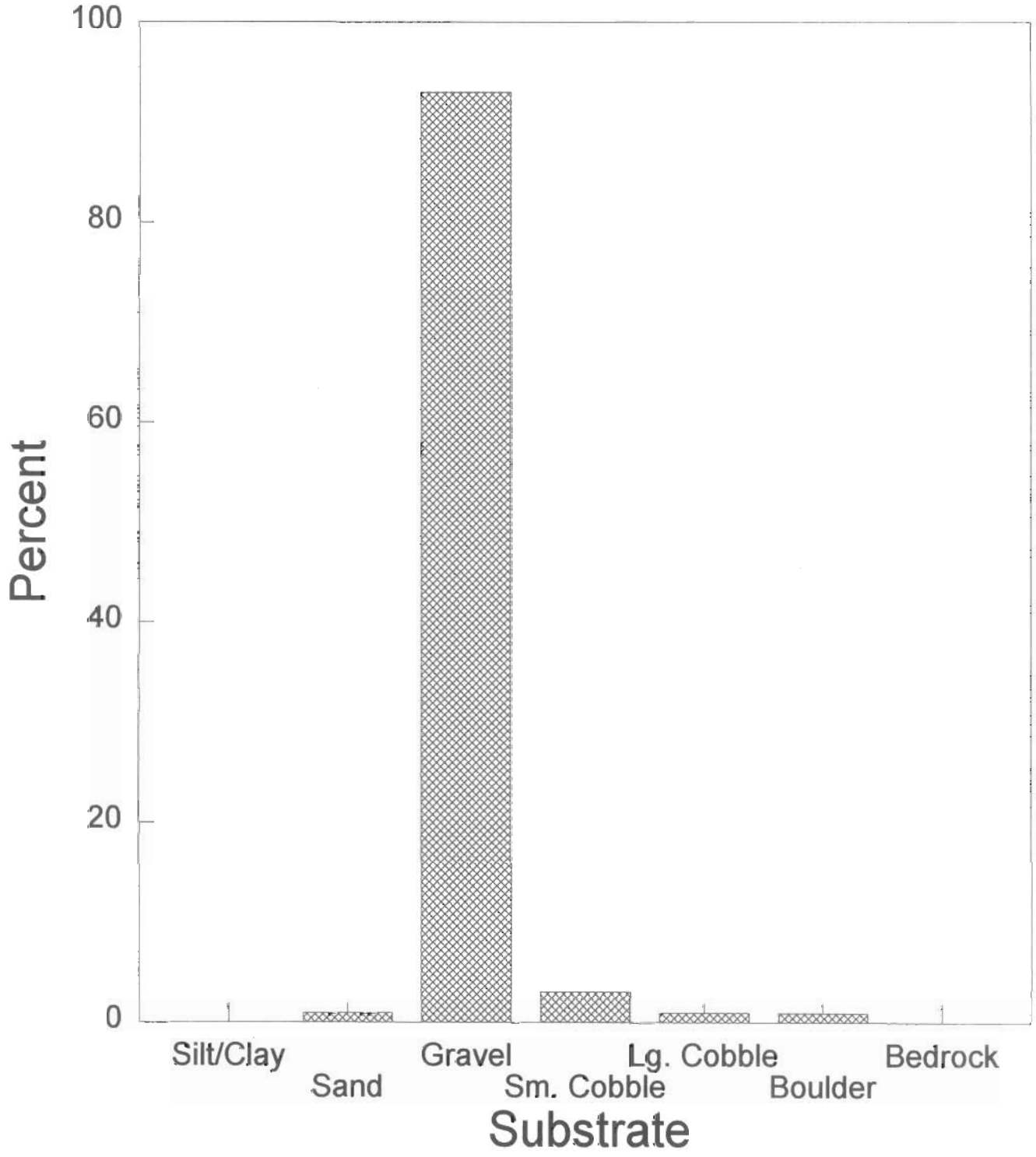
Mean Percent Cover Types In Pools



Graph 6

Felta Creek

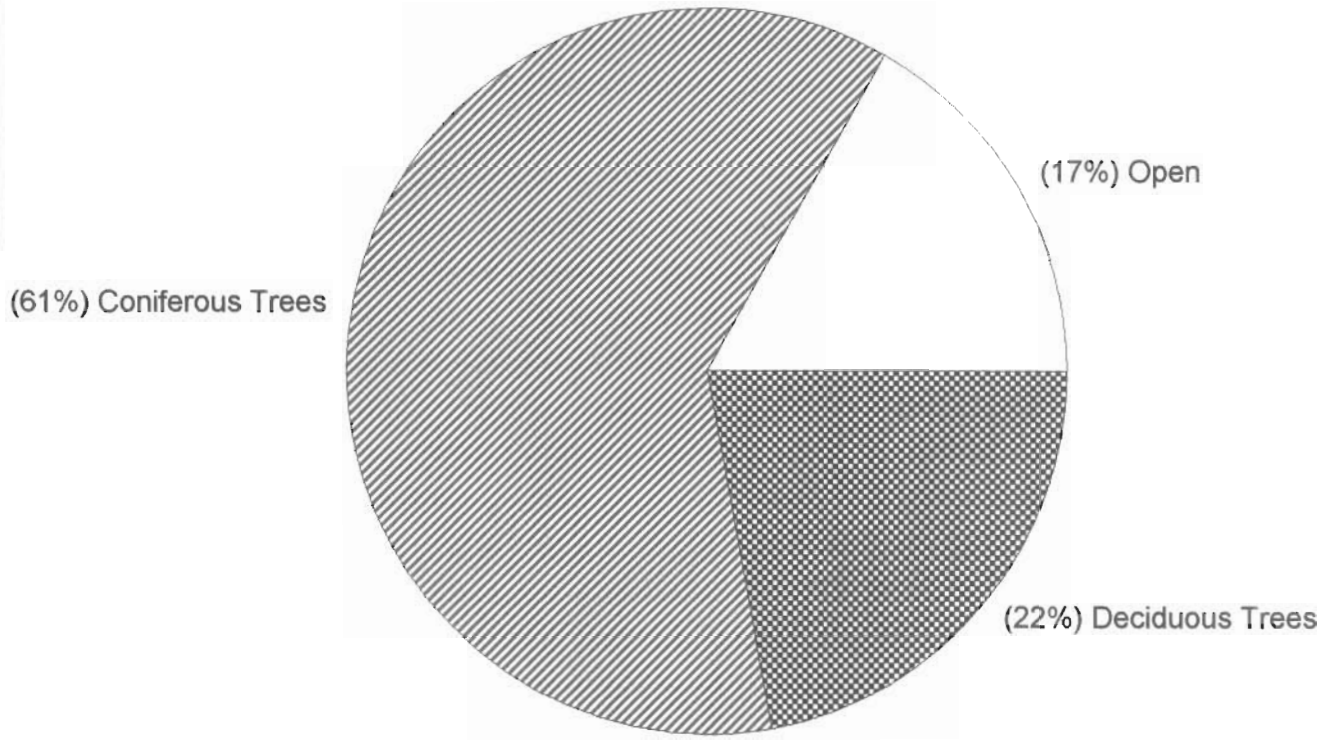
Substrate Composition in Low Gradient Riffles



Graph 7

Felta Creek

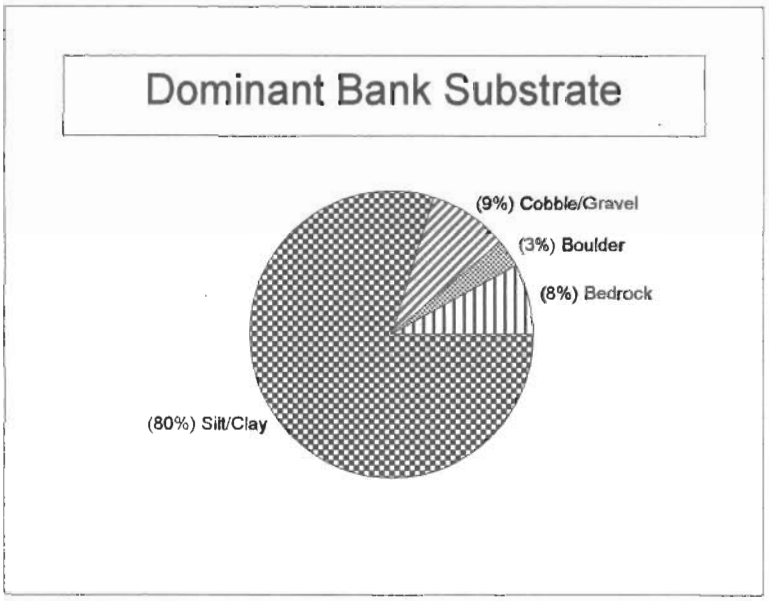
Percent Canopy

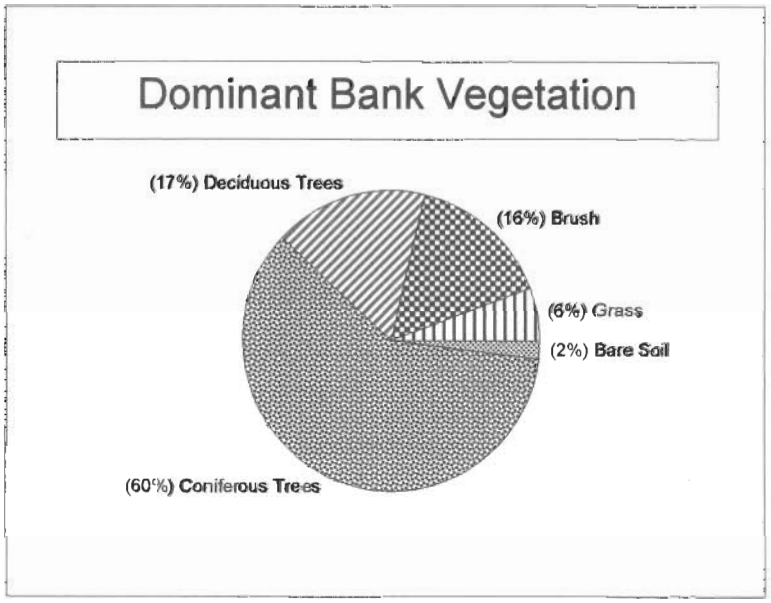


Graph 8

Felta Creek

Percent Bank Composition

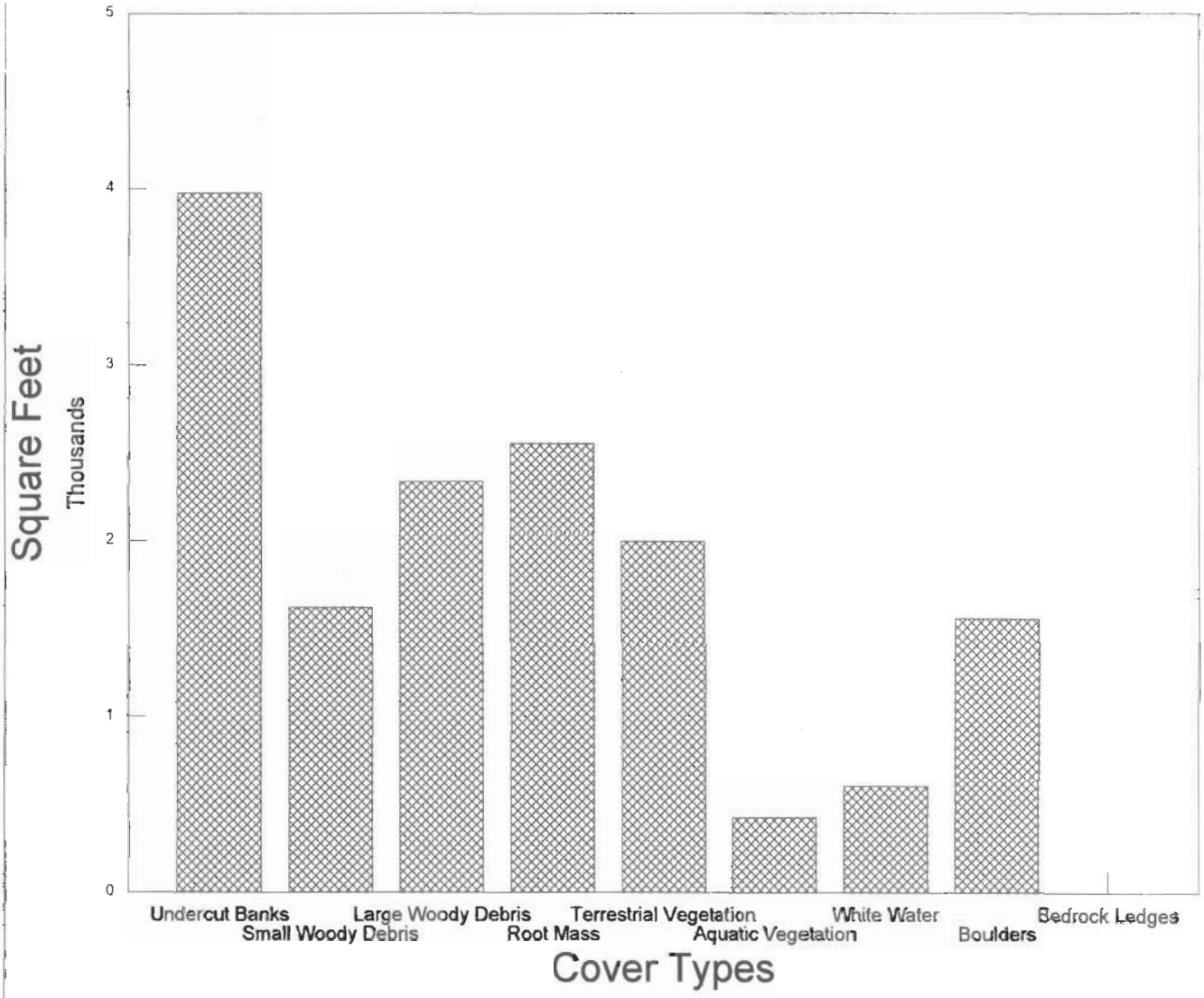




Graph 9

Felta Creek

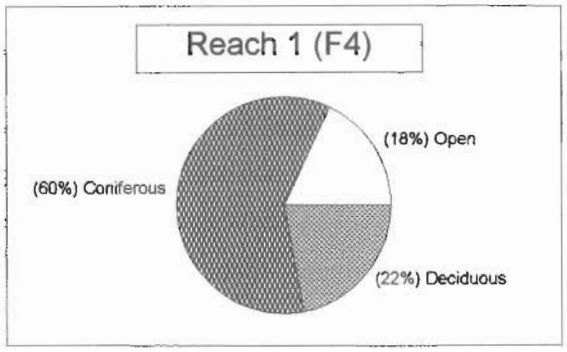
Cover Type Areas in Pools

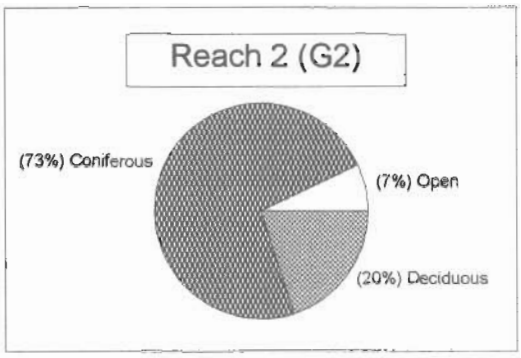


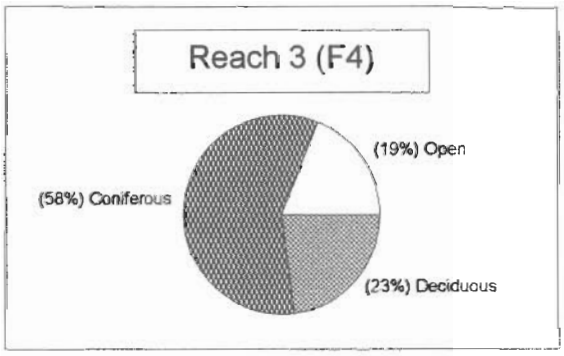
Graph 10

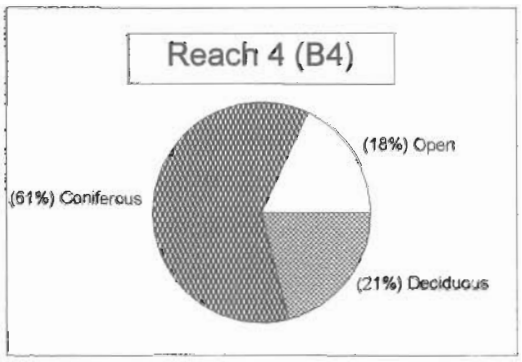
Felta Creek

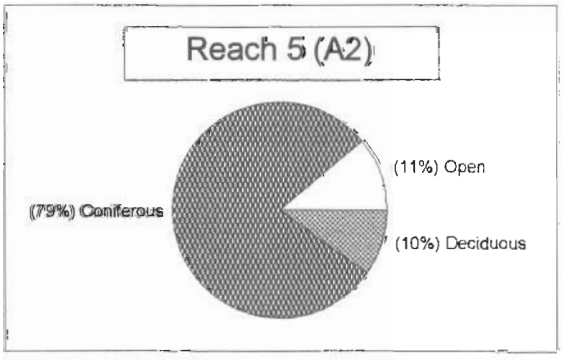
Percent Canopy by Reach



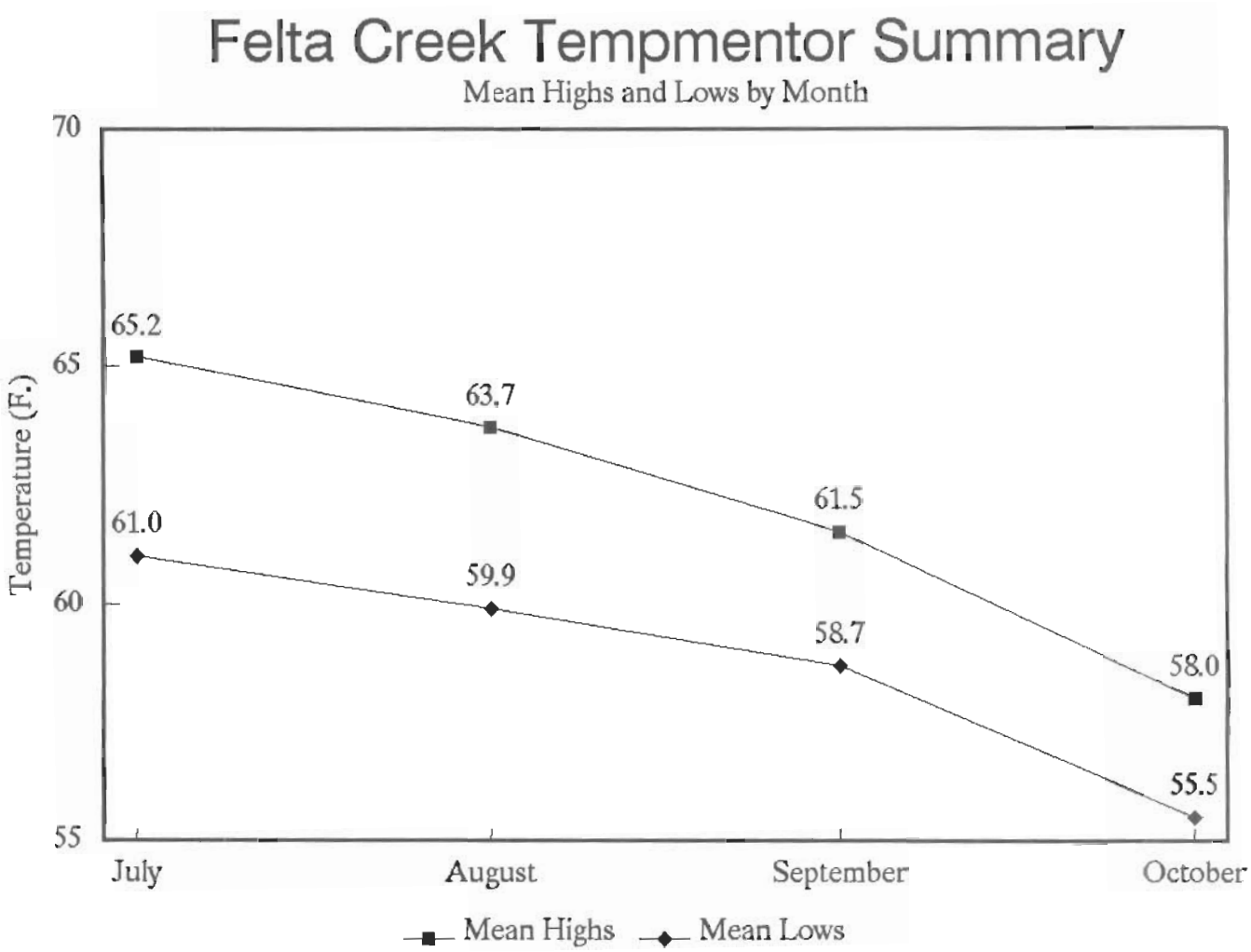


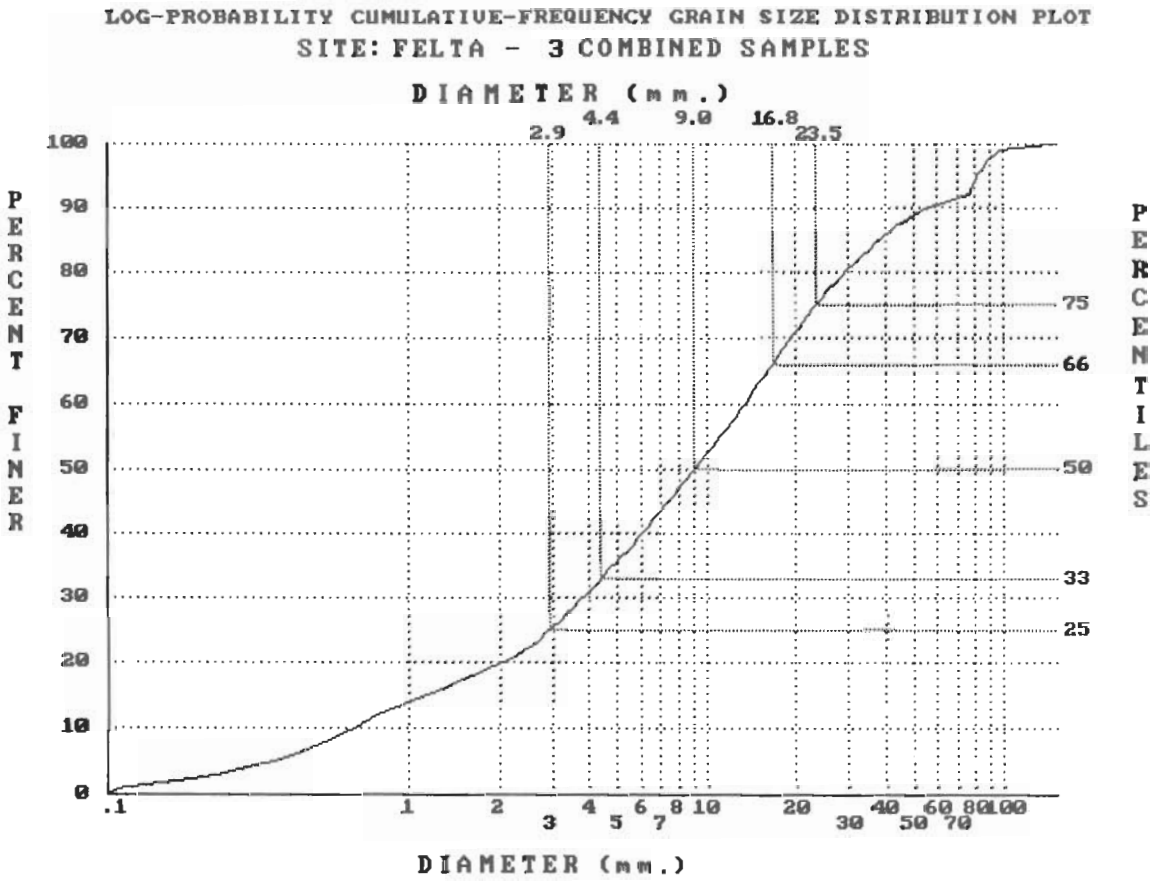






Graph 11


Felta Creek Tempmentor Summary
Mean Highs and Lows by Month
Temperature (F.)
70
65
60
55
65.2
63.7
61.5
58.0
61.0
59.9
58.7
55.5
July
August
September
October
Mean Highs
Mean Lows


LOG-PROBABILITY CUMULATIVE-FREQUENCY GRAIN SIZE DISTRIBUTION PLOT
SITE: FELTA - 3 COMBINED SAMPLES
DIAMETER (mm.)
2.9
4.4
9.0
16.8
23.5
PERCENT FINER
100
90
80
70
60
50
40
30
20
10
0
75
66
50
33
25
PERCENTILES
.1
1
2
3
4
5
6
7
8
10
20
30
40
50
60
70
80
100
DIAMETER (mm.)