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

INTRODUCTION

A stream inventory was conducted during the summer of 1995 on
Bearpen 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 Bearpen 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

Bearpen Creek is a tributary to Big Austin Creek which is a
tributary to the Russian River, located in Sonoma County,
California (See Bearpen Creek map, page 2). The legal description
at the confluence with Big Austin Creek is T9N, R11W, S31. Its
location is 38°34'39" N. latitude and 123°6'6" W. longitude. Year
round vehicle access exists from Kings Ridge Road, via Cazadero
Highway, via Highway 116.

Bearpen Creek is a second order stream and has approximately 3.8
miles of blue line stream, according to the USGS Cazadero and Fort
Ross 7.5 minute quadrangles. Bearpen Creek and its tributaries
drain a basin of approximately 3.4 square miles. Elevations range
from about 360 feet at the mouth of the creek to 760 feet in the
headwater areas. Redwood, oak and California laurel are the
dominant tree species along the creek. Other tree species include
Douglas fir, madrone, willow, and red alder. The entire watershed
is privately owned and there is past evidence of logging in one of
the unnamed tributaries. Recreational uses along Bearpen Creek
include swimming, boating, camping and picnicking.

The endangered Northern Spotted Owl *(Strix occidentalis caurina)* is
listed in DFG's Natural Diversity Database as occurring within
Bearpen Creek watershed. No sensitive plants were listed.

Stream Surveys:

The Department of Fish and Game conducted stream surveys in the fall of 1968 and the summer of 1977 to assess and improve habitat conditions for anadromous salmonids.

The October 1968 survey was conducted to determine the presence of juvenile salmonids in tributaries to the Russian River. Steelhead were the only salmonids found in Bearpen Creek at this time. Roach were also present.

The survey conducted in July of 1977 covers Bearpen Creek from the mouth to the headwaters, approximately 3.8 miles. General descriptions of the survey's findings are summarized as follows:

"Bearpen Creek provides spawning and nursery habitat for steelhead and possibly coho salmon. The very dry conditions prevailing throughout the Austin Creek drainage area in the past two years have had a depressing effect on fish abundance and distribution. Bearpen Creek is supporting a fair number of salmonids and water temperatures have remained low."

METHODS

The habitat inventory conducted in Bearpen 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 of 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 Bearpen Creek to record measurements and observations. There are nine components to the inventory form.

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.

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". Bearpen 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-outs is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Bearpen 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 Bearpen 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.

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 Bearpen 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 Bearpen 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.

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 IV 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
- Shelter type areas by habitat types

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

- Level II Habitat Types by % Occurrence
- Level IV Habitat Types by % Occurrence
- Pool Habitat Types by % Occurrence
- Maximum Depth in Pools
- Percent Embeddedness by Reach
- Percent Cover Types in Pools
- Mean Percent Canopy
- Percent Bank Composition
- Percent Canopy by Reach

HABITAT INVENTORY RESULTS

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

The habitat inventory of July 28 - August 8, 1995 was conducted by
Kurt Gregory, Pam Higgins, and Julie Maggi. The survey began at
the confluence with Austin Creek and extended up Bearpen Creek to
the end of the survey. The total length of the stream surveyed was
16,221 feet, with an additional 160 feet of side channel. On May
25, 1996 flow was measured to be 9.23 cfs at 75 feet west of the
bridge, using a Marsh-McBirney Model 2000 flowmeter.

This section of Bearpen Creek has two channel types, with both
occurring twice in separate reaches: from the mouth to 6326 feet

an F4; the next 3032 feet an F3; the next 1766 feet an F4 and the upper 5097 feet an F3. F4 channel types are entrenched, meandering riffle/pool gravel channels on low gradients with high width/depth ratio. F3 channels have the same characteristics as F4 channels, but have a predominantly cobble substrate.

Water temperatures ranged from 62°F to 70°F. Air temperatures ranged from 66°F to 95°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent **occurrence**, pools made up 47%, riffle types 27%, and flatwater 22% (Graph 1). Pool habitat types made up 34% of the total survey **length**, riffles 28%, and flatwater 19%.

Twenty 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, 25%. The percent occurrence of glides was 9%, mid-channel pools 9%, and l. scour pools - bedrock formed 9% (Graph 2). By percent total **length**, low gradient riffles made up 25%, glides 7%, mid-channel pools 6%, and l. scour pools - bedrock formed 6%.

One hundred sixty-four pools were identified (Table 3). Scour pools were most often encountered at 62%, and comprised 55% 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. Fifty-four of the 164 pools (33%) had a depth of two feet or greater (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. Pool habitat types had the highest mean shelter rating at 34. Riffles had a mean shelter rating of 23 and flatwater had the lowest rating with 17 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 56. Scour pools rated 35 and main channel pools rated 25 (Table 3).

Table 10 summarizes total cover by habitat type. Large woody debris, boulders and root masses are the dominant cover types for pools in Bearpen Creek. Graph 6 describes the pool cover in Bearpen Creek.

Approximately 34% of Bearpen Creek lacked shade canopy. Fifty-six percent of the stream had canopy consisting of coniferous trees and 10% had a canopy of deciduous trees. Graph 8 describes the canopy

in Bearpen Creek. On a reach by reach comparison, Reach 1 had the least canopy with 43% of the stream being open (Graph 11).

For the stream reach surveyed, the mean percent left bank vegetated was 65% and the mean percent right bank vegetated was 64%. For the habitat units measured, the dominant vegetation types for the stream banks were: 77% coniferous trees, 11% deciduous trees, 9% bare soil and 3% grass. The dominant substrate for the stream banks were: 66% silt/clay/sand, 16% bedrock, 12% cobble/gravel and 6% boulder (Graph 9).

SUBSTRATE SAMPLING

No mechanical substrate sampling was conducted in 1995 surveys due to inadequate staffing levels; however, dominant substrate types observed and embeddedness ratings results are presented below. Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in all of the 14 low gradient riffles measured.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 160 pool tail-outs measured, 27 had a value of one (17%); 90 had a value of two (56%); 35 had a value of three (22%); and 8 had a value of four (5%). On this scale, a value of one is best for fisheries (Graph 6). On a reach by reach comparison, Reach 2 had the lowest ratings with 78% having either a 2 or 3, while Reach 3 had the best ratings with only 81% with a 1 or 2. Reach 1 had 60% with either a 2 or 3 and Reach 4 had 86% with a 2 (Graph 5).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

A Biological inventory was taken on September 11 of 1995 to document the fish species and distribution in Bearpen 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 68-73°F and the range in water temperature was 59-65°F. The observers were Ken Mogan and Kurt Gregory.

The inventory of Reach one was conducted starting at the confluence with Austin Creek, 30 yards from Kings Ridge Road in habitat units 1-12. In pool, riffle and glide habitat types 130 0+, 5 1+ and 1 2+ steelhead (40/100') were observed along with 8 Three spin stickleback, 2 sculpin (Cottus Sp.), 1 California Roach, 8 Unidentified frogs and 1 Pacific Giant salamander. This section

had an approximate length of 342'.

The inventory of Reach two was conducted 100 feet below a summer dam in units 190-211. In pool, riffle, run and glide habitat types 109 0+, 12 1+ and 2 2+ steelhead (10/100') were observed along with 7 roach, 10 frogs and 179 juvenile Pacific Giant salamanders. This section had an approximate length of 1209'. The following table summarizes species observed in DFG surveys:

SUMMARY OF SPECIES OBSERVED IN DFG SURVEYS ON BEARPEN CREEK		
SPECIES	**YEARS**	**Native/Introduced**
Steelhead	1968,1977,1995	N
Sculpin	1995	N
Stickleback	1995	N
Roach	1995	N
Frogs	1995	N
Pacific Giant Salamander	1995	N

Historical records reflect that steelhead fingerlings were stocked in Bearpen Creek in 1982 and 1984. Fish rescue operations occurred in 1960 and 1970.

Summary of fish hatchery stocking for Bearpen Creek				
YEAR	SPECIES	SOURCE	#	SIZE
1960	SH	BEARPEN CRK	2,346	FING
1970	SH	AUSTIN CRK	6,468	FING
1970	SH	BEARPEN CRK	3,568	FING
1982	SH	WARM SPRINGS	11,360	FING
1984	SH	WARM SPRINGS	6,552	FING

WARM SPRINGS = Warm Springs Hatchery (Geyserville)
SH = steelhead

DISCUSSION

Bearpen Creek has two channel types, both occurring twice in separate reaches: F4 and F3. The lower 6328 feet of Bearpen Creek is an F4 channel type. There is also a 1766 foot reach of F4 channel in the middle section of Bearpen Creek. F4 channels are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover.

The upper 5097 feet of Bearpen Creek is an F3 channel. There is also a 3032 foot reach of F3 channel in the middle section of Bearpen Creek. F3 channels are good for bank-placed boulders and single and opposing wing-deflectors. They are fair for low-stage weirs, boulder clusters, channel constrictors and log cover. Any work considered in Bearpen Creek will require careful design, placement and construction.

The water temperatures recorded on the survey days 07/28/95 to 08/08/95 ranged from 62°F to 70°. The warmer water temperatures were recorded in Reach 1. These warmer temperatures, if sustained, are above the threshold stress level (65°) 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 needs to be conducted.

Pool habitat types comprised 34% of the total **length** of this survey. The pools are relatively shallow with only 33% having a maximum depth greater than 2 feet (33%). In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. 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.

Pool habitats had a mean shelter rating of 34. However, a pool shelter rating of approximately 100 is desirable. The relatively small amount of pool cover that now exists is being provided primarily by large woody debris, boulders and root mass. Additional log and root wad cover structures in the pool and flatwater habitats would 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.

All of the 14 low gradient riffles measured had gravel as the dominant substrate. This is generally considered good for spawning salmonids.

Seventy-Three percent of pool tail-outs measured had embeddedness ratings of either one or two. This is considered "fair". Cobble embeddedness measured to be 25% or less, a rating of one, is considered best for the needs of salmon and steelhead.

The mean percent canopy for the survey reach was only 66%. This is a low percentage of canopy, since 80 percent is generally considered desirable. Elevated water temperatures could be reduced by increasing stream canopy in all reaches, especially in Reach 1. Cooler water temperatures are desirable in Bearpen Creek. The large trees required to contribute shade to the wide channel typical of this reach would also eventually provide a long term source of large woody debris needed for instream structures.

Biological surveys were conducted to document fish distribution and are not necessarily representative of population information. The inventory on September 11, 1995 found young of the year (0+) steelhead to be especially common, indicating successful spawning conditions in Reaches 1 and 2 of Bearpen Creek. No coho were found during this 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. Overall, few 1+ fish were observed, indicating poor rearing conditions the year before or poor holding-over conditions in general.

There are relatively few pools with adequate depth and shelter. Although riffle habitat exists, some of it is impacted from sediment, making it marginal for spawning. Shade canopy is poor for Bearpen Creek, especially in Reach 1.

GENERAL RECOMMENDATIONS

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

The winter 1995/96 storms brought down many large trees and
other woody debris into the stream, which increased the number
and quality of pools since the date of this survey. This
woody debris, if left undisturbed, will provide fish cover and
rearing habitat, and offset channel incision. Many signs of
recent and historic tree and log removal were evident in the
active channel during our survey. 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
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)   Increase the canopy on Bearpen Creek by planting willow,
     alder, redwood, and Douglas fir along the stream where shade
     canopy is not at acceptable levels (portions of Reaches 1 and
     2). In many cases, planting will need to be coordinated to
     follow bank stabilization or upslope erosion control projects.

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

3)   Map sources of upslope and in-channel erosion, and prioritize
     them according to present and potential sediment yield.
     Identified sites should then be treated to reduce the amount
     of fine sediments entering the stream. Near-stream riparian
     planting along any portion of the stream should be encouraged
     to provide bank stability.

4)   Where feasible, increase woody cover in the pool and flatwater
     habitat units along the entire stream. Adding high quality
     complexity with large woody cover is desirable. Combination
     cover/scour "constricting type" 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 or in conjunction with stream bank armor to prevent
     erosion. In some areas the material is at hand.

REFERENCES:

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

C.D.F.& G. Stream Survey - Bearpen Creek, Sonoma County; July 1977; Baracco, Alan, Asst. Fisheries Biologist Region 3.

PROBLEM SITES AND LANDMARKS - BEARPEN CREEK SURVEY COMMENTS

Habitat Unit #	Stream Length (ft.)	Comments
3.00	141	AT 1ST BRIDGE
10.00	297	E.F. SPOT NUMEROUS STEELHEAD
19.00	773	TRIBUTARY RT BANK DRY
20.00	801	AT BASE OF TRIBUTARY
33.00	1528	POSSIBLE INTERMITTENT IN NEAR FUTURE
47.00	2469	DRY/NEXT TO ROAD
53.00	2811	NUMEROUS STEELHEAD
57.00	3182	LARGE SCHOOL OF STEELHEAD
58.00	3206	TRIB LF BANK STREAM REMAINS INTERMITTENT MAY GO DRY SOON
60.00	3328	AT 2ND BRIDGE 3-4" STEELHEAD
61.00	3461	STEELHEAD IN RIFFLE
62.00	3506	3-4" STEELHEAD
71.00	3841	2 LARGE REDWOODS FALLEN IN CREEK
73.00	3884	STEELHEAD PRESENT
87.00	4375	SUMMER XING
88.00	4432	FOOT BRIDGE WOOD ERODING RT BANK UNDER BRIDGE
89.00	4465	LARGE WOODY DEBRIS 3 PIECES ON RT BANK / LEFT FOR RESTORATION?
101.00	4794	DRY TRIB RT BANK INTERMITTENT 100' UP STEELHEAD IN POOL
111.00	5099	BLOWOUT ON RT BANK BELOW LOG ACCUMUALTION
111.50	5099	0+ STEELHEAD\LOG ACCUMULATION\BLOW OUT RT BANK\TRIB RT BANK
115.00	5392	0+ AND 1+; MANY FISH
120.00	5723	LF BANK CULVERT 3' PARTIALLY BLOCKED\BLOWOUT
121.00	5773	DIRT ROAD LF BANK CUT
135.00	6340	SUMMER XING
137.00	6372	WOODEN BRIDGE RT BANK
141.00	6524	EROSION RT BANK
147.00	6721	SEVERE EROSION RT BANK\LARGE WOODY

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                        DEBRIS OVER PARTLY IN CREEK
150.00          6780 1+ STEELHEAD MANY OTHER STEELHEAD
154.00          6970 ROAD RT BANK INTO CREEK XING LF
                        BANK
155.00          7028 TRIB RT BANK
156.00          7077 BEGIN TRIB TYPING HERE
159.00          7123 STEELHEAD IN POOL
163.00          7409 WOODEN BRIDGE ABANDONED\EROSION RT
                        BANK
173.00          7774 LARGE LOG ACCUMULATION
179.00          7983 END OF TRIBUTARY SURVEY.SURVEY
                        CONTINUED ABOVE DAM. DRY FOR 600
                        FT. NO FISH WERE OBSERVED IN ANY OF
                        THE 6 POOLS FOUND.
184.00          8134 SPRING AT END OF UNIT, A TRICKLE.
196.00          8685 BLOWOUT RT BANK
203.00          8928 RT BANK BLOWOUT
209.00          9379 TRIBUTARY RT BANK FLAT AND STEEP 60
                        DEGREES.TRIBUTARY AT END OF UNIT RT
                        BANK
219.00          9806 FISH <1"
226.00         10017 DRY TRIB LF BANK STEEP & BOULDERED.
227.00         10049 GRAVEL\PLASTIC TARP DAM @DOWN
                        STREAM END OF UNIT. 2' HIGH ACROSS
                        CREEK (E.F. SPOT)
231.00         10243 MASSIVE BOULDER ACCUMUALTION AVERAGE
                        BOULDER SIZE OF JEEP.
233.00         10310 NO FISH OBSERVED ABOVE BOULDER
                        ACCUMULATION YET.
251.00         10706 DRY TRIB \GULLY LF BANK STEEP WITH
                        BOULDERS
254.00         10834 BLOWOUT RT BANK OLDER EROSION AREA
                        50x10x20
265.00         11188 EROSION LF BANK
279.00         11629 DRY TRIB RT BANK
287.00         14250 SPRING FED FROM HEADWATERS FROM
                        THIS POINT ONWARD.
301.00         14764 FROGS & NEWTS (NO FISH)
309.00         14983 FISH OBSERVED.
315.00         15144 LF BANK EROSION
319.00         15360 RT BANK EROSION
326.00         15515 SM. LOG ACCUMULATION (LWD)
328.00         15578 DRY TRIB LF BANK STEEP\BOULDERS
344.00         16248 ENDED SURVEY 500'PAST\UPSTREAM OF
                        XING FISH PRESENT
                        BOULDERS\BEDROCK\SMALL POOLS
                        CHANNEL CHANGE.  XING BANK THROUGH
                        CREEK.
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Bearpen Creek

Reach 4 (F3)

Reach 3 (F4)

Austin Creek

Reach 2 (F3)

Bearpen Creek

Reach 1 (F4)
Confluence With
Austin Creek
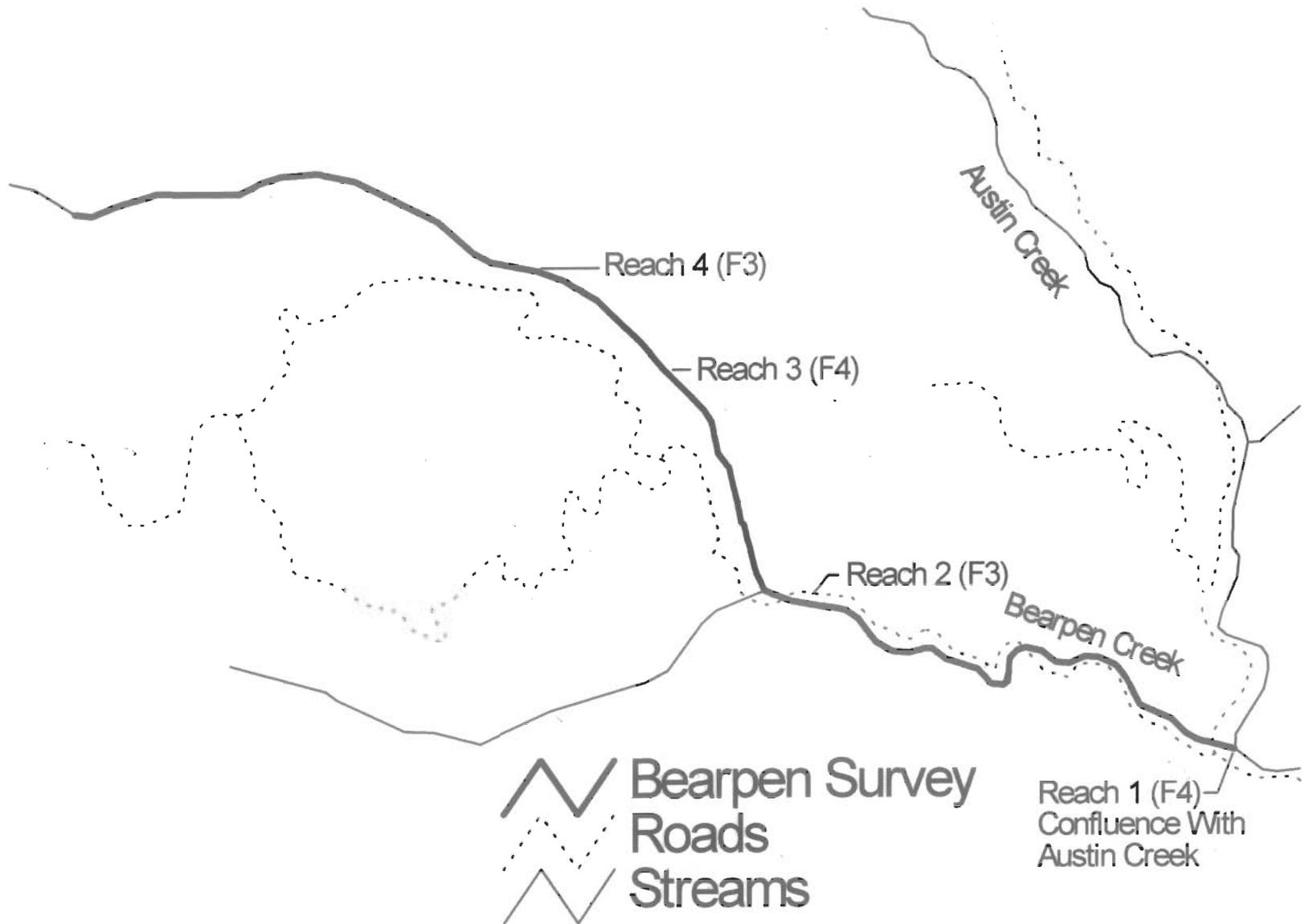
/\/ Bearpen Survey
/\/ Roads
/\/ Streams

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

0.5   0   0.5 Miles

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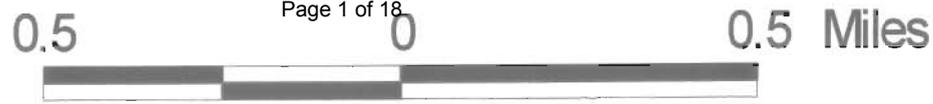
Bearpen Creek   Drainage: Big Austin Creek

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES   Survey Dates: 07/28/95 to 08/08/95

Confluence Location: QUAD: CAZADERO   LEGAL DESCRIPTION: T9NR11WS31   LATITUDE: 38°34'39"   LONGITUDE: 123°6'6"

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
94	0	RIFFLE	27	48	4530	28	7.5	0.3	197	18511	66	6224	0	23
78	5	FLATWATER	22	40	3085	19	6.9	0.6	239	18621	123	9630	0	17
164	31	POOL	47	34	5570	34	9.7	1.4	273	44742	283	46426	206	34
15	1	DRY	4	213	3197	20	7.0	0.0	255	3822	0	0	0	5

TOTAL UNITS	TOTAL UNITS				TOTAL LENGTH (ft.)					TOTAL AREA (sq. ft.)		TOTAL VOL. (cu. ft.)		
351	37				16381					85696		62280		

Bearpen Creek

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Drainage: Big Austin Creek

Survey Dates: 07/28/95 to 08/08/95

Confluence Location: QUAD: CAZADERO   LEGAL DESCRIPTION: T9NR11WS31   LATITUDE: 38°34'39"   LONGITUDE: 123°6'6"

HABITAT UNITS #	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft.	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MEAN 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 %
87	0	LGR	25	46	4031	25	8	0.3	1.8	178	15472	57	4983	0	23	63
6	0	HGR	2	63	376	2	6	0.4	0.8	292	1754	111	666	0	0	78
1	0	CAS	0	123	123	1	0	0.0	0.0	0	0	0	0	0	0	0
6	1	POW	2	34	204	1	7	0.8	2.3	231	1387	173	1039	0	8	61
32	0	GLD	9	35	1106	7	7	0.6	0.9	213	6810	107	3415	0	35	65
26	2	RUN	7	32	831	5	8	0.5	0.9	166	4306	85	2213	0	3	64
14	2	SRN	4	67	944	6	7	0.5	1.3	295	4131	140	1959	0	33	69
33	4	MCP	9	32	1045	6	9	1.0	3.4	343	11319	355	11701	239	16	65
2	0	CCP	1	36	73	0	10	0.8	3.3	200	400	160	320	80	0	40
13	3	STP	4	81	1054	6	14	0.5	2.3	505	6561	235	3058	60	42	76
5	1	CRP	1	28	139	1	8	0.7	2.3	205	1024	143	717	82	18	78
8	3	LSL	2	30	238	1	9	2.8	2.8	300	2400	728	5823	626	74	70
27	6	LSR	8	31	825	5	10	0.8	3.0	306	8270	249	6718	151	39	61
30	5	LSBk	9	35	1045	6	12	1.0	5.1	322	9673	288	8650	193	19	69
20	5	LSBo	6	25	504	4	10	0.8	2.5	223	4469	191	3822	131	30	56
12	2	PLP	3	25	297	2	4	5.8	4.7	52	619	280	3363	382	34	86
4	1	SCP	1	19	78	0	5	0.6	2.5	45	180	27	108	18	63	90
7	1	BPB	2	23	164	1	7	0.9	2.1	64	448	57	397	36	56	79
2	0	BPL	1	17	34	0	0	0.0	3.9	0	0	0	0	0	60	40
1	0	DPL	0	75	75	0	0	0.0	2.0	0	0	0	0	0	30	0
15	1	DRY	4	213	3197	20	7			255	3822	0	0	0	5	68

TOTAL UNITS	TOTAL UNITS				LENGTH (ft.)						AREA (sq.ft)		TOTAL VOL. (cu.ft)			
351	37				16381						83045		58951			

Bearpen Creek

Drainage: Big Austin Creek

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 07/28/95 to 08/08/95

Confluence Location: QUAD: CAZADERO   LEGAL DESCRIPTION: T9NR11WS31   LATITUDE: 38°34'39"   LONGITUDE: 123°6'6"

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
48	7	MAIN	29	45	2172	39	10.8	0.8	377	18106	299	14367	169	25
102	22	SCOUR	62	30	3047	55	9.6	1.8	256	26134	307	31299	239	35
14	2	BACKWATER	9	25	351	6	6.3	0.8	58	807	47	655	27	56

TOTAL UNITS	TOTAL UNITS				TOTAL LENGTH (ft.)					TOTAL AREA (sq.ft.)		TOTAL VOL. (cu.ft.)		
164	31				5570					45047		46321		

Bearpen Creek Tables Graphs Map
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Bearpen Creek   Drainage: Big Austin Creek

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES   Survey Dates: 07/28/95 to 08/08/95

Confluence Location: QUAD: CAZADERO   LEGAL DESCRIPTION: T9NR11WS31   LATITUDE: 38°34'39"   LONGITUDE: 123°6'6"

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
33	MCP	20	2	6	20	61	9	27	2	6	0	0
2	CCP	1	0	0	1	50	0	0	1	50	0	0
13	STP	8	3	23	8	62	2	15	0	0	0	0
5	CRP	3	0	0	3	60	2	40	0	0	0	0
8	LSL	5	1	13	5	63	2	25	0	0	0	0
27	LSR	16	1	4	16	59	9	33	1	4	0	0
30	LSBk	18	3	10	15	50	7	23	4	13	1	3
20	LSBo	12	2	10	15	75	3	15	0	0	0	0
12	PLP	7	2	17	4	33	2	17	3	25	1	8
4	SCP	2	1	25	2	50	1	25	0	0	0	0
7	BPB	4	0	0	6	86	1	14	0	0	0	0
2	BPL	1	0	0	0	0	1	50	1	50	0	0
1	DPL	1	0	0				100	0	0	0	0

TOTAL
UNITS
164

Bearpen Creek   Drainage: Big Austin Creek

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE   Survey Dates: 07/28/95 to 08/08/95

Confluence Location: QUAD: CAZADERO   LEGAL DESCRIPTION: T9NR11WS31   LATITUDE: 38°34'39"   LONGITUDE: 123°6'6"

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
87	0	LGR	0	0	100	0	0	0	0
6	0	HGR	0	0	33	33	0	0	33
1	0	CAS	0	0	0	0	0	0	0
6	1	POW	0	33	33	0	0	0	33
32	0	GLD	0	25	50	25	0	0	0
26	2	RUN	0	0	67	33	0	0	0
14	2	SRN	0	0	33	17	33	17	0
33	4	MCP	0	17	83	0	0	0	0
2	0	CCP	0	0	100	0	0	0	0
13	3	STP	0	0	25	25	25	25	0
5	1	CRP	0	100	0	0	0	0	0
8	3	LSL	0	50	50	0	0	0	0
27	6	LSR	0	17	67	17	0	0	0
30	5	LSBk	0	20	80	0	0	0	0
20	5	LSBo	0	0	50	33	0	17	0
12	2	PLP	0	50	0	0	0	0	50
4	1	SCP	0	0	100	0	0	0	0
7	1	BPB	0	0	0	0	0	0	50
2	0	BPL	0	0	0	0	0	0	0
1	0	DPL	0	0	0	0	0	0	0
15	·	DRY	0	0	50	50	0	0	0

Bearpen Creek

Drainage: Big Austin Creek

Table 10 - Summary of Shelter Type Areas by Habitat Type

Survey Dates: 07/28/95 to 08/08/95

Confluence Location: QUAD: CAZADERO   LEGAL DESCRIPTION: T9NR11WS31   LATITUDE: 38°34'39"   LONGITUDE: 123°6'6"

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
87	0	LGR	0	0	0	0	0	0	0	0	0
6	0	HGR	0	0	0	0	0	0	0	0	0
1	0	CAS	0	0	0	0	0	0	0	0	0
6	1	POW	0	0	0	0	0	0	0	46	0
32	0	GLD	0	0	0	0	0	0	0	0	0
26	2	RUN	0	0	0	0	0	0	0	6	0
14	2	SRN	0	0	0	0	0	0	0	155	0
33	4	MCP	0	16	1	53	16	0	0	25	0
2	0	CCP	0	0	0	0	0	0	0`	0	0
13	3	STP	0	367	458	0	0	0	0	326	0
5	1	CRP	41	0	0	0	0	0	0	0	0
8	3	LSL	1	28	276	0	1	0	0	0	0
27	6	LSR	0	4	12	544	0	0	0	0	0
30	5	LSBk	88	0	0	0	0	0	0	63	116
20	5	LSBo	0	0	0	0	0	0	0	268	22
12	2	PLP	0	16	21	4	0	0	2	0	9
4		SCP	.	0	2	0	.	0	0	0	0
7	,	BPB	0	0	0	18	0	0	0	4	0
2	0	BPL	0	0	0	0	0	0	0	0	0
1	0	DPL	0	0	0	0	0	0	0	0	0
15	1	DRY	0	0	13	0	..	0	0	0	0
TOTAL 351	37		130	434	787	619	17	0	2	893	147
TOTAL FOR POOLS 164	31		130	431	770	619	17	0	2	686	147

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
65.99	85.28	14.72	64.28	65.33

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Bedrock	13	11	15.79
Boulder	8	1	5.92
Cobble/Gravel	8	10	11.84
Silt/clay	47	54	66.45

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Grass	4	1	3.29
Brush	0	0	0
Decid. Trees	10	6	10.53
Conif. Trees	58	59	76.97
No Vegetation	4	10	9.21

FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Bearpen Creek
SAMPLE DATES: 07/28/95 to 08/08/95
STREAM LENGTH: 16221 ft.
LOCATION OF STREAM MOUTH:
  USGS Quad Map: CAZADERO   Latitude: 38°34'39"
  Legal Description: T9NR11WS31   Longitude: 123°6'6"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 1

Channel Type: F4	Canopy Density: 57%
Channel Length: 6328 ft.	Coniferous Component: 93%
Riffle/Flatwater Mean Width: 9 ft.	Deciduous Component: 7%
Total Pool Mean Depth: 1.3 ft.	Pools by Stream Length: 31%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 4%
Water: 64 - 70 °F Air: 66 - 95 °F	Mean Pool Shelter Rtn: 37
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Boulders
Vegetative Cover: 58%	Occurrence of LOD: 71%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 531 ft.

Embeddness Value: 1. 13% 2. 59% 3. 23% 4. 5%

STREAM REACH 2

Channel Type: F3	Canopy Density: 70%
Channel Length: 3032 ft.	Coniferous Component: 70%
Riffle/Flatwater Mean Width: 7 ft.	Deciduous Component: 30%
Total Pool Mean Depth: 0.9 ft.	Pools by Stream Length: 54%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 8%
Water: 63 - 66 °F Air: 74 - 85 °F	Mean Pool Shelter Rtn: 41
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Boulders
Vegetative Cover: 72%	Occurrence of LOD: 58%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 14 ft.

Embeddness Value: 1. 15% 2. 34% 3. 44% 4. 7%

STREAM REACH 3

Channel Type: F4	Canopy Density: 74%
Channel Length: 1766 ft.	Coniferous Component: 81%
Riffle/Flatwater Mean Width: 5 ft.	Deciduous Component: 19%
Total Pool Mean Depth: 3.0 ft.	Pools by Stream Length: 50%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 19%
Water: 62 - 66 °F Air: 71 - 78 °F	Mean Pool Shelter Rtn: 24
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Boulders
Vegetative Cover: 56%	Occurrence of LOD: 17%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 23 ft.

Embeddness Value: 1. 34% 2. 47% 3. 9% 4. 9%

STREAM REACH 4

Channel Type: F3	Canopy Density: 74%
Channel Length: 5094 ft.	Coniferous Component: 95%
Riffle/Flatwater Mean Width: 3 ft.	Deciduous Component: 5%
Total Pool Mean Depth: 0.9 ft.	Pools by Stream Length: 20%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 3%
Water: 63 - 65 °F Air: 72 - 78 °F	Mean Pool Shelter Rtn: 30
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Root masses
Vegetative Cover: 81%	Occurrence of LOD: 30%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 2592 ft.

Embeddness Value: 1. 8% 2. 86% 3. 6% 4. 0%

Bearpen Creek
Level II Habitat Types by % Occurrence

(4%) Dry

(27%) Riffle

(47%) Pool

(22%) Flatwater
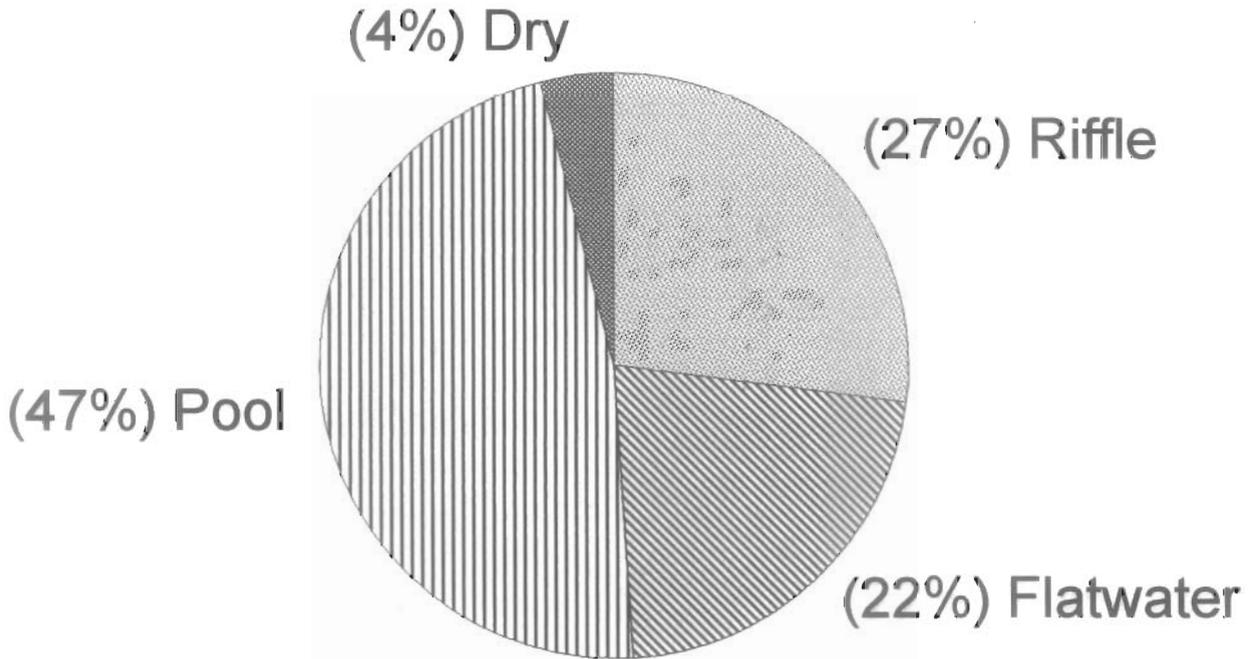
Graph 1

Bearpen Creek
Level IV Habitat Types by Percent Occurrence

Percent Occurence (y-axis), values 10 and 20 marked

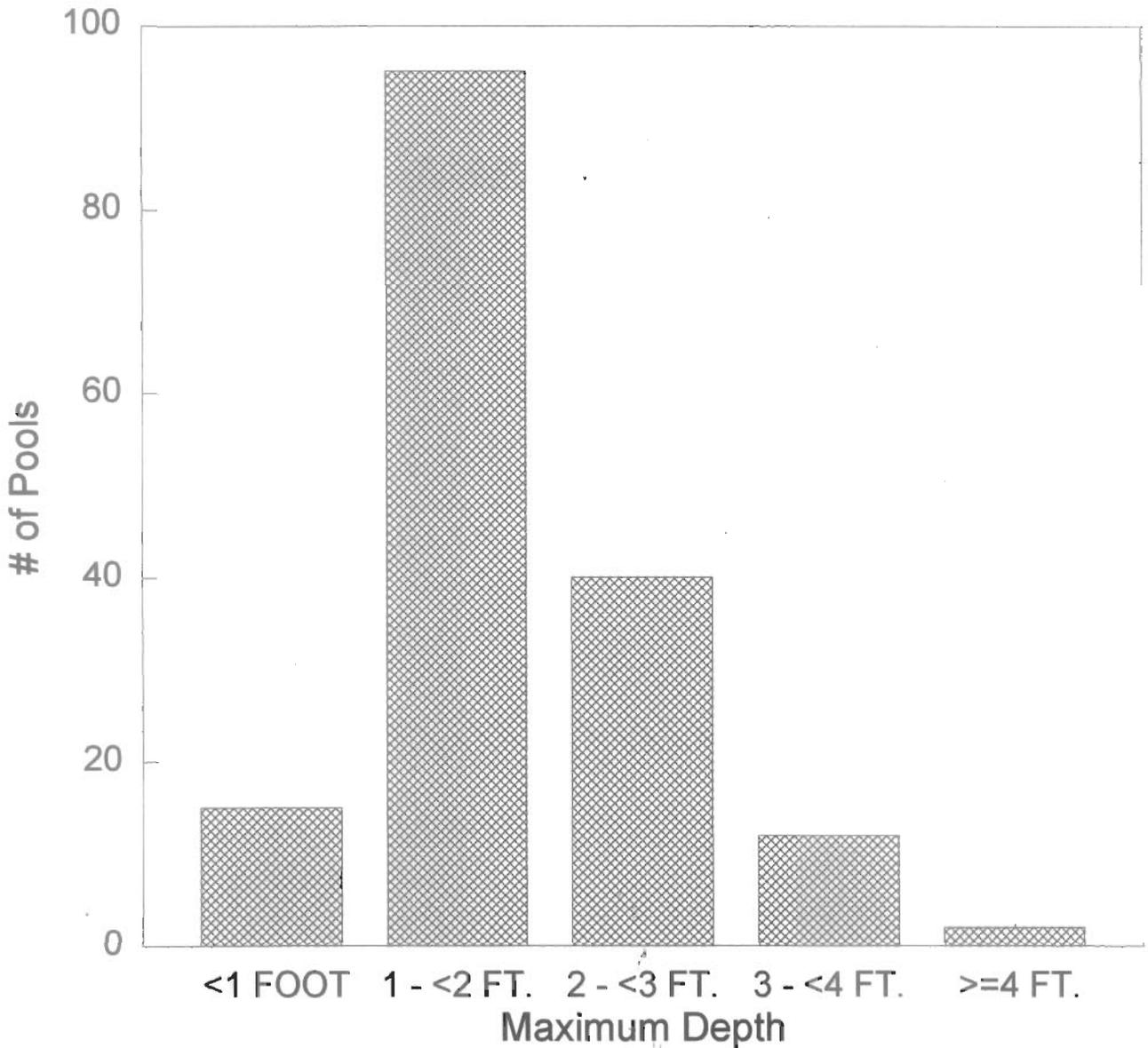Habitat Type (x-axis): LGR HGR CAS POW GLD RUN SRN MCP ... LSL LSR LSBk LSBo PLP SCP BPB BPL DPL DRY
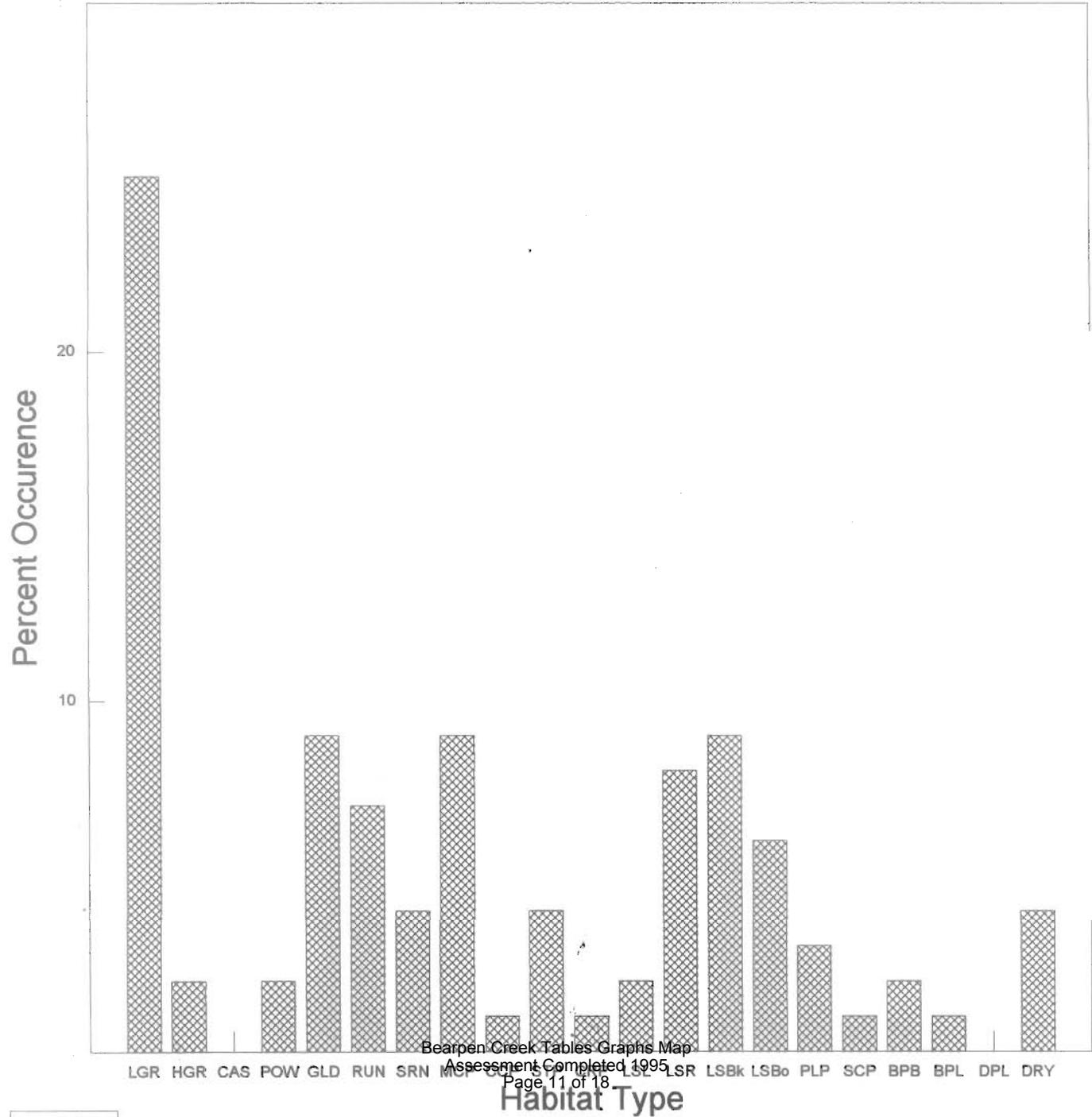
Graph 2

Bearpen Creek
Pool Habitat Types by % Occurrence

(9%) Backwater

(29%) Main

(62%) Scour
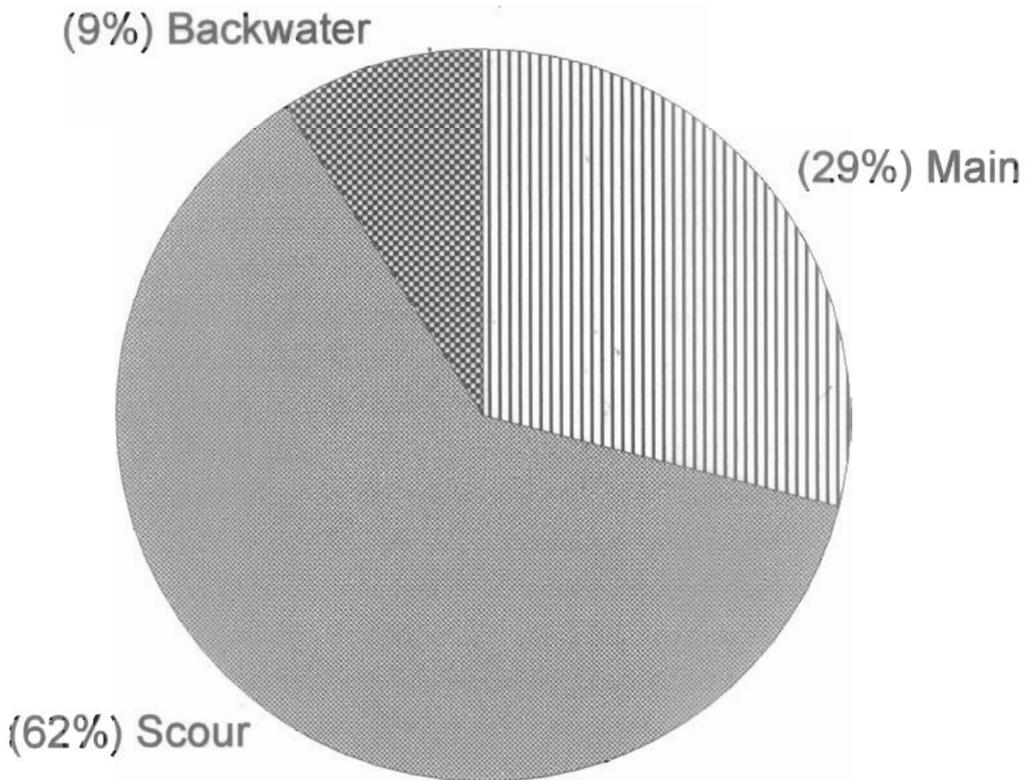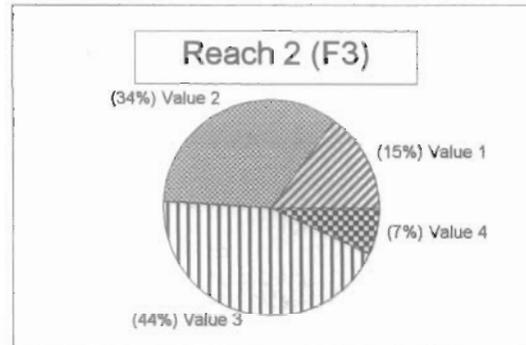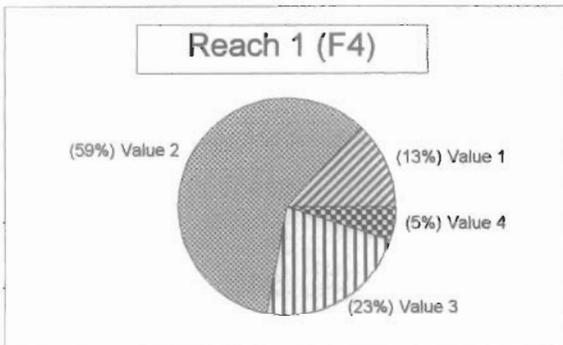
Graph 3

Bearpen Creek
Maximum Depth in Pools

Bearpen Creek Tables Graphs Map
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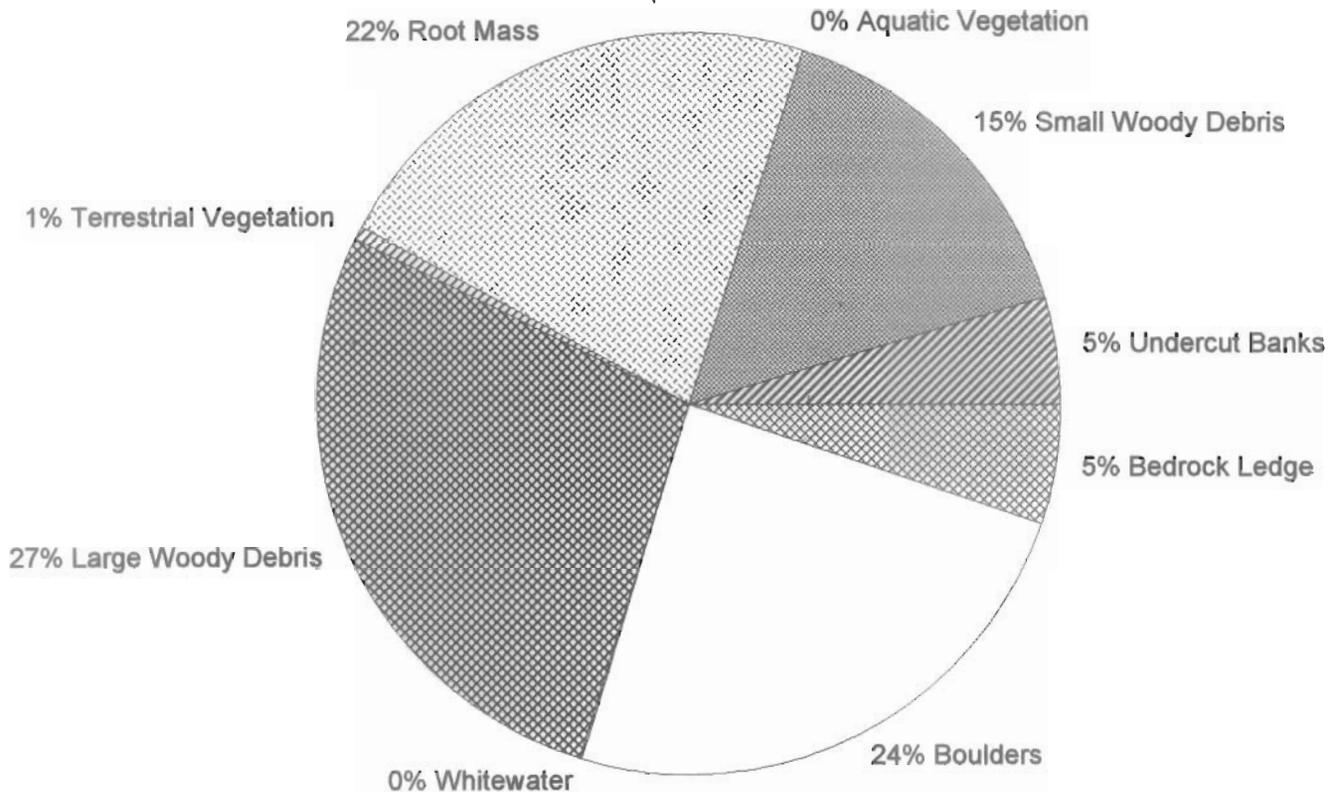Graph 4

Bearpen Creek
Percent Embeddedness by Reach

Reach 1 (F4)

(59%) Value 2
(13%) Value 1
(5%) Value 4
(23%) Value 3

Reach 2 (F3)

(34%) Value 2
(15%) Value 1
(7%) Value 4
(44%) Value 3

Reach 3 (F4)

(34%) Value 1
(9%) Value 4
(47%) Value 2
(9%) Value 3

Reach 4 (F3)

(8%) Value 1
(0%) Value 4
(6%) Value 3
(86%) Value 2
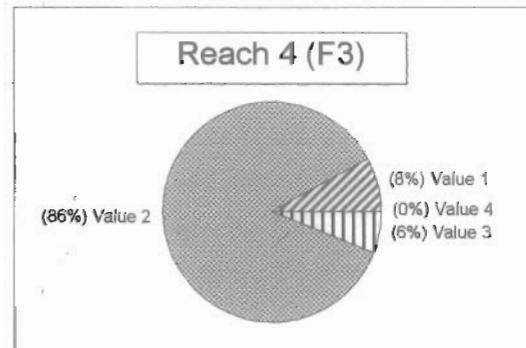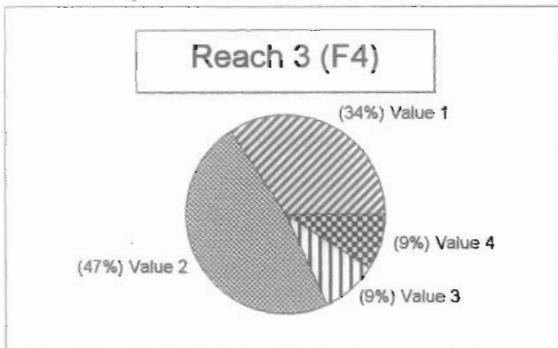
Value 1 = <25% Value 2 = 25-50% Value 3 = 51-75% Value 4 = >76%

Graph 5

Bearpen Creek

Percent Cover Types in Pools

22% Root Mass

0% Aquatic Vegetation

15% Small Woody Debris

1% Terrestrial Vegetation

5% Undercut Banks

5% Bedrock Ledge

27% Large Woody Debris

24% Boulders

0% Whitewater

Graph 6

Bearpen Creek
Mean Percent Canopy

(34%) Open

(10%) Deciduous Trees

(56%) Coniferous Trees

Graph 8
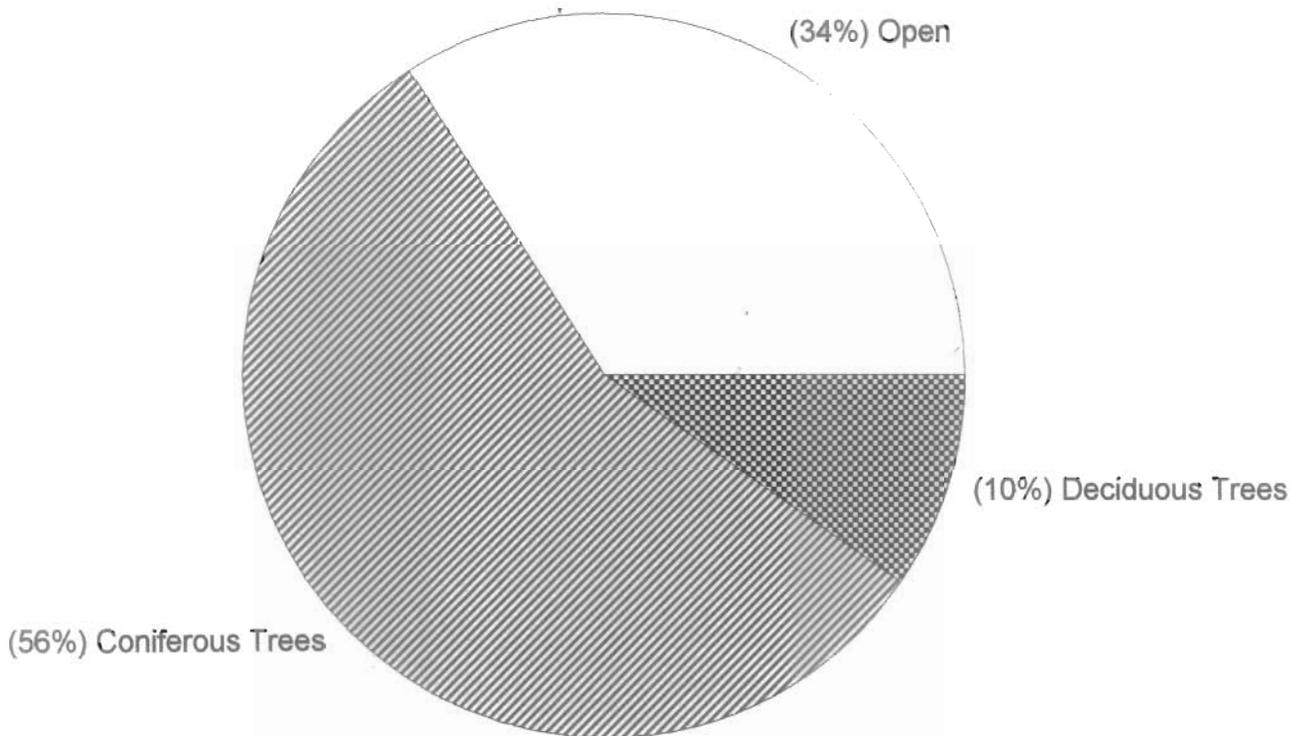
Bearpen Creek

Percent Bank Composition

Dominant Bank Substrate

(12%) Cobble/Gravel   (6%) Boulder

(16%) Bedrock

(66%) Silt/Clay
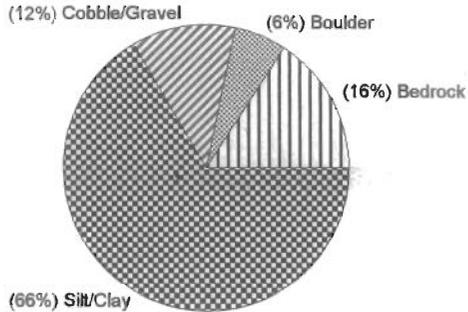
Dominant Bank Vegetation

(11%) Deciduous Trees

(0%) Brush
(3%) Grass

(77%) Coniferous Trees

(9%) Bare Soil

Graph 9
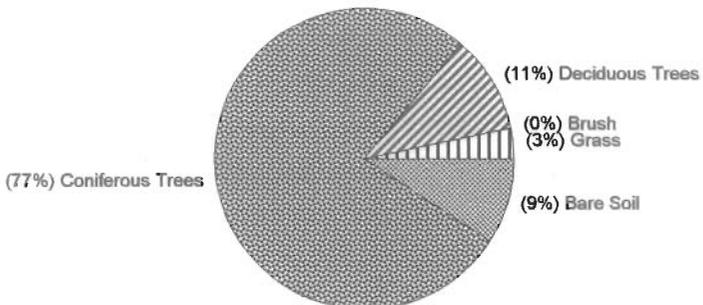
Bearpen Creek
Percent Canopy by Reach

Reach 1 (F4)
- (43%) Open
- (4%) Deciduous
- (53%) Coniferous

Reach 2 (F3)
- (30%) Open
- (49%) Coniferous
- (21%) Deciduous

Reach 3 (F4)
- (26%) Open
- (60%) Coniferous
- (14%) Deciduous

Reach 4 (F3)
- (26%) Open
- (4%) Deciduous
- (70%) Coniferous

Graph 11