CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Bear Canyon Creek
Report Revised April 14, 2006
Report Completed 2005
Assessment Completed 2001

INTRODUCTION

A stream inventory was conducted on August 2, 2001 on Bear Canyon Creek. The survey began at the confluence with Squaw Creek and extended upstream 5,882 feet.

The Bear Canyon Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Bear Canyon Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon, and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Bear Canyon Creek is a tributary to Squaw Creek, a tributary to Big Sulphur Creek, a tributary to the Russian River, a tributary to the Pacific Ocean, located in Sonoma County, California (Map 1). Bear Canyon Creek's legal description at the confluence with Squaw Creek is T11N R9W S1. Its location is 38.828125968527° north latitude and 122.815064288285° west longitude. Bear Canyon Creek is a first order stream and has approximately 7,081 feet of solid blue line stream according to the USGS Geysers 7.5 minute quadrangle. Bear Canyon Creek drains a watershed of approximately 0.7 square miles. Elevations range from about 1,880 feet at the mouth of the creek to 3,284 feet in the headwater areas. Shrub land dominates the watershed. The watershed is entirely privately owned. Vehicle access exists via Highway 101 to Geysers Road near Cloverdale. Follow Geysers Road east to the mouth of Bear Canyon Creek. Central California coast endangered species unit steelhead (*Oncorhynchus mykiss*) are a threatened species present in the Bear Canyon Creek watershed.

METHODS

The habitat inventory conducted in Bear Canyon Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al., 1998). The California Department of Fish and Game field crew that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail

crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

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 Bear Canyon 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 a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

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

3. Temperatures:

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

4. Habitat Type:

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

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Bear Canyon Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5

was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, bedrock, or other considerations.

6. Shelter Rating:

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

7. Substrate Composition:

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

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Bear Canyon Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated visually into percentages of evergreen or deciduous trees.

9. Bank Composition and Vegetation:

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

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Bear Canyon Creek. In addition, one site was electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat 8.4, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following tables:

- Summary of riffle, flatwater, and pool habitat types
- Summary of habitat types and measured parameters
- Summary of pool types
- Summary of maximum pool depths by pool habitat types
- Summary of mean percent cover by habitat type
- Summary of dominant substrates by habitat type
- Summary of fish habitat elements by stream reach

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Bear Canyon Creek include:

- Level II habitat types by % occurrence
- Level II habitat types by % total length
- Level IV habitat types by % occurrence
- Level I pool habitat types by % occurrence
- Maximum depth in pools
- Percent embeddedness estimated in pool tail-outs
- Mean percent cover types in pools
- Substrate composition in pool tail-outs
- Mean percent canopy
- Dominant bank composition in survey reach
- Dominant bank vegetation in survey reach

HABITAT INVENTORY RESULTS

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

The habitat inventory of August 2, 2001, was conducted by Mitsuko Terry and Jake Newell (DFG). The total length of the stream surveyed was 5,882 feet.

Stream flow was not measured on Bear Canyon Creek.

Bear Canyon Creek is an A2 channel type for 4,381 feet and a G3 for 1,501 feet of the stream surveyed. A2 channels are steep, narrow, cascading, step-pool streams with high energy/debris transport associated with depositional soils; very stable bedrock-dominant channels

Water temperatures taken during the survey period ranged from 62 to 66 degrees Fahrenheit. Air temperatures ranged from 69 to 79 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of *occurrence* there were 13% riffle units, 37% flatwater units, 37% pool units, 12% dry units, and 1% culvert units (Graph 1). Based on total *length* of Level II habitat types there were 5% riffle units, 58% flatwater units, 6% pool units, 29% dry units, and 3% culvert units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by

percent *occurrence* were step runs, 35%; mid-channel pools, 15%; and dry, 12% (Graph 3). Based on percent total *length*, step runs made up 57%, dry units 29%, and cascade and culvert units each 3%.

A total of 25 pools were identified (Table 3). Main-channel pools were the most frequently encountered, at 52%, and comprised 67% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Four of the 25 measured pools (16%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 25 pool tail-outs measured, zero had a value of 1; 12 had a value of 2 (48%); 11 had a value of 3 (44%); zero had a value of 4; and two had a value of 5 (8%), (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 2, and pool habitats had a mean shelter rating of 17 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 25. Main-channel pools had a mean shelter rating of 11 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Bear Canyon Creek. Graph 7 describes the pool cover in Bear Canyon Creek. Boulders are the dominant pool cover type followed by bedrock ledges.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was the dominant substrate observed in 44% of pool tail-outs while gravel was the next most frequently observed substrate type, at 24%.

The mean percent canopy density for the surveyed length of Bear Canyon Creek was 87%. The mean percentages of evergreen and deciduous trees were 70% and 17%, respectively. Thirteen percent of the canopy was open. Graph 9 describes the mean percent canopy in Bear Canyon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 9%. The mean percent left bank vegetated was 9%. The dominant elements composing the structure of the stream banks consisted of 41% bedrock, 20% boulder, 19% cobble/gravel, and 20% sand/silt/clay (Graph 10). Evergreen trees were the dominant vegetation type observed in 58% of the units surveyed. Additionally, 11% of the units surveyed had grass as the dominant vegetation type, and 9% had deciduous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

On 10/23/01 a biological inventory was conducted at two sites on Bear Canyon Creek to document fish species composition and distribution. Site 1 was between Lat. N 38:49’51.6”, Long. W 122:48’38.1” and Lat. N 38:49’48.8”, Long. W 122:48’26.8”. Fish from the site were counted by species, and returned to the stream. The air temperature ranged from 69-70ºF and the water

temperature ranged from 58-61ºF.

The inventory began at 1510 hours in Reach 3 and ended at 1600 hours 752' upstream. Habitat types surveyed were lateral scour pool - bedrock formed, mid-channel pools, runs and glides. The following table displays the information yielded from this site.

Species Observed	**Numbers Recorded at Site 1**
Steelhead YOY	8
Steelhead Y+	14
Steelhead 2+	3
Newt	6
Salamander	3
Tree Frog	1
Yellow-legged Frog	1

Site 2 was between Lat. N 38:49'43.0", Long. W 122:48'52.7" and N Lat. 38:49'41.3", Long. W 122:48'50.5". Fish from the site were counted by species, and returned to the stream. The air temperature ranged from 69-70ºF and the water temperature ranged from 57-58ºF.

The inventory began at 14:02 hours in Reach 2 and ended at 14:45 hours 129' upstream. Habitat types surveyed were lateral scour pool - bedrock formed, mid-channel pools, runs and glides. The following table displays the information yielded from this site.

Species Observed	**Numbers Recorded at Site 2**
Steelhead YOY	4
Steelhead Y+	7
Steelhead 2+	1
Newt	2
Salamander	1

There is no record of hatchery stocking or fish rescue/transfer operations in Bear Canyon Creek.

DISCUSSION

Bear Canyon Creek is an A2 channel type for the first 4,381 feet of stream surveyed and a G3 channel type for the remaining 1,501 feet. The suitability of A2 and G3 channel types for fish habitat improvement structures are as follows: A2 channel types are generally not suitable for fish habitat improvement structures. G3 channel types are good for bank-placed boulders, fair for plunge weirs, opposing wing deflectors and log cover, and poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days August 2, 2001, were above the suitable range for salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 58% of the total length of this survey, dry 29%, pools 6%, riffles 5%, and culverts 3%. The pools are relatively shallow, with only four of the 25 (16%) measured pools having a maximum depth greater than two feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream 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. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream.

Ten of the 25 pool tail-outs measured had embeddedness ratings of 1 or 2. Eleven of the pool tail-outs had embeddedness ratings of 3 or 4. Two of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Bear Canyon Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seventeen of the 25 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter for flatwater was 2. The mean shelter rating for pools was 17. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, bedrock ledges contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance 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.

The mean percent canopy density for the stream was 87%. Reach 1 had a canopy density of 87% while Reach 2 had a canopy density of 90%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was low at 9% and 9%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable

levels, planting endemic trees species, in conjunction with bank stabilization, is recommended.

GENERAL MANAGEMENT RECOMMENDATIONS

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

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

RECOMMENDATIONS

1) Due to the high gradient of the stream, access for migrating salmonids is an ongoing potential problem. Fish passage should be monitored and improved where possible.

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

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with log and root wad cover is desirable.

4) Inventory and map sources of stream bank 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.

5) The limited water temperature data available suggest that maximum temperatures are above the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for three to five years.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey.

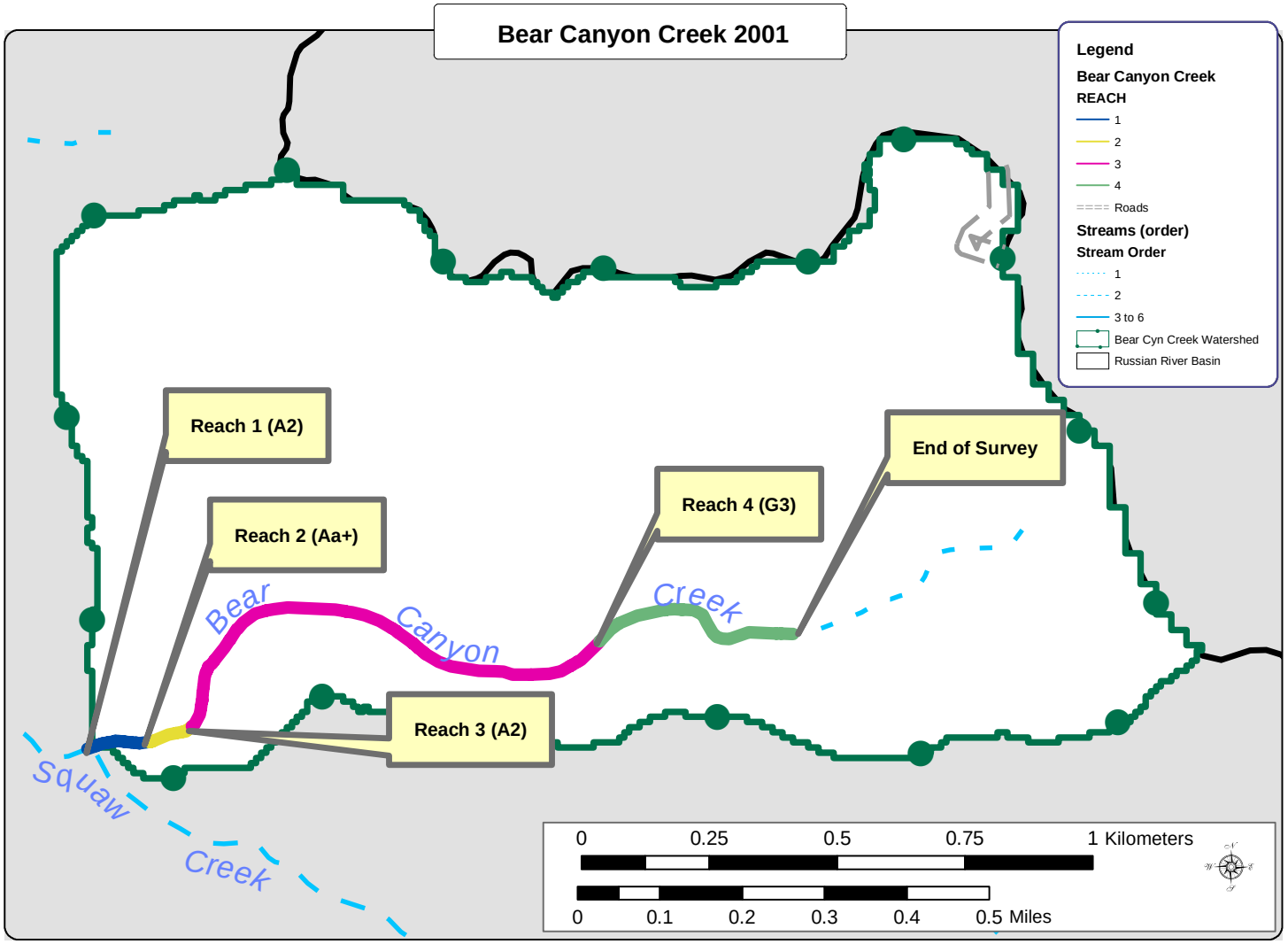
0'	Begin survey at confluence with Squaw Creek. Channel type is A2.
160'	YOY
167'	3' jump
216'	3' jump
229'	4' jump
328'	Erosion LB
398'	Channel Type change: A2a+ There is passage through on the dry side of the channel.
409'	Bedrock/Boulder accumulation
433'	2' jump, 3' jump YOY

608'	Series of 1'-2' jumps.
722'	YOY
739'	Channel Type change: A2
947'	Erosion LB
1001'	Gully LB. Salamanders. YOY (1)
1170'	1+ SH (2)
1177'	Passage okay in high flows.
1207'	1+, 2+ SH, 2' jump, 3' jump
1276'	Wet trib RB, Water Temp in trib: 65*F, Water Temp at conf: 60*F
1846'	Small dry trib RB, Fresh mountain lion kill, Large wet trib RB: 1+ SH
2777'	Series of 2'-4' jumps Erosion LB
2819'	1, 0.6" SH
2975'	Intermittent; Fish in some "pools"
3079'	Erosion RB, some trees perched across creek, also in creek - see form (accumulation/erosion) GULLY/BANK EROSION Active RB-D:15' L:80' W:100', Not effected upslope, debris influenced Comments: severe
3824'	2 dozen newts in a ball, 8' plunge
4171'	Gully RB, CULVERT L: 180' W: 8' – instream Downcutting: 3' Culvert lip to water level: 2' not retaining gravel, no maintenance required Comments: concrete/cobble laid on bottom - good for fish passage when there is flow
4381'	Dry- see culvert form Channel Type change: G3
4561'	2 dry tribs RB
4958'	ALL 3.0' D 30.0' L
4964'	Intermittent
5769'	4' jump with no pool beneath, Sulphur smell
5799'	END OF SURVEY: no fish seen since HU# 050

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

APPENDIX A: MAP



L:\mondo3\data\stream-maps\bearcyn2001.mxd

Prepared by: Ann-Marie Osterback, December 17, 2003

Bear Canyon Creek — Drainage: RUSSIAN RIVER

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 07/31/01 TO 08/01/01

Confluence Location: QUAD: GEYERS LEGAL DESCRIPTION: T11NR9WS1 LATITUDE:38°49'41" LONGITUDE:38°49'41"

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
9	8	RIFFLE	13	31	276	5	3.1	0.2	84	758	25	229	0	0
25	8	FLATWATER	37	136	3392	58	3.1	0.3	204	5111	79	1974	0	2
25	25	POOL	37	14	348	6	5.4	0.9	76	1896	67	1679	51	17
8	0	DRY	12	211	1686	29	0.0	0.0	0	0	0	0	0	0
1	0	CULVERT	1	180	180	3	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.)
68	41	5882	7765	3881

Bear Canyon Creek — Drainage: RUSSIAN RIVER

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 07/31/01 TO 08/01/01

Confluence Location: QUAD: GEYERS LEGAL DESCRIPTION: T11NR9WS1 LATITUDE:38°49'41" LONGITUDE:38°49'41"

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 %
3	2	HGR	4	31	94	2	3	0.2	0.3	66	198	13	40	0	0	83
5	5	CAS	7	34	171	3	4	0.3	0.9	106	531	35	176	0	0	89
1	1	BRS	1	11	11	0	1	0.1	0.2	11	11	1	1	0	0	85
1	1	RUN	1	42	42	1	1	0.1	0.2	25	25	3	3	0	0	95
24	7	SRN	35	140	3350	57	3	0.4	1.9	230	5521	90	2157	0	2	86
10	10	MCP	15	10	102	2	6	1.0	2.5	55	550	59	590	47	12	90
3	3	STP	4	44	132	2	6	0.8	1.7	268	803	191	574	149	8	85
1	1	CRP	1	13	13	0	3	0.6	0.9	39	39	23	23	0	35	80
1	1	LSR	1	6	6	0	4	0.8	1.3	24	24	19	19	0	100	95
4	4	LSBk	6	11	42	1	6	1.0	2.0	53	210	51	206	43	18	93
5	5	LSBo	7	9	46	1	5	1.0	2.6	46	228	47	233	34	17	90
1	1	PLP	1	7	7	0	6	0.8	1.1	42	42	34	34	0	5	90
8	0	DRY	12	211	1686	29	0	0.0	0.0	0	0	0	0	0	0	80
1	0	CUL	1	180	180	3	0	0.0	0.0	0	0	0	0	0	0	0

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
68	41	5882	8182	4055

Bear Canyon Creek — Drainage: RUSSIAN RIVER

Table 3 - SUMMARY OF POOL TYPES — Survey Dates: 07/31/01 TO 08/01/01

Confluence Location: QUAD: GEYERS LEGAL DESCRIPTION: T11NR9WS1 LATITUDE:38°49'41" LONGITUDE:38°49'41"

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
13	13	MAIN	52	18	234	67	5.7	1.0	104	1353	90	1164	71	11
12	12	SCOUR	48	10	114	33	5.0	0.9	45	543	43	515	29	25

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
25	25	348	1896	1679

Bear Canyon Creek — Drainage: RUSSIAN RIVER

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES — Survey Dates: 07/31/01 TO 08/01/01

Confluence Location: QUAD: GEYERS LEGAL DESCRIPTION: T11NR9WS1 LATITUDE:38°49'41" LONGITUDE:38°49'41"

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
10	MCP	40	1	10	7	70	2	20	0	0	0	0
3	STP	12	0	0	3	100	0	0	0	0	0	0
1	CRP	4	1	100	0	0	0	0	0	0	0	0
1	LSR	4	0	0	1	100	0	0	0	0	0	0
4	LSBk	16	0	0	3	75	1	25	0	0	0	0
5	LSBo	20	0	0	4	80	1	20	0	0	0	0
1	PLP	4	0	0	1	100	0	0	0	0	0	0

TOTAL UNITS
25

Bear Canyon Creek — Drainage: RUSSIAN RIVER

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE — Survey Dates: 07/31/01 TO 08/01/01

Confluence Location: QUAD: GEYERS LEGAL DESCRIPTION: T11NR9WS1 LATITUDE:38°49'41" LONGITUDE:38°49'41"

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
3	0	HGR	0	0	0	0	0	0	0	0	0
5	0	CAS	0	0	0	0	0	0	0	0	0
1	0	BRS	0	0	0	0	0	0	0	0	0
1	0	RUN	0	0	0	0	0	0	0	0	0
24	3	SRN	0	0	0	0	5	0	0	78	17
10	10	MCP	10	9	5	15	0	0	0	35	27
3	3	STP	0	10	0	0	3	0	0	48	38
1	1	CRP	30	70	0	0	0	0	0	0	0
1	1	LSR	0	50	0	50	0	0	0	0	0
4	4	LSBk	0	0	0	0	0	0	0	26	74
5	5	LSBo	0	7	0	0	0	0	0	87	6
1	1	PLP	0	0	0	0	0	0	0	100	0
8	0	DRY	0	0	0	0	0	0	0	0	0
1	0	CUL	0	0	0	0	0	0	0	0	0

Bear Canyon Creek — Drainage: RUSSIAN RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE — Survey Dates: 07/31/01 TO 08/01/01

Confluence Location: QUAD: GEYERS LEGAL DESCRIPTION: T11NR9WS1 LATITUDE:38°49'41" LONGITUDE:38°49'41"

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
3	2	HGR	0	0	0	50	50	0	0
5	4	CAS	0	0	0	0	0	50	50
1	1	BRS	0	0	0	0	0	0	100
1	1	RUN	0	0	100	0	0	0	0
24	8	SRN	0	0	0	38	13	25	25
10	6	MCP	0	0	17	50	0	0	33
3	3	STP	0	0	0	0	33	0	67
1	0	CRP	0	0	0	0	0	0	0
1	1	LSR	0	0	100	0	0	0	0
4	3	LSBk	0	33	33	0	0	0	33
5	3	LSBo	0	0	100	0	0	0	0
1	1	PLP	0	0	0	0	0	0	100
8	1	DRY	0	0	0	100	0	0	0
1	0	CUL	0	0	0	0	0	0	0

TABLE 8. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: Bear Canyon Creek
SAMPLE DATES:
STREAM LENGTH: 5882 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: GEYERS — Latitude: 38°49'41"
Legal Description: T11NR9WS1 — Longitude: 38°49'41"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 1

Channel Type: A2	Canopy Density: 87%
Channel Length: 4381 ft.	Coniferous Component: 81%
Riffle/flatwater Mean Width: 3 ft.	Deciduous Component: 19%
Total Pool Mean Depth: 1.0 ft.	Pools by Stream Length: 7%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 0%
Water: 63 - 66 °F Air: 69 -79 °F	Mean Pool Shelter Rtn: 13
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Boulders
Vegetative Cover: 8%	Occurrence of LOD: 2%
Dom. Bank Substrate: Bedrock	Dry Channel: 1296 ft.

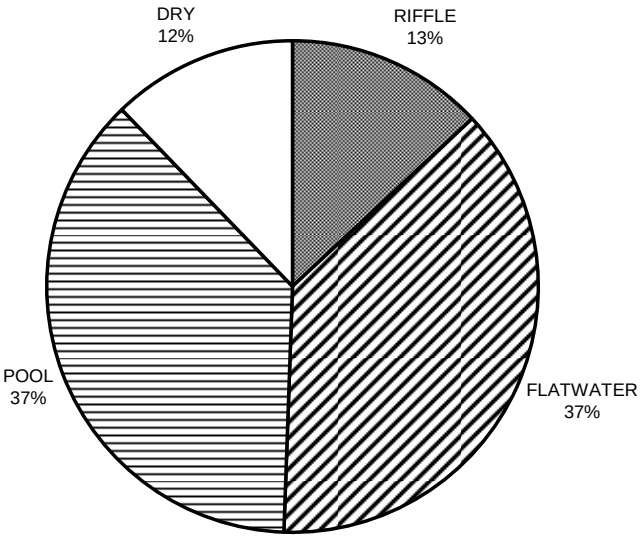
Embeddness Value: 1. 5% 2.50% 3. 36% 4. 0% 5. 9%

STREAM REACH 2

Channel Type: G3	Canopy Density: 90%
Channel Length: 1501 ft.	Coniferous Component: 76%
Riffle/flatwater Mean Width: 2 ft.	Deciduous Component: 24%
Total Pool Mean Depth: 0.7 ft.	Pools by Stream Length: 2%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 0%
Water: 62 - 66 °F Air: 75 -76 °F	Mean Pool Shelter Rtn: 47
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Small Woody Debris
Vegetative Cover: 17%	Occurrence of LOD: 0%
Dom. Bank Substrate: Bedrock	Dry Channel: 390 ft.

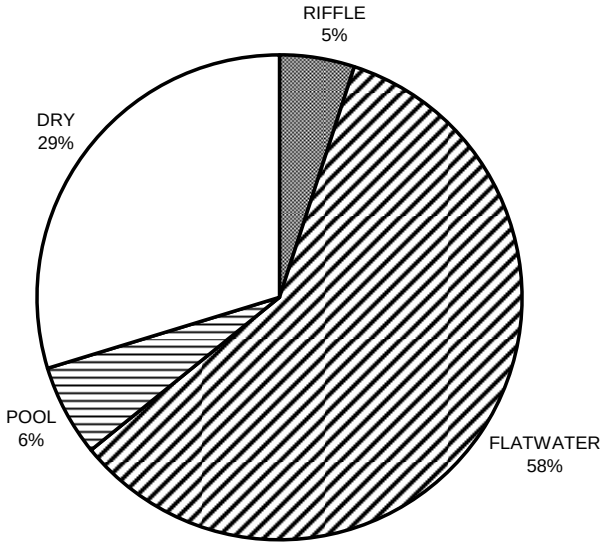
Embeddness Value: 1. 0% 2.33% 3. 67% 4. 0% 5. 0%

BEAR CANYON CREEK
LEVEL II HABITAT TYPES BY PERCENT OCCURRENCE



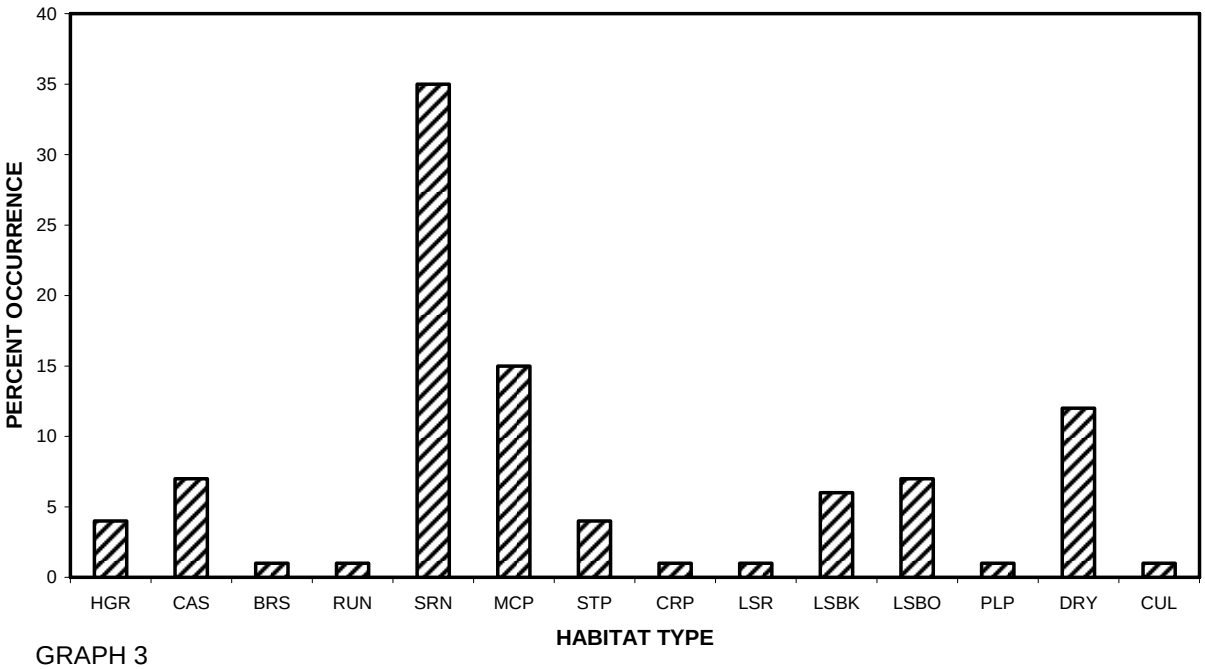
GRAPH 1

BEAR CANYON CREEK
LEVEL II HABITAT TYPES BY PERCENT TOTAL LENGTH



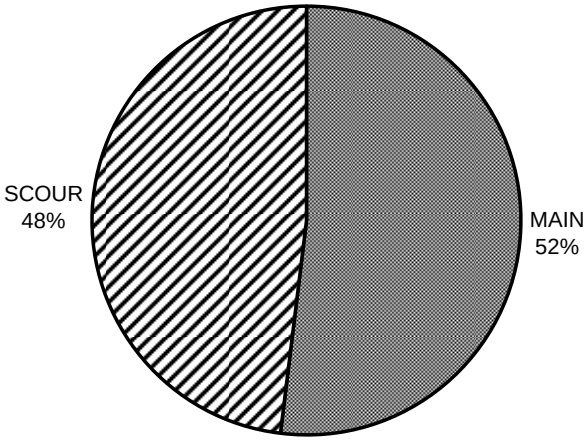
GRAPH 2

BEAR CANYON CREEK
LEVEL IV HABITAT TYPES BY PERCENT OCCURRENCE



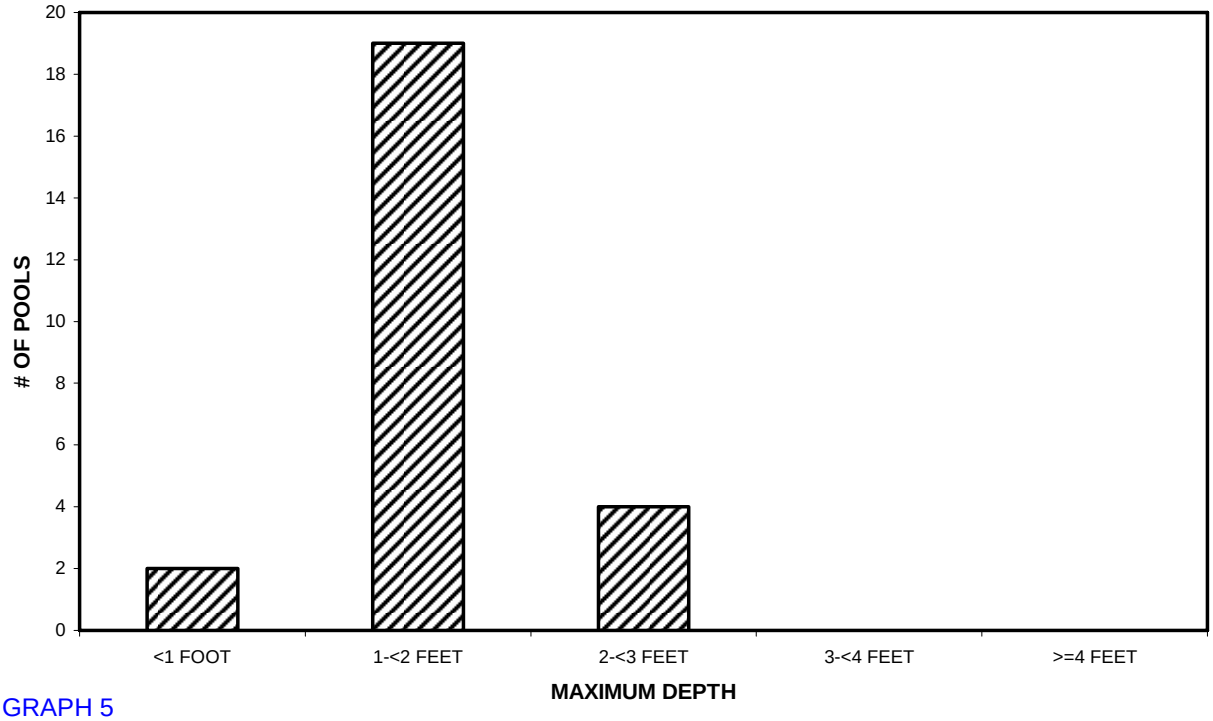
GRAPH 3

BEAR CANYON CREEK
LEVEL I POOL HABITAT TYPES BY PERCENT OCCURRENCE



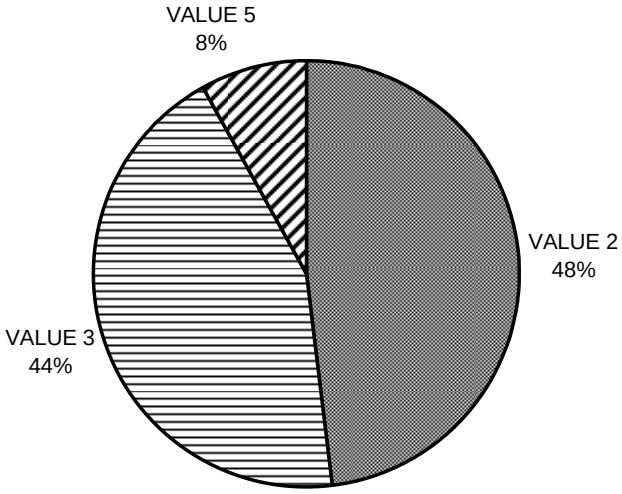
GRAPH 4

BEAR CANYON CREEK
MAXIMUM DEPTH IN POOLS



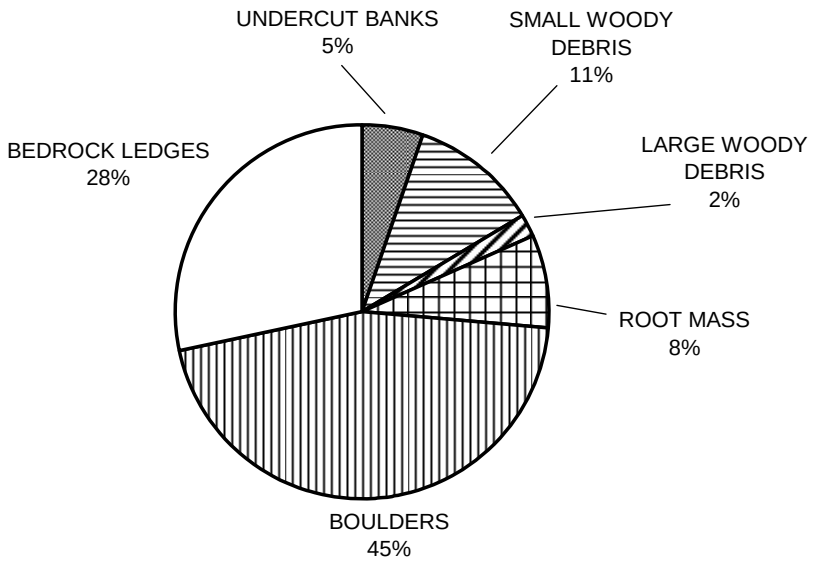
GRAPH 5

BEAR CANYON CREEK
PERCENT EMBEDDEDNESS



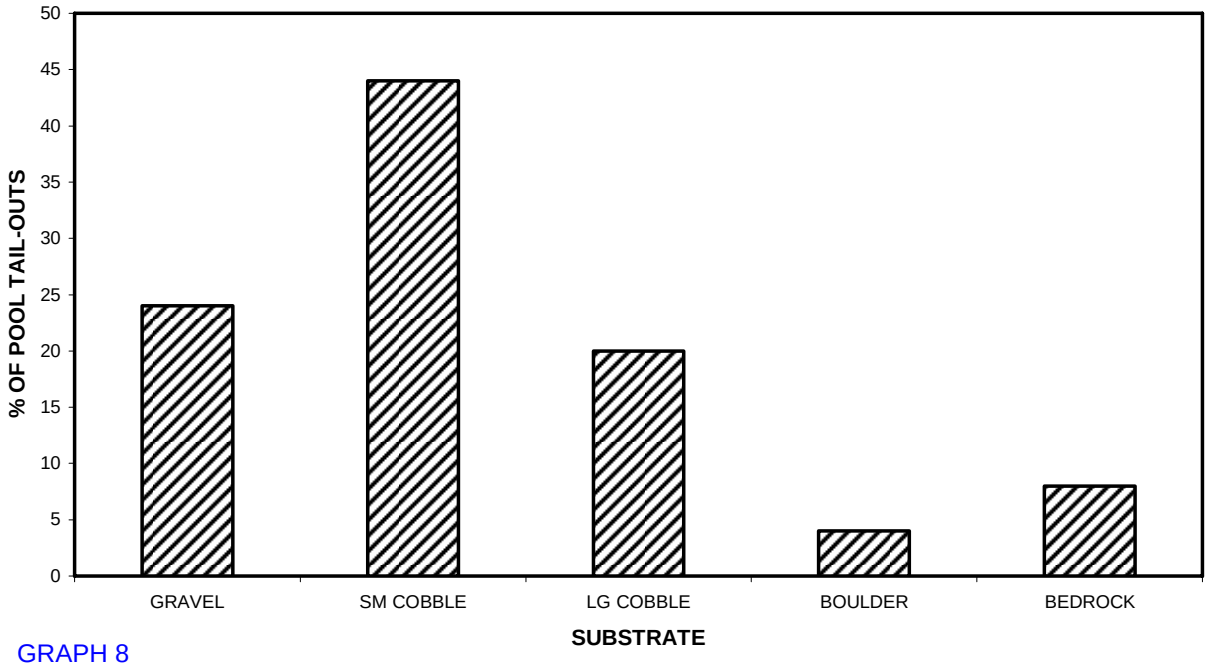
GRAPH 6

BEAR CANYON CREEK
MEAN PERCENT COVER TYPES IN POOLS



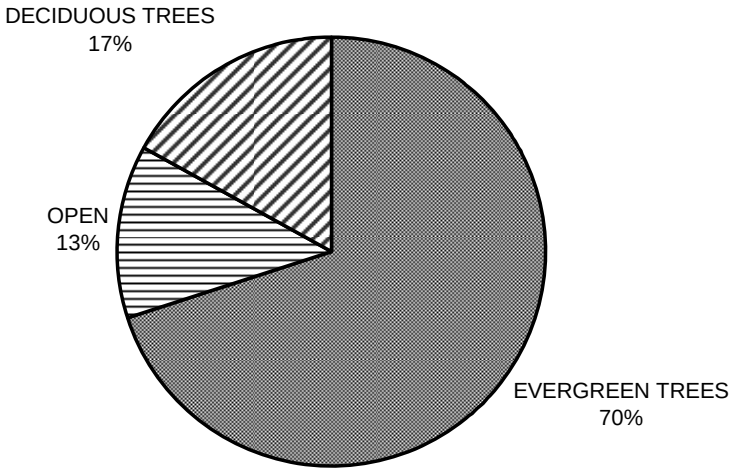
GRAPH 7

BEAR CANYON CREEK
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



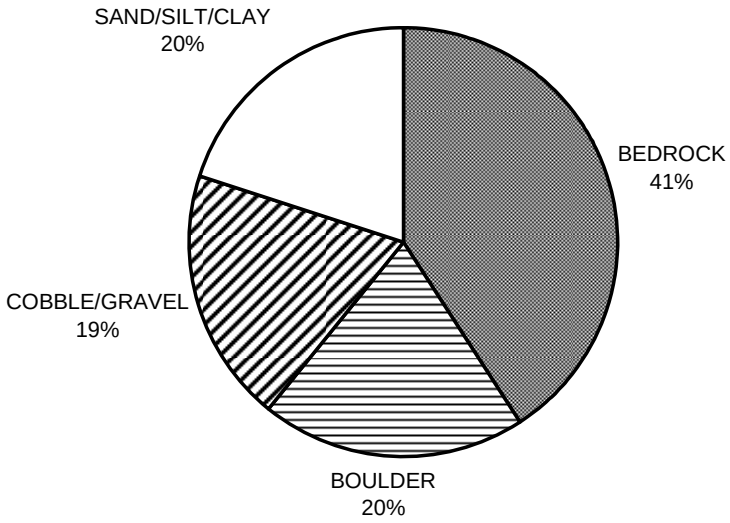
GRAPH 8

BEAR CANYON CREEK
MEAN PERCENT CANOPY



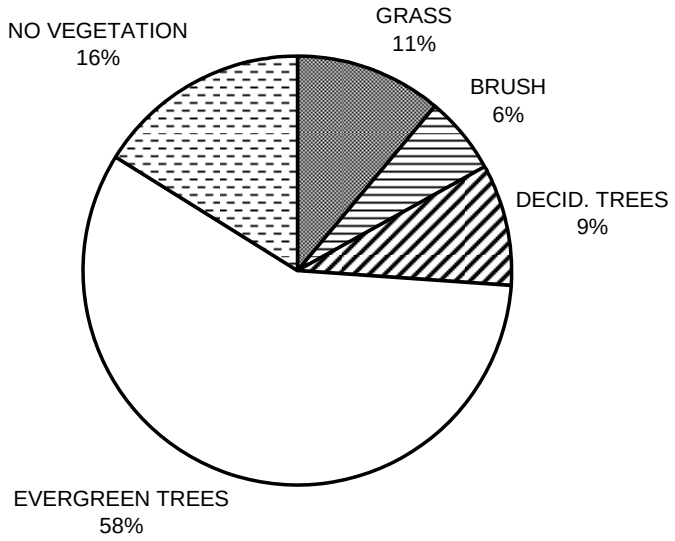
GRAPH 9

BEAR CANYON CREEK
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

BEAR CANYON CREEK
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Watershed Hydroid **404** Bear Canyon Creek

Hydrologic Sub-Areas covered by the watershed:

Name:	LLId: (1:24k)	County:
Bear Canyon Creek	1228150388281	Sonoma

Tributary to Squaw Creek
Tributary to Big Sulphur Creek
Tributary to Russian River

Location: **T:** 11N **R:** 09W **S:** 1 **Latitude:** 38.8281259685279 **Longitude** 122.815064288285

Hydrologic Boundary Delineation: Watershed boundaries were delineated using the Watershed Point tool in ArcHydro, running under ArcMap 8.3 (ArcInfo version). A 1:24k stream network was "burned" into the underlying DEM to enforce hydrologic routing.

Aerial Photos (Source): For Mendocino County watersheds, 1993 USGS DOQQs are available in the Teale Albers, NAD27 projection. For Sonoma County watersheds, 2000 County-created orthophotos in the State Plane, NAD83 projection are also available.

Stream Order: 1 **Total Length:** 1.34 Miles (2.16 Km) Note: Length is for the USGS blue-line 1:24,000 stream.

Note: Stream order is by Strahler method, recorded in CDF-NCWAP "nchydro1" 1:24k streams layer.

Drainage Area: 199 Hectares; 491 Acres; 0.76 sq. mi.

Elevations: Mouth: 1880 feet; Headwaters: 3284 feet

Note: Headwaters elevation is the highest elevation found in the watershed.

Lakes in Watershed: Number: 0 Surface area: 0 sq. mi.

Note: Source for lakes data is the USGS-DFG 1:100k lakes layer "lakes.shp"

Fish Species (as indicated by historical salmonid streams layer created by Bob Coey): Steelhead

Ownership, for the watershed, in acres (and % of total watershed):

Federal:	State:	Local:	Private:
0.0 acres	0.0	0.0	491.5
0.00 %	0.00 %	0.00 %	100.00 %

Note: Source for owneship data is 2002 DFG-CCR "ccr_public_lands.shp" GIS layer.

Major Land Uses in the Watershed, in acres (and % of total watershed)

Mixed hardwood/conifer:	Hardwood:	Conifer:	Agriculture:	Urban:
34.74 acres	75.52	11.11	0.00	4.47
7.1 %	15.4 %	2.3 %	0.0 %	0.9 %

Shrub:	Herbaceous:	Barren/rock:	Water:
316.29	16.06	30.73	0.00
64.7 %	3.3 %	6.3 %	0.0 %

Note: Land use areas were calculated using the 1994 CDF-USFS "Calveg" GIS layer.

USGS 7.5' Topographic Quads completely or partially in the watershed:

Quad Name	USGS Code
THE GEYSERS	38122G7

Endangered/Threatened/Sensitive Species: (California Natural Diversity Database, May 5, 2003 version)

Scientific Name	Common Name
Oncorhynchus mykiss irideus	steelhead-central California coast esu

Hydrologic Sub-Areas covered by the watershed

Hydrologic Sub-Area Name:	ID code (RBUAS)	Hydrologic Area Name	% of watershed in this HSA
Sulphur Creek	111426	Middle Russian River	99.68
Lakeport	551355	Upper Cache Creek	0.32