STREAM INVENTORY REPORT

Grizzly Creek, 2006

INTRODUCTION

A stream inventory was conducted from 6/19/2006 to 7/5/2006 on Grizzly Creek. The survey began at the confluence with Van Duzen River and extended upstream 2.9 miles.

The Grizzly 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 Grizzly 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.

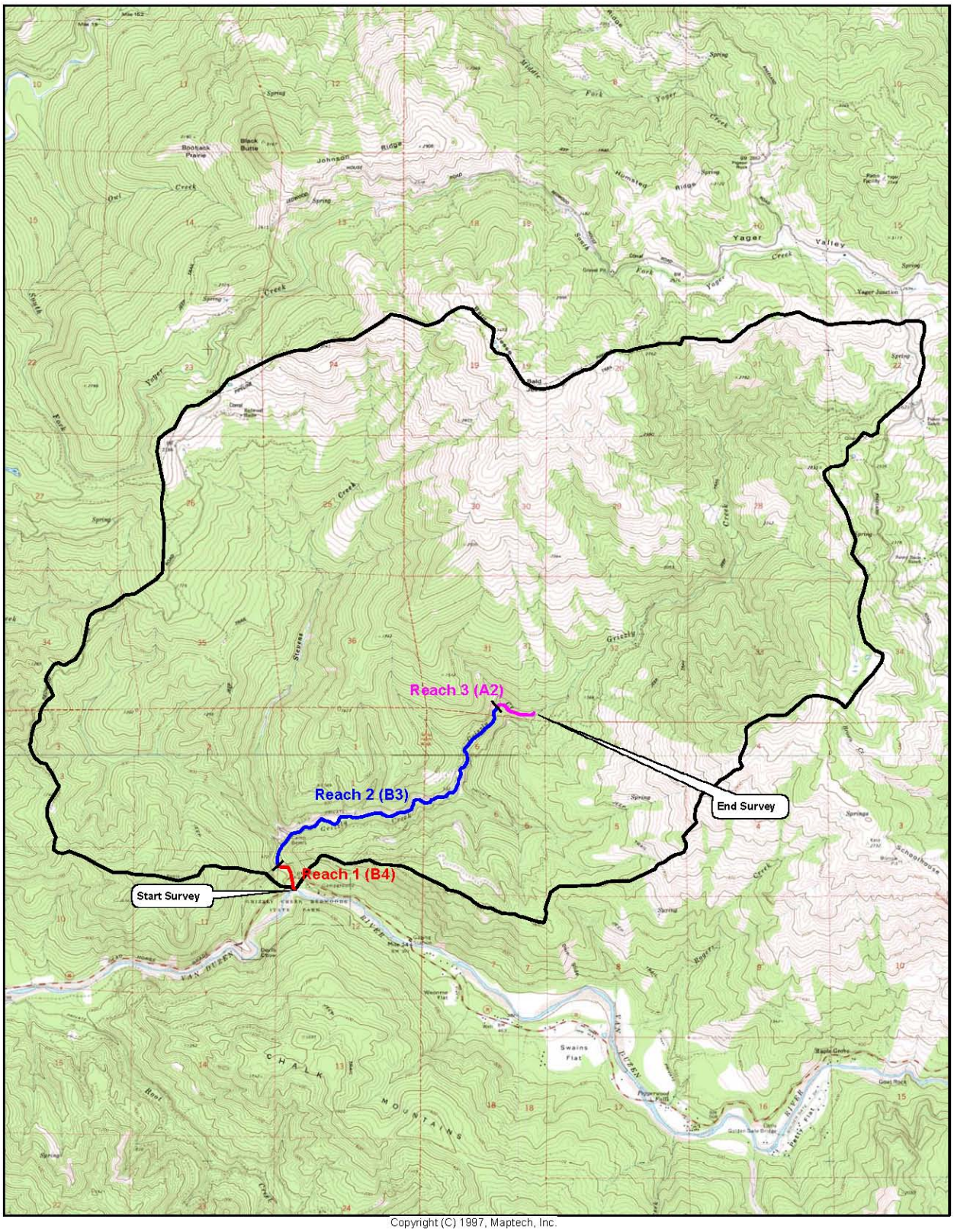
WATERSHED OVERVIEW

Grizzly Creek is a tributary to the Van Duzen River, a tributary to Eel River, a tributary to the Pacific Ocean, located in Humboldt County, California (Map 1). Grizzly Creek's legal description at the confluence with Van Duzen River is T01N R02E S12. Its location is 40°29'10.0" north latitude and 123°54'18.0" west longitude, LLID number 1239050404861. Grizzly Creek is a third order stream and has approximately 13.87 miles of blue line stream according to the USGS Owl Creek 7.5 minute quadrangle. Grizzly Creek drains a watershed of approximately 18.9 square miles. Elevations range from about 358 feet at the mouth of the creek to 2,500 feet in the headwater areas (average elevation of headwaters, not highest point). Redwood forest dominates the watershed. The lower watershed is in Grizzly Creek State Park and the remainder of the watershed is privately owned and managed primarily for timber production. Vehicle access exists via a private road, as well as mouth access through Grizzly Creek State Park off of Highway 36, approximately 17 miles east of the Highway 101 junction.

METHODS

The habitat inventory conducted in Grizzly Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP) Members 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.

Grizzly Creek



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. All pools except step-pools are fully sampled.

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 Grizzly Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near 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 (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 (1990). 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". Grizzly 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 Grizzly Creek, embeddedness was ocularly 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 like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile 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 for prey. 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 Grizzly 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 ocularly 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 Grizzly 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 ocularly into percentages of coniferous or hardwood 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 Grizzly 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.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

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 Grizzly Creek. In addition, seven sites were 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 Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream

Grizzly Creek

- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

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

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HABITAT INVENTORY RESULTS

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

The habitat inventory of 6/19/2006 to 7/5/2006 was conducted by T. Fisher and D. Heaton (WSP). The total length of the stream surveyed was 15,557 feet with an additional 292 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 2.9 cfs on 6/19/2006.

Grizzly Creek is a B4 channel type for 1,368 feet of the stream surveyed (Reach 1), an B3 channel type for 12,634 feet of the stream surveyed (Reach 2), and an A2 channel type for 1,555 feet of the stream surveyed (Reach 3).

B4 channel types are moderately entrenched with a moderate gradient and are riffle dominated channels with infrequently spaced pools. B4 channels have a very stable plan and profile with stable banks and gravel channel. B3 channel types are moderately entrenched with a moderate gradient and are riffle dominated channels with infrequently spaced pools. B3 channels have a very stable plan and profile with stable banks and cobble channel. A2 channel types are steep, narrow, cascading, step-pool streams with high energy/debris transport associated with depositional soils and boulder channel.

Water temperatures taken during the survey period ranged from 59 to 68 degrees Fahrenheit. Air temperatures ranged from 54 to 74 degrees Fahrenheit.

Grizzly Creek

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 45% riffle units, 34% pool units, 21% flatwater units (Graph 1). Based on total length of Level II habitat types there were 47% riffle units, 31% pool units, 22% flatwater units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 35% low gradient riffle units, 19% run units and 11% mid-channel pool units (Graph 3). Based on percent total length, there were 40% low gradient riffle units, 19% run units and 9% mid-channel pool units.

A total of 81 pools were identified (Table 3). Scour pools were the most frequently encountered, at 53% (Graph 4), and comprised 49% of the total length of all pools (Table 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-one of the 81 (26%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 81 pool tail-outs measured, 31 had a value of 1 (38.3%); 40 had a value of 2 (49.4%); 5 had a value of 3 (6.2%); 5 had a value of 5 (6.2%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions 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 such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each fully measured 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 13, flatwater habitat types had a mean shelter rating of 18, and pool habitats had a mean shelter rating of 39 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 41, scour pools had a mean shelter rating of 38, and backwater pools had a mean shelter rating of 30 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Grizzly Creek. Graph 7 describes the pool cover in Grizzly Creek. Boulders are the dominant pool cover type followed by large woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was observed in 62% of pool tail-outs and gravel was observed in 17% of pool tail-outs.

The mean percent canopy density for the surveyed length of Grizzly Creek was 70%. Thirty percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 52% and 48%, respectively. Graph 9 describes the mean percent canopy in Grizzly Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 88%. The mean percent left bank vegetated was 86%. The dominant elements composing the structure of the

stream banks consisted of 16% bedrock, 35% boulder, 34% cobble/gravel, and 15% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 51% of the units surveyed. Additionally, 44% of the units surveyed had coniferous trees as the dominant vegetation type, and 4% had grass as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Seven sites were electrofished for species composition and distribution in Grizzly Creek on July 13, 2006. Water temperatures taken during the electrofishing period 10:20-16:00 ranged from 62 to 64 degrees Fahrenheit. Air temperatures ranged from 62 to 64 degrees Fahrenheit. The sites were sampled by T. Fisher, D. Heaton and E. Meiners (WSP) and P. Divine (DFG).

In reach 1, which comprised the first 1,368 feet of stream, 2 sites were sampled. The sites yielded 33 young-of-the-year steelhead/rainbow trout (SH/RT) and 12 age 1+ SH/RT.

In reach 2, five sites were sampled starting approximately 2,938 from the confluence with the Van Duzen River and continuing upstream 12,634 feet. The 5 sites yielded 133 young-of-the-year SH/RT, 12 age 1+ SH/RT, two age 2+ SH/RT and one lamprey. Reach 3 was not sampled.

The following chart displays the information yielded from these sites:

2006 Grizzly Creek E-fish Observations:

Date	Site #	Hab. Unit #	Hab. Type	Approx. Dist. from mouth (ft.)	Coho		SH/RT		
					YOY	1+	YOY	1+	2+
Reach 1 B4 Channel Type									
07/13/06	1	014	5.2	1,241	0	0	15	6	0
07/13/06	2	016	4.2	1,368	0	0	18	6	0
Reach 2 F3 Channel Type									
07/13/06	3	035	5.3	2,938	0	0	10	2	0
07/13/06	4	060	4.4	4,780	0	0	28	3	0
07/13/06	5	077	4.2	6,304	0	0	20	1	0
07/13/06	6	098	5.2	8,256	0	0	31	1	1
07/13/06	7	116	5.2	9,482	0	0	34	5	1

DISCUSSION

Grizzly Creek is a B4 channel type for the first 1,368 feet of stream surveyed and a B3 channel type for the next 12,634 feet and an A2 channel type for the remaining 1,555 feet. The suitability of B4, B3, and A2 channel types for fish habitat improvement structures is as follows: B channel types are excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing deflectors, as well as for log cover. An A2 channel type is generally not suitable for habitat improvement structures as it is a high energy stream with stable banks and poor gravel retention capabilities.

The water temperatures recorded on the survey days 6/19/2006 to 7/5/2006, ranged from 59 to 68 degrees Fahrenheit. Air temperatures ranged from 54 to 74 degrees Fahrenheit. To make any 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 22% of the total length of this survey, riffles 47%, and pools 31%. The pools are relatively shallow, with only 21 of the 81 (26%) pools having a maximum residual depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum residual depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Seventy-one of the 81 pool tail-outs measured had embeddedness ratings of 1 or 2. Five of the pool tail-outs had embeddedness ratings of 3 or 4. Five 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.

Sixty-four of the 81 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 39. The shelter rating in the flatwater habitats was 18. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Grizzly Creek. Boulders are the dominant cover type in pools followed by large woody debris. 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 70%. Reach 1 had a canopy density of 66%, Reach 2 had a canopy density of 69%, and Reach 3 had a canopy density of 78%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 88% and 86%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of

coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Grizzly Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within 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 3 to 5 years.

3) In reach one and two, 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.

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

5) Increase the canopy on Grizzly Creek by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

COMMENTS AND LANDMARKS

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

Position (ft.):	Habitat Unit #:	Comments:
0	0001.00	Start of survey at confluence with Van Duzen River
335	0004.00	Highway 36 bridge
706	0006.00	Grizzly Creek channel appears to be out of the hydraulic influence of Van Duzen River
952	0009.00	Erosion left bank, 50’ long x 50’ high
1212	0012.00	Log debris accumulation (LDA),11’ high x 20’ wide x 30’ long; approximately10 pieces Large woody debris (LWD); water flows through with visible gaps; no sediment retention; fish seen above LDA; not a barrier to juvenile/adult salmonids
1368	0016.00	Channel type change from B4 to B3

Grizzly Creek

Position (ft.):	Habitat Unit #:	Comments:
1976	0022.00	Tributary #1 enters right bank; flow measured at 0.55 cfs and contributes approximately 10% to downstream flow; Water temperature of tributary 61º F; accessible to fish; steelhead juveniles observed
2342	0025.00	Scour log with large woody debris and boulders
2509	0027.00	Boulder weir with associated large and small woody debris
2637	0029.00	Tributary #2 enters right bank (Stephens Creek) flow measured at 1.08 cfs and contributes approximately 10% to downstream; Water temperature 62º F; accessible to fish; steelhead juveniles observed
2938	0035.00	Right bank cover log
3574	0042.00	Log debris accumulation (LDA):12’ high x 25’ wide x 25’ long; approximately 13 pieces with water flowing through and visible gaps; no sediment retention; fish observed above LDA; not a barrier to juvenile/adult salmonids
3637	0044.00	Cover log
4661	0058.00	Left bank boulder wing deflector and right bank cover log
4780	0060.00	Wing deflector on right bank at downstream end of unit, a series of four boulder weirs create a 353 feet long step pool unit
5133	0061.00	Tributary #3 enters right bank; flow estimated at less than 0.1 cfs; contributes approximately 0.1% to downstream flow; Water temperature of tributary is 57º F; not accessible to fish; channel slope approximately 27%; no fish observed, checked upstream100 feet
5163	0062.00	Log weir with large plunge pool, cover logs extending into pool on right and left banks
5395	0064.00	Wing deflector
5439	0065.00	Small active slide on left bank 20’ high x 25’ long; seep and sheared bedrock
5494	0066.00	Tributary #4 enters right bank; flow estimated at 0.3 cfs and contributes approximately 2% to downstream flow; water temperature of tributary is 59º F; not accessible to fish, channel slope approximately 17%; checked up tributary 100 feet, no fish observed
5601	0068.00	Seep in left bank Left bank spider log structure
5689	0069.00	Small old slide on left bank
5967	0071.00	Digger log
7182	0085.00	Seep left bank
7265	0086.00	Seep left bank
7471	0089.00	Left bank erosion generated out of an old, much larger landslide 120' long x 70' high.

Grizzly Creek

Position (ft.):	Habitat Unit #:	Comments:
7677	0091.00	Seep left bank
8032	0096.00	Seep right bank
9150	0110.00	Right bank erosion 50' long x 10' high
9322	0113.00	Seep right bank
9482	0116.00	Digger log
9884	0122.00	Tributary #5 enters left bank; flow estimated at 1 cfs and contributes approximately 15% of downstream flow; water temperature of tributary is 58º F; accessible to fish, juvenile salmonids observed, checked upstream 150'-200'; channel slope approximately 6%
9884	0122.00	Collapsed log stringer bridge 100 feet upstream of tributary
10038	0123.00	Steel railroad car, 20' wide x 14.5' high x 40' long; haul road vehicle bridge; recently constructed
10062	0124.00	Boulder weir
10149	0126.00	Boulder weir
10221	0127.00	Cover log structure
10276	0128.00	Boulder weir
10409	0131.00	Boulders with cover log
10452	0132.00	Digger logs with boulders on left bank
10562	0135.00	Right bank erosion, 100' long x 50' high, large mid-channel bar associated with slide area
10562	0135.00	LDA, 4' high x 40' wide x 30' long; water flows through with visible gaps in LDA; no sediment retention; fish observed above LDA; not a barrier to juvenile or adult salmonids
10869	0138.00	Tributary #6 enters right bank; flow estimated at 0.3 cfs and contributes less than 1% to downstream flow; Water temperature 61ºF; inaccessible to fish, checked up tributary 20 feet; no fish observed
11096	0144.00	Bank erosion on right and left banks; slide is approximately 200 feet long
11096	0144.00	LDA, 50' long x 50' wide x 15' high; approximately 75 pieces of LWD; water flows through with visible gaps and no sediment retention; fish observed above LDA; not a likely barrier to juvenile or adult salmonids
11142	0145.00	Seep right bank
11540	0151.00	Right bank erosion: 200' long x 20' high; small seep right bank
11798	0153.00	Left bank erosion: 70' long x 15' high; sheared bedrock
12286	0160.00	LDA, 15' high x 50' wide x 50' long; approximately 30 pieces of LWD; water flows through with visible gaps and no sediment retention; not a

Grizzly Creek

Position (ft.):	Habitat Unit #:	Comments:
		likely barrier to juvenile or adult salmonids; Large active landslides on both right and left banks
12534	0164.00	LDA, 15' high X 70' wide x 80' long; approximately 50 pieces of LWD; water flows through with visible gaps and no sediment retention; fish observed above LDA; not a likely barrier to juvenile or adult salmonids
12599	0167.00	Right bank erosion
12768	0170.00	Left and right bank erosion
12954	0173.00	Large boulder, approximately 6 cubic yards in size obstructing channel creating side channel and LDA
13018	0173.01	LDA, 12' high x 20' wide x 20' long; approximately 30 pieces of LWD; water flows through, no visible gaps, no sediment retention; fish observed above LDA; possible barrier to juvenile and adult salmonids
13107	0176.00	LDA, 15' high x 35' wide x 70' long; approximately 100 or more pieces of LWD; water flows through, no visible gaps; retaining sediment ranging from silt to boulder approximately 50' wide x 95'long x 15' deep; fish observed above LDA; possible juvenile and adult salmonid barrier do to a 5' high plunge Bank erosion at right and left bank.
13180	0178.00	Young of the year salmonids observed
13690	0192.00	LDA, partially washed out 7' high x 30' wide x 25' long; approximately 25 pieces of LWD, water flows through with visible gaps and no sediment retention; fish observed above LDA; not a barrier to salmonids
13860	0194.00	LDA, 14' high x 60' wide x 50' long; approximately 50 pieces of LWD; water flows through with visible gaps and no sediment retention (although there is evidence of past sediment retention build-up on right bank); fish observed above LDA; not a barrier juvenile and adult
14002	0198.00	Channel type changes from B3 to A2
14088	0201.00	Six inch salmonid observed
14119	0202.00	Tributary #7 enters right bank; flow estimated at 0.5cfs, contributes approximately 1.0% to downstream flow; Water temperature 60ºF; not accessible to fish; checked up tributary 100'; channel slope approximately 50%; no fish observed
14197	0203.00	LDA, 25' high x 65' wide x 120' long; over 120 pieces of LWD; water flows through with visible gaps; sediment retention 30' wide x 300' long x 10' deep, sediment ranges from silt to boulder, fish observed above LDA (6" trout likely a "resident"); possible barrier for juvenile and adult salmonids
14335	0207.00	Very few young of the year salmonids observed
14993	0224.00	LDA, 12' high x 35' wide x 20' long; approximately 20 pieces of LWD; water flows through with visible gaps and no sediment retention; very few juvenile salmonids observed above LDA; not a barrier to

Grizzly Creek

Position (ft.):	Habitat Unit #:	Comments:
		salmonids
15320	0233.00	Tributary #8 enters left bank; flow estimate at 0.01cfs, contributes approximately 1.0% to downstream flow; Water temperature 56ºF; not accessible to fish; checked up tributary 50’ to a 15' waterfall/plunge; channel slope is approximately 40%; no fish observed
15557	0236.00	End of survey: extremely high jumps due to steep gradient and cascade; large boulders and no pools; not accessible to juvenile/adult salmonids; no juveniles observed above cascade

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.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

Table 1 - Summary of Riffle, Flatwater, and Pool Habitat Types

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max 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
51	9	FLATWATER	21.4	69	3498	22.1	14.6	0.7	1.2	1058	53943	799	40773		18
81	81	POOL	34.0	60	4868	30.7	14.6	0.9	2.5	880	71249	1379	111734	982	39
106	20	RIFFLE	44.5	71	7483	47.2	13.3	0.5	0.8	531	56246	307	32540		13

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
238	110	15849	181438	185048

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max 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	Mean Canopy (%)
84	14	LGR	35.3	76	6383	40.3	10	0.4	1	604	50720	349	29329		10	67
20	5	HGR	8.4	48	953	6.0	20	0.5	1.1	400	7997	225	4494		15	63
2	1	CAS	0.8	74	147	0.9	20	0.8	1.4	160	320	128	256		30	53
1	1	GLD	0.4	55	55	0.3	9	0.9	1.4	495	495	446	446		0	76
46	6	RUN	19.3	66	3040	19.2	16	0.7	1.7	1174	54006	906	41654		19	77
4	2	SRN	1.7	101	403	2.5	14	0.7	1.3	990	3960	658	2633		23	46
26	26	MCP	10.9	52	1361	8.6	16	0.8	5.4	806	20961	1103	28690	721	38	74
11	11	STP	4.6	98	1081	6.8	14	1.0	4.7	1254	13794	2132	23449	1619	47	67
2	2	CRP	0.8	110	221	1.4	21	1.8	5.7	2262	4524	5054	10107	3908	45	71
10	10	LSL	4.2	52	518	3.3	14	0.8	3.9	723	7228	985	9849	664	50	80
11	11	LSR	4.6	44	482	3.0	13	1.0	4.1	579	6374	902	9924	612	44	66
9	9	LSBk	3.8	81	729	4.6	15	1.0	3.7	1249	11245	1904	17132	1378	18	73
4	4	LSBo	1.7	38	153	1.0	14	1.1	2.7	458	1833	715	2861	541	55	65
7	7	PLP	2.9	44	306	1.9	14	0.9	4.5	727	5087	1345	9416	996	26	67
1	1	DPL	0.4	17	17	0.1	12	1.2	2.6	204	204	306	306	245	30	100

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
238	110	15849	188747	190546

Table 3 - Summary of Pool Types

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Residual Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Residual Pool Vol (cu.ft.)	Estimated Total Resid.Vol. (cu.ft.)	Mean Shelter Rating
37	37	MAIN	46	66	2442	50	15.1	0.9	939	34755	988	36558	41
43	43	SCOUR	53	56	2409	49	14.2	1.0	844	36290	994	42723	38
1	1	BACKWATER	1	17	17	0	12.0	1.2	204	204	245	245	30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
81	81	4868	71249	79526

Table 4 - Summary of Maximum Residual Pool Depths By Pool Habitat Types

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Habitat Units	Habitat Type	Habitat Occurrence (%)	< 1 Foot Maximum Residual Depth	< 1 Foot Percent Occurrence	1 < 2 Feet Maximum Residual Depth	1 < 2 Feet Percent Occurrence	2 < 3 Feet Maximum Residual Depth	2 < 3 Feet Percent Occurrence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
26	MCP	32	2	8	11	42	9	35	3	12	1	4
11	STP	14	0	0	3	27	5	45	2	18	1	9
2	CRP	2	0	0	0	0	0	0	0	0	2	100
10	LSL	12	0	0	3	30	3	30	4	40	0	0
11	LSR	14	0	0	4	36	4	36	1	9	2	18
9	LSBk	11	0	0	1	11	5	56	3	33	0	0
4	LSBo	5	0	0	1	25	3	75	0	0	0	0
7	PLP	9	0	0	3	43	2	29	1	14	1	14
1	DPL	1	0	0	0	0	1	100	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
81	2	2	26	32	32	40	14	17	7	9

Mean Maximum Residual Pool Depth (ft.): 2.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006 Dry Units: 0

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Habitat Units	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
84	14	LGR	0	5	0	0	3	0	0	49	0
20	5	HGR	0	1	12	0	2	0	6	59	0
2	1	CAS	0	0	0	0	0	0	50	50	0
106	20	TOTAL RIFFLE	0	4	3	0	2	0	4	51	0
1	1	GLD	0	0	100	0	0	0	0	0	0
46	6	RUN	9	0	10	3	15	0	2	62	0
4	2	SRN	0	23	23	0	5	0	3	48	0
51	9	TOTAL FLAT	6	5	23	2	11	0	2	52	0
26	26	MCP	2	8	8	2	7	0	7	57	2
11	11	STP	3	6	6	2	1	0	16	59	7
2	2	CRP	5	40	28	0	3	0	0	25	0
10	10	LSL	1	2	40	10	8	0	6	34	0
11	11	LSR	5	6	23	44	2	0	6	14	0
9	8	LSBk	0	1	17	5	16	0	3	37	8
4	4	LSBo	0	10	18	0	15	0	6	51	0
7	7	PLP	0	4	11	1	1	0	19	64	0
1	1	DPL	0	20	60	0	0	0	0	20	0
81	80	TOTAL POOL	2	7	17	9	6	0	8	45	2
238	109	TOTAL	2	6	15	7	6	0	7	47	2

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006 Dry Units: 0

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Habitat Units	Units Fully Measured	Habitat Type	% Total Silt/Clay Dominant	% Total Sand Dominant	% Total Gravel Dominant	% Total Small Cobble Dominant	% Total Large Cobble Dominant	% Total Boulder Dominant	% Total Bedrock Dominant
84	14	LGR	0	0	7	21	21	50	0
20	5	HGR	0	0	20	0	0	80	0
2	1	CAS	0	0	0	0	0	100	0
1	1	GLD	0	0	0	0	100	0	0
46	6	RUN	0	17	17	17	33	17	0
4	2	SRN	0	50	0	0	0	50	0
26	26	MCP	0	15	27	8	8	38	4
11	11	STP	0	9	0	9	9	55	18
2	2	CRP	0	50	50	0	0	0	0
10	10	LSL	0	0	50	10	0	40	0
11	11	LSR	0	18	64	18	0	0	0
9	9	LSBk	0	22	11	0	0	56	11
4	4	LSBo	0	25	0	25	0	50	0
7	7	PLP	14	14	0	0	0	71	0
1	1	DPL	0	0	0	0	0	100	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
70	48	52	1	88	86

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006 Survey Length (ft.): 15849 Main Channel (ft.): 15557 Side Channel (ft.): 292

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: B4
Reach Length (ft.): 1368
Riffle/Flatwater Mean Width (ft.): 11.0
BFW:
Range (ft.): 54 to 62
Mean (ft.): 57
Std. Dev.: 4
Base Flow (cfs.): 2.9
Water (F): 60 - 60 Air (F): 58 - 61
Dry Channel (ft): 0

Canopy Density (%): 65.5
Coniferous Component (%): 53.3
Hardwood Component (%): 46.7
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 75.5
Dominant Shelter: Small Woody Debris
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 17
LWD per 100 ft.:
Riffles: 1
Pools: 9
Flat: 1

Pools by Stream Length (%): 30.8
Pool Frequency (%): 37.5
Residual Pool Depth (%):
< 2 Feet Deep: 0
2 to 2.9 Feet Deep: 33
3 to 3.9 Feet Deep: 33
>= 4 Feet Deep: 33
Mean Max Residual Pool Depth (ft.): 3.6
Mean Pool Shelter Rating: 103

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 17 Gravel: 0 Sm Cobble: 67 Lg Cobble: 17 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 83.3 2. 16.7 3. 0.0 4. 0.0 5. 0.0

STREAM REACH: 2

Channel Type: B3
Reach Length (ft.): 12634
Riffle/Flatwater Mean Width (ft.): 15.2
BFW:
Range (ft.): 23 to 62
Mean (ft.): 36
Std. Dev.: 9
Base Flow (cfs.): 2.9
Water (F): 60 - 68 Air (F): 54 - 74
Dry Channel (ft): 0

Canopy Density (%): 69.6
Coniferous Component (%): 48.5
Hardwood Component (%): 51.5
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 85.8
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 13
LWD per 100 ft.:
Riffles: 4
Pools: 11
Flat: 5

Pools by Stream Length (%): 29.8
Pool Frequency (%): 32.8
Residual Pool Depth (%):
< 2 Feet Deep: 37
2 to 2.9 Feet Deep: 35
3 to 3.9 Feet Deep: 20
>= 4 Feet Deep: 8
Mean Max Residual Pool Depth (ft.): 2.4
Mean Pool Shelter Rating: 33

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 3 Gravel: 15 Sm Cobble: 63 Lg Cobble: 5 Boulder: 13 Bedrock: 0

Embeddedness Values (%): 1. 41.7 2. 45.0 3. 6.7 4. 0.0 5. 6.7

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: A2
Reach Length (ft.): 1555
Riffle/Flatwater Mean Width (ft.): 9.6
BFW:
Range (ft.): 36 to 45
Mean (ft.): 40
Std. Dev.: 3
Base Flow (cfs.): 2.9
Water (F): 59 - 65 Air (F): 58 - 73
Dry Channel (ft): 0

Canopy Density (%): 75.7
Coniferous Component (%): 46.7
Hardwood Component (%): 53.3
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 97.6
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 22
LWD per 100 ft.:
Riffles: 17
Pools: 44
Flat: 6

Pools by Stream Length (%): 38.0
Pool Frequency (%): 38.5
Residual Pool Depth (%):
< 2 Feet Deep: 40
2 to 2.9 Feet Deep: 60
3 to 3.9 Feet Deep: 0
>= 4 Feet Deep: 0
Mean Max Residual Pool Depth (ft.): 2.2
Mean Pool Shelter Rating: 37

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 33 Sm Cobble: 53 Lg Cobble: 0 Boulder: 13 Bedrock: 0
Embeddedness Values (%): 1. 6.7 2. 80.0 3. 6.7 4. 0.0 5. 6.7

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	16	20	16.4
Boulder	34	43	35.0
Cobble / Gravel	40	34	33.6
Sand / Silt / Clay	20	13	15.0

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	5	3	3.6
Brush	0	0	0.0
Hardwood Trees	50	63	51.4
Coniferous Trees	54	43	44.1
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

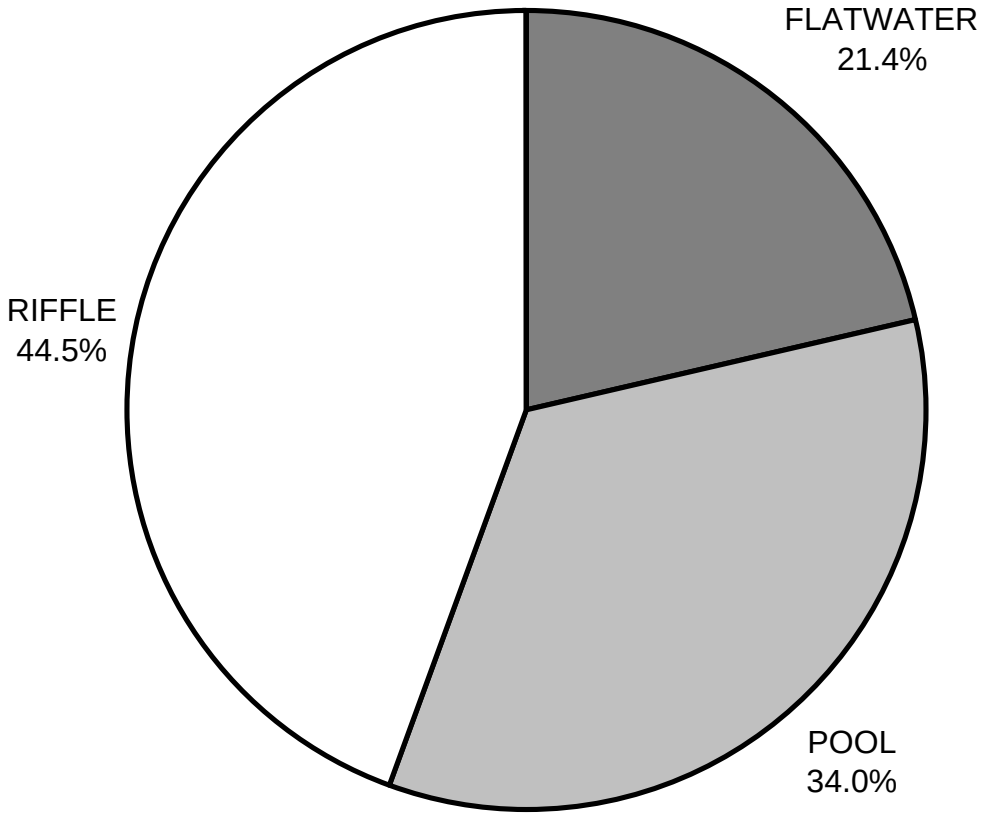
StreamName: Grizzly Creek LLID: 1239050404861 Drainage: Van Duzen River

Survey Dates: 6/19/2006 to 7/5/2006

Confluence Location: Quad: OWL CREEK Legal Description: T01NR02ES12 Latitude: 40:29:10.0N Longitude: 123:54:18.0W

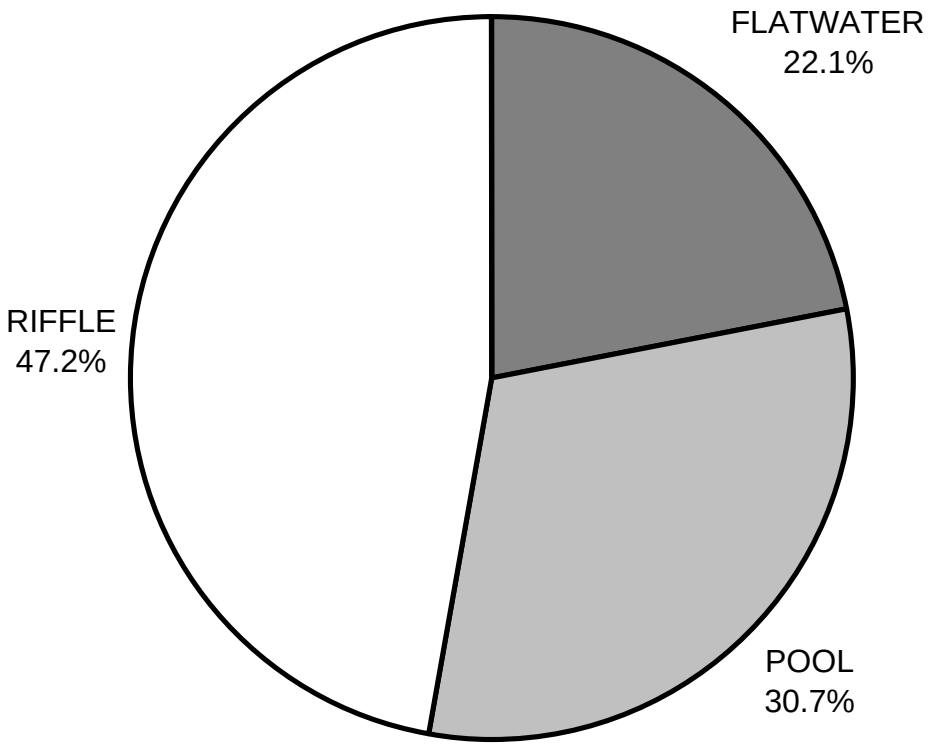
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	6	2
SMALL WOODY DEBRIS (%)	4	5	7
LARGE WOODY DEBRIS (%)	3	23	17
ROOT MASS (%)	0	2	9
TERRESTRIAL VEGETATION (%)	2	11	6
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	4	2	8
BOULDERS (%)	51	52	45
BEDROCK LEDGES (%)	0	0	2

GRIZZLY CREEK 2006
HABITAT TYPES BY PERCENT OCCURRENCE



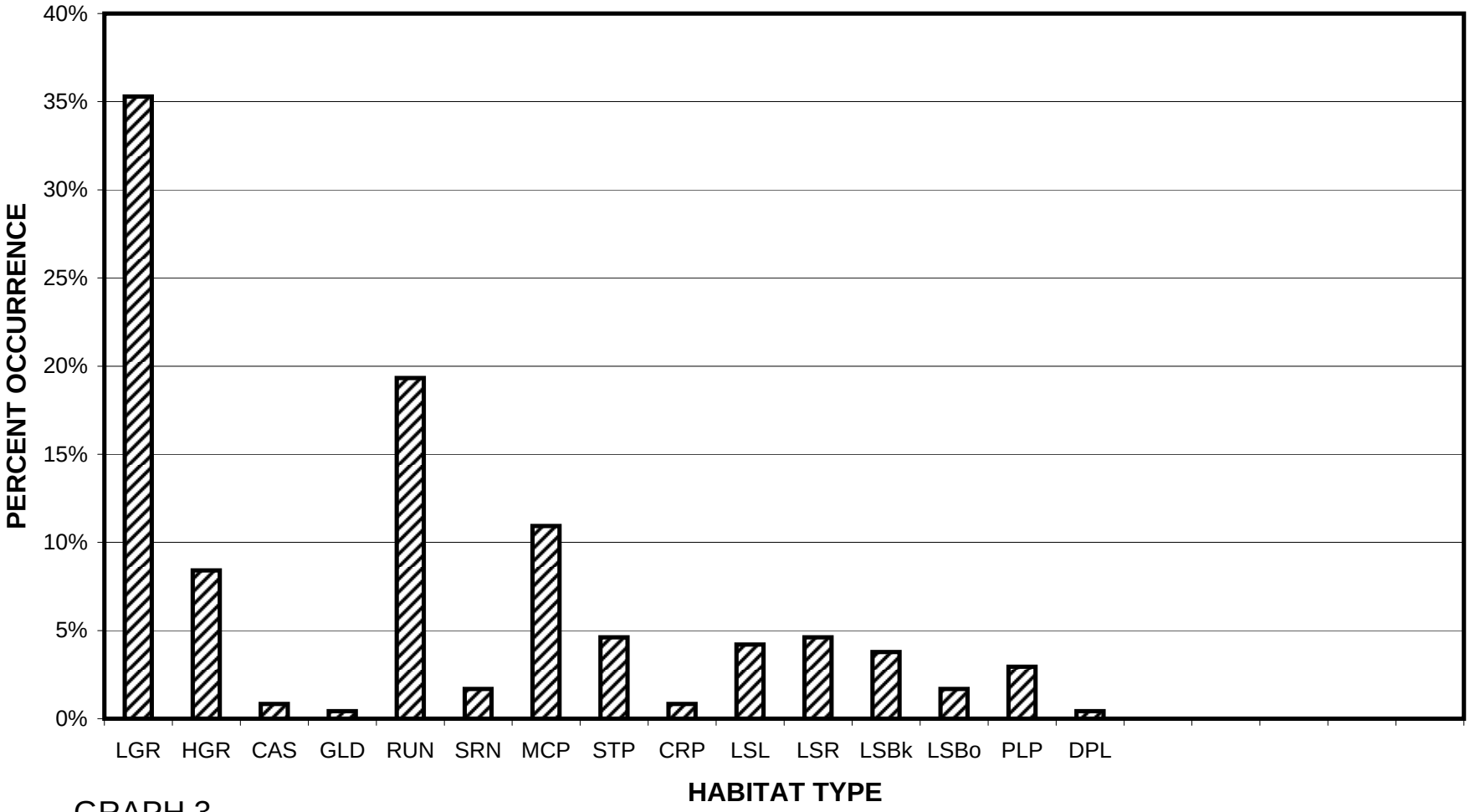
GRAPH 1

GRIZZLY CREEK 2006
HABITAT TYPES BY PERCENT TOTAL LENGTH



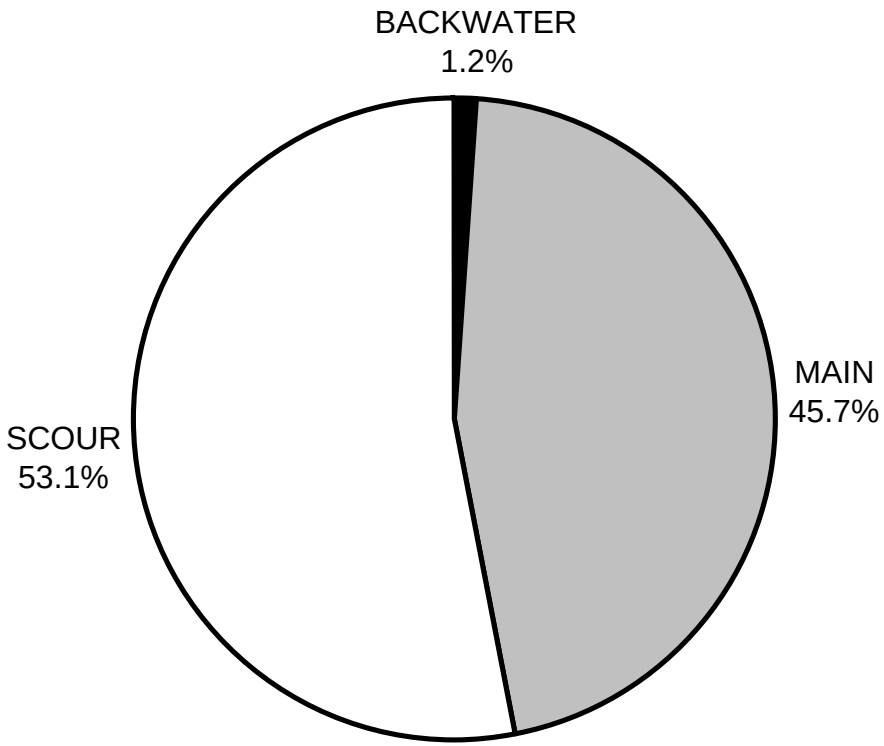
GRAPH 2

GRIZZLY CREEK 2006
HABITAT TYPES BY PERCENT OCCURRENCE



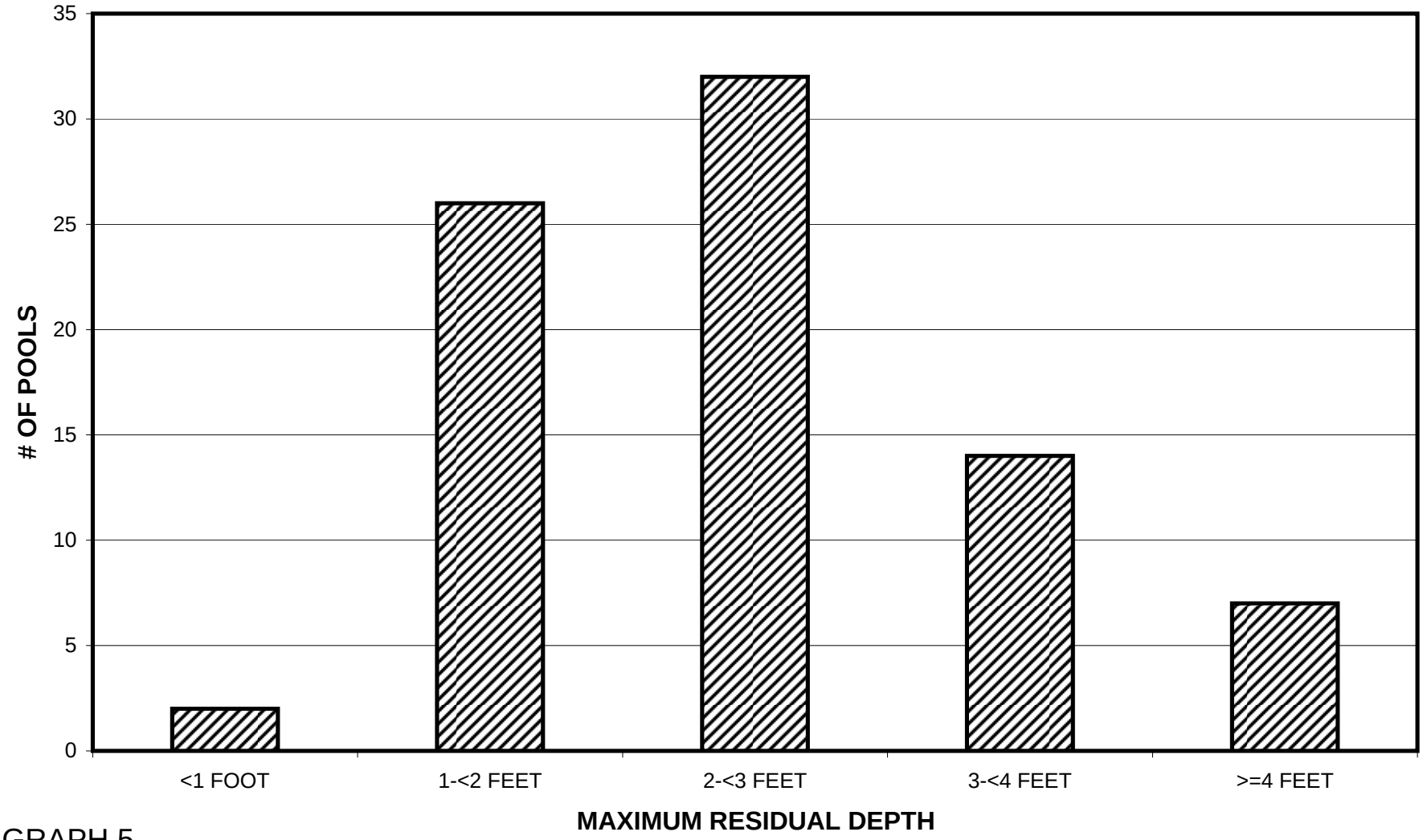
GRAPH 3

GRIZZLY CREEK 2006
POOL TYPES BY PERCENT OCCURRENCE



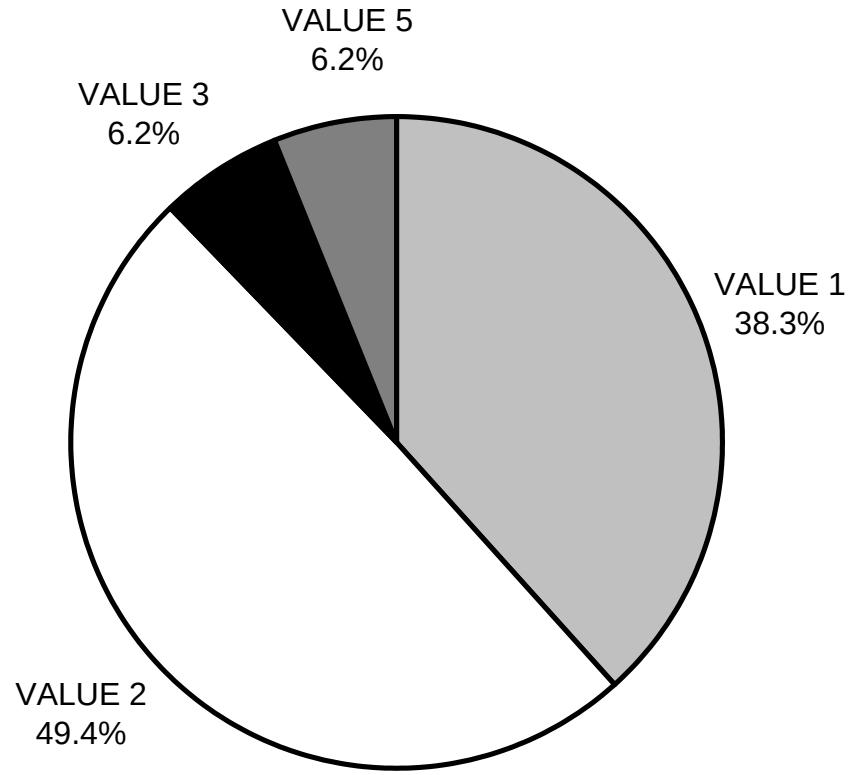
GRAPH 4

GRIZZLY CREEK 2006
MAXIMUM DEPTH IN POOLS



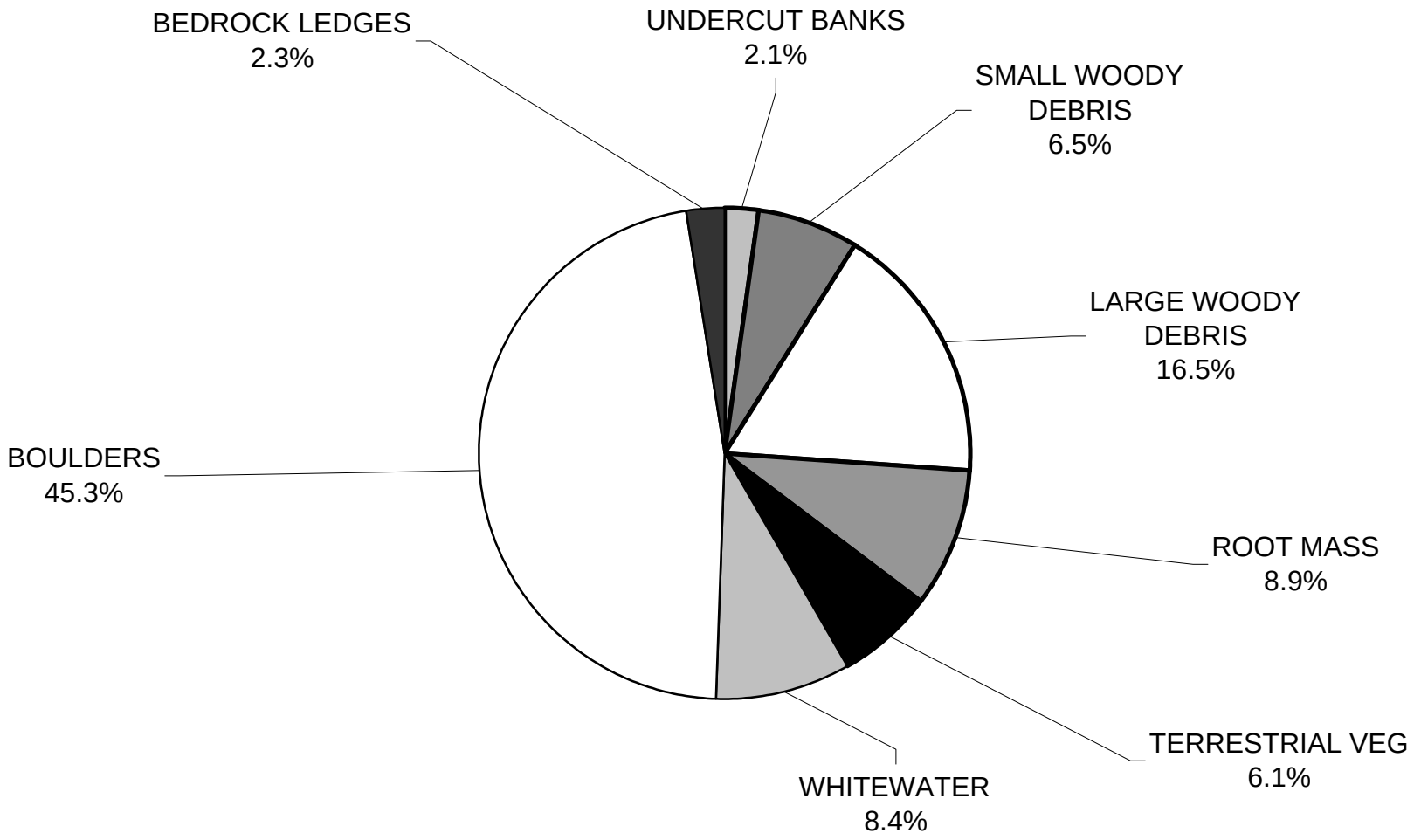
GRAPH 5

GRIZZLY CREEK 2006
PERCENT EMBEDDEDNESS



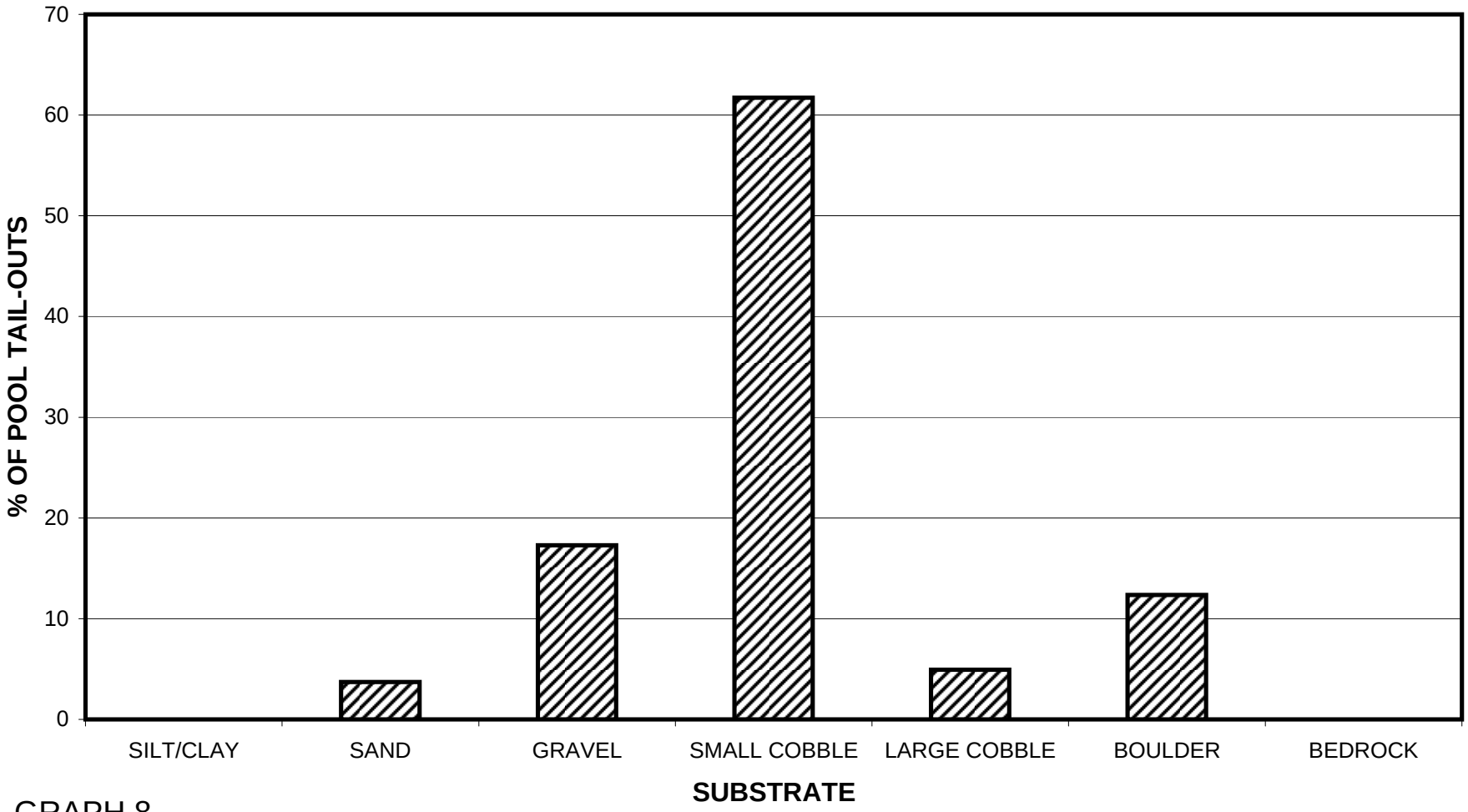
GRAPH 6

GRIZZLY CREEK 2006
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

GRIZZLY CREEK 2006
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

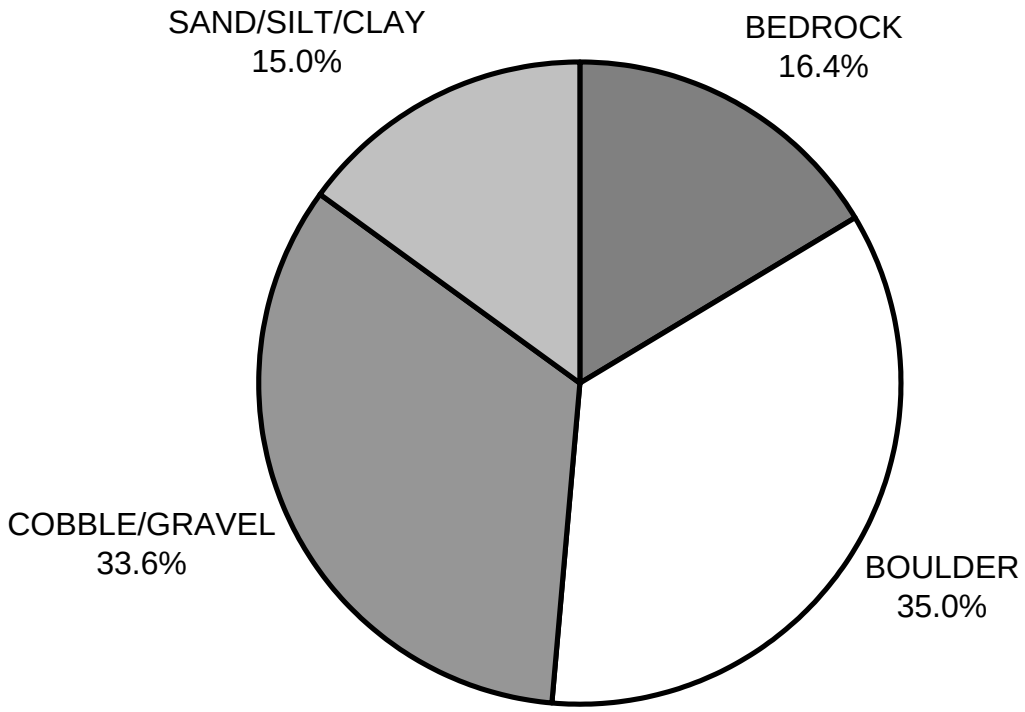


GRAPH 8

GRIZZLY CREEK 2006
MEAN PERCENT CANOPY

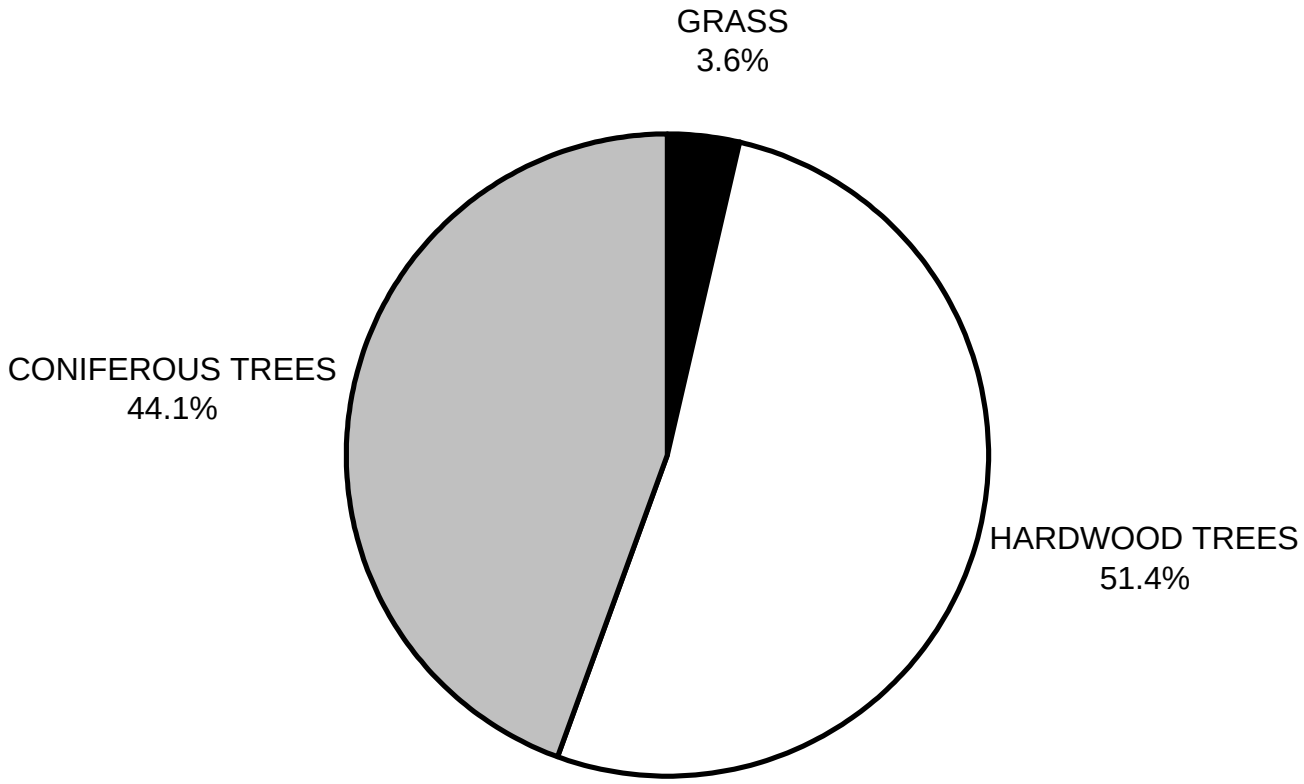
GRAPH 9

GRIZZLY CREEK 2006
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

GRIZZLY CREEK 2006
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11