

CALIFORNIA DEPARTMENT OF FISH AND GAME  
STREAM INVENTORY REPORT  
Feliz Creek  
*Report Completed June 9, 2006*  
*Assessment Completed 2001*

## INTRODUCTION

A stream inventory was conducted beginning July 11 and ending July 19, 2001 on Feliz Creek. The survey began at the confluence with the Russian River and extended upstream 24,764 feet. Not all of Feliz Creek was assessed in 2001. For a comprehensive evaluation of the entire stream a new assessment should be completed.

The Feliz 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 Feliz 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

Feliz Creek is a tributary to the Russian River, a tributary to the Pacific Ocean, located in Mendocino County, California (Maps 1 and 2). Feliz Creek's legal description at the confluence with the Russian River is T13N R12W. Its location is 38°57'53" north latitude and 123°06'18" west longitude. Feliz Creek is a third order stream and has approximately 46,464 feet of solid blue line stream according to the USGS Hopland 7.5 minute quadrangle. Feliz Creek drains a watershed of approximately 42 square miles. Elevations range from about 560 feet at the mouth of the creek to 3,198 feet in the headwater areas. Mixed hardwood dominates the watershed. The watershed is primarily privately owned and is managed for rangeland. Vehicle access exists via Highway 101, south of Hopland, at the Feliz Creek Bridge.

## METHODS

The habitat inventory conducted in Feliz 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 and/or the Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) 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.

## 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 Feliz 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". Feliz 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 Feliz 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 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 Feliz 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Feliz 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 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 Feliz 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.

### 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 six 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 shelter by habitat types
- Summary of dominant substrates by habitat types
- Summary of fish habitat elements by stream reach

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Feliz 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 July 11 to July 19, 2001, was conducted by M. Terry and D. Mitchell (DFG). The total length of the stream surveyed was 24,764 feet with an additional 196 feet of side channel.

Stream flow was not measured on Feliz Creek.

Feliz Creek is a B3 channel type for the entire 24,764 feet of the stream surveyed. B3 channels are moderately entrenched, moderate gradient, riffle-dominated channels with infrequently spaced pools, a very stable plan and profile, stable banks and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 61 to 68 degrees Fahrenheit. Air temperatures ranged from 57 to 88 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 2.3% riffle units, 43.1% flatwater units, 29.2% pool units, and 25.4% dry units (Graph 1). Based on total length of Level II habitat types there were 0.7% riffle units, 22.9% flatwater units, 13.0% pool units, and 63.4% dry units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 25.4% dry units; 21.5% glide units; and 21.5% run units (Graph 3). Based on percent total length, dry units made up 63.4%, runs 12.9%, and glides 10%.

A total of thirty-eight pools were identified (Table 3). Scour pools were the most frequently encountered, at 53%, and comprised 48% 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. Thirty-five of the 38 measured pools (92%) had a depth of two feet or

greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 38 pool tail-outs measured, nine had a value of 1 (24%); nineteen had a value of 2 (50%); nine had a value of 3 (24%); one had a value of 4 (2%); and none had a value of 5 (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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 0, and pool habitats had a mean shelter rating of 12 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 14. Main-channel pools had a mean shelter rating of 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Feliz Creek. Graph 7 describes the pool cover in Feliz 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 50% of pool tail-outs while gravel was the next most frequently observed substrate type, at 26%.

The mean percent canopy density for the surveyed length of Feliz Creek was 28%. The mean percentages of evergreen and deciduous trees were 7% and 91%, respectively. Graph 9 describes the mean percent canopy in Feliz Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 50%. The mean percent left bank vegetated was 55%. The dominant elements composing the structure of the stream banks consisted of 21.3% bedrock, 7.4% boulder, 34.0% cobble/gravel, and 37.2% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 58.5% of the units surveyed. Additionally, 27.7% of the units surveyed had brush as the dominant vegetation type, and 8.5% had evergreen trees as the dominant vegetation (Graph 11).

## DISCUSSION

Feliz Creek is a B3 channel type for the entire 24,764 feet of stream surveyed. The suitability of B3 channel types for fish habitat improvement structures is as follows: B3 channel types are excellent for plunge weirs, boulder clusters and bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 11 to July 19, 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 23% of the total length of this survey, pools 13%, and riffles 1%. The pools are relatively deep, with 35 of the 38 (92%) measured pools having a maximum depth greater than 2 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.

Twenty-eight of the 38 pool tail-outs measured had embeddedness ratings of 1 or 2. Ten of the pool tail-outs had embeddedness ratings of 3 or 4. One 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 Feliz Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-nine of the 38 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 0. The mean shelter rating for pools was 12. 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 28%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 51% and 55%, 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

Feliz 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. Access for migrating salmonids is an ongoing problem, therefore, fish passage should be monitored, and improved where possible.
2. Increase the canopy on Feliz Creek by planting 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.

3. Feliz Creek would benefit from utilizing bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.
4. Not all of Feliz Creek was assessed in 2001. It is recommended that Feliz Creek be re-assessed in its entirety from the mouth to the headwaters.
5. 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.
6. Active and potential sediment sources, related to roads, need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.
7. 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.
8. There are sections of the stream that are being impacted from livestock in the riparian zone. Livestock in streams generally inhibit the growth of new trees, exasperate erosion, and reduce summertime survival of juvenile fish by defecating in the water. Alternatives to limit cattle access, control erosion and increase canopy, should be explored with the landowner, and developed if possible.

#### COMMENTS AND LANDMARKS

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

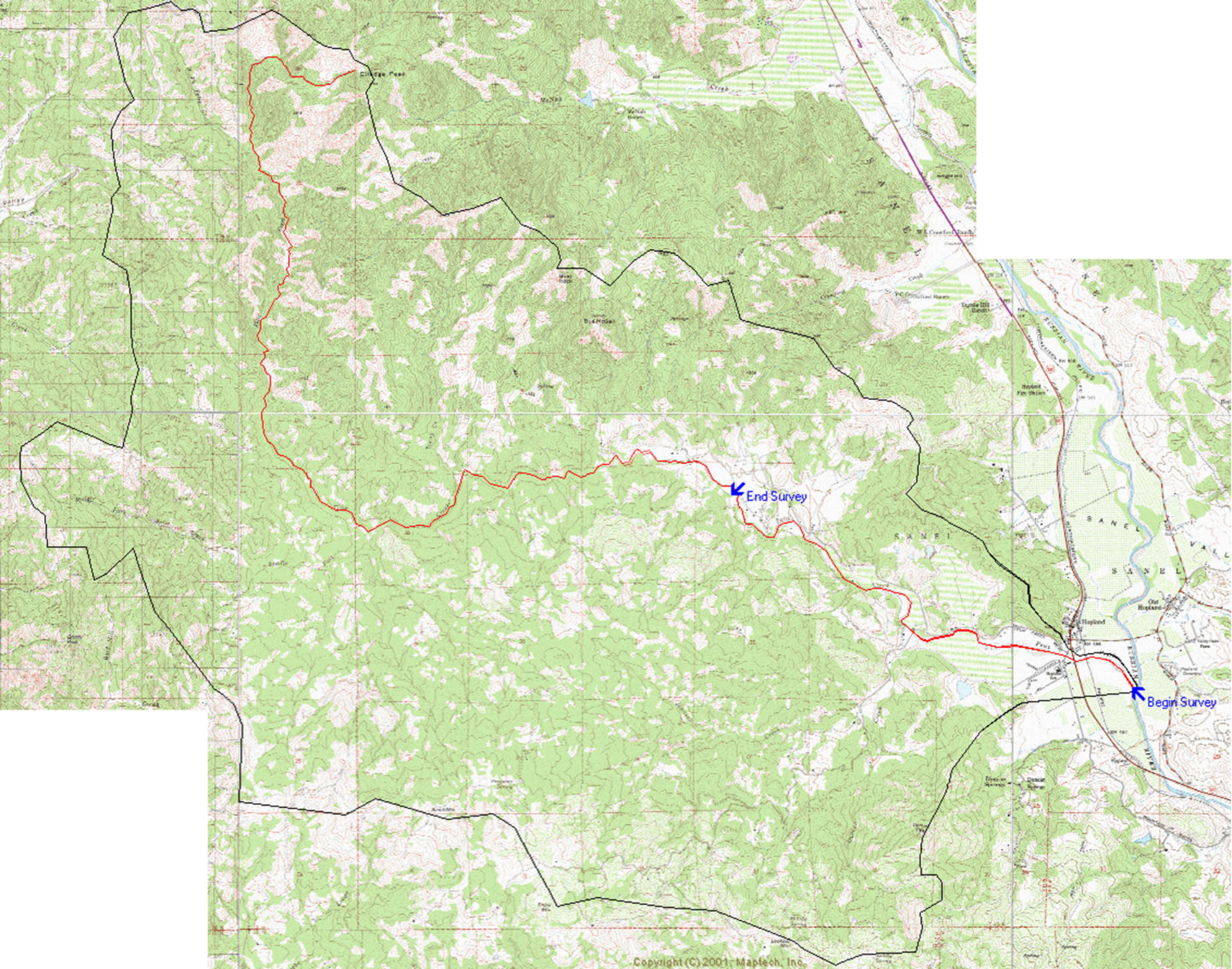
0'	Begin survey. Gully at 335' RB
560'	Fish (non-salmonid)
618'	WP 002 - wet road 1836', WP 003 - Bridge #1 (railroad) 2550', Culvert LB at 2676', WP 004 Bridge #2 at 2893', WP 005 Bridge #3 at 3345' Mountain House Rd, Culvert RB at 3448', WP 006 Wet road at 5524', Pump and culvert at 7302', BRIDGE #1, Size H 1
8702'	Dozens of 2" Salmonids
8869'	One 6" long fish
8998'	Lots of salmonids, WP 007
9058'	Salmonids
9203'	Wet road at end of HU, WP 008
9851'	Non-salmonid fish 5" +
10011'	Rip rap on LB
10799'	WP 009
11310'	Starting point today is confluence with Johnson Cr.
11393'	Salmonids, lots, YOY hundreds- thousands possible CHANNEL CHANGE
11729'	Many small fish.
11799'	BRIDGE, Size H 14 W 55 L 20, Downcutting: No Height from water to sill: No, Retaining gravel: No Comments: WP 012
11861'	A few YOY salmonids which will be dead soon if not saved
11873'	Bridge at end of unit WP 012
11990'	Boulder formed DAM WP 013

12098' At 40' there is a pipe structure which is dripping foul smelling water into creek.  
 12160' Many small fish and many salmonids  
 12250' Lots of salmonids. YOY 1-2"  
 12289' 44' to pump hose  
 12746' WP 014  
 12967' L. Bank lots of concrete debris acting as rip rap.  
 15359' Culvert or other water duct is emptying water into this, HU cannot see where  
 15729' 8" Roach, 15913', WP 005  
 16589' R Bank trib (dry) at 230', L Bank drainage spouts (10") at 250' + 280'  
 17179' R Bank trib at 300'  
 18133' R Bank erosion, 30' high 200'- 300' into unit  
 19277' BRIDGE, Size H8'W150'L10', Downcutting: No; Height from water to sill: No;  
 Retaining gravel: No; Comments: WP 010  
 19362' 38 58' 58.5" N, 123 09' 20.1" W  
 19404' Bridge WP 010  
 19723' cable crossing  
 20187' R Bank spring L Bank trib, dry  
 21674' BRIDGE Size H11'W 90'L 9', Downcutting: No; Height from water to sill: No;  
 Retaining gravel: No; Comments: WP 013  
 21855' Bridge at 300'  
 22399' L Bank erosion approx. 300' long and 15' high  
 22547' Bank erosion active: Yes; length: 300'height: 100', Roots of mature trees hanging  
 loose at top- exposed  
 22739' Serious RB erosion, 150' high  
 22854' Gully LB at 30'  
 22916' DAM: height: 9 ft, length: 2 ft, width: 125 ft, flashboards: yes, downcutting: HT. sill  
 to water: 9 ft, retaining gravel: Yes, 8 ft comments: concrete and boulder fish ladder,  
 pools below DAM WP 015  
 23137' LB erosion 30' high, 100' long  
 23162' WP 015, 9' high Dam with fish ladder, see photos  
 24123' RB trib. At 150'

## 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.





End Survey

Begin Survey

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

Stream Name: Feliz Creek

LLID: 1231046389652 Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Confluence Location: Quad: ELLEDGE PEAK Legal Description: T13NR13WS12 Latitude: 38:57:55.0N Longitude: 123:06:17.0W

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
33	0	DRY	25.4	480	15824	63.4									
56	21	FLATWATER	43.1	102	5706	22.9	12.5	0.5	1.0	755	42268	443	24823		
38	38	POOL	29.2	86	3257	13.0	19.8	0.1	1.6	1657	62974	3032	112166	754	13
3	3	RIFFLE	2.3	58	173	0.7	12.0	0.4	0.6	456	1369	178	534		
<b>Total Units</b>	<b>Total Units Fully Measured</b>				<b>Total Length (ft.)</b>					<b>Total Area (sq.ft.)</b>			<b>Total Volume (cu.ft.)</b>		
130	62				24960					106611			137523		

**Table 2 - Summary of Habitat Types and Measured Parameters**

Stream Name: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

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 (%)
3	3	LGR	2.3	58	173	0.7	12	0.4	0.8	456	1369	178	534			37
28	12	GLD	21.5	89	2485	10.0	12	0.6	1.4	750	21003	453	12696			31
28	9	RUN	21.5	115	3221	12.9	14	0.5	1.6	761	21309	430	12032			24
18	18	MCP	13.8	94	1692	6.8	21	-0.1	2.8	1958	35249	3586	60956	673	10	27
1	1	LSL	0.8	70	70	0.3	38	1.1	1.8	2660	2660	3458	3458	2926	30	45
1	1	LSR	0.8	46	46	0.2	7	-1.4		322	322	193	193	-451	20	80
8	8	LSBk	6.2	81	647	2.6	14	0.2	4	1143	9143	2138	17104	241	9	33
9	9	LSBo	6.9	74	670	2.7	22	0.4	2.4	1367	12300	1990	17914	672	19	32
1	1	PLP	0.8	132	132	0.5	25	1.8	5	3300	3300	12540	12540	5940		25
33	0	DRY	25.4	480	15824	63.4										18

Total Units  
130

Total Units Fully Measured  
62

Total Length (ft.)  
24960

Total Area (sq.ft.)  
106654

Total Volume (cu.ft.)  
137428

**Table 3 - Summary of Pool Types**

Stream Name: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

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
18	18	MAIN	47	94	1692	52	21.1	-0.1	1958	35249	673	10769	10
20	20	SCOUR	53	78	1565	48	18.8	0.3	1386	27725	819	16387	16

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
38	38	3257	62974	27156

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

Stream Name: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

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
17	MCP	46	5	29	8	47	4	24	0	0	0	0
1	LSL	3	0	0	1	100	0	0	0	0	0	0
1	LSR	3	1	100	0	0	0	0	0	0	0	0
8	LSBk	22	0	0	2	25	5	63	0	0	1	13
9	LSBo	24	1	11	5	56	3	33	0	0	0	0
1	PLP	3	0	0	0	0	0	0	0	0	1	100

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
37	7	19	16	43	12	32	0	0	2	5

Mean Maximum Residual Pool Depth (ft.): 1.6

**Table 5 - Summary of Mean Percent Cover By Habitat Type**

Stream Name: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Dry Units: 33

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

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
3	0	LGR									
3	0	TOTAL RIFFLE									
28	0	GLD									
28	0	RUN									
56	0	TOTAL FLAT									
18	15	MCP	9	12	0	11	18	3	0	26	20
1	1	LSL	20	0	0	0	80	0	0	0	0
1	1	LSR	0	30	0	60	10	0	0	0	0
8	7	LSBk	22	2	1	21	4	0	0	9	39
9	9	LSBo	0	2	0	0	19	0	0	58	21
1	0	PLP									
38	33	TOTAL POOL	10	7	0	12	17	2	0	30	23
130	33	TOTAL	10	7	0	12	17	2	0	30	23

**Table 6 - Summary of Dominant Substrates By Habitat Type**

Stream Name: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Dry Units: 33

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

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
3	3	LGR	0	0	0	0	33	33	33
28	12	GLD	8	42	0	33	17	0	0
28	9	RUN	0	22	0	56	22	0	0
18	10	MCP	0	60	0	20	0	10	10
1	1	LSL	0	100	0	0	0	0	0
1	1	LSR	0	100	0	0	0	0	0
8	5	LSBk	0	60	0	40	0	0	0
9	7	LSBo	0	71	0	14	0	14	0
1	1	PLP	0	0	0	0	100	0	0

**Table 7 - Summary of Mean Percent Canopy for Entire Stream**

Stream Name: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

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Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
28	7	91	18	50	55

---

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 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

**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	8	12	21.3
Boulder	1	6	7.4
Cobble / Gravel	21	11	34.0
Sand / Silt / Clay	17	18	37.2

**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	2	1	3.2
Brush	12	14	27.7
Hardwood Trees	29	26	58.5
Coniferous Trees	3	5	8.5
No Vegetation	0	1	1.1

**Total Stream Cobble Embeddedness Values:** 1

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

StreamName: Feliz Creek

LLID: 1231046389652

Drainage: Russian River - Upper

Survey Dates: 7/11/2001 to 7/19/2001

Confluence Location: Quad: ELLEDGE PEAK

Legal Description: T13NR13WS12

Latitude: 38:57:55.0N

Longitude: 123:06:17.0W

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	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)			10
SMALL WOODY DEBRIS (%)			7
LARGE WOODY DEBRIS (%)			0
ROOT MASS (%)			12
TERRESTRIAL VEGETATION (%)			17
AQUATIC VEGETATION (%)			2
WHITEWATER (%)			0
BOULDERS (%)			30
BEDROCK LEDGES (%)			23

## APPENDIX C

**Table 8 - Fish Habitat Inventory Data Summary**

Stream Name: Feliz Creek	LLID: 1231046389652	Drainage: Russian River -
Survey Dates: 7/11/2001 to 7/19/2001	Survey Length (ft.): 24960	Main Channel (ft.): 24909 Side Channel (ft.): 51
Confluence Location: Quad: ELLEDGE PEAK	Legal Description: T13NR13WS12	Latitude: 38:57:55.0N Longitude: 123:06:17.0W

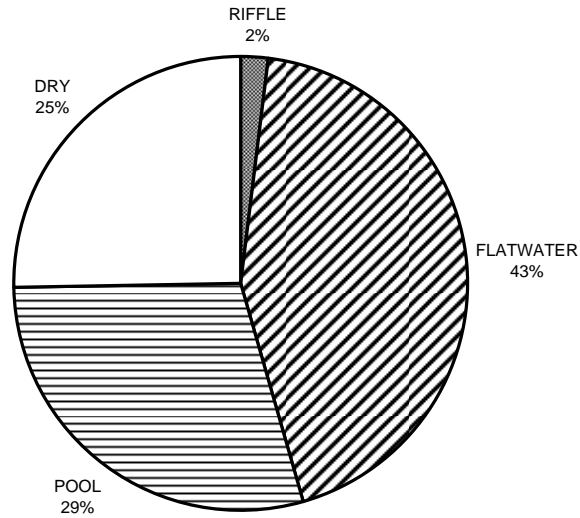
### Summary of Fish Habitat Elements By Stream Reach

**STREAM REACH: 1**

Channel Type: B3	Canopy Density (%): 27.7	Pools by Stream Length (%): 13.1
Reach Length (ft.): 24909	Coniferous Component (%): 7.7	Pool Frequency (%): 29.7
Riffle/Flatwater Mean Width (ft.): 12.8	Hardwood Component (%): 92.3	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 62.2
Range (ft.): to	Vegetative Cover (%): 52.3	2 to 2.9 Feet Deep: 32.4
Mean (ft.):	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0.0
Std. Dev.:	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 5.4
Base Flow (cfs): 0	Occurrence of LWD (%): 0.3	Mean Max Residual Pool Depth (ft.): 1.63
Water (F): 61 - 68 Air (F): 57 - 88	LWD per 100 ft.:	Mean Pool Shelter Rating: 13
Dry Channel (ft.): 15824	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 2.7 Sand: 0.0 Gravel: 27.0 Sm Cobble: 48.6 Lg Cobble: 16.2 Boulder: 0.0 Bedrock: 5.4		
Embeddedness Values (%): 1. 40.0 2. 46.7 3. 6.7 4. 6.7 5. 0.0		

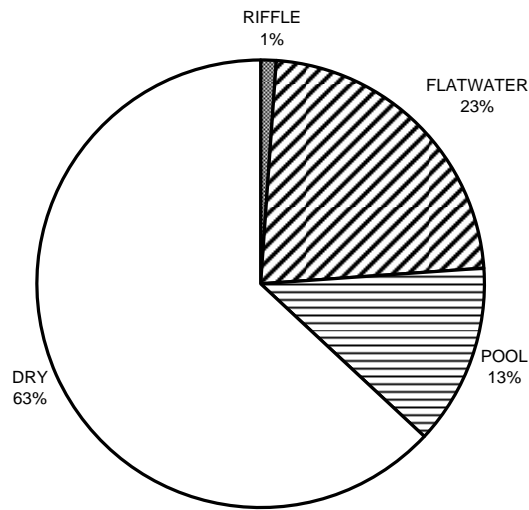
APPENDIX D: GRAPHS

**FELIZ CREEK**  
**HABITAT TYPES BY PERCENT OCCURRENCE**



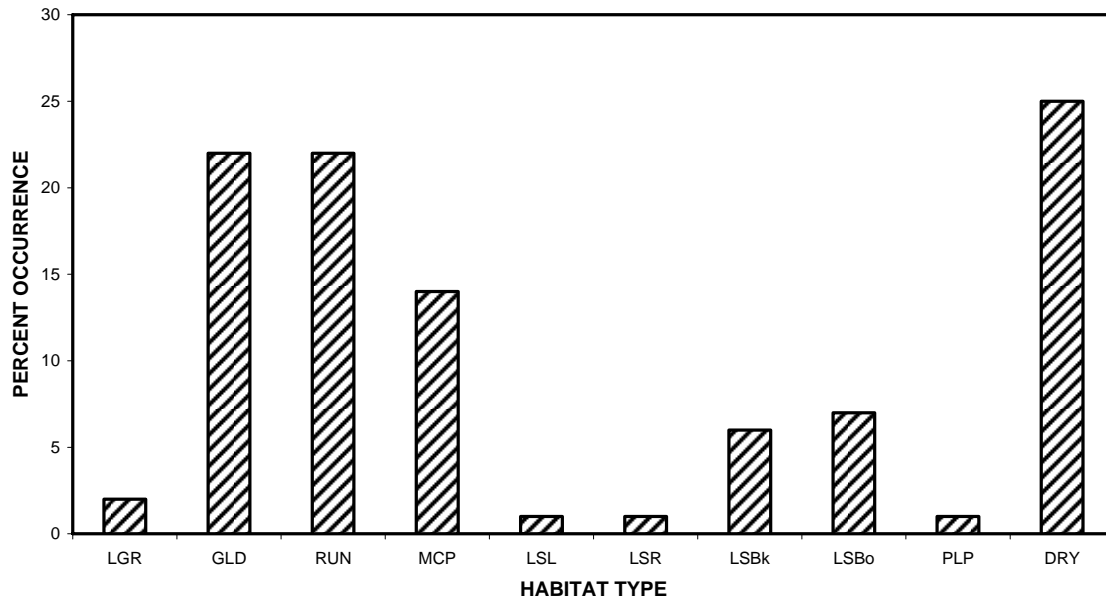
GRAPH 1: Level II habitat types by percent occurrence

**FELIZ CREEK**  
**HABITAT TYPES BY PERCENT TOTAL LENGTH**



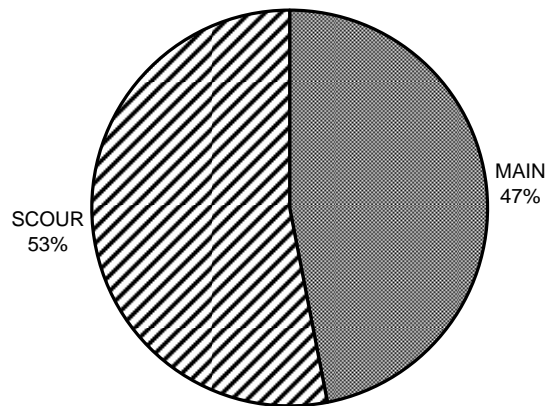
GRAPH 2: Level II habitat types by percent total length

## FELIZ CREEK HABITAT TYPES BY PERCENT OCCURRENCE



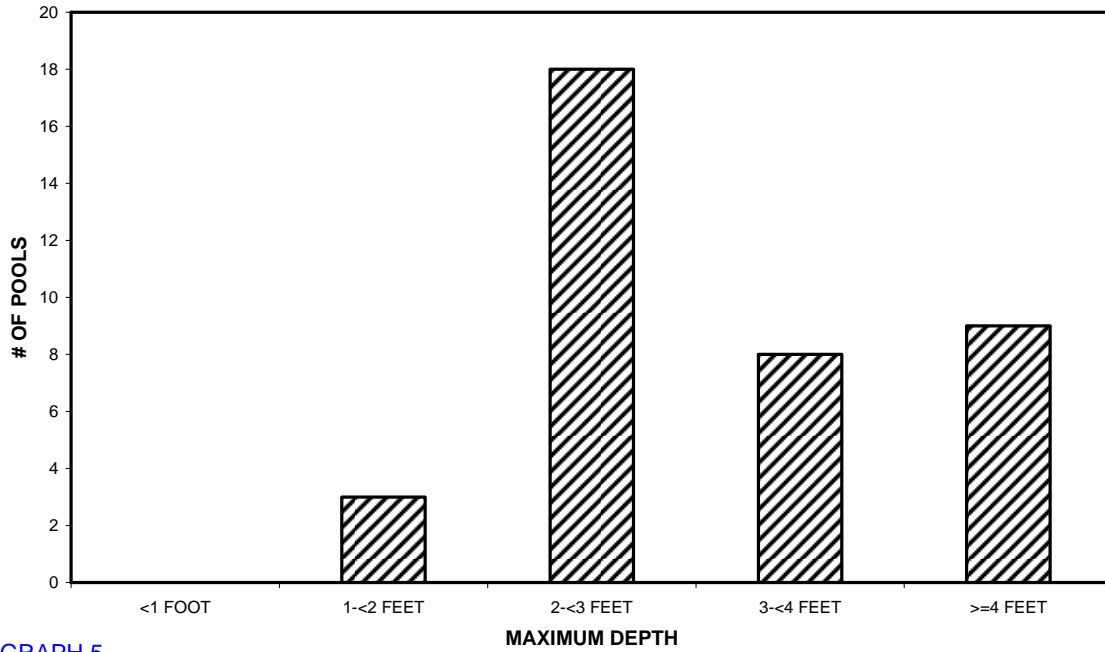
GRAPH 3: Level IV habitat types by percent occurrence

## FELIZ CREEK POOL HABITAT TYPES BY PERCENT OCCURRENCE



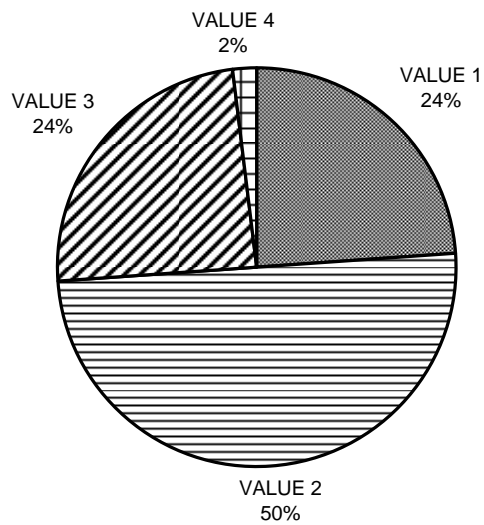
GRAPH 4: Level I pool habitat types by percent occurrence

### FELIZ CREEK MAXIMUM DEPTH IN POOLS



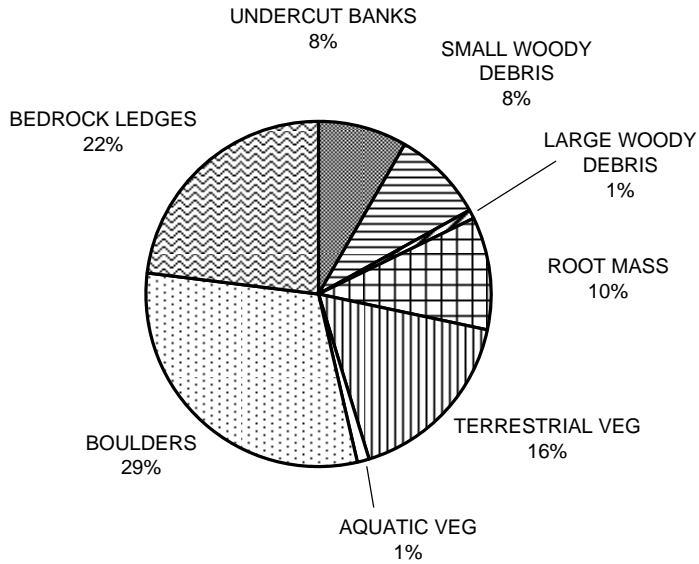
GRAPH 5

### FELIZ CREEK PERCENT EMBEDDEDNESS



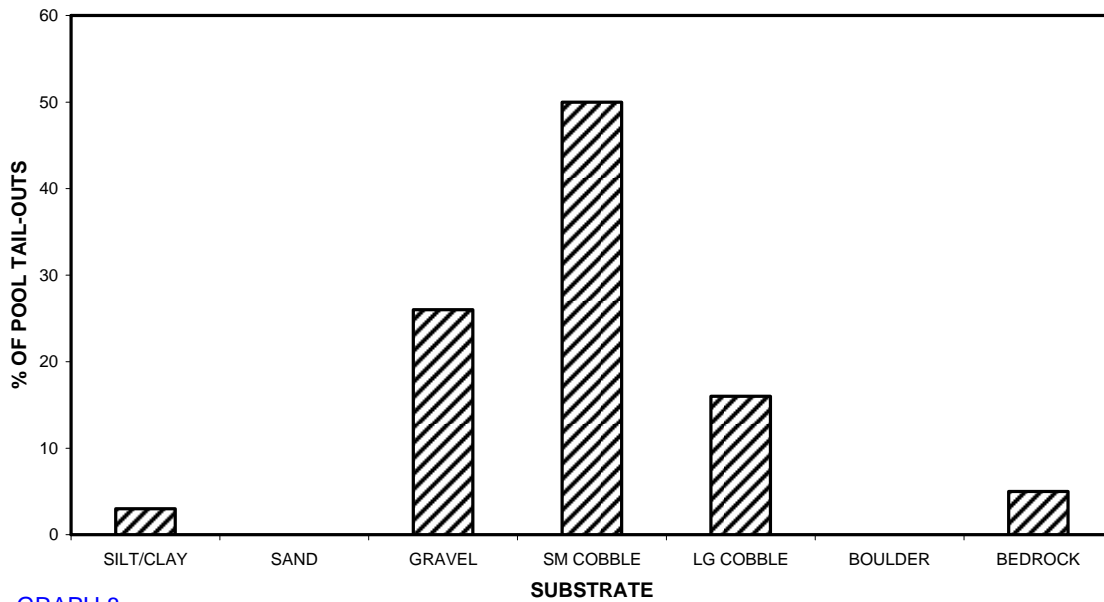
GRAPH 6

## FELIZ CREEK MEAN PERCENT COVER TYPES IN POOLS



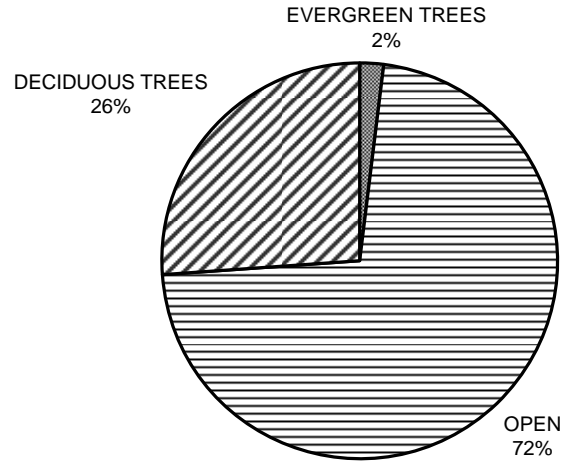
GRAPH 7

## FELIZ CREEK SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



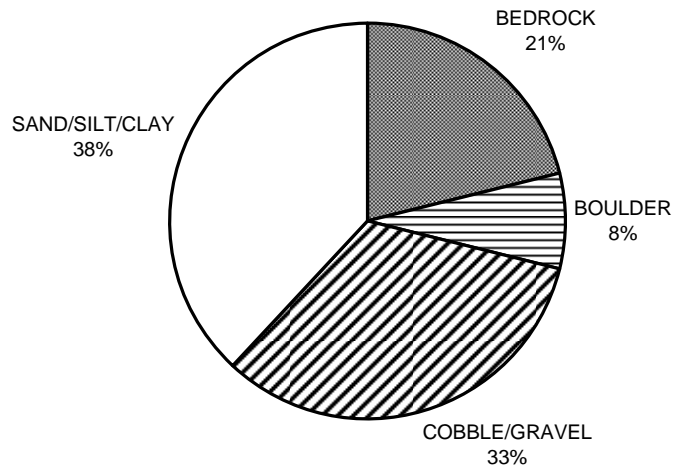
GRAPH 8

# FELIZ CREEK MEAN PERCENT CANOPY



GRAPH 9

# FELIZ CREEK MEAN PERCENT CANOPY

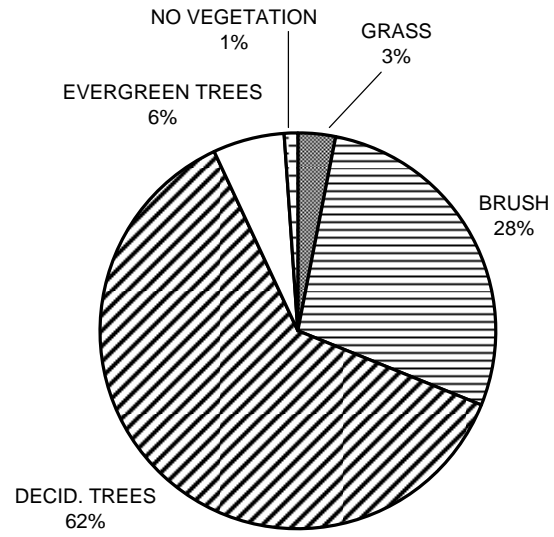


GRAPH 10



# FELIZ CREEK

## DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11