STREAM INVENTORY REPORT

North Fork Gualala River (Upper Watershed)

INTRODUCTION

A stream inventory was conducted beginning August 28 and ending November 4, 2003 on North Fork Gualala River. The survey began on the mainstem near an unnamed left bank tributary, upstream of Stewart Creek. The survey extended upstream 14,832 feet.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in North Fork Gualala River.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for 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

North Fork Gualala River is a tributary to the Gualala River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). North Fork Gualala River's legal description at the confluence with Gualala River is T11N R14W S03. Its location is 38°46′42″ north latitude and 123°29′52″ west longitude. North Fork Gualala River is a third order stream and has approximately 72,147 feet of blue line stream according to the USGS Gualala 7.5 minute quadrangle. North Fork Gualala River drains a watershed of approximately 48.1 square miles. Elevations range from about 5 feet at the mouth of the creek to 2,550 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists at the confluence of North Fork Gualala River and South Fork Gualala. From Gualala, take Old State Highway to Gualala Road. A road follows the North Fork Gualala River to the beginning of the survey.

METHODS

The habitat inventory conducted in North Fork Gualala River 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 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 North Fork Gualala River 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". North Fork Gualala River 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 North Fork Gualala River, 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 not suitable 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 North Fork Gualala River, 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 North Fork Gualala River, 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 North Fork Gualala River, 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 Stream Habitat 1.0.37, 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:

- 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 North Fork Gualala River 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 28 to November 4, 2003, was conducted by S. Ganas, S. Thompson, and G. Trousdale (WSP/AmeriCorps), and B. Budnick (DFG). The total length of the stream surveyed was 14,832 feet.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 3.74 cfs on November 5, 2003.

North Fork Gualala River

North Fork Gualala River is an F4 channel type for 9,584 feet and an F2 for 5,284 feet of the stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. F2 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and bedrock-dominant channels.

Water temperatures taken during the survey period ranged from 58° to 69° Fahrenheit. Air temperatures ranged from 56° to 76° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 41% riffle units, 32% flatwater units, and 27% pool units (Graph 1). Based on total length of Level II habitat types there were 44% riffle units, 35% flatwater units, and 20% pool units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low-gradient riffles, 32%; runs, 27%; and mid-channel pools, 19% (Graph 3). Based on percent total length, low-gradient riffles made up 39%, runs 31%, and mid-channel pools 13%.

A total of 35 pools were identified (Table 3). Main-channel pools were the most frequently encountered, at 77%, and comprised 77% 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. Twenty-five of the 35 measured pools (71%) had a depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 35 pool tail-outs measured, 5 had a value of 1 (14%); 8 had a value of 2 (23%); 9 had a value of 3 (26%); 3 had a value of 4 (9%); and 10 had a value of 5 (29%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

Riffle habitat types had a mean shelter rating of 31, pool habitats had a mean shelter rating of 26, and flatwater habitat types had a mean shelter rating of 15 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 29. Main-channel pools had a mean shelter rating of 24 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in North Fork Gualala River. Graph 7 describes the pool cover in North Fork Gualala River. Boulders are the dominant pool cover types followed by bedrock ledges.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was the dominant substrate observed in 60% of pool tail-outs while bedrock was the next most frequently observed substrate type, at 17%.

The mean percent canopy density for the surveyed length of North Fork Gualala River was 59%.

North Fork Gualala River

The mean percentages of evergreen and deciduous trees were 28% and 31%, respectively with 41% of the canopy open. Graph 9 describes the mean percent canopy in North Fork Gualala River.

For the stream reach surveyed, the mean percent right bank vegetated was 49%. The mean percent left bank vegetated was 51%. The dominant elements composing the structure of the stream banks consisted of 45% bedrock, 24% cobble/gravel, 18% boulder, and 13% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 67% of the units surveyed. Additionally, 31% of the units surveyed had coniferous trees as the dominant vegetation type, 1% brush, and 1% grass as the dominant vegetation (Graph 11).

DISCUSSION

North Fork Gualala River is an F4 channel type for 9,584 feet and an F2 for 5,248 feet of stream surveyed. The suitability of F4 and F2 channel types for fish habitat improvement structures are as follows: F4 channels are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. F2 channels are fair for plunge weirs, single and opposing wing-deflectors, and log cover.

The water temperatures recorded during the survey ranged from 58° to 69° Fahrenheit. Air temperatures ranged from 56° to 76° Fahrenheit. Recorded water temperatures below 60° Fahrenheit are suitable 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.

Riffle habitat types comprised 41% of the total length of this survey, flatwater 32%, and pools 27%. The pools are relatively deep, with 25 of the 35 (71%) measured pools having a maximum 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.

Thirteen of the 35 pool tail-outs measured had embeddedness ratings of 1 or 2. Twelve of the pool tail-outs had embeddedness ratings of 3 or 4. Ten of the pool tail-outs had a rating of 5, which is considered not suitable 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 North Fork Gualala River should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-five of the 35 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 15. The mean shelter rating for pools was 26. 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 59%. Reach 1 had a canopy density of 57% while Reach 2 had a canopy density of 63%. 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 49% and 51%, 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.

RECOMMENDATIONS

1) North Fork Gualala River should be managed as an anadromous, natural production stream.

2) 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 3 to 5 years.

3) Active and potential sediment sources need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

4) 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.

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) 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.

7) Increase the canopy on North Fork Gualala River 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.

North Fork Gualala River

COMMENTS AND LANDMARKS

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

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Start of survey at first left bank tributary above Stewart Creek. Left bank tributary #1.
304	0007.00	Channel-type and BFW taken.
1280	0022.00	Erosion site on right bank measures 10’ high x 50’ long x 5’ deep.
1605	0028.00	Right bank tributary #1.
1958	0031.00	Right bank erosion site measures 150’ high x 100’ long x 20’ deep.
2434	0037.00	Right bank hot spring enters river flowing from bedrock. The temperature of the hot spring is 97 degrees Fahrenheit. The temperature of North Fork Gualala River upstream of the tributary is 67 degrees Fahrenheit. The temperature downstream is 68 degrees Fahrenheit.
3284	0044.00	Right bank tributary #2 enters at approximately 50 ft into unit.
3532	0045.00	Dry right bank tributary.
4158	0050.00	Left bank tributary with 15-20% gradient; not accessible to fish.
4625	0053.00	Sugar Pine Road crosses river.
4998	0056.00	Sparse vegetation on both banks, erosion was possibly the cause.
5914	0063.00	Right bank failure.
6034	0065.00	Spring on right bank.
6797	0071.00	Right bank tributary #3. Dry left bank tributary.
7027	0072.00	Left bank tributary #4 (see form).
7203	0075.00	Gravel bar and aquatic vegetation spread out over channel.
7715	0078.00	Dry left bank tributary.

North Fork Gualala River

7832	0080.00	Left bank erosion site depositing sediment into creek. The erosion site measures 100’ long x 100’ high x and 20’ deep.
8404	0086.00	Dry left bank tributary at end of unit.
8893	0089.00	Stickleback and steelhead observed.
9463	0092.00	Landslide measures 150’ high x 40’ deep x 120’ long. It is contributing gravel, cobble, and woody debris to the channel. Water flows under the slide.
9584	0093.00	2+ Steelhead and large schools of stickleback observed upstream of slide.
9653	0094.00	Landslide measures 150’ high x 40’ deep x 120’ long. Hillside is left bare and eroded.
9818	0096.00	Right bank tributary with high gradient.
10214	0098.00	Older slide on left bank measures 50’ high x 20’ wide x 20’ long. It is contributing gravel to the channel.
11036	0101.00	Riparian vegetation: alder, bay laurel, canyon oak, doug fir, elderberry, huckleberry, madrone, maple, redwood, and tan oak.
11096	0102.00	3’-4’ high bedrock steps.
11229	0104.00	Hayfield Creek enters on the right bank. There is a 3’ high plunge at the mouth.
11335	0105.00	Right bank erosion site measures 60’ long x 25’ high x 5’ deep.
11669	0108.00	Left bank erosion (older slide) measures 50’ high x 15’ deep x 60’ long.
13096	0117.00	Right bank erosion site measures 20’-30’ high x 5’ deep x 70’ long.
13400	0120.00	Right bank erosion site.
14216	0125.00	Right bank tributary. Minor right bank erosion.
14318	0126.00	Many steelhead observed since gradient increase at HU #118; channel is enclosed in a steep bedrock canyon.
14541	0128.00	Pool depths estimated.
14604	0129.00	Dominant substrate changed to gravel. Large debris accumulation on right bank.

14775	0130.00	End of survey at confluence with Robinson Creek. Canyon opens up. Dominant substrate continues to be gravel. BFW taken just below confluence.

North Fork Gualala River

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]	

North Fork Gualala River

TABLES AND GRAPHS

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

Stream Name: North Fork Gualala River Drainage: Gualala River

Survey Dates: 8/28/2003 to 11/4/2003

Confluence Location: Quad: GUALALA Legal Description: T11NR14WS03 Latitude: 38:46:42.0N Longitude: 123:29:52.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Percent 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
41	4	FLATWATER	31.5	127	5226	35.2	15.0	1.0	1.9	1286	52722	1284	52646		15
1	0	NOSURVEY	0.8	121	121	0.8									
35	35	POOL	26.9	86	3007	20.3	20.3	2.1	4.0	1652	57805	4314	150982	3688	26
53	11	RIFFLE	40.8	122	6478	43.7	16.1	0.6	1.3	1034	54798	570	30204		31

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
130	50	14832	165325.5	233831.4

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: North Fork Gualala River Drainage: Gualala River

Survey Dates: 8/28/2003 to 11/4/2003

Confluence Location: Quad: GUALALA Legal Description: T11NR14WS03 Latitude: 38:46:42.0N Longitude: 123:29:52.0W

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 (%)
42	8	LGR	32.3	136	5706	38.5	18	0.5	1.9	1175	49346	608	25545		33	55
9	2	HGR	6.9	78	702	4.7	8	0.9	2.1	626	5632	485	4363		25	71
2	1	CAS	1.5	35	70	0.5	17	0.6	1.1	723	1445	434	867		30	98
2	1	POW	1.5	106	213	1.4	15	1.1	2.4	1872	3744	2059	4118		40	64
35	2	RUN	26.9	131	4575	30.8	16	1.0	2.5	1233	43142	1216	42558		8	62
4	1	SRN	3.1	110	438	3.0	14	0.8	1.5	806	3226	645	2580		5	49
24	24	MCP	18.5	83	1993	13.4	20	2.1	7.5	1530	36731	4087	98078	3542	25	59
1	1	CCP	0.8	106	106	0.7	20	2.4	3.9	2014	2014	5438	5438	4834	20	80
2	2	STP	1.5	102	204	1.4	28	2.1	5.1	2517	5034	6088	12176	5195	20	74
6	6	LSBk	4.6	100	603	4.1	21	2.0	4.8	2047	12282	5155	30928	4162	33	62
1	1	LSBo	0.8	63	63	0.4	20	2.2	4	1260	1260	3150	3150	2772	20	47
1	1	PLP	0.8	38	38	0.3	15	2.3	3.5	485	485	1211	1211	1114	20	35
1	0	NS	0.8	121	121	0.8										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
130	50	14832	164339	231013.3

North Fork Gualala River

Table 3 - Summary of Pool Types

Stream Name: North Fork Gualala River Drainage: Gualala River

Survey Dates: 8/28/2003 to 11/4/2003

Confluence Location: Quad: GUALALA Legal Description: T11NR14WS03 Latitude: 38:46:42.0N Longitude: 123:29:52.0W

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
27	27	MAIN	77	85	2303	77	20.3	2.1	1621	43779	3712	100236	24
8	8	SCOUR	23	88	704	23	20.1	2.1	1753	14026	3608	28860	29

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
35	35	3007	57804.75	129095.9

North Fork Gualala River

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

Stream Name: North Fork Gualala River Drainage: Gualala River

Survey Dates: 8/28/2003 to 11/4/2003

Confluence Location: Quad: GUALALA Legal Description: T11NR14WS03 Latitude: 38:46:42.0N Longitude: 123:29:52.0W

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
24	MCP	69	0	0	0	0	9	38	5	21	10	42
1	CCP	3	0	0	0	0	0	0	1	100	0	0
2	STP	6	0	0	0	0	0	0	0	0	2	100
6	LSBk	17	0	0	0	0	1	17	1	17	4	67
1	LSBo	3	0	0	0	0	0	0	0	0	1	100
1	PLP	3	0	0	0	0	0	0	1	100	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
35	0	0	0	0	10	29	8	23	17	49

Mean Maximum Residual Pool Depth (ft.): 4

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: North Fork Gualala River Drainage: Gualala River
Survey Dates: 8/28/2003 to 11/4/2003 Dry Units: 0
Confluence Location: Quad: GUALALA Legal Description: T11NR14WS03 Latitude: 38:46:42.0N Longitude: 123:29:52.0W

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
42	8	LGR	0	1	0	0	8	4	20	68	0
9	2	HGR	0	0	0	0	0	0	45	25	30
2	1	CAS	0	0	0	0	0	0	50	50	0
53	11	TOTAL RIFFLE	0	1	0	0	5	3	27	58	5
2	1	POW	0	10	0	0	0	0	0	90	0
35	2	RUN	0	10	0	0	0	0	0	45	45
4	1	SRN	0	0	0	25	0	0	30	45	0
41	4	TOTAL FLAT	0	8	0	6	0	0	8	56	23
24	24	MCP	4	2	6	3	3	3	4	51	25
1	1	CCP	0	0	0	0	0	0	5	95	0
2	2	STP	0	0	0	0	0	0	10	10	80
6	6	LSBk	0	0	0	23	1	13	0	14	49
1	1	LSBo	0	0	0	0	5	0	0	95	0
1	1	PLP	0	0	0	0	0	0	40	50	10
35	35	TOTAL POOL	3	1	4	6	2	4	4	45	30
1	0	NS									
130	50	TOTAL	2	2	3	5	3	3	10	49	24

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: North Fork Gualala River Drainage: Gualala River
Survey Dates: 8/28/2003 to 11/4/2003 Dry Units: 0
Confluence Location: Quad: GUALALA Legal Description: T11NR14WS03 Latitude: 38:46:42.0N Longitude: 123:29:52.0W

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
42	8	LGR	0	0	25	13	13	38	13
9	2	HGR	0	0	0	0	0	50	50
2	1	CAS	0	0	0	0	0	100	0
2	1	POW	0	0	0	0	0	100	0
35	2	RUN	0	0	100	0	0	0	0
4	1	SRN	0	0	100	0	0	0	0
24	24	MCP	0	8	58	4	4	21	4
1	1	CCP	0	0	100	0	0	0	0
2	2	STP	0	0	50	0	0	0	50
6	6	LSBk	0	17	83	0	0	0	0
1	1	LSBo	0	0	100	0	0	0	0
1	1	PLP	0	0	100	0	0	0	0

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: North Fork Gualala River Drainage: Gualala River

Survey Dates: 8/28/2003 to 11/4/2003 Survey Length (ft.): 14832 Main Channel (ft.): 14832 Side Channel (ft.): 0

Confluence Location: Quad: GUALALA Legal Description: T11NR14WS03 Latitude: 38:46:42.0N Longitude: 123:29:52.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4
Reach Length (ft.): 9584
Riffle/Flatwater Mean Width (ft.): 15.5
BFW:
Range (ft.): 29 to 54
Mean (ft.): 38
Std. Dev.: 7
Base Flow (cfs.): 3.9
Water (F): 58 - 69 Air (F): 56 - 76
Dry Channel (ft): 0

Canopy Density (%): 57
Coniferous Component (%): 32
Deciduous Component (%): 68
Dominant Bank Vegetation: Deciduous Trees
Vegetative Cover (%): 89
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Bedrock
Occurrence of LWD (%): 2
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 16
Pool Frequency (%): 25
Residual Pool Depth (%):
< 2 Feet Deep: 0
2 to 2.9 Feet Deep: 39
3 to 3.9 Feet Deep: 30
>= 4 Feet Deep: 30
Mean Max Residual Pool Depth (ft.): 3.6
Mean Pool Shelter Rating: 22

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 4 Gravel: 61 Sm Cobble: 13 Lg Cobble: 0 Boulder: 9 Bedrock: 13

Embeddedness Values (%): 1. 22 2. 22 3. 26 4. 4 5. 26

STREAM REACH: 2

Channel Type: F2
Reach Length (ft.): 5248
Riffle/Flatwater Mean Width (ft.): 16.4
BFW:
Range (ft.): 36 to 76
Mean (ft.): 59
Std. Dev.: 16
Base Flow (cfs.): 3.9
Water (F): 58 - 61 Air (F): 58 - 65
Dry Channel (ft): 0

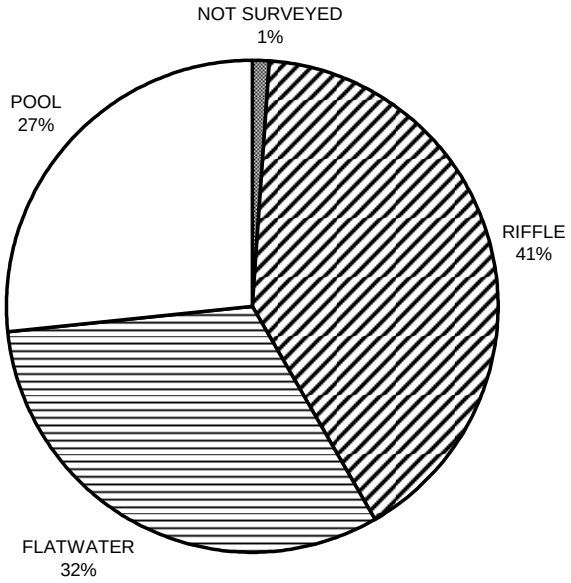
Canopy Density (%): 63
Coniferous Component (%): 78
Deciduous Component (%): 22
Dominant Bank Vegetation: Evergreen Trees
Vegetative Cover (%): 60
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Bedrock
Occurrence of LWD (%): 6
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 25
Pool Frequency (%): 32
Residual Pool Depth (%):
< 2 Feet Deep: 0
2 to 2.9 Feet Deep: 8
3 to 3.9 Feet Deep: 8
>= 4 Feet Deep: 83
Mean Max Residual Pool Depth (ft.): 4.7
Mean Pool Shelter Rating: 32

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 58 Sm Cobble: 8 Lg Cobble: 0 Boulder: 8 Bedrock: 25

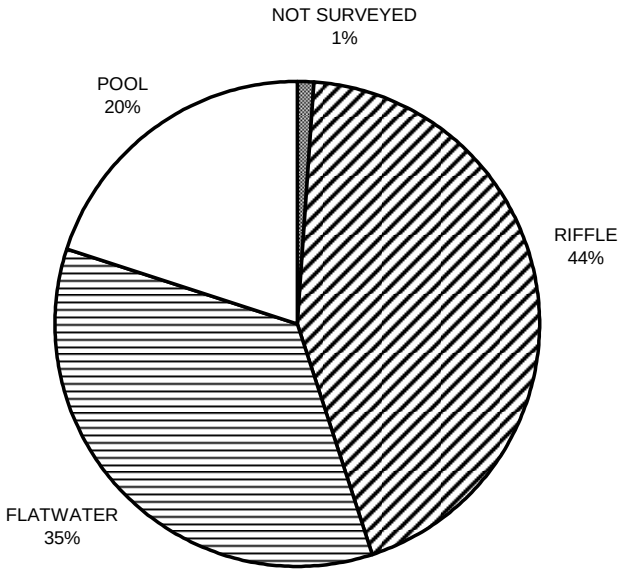
Embeddedness Values (%): 1. 0 2. 25 3. 25 4. 17 5. 33

NORTH FORK GUALALA RIVER
HABITAT TYPES BY PERCENT OCCURRENCE



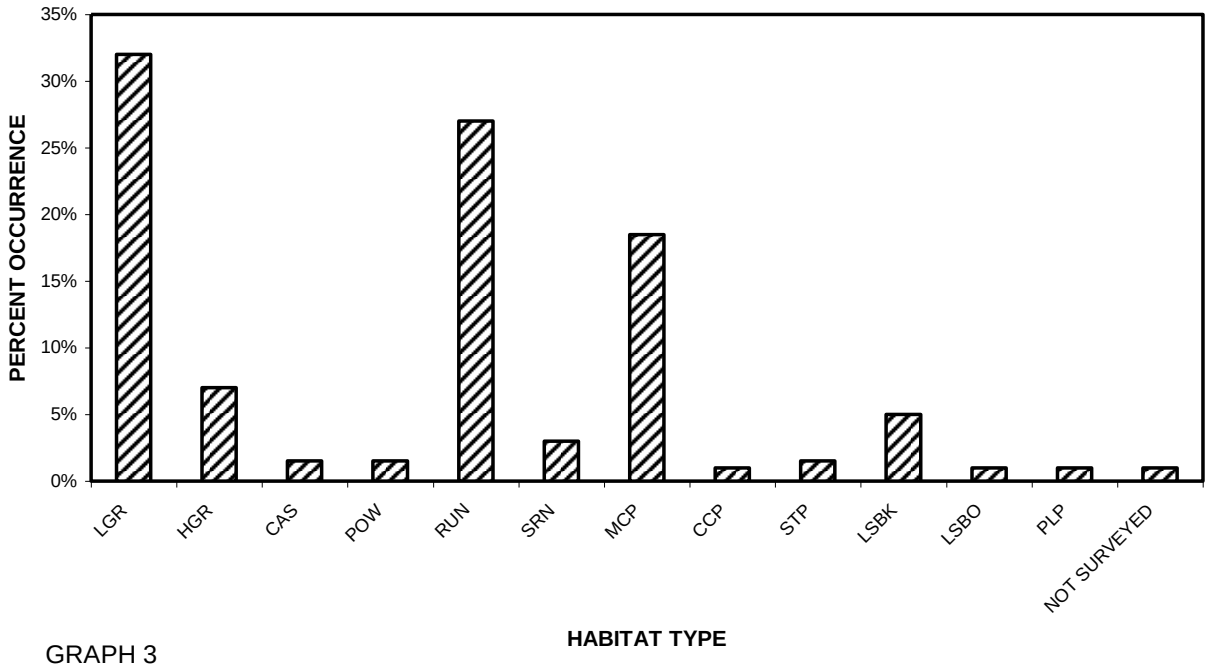
GRAPH 1

NORTH FORK GUALALA RIVER
HABITAT TYPES BY PERCENT TOTAL LENGTH



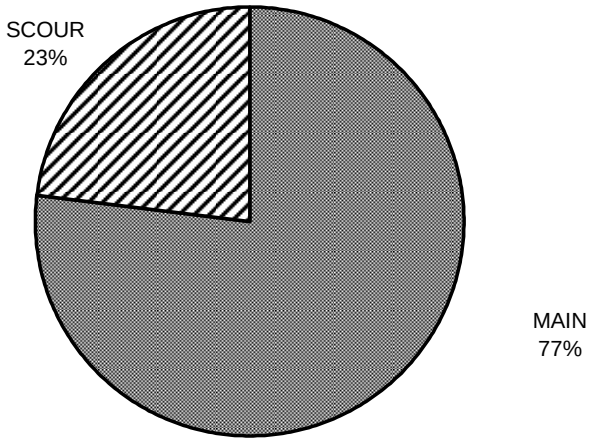
GRAPH 2

NORTH FORK GUALALA RIVER
HABITAT UNIT TYPES BY PERCENT OCCURRENCE

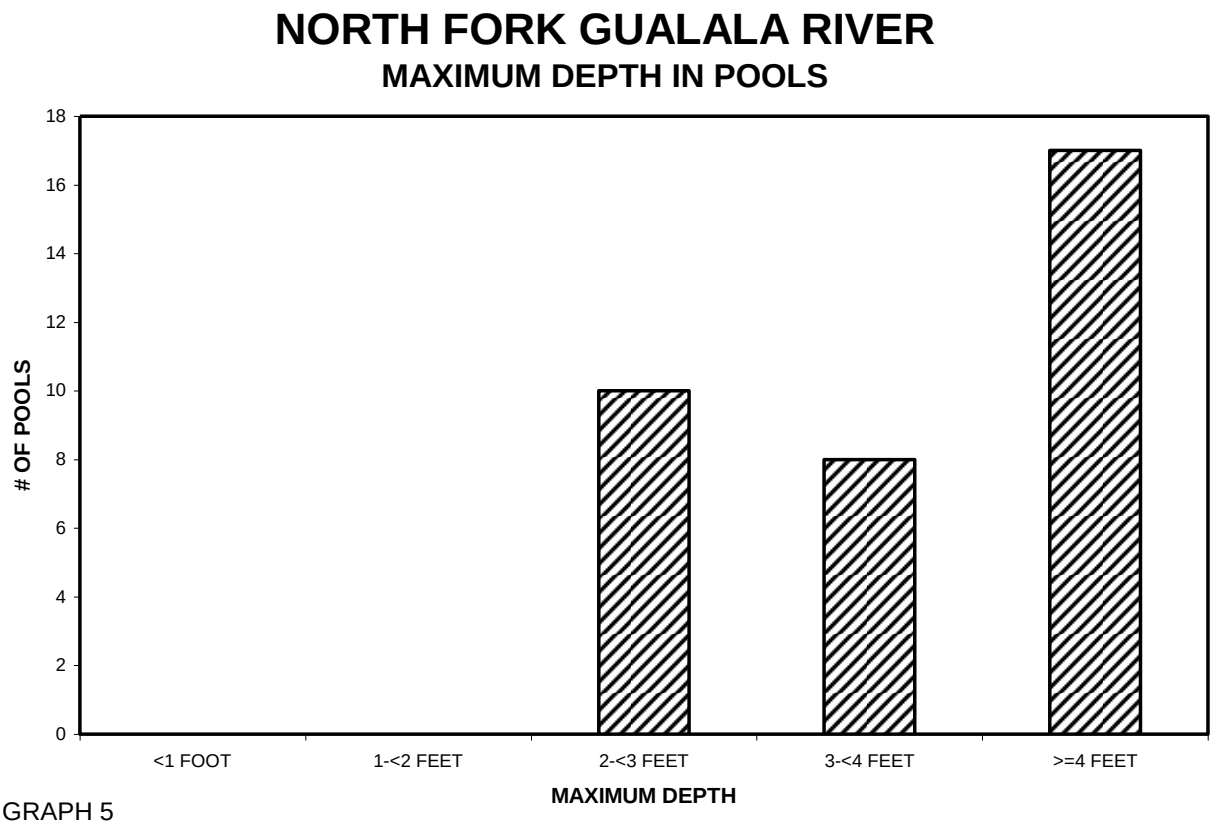


GRAPH 3

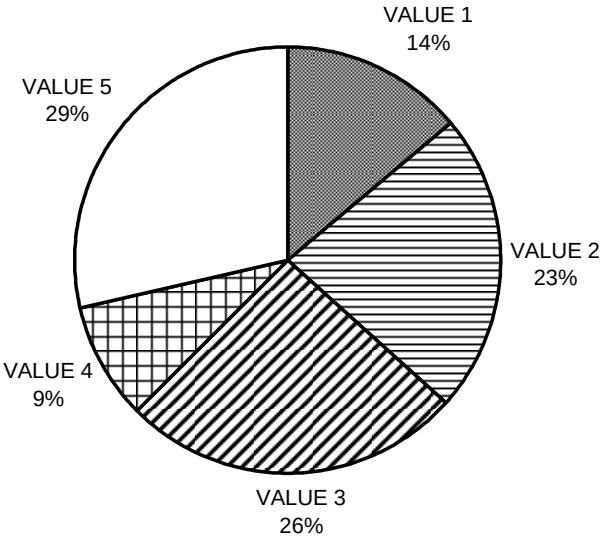
NORTH FORK GUALALA RIVER
POOL HABITAT TYPES BY PERCENT OCCURRENCE



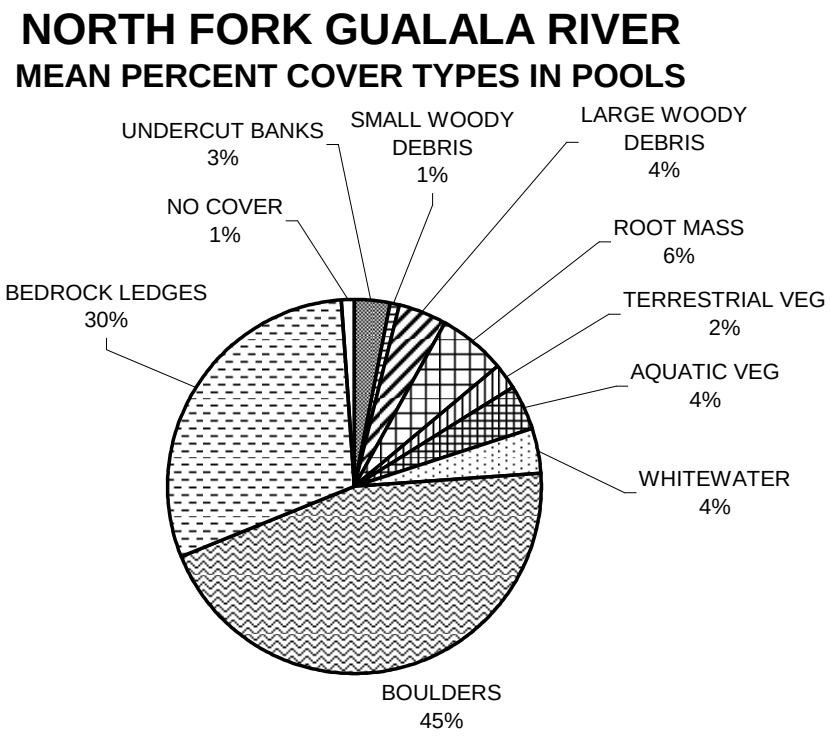
GRAPH 4



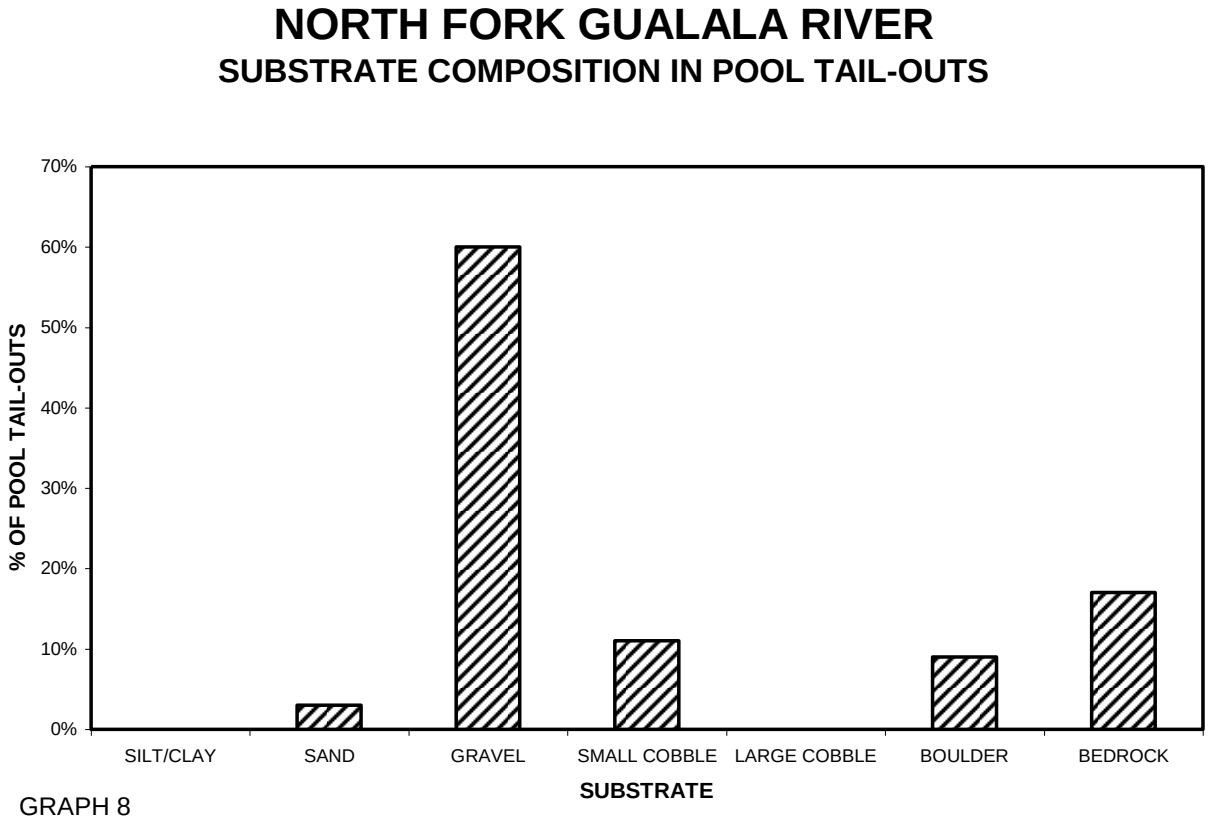
GRAPH 5



GRAPH 6

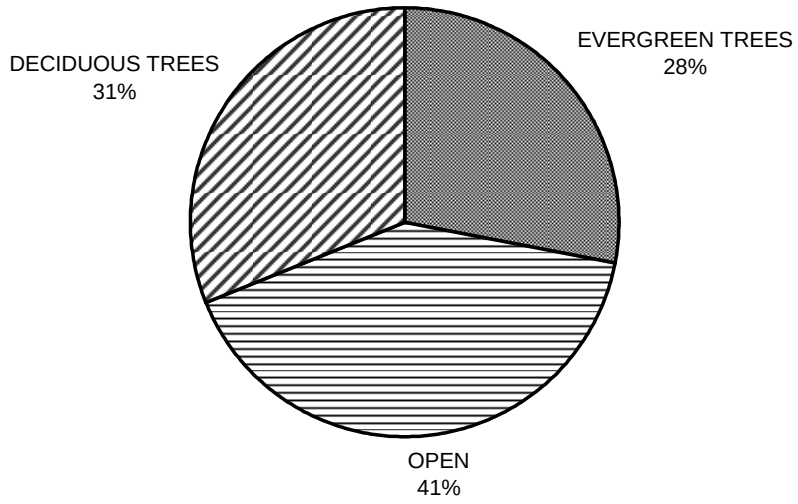


GRAPH 7



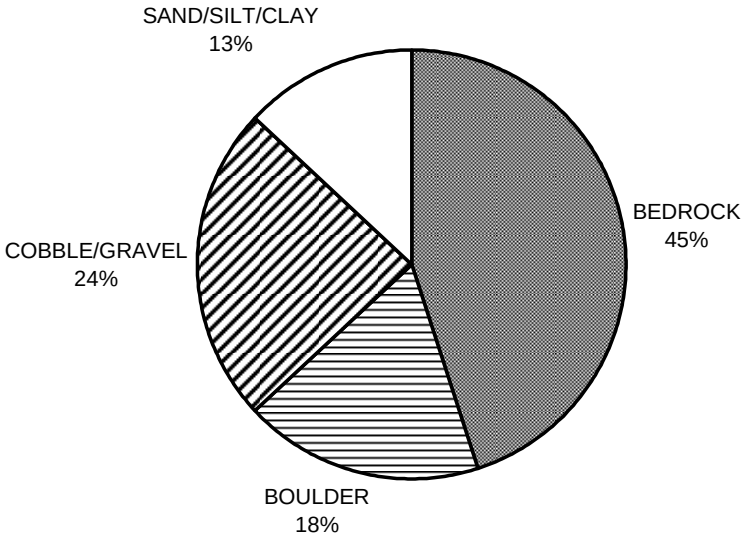
GRAPH 8

NORTH FORK GUALALA RIVER
MEAN PERCENT CANOPY



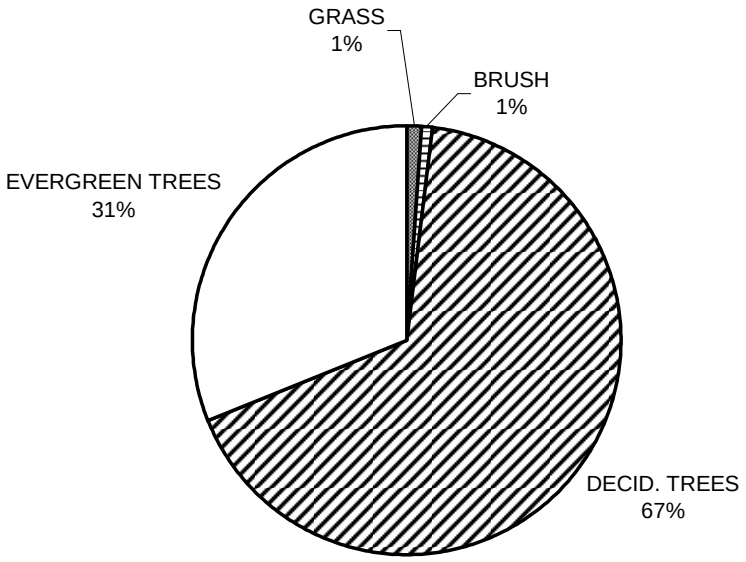
GRAPH 9

NORTH FORK GUALALA RIVER
DOMINANT BANK COMPOSITION IN SURVEY REACH



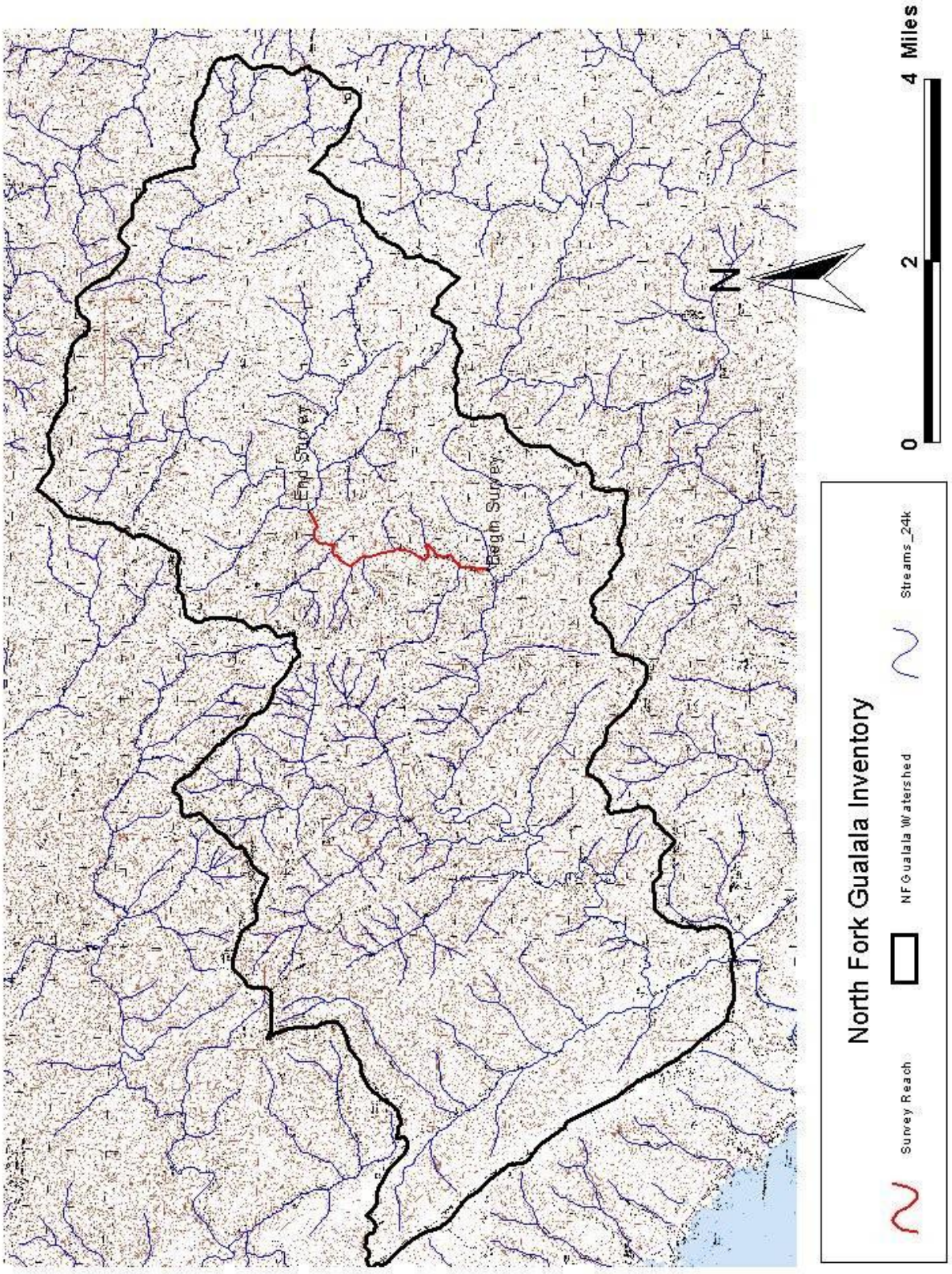
GRAPH 10

NORTH FORK GUALALA RIVER
DOMINANT BANK VEGETATION IN SURVEY REACH



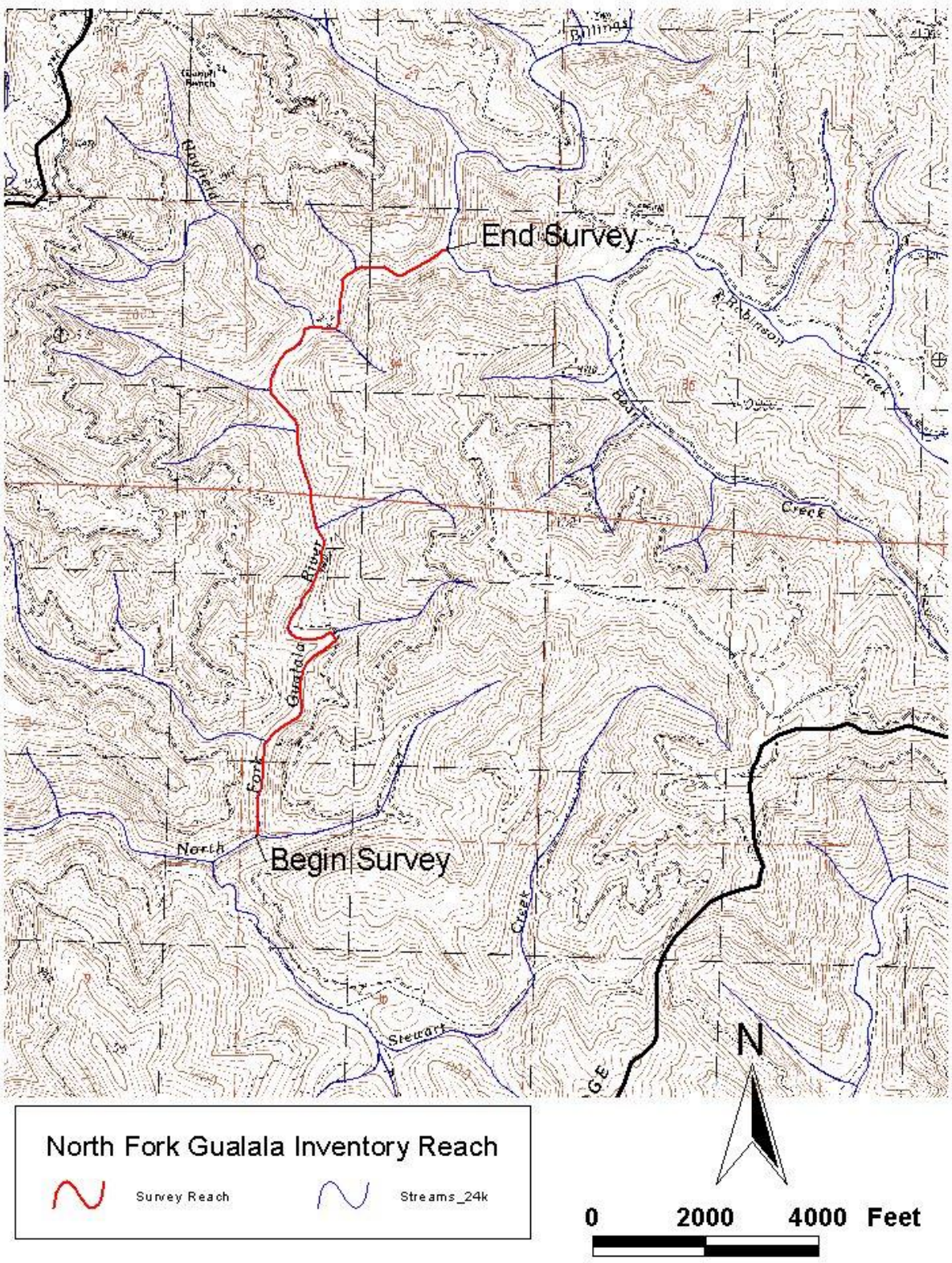
GRAPH 11

North Fork Gualala River



MAP 1. Map of Little Pepperwood Creek showing the stream habitat inventory reach and

watershed boundary.



MAP 2. Map of Little Pepperwood Creek showing the stream habitat inventory reach and

watershed boundary.

REFERENCES

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Rosgen, D.L., 1994. A Classification of Natural Rivers. Catena, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.