CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT

Redwood Creek

Report Revised April 14, 2006
Report Completed 2005
Assessment Completed 2001

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Redwood Creek. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish and other aquatic species with an emphasis on anadromous salmonids in Redwood Creek. The objective of the biological inventory was to document the presence and distribution of salmonids and other aquatic 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

Redwood Creek is a tributary to Maacama Creek, a tributary of the Russian River, and is located in Sonoma County, California (see Redwood Creek map, Appendix A). The legal description at the confluence with the Maacama Creek is T9, R8, S9. Its location is 38.641042410013 N latitude and 122.745034410003 W longitude, LLID: 1227450386410. Year round vehicle access exists from Highway 128 in Knights Valley.

Redwood Creek and its tributaries drain a basin of approximately 13.46 square miles. Redwood Creek is a fourth order stream and has approximately 4.5 miles of perennial stream according to the USGS Mount Saint Helena, Mark West Springs, and Detert Reservoir 7.5 minute quadrangles. Major tributaries include Foote Creek, Kellog Creek, and Yellowjacket Creek. Due to access problems we could not survey Kellog and Yellowjacket Creeks. Foote Creek was surveyed and is described in a separate report. Summer flow was not measured due to low-flow conditions. Elevations range from about 213 feet at the mouth of the creek to 4331 feet in the headwaters. The upper watershed begins near Mount St. Helena and contains chaparral, oak woodland, and some conifers. The creek then enters Knights Valley, which is dominated by vineyards, but contains some oak woodland and grassy areas. The riparian vegetation here has been stripped, though willow saplings are starting to regenerate. After leaving Knights Valley, the creek enters a well-shaded canyon, with a canopy of bay, alder, buckeye, willow, bay, and redwood. There are several ponds and reservoirs in the watershed, including an in-stream (measure surface area) acre reservoir on Foote Creek. The watershed is 80% privately owned and 20% state owned and is managed for vineyard development and grazing. Sensitive plants and animals listed in the

Redwood watershed are listed in Table A.

Table A. Sensitive Species in Redwood Creek Watershed

Scientific Name	Common Name	Federal Status	State Status	Source
Onchorynchus kisutch	Coho Salmon	Threatened	Candidate for Endangered	DFG
Onchorynchus mykiss irideus	Steelhead Trout	Threatened	None	DFG
Strix occidentalis caurina	Northern Spotted Owl	Threatened	CDFG: Sensitive	CNDDB
Rana boylii	Foothill Yellow-Legged Frog	Species of Concern	CDFG: Species of Special Concern	DFG
Limnanthes vinculans	Sebastopol Meadowfoam	Endangered	Endangered	CNDDB
Sidalcea oregana ssp. valida	Kenwood Marsh Checkerbloom	Endangered	Endangered	CNDDB
Amorpha Californica var. napensis	Napa False Indigo	None	None	CNDDB
Lupinus sericatus	Cobb Mountain Lupine	None	None	CNDDB
Hesperolinon bicarpellatum	Two-Carpellate Western Flax	None	None	CNDDB
Linanthus jepsonii	Jepson's Linanthus	None	None	CNDDB
Ceanothus confusus	Rincon Ridge Ceanothus	None	None	CNDDB
Erigeron angustatus	Narrow-Leaved Daisy	None	None	CNDDB
Ceanothus divergens	Calistoga Ceanothus	None	None	CNDDB
Penstemon newberryi var. sonomensis	Sonoma beardtongue			CNDDB

Hysterocarpus traski pomo	Russian River tule perch			CNDDB
Sidalcea oregano ssp. hydrophila	Marsh checkerbloom			CNDDB
Streptanthus breweri var. hesperidis	Green jewel-flower			CNDDB
Brodiaea californica var. leptandra	Narrow-anthered California brodiaea	None	None	CNDDB
Arctostaphylos manzanita ssp. elegans	Konocti manzanita			CNDDB

CNDDB = California Natural Diversity Data Database
DFG = California Department of Fish and Game

METHODS

The habitat inventory conducted in Redwood Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). The AmeriCorps Volunteers 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 and was supervised by Bob Coey, Russian River Basin Planner (DFG).

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 (1998). This form was used in Redwood Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows are also measured or estimated at major tributary confluences.

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 (1998). 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.

3. Temperatures:

Water and air temperatures, and time, are measured by crew members with hand-held thermometers and recorded at each tenth unit typed. Temperatures are measured in Fahrenheit at the middle of the habitat unit and within one foot of the water surface. Temperatures are also recorded using remote temperature recorders which log temperature at set intervals, 24 hours/day.

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". Redwood 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 unit lengths were measured. The first occurrence of each unit type and a randomly selected 10% subset of all units were completely sampled (Length, Mean Width, Mean Depth, Maximum Depth and Pool Tail Crest Depth). All measurements are in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Redwood Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). "Not suitable" (value 5) is assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, absence of particulate substrate (e.g. 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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Redwood Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the

shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. Thus, shelter ratings can range from 0-300, and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

In all fully measured habitat units, dominant and sub-dominant substrate elements are visually estimated using a list of seven size classes: Silt/Clay, Sand, Gravel, Small Cobble, Large Cobble, Boulder, and Bedrock.

8. Canopy:

Stream canopy density is estimated using modified handheld spherical densiometers as described in the California Salmonid Stream Habitat Restoration Manual (1998). Canopy density relates to the amount of stream shaded from the sun. In Redwood 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. Finally, the total canopy over each habitat unit is visually divided into evergreen and deciduous, and the estimated percentages are recorded.

9. Bank Composition and Vegetation:

Banks may be composed primarily of (1) Bedrock, (2) Boulders, (3) Cobble/Gravel, or (4) Silt/Clay/Sand, and may be covered predominantly with (5) Grass, (6) Brush, (7) Deciduous Trees, (8) Coniferous Trees, or (9) No Vegetation at all. These factors influence the ability of stream banks to withstand winter flows. For each fully measured habitat unit in Redwood Creek, the dominant Bank Composition Type and Vegetation Type of both the right and left banks were chosen from the options above. Additionally, the percentage of vegetal coverage was estimated and recorded for each bank.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species present and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, and 3) electro-fishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual (1998).

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE IV data entry program developed by CDFG. This program processes and summarizes the data, and produces the following tables and appendices:

- 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
- 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 Redwood 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

HISTORICAL STREAM SURVEYS:

There were no historical habitat surveys conducted on Redwood Creek. However, in 1993 a fishery consultant, with the city of Santa Rosa, seined Redwood Creek from the Highway 128 bridge in Knight's Valley upstream for ¼ mile to a small dam. No sampling was done above the dam.

HABITAT INVENTORY RESULTS

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

The habitat inventory of Redwood Creek was conducted from June 20-26, 2001 by J. Smith and C. Sangiacomo with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Maacama Creek and extended up Redwood Creek to the where it became nearly dry and the surveyors reached the end of landowner access permission. The total length of stream surveyed was 23,763 feet.

Flows were not measured on Redwood Creek, and there was almost no flow in the upper reaches.

This section of Redwood Creek has two reaches with two distinct channel types: from the mouth to 10,330 feet a F3 and 13,433 feet a B3.

B3 channel types are moderately entrenched, moderate gradient (2-4%), riffle dominated channels, with infrequently spaced pools, a very stable plan and profile, stable banks and have a predominantly cobble substrate.

F3 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly cobble substrate.

Water temperatures measured by the surveyors on June 20 to June 26 ranged from 59ºF to 70ºF. Air temperatures ranged from 57ºF to 90ºF.

Summer temperatures were also measured using remote temperature recorders placed in pools (see Temperature Summary graphs, Appendix E). A recorder in Reach 1, 500 feet upstream from the mouth, logged temperatures every two hours from July 5 to October 19, 2001. The highest temperature recorded was 68.4ºF in early July and the lowest was 57.4ºF in mid-October. The mean of the daily highs was 66.6ºF for the month of July, 66.0ºF for August, 63.0ºF for September, and 60.5ºF for October.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of *occurrence* there were 34.5% Riffle units, 27.7% Flatwater units, 25.7% Pool units and 12.2% Dry units. Based on total *length* there were 41.1% Dry units, 32.5% Riffle units, 17.8% Flatwater units and 8.6% Pool units (Graph 1).

There were 148 habitat units measured and 15% were completely sampled. Eleven Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent *occurrence* were Low Gradient Riffle at 33%, Run at 21%, Mid-Channel Pool at 18%, and Dry at 12%, (Graph 2). By percent total *length*, Dry at 41%, Low Gradient Riffle at 32%, Run at 13%, and Mid-Channel Pool at 6%.

There were 38 pools identified (Table 3). Mid-Channel Pool pools were most often encountered at 18%, and comprised 74% of the total length of pools (Graph 3).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twenty-six of the 38 pools (68%) had a depth of two feet or greater (Graph 4). These deeper pools comprised 76% of the total length of stream habitat.

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. Riffles rated 5, Flatwater units rated 5 and Pools rated 43 (Table 1). Of the pool types, Lateral Scour Pool - Log Enhanced rated 158, Lateral Scour

Pool - Root Wad Enhanced rated 46, Mid-Channel Pool rated 35, Lateral Scour Pool - Boulder Formed rated 30 and Lateral Scour Pool - Bedrock Formed rated 13 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were Undercut Banks at 24%, Large Wood at 23%, Terrestrial Vegetation at 19%, Root Mass at 11%, Small Wood at 9%, Boulders at 9%, Bedrock at 4%, Aquatic Vegetation at 1%. Graph 5 describes the pool shelter in Redwood Creek.

Table 6 summarizes the dominant substrate by habitat type. In the 49 Low-Gradient Riffles surveyed, the dominant substrate was: Small Cobble in six riffles, Large Cobble in two riffles and Boulders in one riffle (Graph 6).

No mechanical gravel sampling was conducted in 2001 surveys due to inadequate staffing levels.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 35 pool tail-outs measured, seven had a value of 1 (20%), twenty had a value of 2 (57%) and eight had a value of 3 (23%). Zero riffles rated a 5 (unsuitable substrate type for spawning). On this scale, a value of 1 is best for fisheries. Small Cobble was the dominant substrate observed at pool tail-outs.

The mean percent canopy density for the stream reach surveyed was 58%. The mean percentages of deciduous and evergreen trees were 58% and 42%, respectively. Graph 7 describes the canopy for the entire survey.

For the entire stream reach surveyed, the mean percent right bank vegetated was 68% and the mean percent left bank vegetated was 78%. For the habitat units measured, the dominant substrate for the stream banks were: 64% Cobble & Gravel, 27% Bedrock, 5% Silt, Clay & Sand and 5% Boulder (Graph 10). The dominant vegetation types for the stream banks were: 36% Evergreen Trees, 27% Deciduous Trees, 23% Brush and 7% Grass (Graph 11).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

Steelhead trout and coho salmon are known to inhabit Redwood Creek.

During one year in the mid-1980's a Fish and Game warden reported seeing coho salmon in Maacama Creek. In November of 1993, a fisheries consultant working for the city of Santa Rosa seine netted Redwood creek from the Highway 128 Bridge in Knights Valley upstream for about a quarter mile to a small dam. He found more coho than steelhead at this location. No sampling was done above the dam, which is located just downstream from the confluence of Kellog and Yellowjacket Creeks. The 2001 habitat surveyors considered this seven-foot dam to be a probable fish migration barrier.

On October 2-3, 2001, a biological inventory was conducted in Redwood Creek to document the fish species composition and distribution at several locations. Each habitat unit was seine netted, single-pass electro-fished using one Smith Root Model 12 electro-fisher. Fish from each site were counted by species and returned to the stream. A random sample of fish was selected from each reach and tissues were taken for genetic analysis. Air temperatures ranged from to 79° to 65° F and water temperatures ranged from 60° to 63° F.

The inventory of Site 1 started at the mouth and ended approximately 5000 feet upstream. In pool habitat types, at least seven steelhead (young-of-year and one-year-olds) were observed along with at least 46 roach, 16 stickleback, 23 suckers, 18 crayfish, 35 sculpin, nine yellow-legged frogs, and one lamprey larva.

The inventory of Site 2 started near habitat unit #100 (near the confluence of La Franchi Creek and Redwood Creek) and ended approximately 2000 feet downstream. In pool and glide habitat types four steelhead (young-of-year) and two coho salmon (young-of-year) were observed along with at least 25 three-spine stickleback, 50 California roach, 46 sculpin, 30 Sacramento sucker, 12 crayfish, and two lamprey larvae.

A summary of historical and recent data collected appears in the table below.

Table 1. Species Observed in Historical and Recent Surveys

YEARS	SPECIES	SOURCE	Native/Introduced
1993, 2001	Coho salmon	DFG	N
1993, 2001	Steelhead	DFG	N
2001	Sculpin	DFG	N
2001	Roach	DFG	N
2001	Foothill yellow-legged frog	DFG	N
2001	Sacramento sucker	DFG	N
2001	Three-spine stickleback	DFG	N
2001	Lamprey	DFG	N
2001	Crayfish	DFG	N

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

ADULT SURVEYS:

On January 12, 2002, a carcass/spawner survey was conducted on Redwood Creek. The survey began at the property boundary approximately 2000 feet downstream of the confluence of Foote Creek and Redwood Creek, and extended 2.5 miles downstream to the mouth of Redwood Creek. No adult salmonids, carcasses or redds were observed. The substrate of the pool tail-outs seemed larger than the ideal size for salmonid spawning.

DISCUSSION

Redwood Creek has two reaches: 10330 feet of F3 and 13433 feet of B3.

According to the DFG Salmonid Stream Habitat Restoration Manual, F3 channel types are good for bank-placed boulders as well as single and opposing wing-deflectors. They are fair for low-stage weirs, boulder clusters, channel constrictors and log cover. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

B3 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors and log cover. They are also good for medium-stage plunge weirs. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. These channel types have suitable gradients and the stable stream banks that are necessary for the installation of instream structures designed to increase pool habitat, trap spawning gravels, and provide protective shelter for fish.

The water temperatures recorded on the survey days 6/20/2001 - 6/26/2001 ranged from 59ºF to 70ºF. Air temperatures ranged from 57ºF to 90ºF. The warmest water temperatures were recorded in Reach 2. These temperatures, if sustained, are above the threshold stress level (65ºF) for salmonids.

Summer temperatures measured using remote temperature recorders placed in pools in Reach 1 ranged from 57.4ºF to 68.4ºF. The Temperature Summary graph shows that for much of the summer (July through August) the lower watershed exhibited temperatures slightly above optimal for salmonids. In the future, temperature monitoring should focus on the upper parts of Reach 2 in Knight's Valley, where the riparian canopy is stripped and water temperatures are higher.

Pools comprised 9% of the total length of this survey. 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. In Redwood Creek, the pools are relatively deep with 68% having a maximum depth of at least two feet. These pools comprised 76% of the total length of stream habitat. In coastal coho and steelhead streams, it is generally

desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 43. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by Undercut Banks at 24%, Large Wood at 23%, Terrestrial Vegetation at 19%, and Root Mass at 11%. Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Six of the nine low-gradient riffles measured (67%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Twenty-three percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 20% had a rating of 1. Cobble embeddedness measured to be 25% or less (a rating of 1) is considered best for the needs of salmon and steelhead.

The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence.

The mean percent canopy for the survey was 58%. This is a low percentage of canopy, since 80 percent is generally considered desirable. Cooler water temperatures are desirable in Redwood Creek. Elevated water temperatures could be reduced by increasing stream canopy. The large trees required for adequate stream canopy would also eventually provide a long term source of large woody debris needed for instream shelter and bank stability.

The riparian buffer is almost completely nearly absent in areas with agriculture/urban development. Riparian removal/intense grazing/vineyard development within the riparian corridor could all lead to less stream canopy and channel incision causing bank erosion and higher water temperatures.

GENERAL MANAGEMENT RECOMMENDATIONS

Redwood 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.

PRIORITY FISHERY ENHANCEMENT OPPORTUNITIES

1. Vineyard cross-fencing inhibits adult migration. A floating fence should be installed at each location in order to allow access for migrating salmonids.

2. There are several sections where the stream is 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.

3. Increase the canopy on Redwood Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reach above the survey section should be assessed for planting and treated as well, since water temperatures throughout are effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

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

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

6. Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

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

8. If riparian areas are not improved in Reaches 1 and 2, temperatures in sections of Redwood Creek, should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

REDWOOD CREEK 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.

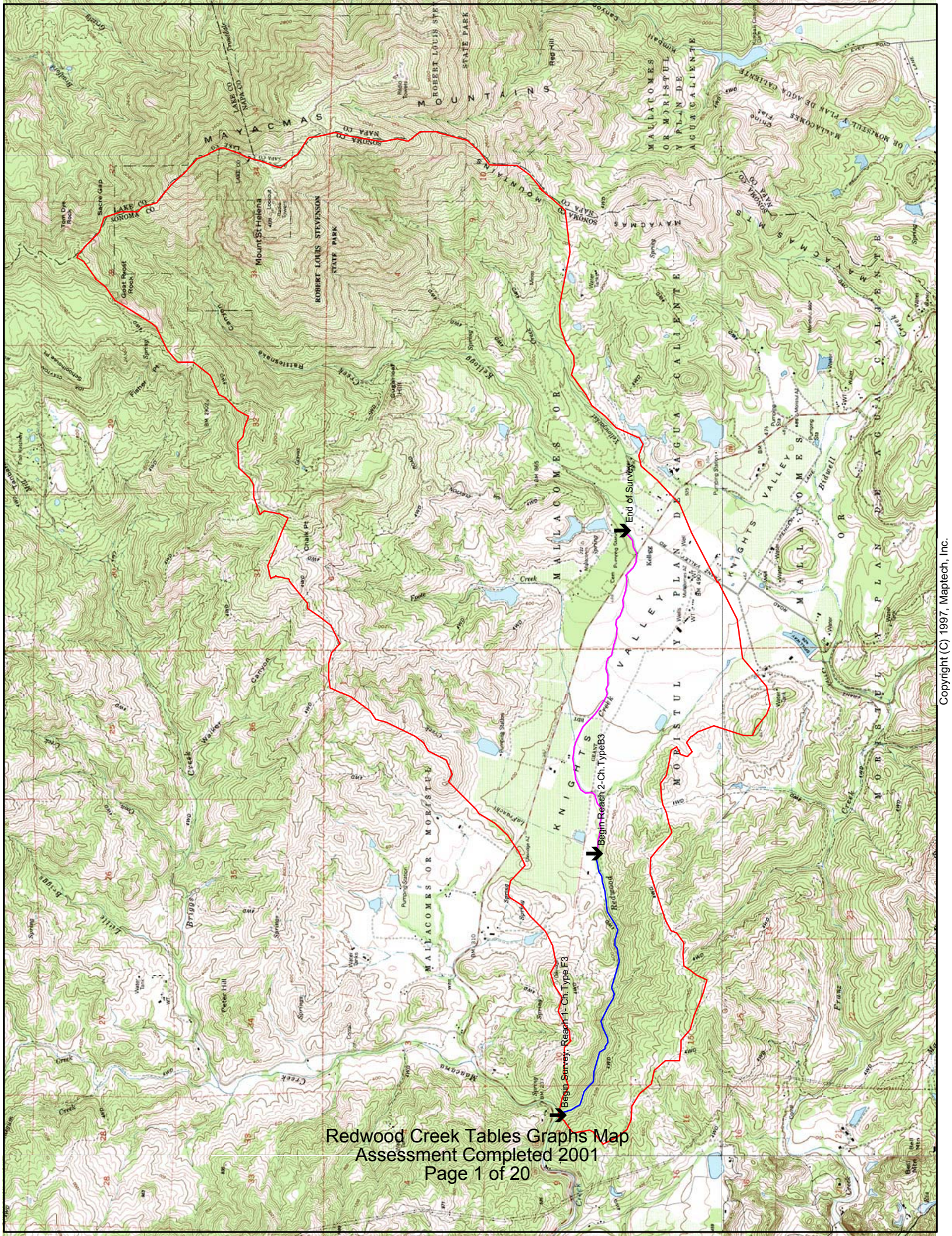
Redwood Creek

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	WP 015(f6); Upstream of Ferrari-Carano(Maacama) Bridge.
85.5	0002.00	A lot of green algae
126.5	0004.00	Rip Rap LB 65'L x 25'H
149.4	0005.00	Approximately 30 Roach 2-3"; Old road crossing
231.4	0006.00	One dead crayfish
386.4	0007.00	LWD (AL/1.5/30); Old Road LB
536.4	0010.00	One dead crayfish; Dry Trib RB @ 15'
567.4	0011.00	Dry Trib LB @ 70'
798.4	0013.00	LWD (RW/4.0/>30/B/>16); 15 Roach 2-5"
886.4	0014.00	LB Dry Trib 3' From base of unit; 160 L x 75 H Land slide
1060.4	0016.00	Live crayfish; >100 Tadpole
1206.4	0018.00	10 Salmonids YOY; 2 may be coho; 4 crayfish; >50 Roach; 63 degree water temp; Dry Trib LB 1' into unit
1439.4	0020.00	4 crayfish; 10 YOY; 38`38'18.5"/122`44'31"
1568.4	0021.00	3 crayfish

1754.4	0022.00	Approximately 100 Roach
2043.4	0025.00	LB Dry Trib at base of unit
2105.4	0026.00	70 degree water
2327.4	0030.00	N38`38'15.2"/W122`44'22.9"
2353.4	0031.00	4 YOY
2917.4	0034.00	1 YOY 72 degrees; Dry Trib LB & RB
3220.4	0038.00	50 L x 30 H Landslide; YOY
3279.4	0040.00	N38`38'11.4"/W122`44'12.7"
3799.4	0046.00	Some YOY; N38`38'12.9"/122`44'7"
4058.4	0048.00	YOY
4575.4	0052.00	5 YOY
4630.4	0053.00	1 Dead crayfish
4835.4	0056.00	YOY; N38`38'9.1"/W122`43'51.9"
5577.4	0059.00	15 YOY
5957.4	0062.00	15 YOY
6000.4	0063.00	Cattle have access to stream
6233.4	0065.00	YOY
6361.4	0066.00	NO GPS available
6629.4	0067.00	30 YOY

6867.4	0070.00	YOY
7404.4	0078.00	YOY
7818.4	0083.00	Old Road RB
8068.4	0084.00	Needs more cover 64 degree water
8201.4	0086.00	N38`38'5.6"/W122`43'20.5"
8249.4	0087.00	200' in HU cattle access to stream
8534.4	0088.00	Cattle access to stream
8754.4	0089.00	Old road crossing on map
8820.4	0090.00	Washed out culvert from upstream LB
9030.4	0092.00	RB Dry Trib
9349.4	0095.00	Cattle access to stream
9519.4	0096.00	Cattle access to stream N38`38'10.6"/W122`43'4.2"
10330.4	0104.00	Channel Type Change
10477.4	0105.00	Dry Trib RB
10717.4	0106.00	Wet road crossing bottom of HU; Cattle; N38`38'13.2"/W122`42'49.7"
11277.4	0112.00	YOY <10
11450.4	0114.00	80 degree water
11799.4	0116.00	YOY; N38`38'13.5"/W122`42'37.8"
11853.4	0117.00	Cattle in stream

12146.4	0119.00	Needs shelter and canopy
12415.4	0122.00	Good canopy >30 Roach
12550.4	0124.00	Cattle access to stream
12573.4	0125.00	Cattle, House LB
15079.4	0126.00	Wet road crossing end of HU; N38`38'22.3"/122`42'4.4"
15394.4	0128.00	Young willows on both banks
15889.4	0129.00	Good cover due to overhanging willows
16004.4	0130.00	Dry Trib RB 900' in unit; could use willow planting ; bridge
18210.4	0132.00	Roach
18432.4	0136.00	N38`38'10"/W122`41'25.9"
18507.4	0137.00	65 degree water
18560.4	0138.00	Wet road crossing
18655.4	0140.00	No canopy only grass on banks; wet road crossing
22709.4	0143.00	HWY 128 crossing
22853.4	0144.00	HWY 128 crossing
22918.4	0145.00	450' retaining wall LB; Bridge; Bridge is not in channel 600'
23727.4	0148.00	DAM; End of survey.



Redwood Creek Tables Graphs Map
Assessment Completed 2001

APPENDIX B: TABLES

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

Stream Name: Redwood Creek LLID: 1227450386410

Drainage:

Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

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
18	0	DRY	12.2	543	9775	41.1									
41	6	FLATWATER	27.7	103	4223.9	17.8	12.5	0.7	1.2	733	30057	507	20767		5
38	37	POOL	25.7	54	2053	8.6	13.8	1.3	2.4	780	29629	1401	51802	1281	43
51	10	RIFFLE	34.5	151	7711.5	32.5	8.3	0.3	0.6	738	37658	214	10903		5

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
148	53	23763.4	97344	83471

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Redwood Creek LLID: 1227450386410 Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

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 (%)
49	9	LGR	33.1	155	7597	32.0	9	0.3	0.9	801	39268	228	11173		5	53
2	1	HGR	1.4	58	115	0.5	4	0.5	1	172	343	86	172			30
10	1	GLD	6.8	105	1055	4.4	15	0.6	0.9	344	3435	206	2061		5	63
31	5	RUN	20.9	102	3169	13.3	12	0.7	2.4	811	25142	567	17564		5	65
27	27	MCP	18.2	56	1518	6.4	15	1.6	5.8	871	23524	1726	44869	1592	35	70
1	0	STP	0.7	70	70	0.3										
2	2	LSL	1.4	40	79	0.3	15	0.6	1.7	526	1052	421	842	306	158	70
5	5	LSR	3.4	42	211	0.9	9	0.8	2.4	384	1921	356	1781	279	46	63
2	2	LSBk	1.4	66	132	0.6	14	1.1	3.8	918	1836	1215	2430	1123	13	
1	1	LSBo	0.7	43	43	0.2	12	0.9	1.7	516	516	516	516	464	30	
18	0	DRY	12.2	543	9775	41.1										53

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
148	53	23763.4	97036	81408

Table 3 - Summary of Pool Types

Stream Name: Redwood Creek

LLID: 1227450386410

Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

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
28	27	MAIN	74	57	1588	77	14.7	1.6	871	24395	1592	42936	35
10	10	SCOUR	26	47	465	23	11.5	0.8	533	5325	472	4720	60

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
38	37	2053	29720	47656

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

Stream Name: Redwood Creek

LLID: 1227450386410

Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

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
27	MCP	73	1	4	3	11	15	56	6	22	2	7
2	LSL	5	0	0	2	100	0	0	0	0	0	0
5	LSR	14	0	0	4	80	1	20	0	0	0	0
2	LSBk	5	0	0	1	50	0	0	1	50	0	0
1	LSBo	3	0	0	1	100	0	0	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
37	1	3	11	30	16	43	7	19	2	5

Mean Maximum Residual Pool Depth (ft.): 2.4

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Redwood Creek LLID: 1227450386410 Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001 Dry Units: 18

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

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
49	3	LGR	0	0	0	20	33	0	0	13	0
2	0	HGR									
51	3	TOTAL RIFFLE	0	0	0	20	33	0	0	13	0
10	1	GLD	0	0	0	0	100	0	0	0	0
31	4	RUN	0	0	0	33	0	0	0	0	18
41	5	TOTAL FLAT	0	0	0	26	20	0	0	0	14
27	24	MCP	28	5	8	16	20	2	0	14	4
1	0	STP									
2	2	LSL	13	15	25	0	45	0	0	3	0
5	5	LSR	37	13	16	24	4	0	0	4	0
2	2	LSBk	0	0	0	0	15	0	0	50	35
1	1	LSBo	10	60	0	0	0	0	0	30	0
38	34	TOTAL POOL	26	8	9	15	18	1	0	14	5

148	42	TOTAL	21	7	8	16	20	1	0	12	5

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Redwood Creek LLID: 1227450386410 Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001 Dry Units: 18

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

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
49	9	LGR	0	0	0	67	22	11	0
2	1	HGR	0	0	0	0	0	100	0
10	1	GLD	0	0	0	100	0	0	0
31	5	RUN	0	0	0	80	20	0	0
27	4	MCP	0	0	0	50	25	25	0
1	0	STP	0	0	0	0	0	0	0
2	1	LSL	0	0	0	100	0	0	0
5	1	LSR	0	0	0	0	100	0	0
2	0	LSBk	0	0	0	0	0	0	0
1	0	LSBo	0	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Redwood Creek LLID: 1227450386410 Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
60	43	57	0	67	69

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: Redwood Creek LLID: 1227450386410 Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

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	5	7	27.3
Boulder	1	1	4.5
Cobble / Gravel	15	13	63.6
Sand / Silt / Clay	1	1	4.5

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	6.8
Brush	3	7	22.7
Hardwood Trees	7	5	27.3
Coniferous Trees	9	7	36.4
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Redwood Creek LLID: 1227450386410 Drainage: Russian River - Middle

Survey Dates: 6/20/2001 to 6/26/2001

Confluence Location: Quad: MOUNT ST. HELENA Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	26
SMALL WOODY DEBRIS (%)	0	0	8
LARGE WOODY DEBRIS (%)	0	0	9
ROOT MASS (%)	20	26	15
TERRESTRIAL VEGETATION (%)	33	20	18
AQUATIC VEGETATION (%)	0	0	1
WHITEWATER (%)	0	0	0
BOULDERS (%)	13	0	14
BEDROCK LEDGES (%)	0	14	5

APPENDIX C

Table 8 - Fish Habitat Inventory Data

Stream Name: Redwood Creek LLID: 1227450386410 Drainage: Russian River -

Survey Dates: 6/20/2001 to 6/26/2001 Survey Length (ft.): 23763. Main Channel (ft.): 23763. Side Channel (ft.): 0

Confluence Location: Quad MOUNT ST. Legal Description: T09NR08WS09 Latitude: 38:38:28.0N Longitude: 122:44:42.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F3
Reach Length (ft.): 10330.4
Riffle/Flatwater Mean Width (ft.): 10.3
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 63 - 70 Air (F): 63 - 90
Dry Channel (ft.): 528

Canopy Density (%): 61.1
Coniferous Component (%): 52.2
Hardwood Component (%): 47.8
Dominant Bank Coniferous Trees
Vegetative Cover (%): 64.6
Dominant Undercut Banks
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 7.6
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 16.3
Pool Frequency (%): 28.2
Residual Pool Depth (%):
< 2 Feet Deep: 35.7
2 to 2.9 Feet Deep: 39.3
3 to 3.9 Feet Deep: 21.4
>= 4 Feet Deep: 3.6
Mean Max Residual Pool Depth (ft.): 2.36
Mean Pool Shelter 33

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 3.6 Gravel: 0.0 Sm Cobble: 96.4 Lg 0.0 Boulder: 0.0 Bedrock: 0.0

Embeddedness Values (%): 1. 15.4 2. 61.5 3. 23.1 4. 0.0 5. 0.0

STREAM REACH: 2

Channel Type: B3
Reach Length (ft.): 13433
Riffle/Flatwater Mean Width (ft.): 8.9
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 59 - 70 Air (F): 57 - 89
Dry Channel (ft.): 9247

Canopy Density (%): 56.1
Coniferous Component (%): 11.4
Hardwood Component (%): 88.6
Dominant Bank Brush
Vegetative Cover (%): 79.5
Dominant Terrestrial Veg.
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 6.7
LWD per 100 ft.:
Riffles:
Pools:
Flat:

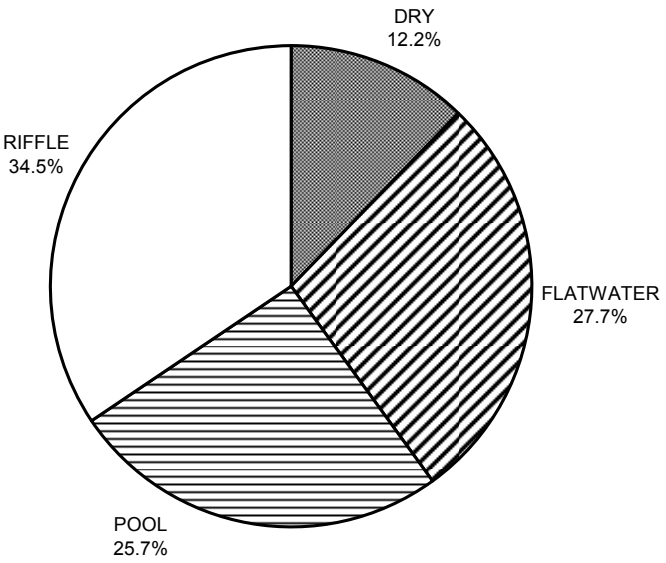
Pools by Stream Length (%): 2.7
Pool Frequency (%): 20.0
Residual Pool Depth (%):
< 2 Feet Deep: 22.2
2 to 2.9 Feet Deep: 55.6
3 to 3.9 Feet Deep: 11.1
>= 4 Feet Deep: 11.1
Mean Max Residual Pool Depth (ft.): 2.62
Mean Pool Shelter 73

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 11.1 Sm Cobble: 77.8 Lg 11.1 Boulder: 0.0 Bedrock: 0.0

Embeddedness Values (%): 1. 33.3 2. 44.4 3. 22.2 4. 0.0 5. 0.0

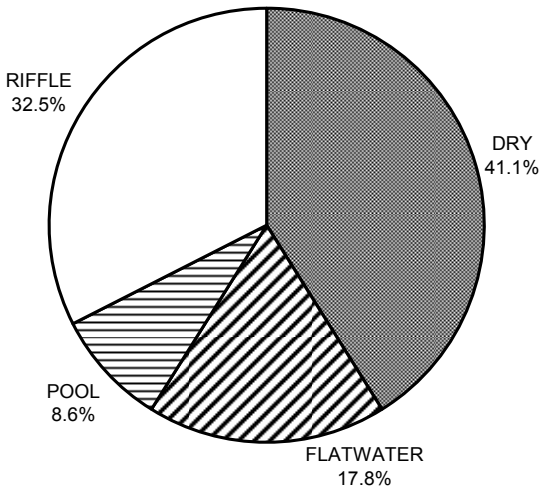
APPENDIX D: GRAPHS

REDWOOD CREEK 2001
HABITAT TYPES BY PERCENT OCCURRENCE



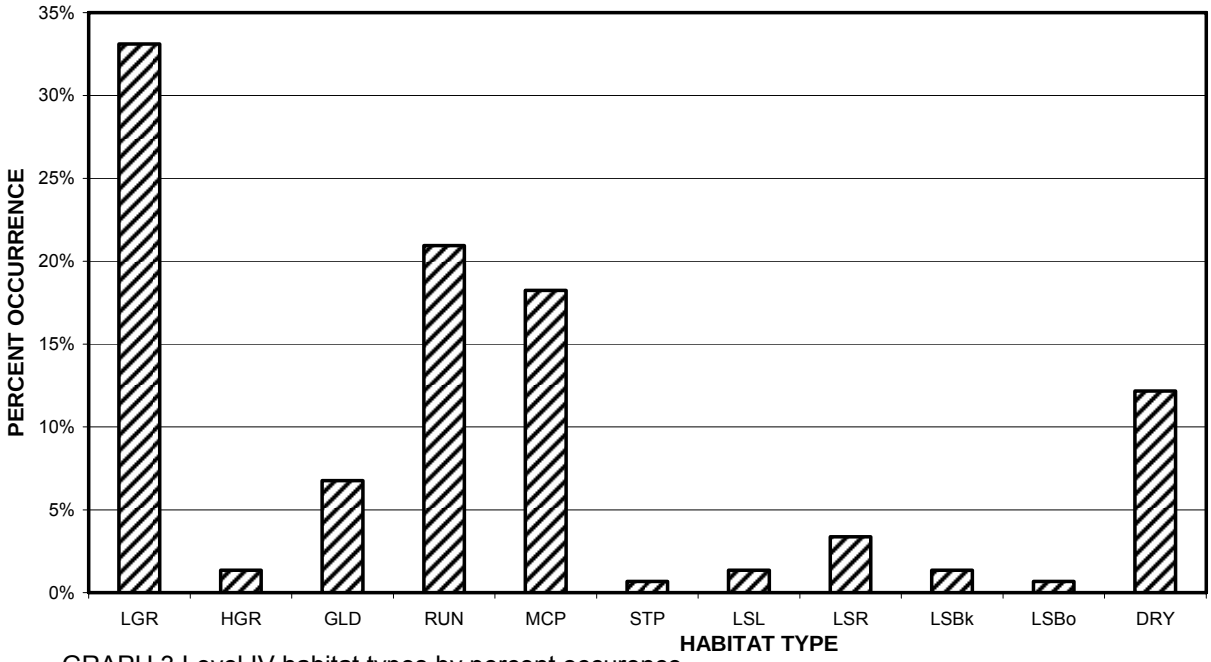
GRAPH 1 Level II habitat types by percent occurence

REDWOOD CREEK 2001
HABITAT TYPES BY PERCENT TOTAL LENGTH



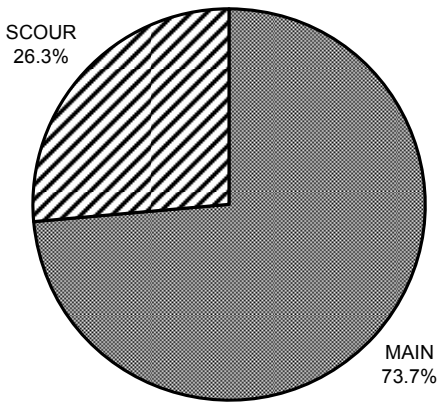
GRAPH 2 Level II habitat types by percent total length

REDWOOD CREEK 2001
HABITAT TYPES BY PERCENT OCCURRENCE



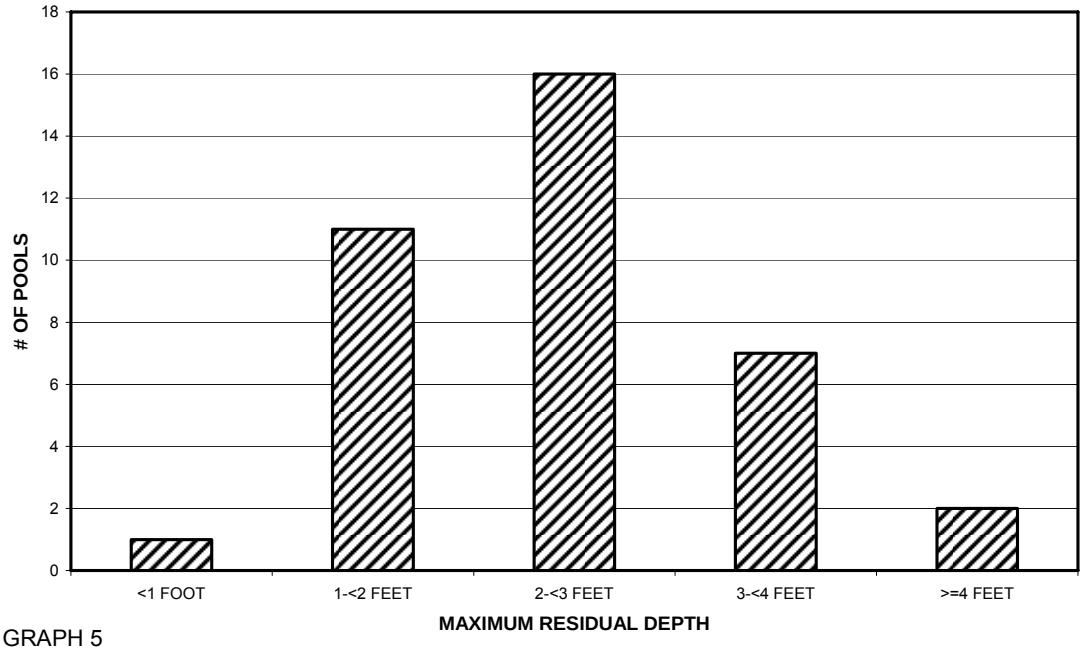
GRAPH 3 Level IV habitat types by percent occurence

REDWOOD CREEK 2001
POOL TYPES BY PERCENT OCCURRENCE



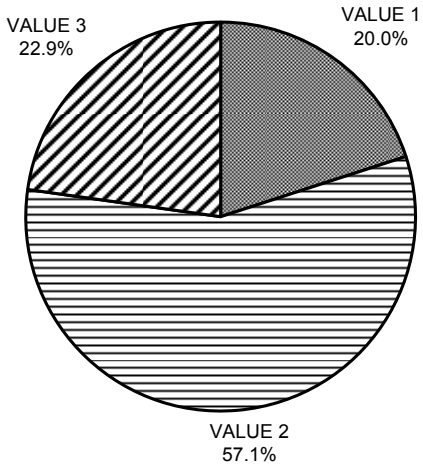
GRAPH 4 Level I pool types by percent occurence

REDWOOD CREEK 2001
MAXIMUM DEPTH IN POOLS



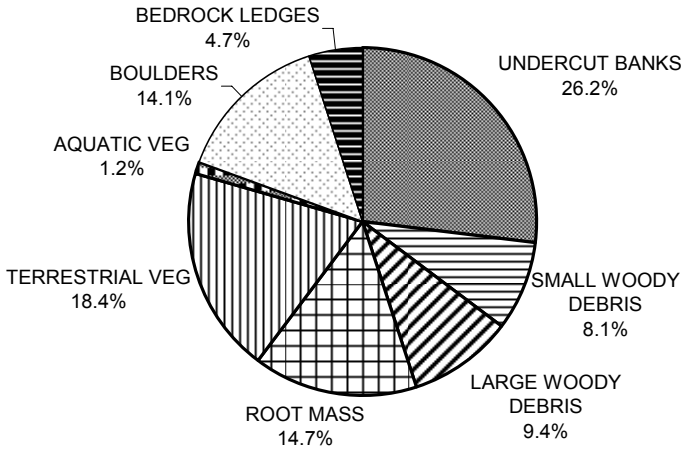
GRAPH 5

REDWOOD CREEK 2001
PERCENT EMBEDDEDNESS



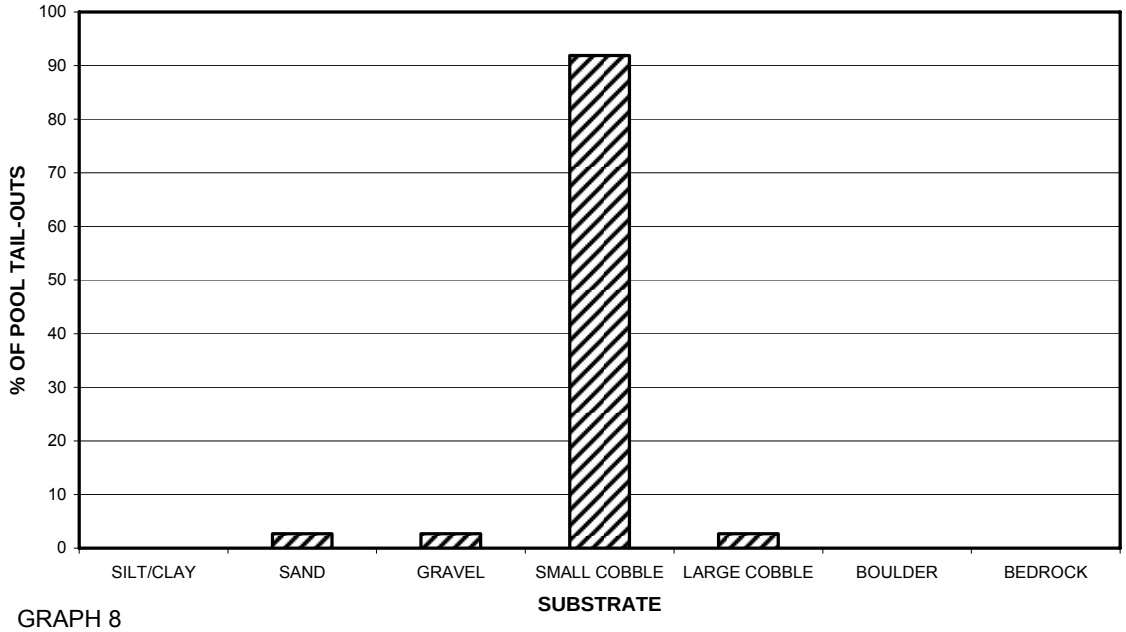
GRAPH 6

REDWOOD CREEK 2001
MEAN PERCENT COVER TYPES IN POOLS



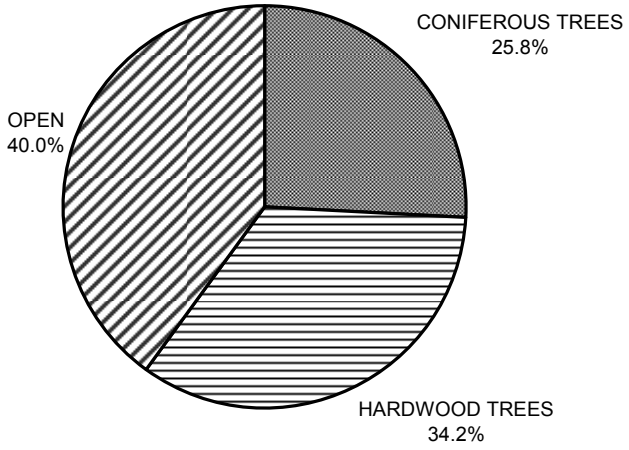
GRAPH 7

REDWOOD CREEK 2001
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



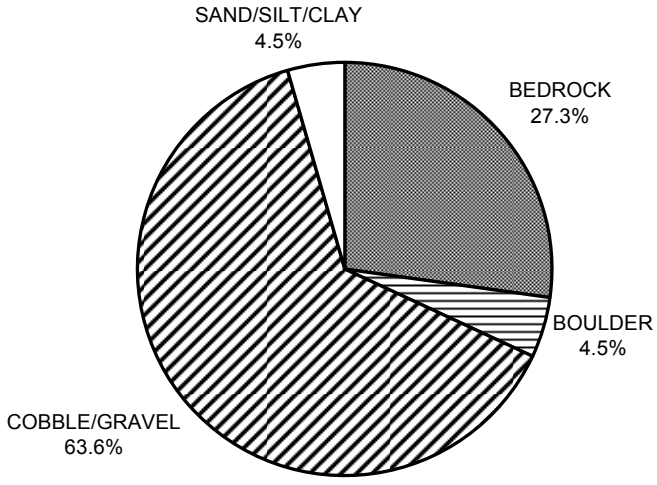
GRAPH 8

REDWOOD CREEK 2001
MEAN PERCENT CANOPY



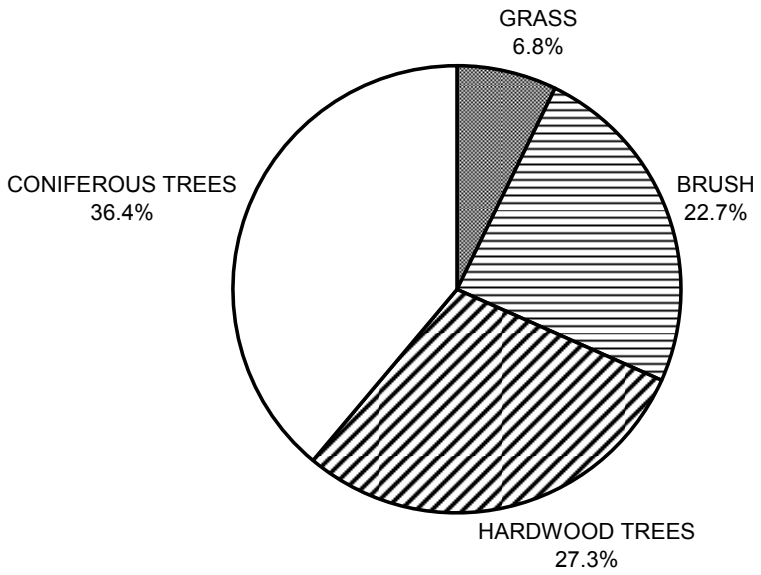
GRAPH 9

REDWOOD CREEK 2001
DOMINANT BANK COMPOSITION



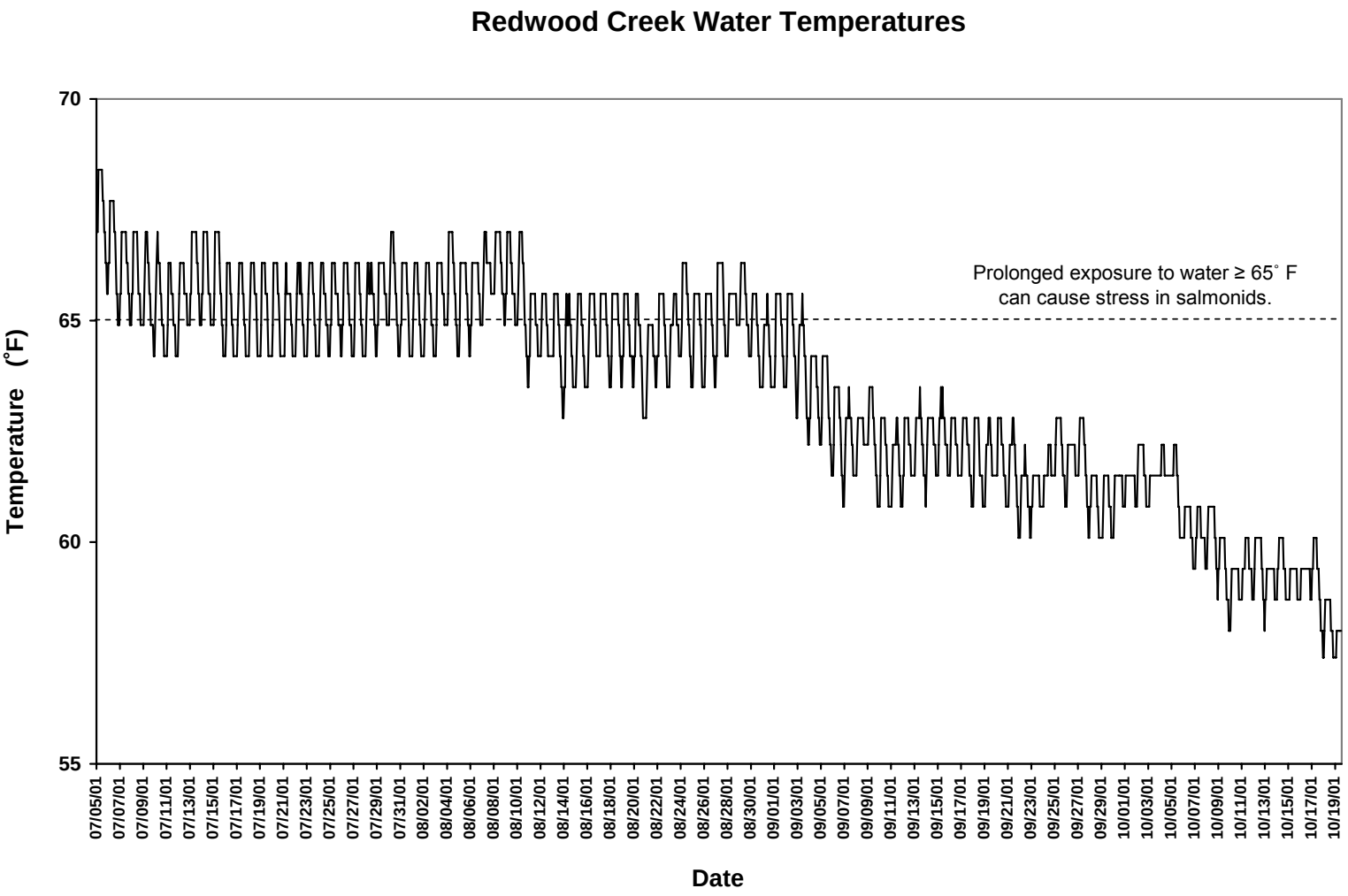
GRAPH 10

REDWOOD CREEK 2001
DOMINANT BANK VEGETATION



GRAPH 11

APPENDIX E


Redwood Creek Water Temperatures
Temperature (˚F)
70
65
60
55
Prolonged exposure to water ≥ 65˚ F
can cause stress in salmonids.
07/05/01
07/07/01
07/09/01
07/11/01
07/13/01
07/15/01
07/17/01
07/19/01
07/21/01
07/23/01
07/25/01
07/27/01
07/29/01
07/31/01
08/02/01
08/04/01
08/06/01
08/08/01
08/10/01
08/12/01
08/14/01
08/16/01
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09/25/01
09/27/01
09/29/01
10/01/01
10/03/01
10/05/01
10/07/01
10/09/01
10/11/01
10/13/01
10/15/01
10/17/01
10/19/01
Date

Watershed Hydroid **446** Redwood Creek (Maacama)

Hydrologic Sub-Areas covered by the watershed:

Name:	LLId: (1:24k)	County:
Redwood Creek (Maacama)	1227450386410	Sonoma

Tributary to Maacama Creek
Tributary to Russian River
Tributary to

Location: **T:** 09N **R:** 08W **S:** 9 **Latitude:** 38.641042410013 **Longitude** 122.745034410003

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

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

Stream Order: 2

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

Total Length: 4.51 Miles / 7.27 Km

Note: Length is for the USGS blue-line 1:24,000 stream.

Drainage Area: 3488 Hectares / 8619 Acres / 13.46 sq. mi.

Elevations: Mouth: 213 feet; Headwaters: 4331 feet

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

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

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

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

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

Federal:	State:	Local:	Private:
0.0 acres	1672.6	0.0	6946.2
0.00 %	19.40 %	0.00 %	80.60 %

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

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

Mixed hardwood/conifer:	Hardwood:	Conifer:	Agriculture:	Urban:
627.79 acres	2739.30	408.80	715.52	0.00
7.3 %	31.8 %	4.7 %	8.3 %	0.0 %

Shrub:	Herbaceous:	Barren/rock:	Water:
1502.08	2548.10	0.00	60.38
17.5 %	29.6 %	0.0 %	0.7 %

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

Watershed HydroId **446** Redwood Creek (Maacama)

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

Quad Name	USGS Code
MARK WEST SPRINGS	38122E6
DETERT RESERVOIR	38122F5
MOUNT ST. HELENA	38122F6

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

Scientific Name	Common Name
Lupinus sericatus	Cobb Mountain lupine
Limnanthes vinculans	Sebastopol meadowfoam
Sidalcea oregana ssp. valida	Kenwood Marsh checkerbloom
Penstemon newberryi var. sonomensis	Sonoma beardtongue
Hysterocarpus traski pomo	Russian River tule perch
Ceanothus confusus	Rincon Ridge ceanothus
Amorpha californica var. napensis	Napa false indigo
Erigeron angustatus	narrow-leaved daisy
Sidalcea oregana ssp. hydrophila	marsh checkerbloom
Streptanthus breweri var. hesperidis	green jewel-flower
Brodiaea californica var. leptandra	narrow-anthered California brodiaea
Arctostaphylos manzanita ssp. elegans	Konocti manzanita
Leptosiphon jepsonii	Jepson's leptosiphon
Ceanothus divergens	Calistoga ceanothus
Hesperolinon bicarpellatum	two-carpellate western flax

Hydrologic Sub-Areas covered by the watershed

Hydrologic Sub-Area Name:	ID code (RBUAS)	Hydrologic Area Name	% of watershed in this HSA
Upper Putah Creek	551230	Upper Putah Creek	0.02
Napa River	220650	Napa River	0.03
Geyserville	111425	Middle Russian River	99.95