

**CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT**

Mill Creek

Report revised April 14, 2006

Report Completed 2005

Assessment Completed 2001

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Mill 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 Mill 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

Mill Creek, located in Mendocino County, California, is a tributary to McClure Creek, a tributary to the Russian River. The legal description at the confluence with the Russian River is T15N, R12W, Rancho Yokayo. Its location is 39°08'2.9" N. latitude and 123°10'36" W. longitude. Year round vehicle access exists from Highway 101 near Ukiah by heading east on Talmage Road to where it crosses the Russian River.

Mill Creek and its tributaries drain a basin of approximately 117 square miles. Mill Creek is a third order stream and has approximately 6.0 miles of blue line stream, according to the USGS Ukiah, Elledge Peak, Purdys Garden, and Cow Mountain 7.5 minute quadrangles. Major tributaries include McClure Creek and North Fork Mill Creek, both of which are described in separate stream reports. Summer flow was measured as approximately 0.4 cfs at habitat unit number 51. Elevations range from about 581 feet at the mouth of the creek to 3766 feet in the headwaters. South-facing slopes in the upper watershed are covered with chaparral, oak woodland covers north-facing slopes and canyon bottoms. Natural vegetation in the lower watershed includes open grasslands, oak woodland, and some wetlands, but most of the area has been converted to agriculture and development. There are three dams on Mill Creek that form complete barriers to anadromous salmonids. The lower dam is approximately 1.2 miles upstream from the confluence of Mill Creek and the North Fork Mill Creek. The area upslope of this dam was recently severely charred by an arson-caused fire. About 0.4 miles above the first dam is another larger dam which forms a 4-acre reservoir. Approximately 62.5% of the watershed is owned by the BLM, 35% privately held, and the remaining 2.5% is a Mendocino County park. Land uses in the lower watershed include vineyards, orchards, rural-residential development,

suburban residential development, limited commercial development (the city of Talmage), and a Buddhist Monastery. Land uses in the upper watershed include recreation activities like hiking, hunting, and a heavily used off-road vehicle area. According to the California Natural Diversity Data Database, Bolander's Horkelia (*Horkelia bolanderi*) glandular western flax (*Hesperolinon adenophyllum*) and Raiche's Manzanita (*Arctostaphylos stanfordiana* ssp. *rachei*) are known to exist in the watershed. None of the plants has a federal or state status. Mill Creek is a steelhead stream.

METHODS

The habitat inventory conducted in Mill 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 Mill 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.

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. De-watered units are labeled "DRY". Mill 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 Mill 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 Mill 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 Mill 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 Mill 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 Mill 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 is no record of stream surveys conducted by the Department of Fish and Game on Mill Creek prior to this year.

HABITAT INVENTORY RESULTS

The habitat inventory of Mill Creek, August 6, 2001 - August 8, 2001, was conducted by L. MacTague (DFG) and M. Shugars (DFG), and J. Newell (DFG) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with the Russian River and extended up Mill Creek to the end of anadromous fish passage at a dam with a 17 foot vertical barrier. The total length of stream surveyed was 13809 feet, with no side channels.

A flow of 0.4 cfs was measured on August 8, 2001, in Reach 1, with a Marsh-McBirney Model 2000 flow meter.

This section of Mill Creek has two reaches with two distinct channel types: from the mouth to 12423 feet a F3 and 1386 feet a A2.

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

A2 channel types are steep (4-10%), narrow, cascading, step-pool streams with a high energy/debris transport associated with depositional soils and a predominantly boulder substrate.

Water temperatures ranged from 62°F to 68°F. Air temperatures ranged from 70°F to 88°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of *occurrence* there were 49.5% Flatwater units, 37.9% Pool units, 10.5% Riffle units and 2.1% Dry units (Graph 1). Based on total *length* there were 62.5% Dry units, 27.8% Flatwater units, 7.2% Pool units and 2.5% Riffle units (Table 1).

Ninety-five habitat units were measured and 47% were completely sampled. 13 Level IV habitat

types were identified. The data is summarized in Table 2. The most frequent habitat types by percent *occurrence* were Run at 27%, Mid-Channel Pool at 21%, and Step Run at 16%. By percent total *length*, Dry at 63%, Flatwater at 27.8%, and Pool at 7.2% (Graph 2).

Thirty-six pools were identified (Table 3). Mid-Channel Pool pools were most often encountered at 58% (Graph 4), and comprised 68% of the total length of pools.

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth.

One of the 36 pools (3%) had a depth of three feet or greater (Graph 5). These deeper pools comprised 2% 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 8, Pools rated 25 and Flatwater units rated 17 (Table 1). Of the pool types, Scour Pools rated 47, Main-Channel Pools rated 12, and Backwater pools rated 10 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were Undercut Banks at 29%, Boulders at 16%, and Root Mass at 15%. Graph 7 describes the pool shelter in Mill Creek.

Table 6 summarizes the dominant substrate by habitat type. In the 6 Low-Gradient Riffles surveyed, the dominant substrate was Gravel.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 35 pool tail-outs measured, 17 had a value of 1 (49%), ten had a value of 2 (29%) and three had a value of 3 (9%). Five (14%) riffles rated a 5 (unsuitable substrate type for spawning). On this scale, a value of one is best for fisheries. Gravel was the dominant substrate observed at pool tail-outs. Graph 6 describes percent embeddedness, and Graph 8 describes the dominant substrate in pool tail outs.

The mean percent canopy density for the stream reach surveyed was 89%. The mean percentages of deciduous and evergreen trees were 32% and 68%, respectively (Table 7). Graph 9 describes the canopy for the entire survey and Table 8 describes the canopy by reach.

For the entire stream reach surveyed, the mean percent of the right and left bank vegetated was 92% each (Table 9). For the habitat units measured, the dominant vegetation types for the stream banks were: 48% Brush, 32% Evergreen Trees, and 8% Bare Soil. (Graph 8) The dominant substrate for the stream banks were: 74% Silt, Clay & Sand, 11% Boulder, 9% Cobble & Gravel and 4% Bedrock (Graph 10).

BIOLOGICAL INVENTORY

Steelhead, sculpin, crawfish, roach, newt, sunfish and an adult rainbow trout were observed by DFG in 2001.

JUVENILE SURVEYS:

On August 16, 2001, a biological inventory was conducted on Mill Creek to determine the presence of Coho Salmon, as well as all other fish species present. Each pool was electro-fished using one Smith Root Model 12 electro-fisher. Fish from each site were counted by species and returned to the stream. This inventory study was done using the Brown and Moyle Modified Ten Pool Protocol. A random sample of fish were selected from each pool, however only tissues from salmonids were taken for genetic analysis. Air temperatures ranged from 74° to 75° F and water temperature was 60° F.

In Scour Pool and Mid-Channel Pool habitats, 16 steelhead (ranging from 58mm-139mm) were observed along with 29 roach, 10 sculpin and 1 blue gill.

On October 16, 2001 and October 24, 2001, a biological inventory was conducted in Mill Creek to document the fish species composition and distribution at several locations. Each site was 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 were selected from each reach, however only tissues from salmonids were taken for genetic analysis. Air temperatures ranged from 56° to 76° degrees F and water temperatures ranged from 57° to 60° F.

The inventory of Site 1 started near habitat unit #44, just upstream of where Mill Creek Road crosses Mill Creek, east of Talmage, and ended approximately 215 feet upstream. In pool, run and step-run habitats, at least 3 steelhead were observed along with at least 4 sculpin.

The inventory of Site 2 started approximately 200 feet upstream of the end of Site 1 and ended approximately 415 feet upstream. In pool, riffle and step-run habitats, 10 steelhead (ranging from young of the year to 2+) were observed along with at least 16 sculpin, 1 sunfish and at least 9 crayfish.

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
2001	Steelhead	DFG	N

Table 1. Species Observed in Historical and Recent Surveys			
YEARS	SPECIES	SOURCE	Native/Introduced
2001	Sculpin	DFG	N
2001	Crayfish	DFG	N
2001	California Newt	DFG	N
2001	Sunfish	DFG	I

ADULT SURVEYS:

There is no record of adult surveys or carcass surveys having been performed on Mill Creek, according to DFG current and historical records.

DISCUSSION

Mill Creek has two reaches: 12423 feet a F3 and 1386 feet a A2

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.

The high energy, steep gradient A2 channel types have stable stream banks and poor gravel retention capabilities and are generally not suitable for in-stream enhancement structures.

The water temperatures recorded on the survey days August 6, 2001 - August 8, 2001 ranged from 62°F to 68°F. Air temperatures ranged from 70°F to 88°F. The warmest water temperatures were recorded in Reach 2. These temperatures, if sustained, are above the threshold stress level (65°F) for salmonids.

It is unknown if this thermal regime is typical. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and/or more extensive biological sampling conducted.

Pools comprised 7% of the total length of this survey. In third and fourth order streams a primary pool is defined to have a maximum depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. In Mill Creek, the pools are relatively shallow with 3% having a maximum depth of at least three feet. These pools comprised

2% 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 25. 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 27%, Large Wood at 17%, Small Wood at 15%, Boulders at 13% and Root Mass at 13%. 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.

The one and only low gradient riffle measured (100%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Nine percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Forty-six percent 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 mean percent canopy for the survey was 89%. This is a high percentage of canopy, since at least 80 percent is generally considered desirable.

GENERAL MANAGEMENT RECOMMENDATIONS

Mill 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) Access for migrating salmonids is an ongoing problem in Mill Creek, therefore, fish passage should be monitored, and improved where possible. For an inventory of Mendocino County culverts in the Russian River Basin please refer to the CATALOG OF MENDOCINO COUNTY CULVERTS LOCATED ON FISH-BEARING STREAM REACHES WITHIN THE RUSSIAN RIVER BASIN by Ross Taylor and Associates.

The first culvert on Mill Creek at the gravel mine is a barrier to fish passage. Complete replacement with a bridge or open bottom arch culvert is recommended.

The culvert on Mill Creek at Highway 222 is currently not a barrier to fish passage, however it should be inspected regularly.

The culvert on Mill Creek at Mill Creek Road is a partial fish barrier. Reduction of jump height and back watering the culvert outfall with rock weirs is recommended. Baffles inside the culvert may also improve passage, however baffles should be designed so that culvert capacity is not significantly reduced.

The three county dams on Mill Creek are complete barriers to fish migration.

- 2) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. 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 stabilization to prevent erosion.
- 3) Where feasible, design and engineer pool enhancement structures to increase the number of pools in both reaches. This must be done where the banks are stable or in conjunction with stream bank stabilization to prevent erosion.
- 4) Increase the canopy on Mill Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels (portions of Reach 1). 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) If the three county dams are removed, active and potential sediment sources related to the road system need to be mapped, and treated according to their potential for sediment delivery to the stream and its tributaries.
- 6) If the three county dams are removed, sources of upslope and in-channel erosion (above reach 2) should be mapped, and prioritized according to present and potential sediment delivery to the stream. Identified sites should be prioritized, then treated to reduce the amount of fine sediments entering the stream.

COMMENTS AND LANDMARKS

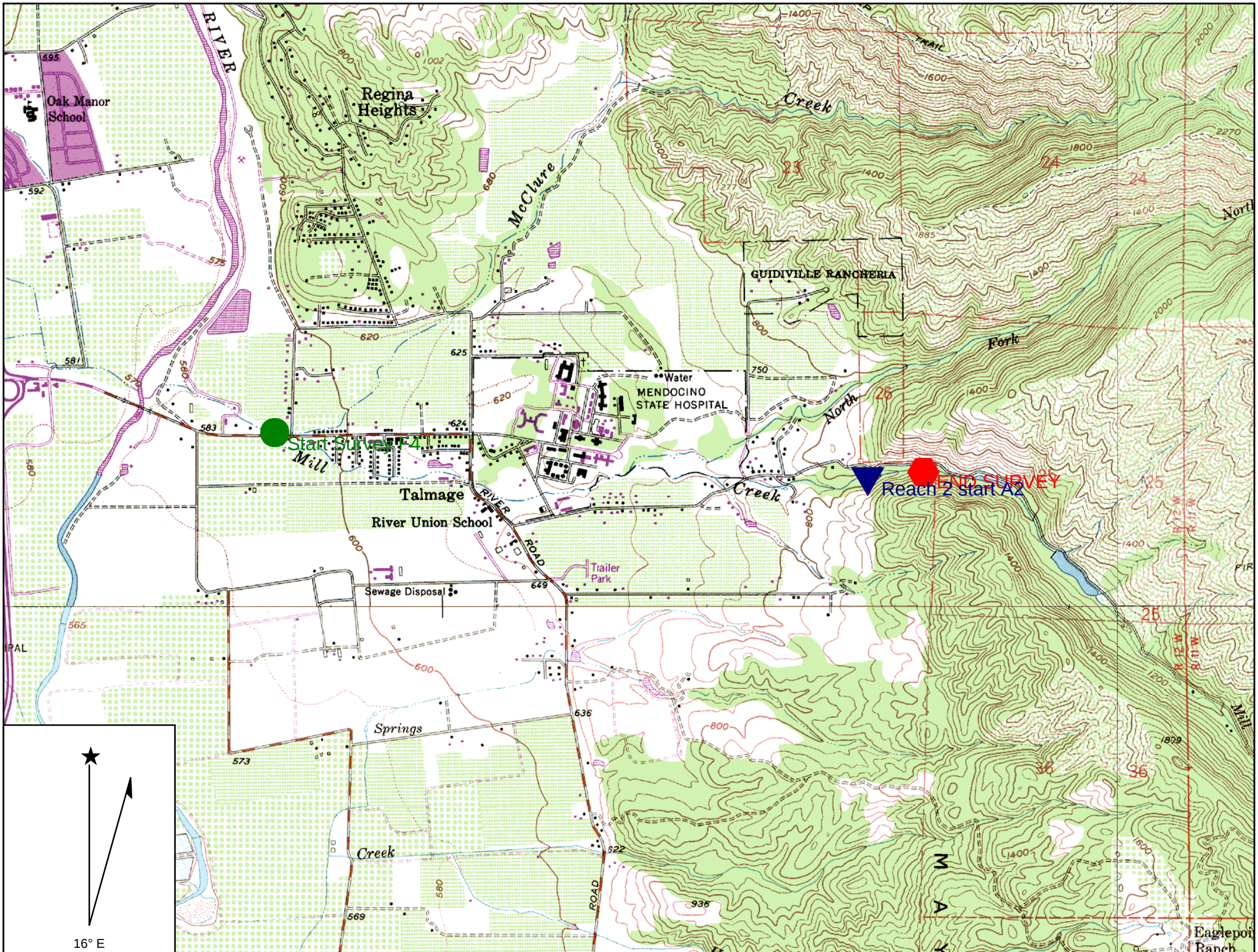
The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Mill Creek

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Bridge at 31', see form. Right bank structures from upstream end of bridge - 1520'. Refuse and debris on both banks and bed throughout unit. Right bank <i>Arundo</i> at 400', 558'. Him. blackberry from mouth to 2100', intermittent throughout. Left bank <i>Arundo</i> at 620'. Right bank wall/fence approximately 700' - 1753', 1990' - 2135'. Left bank rip rap at 1018', 1220', 1430', 1760 - 1780'. Right bank various non - indigenous plants throughout. Right bank stretches from 1775'. Right bank riprap 1770' - 1924'. Bridge at 2100' - see form. Left bank wall in bed (on bank) - 2133' - intermittent throughout unit. Bridge at 2626' see form. Bridge at 2753' - see form. Homes along most. Channelized by walls in places. Landowners have seen fish going upstream - not many, used to see a lot during hatchery days. Both banks arundo at 2850', 2990 - 3740'. Bridge at 3815' - see form. Bridge at 4102' - see form. Drainage from culvert at 4250' right bank. From approximately 4100' the arundo is too thick to walk through. Bridge 5540' see form. (actually a culvert). Heavy him. blackberry beyond bridge. Channel becomes N.F. Mill at 7870' (mill turns to right - invisible under overgrowth).
8628	0002.00	<i>H. Regilla</i>
8918	0010.00	WP (F4) 51. 39°07'53". 123°09'4.1".
8955	0011.00	Right bank <i>vinca</i> .
9126	0015.00	Signal crayfish
9259	0018.00	LWD protocol: AL 1.5 30. Yoy and 1+ steel head.

9468	0020.00	1+ steelhead.
9604.8	0022.00	YOY and 1+ steel head. Left bank rip rap whole unit.
9632.8	0023.00	Sculpin
9691.8	0024.00	Signal crayfish (s.c.).
9742.8	0026.00	Left bank 1" pipeline along creek.
9844.8	0029.00	LWD protocol: BA 2.0 30.
9869.8	0030.00	WP (F4). 39°07'52.2". 123°08'54.1".
9952.8	0034.00	This unit is a bridge - see form. (Mill Creek Road).
10102.8	0038.00	Bottom weir this unit - raising unit and creating good pool habitat.
10155.8	0040.00	S.C. WP (F4) 54. 39°07'5.3". 123°08'5.2".
10182.8	0041.00	Still ubiquitous Himalayan blackberry right bank. <i>Arundo</i> left bank at 68".
10688.8	0045.00	Many weirs. Riparian willows and berries.
10787.8	0047.00	Dam at bottom of unit, see form.
10866.8	0049.00	2+ steel head. Bridge - see form.
10920.8	0050.00	WP (F4) 56. 39°07'50.9". 123°08'42.7". Left bank retaining wall for 35' from bridge. Bamboo right bank.
10965.8	0051.00	YOY
11146.8	0055.00	Right bank rip rap and concrete slabs. Erosion undercut.
11244.8	0058.00	Concrete and riprap at 35'.

11357.8	0060.00	WP (F4) 57. 39°07'50.2". 123°08'34.8". YOY.
11745.8	0063.00	1+ steel head. 10 S.C.
12403.8	0066.00	2+ steel head
12422.8	0067.00	Channel change to A2.
12674.8	0070.00	WP (F4) 58. 39°07'51.4". 123°08'24.9".
13018.8	0080.00	Still a lot of garbage in creek; WP 059 (F4) N39°07'53.7"/W123°08'20.7"
13377.8	0086.00	Small debris accumulation
13474.8	0089.00	Roach and sculpin
13596.8	0091.00	WP # 01(F4)/N39°7'54"/W123°8'15.1"
13616.8	0092.00	At pool tail: LWD retaining 2' gravel
13791.8	0095.00	1' adult rainbow trout; END OF SURVEY; WP #02(F4)/N39°7'5.4"/W123°8'12.6"----->DAM-17' vertical jump-->



16° E

Markers

Name: END SURVEY

Short Name: NDSRVY

Coordinates: 039.1315052° N, 123.1368256° W

Name: Reach 2 start A2

Short Name: Rch2st

Coordinates: 039.1311780° N, 123.1402427° W

Name: Start Survey F4

Short Name: StrtSr

Coordinates: 039.1333349° N, 123.1769504° W

Appendix B: Tables

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

Stream Name: Mill Creek

LLID:

1231767391334

Drainage:

Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

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
2	0	DRY	2.1	4317	8634	62.5									
47	9	FLATWATER	49.5	82	3834.8	27.8	5.4	0.4	0.9	223	10489	96	4528		17
36	35	POOL	37.9	28	990	7.2	7.3	0.8	1.7	196	7053	210	7567	168	25
10	3	RIFFLE	10.5	35	350	2.5	5.7	0.2	0.5	206	2059	30	302		8
Total Units	Total Units Fully Measured			Total Length (ft.)						Total Area (sq.ft.)			Total Volume (cu.ft.)		
95	47			13808.8						19600			12397		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Mill Creek

LLID:

1231767391334

Drainage: Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

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 (%)
6	1	LGR	6.3	37	222	1.6	9	0.1	0.5	432	2592	43	259		10	95
4	2	HGR	4.2	32	128	0.9	4	0.3	0.6	93	371	24	95		5	85
6	3	GLD	6.3	32	195	1.4	6	0.4	1.2	165	988	83	498		13	95
26	2	RUN	27.4	80	2091	15.1	4	0.3	1	94	2444	23	600			93
15	4	SRN	15.8	103	1549	11.2	6	0.4	1.6	332	4974	143	2145		20	88
20	20	MCP	21.1	31	617	4.5	7	0.8	2.4	216	4323	215	4307	169	13	93
1	1	STP	1.1	57	57	0.4	7	0.6	1.6	399	399	319	319	239	5	100
4	3	CRP	4.2	28	114	0.8	5	0.6	1.5	159	636	131	526	92	17	90
1	1	LSL	1.1	18	18	0.1	7	0.6	1.3	113	113	79	79	68	210	100
5	5	LSR	5.3	20	102	0.7	6	0.8	2.5	119	597	141	703	108	40	100
4	4	PLP	4.2	15	59	0.4	13	1.3	4	197	787	348	1392	309	25	65
1	1	DPL	1.1	23	23	0.2	7	0.9	2	161	161	161	161	145	10	90
2	0	DRY	2.1	4317	8634	62.5										40

Total Units
95

Total Units Fully Measured
47

Total Length (ft.)
13808.8

Total Area (sq.ft.)
18385

Total Volume (cu.ft.)
11085

Table 3 - Summary of Pool Types

Stream Name: Mill Creek

LLID:

1231767391334

Drainage: Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

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
21	21	MAIN	58	32	674	68	6.8	0.8	225	4722	172	3612	12
14	13	SCOUR	39	21	293	30	8.0	0.9	152	2126	163	2286	47
1	1	BACKWATER	3	23	23	2	7.0	0.9	161	161	145	145	10
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
36	35				990					7009		6042	

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

Stream Name: Mill Creek

LLID:

1231767391334

Drainage: Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

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
20	MCP	56	0	0	14	70	6	30	0	0	0	0
1	STP	3	0	0	1	100	0	0	0	0	0	0
4	CRP	11	0	0	4	100	0	0	0	0	0	0
1	LSL	3	0	0	1	100	0	0	0	0	0	0
5	LSR	14	0	0	4	80	1	20	0	0	0	0
4	PLP	11	0	0	1	25	2	50	0	0	1	25
1	DPL	3	0	0	0	0	1	100	0	0	0	0

Total Units

	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
36	0	0	25	69	10	28	0	0	1	3

Mean Maximum Residual Pool Depth (ft.): 1.7

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Mill Creek

LLID:

1231767391334

Drainage:

Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Dry Units: 2

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

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
6	1	LGR	0	90	10	0	0	0	0	0	0
4	1	HGR	0	50	0	50	0	0	0	0	0
10	2	TOTAL RIFFLE	0	70	5	25	0	0	0	0	0
6	2	GLD	75	0	0	25	0	0	0	0	0
26	0	RUN									
15	3	SRN	7	13	8	3	53	0	0	15	0
47	5	TOTAL FLAT	34	8	5	12	32	0	0	9	0
20	16	MCP	33	13	7	13	12	0	1	14	6
1	1	STP	100	0	0	0	0	0	0	0	0
4	3	CRP	17	3	0	20	3	0	0	33	23
1	1	LSL	0	20	80	0	0	0	0	0	0
5	4	LSR	26	29	3	39	3	0	0	1	0
4	2	PLP	0	18	5	0	10	0	8	58	0
1	1	DPL	30	0	0	0	70	0	0	0	0
36	28	TOTAL POOL	29	14	7	15	11	0	1	16	6
95	35	TOTAL	28	16	7	15	13	0	1	14	5

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Mill Creek

LLID:

1231767391334

Drainage:

Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Dry Units: 2

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

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
6	1	LGR	0	0	100	0	0	0	0
4	2	HGR	0	0	50	0	0	0	50
6	3	GLD	33	67	0	0	0	0	0
26	2	RUN	0	50	50	0	0	0	0
15	4	SRN	0	0	50	50	0	0	0
20	3	MCP	33	0	67	0	0	0	0
1	0	STP	0	0	0	0	0	0	0
4	1	CRP	100	0	0	0	0	0	0
1	1	LSL	0	100	0	0	0	0	0
5	3	LSR	67	0	0	0	33	0	0
4	3	PLP	0	33	33	33	0	0	0
1	1	DPL	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Mill Creek LLID: 1231767391334 Drainage: Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Confluence Location: Quad: UKIAH Legal Description: T15NR11WS31 Latitude: 39:08:00.0N Longitude: 123:10:36.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
89	68	32	0	66	54

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: Mill Creek

LLID:

1231767391334 Drainage: Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

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	0	2	3.7
Boulder	5	1	11.1
Cobble / Gravel	1	4	9.3
Sand / Silt / Clay	21	19	74.1

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	1	1	3.7
Brush	14	12	48.1
Hardwood Trees	2	1	5.6
Coniferous Trees	7	10	31.5
No Vegetation	2	2	7.4

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Mill Creek

LLID:

1231767391334

Drainage: Russian River - Upper

Survey Dates: 8/6/2001 to 8/8/2001

Confluence Location: Quad: UKIAH

Legal Description: T15NR11WS31

Latitude: 39:08:00.0N

Longitude: 123:10:36.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	34	29
SMALL WOODY DEBRIS (%)	70	8	14
LARGE WOODY DEBRIS (%)	5	5	7
ROOT MASS (%)	25	12	15
TERRESTRIAL VEGETATION (%)	0	32	11
AQUATIC VEGETATION (%)	0	0	0
WHITewater (%)	0	0	1
BOULDERS (%)	0	9	16
BEDROCK LEDGES (%)	0	0	6

Appendix C: Fish Habitat Inventory Survey

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Mill Creek	LLID: 1231767391334	Drainage: Russian River -
Survey Dates: 8/6/2001 to 8/8/2001	Survey Length (ft.): 13808	Main Channel (ft.): 13808 Side Channel (ft.): 0
Confluence Location: Quad: UKIAH	Legal Description: T15NR11WS31	Latitude: 39:08:00.0N Longitude: 123:10:36.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F3	Canopy Density (%): 91.4	Pools by Stream Length (%): 5.9
Reach Length (ft.): 12422.8	Coniferous Component (%): 65.0	Pool Frequency (%): 36.4
Riffle/Flatwater Mean Width (ft.): 5.8	Hardwood Component (%): 35.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 75.0
Range (ft.): to	Vegetative Cover (%): 73.5	2 to 2.9 Feet Deep: 25.0
Mean (ft.):	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 0.0
Std. Dev.:	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs):	Occurrence of LWD (%): 7.6	Mean Max Residual Pool Depth (ft.): 1.64
Water (F): 0 - 68 Air (F): 70 - 86	LWD per 100 ft.:	Mean Pool Shelter Rating: 30
Dry Channel (ft.): 8628	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 61.9 Sm Cobble: 38.1 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 59.1 2. 27.3 3. 4.5 4. 0.0 5. 9.1		

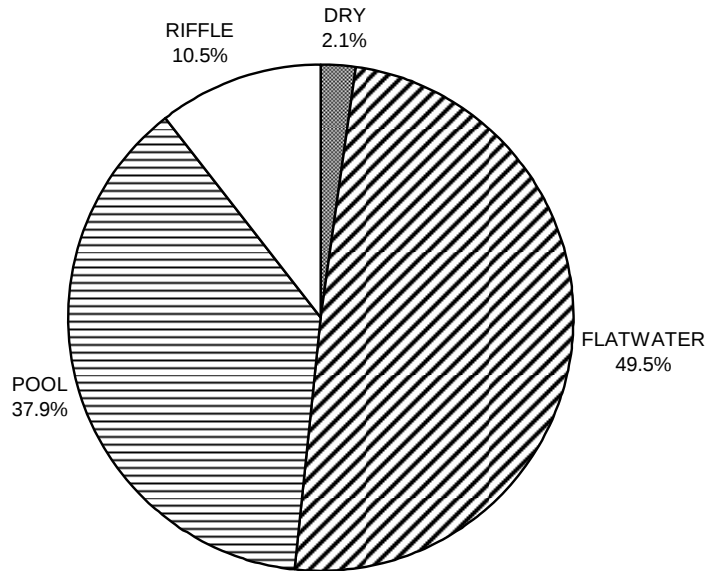
STREAM REACH: 2

Channel Type: A2	Canopy Density (%): 83.4	Pools by Stream Length (%): 18.5
Reach Length (ft.): 1386	Coniferous Component (%): 73.8	Pool Frequency (%): 41.4
Riffle/Flatwater Mean Width (ft.): 5.0	Hardwood Component (%): 26.3	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 58.3
Range (ft.): to	Vegetative Cover (%): 31.3	2 to 2.9 Feet Deep: 33.3
Mean (ft.):	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0.0
Std. Dev.:	Dominant Bank Substrate Type: Boulder	>= 4 Feet Deep: 8.3
Base Flow (cfs): 0	Occurrence of LWD (%): 4.6	Mean Max Residual Pool Depth (ft.): 1.925
Water (F): 62 - 68 Air (F): 80 - 88	LWD per 100 ft.:	Mean Pool Shelter Rating: 13
Dry Channel (ft.): 6	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 0.0 Sm Cobble: 100. Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 25.0 2. 33.3 3. 16.7 4. 0.0 5. 25.0		

Appendix D:

MILL CREEK 2001

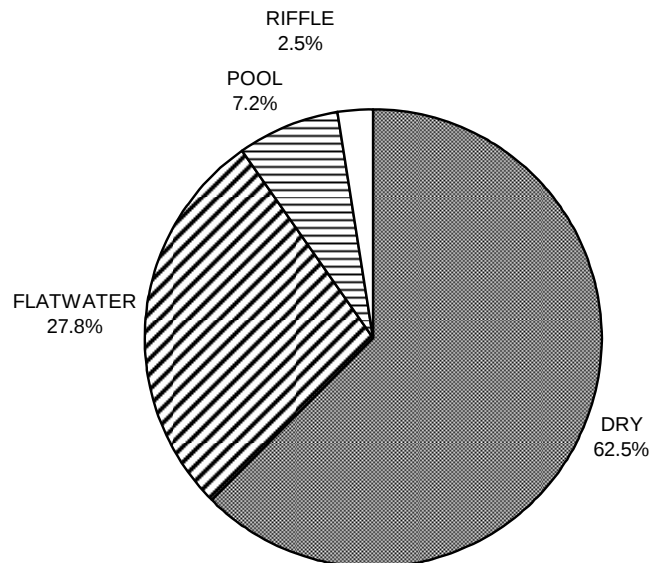
LEVEL II HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

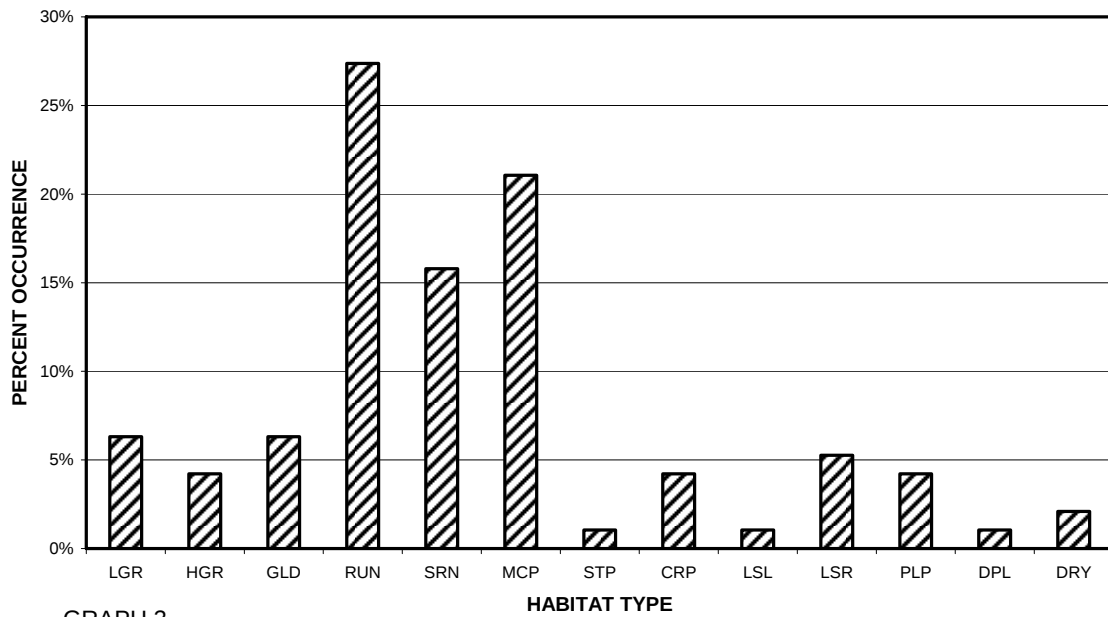
MILL CREEK 2001

LEVEL II HABITAT TYPES BY PERCENT TOTAL LENGTH



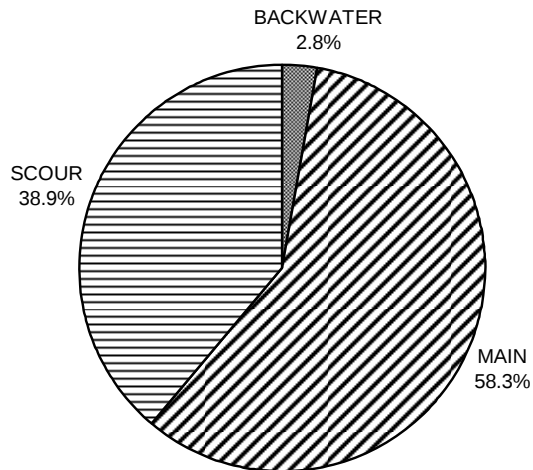
GRAPH 2

**MILL CREEK 2001
LEVEL IV HABITAT TYPES BY PERCENT OCCURRENCE**



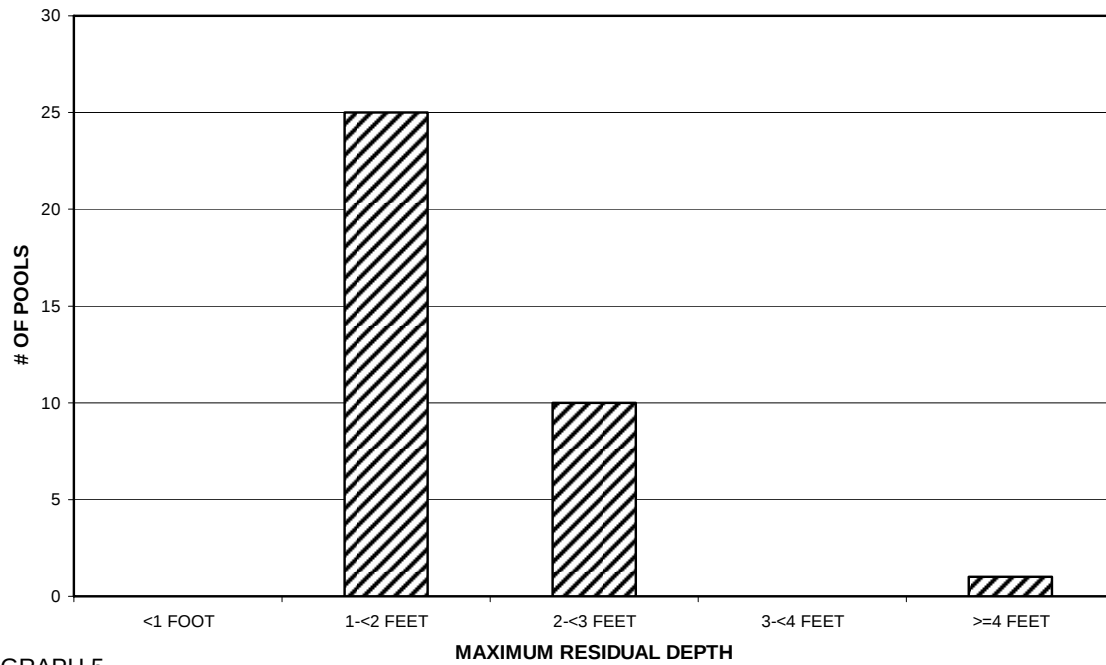
GRAPH 3

**MILL CREEK 2001
LEVEL I POOL TYPES BY PERCENT OCCURRENCE**



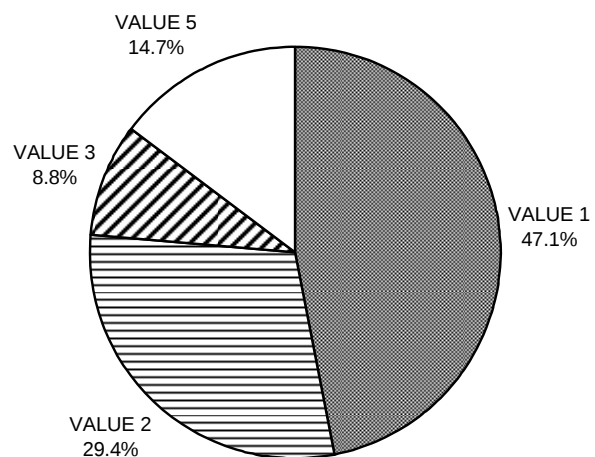
GRAPH 4

MILL CREEK 2001 MAXIMUM DEPTH IN POOLS



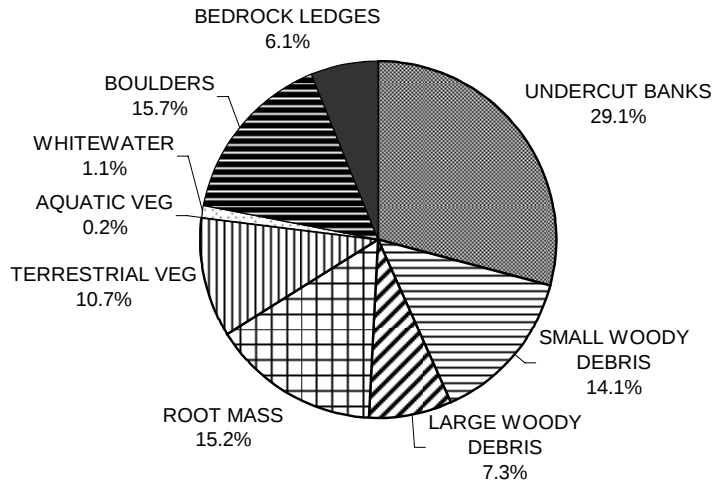
GRAPH 5

MILL CREEK 2001 PERCENT EMBEDDEDNESS



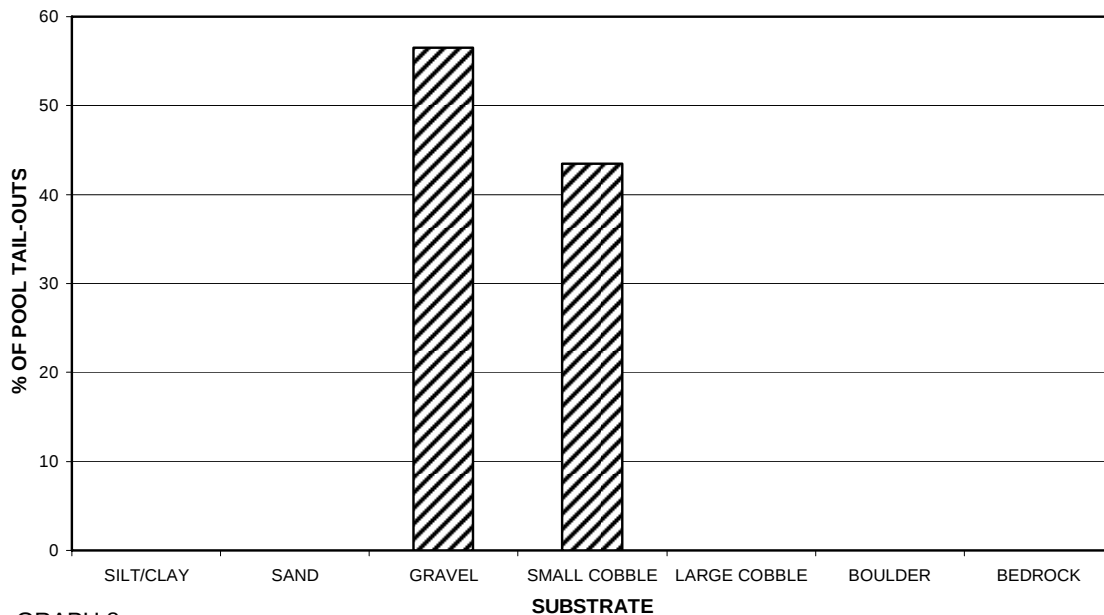
GRAPH 6

MILL CREEK 2001 **MEAN PERCENT COVER TYPES IN POOLS**



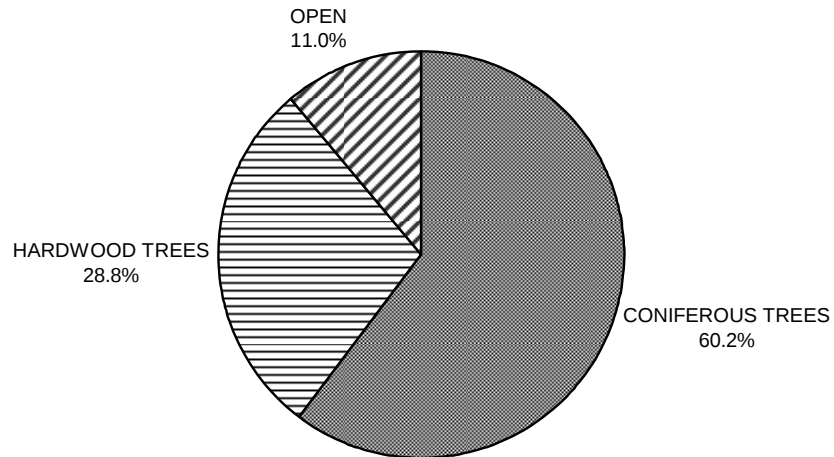
GRAPH 7

MILL CREEK 2001 **SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



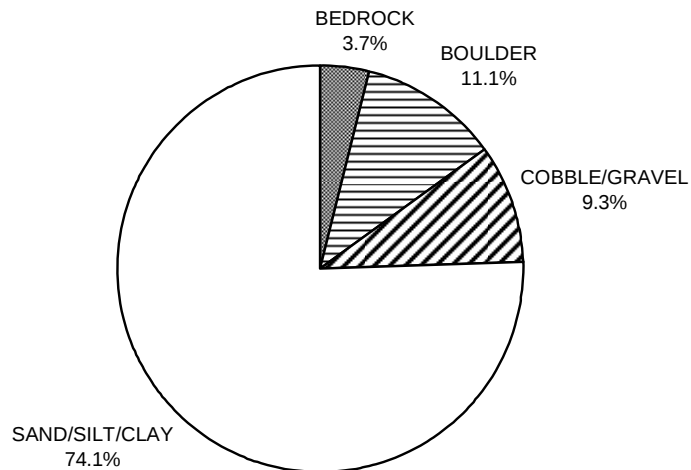
GRAPH 8

**MILL CREEK 2001
MEAN PERCENT CANOPY**



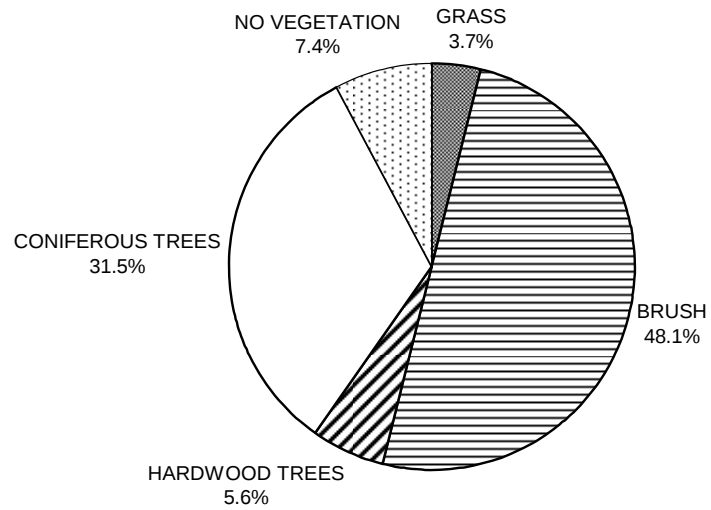
GRAPH 9

**MILL CREEK 2001
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**MILL CREEK 2001
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

Hydrologic Sub-Areas covered by the watershed:

Name:	LLId: (1:24k)	County:	Tributary to	McClure Creek
Mill Creek (McClure Creek)	1231767391334	Mendocino	Tributary to	Russian River
Location:	T: 15N	R: 12W	S: 27	Latitude: 39.1334140569507
				Longitude 123.176754693705

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: <u>3</u>	Total Length:	6.00 Miles	Note: Length is for the USGS blue-line 1:24,000 stream.
Note: Stream order is by Strahler method, recorded in CDF-NCWAP "nchydro1" 1:24k streams layer.		9.67 Km	

Drainage Area:	4512 Hectares	Elevations:	Mouth: <u>581</u> feet
	11149 Acres		Headwaters: <u>3766</u> feet
	17.42 sq. mi.		Note: Headwaters elevation is the highest elevation found in the watershed.

Lakes in Watershed: Number: 0 Surface area: 0 sq. mi.
Note: Source for lakes data is the USGS-DFG 1:100k lakes layer "lakes.shp"

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

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

Federal:	State:	Local:	Private:
6965.8 acres	132.7	0.0	4050.7
62.47 %	1.19 %	0.00 %	36.34 %

Note: Source for ownership 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:
794.44 acres	3091.12	109.80	1022.39	173.59
32.2 %	41.8 %	1.5 %	13.8 %	2.3 %
Shrub:	Herbaceous:	Barren/rock:	Water:	
5726.95	194.59	0.00	18.68	
77.4 %	2.6 %	0.0 %	0.2 %	

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

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

Quad Name	USGS Code
PURDYS GARDENS	39123A1
ELLEDGE PEAK	39123A2
COW MOUNTAIN	39123B1
UKIAH	39123B2

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

Scientific Name	Common Name
Horkelia bolanderi	Bolander's horkelia
Arctostaphylos stanfordiana ssp. raichei	Raiche's manzanita
Hesperolinon adenophyllum	glandular western flax

Hydrologic Sub-Areas covered by the watershed

Hydrologic Sub-Area Name:	ID code (RBUAS)	Hydrologic Area Name	% of watershed in this HSA
Ukiah	111431	Upper Russian River	99.84
Lakeport	551355	Upper Cache Creek	0.15
Coyote Valley	111432	Upper Russian River	0.01