

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

Millington Creek

Report Revised April 14, 2006

Report Completed 2005

Assessment Completed 1998

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Millington 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 Millington Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

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

Millington Creek is a tributary to Santa Rosa Creek, a tributary to Mark West Creek, a tributary of the Russian River, located in Sonoma County, California (see Millington Creek map, Appendix A). The legal description at the confluence with the Russian River is T7, R6W, S6. Its location is 38.4807674634664° N latitude and 122.571120323058° W longitude. Year round vehicle access exists from Highway 101 to Highway 12 East, via Los Alamos Road.

Millington Creek and its tributaries drain a basin of approximately 3.09 square miles. Millington Creek is a third order stream and has approximately 2.62 miles of blue line stream, according to the USGS Kenwood 7.5 minute quadrangle. Summer flow was measured as approximately 0.90 cfs at habitat unit #015 with a Global flow meter. Elevations range from about 755 feet at the mouth of the creek to 2,720 feet in the headwaters. Hardwood forest and shrubland dominate the watershed. The watershed is primarily privately owned. Endangered/Threatened/Sensitive species present in the Millington Creek watershed include; narrow-anthered California brodiaea (*Brodiaea californica var.leptandra*), Rincon Ridge ceanothus (*Ceanothus confuses*), and Colusa layia (*Layia septentrionalis*).

METHODS

The habitat inventory conducted in Millington Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). The Sonoma County Water Agency field crew 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. This form was used in Sample 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. See Santa Rosa Creek report for discussion of specific methods used.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species 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, 3) electrofishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE IV data entry program developed CDFG. Refer to Santa Rosa Creek report for discussion of methods.

HISTORICAL STREAM SURVEYS:

No historical stream surveys exist for Millington Creek.

HABITAT INVENTORY RESULTS

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

The habitat inventory of August 18, 1998 to August 25, 1998 was conducted by Ron Benkert,

Steve Brady and Shawn Chase (Sonoma County Water Agency) with supervision and analysis by CDFG. The survey began at the confluence with Santa Rosa Creek and extended up Millington Creek to four large falls. The total length of the stream surveyed was 3957 feet, with an additional 40 feet of side channel.

A flow of 0.90 cfs was measured on August 18, 1998 at habitat unit #015 with a Global flow meter.

This section of Millington Creek has 3 channel types: from the mouth to 2092 feet an F2; next 502 feet a B2 and the upper 1363 feet an F4.

F2 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly boulder substrate.

B2 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 boulder substrate.

F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate.

Water temperatures ranged from 57°F to 63°F. Air temperatures ranged from 63°F to 75°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of *occurrence* there were 38% pool units, 36% riffle units and 26% flatwater units (Graph 1). Based on total *length* there were 40% pool units, 36% flatwater units and 24% riffle units (Graph 2).

Seventeen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent *occurrence* were mid-channel pools at 21%, high gradient riffles 19%, cascades 12% and step runs 11% (Graph 3). By percent total *length*, mid-channel pools made up 27%, step runs 19%, high gradient riffles 15%, and runs 10%.

Fifty-three pools were identified (Table 3). Main Channel pools were most often encountered at 64%, and comprised 77% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fourteen of the 49 pools (29%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 47 pool tail-outs measured, seven had a value of 1 (15%); ten had a value of 2 (21%); three had a value of 3 (6%); one had a value of 4 (2%); and 26 had a value of 5 (55%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle types had the highest shelter rating at 25. Flatwater had the lowest rating with 15 and pool rated 24 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 36, scour pools rated 32, and main channel pools rated 20 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Millington Creek. Graph 7 describes the pool cover in Millington Creek.

Table 6 summarizes the dominant substrate by habitat type. No pool tail out substrate data was collected for Millington Creek.

The mean percent canopy density for the stream reach surveyed was 87%. The mean percentages of hardwood and coniferous trees were 46% and 41%, respectively. Thirteen percent of the canopy was open. Graph 9 describes the mean percent canopy in Millington Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 20% and the mean percent left bank vegetated was 26%. The dominant substrate for the stream banks were: 55% boulder, 23% bedrock, 15% cobble/gravel and 6% silt/clay/sand (Graph 10). For the habitat units measured, the dominant vegetation types for the stream banks were: 50% coniferous trees, 46% hardwood trees, and 5% grass (Graph 11).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

The Department of Fish and Game has never conducted a stream survey of Millington Creek; Although, Millington Creek was included in a steelhead trout population estimate for the Santa Rosa Creek watershed. One of the sample sites in the population study was on Millington Creek.

The steelhead trout population estimate was conducted October 31 and November 1, 1973, by the Department of Fish and Game. The site on Millington Creek was surveyed on October 31, 1973. At 1200 the air temperature was 77°F. and the water temperature was 65°F. At this time the average width was 4' and the average depth was 0.5'. The length of the sampling reach was 50'. The steelhead trout population estimate for this site was 21/50'. The two pass electrofishing method was used to determine the population estimate. The steelhead trout sampled ranged from 2.3 - 6.0 inches in length, with a median fork length of 3.2 inches. During the sample period 10 sculpin were observed as well. The survey was conducted by Bryan J. Finlayson.

The Sonoma County Water Agency (SCWA) conducted juvenile steelhead population surveys in the Santa Rosa Creek basin that started on September 28, 1999, and continued through October 29, 1999. A total of 20 sites were sampled in Millington Creek. The electrofishing surveys were conducted by a crew of 3-6 SCWA staff members using one to two Smith-Root Model 12B Backpack Electrofishers. Multiple pass electrofishing was conducted in the unit with the samplers

waiting a minimum of 15 minutes between each pass. The fish were held in 5-gallon buckets, anesthetized with Alka-Seltzer, and measured and weighed. The fish were then placed in net pens located in an adjacent habitat unit in order to recover and then were redistributed in the unit from which they were captured.

The survey of Reach 1, 2, and 3 started with habitat unit #037 and ended with habitat unit #133. In riffle, run and pool habitat types, 263 0+, 51 1+, 10 2+, and 3 3+ steelhead were observed along with 13 sculpin.

During the habitat inventory, rainbow trout were observed upstream of habitat unit 134, where a series of four rock falls appears to impede further passage.

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
1973,1998,1999	Steelhead	SCWA	N
1973,1999	Sculpin	SCWA	N

No introduced fish species were observed during the survey, however introduced fish have been observed in Santa Rosa Creek. Historical records reflect that no hatchery stocking, transfers, or rescues have occurred in Millington Creek. However, transfers and rescues have occurred in Santa Rosa Creek.

ADULT SURVEYS:

No spawning/carcass survey was conducted 1998/1999.

DISCUSSION

Millington Creek has 3 channel types: F2 (2092 ft.), B2 (502 ft.) and F4 (1363 ft.).

There are 2092 feet of F2 channel type in Reach 1. According to the DFG Salmonid Stream Habitat Restoration Manual, F2 channel types are fair for low-stage weirs, single and opposing wing-deflectors and log cover. Any work considered in F channel types will require careful design, placement, and construction that must include protection for any unstable banks.

There are 502 feet of B2 channel type in Reach 2. B2 channel types are excellent for low and

medium-stage plunge weirs, single and opposing wing deflectors and bank cover. B 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.

There are 1363 feet of F4 channel type in Reach 3. F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover.

The water temperatures recorded on the survey days August 18, 1998 to August 25, 1998 ranged from 57°F to 63°F. Air temperatures ranged from 63°F to 75°F. The warmer water temperatures were recorded in Reach 1. This temperature regime is favorable to 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 40% 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 Millington Creek, the pools are relatively shallow with 34% having a maximum depth of at least 2 feet. These pools comprised 19% 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 24. 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 boulders (64%), undercut banks (11%), bedrock ledges (9%), and small woody debris (4%). 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.

None of the low gradient riffles observed were measured for substrate composition. Low gradient riffles provide the habitats and substrates which are ideal for salmonid spawning habitat. Nine of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Only 15% 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. Reach 3 had the best ratings. The dominant substrate in Reach 1 and Reach 2 is boulders, which are generally considered unsuitable for spawning due to the size of the substrate.

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 and/or because of fine sediment capping the redd and preventing fry emergence. In Millington, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean percent canopy for the survey was 87%. This is very good, since 80 percent is generally considered desirable.

GENERAL MANAGEMENT RECOMMENDATIONS

Millington 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 potential problem in Reach 3, therefore, fish passage should be monitored, and improved where possible.
- 2) Spawning gravels on Millington Creek are limited to relatively few reaches. Structures to decrease channel incision and recruit spawning gravel (using gravel retention structures), should be installed to trap, sort and expand redd distribution in the stream.
- 3) 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.
- 4) In Millington 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.
- 5) 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.

- 6) 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.
- 7) If riparian areas are not improved, temperatures in Millington Creek should be monitored to determine if they are having a deleterious effect upon juvenile salmonids. To achieve this, biological sampling is also required.

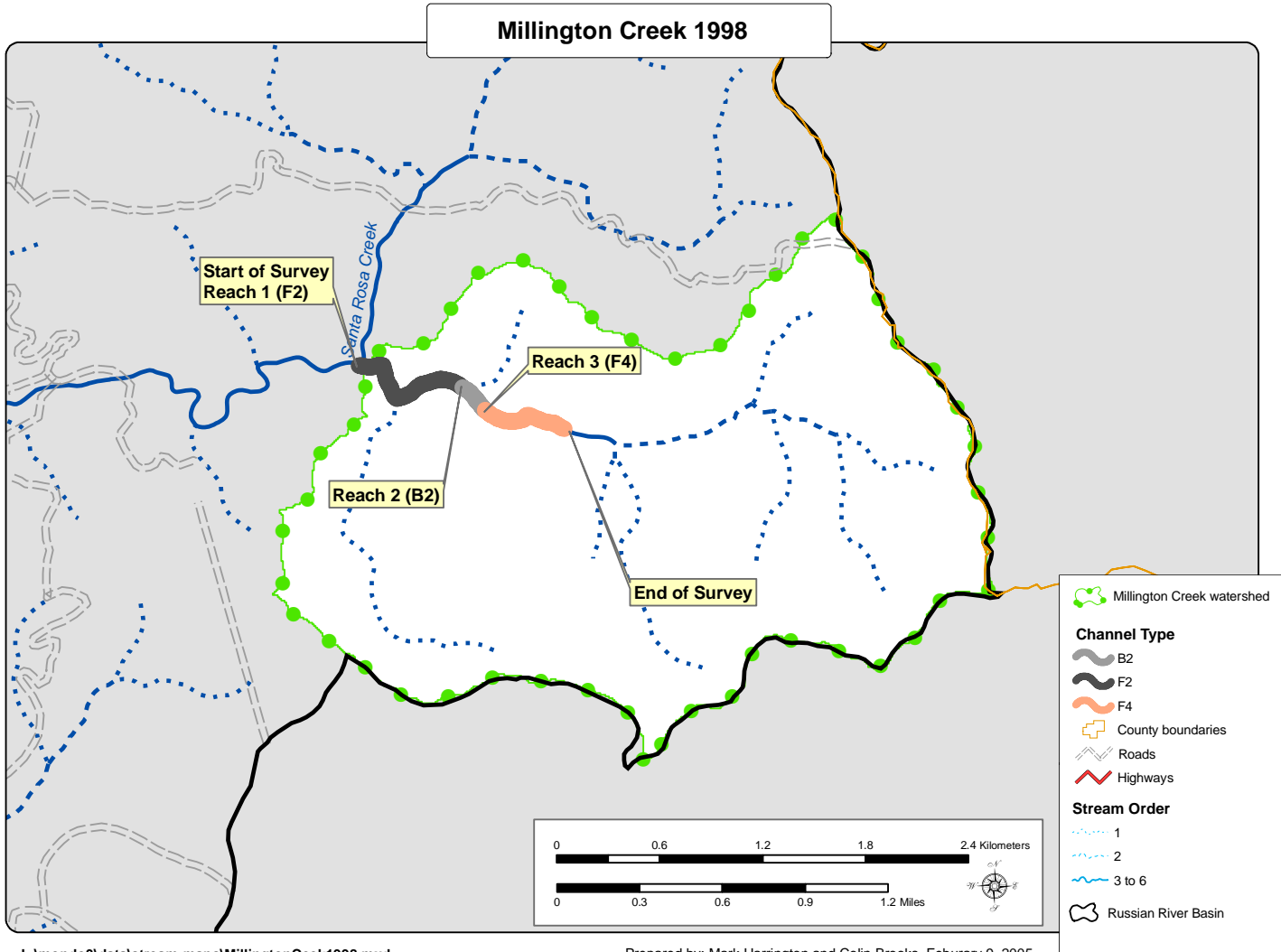
MILLINGTON CREEK SURVEY COMMENTS

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

HABITAT UNIT#	STREAM LENGTH(FT)	COMMENTS
Reach 1		
1.00	12	Beginning of survey at confluence with Santa Rosa Creek at Homestead Meadow in Hood Mtn. Park.
7.00	123	Gully on left bank. One 1+STHD.
9.00	193	Right bank stabilized with chain link fence and wire. Three 0+STHD.
10.00	213	Erosion on left bank.
18.00	465	Two 0+STHD.
29.00	821	Channel typed here in 8/18/98.
30.00	868	Four 0+, Two 1+, and One 2+STHD.
31.00	896	At 14' gully on right bank.
32.00	935	One 0+STHD.
33.00	959	At 6' 6.1 side channel. Two 0+STHD.
53.00	1418	At 2' flowing tributary (2-3 cfs) on left bank. A large landslide/slough occurs on the tributary approx. 250 yards upstream of confluence with Millington Creek. The right bank has failed for approx. 100 yards, inundating the channel with boulders, trees, clay, and other sediment. High sediment loads were observed in the pools below the failure. Above the slide the stream is high gradient (A1 channel) and dry.
58.00	1640	Terrestrial vegetation is leaf litter. Ten 0+ & Two 1+STHD.
62.00	1722	At 1' 6.1 side channel on right bank.
Reach 2		
74.00	2123	At 10' gully on right bank. Channel type change to a B2. At 12' 6.1 side channel on right bank.
92.00	2502	At 2' 6.1 side channel on right bank.

	94.00	2539	At 2' 6.1 side channel on left bank.
	95.00	2594	At 15' 4.4 side channel pool on right bank.
	95.10	2594	Erosion on right bank. Nine 0+STHD.
Reach 3			
	96.00	2611	Channel type change to F4.
	97.00	2646	Four 0+ & two 1+STHD.
	102.00	2740	Nine 0+, two 1+, and one 2+STHD.
	104.00	2782	Pool drains through boulders.
	106.00	2811	Eight 0+STHD.
	107.00	2817	At 1' debris jam that cover entire unit.
	113.00	2986	At 45' gully erosion on right bank.
	115.00	3023	Gully erosion on right bank.
	118.00	3088	25-0+STHD. Spring entering on right bank.
	128.00	747	6-0+STHD.
	134.00	3957	Four large falls. <i>Oncorhynchus mykiss</i> observed above falls in 63 degree water. End of survey.

APPENDIX A: MAP



APPENDIX B: TABLES

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

Stream Name: Millington Creek

LLID:

1225711384807

Drainage:

Russian River - Middle

Survey Dates: 8/18/1998 to 8/25/1998

Confluence Location: Quad: KENWOOD

Legal Description: T07NR06WS06

Latitude: 38:28:51.0N

Longitude: 122:34:16.0W

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
37	37	FLATWATER	26.2	38	1421	35.6	6.8	0.4	0.9	255	9445	109	4038		15
53	48	POOL	37.6	30	1611	40.3	8.8	0.8	1.6	305	16168	322	17087	259	24
51	49	RIFFLE	36.2	19	965	24.1	5.5	0.3	0.7	125	6397	37	1909		25
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
141	134				3997					32010			23033		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Millington Creek

LLID:

1225711384807 Drainage: Russian River - Middle

Survey Dates: 8/18/1998 to 8/25/1998

Confluence Location: Quad: KENWOOD

Legal Description: T07NR06WS06

Latitude: 38:28:51.0N

Longitude: 122:34:16.0W

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 (%)
4	3	LGR	2.8	22	86	2.2	4	0.2	0.5	126	505	23	91		1	67
27	26	HGR	19.1	22	604	15.1	7	0.3	1.4	178	4797	52	1406		11	85
17	17	CAS	12.1	15	249	6.2	4	0.3	1.9	63	1075	24	400		58	93
3	3	BRS	2.1	9	26	0.7	3	0.1	0.4	24	73	4	12		0	97
6	6	POW	4.3	38	230	5.8	10	0.5	1.4	321	1927	171	1025		23	94
2	2	GLD	1.4	24	49	1.2	8	0.5	0.9	209	419	98	195		2	92
13	13	RUN	9.2	31	401	10.0	7	0.5	1.2	222	2888	89	1155		13	88
16	16	SRN	11.3	46	741	18.5	6	0.4	1.1	263	4212	104	1662		15	86
30	30	MCP	21.3	36	1087	27.2	10	0.7	3.8	338	10129	332	9968	253	20	89
4	3	STP	2.8	36	146	3.7	9	0.5	1.5	334	1335	239	958	186	21	91
1	1	CRP	0.7	83	83	2.1	15	1.4	2.5	1220	1220	1830	1830	1708	3	75

**Table 2 - Summary of Habitat Types and Measured Parameters
(continued)**

Stream Name: Millington Creek

LLID:

1225711384807 Drainage: Russian River - Middle

Survey Dates: 8/18/1998 to 8/25/1998

Confluence Location: Quad: KENWOOD Legal Description: T07NR06WS06 Latitude: 38:28:51.0N Longitude: 122:34:16.0W

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 (%)
2	2	LSBk	1.4	40	81	2.0	9	1.5	3.3	376	753	511	1023	436	13	71
2	2	LSBo	1.4	28	56	1.4	8	1.3	3.1	225	449	376	752	331	30	94
8	8	PLP	5.7	18	143	3.6	6	0.8	2.8	121	971	135	1079	119	41	86
4	0	SCP	2.8	0	0	0.0										
1	1	BPB	0.7	9	9	0.2	11	0.6	1.1	95	95	86	86	57	36	91
1	1	DPL	0.7	6	6	0.2	4	0.7	1.6	24	24	19	19	16	36	49

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
141	134	3997	30872	21661

Table 3 - Summary of Pool Types

Stream Name: Millington Creek

LLID:

1225711384807

Drainage:

Russian River - Middle

Survey Dates: 8/18/1998 to 8/25/1998

Confluence Location: Quad: KENWOOD

Legal Description: T07NR06WS06

Latitude: 38:28:51.0N

Longitude: 122:34:16.0W

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
34	33	MAIN	64	36	1233	77	9.5	0.7	337	11468	247	8396	20
13	13	SCOUR	25	28	363	23	7.4	1.0	261	3393	323	4196	32
6	2	BACKWATER	11	3	15	1	7.5	0.7	59	356	37	220	36
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
53	48				1611					15217		12812	

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

Stream Name: Millington Creek

LLID:

1225711384807

Drainage: Russian River - Middle

Survey Dates: 8/18/1998 to 8/25/1998

Confluence Location: Quad: KENWOOD

Legal Description: T07NR06WS06

Latitude: 38:28:51.0N

Longitude: 122:34:16.0W

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
30	MCP	61	8	27	14	47	7	23	1	3	0	0
4	STP	8	1	25	3	75	0	0	0	0	0	0
1	CRP	2	0	0	0	0	1	100	0	0	0	0
2	LSBk	4	0	0	1	50	0	0	1	50	0	0
2	LSBo	4	0	0	1	50	0	0	1	50	0	0
8	PLP	16	3	38	2	25	3	38	0	0	0	0
1	BPB	2	0	0	1	100	0	0	0	0	0	0
1	DPL	2	0	0	1	100	0	0	0	0	0	0

Total Units

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
49	12	24	23	47	11	22	3	6	0	0

Mean Maximum Residual Pool Depth (ft.): 1.6

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Millington Creek LLID: 1225711384807 Drainage: Russian River - Middle
 Survey Dates: 8/18/1998 to 8/25/1998 Dry Units: 0
 Confluence Location: Quad: KENWOOD Legal Description: T07NR06WS06 Latitude: 38:28:51.0N Longitude: 122:34:16.0W

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
4	3	LGR	0	0	0	0	0	0	0	33	0
27	26	HGR	0	2	0	0	0	0	3	78	0
17	16	CAS	0	2	2	1	0	0	24	59	0
3	3	BRS	0	0	0	0	0	0	0	0	0
51	48	TOTAL RIFFLE	0	2	1	0	0	0	10	64	0
6	6	POW	3	10	1	2	0	0	2	83	0
2	2	GLD	0	0	0	0	0	0	0	100	0
13	13	RUN	0	5	4	1	0	3	0	79	0
16	16	SRN	0	2	2	3	6	1	3	83	0
37	37	TOTAL FLAT	0	4	2	2	3	2	2	82	0
30	30	MCP	10	4	0	4	2	1	2	70	8
4	3	STP	0	0	0	0	0	0	17	83	0
1	1	CRP	0	30	0	0	0	0	0	70	0

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

Stream Name: Millington Creek LLID: 1225711384807 Drainage: Russian River - Middle
 Survey Dates: 8/18/1998 to 8/25/1998 Dry Units: 0
 Confluence Location: Quad: KENWOOD Legal Description: T07NR06WS06 Latitude: 38:28:51.0N Longitude: 122:34:16.0W

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
2	2	LSBk		5	0	0	10	0	0	75	10
2	2	LSBo		0	10	30	0	0	5	55	0
8	8	PLP		5	4	8	1	0	24	51	8
4	0	SCP									
1	1	BPB		0	10	0	0	0	30	60	0
1	1	DPL		0	25	35	0	0	0	40	0
53	48	TOTAL POOL		7	5	3	3	1	7	67	7
141	133	TOTAL		3	4	2	2	1	7	70	2

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Millington Creek

LLID:

1225711384807

Drainage: Russian River - Middle

Survey Dates: 8/18/1998 to 8/25/1998

Dry Units: 0

Confluence Location: Quad:

KENWOOD

Legal Description: T07NR06WS06

Latitude: 38:28:51.0N

Longitude: 122:34:16.0W

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
4	0	LGR	0	0	0	0	0	0	0
27	0	HGR	0	0	0	0	0	0	0
17	0	CAS	0	0	0	0	0	0	0
3	0	BRS	0	0	0	0	0	0	0
6	2	POW	0	0	0	100	0	0	0
2	1	GLD	0	100	0	0	0	0	0
13	1	RUN	0	0	100	0	0	0	0
16	4	SRN	0	25	0	50	25	0	0
30	30	MCP	0	10	60	17	3	7	3
4	3	STP	0	0	67	33	0	0	0
1	1	CRP	0	0	100	0	0	0	0
2	2	LSBk	0	0	100	0	0	0	0
2	2	LSBo	0	0	0	50	0	0	50
8	8	PLP	0	13	63	0	25	0	0
4	0	SCP	0	0	0	0	0	0	0
1	1	BPB	0	0	100	0	0	0	0
1	1	DPL	0	100	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Millington Creek LLID: 1225711384807 Drainage: Russian River - Middle
 Survey Dates: 8/18/1998 to 8/25/1998
 Confluence Location: Quad: KENWOOD Legal Description: T07NR06WS06 Latitude: 38:28:51.0N Longitude: 122:34:16.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
87	47	53	0	20	26

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: Millington Creek
 Survey Dates: 8/18/1998 to 8/25/1998
 Confluence Location: Quad: KENWOOD Legal Description: T07NR06WS06
 LLID: 1225711384807 Drainage: Russian River - Middle
 Latitude: 38:28:51.0N Longitude: 122:34:16.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	8	18	23.2
Boulder	35	27	55.4
Cobble / Gravel	8	9	15.2
Sand / Silt / Clay	5	2	6.3

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	4	1	4.5
Brush	0	0	0.0
Hardwood Trees	31	20	45.5
Coniferous Trees	21	35	50.0
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 4

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

StreamName: Millington Creek LLID: 1225711384807 Drainage: Russian River - Middle
 Survey Dates: 8/18/1998 to 8/25/1998
 Confluence Location: Quad: KENWOOD Legal Description: T07NR06WS06 Latitude: 38:28:51.0N Longitude: 122:34:16.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	7
SMALL WOODY DEBRIS (%)	2	4	5
LARGE WOODY DEBRIS (%)	1	2	3
ROOT MASS (%)	0	2	3
TERRESTRIAL VEGETATION (%)	0	3	1
AQUATIC VEGETATION (%)	0	2	0
WHITEWATER (%)	10	2	7
BOULDERS (%)	64	82	67
BEDROCK LEDGES (%)	0	0	7

Appendix C - Fish Habitat Inventory Data Summary (Table 8)

Stream Name: Millington Creek LLID: 1225711384807 Drainage: Russian River -
 Survey Dates: 8/18/1998 to 8/25/1998 Survey Length (ft.): 3997 Main Channel (ft.): 3957 Side Channel (ft.): 40
 Confluence Location: Quad: KENWOOD Legal Description: T07NR06WS06 Latitude: 38:28:51.0N Longitude: 122:34:16.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F2 Canopy Density (%): 92.0 Pools by Stream Length (%): 46.4
 Reach Length (ft.): 2092 Coniferous Component (%): 46.7 Pool Frequency (%): 38.4
 Riffle/Flatwater Mean Width (ft.): 6.3 Hardwood Component (%): 53.3 Residual Pool Depth (%):
 BFW: Dominant Bank Vegetation: Coniferous Trees < 2 Feet Deep: 78.6
 Range (ft.): to Vegetative Cover (%): 26.9 2 to 2.9 Feet Deep: 17.9
 Mean (ft.): Dominant Shelter: Boulders 3 to 3.9 Feet Deep: 3.6
 Std. Dev.: Dominant Bank Substrate Type: Boulder >= 4 Feet Deep: 0.0
 Base Flow (cfs): 0.9 Occurrence of LWD (%): 2.1 Mean Max Residual Pool Depth (ft.): 1.40
 Water (F): 57 - 63 Air (F): 0 - 64 LWD per 100 ft.: Mean Pool Shelter Rating: 23
 Dry Channel (ft.): 0 Riffles:
 Pools:
 Flat:
 Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:
 Embeddedness Values (%): 1. 14.8 2. 25.9 3. 7.4 4. 0.0 5. 51.9

STREAM REACH: 2

Channel Type: B2 Canopy Density (%): 88.4 Pools by Stream Length (%): 45.8
 Reach Length (ft.): 502 Coniferous Component (%): 45.4 Pool Frequency (%): 40.9
 Riffle/Flatwater Mean Width (ft.): 4.2 Hardwood Component (%): 54.6 Residual Pool Depth (%):
 BFW: Dominant Bank Vegetation: Hardwood Trees < 2 Feet Deep: 66.7
 Range (ft.): to Vegetative Cover (%): 23.4 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: 0.0
 Base Flow (cfs): 0.9 Occurrence of LWD (%): 0.0 Mean Max Residual Pool Depth (ft.): 1.64
 Water (F): 58 - 60 Air (F): 64 - 73 LWD per 100 ft.: Mean Pool Shelter Rating: 25
 Dry Channel (ft.): 0 Riffles:
 Pools:
 Flat:
 Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:
 Embeddedness Values (%): 1. 0.0 2. 12.5 3. 0.0 4. 12.5 5. 75.0

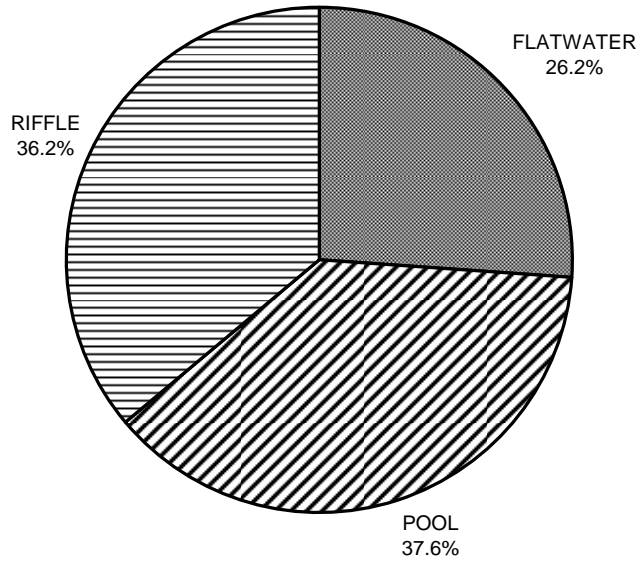
Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: F4	Canopy Density (%): 71.9	Pools by Stream Length (%): 27.2
Reach Length (ft.): 1363	Coniferous Component (%): 50.5	Pool Frequency (%): 28.2
Riffle/Flatwater Mean Width (ft.): 6.5	Hardwood Component (%): 49.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 54.5
Range (ft.): to	Vegetative Cover (%): 10.6	2 to 2.9 Feet Deep: 27.3
Mean (ft.):	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 18.2
Std. Dev.:	Dominant Bank Substrate Type: Bedrock	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0.9	Occurrence of LWD (%): 3.2	Mean Max Residual Pool Depth (ft.): 2.06
Water (F): 60 - 61 Air (F): 73 - 75	LWD per 100 ft.:	Mean Pool Shelter Rating: 26
Dry Channel (ft.): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 27.3 2. 18.2 3. 9.1 4. 0.0 5. 45.5		

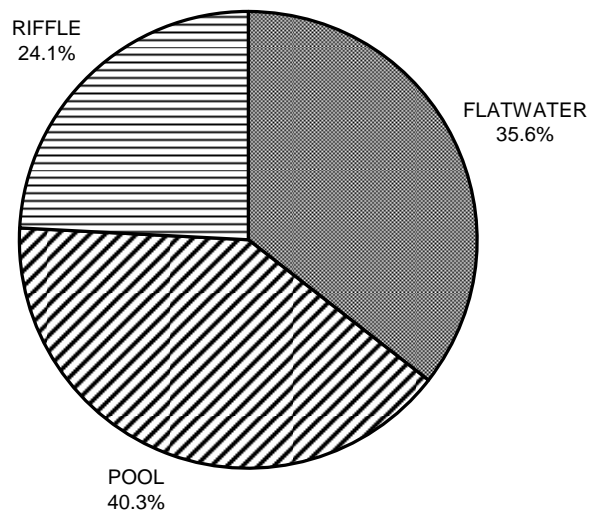
APPENDIX D: GRAPHS

**MILLINGTON CREEK
LEVEL II HABITAT TYPES BY PERCENT OCCURRENCE**



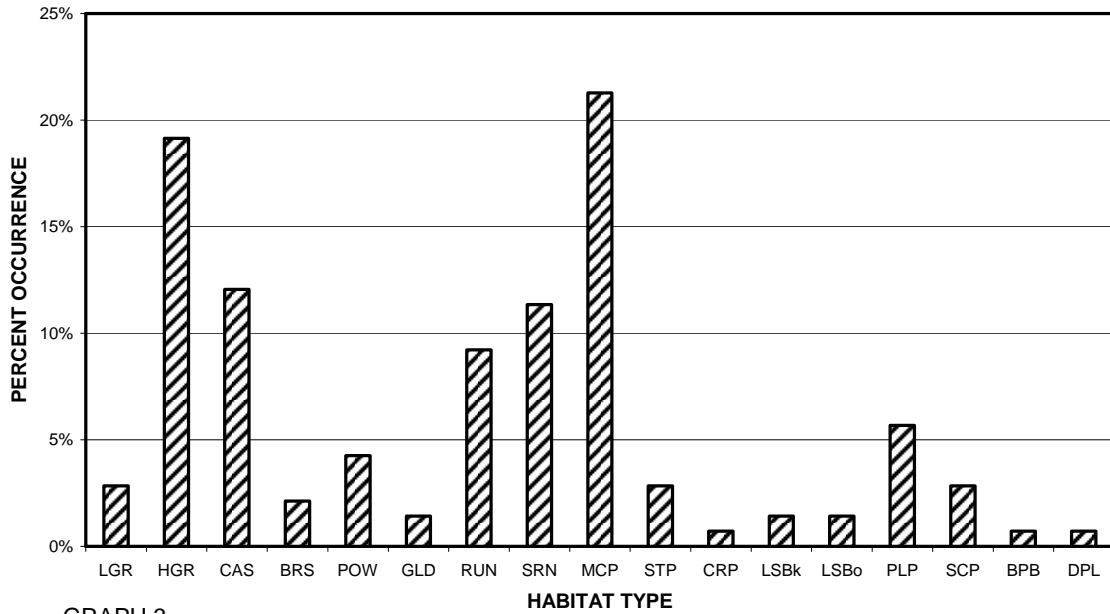
GRAPH 1

**MILLINGTON CREEK
LEVEL II HABITAT TYPES BY PERCENT TOTAL LENGTH**



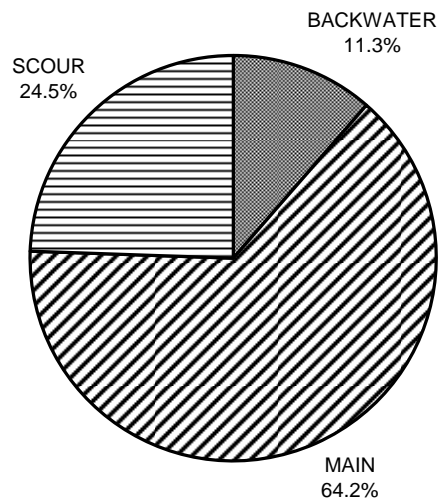
GRAPH 2

**MILLINGTON CREEK
LEVEL IV HABITAT TYPES BY PERCENT OCCURRENCE**



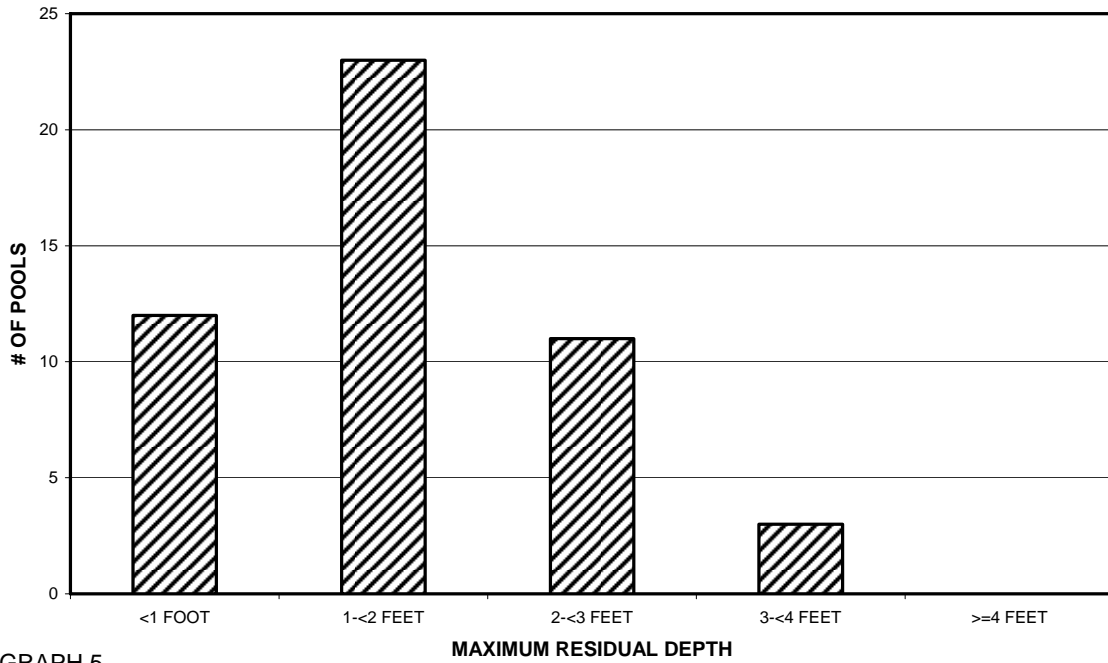
GRAPH 3

**MILLINGTON CREEK
LEVEL I POOL TYPES BY PERCENT OCCURRENCE**



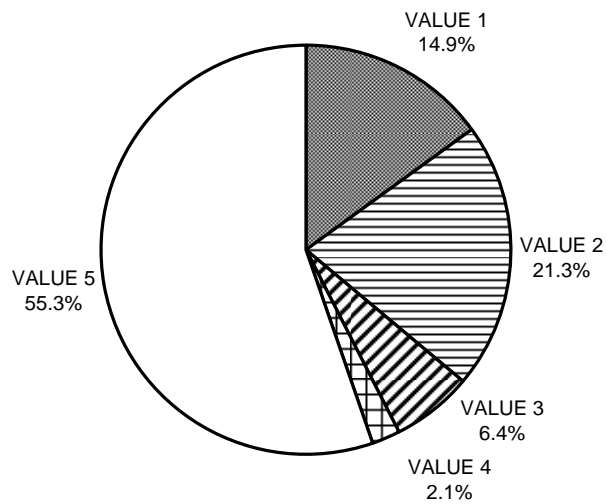
GRAPH 4

**MILLINGTON CREEK
MAXIMUM DEPTH IN POOLS**



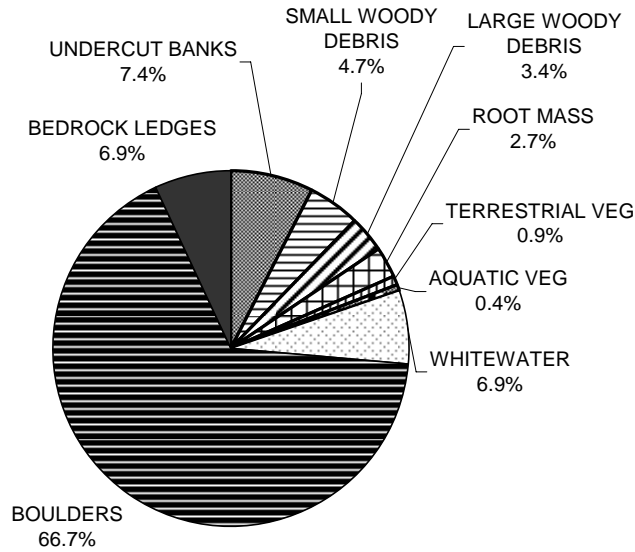
GRAPH 5

**MILLINGTON CREEK
PERCENT EMBEDDEDNESS**



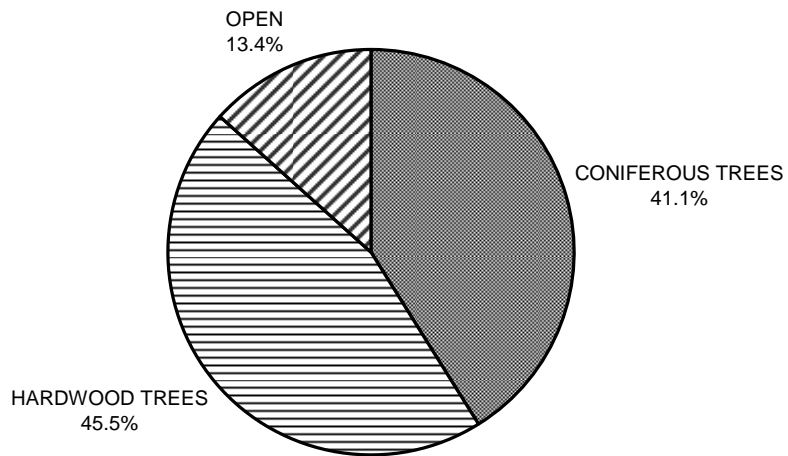
GRAPH 6

**MILLINGTON CREEK
MEAN PERCENT COVER TYPES IN POOLS**



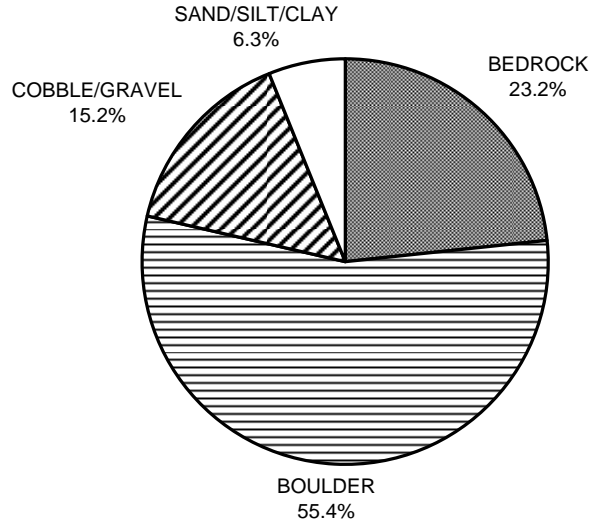
GRAPH 7

**MILLINGTON CREEK
MEAN PERCENT CANOPY**



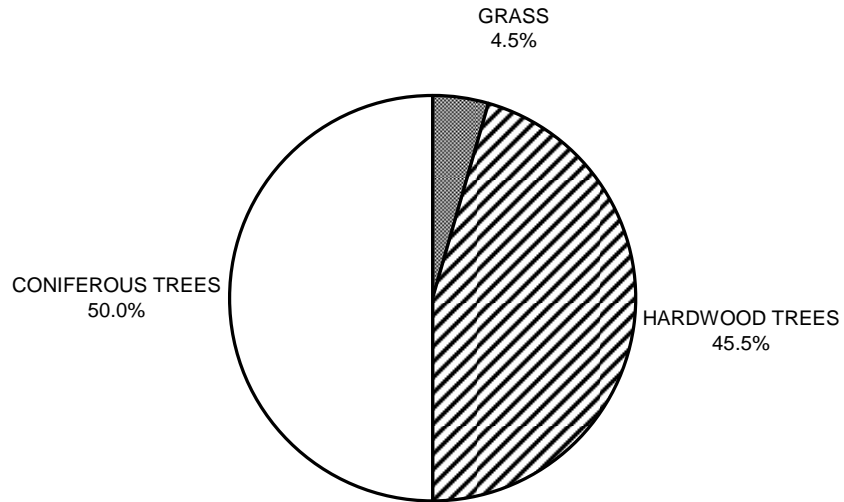
GRAPH 9

**MILLINGTON CREEK
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**MILLINGTON CREEK
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11

Hydrologic Sub-Areas covered by the watershed:

Tributary to Santa Rosa Creek
Tributary to Mark West Creek
Tributary to Russian River

Name: Millington Creek **LLId: (1:24k)** 1225711384807 **County:** Sonoma
Location: **T:** 07N **R:** 06W **S:** 6 **Latitude:** 38.4807674634664 **Longitude** 122.571120323058

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: 3	Total Length: 2.62 Miles	Note: Length is for the USGS blue-line 1:24,000 stream.
Note: Stream order is by Strahler method, recorded in CDF-NCWAP "nhydro1" 1:24k streams layer.	4.22 Km	

Drainage Area:	800 Hectares
	1978 Acres
	3.09 sq. mi.

Elevations:	Mouth: 755 feet
	Headwaters: 2720 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): None

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

Federal:	State:	Local:	Private:
0.0 acres	440.2	474.4	1063.0
0.00 %	22.25 %	23.98 %	53.77 %

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:
16.21 acres	801.54	234.59	0.00	0.00
0.8 %	40.6 %	11.9 %	0.0 %	0.0 %
Shrub:	Herbaceous:	Barren/rock:	Water:	
587.95	331.73	0.00	0.00	
29.8 %	16.8 %	0.0 %	0.0 %	

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
KENWOOD	38122D5

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

Scientific Name	Common Name
<i>Brodiaea californica</i> var. <i>leptandra</i>	narrow-anthered California brodiaea
<i>Ceanothus confusus</i>	Rincon Ridge ceanothus
<i>Layia septentrionalis</i>	Colusa layia

Hydrologic Sub-Areas covered by the watershed

Hydrologic Sub-Area Name:	ID code (RBUAS)	Hydrologic Area Name	% of watershed in this HSA
Sonoma Creek	220640	Sonoma Creek	0.11
Santa Rosa	111422	Middle Russian River	99.81
Napa River	220650	Napa River	0.08