California Department of Fish and Wildlife
East Marin County
San Francisco Bay Watersheds
Stream Habitat Assessment Reports

Old Mill Creek

Surveyed 2009

Report Completed in 2013

STREAM INVENTORY REPORT

Old Mill Creek

Survey Completed Summer 2009

INTRODUCTION

A stream inventory was conducted during 10/1/2009 to 10/7/2009 on Old Mill Creek. The survey began at the confluence with Corte Madera del Presidio and extended upstream 1.95 miles.

The Old Mill Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Old Mill Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Old Mill Creek is a tributary to Corte Madera del Presidio, a tributary to Richardson Bay, which flows into San Francisco Bay, located in Marin County, California (Map 1). Old Mill Creek's legal description at the confluence with Corte Madera del Presidio is T01N R06W S20. Its location is 37°54'18.3" north latitude and 122°32'48.8" west longitude, LLID number 1225458379051. Old Mill Creek is a second order stream and has approximately 3.49 miles of blue line stream within its catchment boundary according to the USGS National Hydrography Dataset (NHD). Old Mill Creek drains a watershed of approximately 1.86 square miles. Elevations range from sea level at the mouth of the creek to 2,520 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is primarily privately owned which accounts for 65.7% of the land area. Eighty two percent of the land is considered natural and 18% is urban. Vehicle access exists via Hwy 101 to Hwy 1 to Almonte Boulevard to Miller Avenue.

METHODS

The habitat inventory conducted in Old Mill Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors and Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Wildlife (CDFW). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are fully measured. All other habitat unit types encountered for the first time in each reach are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Old Mill Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). 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". Old 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 measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Old Mill Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile 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 for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Old 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 cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Old 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. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Old Mill Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Old Mill Creek. In addition, two sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- 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 Old 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

HABITAT INVENTORY RESULTS

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

The habitat inventory of 10/1/2009 to 10/7/2009 was conducted by T. Macias, C. Bell and A. Villalobos, (WSP). The total length of the stream surveyed was 10,305 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.12 cfs on 10/7/2009.

Old Mill Creek is an F4 channel type for 6,964 feet of the stream surveyed (Reach 1), and an A1 channel type for 3,341 feet of the stream surveyed (Reach 2).

F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A1 channels are steep narrow cascading, step-pool streams with high energy/debris transport associated with depositional soils and very stable bedrock channels.

Water temperatures taken during the survey period ranged from 54 to 57 degrees Fahrenheit. Air temperatures ranged from 58 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 33% flatwater units, 28% riffle units and 25% culvert units (Graph 1). Based on total length of Level II habitat types there were 40% riffle units, 39% flatwater units and 11% culvert units (Graph 2).

Sixteen Level IV habitat types were identified (Table 2). The most frequent habitat types by

percent occurrence were 25% Culvert units, 20% Low Gradient Riffle units and 15% Glide units, (Graph 3). Based on percent total length, there were 22% Low Gradient Riffle units, 16% High Gradient Riffle units and 15% Step Run units.

A total of 27 pools were identified (Table 3). Scour pools were the most frequently encountered, at 67%, and comprised 63% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Twelve of the 27 pools (44%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 26 pool tail-outs measured, 11 had a value of 1 (42.3%); 7 had a value of 2 (26.9%); 5 had a value of 3 (19.2%) and 3 had a value of 4 (11.5%) (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 such as bedrock, log sills, boulders, or other considerations.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 6, flatwater habitat types had a mean shelter rating of 7, and pool habitats had a mean shelter rating of 23 (Table 1). Of the pool types, the scour pools had a mean shelter rating of 30, main channel pools had a mean shelter rating of 9 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover types in Old Mill Creek. Graph 7 describes the pool cover in Old Mill Creek. Boulders are the dominant pool cover type followed by bedrock ledges.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel dominance was observed in 70% of pool tail-outs, small cobble dominance was observed in 22% of pool tail-outs.

The mean percent canopy density for the surveyed length of Old Mill Creek was 90%. The mean percentages of hardwood and coniferous trees were 51% and 49%, respectively. 10 percent of the canopy was open. Graph 9 describes the mean percent canopy in Old Mill Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 52%. The mean percent left bank vegetated was 46%. The dominant elements composing the structure of the stream banks consisted of 25% bedrock, 7% boulder, 3% cobble/gravel, 65% sand/silt/clay, (Graph 10). Hardwood trees were the dominant vegetation type observed in 33% of the units surveyed. Additionally, 29.8% of the units surveyed had coniferous tress as the dominant vegetation type, and 27.4% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Old Mill Creek 2009

Two sites were electrofished for species composition and distribution in Old Mill Creek on September 29, 2009. Water temperatures taken during the electrofishing period ranged from 56 to 58 degrees Fahrenheit. Air temperatures ranged from 60 to 66 degrees Fahrenheit. The sites were sampled by C. Bell (WSP), T. Macias (WSP) and D. Resnik (CDFW).

In reach one, which comprised the first 6,964 feet of stream, one site was sampled. The reach sites yielded forty four young-of-the-year steelhead/rainbow trout (SH/RT), eight age 1+ SH/RT and three age 2+ SH/RT. The site also yielded 1 crayfish.

In reach two, one site was sampled. The reach sites yielded two young-of-the-year SH/RT, no age 1+ SH/RT, 1 age 2+ SH/RT. In addition the site yielded 3 pacific giant salamanders and 1 crayfish.

The following chart displays the information yielded from these sites:

2009 Old Mill Creek e-fish observations

Date	Site #	Reference Point	Distance From Reference Point (ft.)	Steelhead/ Rainbow Trout			Non Salmonids Name species
				0+	1+	2+	
9/29/2009	736	Cascade Way Culvert	N/A	44	8	3	1 Crayfish

2009 Old Mill Creek e-fish observations

Date	Site #	Reference Point	Distance From Reference Point (ft.)	Steelhead/ Rainbow Trout			Non Salmonids Name species
				0+	1+	2+	
9/29/2009	737	N/A	N/A	2	0	1	3 Pacific Giant Salamanders, 1 Crayfish

DISCUSSION

Old Mill Creek is an F4 channel type for the first 6,964 feet of stream surveyed (Reach1) and an A1 channel type for the remaining 3,341 feet of stream surveyed (Reach 2).

The suitability of F4/A1 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders. They are fair for plunge weirs, single and

opposing wing-deflectors, channel constrictors and log cover. They are poor for boulder clusters. A1 channel types are generally not suitable for habitat improvement structures because of high energy flows with stable stream banks and poor gravel retention.

The water temperatures recorded on the survey days 10/1/2009 to 10/7/2009, ranged from 54 to 57 degrees Fahrenheit. Air temperatures ranged from 58 to 68 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 39% of the total length of this survey, riffles 40%, and pools 10%. The pools are relatively shallow, with only 12 of the 27 (44%) pools having a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of any log debris accumulations (LDA's) in the stream.

Eighteen of the 26 pool tail-outs measured had embeddedness ratings of 1 or 2. Eight of the pool tail-outs had embeddedness ratings of 3 or 4. None of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Old Mill Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty five of the 27 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 23. The shelter rating in the flatwater habitats was 7. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Old Mill Creek. Boulders are the dominant cover type in pools followed by bedrock ledges. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 90%. Reach 1 had a canopy density of 89.1%, Reach 2 had a canopy density of 93.1%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation 52% and 46%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

GENERAL RECOMMENDATIONS

Old 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.

RECOMMENDATIONS

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

2) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Terrestrial Vegetation. Adding high quality complexity with woody cover in the pools is desirable.

3) Access for migrating salmonids should be assessed at all road crossings and dams. Particular sites of concern include both Dam sites located in Old Mill County Park, the Miller Avenue and Cascade Road in-stream culverts, the Ethel Avenue Road Bridge, Cascade Drive Bridges, Eugene Road Bridge, and the Cornwall Road Bridge, as well as all other Private driveways and access road bridges. Other specific sites also include the Mill Valley downtown office building, parking lot, and in-stream culvert structures which all span the entire channel near the mouth of Old Mill Creek, the structure that is spanning the stream bed just downstream of the 3rd Cascade Road bridge, and the noted Ford crossing near the downstream property boundary of Old Mill County Park. All fish passage assessments should be done according to Part 9 of the California Salmonid Stream Habitat Restoration Manual (Flosi et al, 1998). Where needed, crossings should be replaced or modified to improve fish passage.

4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream. Active and potential sediment sources related to the road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

5) Old Mill Creek would benefit from utilizing bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.

COMMENTS AND LANDMARKS

Old Mill Creek 2009

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

Position (ft.)	Habitat Unit #	Comments
0	0001.00	Start of survey at the confluence of Corte Madera Del Presidio and Old Mill Creek.
0	0001.00	Culvert #1 is a single in-stream concrete culvert in good condition, at Miller Ave. The height is 7 ft, the width is 7 ft, the length is 230 ft., the diameter is 7 ft., and the plunge height is 0 ft. The maximum depth within 5 ft of the outlet is 2.5 ft. The estimated culvert slope is <5%. The culvert is a possible barrier to juvenile and adult salmonids.
258	0003.00	Culvert #2 is a single in-stream concrete culvert in good condition, at a building over the stream channel. The height is 7 ft, the width is 10 ft, and the length is 95 ft. The maximum depth within 5 ft of the outlet is 0.1 ft. The estimated culvert slope is <5%. The culvert is a possible barrier to juvenile and adult salmonids.
408	0006.00	Bridge #1 is made of wood and cement at 30 Miller Ave. The location is an office building and parking lot over the stream channel. The bridge width is 14 ft, the height is 5 ft, and the length is 125 ft. The height from the water to the sill is 0 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
533	0007.00	Juvenile steelhead trout were observed.
590	0008.00	Bridge #2 is a building over the stream channel made of wood and cement. The bridge width is 8 ft, the height is 7 ft, and the length is 34 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
684	0011.00	One salmonid was observed.
779	0012.00	Bridge #3 is a private footbridge made of wood. The width is 20 ft, the height is 8 ft, and the length is 5 ft. There was no gravel retention or evidence of down cutting. The bridge is not likely a barrier to fish.
811	0014.00	Bridge #4 is a parking lot over the stream made of cement and wood. The width is 13 ft, the height is 7 ft, and the length is 80 ft. The height from the water to the sill is 0 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
1,409	0027.00	Bridge #5 is made of cement on Ethel Ave, a county road. The width is 10 ft, the height is 8 ft, and the length is 22 ft. There was gravel retention but no down cutting occurring. The bridge is not likely a barrier to fish.
1,833	0034.00	One salmonid was observed from the bank.

Position (ft.)	Habitat Unit #	Comments
1,937	0036.00	Ford crossing 14ft into this unit.
2,251	0039.00	Dam #1 has no flashboards. The dam length is 2 ft, the height is 5 ft, and the entire width is 31 ft. The height from the water to the sill is 1.3 ft. There was down cutting and gravel retention. The height of the down-cut was 1.0 ft. The dam is a possible barrier to juvenile and adult salmonids.
2,420	0043.00	Bridge #6 is a footbridge made of wood. The width is 45 ft, the height is 11 ft, and the length is 5 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
2,432	0045.00	Bridge #7 is made of cement on Cascade Drive, a county road. The width is 10 ft, the height is 8 ft, and the length is 24 ft. The height from the water to the sill was 0 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish. The coordinate point of the bridge is: N37.90514 W122.55366.
2,456	0046.00	Dam #2 has no flashboards present. The length is 13 ft, the height is 5 ft, and the entire width is 19 ft. There was retained gravel but no down cutting. The dam is a possible barrier to juvenile and adult salmonids.
2,917	0055.00	A salmonid was observed from the bank.
3,065	0059.00	Bridge #8 is a private driveway made of wood. The width is 21 ft, the height is 5 ft, and the length is 12 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
3,222	0063.00	A 6 inch salmonid was observed.
3,281	0064.00	There is a retaining wall on the left bank.
3,322	0065.00	Culvert #3 is a single in-stream concrete culvert in good condition on Cascade Rd. The height is 7 ft, the width is 10 ft, the length is 18 ft, and the plunge height is 0 ft. The maximum depth within 5 ft of the outlet is 0.3 ft. The estimated culvert slope is <2%. The culvert is not likely a barrier to juveniles or adults.
3,353	0067.00	Bridge #9 is a private footbridge made of wood. The width is 22 ft, the height is 6 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
3,510	0070.00	One salmonid was observed.
3,610	0072.00	Bridge #10 is a private driveway made of wood. The width is 23 ft, the height is 4 ft, and the length 9 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
3,665	0075.00	Bridge #11 is a private driveway made of metal. The width is 40 ft, the height is 5 ft, and the length is 12 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.

Position (ft.)	Habitat Unit #	Comments
3,677	0076.00	One salmonid was observed.
3,804	0078.00	Bridge #12 is a private footbridge made of wood. The width is 24 ft, the height is 5 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
3,880	0080.00	Bridge #13 is a private driveway made of wood. The width is 22 ft, the height is 6 ft, and the length is 12 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
3,926	0082.00	Bridge #14 is a private driveway made of wood. The width is 14 ft, the height is 6 ft, and the length is 12 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
3,975	0084.00	One salmonid was observed from the bank.
3,975	0084.00	Bridge #15 is a private driveway made of wood. The width is 18 ft, the height is 6 ft, and the length is 13 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
4,020	0086.00	Bridge #16 is a private footbridge made of wood. The width is 18 ft, the height is 5 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
4,024	0087.00	A 12 inch salmonid was observed.
4,059	0088.00	Bridge #17 is a private driveway made of wood. The width is 18 ft, the height is 6 ft, and the length is 12 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
4,280	0093.00	Bridge #18 is made of concrete on Cascade Rd, a county road. The width is 10 ft, the height is 7 ft, and the length is 21 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to salmonids.
4,338	0096.00	Bridge #19 is a private driveway made of wood. The width is 8 ft, the height it 8 ft, and the length is 14 ft. The height from the water to the sill was 0 ft. There was no down cutting or gravel retention. The bridge is a possible barrier to salmonids. .
4,352	0097.00	One salmonid was observed.
4,390	0098.00	Bridge #20 is a private footbridge made of wood. The width is 56 ft, the height is 9 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
4,516	0100.00	Bridge #21 is a private driveway made of wood. The width is 4 ft, the height is 7 ft, and the length is 11 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.

Position (ft.)	Habitat Unit #	Comments
4,527	0101.00	Tributary #1 on the right bank enters Old Mill Creek 10 ft into the unit and contributes an estimated 1% of its flow to the stream. The estimated discharge is <1 cubic feet per second (cfs). The estimated slope of the tributary is 4%. The water temperature downstream was 55F, the temperature upstream was 55F, and the tributary was 55F. It is accessible to fish (we checked 40 ft up the tributary). No fish were observed while we were there.
4,667	0103.00	Bridge #22 is a private foot bridge made of wood. The width is 20 ft, the height is 8 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
4,858	0106.00	Bridge #23 is made of cement on Eugene Road. The width is 11 ft, the height is 9 ft, and the length is 31 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
4,971	0108.00	Bridge #24 is a private driveway made of wood. The width is 20 ft, the height is 8 ft, and the length is 19 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
5,338	0117.00	Bridge #25 is made of cement on Cornwall Road. The width is 11 ft, the height is 10 ft, and the length is 20 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
5,358	0118.00	One salmonid was observed.
5,450	0120.00	Bridge #26 is a private footbridge made of wood. The width is 24 ft, the height is 4 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
5,454	0121.00	Tributary #2 on the right bank, enters Old Mill Creek 40 ft into the unit. The discharge is 0 cfs. The estimated slope is <10%. The water temperature downstream was 55F, the temperature upstream was 55F, and the tributary was dry. It is accessible to fish (we checked 50 ft up the tributary), but no fish were observed while we were there.
5,549	0122.00	Bridge #27 is a private house over the stream channel made of wood. The width is 16 ft, the height is 8 ft, and the length is 26 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
5,830	0127.00	One salmonid was observed.
5,865	0129.00	Bridge #28 is made of cement on Cascade Rd. The width is 11 ft, the height is 7 ft, and the length is 31 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
5,920	0131.00	Bridge #29 is made of wood on a private road. The width is 15 ft, the height is 8 ft, and the length is 15 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
6,052	0133.00	One salmonid was observed.

Position (ft.)	Habitat Unit #	Comments
6,243	0137.00	Bridge #30 is made of cement on Cascade Rd. The width is 10 ft, the height is 4 ft, and the length is 18 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
6,253	0138.00	tributary #1 on the left bank has a discharge= 0 cfs, and it contributes 0% of its flow to the stream. The estimated slope is <2%. The water temperature downstream was 55 F, the temperature upstream was 55F, and the tributary was dry. It is accessible to fish (we checked 50 ft up the tributary), but no fish were observed while we were there.
6,329	0140.00	One salmonid was observed.
6,406	0142.00	Bridge #31 is a private driveway made of wood. The width is 18 ft, the height is 5 ft, and the length is 12 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
6,634	0144.00	Culvert #4 is a single in-stream culvert, on Cascade Rd. The height is 8 ft, the width is 11 ft, the length is 30 ft, and the plunge height is 0.5 ft. The estimated culvert slope is <2%. The maximum depth within 5 ft of the outlet is 0.9 ft. Water was flowing under the culvert. It is not likely a barrier to salmonids.
6,732	0146.00	One salmonid was observed.
7,234	0153.00	Bridge #32 is a private footbridge made of wood. The width is 17 ft, the height is 5 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
7,252	0155.00	Bridge #33 is a private deck made of wood. The width is 32 ft, the height is 24 ft, and the length is 21 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish
7,372	0159.00	Bridge #34 is a private footbridge made of wood. The width is 16 ft, the height is 5 ft, and the length is 3 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
7,375	0160.00	Tributary #3 on the right bank, enters 384 ft into the unit. The discharge is <1 cfs, and it contributes 50% of its flow to the stream. The water temperature downstream was 55F, the temperature upstream was 55F, and the tributary was 53F. It is inaccessible to fish (checked 50 ft up the tributary).
7,724	0164.00	Bridge #35 is made of cement on Cascade Rd. The width is 6 ft, the height is 5 ft, and the length is 37 ft. The water to sill height is 1 ft. There was no down cutting or gravel retention. The bridge is a possible barrier to fish.
7,861	0166.00	Bridge #36 is a private driveway made of wood. The width is 15 ft, the height is 7 ft, and the length is 10 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.

Position (ft.)	Habitat Unit #	Comments
8,330	0170.00	Bridge #37 is a private driveway made of cement. The width is 11 ft, the height is 6 ft, and the length is 18 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
8,348	0171.00	The right bank culverts have a 1.5 ft diameter at the start of the unit, a 1 ft diameter 50 ft into the unit, and a 4 ft diameter 250 ft into the unit.
8,948	0175.00	Culvert #5 is a single in-stream concrete culvert, on Cascade Rd. The height is 6 ft, the width is 5 ft, the length is 30 ft, and the plunge height is 1 ft. The maximum depth within 5 ft of the outlet is 2 ft. The estimated slope is <5%. There was water flowing under the cement bottom. The culvert is a possible barrier to juvenile and adult salmonids.
9,443	0181.00	Bridge #38 is a private footbridge made of wood. The width is 20 ft, the height is 9 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
9,447	0182.00	Tributary #4 on the right bank, has an estimated slope is >5%. The water temperature downstream was 55F, the temperature upstream was 55F, and the tributary was dry. It is not accessible to fish (we checked 100 ft up the tributary), and no fish were observed while we were there.
9,447	0182.00	One salmonid young of the year was observed.
9,697	0183.00	Bridge #39 is a private footbridge made of wood. The width is 8 ft, the height is 13 ft, and the length is 4 ft. There was no down cutting or gravel retention. The bridge is not likely a barrier to fish.
9,734	0186.00	There was small woody debris accumulation at the top of the unit. The debris height is 8 ft, the width is 12 ft, and the length is 8 ft.
10,305	0187.00	End of survey at Cascade Dam which is a barrier to anadromous fish passage.

REFERENCES

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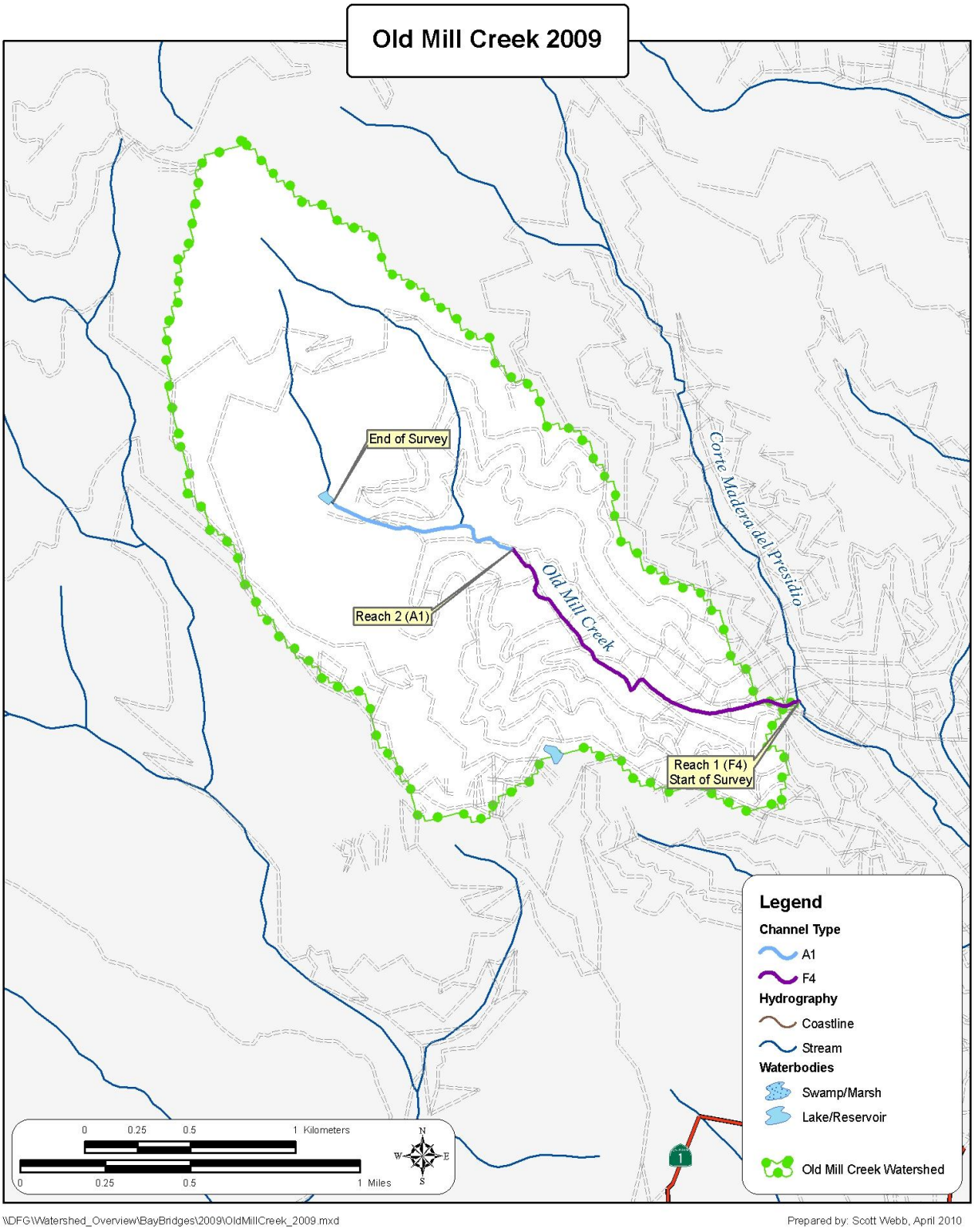
McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

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

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

Old Mill Creek 2009



Old Mill Creek 2009

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

Stream Name: Old Mill Creek **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

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
46	0	CULVERT	24.6	25	1130	11.0									
61	61	FLATWATER	32.6	66	4001	38.8	6.3	0.6	1.1	368	22467	208	12667		7
27	27	POOL	14.4	39	1042	10.1	10.1	1.1	2.1	332	8953	412	11116	366	23
53	53	RIFFLE	28.3	78	4132	40.1	5.8	0.2	0.4	387	20514	71	3773		6

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
187	141	10305	51934	27556

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Old Mill Creek **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: Quad: SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

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	Mean Canopy (%)
37	37	LGR	19.8	60	2237	21.7	6.0	0.1	0.7	337	12466	51	1893		8	92
10	10	HGR	5.3	167	1671	16.2	6.0	0.2	1.0	715	7150	169	1690		2	93
1	1	CAS	0.5	7	7	0.1	2.0	0.1	0.1	14	14	1	1		0	95
5	5	BRS	2.7	43	217	2.1	4.0	0.1	1.4	177	885	38	189		0	56
28	28	GLD	15.0	48	1333	12.9	8.0	0.7	2.1	346	9687	243	6811		14	94
15	15	RUN	8.0	72	1080	10.5	5.0	0.4	1.6	320	4794	152	2281		0	88
18	18	SRN	9.6	88	1588	15.4	5.0	0.4	2.0	444	7985	199	3575		2	95
6	6	MCP	3.2	22	134	1.3	15.0	0.9	2.3	295	1771	319	1916	278	13	82
3	3	STP	1.6	85	255	2.5	9.0	1.4	3.2	623	1869	838	2514	756	3	95
1	1	CRP	0.5	40	40	0.4	7.0	1.6	3.3	280	280	504	504	448	10	100
1	1	LSL	0.5	31	31	0.3	5.0	0.7	1.4	155	155	140	140	109	20	100
7	7	LSR	3.7	43	300	2.9	8.0	1.0	3.3	332	2324	359	2515	326	41	95
4	4	LSBk	2.1	37	148	1.4	5.0	0.8	2.0	198	791	194	775	158	38	75
1	1	LSBo	0.5	30	30	0.3	12.0	1.1	1.9	360	360	432	432	396	20	100
4	4	PLP	2.1	26	104	1.0	14.0	1.5	4.0	351	1403	580	2322	518	14	98
46	0	CUL	24.6	25	1130	11.0										0

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume
187	141	10305	51934	27556

Table 3 - Summary of Pool Habitat Types

Stream Name: Old Mill Creek **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

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
9	9	MAIN	33	43	389	37	13.1	1.1	404	3640	437	3935	9
18	18	SCOUR	67	36	653	63	8.7	1.1	295	5313	330	5941	30

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
27	27	1042	8953	9876

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

Stream Name: Old Mill Creek **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

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 Occurence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
6	MCP	22	0	0	4	67	2	33	0	0	0	0
3	STP	11	0	0	2	67	0	0	1	33	0	0
1	CRP	4	0	0	0	0	0	0	1	100	0	0
1	LSL	4	0	0	1	100	0	0	0	0	0	0
7	LSR	26	0	0	3	43	2	29	2	29	0	0
4	LSBk	15	0	0	3	75	1	25	0	0	0	0
1	LSBo	4	0	0	1	100	0	0	0	0	0	0
4	PLP	15	0	0	1	25	2	50	0	0	1	25

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Feet Max Resid. Depth	Total 1< 2 Feet % Occurrence	Total 2< 3 Feet Max Resid. Depth	Total 2< 3 Feet % Occurrence	Total 3< 4 Feet Max Resid. Depth	Total 3< 4 Feet % Occurrence	Total >= 4 Feet Max Resid. Depth	Total >= 4 Feet % Occurrence
27	0	0	15	56	7	26	4	15	1	4

Mean Maximum Residual Pool Depth (ft.): 2

Table 5 - Summary of Mean Percent Cover By Habitat

Stream Name: Old Mill Creek **Dry Units:** **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

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
37	20	LGR	0	0	0	0	10	0	0	0	0
10	7	HGR	0	0	0	0	21	0	0	7	0
1	1	CAS	0	0	0	0	0	0	0	0	0
5	3	BRS	0	0	0	0	0	0	0	0	0
53	31	TOTAL RIFFLE	0	0	0	0	11	0	0	2	0
28	13	GLD	3	0	0	5	9	0	0	6	0
15	6	RUN	0	0	0	0	0	0	0	0	0
18	11	SRN	0	0	0	0	7	0	0	11	0
61	30	TOTAL FLAT	1	0	0	2	7	0	0	7	0
6	6	MCP	8	10	0	8	8	0	0	22	10
3	3	STP	0	0	0	0	27	0	0	40	0
1	1	CRP	0	0	0	0	0	0	0	100	0
1	1	LSL	0	0	100	0	0	0	0	0	0
7	7	LSR	18	19	1	39	7	0	0	1	14
4	4	LSBk	0	0	0	0	30	0	0	43	28
1	1	LSBo	0	0	0	0	20	0	0	80	0
4	4	PLP	43	0	0	0	0	0	0	35	23
27	27	TOTAL POOL	13	7	4	12	12	0	0	28	13
46	0	CUL									
187	88	TOTAL	4	2	1	4	10	0	0	11	4

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Old Mill Creek **Dry Units:** **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

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
37	18	LGR	0	6	89	6	0	0	0
10	7	HGR	0	0	0	43	29	14	14
1	1	CAS	0	0	0	0	0	0	100
5	3	BRS	0	0	0	0	0	0	100
28	8	GLD	0	13	75	0	13	0	0
15	6	RUN	0	0	83	0	0	17	0
18	6	SRN	17	0	33	0	0	0	50
6	6	MCP	17	17	67	0	0	0	0
3	2	STP	50	0	0	0	0	0	50
1	1	CRP	0	0	100	0	0	0	0
1	1	LSL	0	0	100	0	0	0	0
7	7	LSR	0	29	71	0	0	0	0
4	4	LSBk	25	0	50	0	0	25	0
1	1	LSBo	0	0	0	0	100	0	0
4	4	PLP	0	0	100	0	0	0	0
46	0	CUL	0	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Old Mill Creek **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
90	49	51	2	52	46

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.

Old Mill Creek 2009

Table 8 - Fish Habitat Inventory Data Summary

Stream Old Mill Creek LLID: 1225458379051 Drainage San Rafael

Survey Dates: 10/1/2009 to 10/7/2009 Survey Length (ft.): 10305 Main Channel (ft.): 10305 Side Channel (ft.): 0

Confluence Location: Quad SAN RAFAEL Legal Description: T01NR06WS20 Latitude: 37:54:18.6N Longitude: 122:32:44.9W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4
Reach Length (ft.): 6964
Riffle/Flatwater Mean Width (ft.): 6.3
BFW:
Range (ft.): 12.00 to 21.00
Mean (ft.): 15.13
Std. Dev.: 2.37
Base Flow (cfs): 0.12
Water (F): 54 - 57 Air (F): 63 - 68
Dry Channel (ft.): 0

Canopy Density (%): 89.1
Coniferous Component (%): 48.6
Hardwood Component 51.4
Dominant Bank Hardwood Trees
Vegetative Cover (%): 48.8
Dominant Terrestrial Veg.
Dominant Bank Substrate Sand/Silt/Clay
Occurrence of LWD (%): 1.6
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length 10.7
Pool Frequency (%): 14.9
Residual Pool Depth (%):
< 2 Feet Deep: 54.5
2 to 2.9 Feet Deep: 27.3
3 to 3.9 Feet Deep: 13.6
>= 4 Feet Deep: 4.5
Mean Max Residual Pool Depth 2.14
Mean Pool Shelter 26

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 72.7 Sm Cobble: 27.3 Lg Cobble: 0.0 Boulder 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 36.4 2. 27.3 3. 22.7 4. 13.6 5. 0.0

STREAM REACH: 2

Channel Type: A1
Reach Length (ft.): 3341
Riffle/Flatwater Mean Width (ft.): 5.4
BFW:
Range (ft.): 12.00 to 16.00
Mean (ft.): 12.36
Std. Dev.: 1.15
Base Flow (cfs): 0.12
Water (F): 54 - 55 Air (F): 58 - 65
Dry Channel (ft.): 0

Canopy Density (%): 93.1
Coniferous Component (%): 52.6
Hardwood Component 47.4
Dominant Bank Brush
Vegetative Cover (%): 50.2
Dominant Boulders
Dominant Bank Substrate Bedrock
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length 8.9
Pool Frequency (%): 12.8
Residual Pool Depth (%):
< 2 Feet Deep: 60.0
2 to 2.9 Feet Deep: 20.0
3 to 3.9 Feet Deep: 20.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth 2.14
Mean Pool Shelter 10

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 60.0 Sm Cobble: 0.0 Lg Cobble: 40.0 Boulder 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 75.0 2. 25.0 3. 0.0 4. 0.0 5. 0.0

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Old Mill Creek **LLID:** 1225458379051 **Drainage:** San Rafael

Survey 10/1/2009 to 10/7/2009

Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	16	15	25.0
Boulder	5	4	7.3
Cobble/Gravel	2	2	3.2
Sand/Silt/Clay	39	41	64.5

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage
Grass	0	3	2.4
Brush	19	15	27.4
Hardwood	24	17	33.1
Coniferous	16	21	29.8
No Vegetation	3	6	7.3

Total Stream Cobble Embeddedness Values: 2

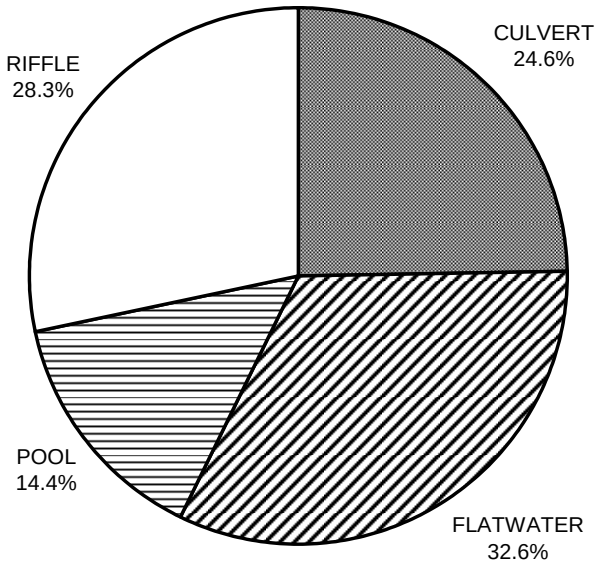
Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

Stream Name: Old Mill Creek **LLID:** 1225458379051 **Drainage:** San Rafael
Survey 10/1/2009 to 10/7/2009
Confluence Location: **Quad:** SAN RAFAEL **Legal Description:** T01NR06WS20 **Latitude:** 37:54:18.6N **Longitude:** 122:32:44.9W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	1	13
SMALL WOODY DEBRIS (%)	0	0	7
LARGE WOODY DEBRIS (%)	0	0	4
ROOT MASS (%)	0	2	12
TERRESTRIAL VEGETATION	11	7	12
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	2	7	28
BEDROCK LEDGES (%)	0	0	13

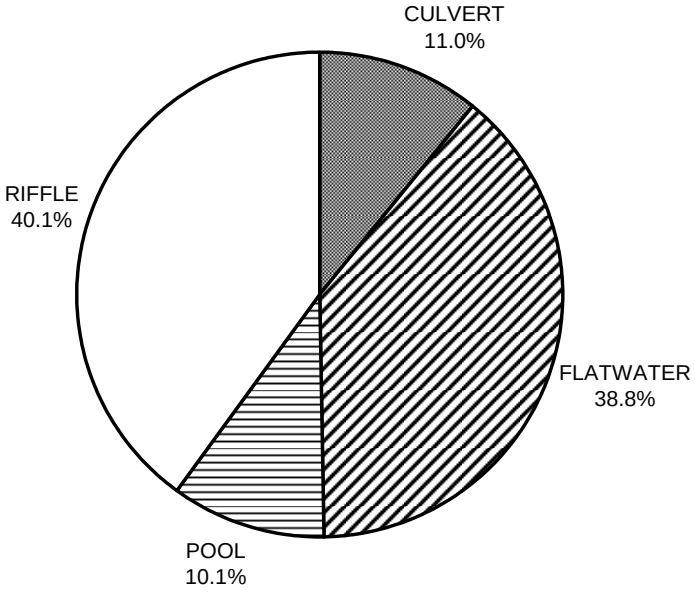
Old Mill Creek 2009

OLD MILL CREEK 2009
HABITAT TYPES BY PERCENT OCCURRENCE



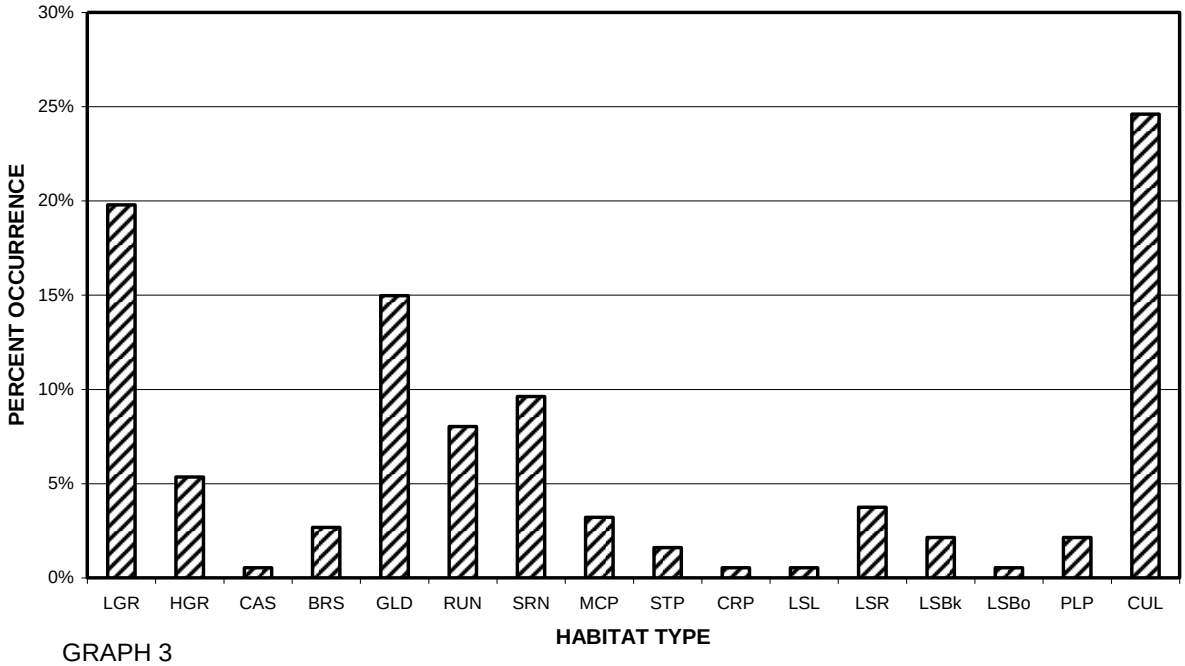
GRAPH 1

OLD MILL CREEK 2009
HABITAT TYPES BY PERCENT TOTAL LENGTH



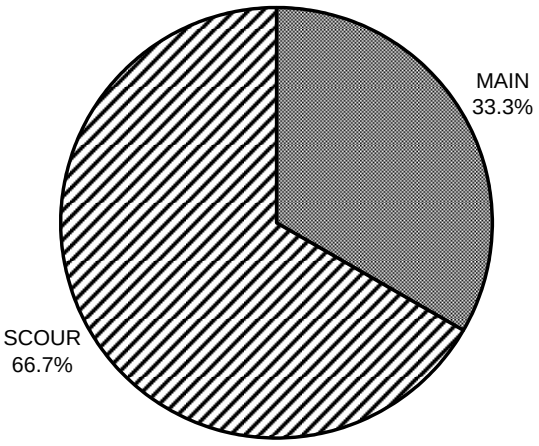
GRAPH 2

OLD MILL CREEK 2009
HABITAT TYPES BY PERCENT OCCURRENCE

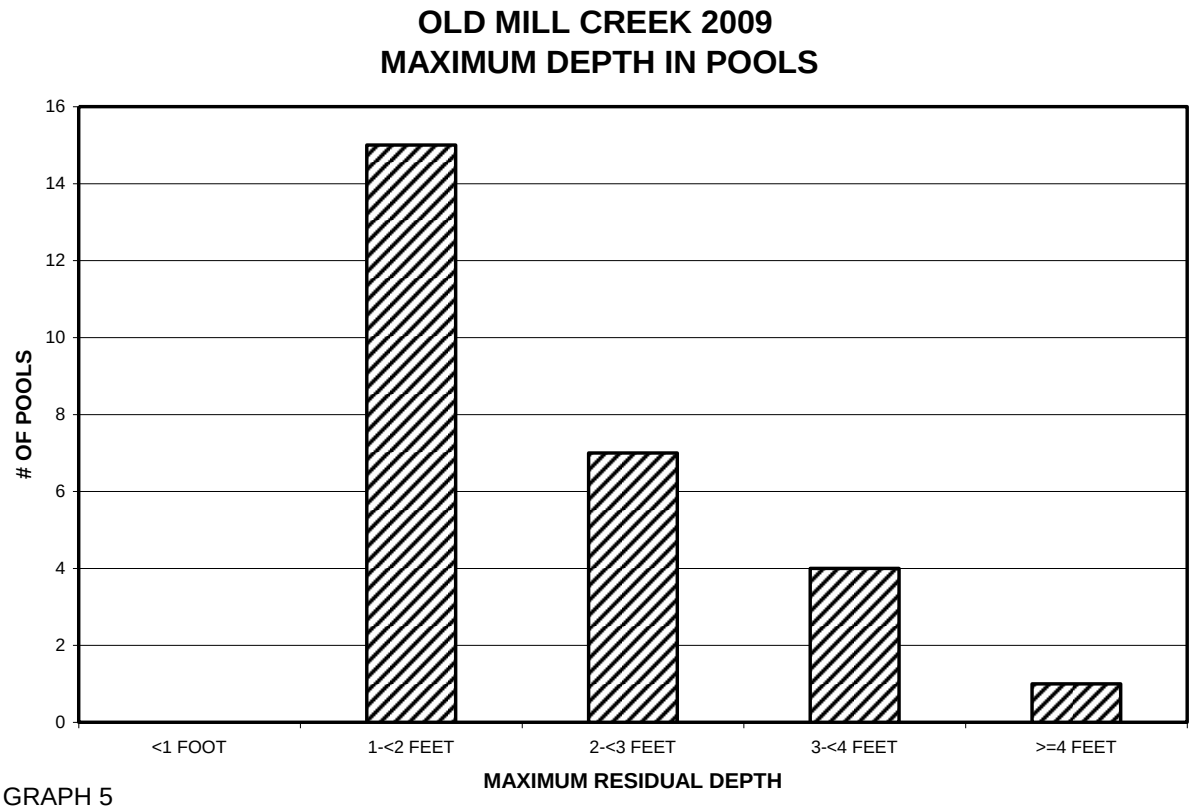


GRAPH 3

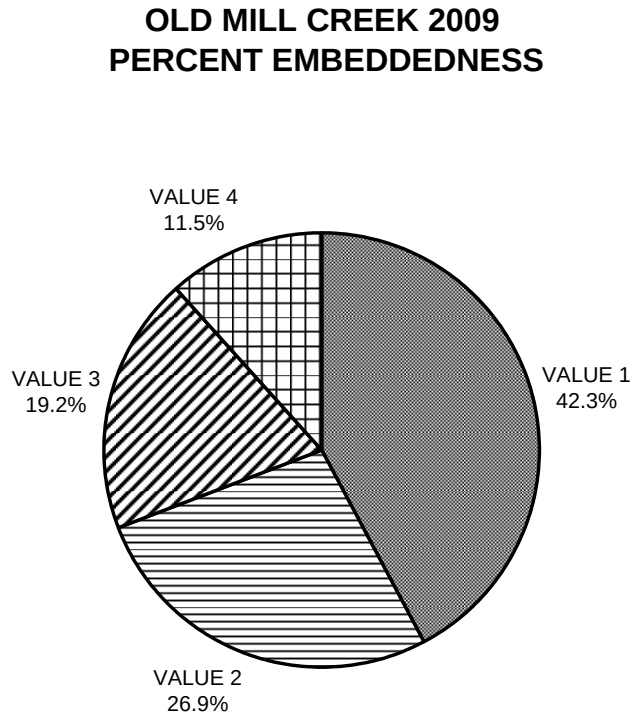
OLD MILL CREEK 2009
POOL TYPES BY PERCENT OCCURRENCE



GRAPH 4

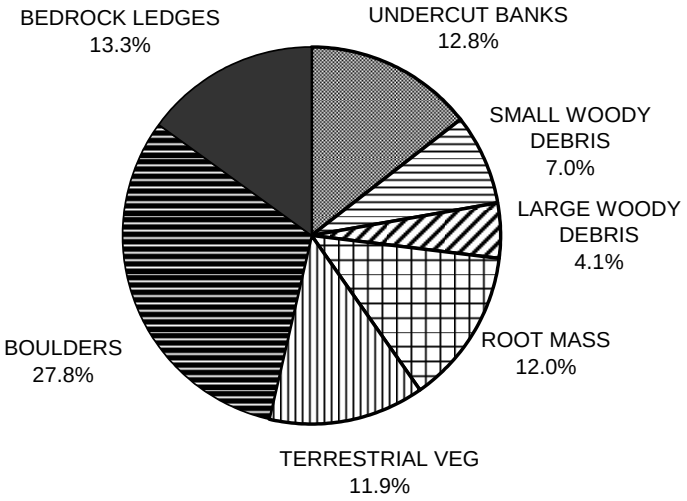


GRAPH 5



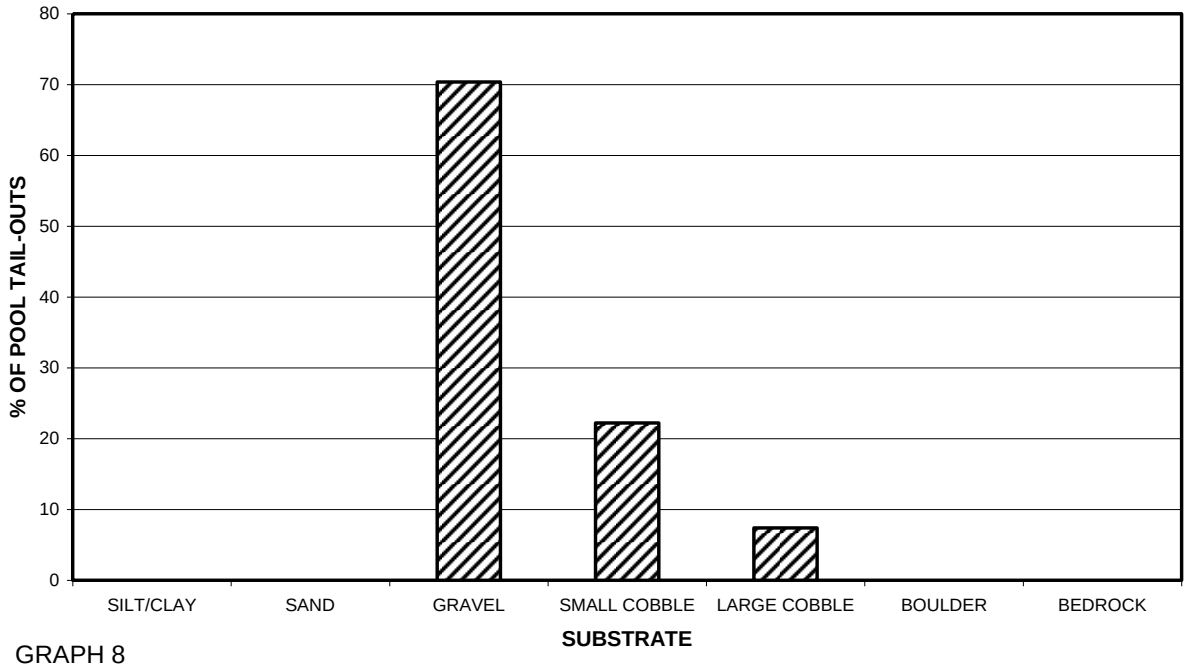
GRAPH 6

OLD MILL CREEK 2009
MEAN PERCENT COVER TYPES IN POOLS



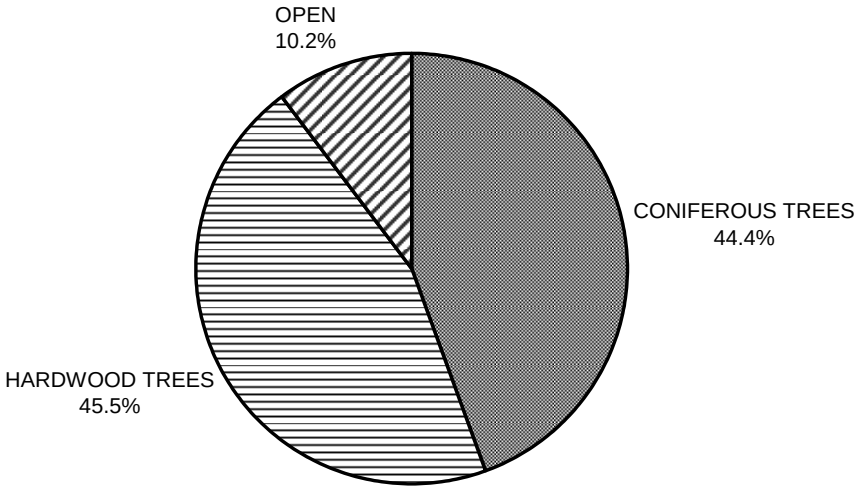
GRAPH 7

OLD MILL CREEK 2009
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



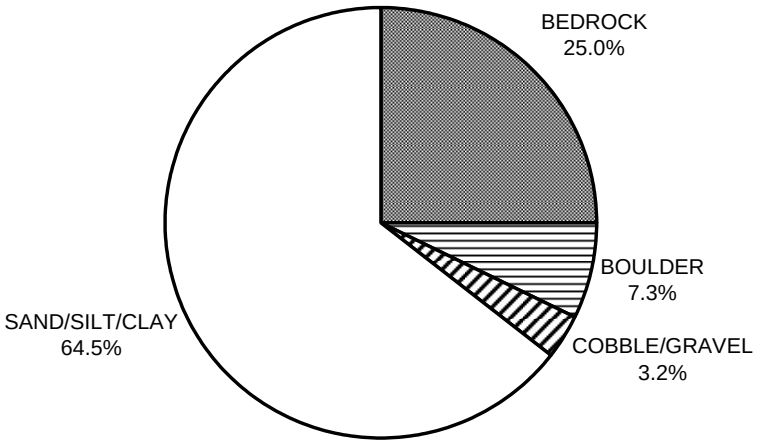
GRAPH 8

OLD MILL CREEK 2009
MEAN PERCENT CANOPY



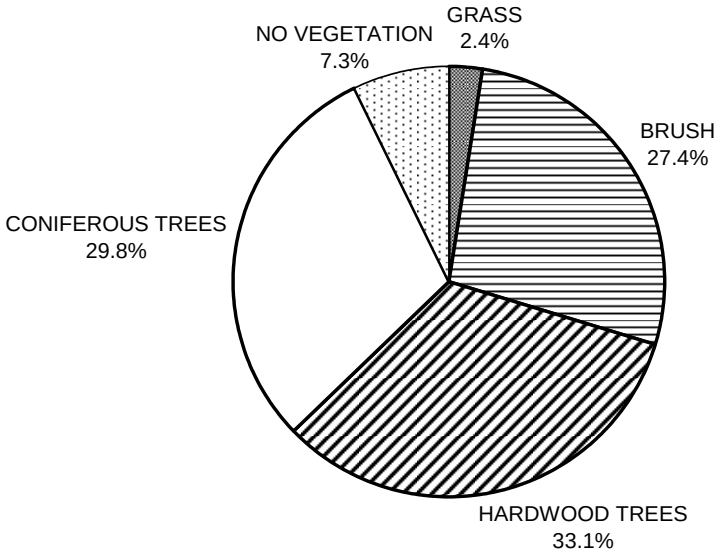
GRAPH 9

OLD MILL CREEK 2009
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

OLD MILL CREEK 2009
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11