



**California Department of Fish and Game
Walker Creek Watershed
Stream Habitat Assessment Reports**

Salmon Creek



From Google maps 2009

STREAM INVENTORY REPORT

Salmon Creek

Assessment October 2008

Report Completed March 2009

INTRODUCTION

A stream inventory was conducted during 10/9/2008 to 10/10/2008 on Salmon Creek. The survey began at the confluence with Walker Creek and extended upstream 5.5 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Salmon Creek.

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

Salmon Creek is a tributary to Walker Creek, is a tributary to Pacific Ocean, located in Marin County, California (Map 1). Salmon Creek's legal description at the confluence with Walker Creek is T04NR08S30. Its location is 38°09'42.0" north latitude and 122°46'49.0" west longitude, LLID number 1227804381617. Salmon Creek is a 2 order stream and has approximately 9.34 miles of blue line stream according to the USGS National Hydrography Datasheet (NHD). Salmon Creek drains a watershed of approximately 5.16 square miles. Elevations range from about 203 feet at the mouth of the creek to 1375 feet in the headwater areas. Mixed hardwood forest dominates the watershed. The watershed is entirely privately owned and is all considered natural. Vehicle access exists via Hicks Valley Road and Marshal Petaluma Road.

METHODS

The habitat inventory conducted in Salmon 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 Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are fully measured. Habitat unit types encountered for

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the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement. All pools except step-pools are fully sampled.

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 Salmon 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". Salmon 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 Salmon Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26

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- 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 Salmon 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Salmon 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 Salmon 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

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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.

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 Game. 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 Salmon 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

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- 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 10/9/2008 to 10/10/2008, was conducted by H. Colton (WSP) and T. Pool (WSP). The total length of the stream surveyed was 28,844 feet.

Stream flow was not measured on Salmon Creek.

Salmon Creek is a F4 channel type for 4,194 feet of the stream surveyed (Reach 1), a NA channel type for 12,785 feet of the stream surveyed (Reach 2) and an E6 channel type for final 11,865 feet of the stream surveyed (Reach 3).

F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. E6 channels are low gradient, meandering riffle/pool stream with low width to depth ratio and little deposition; very efficient and stable; high meander width ratio and silt/clay substrates.

Water temperatures taken during the survey period ranged from NA to 52 degrees Fahrenheit. Air temperatures ranged from 49 to 60 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 31% pool units, 25% dry units, 24% flatwater units, 11% culvert units (Graph 1). Based on total length of Level II habitat types there were 44% no-survey units, 41% dry units, and 7% flatwater units (Graph 2).

Five Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 25% Dry units, 24% Mid-Channel Pool units and 24% Glide units (Graph 3). Based on percent total length, 44% were Not Surveyed unit, 41% were Dry units and 7% were Glide units.

A total of 17 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 100%, and comprised 100% 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 seven of the 17 pools (41%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 17 pool tail-outs measured, 8 had a value of 2 (47.1%); 5 had a value of 3 (29.4%) and 4 had a value of 4 (23.5%) (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.

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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 0, flatwater habitat types had a mean shelter rating of 4, and pool habitats had a mean shelter rating of 7 (Table 1). Of the pool types, the Main Channel pools had a mean shelter rating of 7 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut Banks are the dominant cover types in Salmon Creek. Graph 7 describes the pool cover in Salmon Creek. Undercut Banks are the dominant pool cover type followed by root mass.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. a silt/clay substrate type was observed in 6% of pool tail-outs, sand observed in 18% of pool tail-outs, gravel observed in 59% of pool tail-outs, small Cobble observed in 18% of pool tail-outs, (Use these numbers to choose 2 types).

The mean percent canopy density for the surveyed length of Salmon Creek was 69%. The mean percentages of hardwood and coniferous trees were 100% and 0%, respectively. Thirty one percent of the canopy was open. Graph 9 describes the mean percent canopy in Salmon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 78%. The mean percent left bank vegetated was 82%. The dominant elements composing the structure of the stream banks consisted of 92% cobble/gravel, 8% sand/silt/clay, (Graph 10). Deciduous trees were the dominant vegetation type observed in 90% of the units surveyed. Additionally, 8% of the units surveyed had grass as the dominant vegetation type.

DISCUSSION

Salmon Creek is a F4 channel type for the first 4,194 feet of stream surveyed and a NA channel type for the next 12,785 feet and an E6 channel type for the remaining 11,865 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing deflectors, channel constrictors; poor for boulder clusters. The suitability of E6 channel types for fish habitat improvement structures is as follows: good for bank placed boulders; fair for opposing wing-deflectors; poor for weirs, boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days 10/9/2008 to 10/10/2008, ranged from NA to 52 degrees Fahrenheit. Air temperatures ranged from 49 to 60 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 7% of the total length of this survey, riffles 1%, dry units 41%, no survey unit 44% and pools 5%. The pools are relatively shallow, with only 7 of the 17 (41%) 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

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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 channels 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 the numerous log debris accumulations (LDA's) in the stream.

Eight of the 17 pool tail-outs measured had embeddedness ratings of 1 or 2. Nine 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 Salmon Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirteen of the 17 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 7. The shelter rating in the flatwater habitats was 4. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Salmon Creek. Undercut banks are the dominant cover type in pools followed by root mass. 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 69%. Reach 1 had a canopy density of 66% and Reach 3 had a canopy density of 87%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was HIGH at 78% and 82%, 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

Salmon 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. Access for migrating salmonids should be assessed at all 6 stream crossings. Where

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needed crossings should be replaced or modified to improve fish passage.

2. There are sections where the stream is being impacted from cattle trampling the riparian zone. Alternatives to uncontrolled riparian grazing should be explored with the grazier and developed if possible.
3. Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from Undercut Banks. Adding high quality complexity with woody cover in the pools is desirable.
4. Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.
5. 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.
6. Increase the canopy on Salmon Creek by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.
7. Salmon Creek would benefit from utilizing bio-technical vegetative techniques for bank stabilization and 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

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

<u>Position</u> (feet)	<u>Habitat Unit</u> #	<u>Comments:</u>
0	0001.00	Start of Survey: Start of Survey at the confluence with Walker Creek. Channel type is F4 (Reach 1)
366	0007.00	Bio Sample: (Bank Observation) Salmonid observed.
591	0009.00	Bio Sample: (Bank Observation) Salmonids observed. Evidence of cows accessing creek.
1273	0015.00	Access Points / Location: (Culvert) 310 feet into unit left bank culvert with rip rap.
1649	0017.00	Bio Sample: (Bank Observation) Salmonid observed.

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<u>Position</u> (feet)	<u>Habitat Unit</u> #	<u>Comments:</u>
2108	0021.00	Access Points / Location: (Bridge) Bridge 1 is a car bridge where creek crosses Marshall/Petaluma RD. The bridge is 24 feet wide and is 22 feet long. It is made out of concrete, is not a barrier and there was no down cutting.
2610	0025.00	Erosion Site: (Bank) Erosion right bank.
2610	0025.00	Bio Sample: (Bank Observation) Roach observed.
2737	0026.00	Erosion Site: (Bank) Erosion left bank.
2940	0029.00	Erosion Site: (Bank) Erosion on right bank.
2940	0029.00	Bio Sample: (Bank Observation) Roach observed.
4194	0041.00	General Comment: No Access. Channel type change Reach 1 (F4) to Reach 2 (NA).
16904	0042.00	General Comment: Channel type change. Reach 2 (NA) to Reach 3 (E6). Tributaries: 1,668 feet into unit right bank dry tributary. 2,330 feet into unit right bank dry tributary. 3,200 feet into unit left bank dry tributary.
21034	0043.00	Access Points / Location: (Bridge) Bridge 2 is located at Hicks valley road. Its dimensions are 8 feet wide, 8 feet tall and 51.2 feet long. It is made out of concrete, is not a barrier and there was no down cutting. WP 275
21085	0044.00	Tributaries: 578 feet into unit right bank tributary. 668 feet into unit right bank tributary.
21908	0046.00	Access Points / Location: (Culvert) Culvert 1 is located under the landowners yard. It is a box culvert made out of concrete. The dimensions measured 5.5feet tall, 7 feet wide and 75 feet long. It had a plunge height of 3 feet and a max depth within 5 feet of 2 feet. It was in good condition and is a possible barrier to juvenile and adult salmonids.
22051	0048.00	Access Points / Location: (Bridge) Bridge 3 is a located on a driveway. It is 6.1 feet wide, 5.6 feet tall and 48 feet long. It is made out of concrete and is a possible barrier to salmonids and was down cutting. WP 277
22299	0050.00	Access Points / Location: (Bridge) Bridge 4 was a footbridge to landowner's yard. It was 21feet wide, 5 feet tall and 6.2feet long. It was made out of wood. It was not a barrier and there was no down cutting.
22366	0052.00	Access Points / Location: (Culvert) Culvert 2 was in the yard of a landowner. It was a corrugated metal pipe (CMP). It was 3.5 feet tall, 2.8 feet wide and 17 feet long. It was 3 feet in diameter and about 1% slope. It was rusted out and was not a barrier to salmonids.
22383	0053.00	Tributaries: 710 feet into unit right bank dry tributary. 1,800 feet into unit pond off to side of creek. 1,600 feet into unit right bank dry tributary. 3,200 feet into unit left bank dry tributary. 3,784 feet into unit right bank dry tributary. 3,800 feet into unit left bank dry tributary.

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<u>Position</u> (feet)	<u>Habitat Unit</u> #	<u>Comments:</u>
27810	0054.00	Access Points / Location: (Culvert) Culvert 3 was a CMP. It was 4 feet wide, 4 feet tall and 34 feet long. It had about a 1% slope. It was in good condition and was not a barrier to salmonids.
27844	0055.00	Erosion Site: (Bank) Erosion on left bank.
28844	0055.00	End of Survey: Survey ended at the headwaters of Salmon Creek.

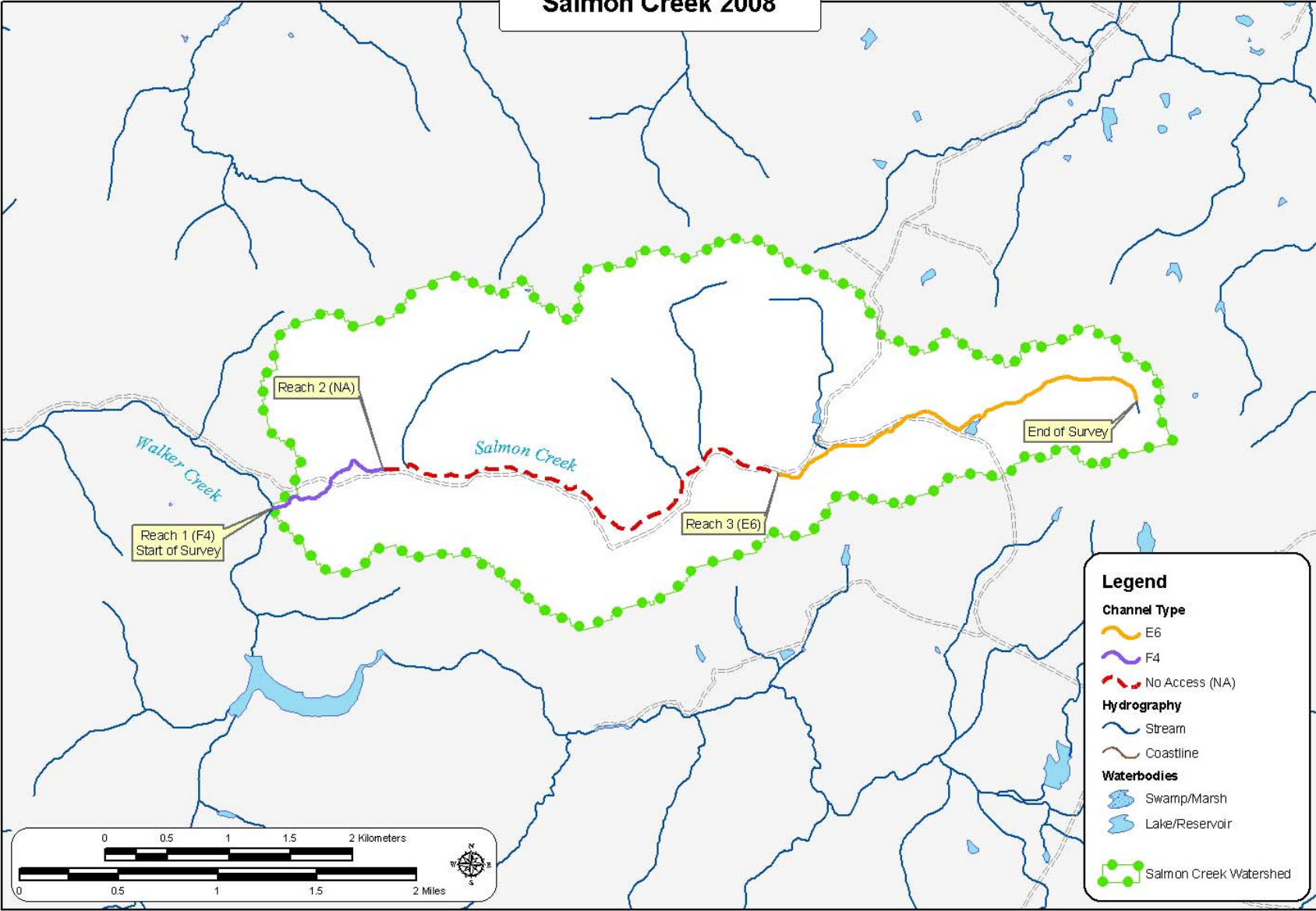
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McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

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

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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]	

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

Stream Name: Salmon Creek

LLID: 1227804381617

Drainage: Tomales Bay

Survey 10/9/2008 to 10/10/2008

Confluence Location: Quad: POINT REYES NE

Legal Description: T04NR08S30

Latitude: 38:09:42.0N

Longitude: 122:46:49.0W

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
6	0	CULVERT	10.9	41	247	0.9									
14	0	DRY	25.5	855	11968	41.5									
13	2	FLATWATER	23.6	154	2000	6.9	7.4	0.7	1.0	919	11952	615	7994		5
1	0	NOSURVEY	1.8	12710	12710	44.1									
17	17	POOL	30.9	90	1533	5.3	9.7	1.2	1.7	927	15754	1216	20668	1123	7
4	1	RIFFLE	7.3	96	386	1.3	5.3	0.1	0.2	168	672	17	67		0
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)		
55	20				28844						28377		28729		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Salmon Creek

LLID: 1227804381617

Drainage: Tomales Bay

Survey 10/9/2008 to 10/10/2008

Confluence Location: Quad: POINT REYES NE

Legal Description: T04NR08S30

Latitude: 38:09:42.0N

Longitude: 122:46:49.0W

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	Mean Canopy (%)
4	1	LGR	7.3	96	386	1.3	5.0	0.1	0.2	168	672	17	67		0	13
13	2	GLD	23.6	154	2000	6.9	7.0	0.7	1.1	919	11952	615	7994		5	58
13	13	MCP	23.6	74	958	3.3	9.0	1.1	2.3	632	8217	712	9252	639	7	75
4	4	STP	7.3	144	575	2.0	13.0	1.3	2.1	1884	7537	2854	11416	2693	7	63
14	0	DRY	25.5	855	11968	41.5										82
6	0	CUL	10.9	41	247	0.9										
1	0	NS	1.8	12710	12710	44.1										
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)			
55	20				28844						28377		28729			

Table 3 - Summary of Pool Types

Stream Name: Salmon Creek

LLID: 1227804381617

Drainage: Tomales Bay

Survey 10/9/2008 to 10/10/2008

Confluence Location: Quad: POINT REYES NE

Legal Description: T04NR08S30

Latitude: 38:09:42.0N

Longitude: 122:46:49.0W

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
17	17	MAIN	100	90	1533	100	9.7	1.2	927	15754	1123	19087	7
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
17	17				1533					15754		19087	

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

Stream Name:		Salmon Creek					LLID:		1227804381617		Drainage:			Tomales Bay					
Survey		10/9/2008 to 10/10/2008																	
Confluence Location: Quad:			POINT REYES NE			Legal Description:			T04NR08S30			Latitude:		38:09:42.0N		Longitude:		122:46:49.0W	
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							
13	MCP	76	1	8	6	46	6	46	0	0	0	0							
4	STP	24	0	0	3	75	1	25	0	0	0	0							
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							
17			1	6	9	53	7	41	0	0	0	0							
Mean Maximum Residual Pool Depth (ft.):			2																

Salmon Creek

Table 5 - Summary of Mean Percent Cover By Habitat Types

Stream Name:		Salmon Creek	Dry Units:		14	LLID:		1227804381617	Drainage:			Tomales Bay	
Survey		10/9/2008 to 10/10/2008											
Confluence Location:		Quad:	POINT REYES NE	Legal Description:		T04NR08S30	Latitude:		38:09:42.0N	Longitude:			122:46:49.0W
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	1	LGR	0	0	0	0	0	0	0	0	0		
4	1	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0		
13	2	GLD	15	35	0	25	25	0	0	0	0		
13	2	TOTAL FLAT	15	35	0	25	25	0	0	0	0		
13	13	MCP	26	20	0	25	4	0	0	2	0		
4	4	STP	25	28	0	20	20	0	0	8	0		
17	17	TOTAL POOL	26	22	0	24	8	0	0	3	0		
6	0	CUL											
1	0	NS											
55	20	TOTAL	24	22	0	23	9	0	0	3	0		

Table 6 - Summary of Dominant Substrates By Habitat Types

Stream Name: Salmon Creek **Dry Units:** 14 **LLID:** 1227804381617 **Drainage:** Tomales Bay

Survey 10/9/2008 to 10/10/2008

Confluence Location: Quad: POINT REYES NE **Legal Description:** T04NR08S30 **Latitude:** 38:09:42.0N **Longitude:** 122:46:49.0W

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	1	LGR	0	0	0	100	0	0	0
13	2	GLD	0	0	0	100	0	0	0
13	13	MCP	15	31	23	31	0	0	0
4	4	STP	0	25	25	50	0	0	0
6	0	CUL	0	0	0	0	0	0	0
1	0	NS	0	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Salmon Creek **LLID:** 1227804381617 **Drainage:** Tomales Bay
Survey 10/9/2008 to 10/10/2008
Confluence Location: **Quad:** POINT REYES NE **Legal Description:** T04NR08S30 **Latitude:** 38:09:42.0N **Longitude:** 122:46:49.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
69	0	100	0	78	82

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.

Salmon Creek

Table 8 - Fish Habitat Inventory Data Summary

Stream Salmon Creek LLID: 1227804381617 Drainage Tomales Bay
 Survey Dates: 10/9/2008 to 10/10/2008 Survey Length (ft.): 28844 Main Channel (ft.): 28844 Side Channel (ft.): 0
 Confluence Location: Quad POINT REYES NE Legal Description: T04NR08S30 Latitude: 38:09:42.0N Longitude: 122:46:49.0W

Summary of Fish Habitat Elements By Stream

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 66.3	Pools by Stream Length	36.0
Reach Length (ft.): 4194	Coniferous Component (%): 0.0	Pool Frequency (%):	40.0
Riffle/Flatwater Mean Width (ft.): 6.7	Hardwood Component	Residual Pool Depth (%):	
BFW:	Dominant Bank	Hardwood Trees	< 2 Feet Deep: 62.5
Range (ft.): 22 to 29	Vegetative Cover (%): 79.3		2 to 2.9 Feet Deep: 37.5
Mean (ft.): 25.75	Dominant	Root masses	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 2.49	Dominant Bank Substrate	Cobble/Gravel	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth	1.66
Water (F): 50 - 52	Air (F): 50 - 57	LWD per 100 ft.:	Mean Pool Shelter
Dry Channel (ft.): 276		Riffles: 1	7
		Pools: 1	
		Flat: 0	
Pool Tail Substrate (%):	Silt/Clay: 0.0	Sand: 18.8	Gravel: 62.5
Embeddedness Values (%):	1. 0.0	2. 50.0	3. 31.3
		4. 18.8	5. 0.0
		Sm Cobble: 18.8	Lg Cobble: 0.0
		Boulder: 0.0	Bedrock: 0.0

STREAM REACH: 2

Channel Type: NA	Canopy Density (%):	Pools by Stream Length	0.0
Reach Length (ft.): 12785	Coniferous Component (%):	Pool Frequency (%):	0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component	Residual Pool Depth (%):	
BFW:	Dominant Bank		< 2 Feet Deep:
Range (ft.): 16 to 18	Vegetative Cover (%): 0.0		2 to 2.9 Feet Deep:
Mean (ft.): 17	Dominant		3 to 3.9 Feet Deep:
Std. Dev.: 1	Dominant Bank Substrate		>= 4 Feet Deep:
Base Flow (cfs):	Occurrence of LWD (%):	Mean Max Residual Pool Depth	
Water (F): 0 - 0	Air (F): 49 - 60	LWD per 100 ft.:	Mean Pool Shelter
Dry Channel (ft.): 0		Riffles:	
		Pools:	
		Flat:	
Pool Tail Substrate (%):	Silt/Clay:	Sand:	Gravel:
Embeddedness Values (%):	1.	2.	3.
		4.	5.
		Sm Cobble:	Lg Cobble:
		Boulder:	Bedrock:

Summary of Fish Habitat Elements By Stream

STREAM REACH: 3

Channel Type: E6	Canopy Density (%): 87.3	Pools by Stream Length: 0.2
Reach Length (ft.): 11865	Coniferous Component (%): 0.0	Pool Frequency (%): 7.7
Riffle/Flatwater Mean Width (ft.):	Hardwood Component: 100.0	Residual Pool Depth (%):
BFW:	Dominant Bank: Hardwood Trees	< 2 Feet Deep: 0.0
Range (ft.): 16 to 18	Vegetative Cover (%): 95.0	2 to 2.9 Feet Deep: 100.0
Mean (ft.): 17.08	Dominant: Undercut Banks	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 0.99	Dominant Bank Substrate: Cobble/Gravel	>= 4 Feet Deep: 0.0
Base Flow (cfs):	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth: 2
Water (F): 0 - 0 Air (F): 49 - 60	LWD per 100 ft.:	Mean Pool Shelter: 10
Dry Channel (ft.): 11692	Riffles:	
	Pools: 0	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 100. Sand: 0.0 Gravel: 0.0 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 0.0 2. 0.0 3. 0.0 4. 100.0 5. 0.0		

Table 9 -Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Salmon Creek

LLID: 1227804381617

Drainage: Tomales Bay

Survey 10/9/2008 to 10/10/2008

Confluence Location: Quad: POINT REYES NE

Legal Description: T04NR08S30

Latitude: 38:09:42.0N

Longitude: 122:46:49.0W

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	0	0	0.0
Boulder	0	0	0.0
Cobble/Gravel	19	18	92.5
Sand/Silt/Clay	1	2	7.5

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	2	1	7.5
Brush	0	0	0.0
Hardwood	17	19	90.0
Coniferous	0	0	0.0
No Vegetation	1	0	2.5

Total Stream Cobble Embeddedness Values: 3

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

Stream Name: Salmon Creek

LLID: 1227804381617

Drainage: Tomales Bay

Survey 10/9/2008 to 10/10/2008

Confluence Location: Quad: POINT REYES NE

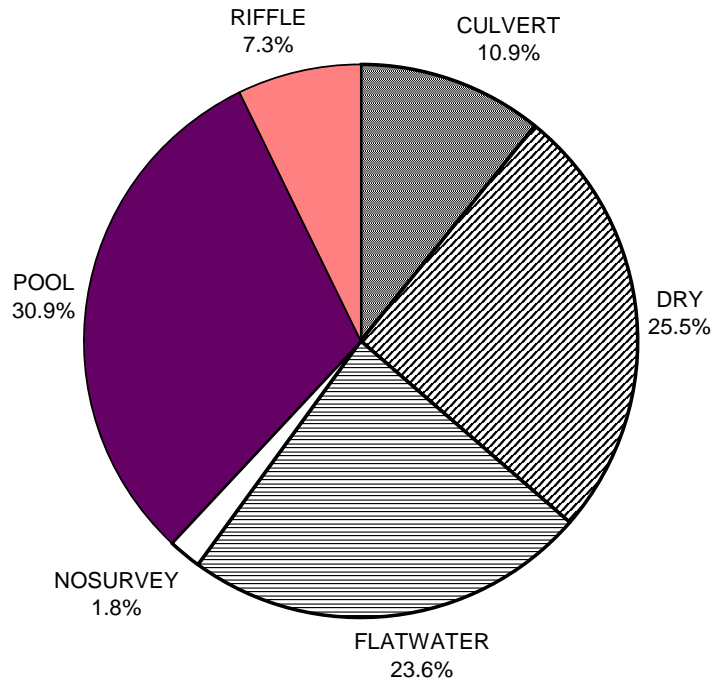
Legal Description: T04NR08S30

Latitude: 38:09:42.0N

Longitude: 122:46:49.0W

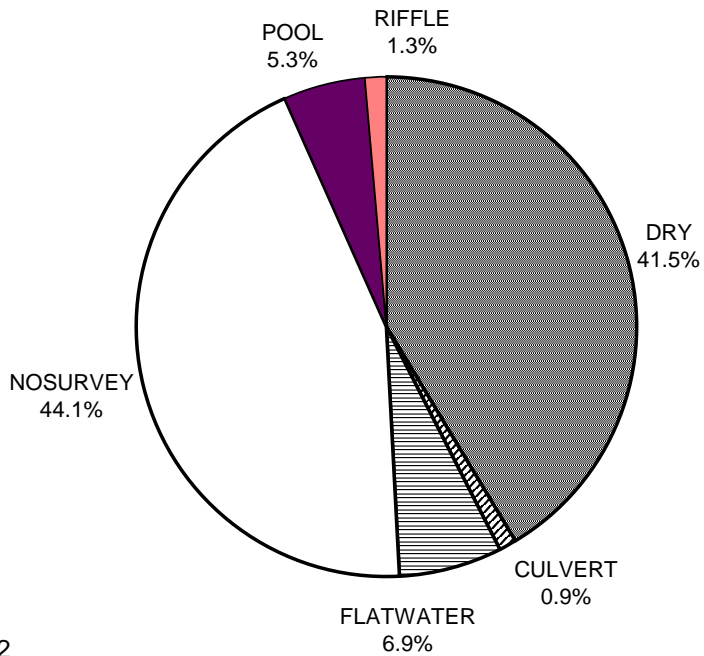
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	15	26
SMALL WOODY DEBRIS (%)	0	35	22
LARGE WOODY DEBRIS (%)	0	0	0
ROOT MASS (%)	0	25	24
TERRESTRIAL VEGETATION	0	25	8
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	3
BEDROCK LEDGES (%)	0	0	0

SALMON CREEK 2008 HABITAT TYPES BY PERCENT OCCURRENCE



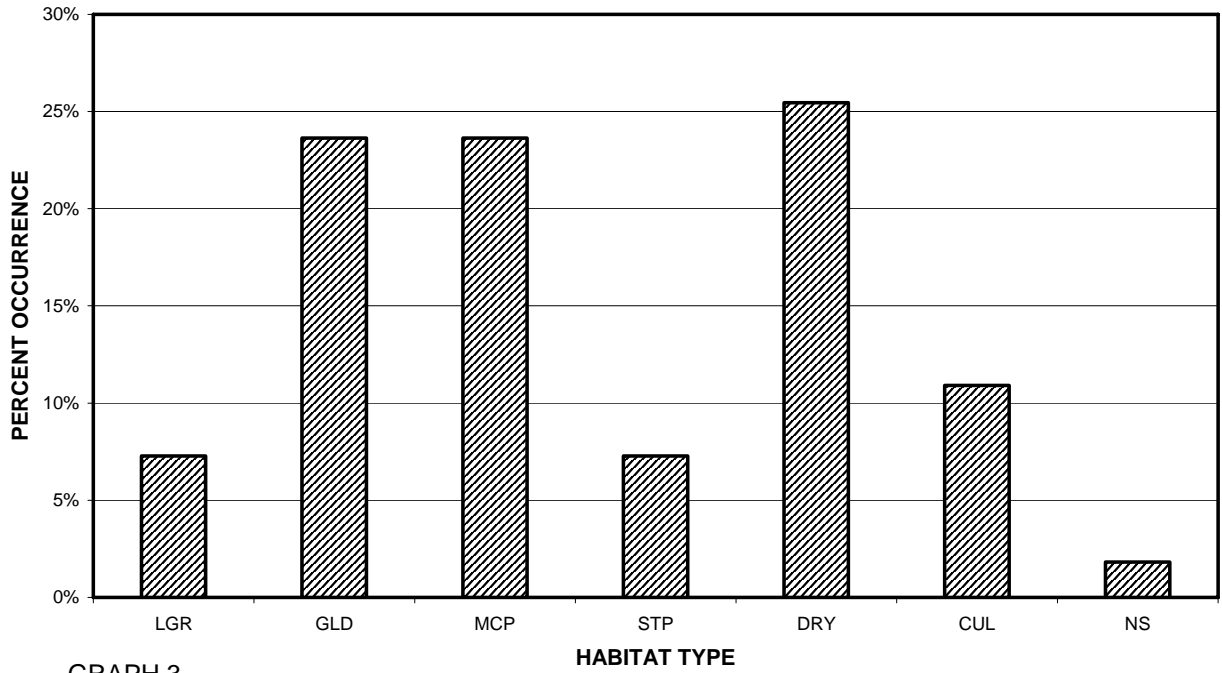
GRAPH 1

SALMON CREEK 2008 HABITAT TYPES BY PERCENT TOTAL LENGTH



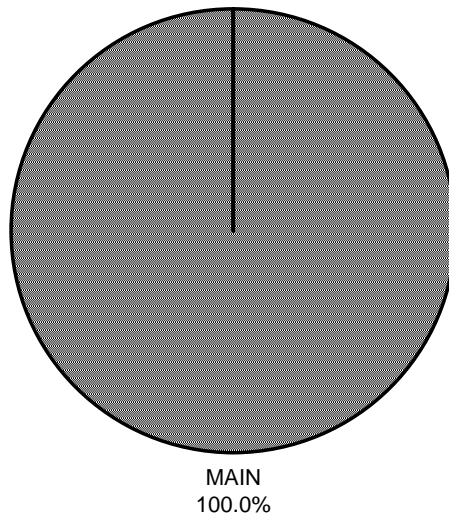
GRAPH 2

SALMON CREEK 2008 HABITAT TYPES BY PERCENT OCCURRENCE



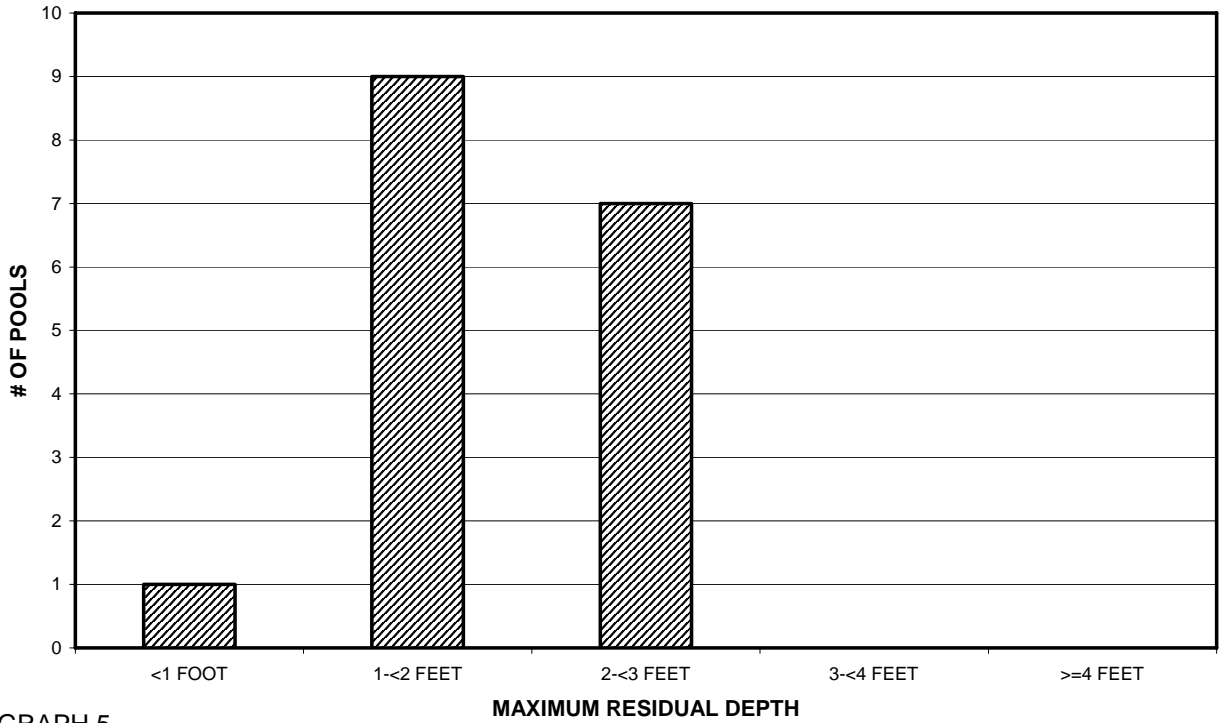
GRAPH 3

SALMON CREEK 2008 POOL TYPES BY PERCENT OCCURRENCE



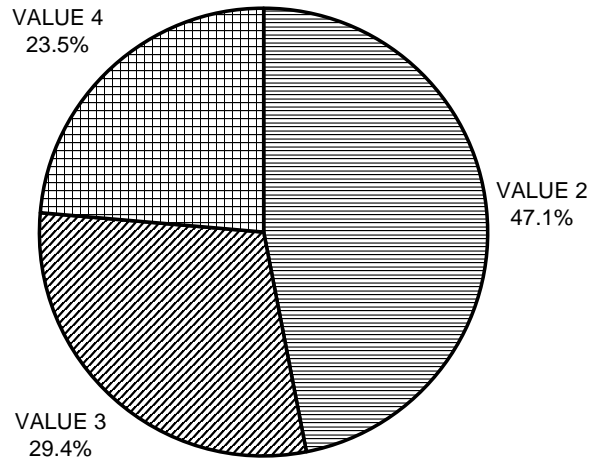
GRAPH 4

SALMON CREEK 2008 MAXIMUM DEPTH IN POOLS



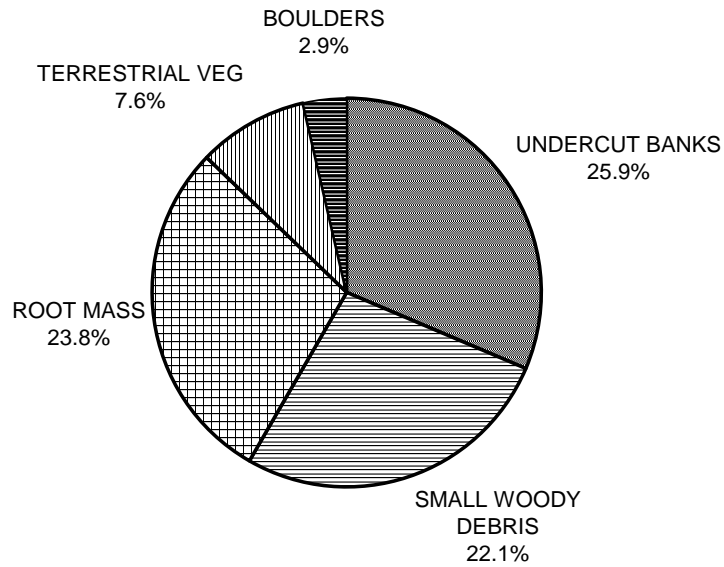
GRAPH 5

SALMON CREEK 2008 PERCENT EMBEDDEDNESS



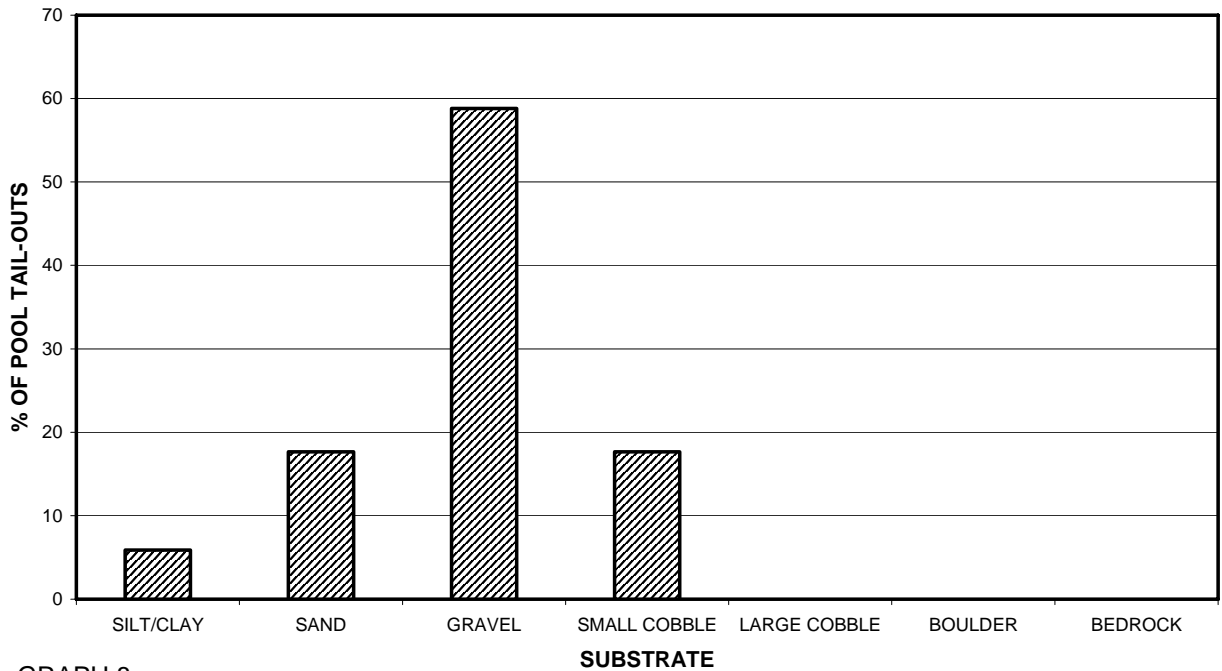
GRAPH 6

SALMON CREEK 2008 MEAN PERCENT COVER TYPES IN POOLS



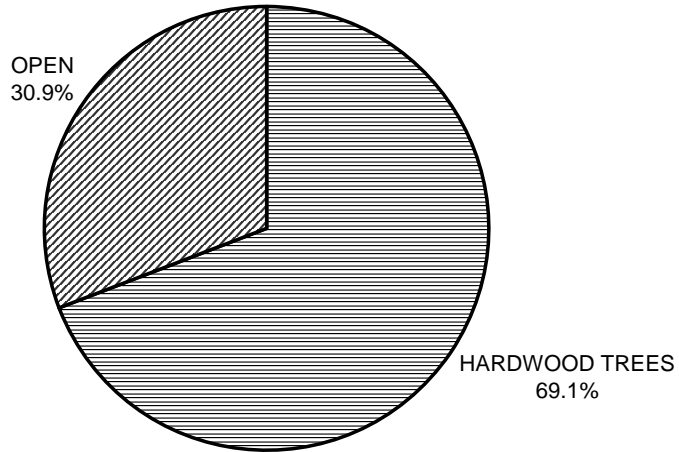
GRAPH 7

SALMON CREEK 2008 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



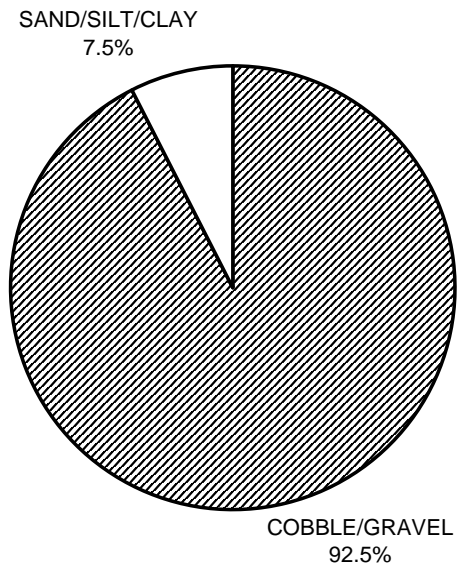
GRAPH 8

**SALMON CREEK 2008
MEAN PERCENT CANOPY**



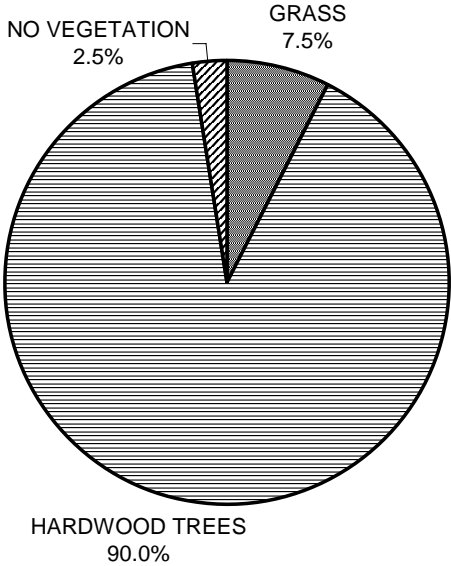
GRAPH 9

**SALMON CREEK 2008
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**SALMON CREEK 2008
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11