CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Paulin Creek
Report Revised June 13, 2006
Report Completed April 14, 2006
Assessment Completed 2005

INTRODUCTION

A stream inventory was conducted during 10/21/2005 to 10/25/2005 on Paulin Creek. The survey began at the confluence with Piner Creek and extended upstream 3.3 miles. Stream inventory and report were completed for Paulin Creek.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Paulin 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

Paulin Creek is a tributary to Piner Creek, is a tributary to Santa Rosa Creek, is a tributary to Mark West Creek, is a tributary to Russian River, is a tributary to Pacific Ocean, located in Sonoma County, California (Map 1). Paulin Creek's legal description at the confluence with Piner Creek is T07N R08W S16. Its location is 38.4571473 north latitude and 122.7563363 west longitude, LLID number 1227562384570. Paulin Creek is a first order stream and has approximately 1.87 miles of blue line stream according to the USGS Sebastopol 7.5 minute quadrangle. Paulin Creek drains a watershed of approximately 4.5 square miles. Elevations range from about 100 feet at the mouth of the creek to 902 feet in the headwater areas. Mixed hardwood and mixed conifer forest dominates the watershed. The watershed is primarily privately owned.

METHODS

The habitat inventory conducted in Paulin 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/AmeriCorps) 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 measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for 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 Paulin 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". Paulin 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 Paulin 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 Paulin 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 Paulin 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 Paulin 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 Paulin Creek.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.16, 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 Paulin 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 10/21/2005 to 10/25/2005 was conducted by D. Acomb, S. Phillips (WSP). The total length of the stream surveyed was 17,361 feet with an additional 21 feet of side channel.

Stream flow was not measured on Paulin Creek

Paulin Creek is an F3 channel type for 10,227.00 feet of the stream surveyed (Reach 1), a B6 channel type for 7,155.00 feet of the stream surveyed (Reach 2).

Water temperatures taken during the survey period ranged from 52 to 57 degrees Fahrenheit. Air temperatures ranged from 47 to 66 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 20% riffle units, 41% flatwater units, 5% no survey marsh units, 15% culvert units, 18% pool units, 1% no survey units, (Graph 1). Based on total length of Level II habitat types there were 13% riffle units, 70% flatwater units, 2% no survey marsh units, 7% culvert units, 6% pool units, 2% no survey units, (Graph 2).

Seven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 20% Low Gradient Riffle units, 19% Glide units, 18% Step Run units, (Graph 3). Based on percent total length: 41% Step Run units, 26% Glide units, 13% Low Gradient Riffle units.

A total of 18 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 94%, and comprised 96% 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. Sixteen of the 18 pools (89%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 18 pool tail-outs measured, 2 had a value of 2 (11.1%); 1 had a value of 3 (5.6%); 15 had a value of 4 (83.3%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders, etc…

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 10 , flatwater habitat types had a mean shelter rating of 9 , and pool habitats had a mean shelter rating of 31 (Table 1). Of the pool types, the Main Channel pools had a mean shelter rating of 33, Scour pools had a mean shelter rating of 5 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial Vegetation is the dominant cover type in Paulin Creek. Graph 7 describes the pool cover in Paulin Creek. Root Mass is the dominant pool cover type followed by undercut banks.

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 17% of pool tail-outs, sand observed in 28% of pool tail-outs, gravel observed in 39% of pool tail-outs, small Cobble observed in 6% of pool tail-outs, boulders observed in 6% of pool tail-outs, bedrock observed in 6% of pool tail-outs.

The mean percent canopy density for the surveyed length of Paulin Creek was 65%. The mean percentages of hardwood and coniferous trees were 99% and 1%, respectively. Thirty five percent of the canopy was open. Graph 9 describes the mean percent canopy in Paulin Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 32%. The mean percent left bank vegetated was 39%. The dominant elements composing the structure of the stream banks consisted of 26% bedrock, 34% boulder, 1% cobble/gravel, 39% sand/silt/clay, (Graph 10). Grass was the dominant vegetation type observed in 56% of the units surveyed. Additionally, 7% of the units surveyed had hardwood trees or brush as the dominant vegetation type, and 0% had coniferous trees as the dominant vegetation (Graph 11).

DISCUSSION

Paulin Creek is an F3 channel type for the first 10,227 feet of stream surveyed and a B6 channel type for the remaining 7,155 feet. The suitability of --- channel types for fish habitat improvement structures is as follows: F3 is good for bank-placed boulders and fair for plunge weirs, while B6 is excellent for bank-placed boulder and log cover. B6 channel type is also good for plunge weirs, single and opposing wing-deflectors and channel constrictors, and is fair for boulder clusters.

The water temperatures recorded on the survey days 10/21/2005 to 10/25/2005, ranged from 52 to 57 degrees Fahrenheit. Air temperatures ranged from 47 to 66 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 70% of the total length of this survey, riffles 13%, and pools 6%. The pools are relatively deep, with 16 of the 18 (89%) 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 the numerous log debris accumulations (LDA's) in the stream.

Two of the 18 pool tail-outs measured had embeddedness ratings of 1 or 2. Sixteen 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 Paulin Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Eight of the 18 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 31. The shelter rating in the flatwater habitats was 9. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Terrestrial Vegetation in Paulin Creek. Root Mass are the dominant cover type in pools followed by undercut banks. 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 65%. Reach 1 had a canopy density of 29.3%, Reach 2 had a canopy density of 84.8%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was LOW at 32% and 39%, 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

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

2. Increase the canopy on Paulin 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.

3. 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.

4. Paulin 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.

5. Suitable size spawning substrate on Paulin Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

6. Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from root mass. Adding high quality complexity with woody cover is desirable.

7. 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.

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.

Paulin Creek

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Start of Survey: Start at confluence with Piner Creek
117	0002.00	General Comment: Terrestrial Vegetation is mainly grass and weeds overhanging into water
651	0003.00	General Comment: cattail plug
1219	0010.00	General Comment: no calibration. see bridge next page
1514	0012.00	General Comment: resident talked of "stone dams" that used to be in the creek.

1619	0013.00	General Comment: overcast with glare on water, can't see bottom or fish
1860	0014.00	General Comment: left bank Scotch Broom, right bank ivy
2907	0015.00	General Comment: unidentified fishes
3257	0017.00	Structures: W. Steele Lane
3389	0019.00	General Comment: oysters in mesh bag in barrel in creek
3717	0020.00	General Comment: Louisiana Crawfish
4512	0021.00	Structures: Apache
4582	0022.00	General Comment: Large amount of garbage in stream
5228	0023.00	Structures: Railroad Bridge
5263	0024.00	General Comment: pampas grass on both banks
5605	0025.00	Structures: Coffee Lane, #4
5660	0026.00	General Comment: RB acacia, LB broom
6398	0027.00	General Comment: More park-like since Coffee, fishing lure in creek, RB acacia, pampas grass, arundo on property, LB broom, turtle
7581	0029.00	General Comment: many bullfrog tadpoles and a turtle
8229	0030.00	Structures: Range, #6
8299	0031.00	General Comment: RB ivy
8772	0032.00	General Comment: resident says bass, Steelhead in the creek
8938	0033.00	General Comment: pampas grass
8938	0033.00	Structures: Culvert/Bridge #7

8993	0034.00	General Comment: LB ivy, back to riprap
9465	0035.00	General Comment: Right Bank owner wants to beauty the creek, sent to city creek master plan meetings
9465	0035.00	Structures: Cleveland, #8
9530	0036.00	General Comment: pampas grass
9927	0038.00	Structures: Highway 101, #9
10227	0039.00	General Comment: County center. Channel type change. Start Reach 2, B6
10272	0040.00	General Comment: RB broom
10729	0042.00	Structures: stone mortar retaining walls
10729	0042.00	Erosion Site: (Bank) RB eroding behind retaining wall
10959	0043.00	General Comment: footings eroding, retaining wall
11187	0044.00	General Comment: head of pool is concrete, sill 1' drop off
11302	0046.00	General Comment: arundo in channel, US Credit Union
11302	0046.00	Tributaries: Confluence with LB trib?
11574	0049.00	General Comment: LB vinca, RB ivy
12034	0052.00	General Comment: LB arundo
12398	0060.00	Structures: Mendocino Avenue, #10
12483	0061.00	General Comment: pool created by concrete chunk acting as weir
12637	0064.00	Structures: Chinate Dr. Culvert #11, has jump
12774	0066.00	General Comment: RB arundo, willow roots making a cascade grade control into this unit approximately 3' tall

12831	0067.00	General Comment: several unidentified fishes
12939	0068.00	Structures: concrete sill utility crossing?
13284	0070.00	Structures: Lomitas Avenue, #12
13334	0071.00	General Comment: mowed
14099	0072.00	General Comment: owner says SH and salmon in the past
14099	0072.00	Structures: concrete weir on downstream end
14142	0073.00	General Comment: mowed
14344	0075.00	General Comment: yard waste
14411	0076.00	General Comment: LB broom
14643	0079.00	General Comment: LWD weakened by chainsaw, cut into 6' segments
14780	0081.00	Structures: right bank retaining wall failing
14821	0082.00	Structures: Strawberry Drive, #2
14833	0083.00	General Comment: LB arundo
15033	0085.00	General Comment: RB broom
15270	0086.00	General Comment: RB riprap
15332	0087.00	Erosion Site: (Bank) RB cut bank
15414	0087.01	Structures: culvert out-fall, possible trib
15414	0089.00	Structures: Chinate, #13
15476	0090.00	General Comment: right and left bank cleared of vegetation
15561	0091.00	General Comment: all riparian vegetation cut down

16236	0099.00	General Comment: RB/LB scotch broom forest. Due to extreme overgrowth (huge quantities of blackberry and poison oak draped over the stream) measured the length by bushwacking along the bank.
16236	0099.00	Structures: sewer line crosses creek
16936	0100.00	General Comment: Decided to continue along trail on left bank at way point 035 due to continuing overgrowth. Distance for unit 100 measure between waypoints on map along creek (425').
16936	0100.00	Structures: Encountered dam at way point 036
17361	0100.00	End of Survey: End of Survey at base of dam. No upstream fish passage past dam.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

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.

End Piner Survey

Type Change-F6

Type Change-B6

End Paulin Survey

Begin Paulin Survey

Begin Piner Survey

Paulin Creek Assessment Completed 2005
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15° E

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

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0

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
15	14	CULVERT	15.0	77	1159	6.7	14.9	0.7	1.0	1258	18874	964	11365		
41	40	FLATWATER	41.0	296	12116	69.7	9.3	0.9	2.0	2990	122587	3391	139043		9
1	0	NOSURVEY	1.0	425	425	2.4									
5	5	NOSURVEY_	5.0	70	352	2.0	8.0	0.5	1.0	558	2790	255	1273		
18	18	POOL	18.0	58	1045	6.0	11.0	1.9	3.2	591	10645	1402	25238	1211	31
20	19	RIFFLE	20.0	114	2285	13.1	6.5	0.3	0.8	555	11103	198	3964		10

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
100	96	17382	165999	180883

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating	Mean Canopy (%)
20	19	LGR	20.0	114	2285	13.1	6	0.3	1.5	555	11103	198	3964		10	65
19	18	GLD	19.0	238	4513	26.0	11	1.3	4	3232	61401	4706	89410		8	61
4	4	RUN	4.0	98	391	2.2	7	0.6	2	585	2341	399	1594		10	59
18	18	SRN	18.0	401	7212	41.5	8	0.7	2.5	3283	59086	2742	49353		11	60
16	16	MCP	16.0	60	960	5.5	10	1.7	5.5	578	9241	1268	20291	1074	33	93
1	1	CCP	1.0	42	42	0.2	15	1.9	2.6	630	630	1386	1386	1197		60
1	1	CRP	1.0	43	43	0.2	18	4.4	5.3	774	774	3560	3560	3406	5	94
15	14	CUL	15.0	77	1159	6.7	15	0.7	1.6	1168	17526	964	11365			100
1	0	NS	1.0	425	425	2.4										
5	5	MAR	5.0	70	352	2.0	8	0.5	1.1	558	2790	255	1273			15

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
100	96	17382	164893	182197

Table 3 - Summary of Pool Types

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

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	94	59	1002	96	10.6	1.7	581	9871	1081	18385	33
1	1	SCOUR	6	43	43	4	18.0	4.4	774	774	3406	3406	5

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
18	18	1045	10645	21790

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

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

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
16	MCP	89	0	0	2	13	7	44	4	25	3	19
1	CCP	6	0	0	0	0	1	100	0	0	0	0
1	CRP	6	0	0	0	0	0	0	0	0	1	100

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
18	0	0	2	11	8	44	4	22	4	22

Mean Maximum Residual Pool Depth (ft.): 3.2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005 Dry Units: 0

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

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
20	2	LGR	0	0	0	10	0	0	0	40	50
20	2	TOTAL RIFFLE	0	0	0	10	0	0	0	40	50
19	12	GLD	7	3	0	24	66	0	0	0	0
4	1	RUN	0	0	0	100	0	0	0	0	0
18	6	SRN	5	2	0	27	67	0	0	0	0
41	19	TOTAL FLAT	6	3	0	29	63	0	0	0	0
16	12	MCP	20	10	1	43	13	0	0	0	12
1	0	CCP									
1	1	CRP	0	0	100	0	0	0	0	0	0
18	13	TOTAL POOL	19	10	8	40	12	0	0	0	11
15	0	CUL									
1	0	NS									
5	0	MAR									
100	34	TOTAL	11	5	3	32	40	0	0	2	7

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005 Dry Units: 0

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

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
20	18	LGR	22	0	11	6	6	39	17
19	18	GLD	22	17	11	0	0	50	0
4	4	RUN	25	0	25	0	0	50	0
18	18	SRN	22	0	17	11	6	44	0
16	16	MCP	69	13	6	0	0	6	6
1	1	CCP	100	0	0	0	0	0	0
1	1	CRP	100	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
65	1	99	3	32	39

Note: Mean percent conifer and hardwood for the entire reach are means of canopy components from units with canopy values greater than zero.

Open units represent habitat units with zero canopy cover.

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	23	23	25.6
Boulder	29	33	34.4
Cobble / Gravel	1	0	0.6
Sand / Silt / Clay	37	34	39.4

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	46	55	56.1
Brush	6	7	7.2
Hardwood Trees	9	3	6.7
Coniferous Trees	0	0	0.0
No Vegetation	29	25	30.0

Total Stream Cobble Embeddedness Values: 4

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

StreamName: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	6	19
SMALL WOODY DEBRIS (%)	0	3	10
LARGE WOODY DEBRIS (%)	0	0	8
ROOT MASS (%)	10	29	40
TERRESTRIAL VEGETATION (%)	0	63	12
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	40	0	0
BEDROCK LEDGES (%)	50	0	11

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Paulin Creek LLID: 1227562384570 Drainage: Russian River - Middle

Survey Dates: 10/21/2005 to 10/25/2005 Survey Length (ft.): 17382 Main Channel (ft.): 17361 Side Channel (ft.): 21

Confluence Location: Quad: SEBASTOPOL Legal Description: T07NR08WS17 Latitude: 38:27:25.0N Longitude: 122:45:22.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F3
Reach Length (ft.): 10227
Riffle/Flatwater Mean Width (ft.): 11.1
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs.): 0.0
Water (F): 54 - 55 Air (F): 47 - 58
Dry Channel (ft): 0

Canopy Density (%): 29.25
Coniferous Component (%): 0
Hardwood Component (%): 100
Dominant Bank Vegetation: Grass
Vegetative Cover (%): 37.7
Dominant Shelter: Terrestrial Veg.
Dominant Bank Substrate Type: Boulder
Occurrence of LWD (%): 0
LWD per 100 ft.:
Riffles: 0
Pools:
Flat: 0

Pools by Stream Length (%): 0.0
Pool Frequency (%): 0.0
Residual Pool Depth (%):
< 2 Feet Deep:
2 to 2.9 Feet Deep:
3 to 3.9 Feet Deep:
>= 4 Feet Deep:
Mean Max Residual Pool Depth (ft.):
Mean Pool Shelter Rating:

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

STREAM REACH: 2

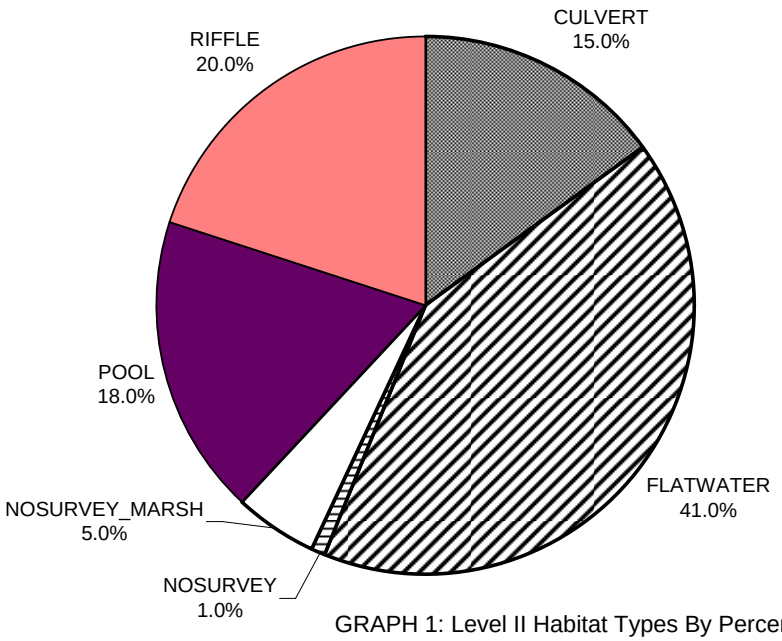
Channel Type: B6
Reach Length (ft.): 7134
Riffle/Flatwater Mean Width (ft.): 6.7
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs.): 0.0
Water (F): 52 - 57 Air (F): 51 - 66
Dry Channel (ft): 0

Canopy Density (%): 84.8
Coniferous Component (%): 2.2
Hardwood Component (%): 97.8
Dominant Bank Vegetation: Grass
Vegetative Cover (%): 33.7
Dominant Shelter: Root masses
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 5
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 14.4
Pool Frequency (%): 27.9
Residual Pool Depth (%):
< 2 Feet Deep: 12
2 to 2.9 Feet Deep: 41
3 to 3.9 Feet Deep: 24
>= 4 Feet Deep: 24
Mean Max Residual Pool Depth (ft.): 3.2
Mean Pool Shelter Rating: 31

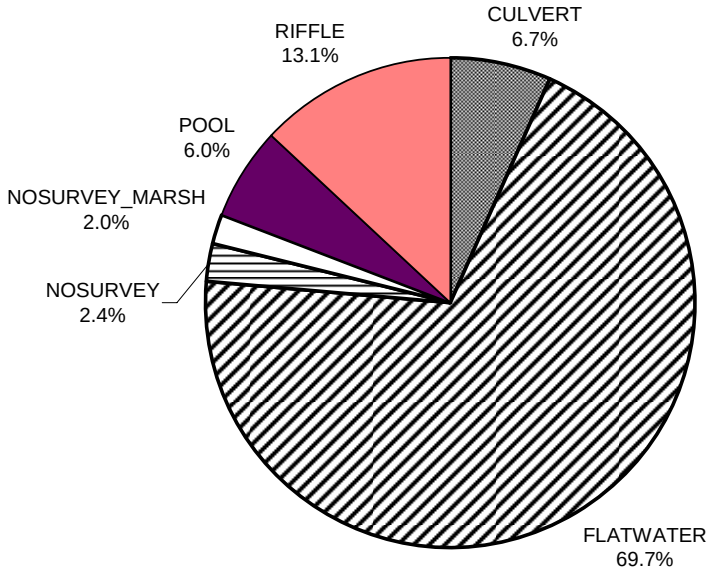
Pool Tail Substrate (%): Silt/Clay: 18 Sand: 24 Gravel: 41 Sm Cobble: 6 Lg Cobble: 0 Boulder: 6 Bedrock: 6
Embeddedness Values (%): 1. 0.0 2. 11.8 3. 5.9 4. 82.4 5. 0.0

Paulin Creek 2005
HABITAT TYPES BY PERCENT OCCURRENCE



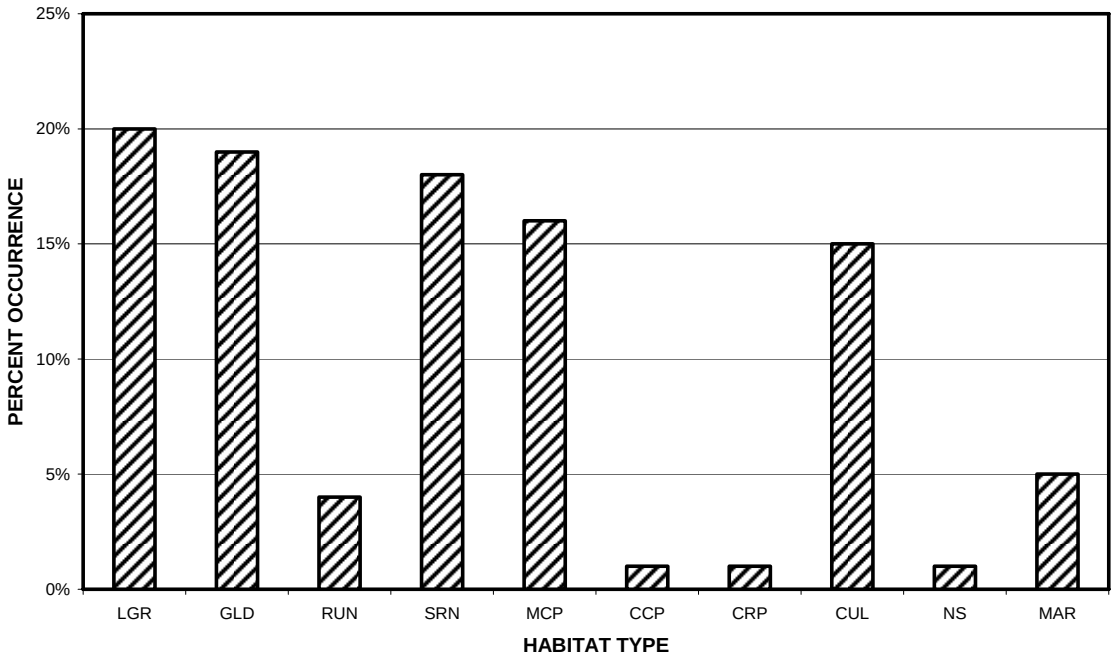
GRAPH 1: Level II Habitat Types By Percent Occerence

Paulin Creek 2005
HABITAT TYPES BY PERCENT TOTAL LENGTH



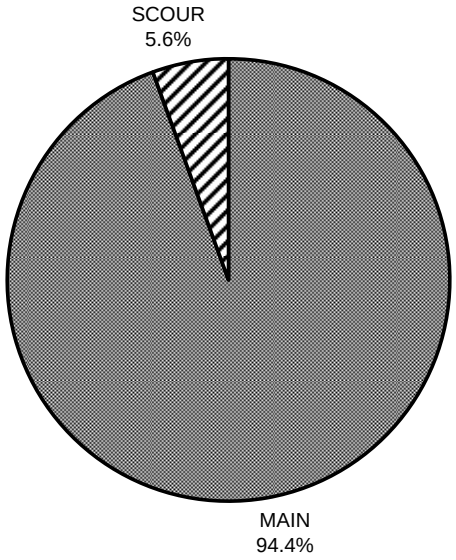
GRAPH 2: Level II Habitat Types by Percent Total Length

Paulin Creek 2005
HABITAT TYPES BY PERCENT OCCURRENCE



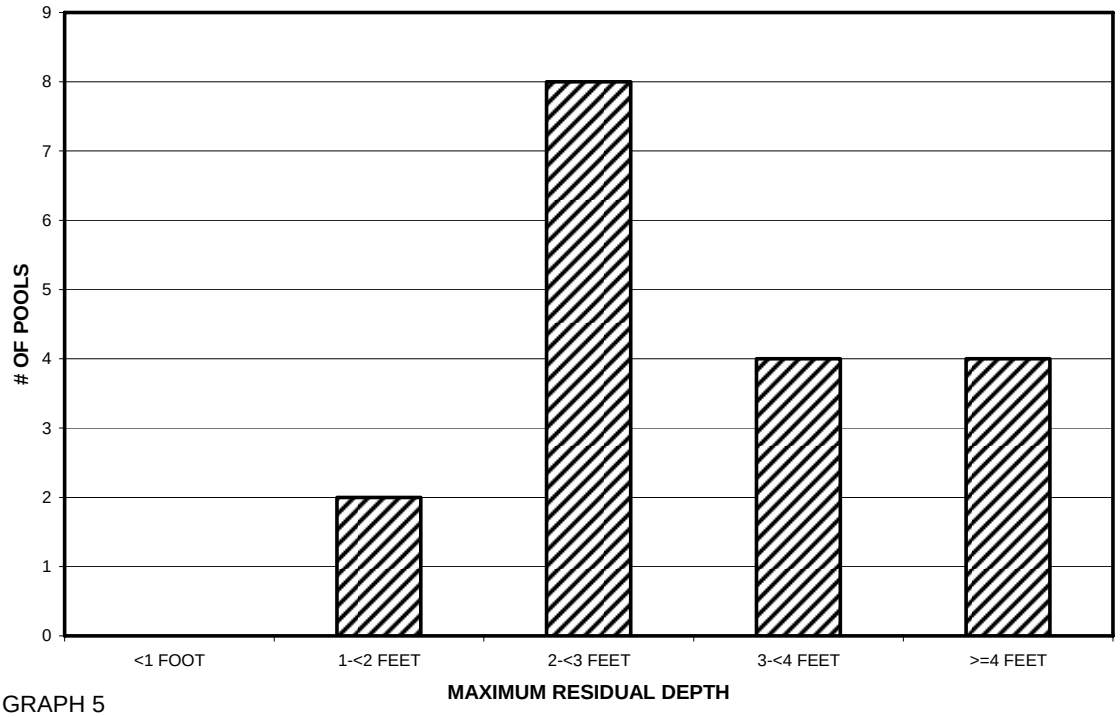
GRAPH 3: Level IV Habitat Types By Percent Occurrence

Paulin Creek 2005
POOL TYPES BY PERCENT OCCURRENCE



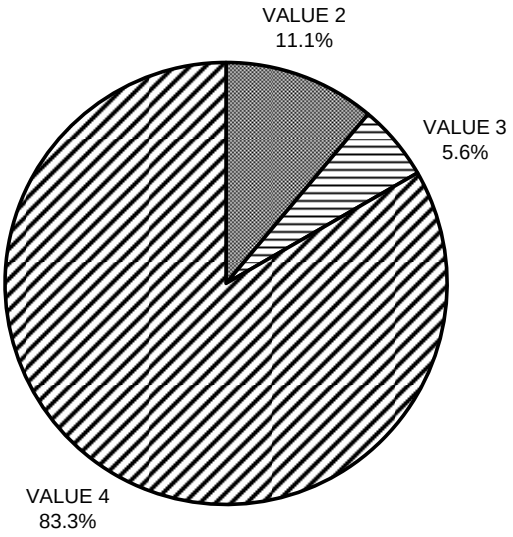
GRAPH 4: Level I Pool Types

Paulin Creek 2005
MAXIMUM DEPTH IN POOLS



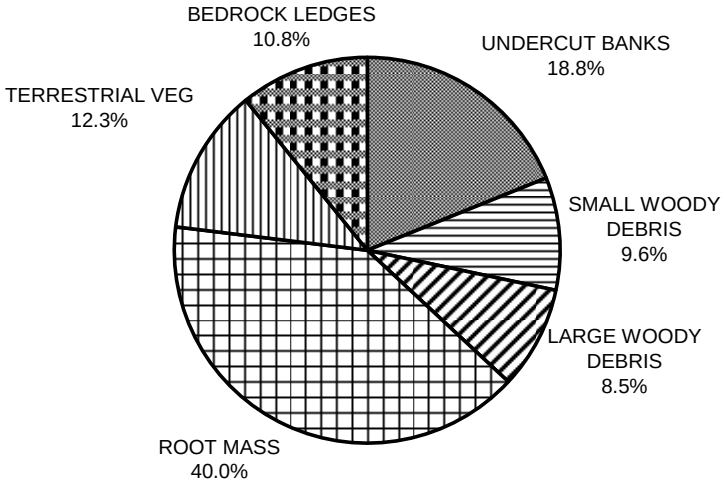
GRAPH 5

Paulin Creek 2005
PERCENT EMBEDDEDNESS



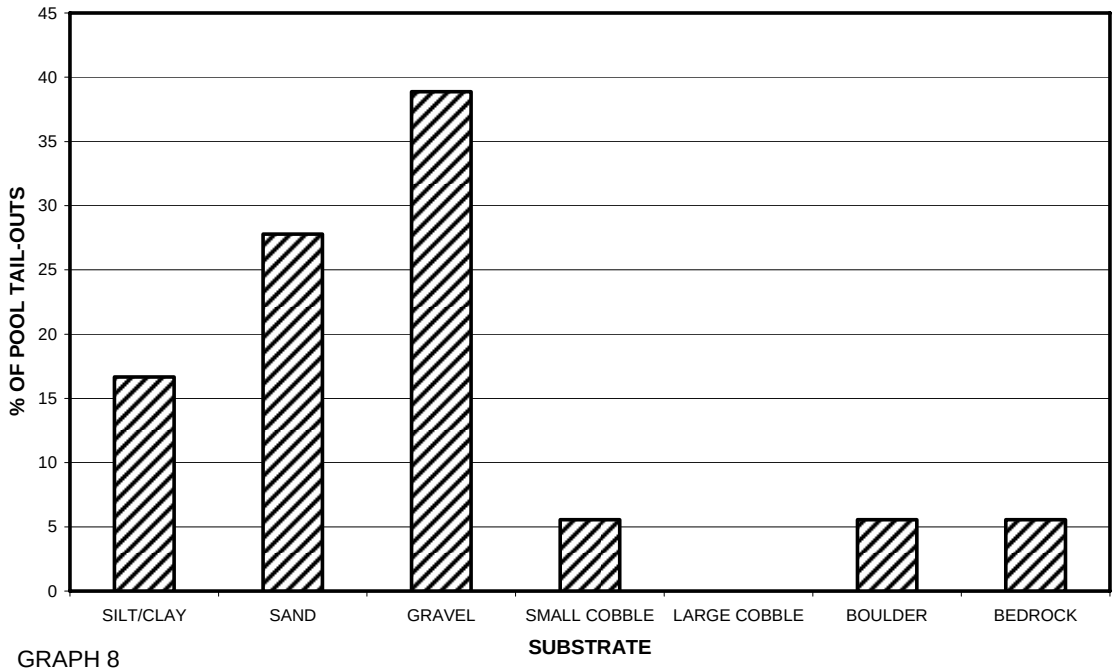
GRAPH 6

Paulin Creek 2005
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

Paulin Creek 2005
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS

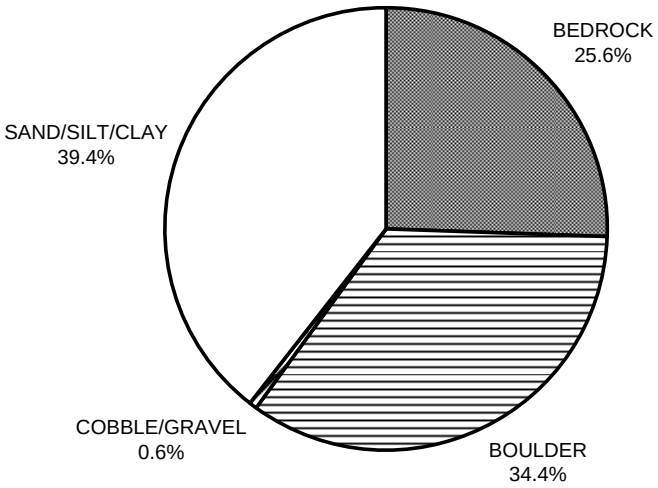


GRAPH 8

Paulin Creek 2005
MEAN PERCENT CANOPY

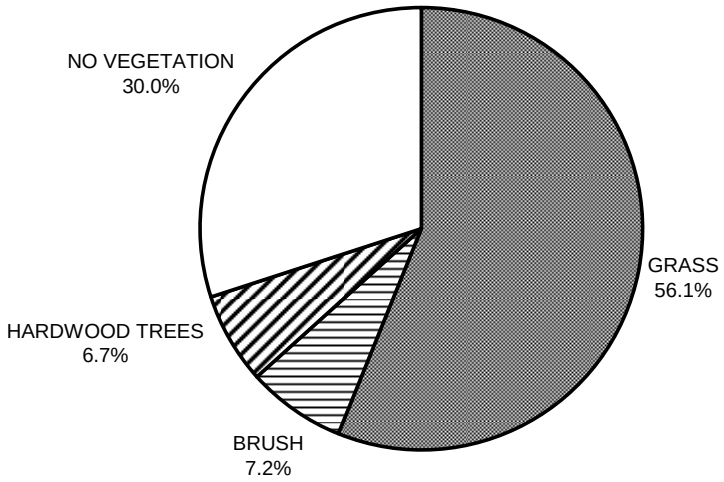
GRAPH 9

Paulin Creek 2005
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

Paulin Creek 2005
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11