CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT
Sheldon Creek
Report Revised April 14, 2006
Report Completed 2005
Assessment Completed 2002

INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Sheldon Creek, a stream in the Russian River basin. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish, and other aquatic species with an emphasis on anadromous salmonids in Sheldon Creek. The objective of the biological inventory was to document the salmonid and other aquatic species present and their distribution.

The objective of this report is to document the current habitat conditions and, after analyzing historical and recent data, 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

Sheldon Creek is located in Mendocino and Lake Counties, California and is a tributary of Coleman Creek which is a tributary of Pieta Creek which drains into the Russian River (see Sheldon Creek map, APPENDIX A). The legal description at the confluence with Coleman Creek is T13N, R10W, S29. Its location is 38°56'41.70"N latitude and 123°00'27.69"W longitude. Access exists by traveling south on Younce Road from Hwy 175 just east of Old Hopland.

Sheldon Creek and its tributaries drain a basin of approximately 840.6 acres (1.3 square miles). Sheldon Creek is a maximum second order stream and has approximately 11161.4 feet (2.11 miles) of blue line stream, according to the USGS “Hopland” 7.5 minute quadrangles. Minor unnamed tributaries of Sheldon Creek were not surveyed. Elevations range from about 1099 feet at the mouth of the creek to 2680 feet in the headwaters. The vegetation is primarily shrub (47%), hardwood (33%), and mixed hardwood/conifer (19%) with minor amounts of herbaceous vegetation (1%). None of the watershed is agricultural or urban. The watershed is 7.5% privately owned and 92.5% federally owned and is managed as Cow Mountain Recreation area. Salmonid fish species historically present include steelhead trout.

METHODS

The habitat inventory conducted in Sheldon Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi, et al., 1998). The California Department of Fish and Game (DFG) field crew that conducted the inventory was trained in standardized habitat inventory methods by DFG. This inventory was conducted by two person

teams and was supervised by Derek Acomb, Russian River Planner (DFG).

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.

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 Sheldon Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, air and water temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows were also measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the California Salmonid Stream Habitat Restoration Manual. 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:

Water and air temperatures, and time, are measured by crew members with hand held thermometers and recorded at each tenth unit typed. Temperatures are measured in Fahrenheit at the middle of the habitat unit and within one foot of the water surface. Temperatures are also recorded using remote temperature recorders which log temperatures every half hour, 24 hours/day.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled dry. Sheldon 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 were in feet to the nearest tenth. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Sheldon Creek, embeddedness was visually estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3), 76 - 100% (value 4). Additionally, a rating of "not suitable" (value 5) was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Sheldon Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. Thus, shelter ratings can range from 0-300, and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully measured habitat units, dominant and sub-dominant substrate elements were visually estimated using a list of seven size classes which are defined in the California Salmonid Stream Habitat Restoration Manual.

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 Sheldon Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the top 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 visually into percentages of evergreen or deciduous 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 Sheldon Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully measured 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.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electro fishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual.

IMPACT INVENTORY & ANALYSIS

Problems such as migration barriers, streambed erosion, poor water quality or temperatures are noted in the comments and landmarks section. In some cases measurements are taken, an analysis of what caused the problem is made and restoration potential and alternatives are recommended.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat for data storage and analysis. Habitat is a Visual Basic extension to Microsoft Access, developed by Zebulon Young, University of California, Berkeley. This program processes and summarizes the data, and produces the following tables and appendices:

- Summary of riffle, flatwater, and pool habitat types
- Summary of habitat types and measured parameters
- Summary of pool types
- Summary of maximum pool depths by pool habitat types
- Summary of shelter by habitat types
- Summary of dominant substrates by habitat types
- Summary of fish habitat elements by stream reach

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Sheldon Creek include:

- Level II habitat types by % occurrence
- Level II habitat types by % total length
- Level IV habitat types by % occurrence

- Level I pool habitat types by % occurrence
- Maximum depth in pools
- Percent embeddedness estimated in pool tail-outs
- Mean percent cover types in pools
- Substrate composition in pool tail-outs
- Mean percent canopy
- Dominant bank composition in survey reach
- Dominant bank vegetation in survey reach

HISTORICAL STREAM SURVEYS:

Sheldon Creek was included in a study of the Pieta Creek Drainage conducted by the Mendocino County Resource Conservation District (MCRCD). In 1985, Sari Sommarstrom, Ph.D., conducted the Pieta Creek Gerothermal Watershed Assessment for MCRCD. The report sought to establish a baseline of biological and enviromemental factors to facilitate future geothermal energy development with minimal impact. Along with being a valuable steelhead habitat, a portion of the Pieta Creek basin (none of Sheldon Creek) lies within the Geysers-Calistoga Known Geothermal Resource Area (KGRA). Land use reported within Sheldon Creek basin was a small BLM maintained campground near the creek and a communication relay station used by utility companies on Cloverdale Peak in the southwestern portion of the basin. Associated with these were pond and resevoir improvements, access roads, jeep trails, fire breaks, septic tanks and utility lines. Sheldon Creek was reported to drain an area vegatatively different from other tributaries in the Pieta basin. The steep south slopes were largely covered with confiers. Vegatative cover in the Sheldon Creek Basin was 62.0% chapparal (477 acres), 23.0% mixed evergreen (177 acres), and 15.0% oak woodland (115 acres). In 1961, 80 acres of BLM land above Sheldon Creek was tresspass logged. In 1984, perscribed fires burned a 200 acres, accounting for 25.7% of the area in the Sheldon sub-basin. The study found the overall water quality of Pieta and its tributaries to be very good. No fish populations estimates were made.

HABITAT INVENTORY RESULTS FOR SHELDON CREEK

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

The habitat inventory of Sheldon Creek, 10/23/2002, was conducted by Derek Acomb and Sarah Green (DFG) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Coleman Creek and extended up Sheldon Creek. The total length of stream surveyed was 2814 feet, with an additional 14 feet of side channel.

Flows were not measured on Sheldon Creek.

This section of Sheldon Creek has one reach with one distinct channel type: from the mouth to 2814 feet an A4. A4 channel types are steep (4-10%), narrow, cascading, step-pool streams with a high energy/debris transport associated with depositional soils and a predominantly gravel substrate.

Water temperatures ranged from 48ºF to 51ºF. Air temperatures ranged from 45ºF to 49ºF. Summer temperatures were also measured using a remote temperature recorder placed in a pool (see Temperature Summary graphs at end of report). The recorder in a reach upstream of Reach 1 logged temperatures every half hour from 7/15/02 to 10/23/02. The highest temperature recorded was 64.8°F on 7/20/02 and the lowest was 51.3°F on 10/2/02 and 10/18/02. The mean of the daily highs was 63.3°F for the month of July, 61.8°F for August, 59.2°F for September, and 55.4°F for October.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 32% flatwater units, 34% riffle units, 26% pool units, 8% dry units, (Graph 1). Based on total **length** of Level II habitat types there were 64% flatwater units, 21% riffle units, 12% pool units, 3% dry units, (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were 26% Step Run units, 24% Low Gradient Riffle units, 6% Step Pool units, 16% Mid-Channel Pool units, 6% High Gradient Riffle units, 6% Run units, 8% Dry units, 2% Lateral Scour Pool - Bedrock Formed units, 4% Cascade units, 2% Plunge Pool units, (Graph 3). Based on percent total **length**, 59% Step Run units, 17% Low Gradient Riffle units, 4% Step Pool units, 6% Mid-Channel Pool units, 3% High Gradient Riffle units, 5% Run units, 3% Dry units, 1% Cascade units, 1% Plunge Pool units.

A total of 12 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 85%, and comprised 90% 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. Nine of the twelve pools (75%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 12 pool tail-outs measured, five had a value of 1 (41.7%); five had a value of 2 (41.7%); two had a value of 5 (16.7%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate like bedrock, log sills, boulders.

A shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 6, flatwater habitat types had a mean shelter rating of 22, and pool habitats had a mean shelter rating of 32 (Table 1). Of the pool types, the Main Channel pools had a mean shelter rating of 29, Scour pools had a mean shelter rating of 50, (Table 3).

Table 5 summarizes mean percent cover by habitat type. Bedrock Ledges are the dominant cover types in Sheldon Creek. Graph 7 describes the pool cover in Sheldon Creek. Bedrock Ledges is the dominant pool cover type followed by boulders.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs.

The mean percent canopy density for the surveyed length of Sheldon Creek was 90%. The mean percentages of hardwood and coniferous trees were 29% and 71%, respectively. Ten percent of the canopy was open. Graph 9 describes the mean percent canopy in Sheldon Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 14%. The mean percent left bank vegetated was 30%. The dominant elements composing the structure of the stream banks consisted of 53% bedrock, 18% boulder, 24% cobble/gravel, 6% sand/silt/clay, (Graph 10). Grass was the dominant vegetation type observed in 88% of the units surveyed. Additionally, 3% of the units surveyed had hardwood trees as the dominant vegetation type, and 3% had coniferous trees as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

Department of Fish and Game has not conducted previous biological inventories of Sheldon Creek nor are there any records of hatchery releases or fish rescues in the Sheldon Creek watershed. A biological inventory was not conducted in 2002.

DISCUSSION FOR SHELDON CREEK

Sheldon Creek has one channel type: an A4. According to the DFG Salmonid Stream Habitat Restoration Manual, A4 channel types are good for bank-placed boulders and fair for low-stage weirs, opposing wing-deflectors and log cover.

The water temperatures recorded on the survey day, 10/23/2002, ranged from 48ºF to 51ºF. Air temperatures ranged from 45ºF to 49ºF. This temperature regime is favorable to salmonids.

Summer temperatures measured using a remote temperature recorder ranged from 51.3° to 64.8°F. The Temperature Summary graph shows that for much of the summer (July through August) the upper watershed exhibited temperatures at the optimal for salmonids. It is unknown if this thermal regime is typical. To make any further conclusions, temperatures need to be monitored in more locations, for a longer period of time through the critical summer months, and biological sampling could be conducted.

Flatwater habitat types comprised 64% of the total length of this survey, riffles 21%, and pools 12%. The pools are relatively deep, with only nine of the twelve (75%) 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.

Ten of the 12 pool tail-outs measured had embeddedness ratings of 1 or 2. None of the pool tail-outs had embeddedness ratings of 3 or 4. Two 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 Sheldon Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Eight of the twelve 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 32 . The shelter rating in the flatwater habitats was 22. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Bedrock Ledges in Sheldon Creek. Bedrock Ledges are the dominant cover type in pools followed by boulders . 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%. 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 14% and 30%, 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 MANAGEMENT RECOMMENDATIONS

Sheldon 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. Efforts to increase flood protection or improve fish access in the short run, have led to long term problems in the system. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

PRIORITY FISHERY ENHANCEMENT OPPORTUNITIES

Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.

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

In Sheldon Creek, active and potential sediment sources related to the road system need to be mapped and treated according to their potential for sediment yield to the stream and its tributaries.

Map sources of upslope and in-channel erosion, and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff.

COMMENTS AND LANDMARKS

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

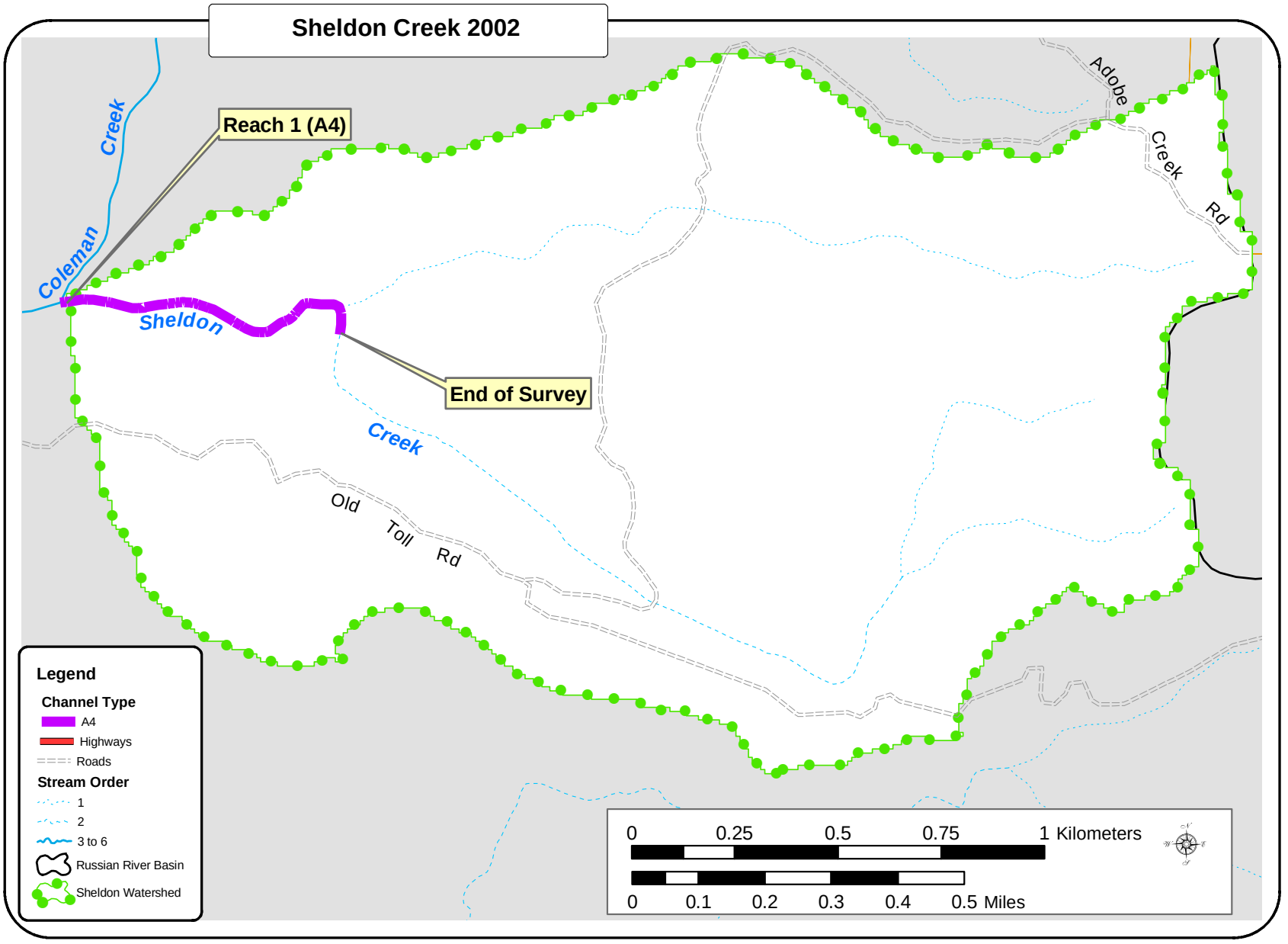
60'	Canopy consists of bay, big leaf maple, alder, coast live oak, fir, nutmeg, and buckeye.
204'	Steelhead 0+, 1+, and 2+ observed periodically from 204' to 1792'.
237'	LB seep
650'	LB seep

684' Channel type measured in this unit
902' LB spring, lots of fines in spring
1066' Downstream end of sediment from LB slide 2 units upstream
1086' DEBRIS ACCUMULATION, 18' wide x 3' thick
1148' LB SLIDE, sediment source.
1214' Top of sediment wedge head cut about 15' into this unit
1277' Above sediment from unit 22 back to unaffected stream channel.
1545' High % of bank vegetated is because of moss.
1792' Approximate jump 9' H x 12' L.
1858' Very steep unit; 25+' rise over course of unit (photo).
2145' Side channel caused by woody DEBRIS ACCMULATION holding back sediment.
2159' Backed up sediment cause stream to flow sub-surface
2711' Wet tributary RB, tributary water temperature: 49°F, confluence water temperature: 50°F. END OF SURVEY: Survey ended on Sheldon Creek in unit 049 since no fish had been seen since unit 034 (9’ x 12’ jump) and gradient of main channel increased significantly.

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.

Sommarstrom, Sari. 1985. Pieta Creek – Geothermal Watershed Assessment. Mendocino County Resource Conservation District, Ukiah. 107+p



L:\mondo3\data\stream-maps\sheldon.mxd

Prepared by: Ann-Marie Osterback, May 7, 2003

APPENDIX B: TABLES

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

Stream Name: Sheldon Creek

LLID: 1230079389447

Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

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
4	0	DRY	8.0	18	72	2.5									
16	4	FLATWATER	32.0	113	1812	64.1	5.3	0.4	1.1	173	2774	73	1173		23
13	13	POOL	26.0	26	339	12.0	9.5	1.1	2.4	181	2358	223	2673	190	32
17	5	RIFFLE	34.0	36	605	21.4	3.8	0.3	0.6	89	1513	23	395		6

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
50	22	2828	6644	4241

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

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 (%)
12	3	LGR	24.0	40	481	17.0	4	0.2	0.7	87	1045	18	211		8	88
3	1	HGR	6.0	31	93	3.3	4	0.4	0.8	133	398	53	159		5	97
2	1	CAS	4.0	16	31	1.1	4	0.2	0.4	51	102	10	20		5	93
3	2	RUN	6.0	49	146	5.2	6	0.4	1.4	210	631	61	183		13	95
13	2	SRN	26.0	128	1666	58.9	5	0.5	1.3	136	1774	86	1114		33	91
8	8	MCP	16.0	23	182	6.4	10	1.2	3	169	1352	223	1559	195	33	90
3	3	STP	6.0	41	124	4.4	9	0.8	2.3	263	788	261	782	203	22	80
1	1	LSBk	2.0	12	12	0.4	9	1.1	2.4	97	97	117	117	107		100
1	1	PLP	2.0	21	21	0.7	6	1.6	2.8	120	120	215	215	192	50	70
4	0	DRY	8.0	18	72	2.5										90

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
50	22	2828	6307	4361

Table 3 - Summary of Pool Types

Stream Name: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

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
11	11	MAIN	85	28	306	90	9.9	1.1	195	2141	198	1976	29
2	2	SCOUR	15	17	33	10	7.5	1.4	108	217	149	298	50

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
13	13	339	2358	2275

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

Stream Name: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

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
7	MCP	58	0	0	2	29	4	57	1	14	0	0
3	STP	25	0	0	1	33	2	67	0	0	0	0
1	LSBk	8	0	0	0	0	1	100	0	0	0	0
1	PLP	8	0	0	0	0	1	100	0	0	0	0

Total Units	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
12	0	0	3	25	8	67	1	8	0	0

Mean Maximum Residual Pool Depth (ft.): 2.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002 Dry Units: 4

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

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
12	2	LGR	0	0	0	0	5	0	0	95	0
3	1	HGR	0	0	0	0	0	0	0	100	0
2	1	CAS	0	0	0	0	100	0	0	0	0
17	4	TOTAL RIFFLE	0	0	0	0	28	0	0	73	0
3	2	RUN	18	0	65	18	0	0	0	0	0
13	2	SRN	5	15	0	0	25	0	0	20	35
16	4	TOTAL FLAT	11	8	33	9	13	0	0	10	18
8	6	MCP	22	2	0	12	2	0	1	8	54
3	3	STP	0	3	0	0	3	0	0	27	67
1	0	LSBk									
1	1	PLP	0	0	0	0	20	0	0	0	80
13	10	TOTAL POOL	13	2	0	7	4	0	1	13	61
50	18	TOTAL	10	3	7	6	11	0	0	26	38

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002 Dry Units: 4

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

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
12	3	LGR	0	0	0	0	33	33	33
3	1	HGR	0	0	0	0	0	100	0
2	1	CAS	0	0	0	0	0	0	100
3	2	RUN	0	0	100	0	0	0	0
13	2	SRN	0	0	50	0	0	50	0
8	3	MCP	0	0	67	0	0	33	0
3	2	STP	0	0	0	0	0	0	100
1	1	LSBk	0	0	100	0	0	0	0
1	1	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
90	71	29	0	14	30

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: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

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	7	11	52.9
Boulder	3	3	17.6
Cobble / Gravel	6	2	23.5
Sand / Silt / Clay	1	1	5.9

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	15	15	88.2
Brush	0	0	0.0
Hardwood Trees	1	0	2.9
Coniferous Trees	0	1	2.9
No Vegetation	1	1	5.9

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Sheldon Creek LLID: 1230079389447 Drainage: Russian River - Upper

Survey Dates: 10/23/2002 to 10/23/2002

Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	11	13
SMALL WOODY DEBRIS (%)	0	8	2
LARGE WOODY DEBRIS (%)	0	33	0
ROOT MASS (%)	0	9	7
TERRESTRIAL VEGETATION (%)	28	13	4
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	1
BOULDERS (%)	73	10	13
BEDROCK LEDGES (%)	0	18	61

Appendix C - Fish Habitat Inventory Data Summary

Stream Name: Sheldon Creek LLID: 1230079389447 Drainage: Russian River -
Survey Dates: 10/23/2002 to 10/23/2002 Survey Length (ft.): 2828 Main Channel (ft.): 2814 Side Channel (ft.): 14
Confluence Location: Quad: HOPLAND Legal Description: T13NR10WS29 Latitude: 38:56:41.0N Longitude: 123:00:28.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: A4
Reach Length (ft.): 2814
Riffle/Flatwater Mean Width (ft.): 4.5
BFW:
Range (ft.): to
Mean (ft.):
Std. Dev.:
Base Flow (cfs): 0
Water (F): 48 - 51 Air (F): 45 - 49
Dry Channel (ft.): 72

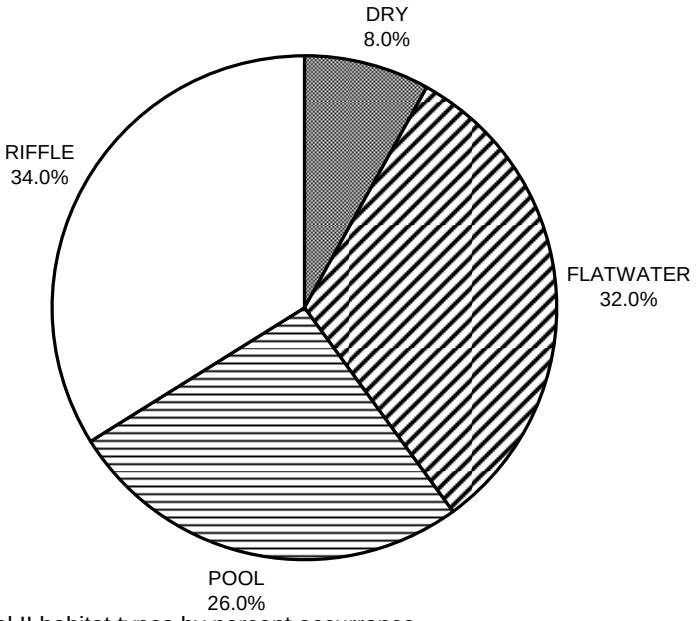
Canopy Density (%): 89.6
Coniferous Component (%): 69.9
Hardwood Component (%): 30.1
Dominant Bank Vegetation: Grass
Vegetative Cover (%): 23.3
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Bedrock
Occurrence of LWD (%): 5.9
LWD per 100 ft.:
Riffles:
Pools:
Flat:

Pools by Stream Length (%): 12.0
Pool Frequency (%): 26.5
Residual Pool Depth (%):
< 2 Feet Deep: 25.0
2 to 2.9 Feet Deep: 66.7
3 to 3.9 Feet Deep: 8.3
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.35
Mean Pool Shelter Rating: 32

Pool Tail Substrate (%):	Silt/Clay:	Sand:	Gravel:	Sm Cobble:	Lg Cobble:	Boulder:	Bedrock:
Embeddedness Values (%):	1. 41.7	2. 41.7	3. 0.0	4. 0.0	5. 16.7		

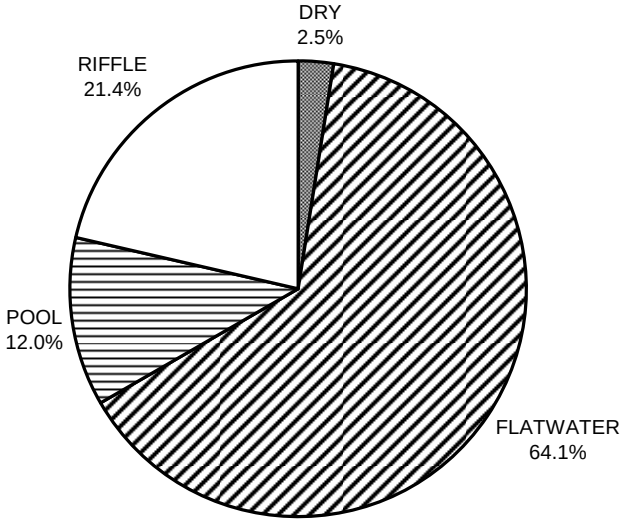
APPENDIX D: GRAPHS

SHELDON CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



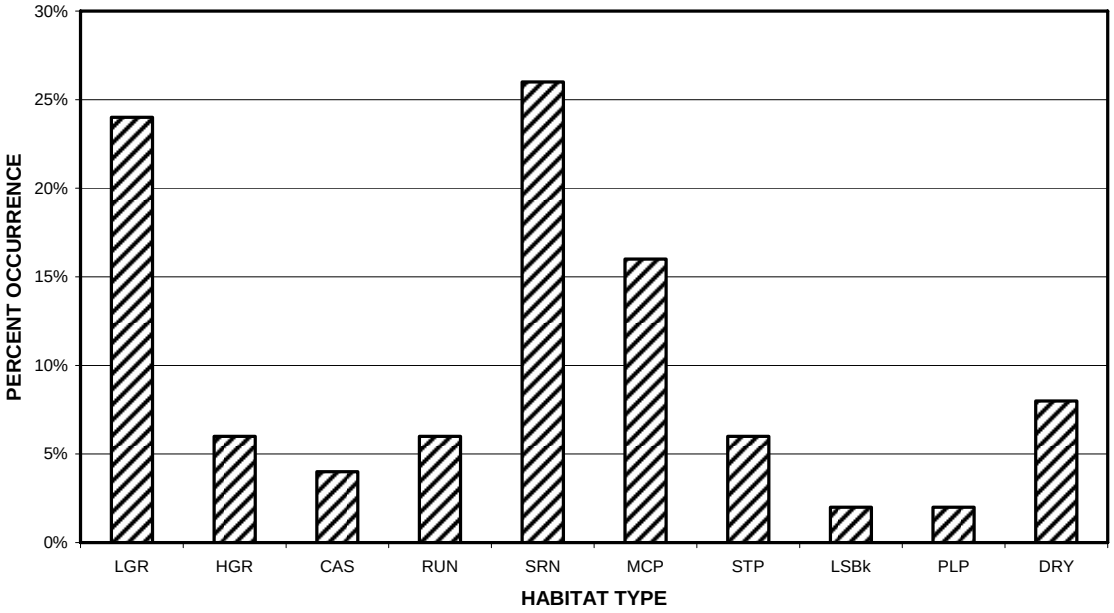
GRAPH 1: Level II habitat types by percent occurrence

SHELDON CREEK 2002
HABITAT TYPES BY PERCENT TOTAL LENGTH



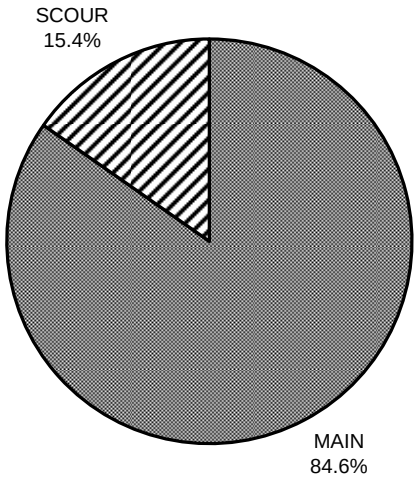
GRAPH 2: Level II habitat types by percent total length

SHELDON CREEK 2002
HABITAT TYPES BY PERCENT OCCURRENCE



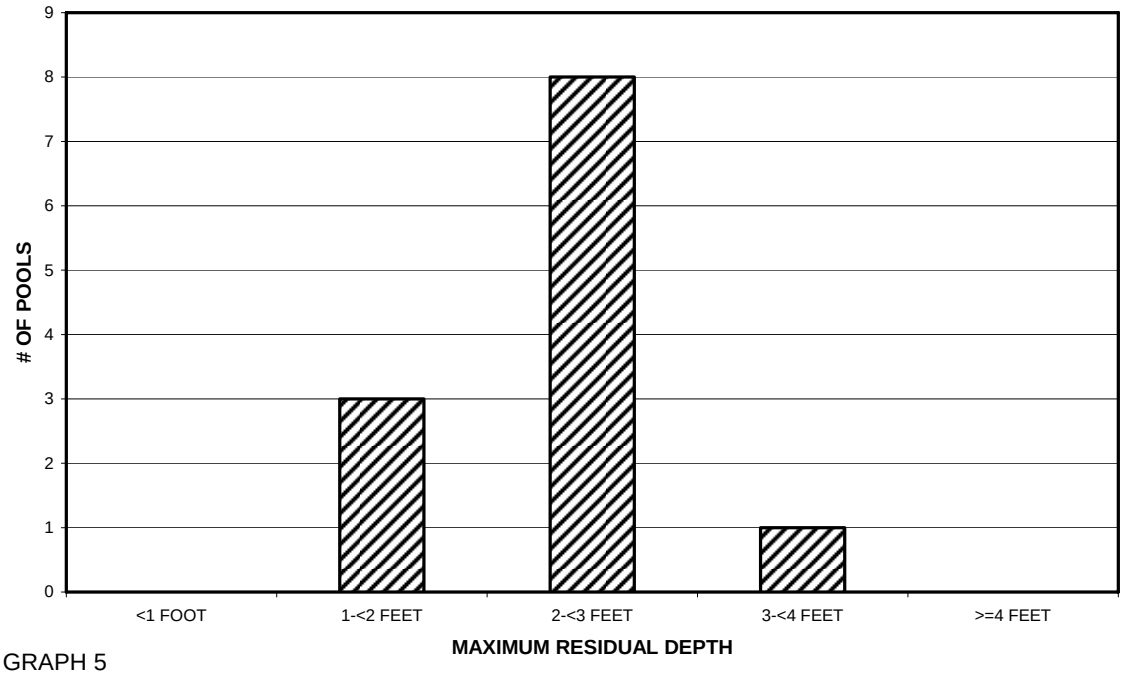
GRAPH 3: Level IV habitat types by percent occurrence

SHELDON CREEK 2002
POOL TYPES BY PERCENT OCCURRENCE



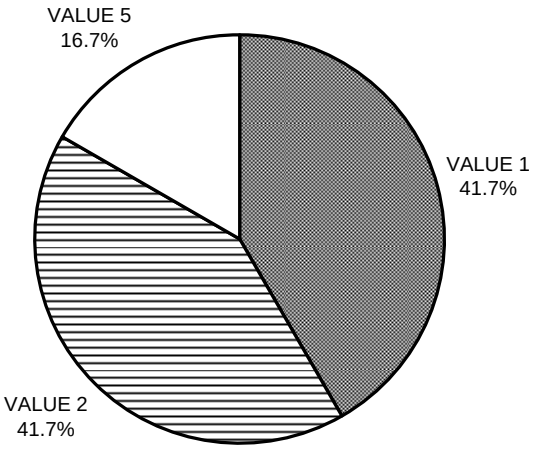
GRAPH 4: Level I pool types by percent occurrence

SHELDON CREEK 2002
MAXIMUM DEPTH IN POOLS



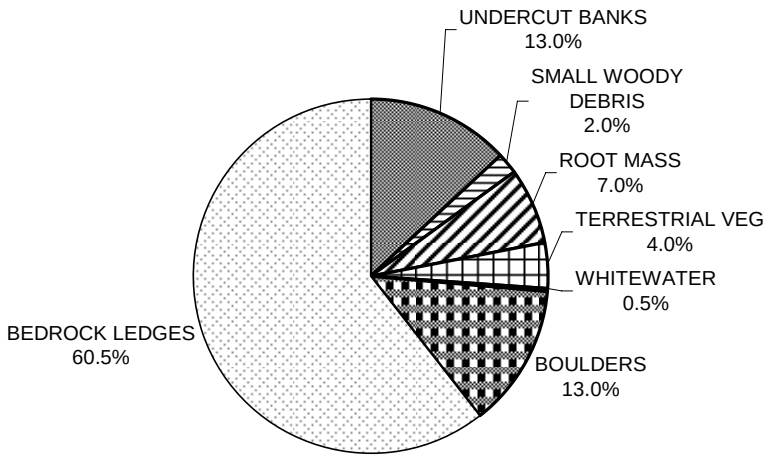
GRAPH 5

SHELDON CREEK 2002
PERCENT EMBEDDEDNESS



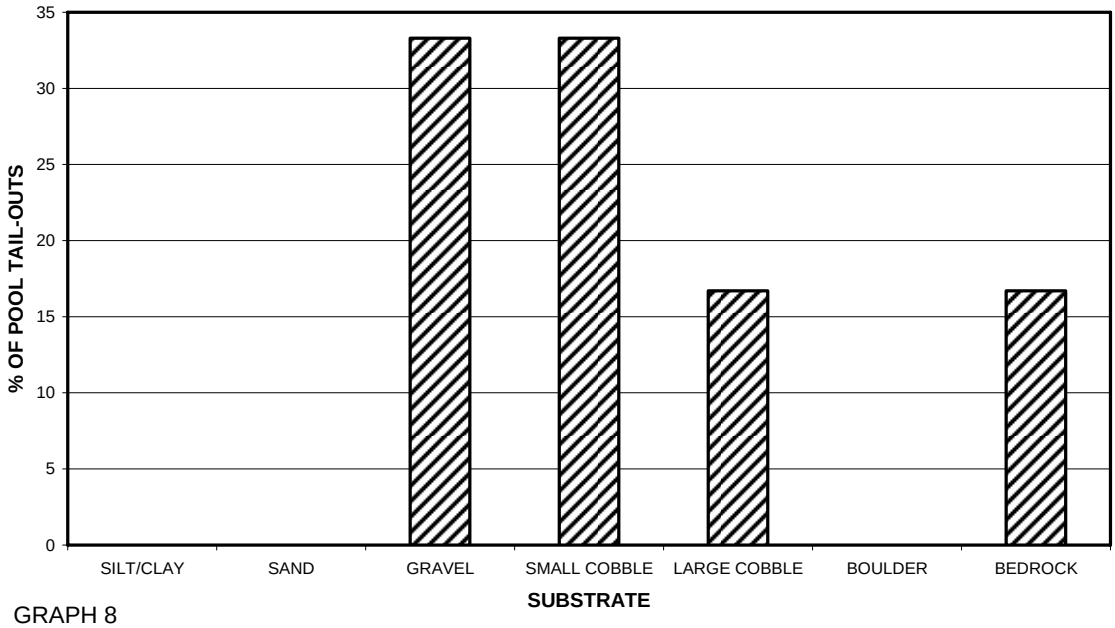
GRAPH 6

SHELDON CREEK 2002
MEAN PERCENT COVER TYPES IN POOLS



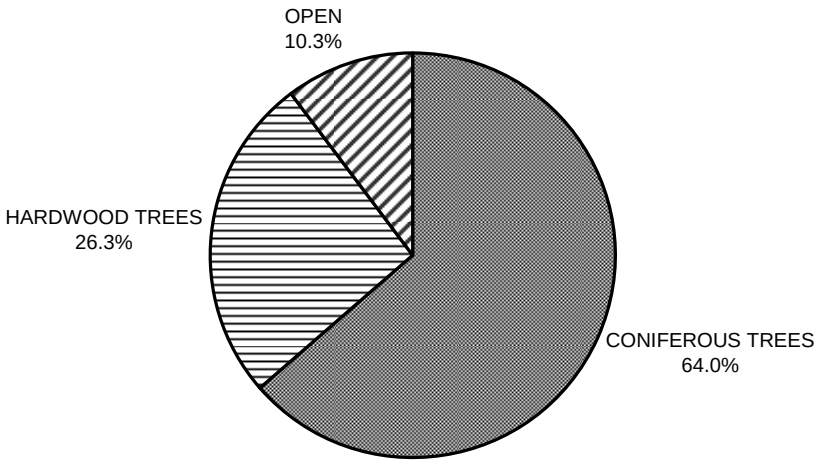
GRAPH 7

SHELDON CREEK 2002
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



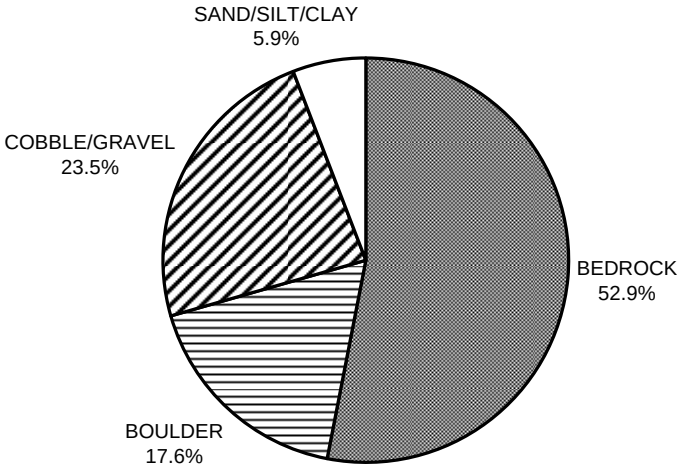
GRAPH 8

SHELDON CREEK 2002
MEAN PERCENT CANOPY



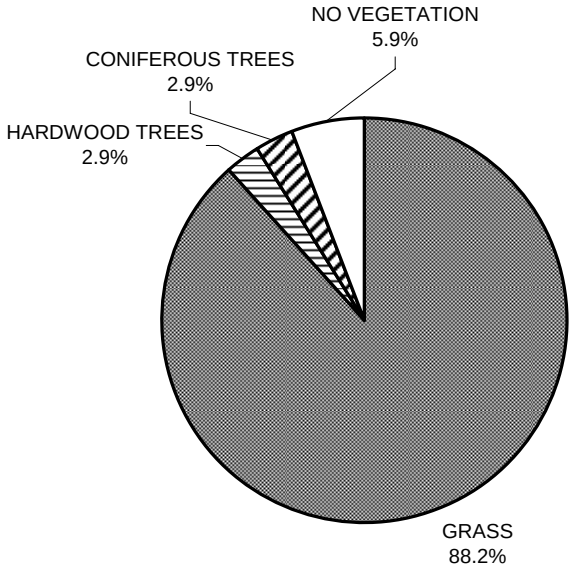
GRAPH 9

SHELDON CREEK 2002
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

SHELDON CREEK 2002
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

Unnamed tributary to Sheldon Creek Water Temperature 2002
(Unsurveyed tributary)