STREAM INVENTORY REPORT

SUGAR CREEK

INTRODUCTION

A stream inventory was conducted from August 16 to August 17, 2005 on Sugar Creek, Siskiyou County. The survey began 160 feet above the confluence with the Scott River and extended upstream 3.5 miles. The objective of the habitat inventory was to document the habitat available to anadromous salmonids within the surveyed sections of Sugar Creek.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for 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

Sugar Creek is a tributary to the Scott River, a tributary to the Klamath River, which drains to the Pacific Ocean. It is located in Siskiyou County, California (Map 1). Sugar Creek's legal description at the confluence with the Scott River is T40N R09W S01. Its location is 41°20'37" north latitude and 122°49'20" west longitude, LLID number 1228222413435. Sugar Creek is a third order stream and has approximately 15.8 miles of blue line stream according to the USGS Eaton Peak 7.5 minute quadrangle. Sugar Creek drains a watershed of approximately 12.6 square miles. Elevations range from approximately 3,000 feet at the mouth of the creek to approximately 6,500 feet in the headwaters area. Mixed conifer forest dominates the watershed. The lower watershed is entirely privately owned and is managed primarily for timber production. Approximately 525 acres are dedicated to agricultural production and pastureland. Vehicle access exists via Sugar Creek Road.

METHODS

The habitat inventory conducted in Sugar Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Pacific States Marine Fisheries Commission Fishery Technicians 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 Sugar 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 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". Sugar 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 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 Sugar 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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Riffle Crest Fine Sediment:

A 14" square grid with fifty equidistant intersections is used to estimate fine sediment < 2mm at velocity crossover locations (riffle crests). Each site has three samples collected for a potential composite score of 150. Samples are taken mid-stream, and halfway between each bank and mid-stream. Using a 2mm gauge (match stick), the crew examines each of the 50 intersections, and measure the fine particles; those < 2mm are recorded. The three sample scores are combined for the composite site score. The site score is combined with other site scores in the survey reach and the percentage calculated.

7. 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 Sugar 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.

8. 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.

9. 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 Sugar 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.

10. 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 Sugar 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.

11. 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.

12. 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 Sugar Creek. Snorkeling in selected areas was also used to identify species composition, distribution and relative abundance. Snorkel survey work was performed by personnel from the Siskiyou Resource Conservation District (SQRCD) in collaboration with DFG.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.17, 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

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- 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
- 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 Sugar 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

The habitat inventory of August 16 to August 17, 2005 was conducted by Dave Snider and Corby Hines (DFG). The total length of the stream surveyed was 18,719 feet with an additional 504 feet of side channel.

The Sugar Creek survey has four reaches stratified by Rosgen channel types (Flosi et al. 1998). Reach 1 is a C4 channel type for 3,832 feet, Reach 2 is a C3 channel type for the next 4,849 feet, Reach 3 is a B1 channel type for the next 4,943 feet; and Reach 4 is a B3 channel type for the remaining 5,095 feet of the stream surveyed.

C4 channels are meandering point-bar riffle/pool alluvial channels with broad well defined floodplain on low gradients and gravel dominant substrates. C3 channels have cobble dominant substrates. B1 channels are moderately entrenched riffle dominated channels with infrequently spaced pools, very stable plan and profile, stable banks on moderate gradients with low width to depth ratios and bedrock dominant substrates. B3 channels have cobble dominant substrates.

During August and September, 2005, flow was measured at 0.8 cfs at the lower end of Reach 2.

DFG crews measured water temperatures during the survey period. They ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 61 to 87 degrees Fahrenheit.

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Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence, there were approximately 42% flatwater units, 33% riffle units, and 24% pool units (Graph 1). Based on total length of Level II habitat types there were 58% flatwater units, 19% unsurveyed units, 15% riffle units, and 8% pool units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 34% step run units, 30% low gradient riffle units, and 20% mid-channel pool units (Graph 3). Based on percent total length, 50% were step run units, 19% were unsurveyed units, and 15% were low gradient riffle units.

A total of 29 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 90% (Graph 4). Main channel pools comprised 94% of the total length of all pools (Table 3). Table 4 is a summary of maximum residual pool depths by pool habitat types. Six of the 29 pools (21%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 29 pool tail-outs measured, three had a value of 1 (10%); 18 had a value of 2 (62%); five had a value of 3 (17%); one had a value of 4 (3%); and two had a value of 5 (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 not suitable for spawning due to inappropriate substrate such as bedrock, log sills, boulders, or other considerations.

A 14" square grid with fifty equidistant intersections was used to estimate fine sediment < 2mm at pool tail crest / velocity crossover locations. In Sugar Creek nine sites were sampled. The sites were distributed throughout the survey (see Comments and Landmarks section below). Each site had three samples taken for a potential composite score of 150. The site scores ranged from 0 – 92. The average percent fines < 2mm for all sites was 20%.

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 41, flatwater habitat types had a mean shelter rating of 72, and pool habitats had a mean shelter rating of 87 (Table 1). Of the pool types, scour pools had a mean shelter rating of 103 and main channel pools had a mean shelter rating of 85 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Sugar Creek. Graph 7 describes the pool cover in Sugar Creek. Boulders are the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Large cobble was dominant in 41% of pool tail-outs and boulders in 24% of pool tail-outs.

The mean percent canopy density for the surveyed length of Sugar Creek was 89%. Eleven percent of the canopy was open (Table 7). Of the mean percent canopy density, the mean percentages of hardwood and coniferous trees were 91% and 9%, respectively. Graph 9 describes the mean percent canopy in Sugar Creek.

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For the stream reach surveyed, the mean percent right bank vegetated was 91%. The mean percent left bank vegetated was 86%. The dominant elements composing the structure of the stream banks consisted of 78% cobble/gravel, 19% boulders, and 3% bedrock (Graph 10).

Hardwood trees were the dominant vegetation type observed in 69% of the units surveyed. Additionally, 17% of the units surveyed had coniferous trees as the dominant vegetation type, and 12% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. During Sugar Creek habitat typing surveys, fish presence was observed from the stream banks. Subsequent snorkel surveys conducted by personnel from the SQRCD on August 15, 17, and September 15, 2005 recorded the following fish species and abundance information.

Young-of-the-year (YOY) rainbow trout/steelhead (*Oncorhynchus mykiss*) were observed by divers in all four stream reaches. Coho salmon YOY (*O. kisutch*) were also observed throughout the length of the survey, with the greatest concentrations occurring in reach one. Older rainbow trout/steelhead were observed in reaches 3 and 4. There were no 1+ coho observed. Other fish species encountered included speckled dace (*Rhinichthys osculus)* and sculpin (*Cottus spp.)* primarily in the lower two reaches (Reaches 1 and 2). Pacific Giant Salamanders (*Dicamptodon ensatus)* were present in Reaches 3 and 4.

	Habitat type		
Reach 1	**Riffle**	**Run**	**Pool**
Linear feet sampled	*37*	*370*	*NS*[1]
YOY coho	13	664	--
YOY rainbow trout/steelhead	58	184	--
Reach 2			
Linear feet sampled	*28*	*174*	*NS*
YOY coho	1	238	--
YOY rainbow trout/steelhead	13	67	--
Reach 3			
Linear feet sampled	*173*	*284*	*267*
YOY coho	19	244	326
YOY rainbow trout/steelhead	93	98	43
1^+ rainbow trout/steelhead	3	7	8
2^+ rainbow trout/steelhead	1	4	4
Reach 4			
Linear feet sampled	*NS*	*232*	*373*
YOY coho	--	140	309
YOY rainbow trout/steelhead	--	34	42

1^+ rainbow trout/steelhead	--	6	5
2^+ rainbow trout/steelhead	--	3	7
3^+ rainbow trout/steelhead	--	0	3

[1] NS = None sampled

[2] n/a = not applicable

DISCUSSION

Sugar Creek is a C4 channel type for the first 3,832 feet of stream surveyed, a C3 channel type for the next 4,849 feet, a B1 channel type for the next 4,943 feet, and a B3 channel type for the remaining 5,095 feet. The suitability of these channel types for fish habitat improvement structures is as follows: C4 channels are good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover. C3 channels are excellent for bank-placed boulders; good for plunge weirs, boulder clusters, single and opposing wing deflectors, and log cover. B1 channels are excellent for bank-placed boulders; fair for plunge weirs, opposing wing-deflectors, and log cover; poor for boulder clusters and single wing-deflectors. B3 channels are excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing deflectors, and log cover.

The water temperatures recorded on the survey days August 16 to August 17, 2005 ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 61 to 87 degrees Fahrenheit. This water temperature range is excellent for rearing salmonids. Since 2002, the SQRCD has deployed continuous temperature recorders throughout the spring and summer months and has additional information available. Their temperature samples indicate favorable conditions in Sugar Creek.

Flatwater habitat types comprised 58% of the total length of this survey, riffles 15%, and pools 8%. The pools are relatively shallow, with only six of the 29 (21%) pools having a maximum residual depth greater than 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third order streams, a primary pool is defined to have a maximum residual depth of at least three 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.

Twenty-nine pool tail-outs were measured. Eight had either bedrock or boulder as their dominant substrate and as such were rated at a value of five and determined to be not suitable for spawning. Of the remaining twenty-one pool tail-outs, 81% (17) had embeddedness ratings of 1 or 2 and were of suitably sized substrate to provide good to fair spawning habitat. Four tail-outs, 19%, had suitably sized substrate, but had embeddedness ratings of 3; as such they provide poor spawning habitat. Although Sugar Creek currently has good to fair spawning conditions, sediment sources should be identified, mapped and rated according to their potential sediment yields, and control measures initiated as warranted.

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Embeddedness:	Gravel	Small Cobble	Large Cobble	Boulder/Bedrock
1	1	0	1	
2	1	5	9	
3	0	1	3	
4	0	0	0	
5				8

The juvenile salmonid cover in Sugar Creek is currently being provided primarily by boulders. The mean shelter rating for pools was eighty-seven, with boulders as the dominant cover type followed by small woody debris. The shelter rating in the flatwater habitats was 72. A shelter rating of approximately 100 is desirable. Log and root wad cover 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 89%. Reach 1 had a canopy density of 79%, Reach 2 had a canopy density of 87%, Reach 3 had a canopy density of 93%, and Reach 4 had a canopy density of 95%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank vegetation cover was high at 91% and 86%, 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.

RECOMMENDATIONS

1) Sugar Creek should be managed as an anadromous, natural production stream.

2) Flow was measured at 0.8 cfs at the time of the survey. In low flow years this late summer discharge could be reduced to levels that would likely compromise the capacity of the stream for rearing coho. Continue to work with local irrigation diverters to coordinate withdrawals and establish a minimum instream base flow at the gage below Fay Ditch to benefit rearing salmonids.

3) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July, August and early September temperature extreme period should be performed for 3 to 5 years.

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) Suitably sized spawning substrate on Sugar 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

in the pools is from boulders. Adding high quality complexity with woody cover in the pools is desirable.

7) Increase potential future LWD recruitment along Sugar Creek by planting appropriate native vegetation in reaches identified to have shade canopy below target levels.

8) 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.

9) Active and potential sediment sources related to the catchment's road system need to be identified, mapped, and treated according to their potential for sediment yield to the stream and its tributaries.

10) Sugar Creek offers good conditions for rearing salmonids, especially juvenile coho. Fish passage at all life stages should be monitored at diversions, beaver dams, and the 3' plunge at 1972' and improved if warranted.

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.

Position (ft.)	Habitat Unit #	Comments
0	0001.00	Start of survey 160' upstream from the confluence with the Scott River. Many coho salmon juveniles observed. The channel is a C4.
820	0002.00	Highway 3 bridge.
1,206	0003.00	766' long unsurveyed section.
1,972	0004.00	3' high plunge
3,302	0014.00	Bridge measures 40' x 10' x 12'
3,432	0017.00	The channel is a C3.
3,736	0020.00	2,900' long unsurveyed section.
6,853	0022.00	Tailout fines = 46
7,005	0024.00	Tailout fines = 27
7,506	0030.00	Low water crossing.

7,545	0031.00	Tailout fines = 37
7,655	0033.00	Diversion 171' into unit
7,853	0034.00	Log debris accumulation (LDA) measures 20' wide x 10' long x 6' high. Water is flowing through the LDA and it is not retaining sediment.
8,053	0036.00	Diversion on right bank at top of unit.
8,241	0038.00	The channel is a B1.
8,902	0041.01	Beaver dam at top of unit
8,902	0042.00	Beaver dam 46' into unit
9,198	0045.00	Flow gauge 55' into HU. Flow = stage 5
9,866	0052.00	Diversion pipe 91' into HU, 20' above stream bed
9,977	0052.01	Large boulder creates side channel, 10' high x 15' wide.
11,280	0071.00	Tiger Fork tributary enters on the left bank.
12,712	0076.00	Tailout Fines = 19
13,039	0078.00	The channel is a B3.
13,517	0084.00	Tailout Fines = 0
13,517	0084.00	Gravel low-water crossing
15,613	0099.00	Tailout Fines = 38
15,715	0101.00	Tailout Fines = 6
16,669	0104.00	Tailout Fines = 4
16,687	0105.00	Low water crossing 621' into HU
17,626	0106.00	Fish return pipe from Darby Ditch.
17,941	0108.00	Darby Ditch diversion
18,469	0113.00	Tailout Fines = 92

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18,692	0115.00	End of Survey at Fruitgrowers Inc. bridge.

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.

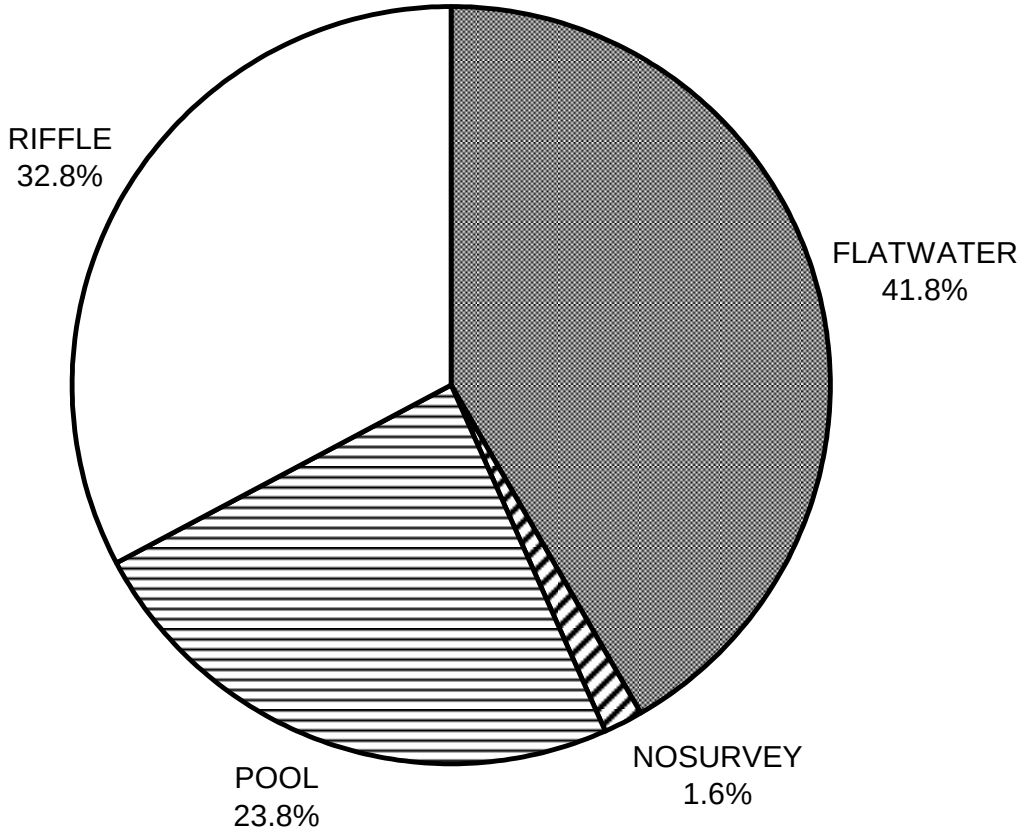
McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

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

LEVEL III and LEVEL IV HABITAT TYPES

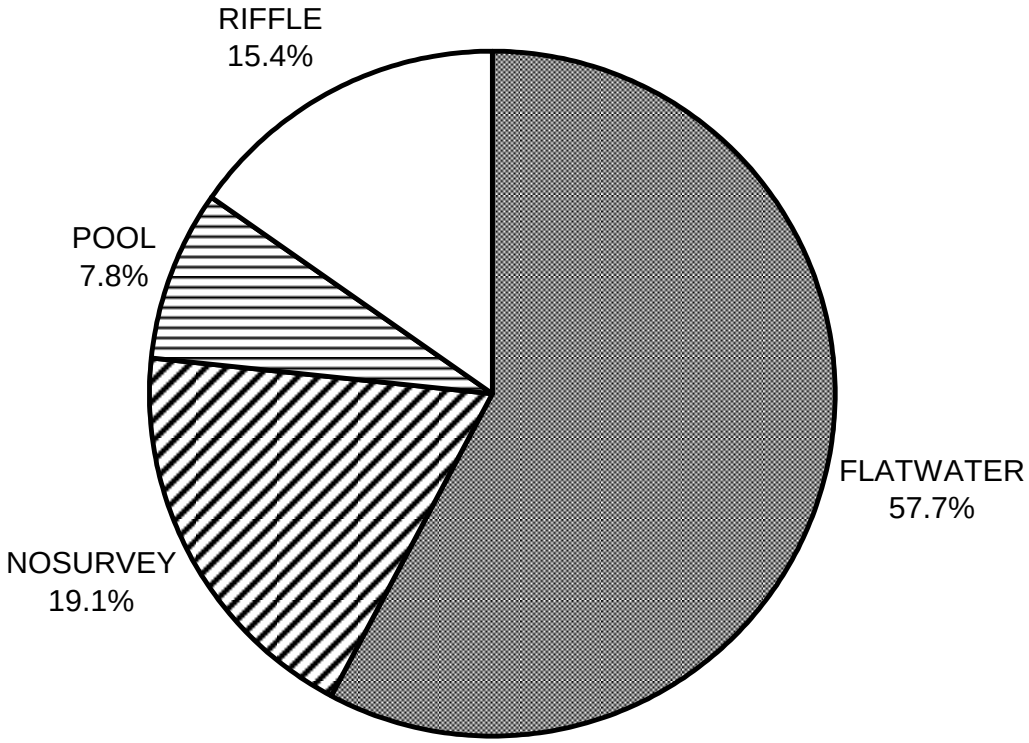
RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL 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]	

SUGAR CREEK 2005
HABITAT TYPES BY PERCENT OCCURRENCE



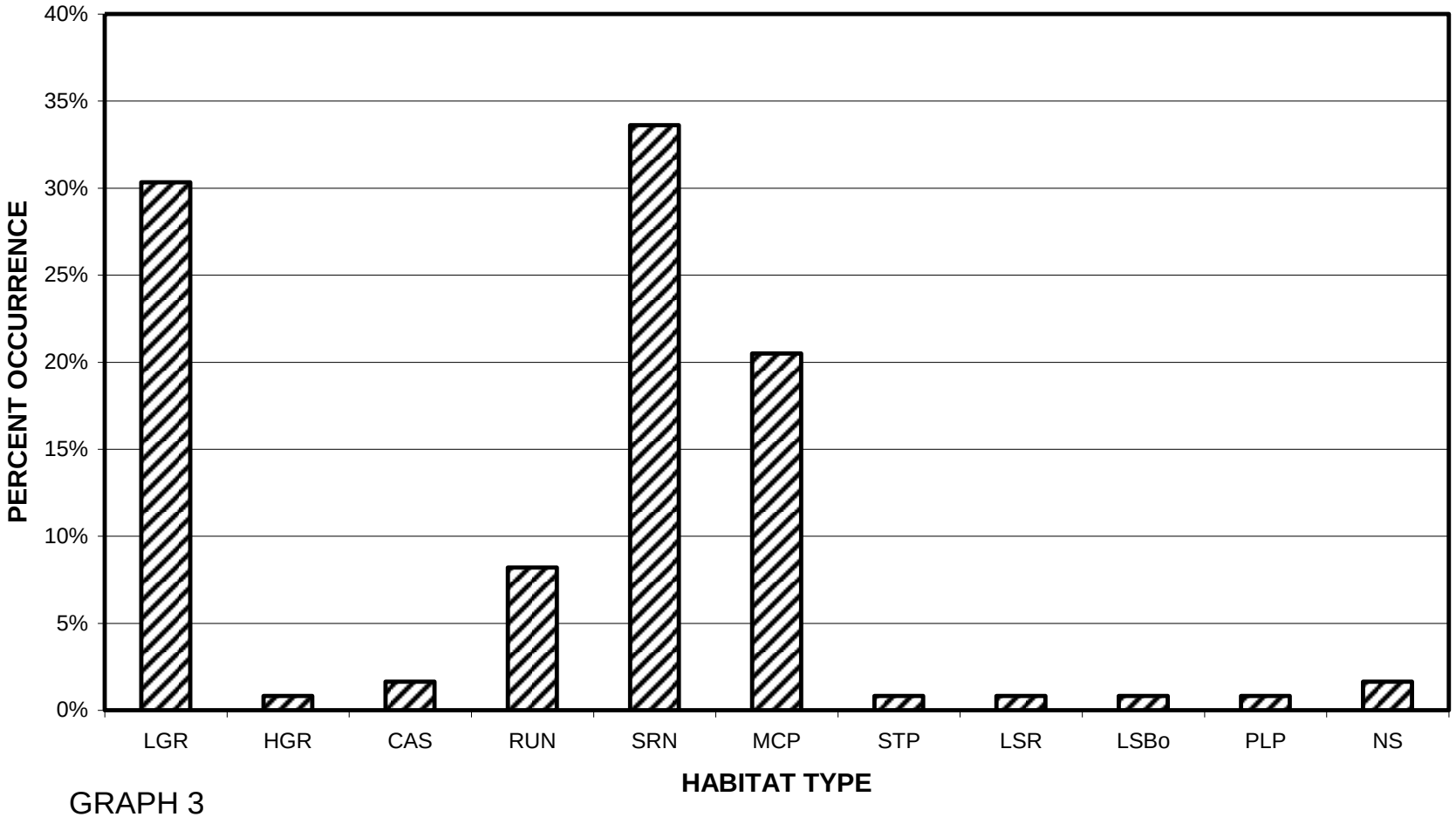
GRAPH 1

SUGAR CREEK 2005
HABITAT TYPES BY PERCENT TOTAL LENGTH



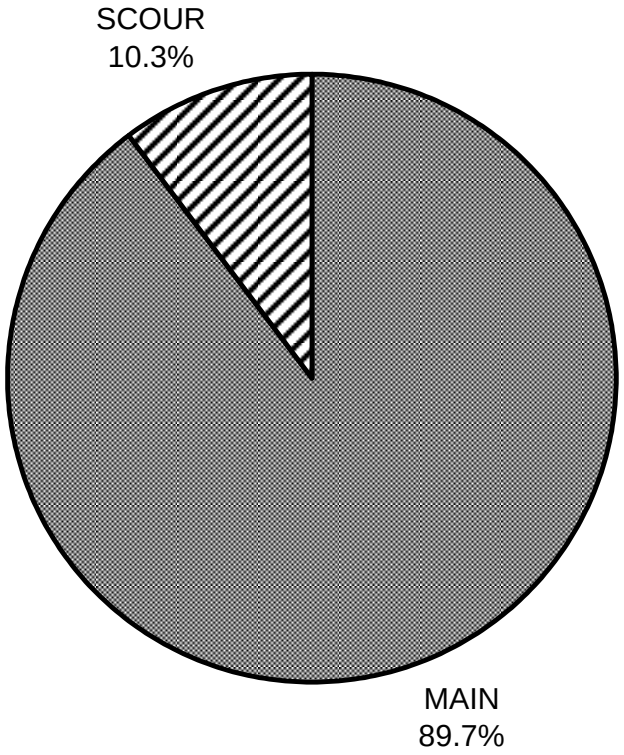
GRAPH 2

SUGAR CREEK 2005
HABITAT TYPES BY PERCENT OCCURRENCE

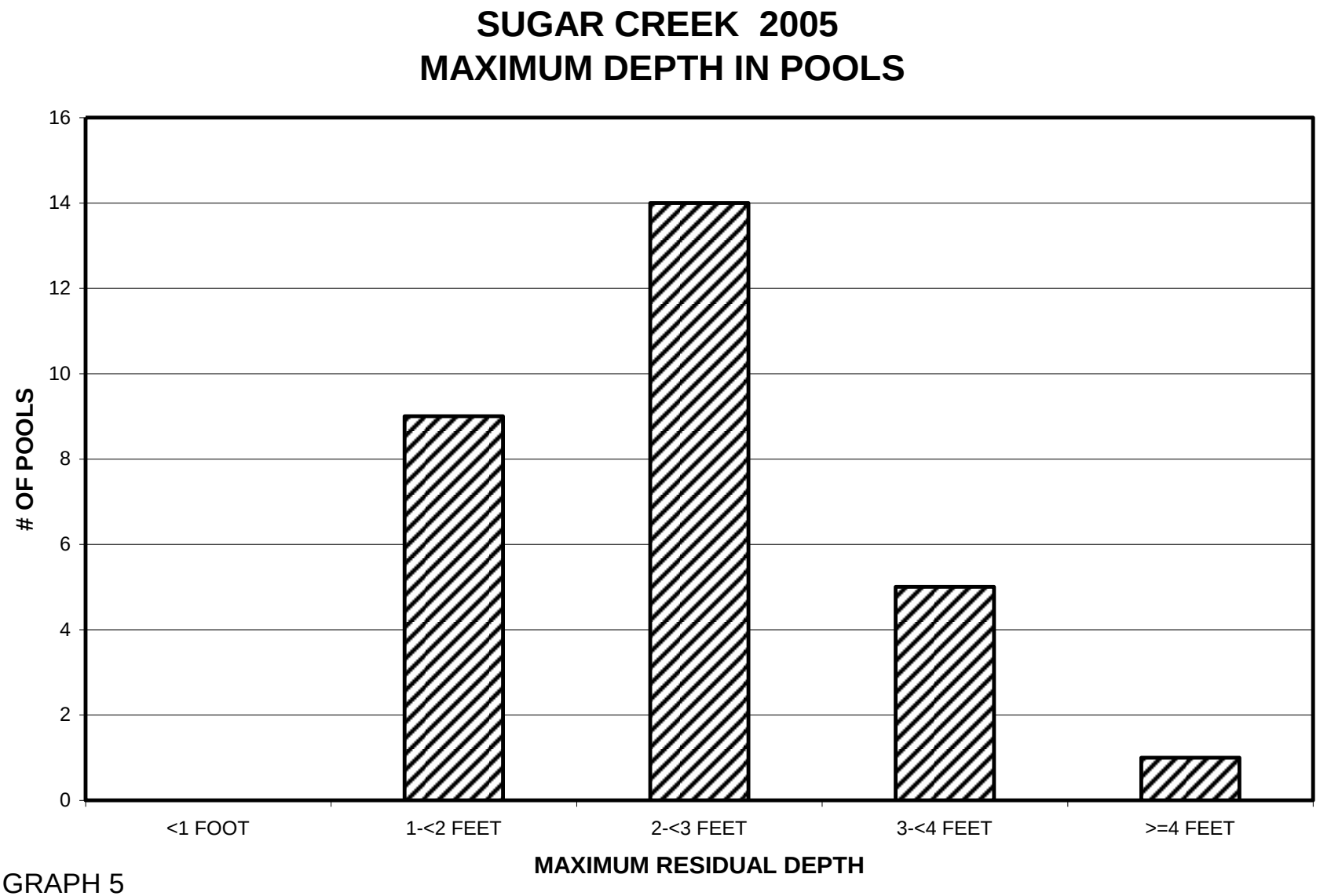


GRAPH 3

SUGAR CREEK 2005
POOL TYPES BY PERCENT OCCURRENCE

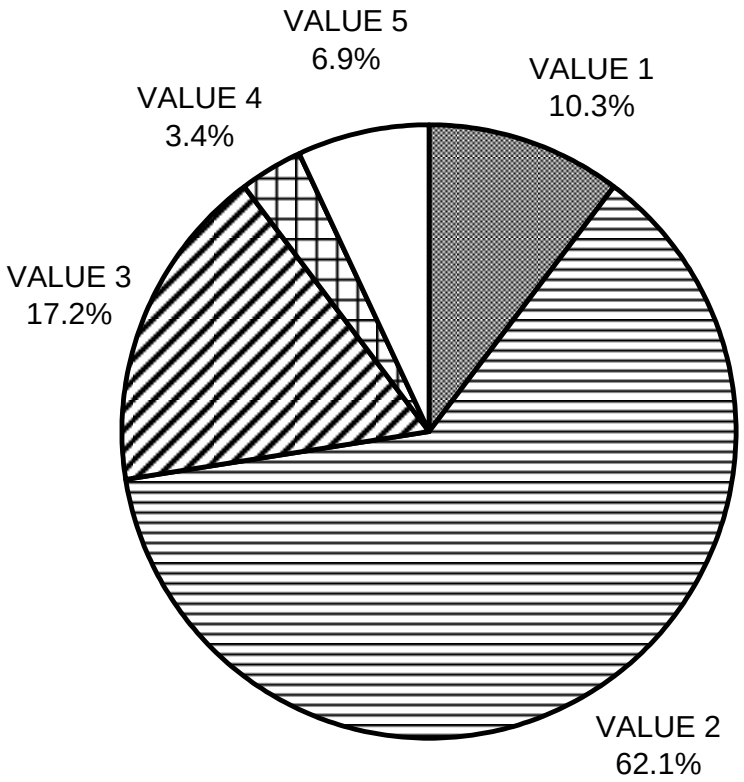


GRAPH 4


SUGAR CREEK 2005
MAXIMUM DEPTH IN POOLS
16
14
12
10
8
6
4
2
0
OF POOLS
<1 FOOT
1-<2 FEET
2-<3 FEET
3-<4 FEET
>=4 FEET
MAXIMUM RESIDUAL DEPTH

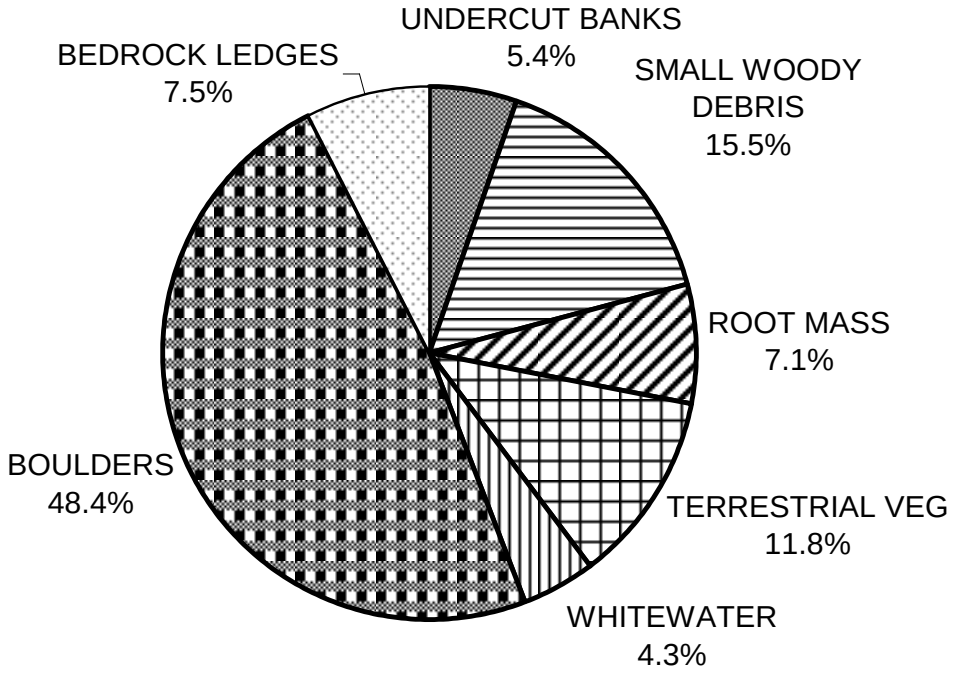
GRAPH 5

SUGAR CREEK 2005
PERCENT EMBEDDEDNESS



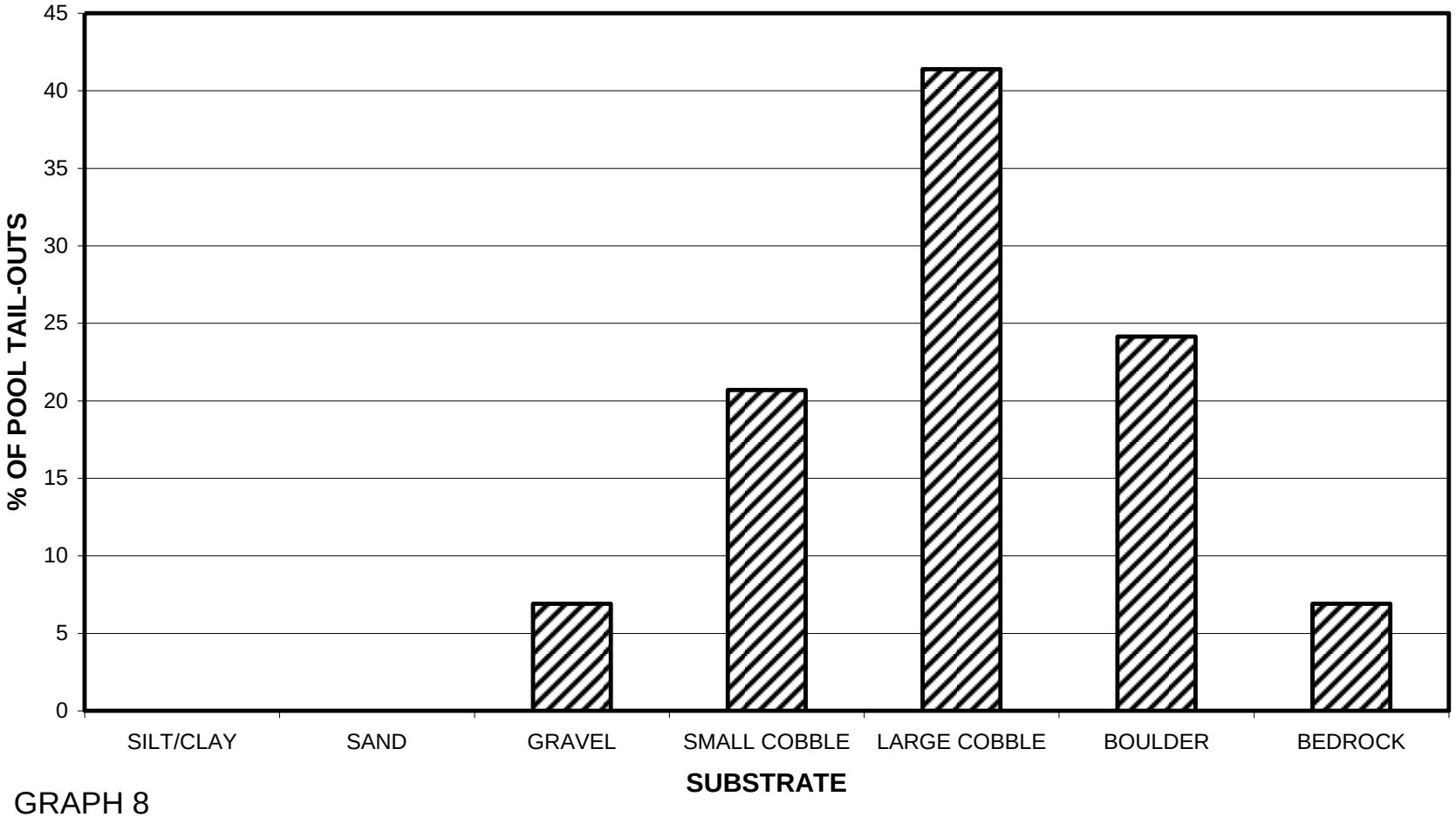
GRAPH 6

SUGAR CREEK 2005
MEAN PERCENT COVER TYPES IN POOLS



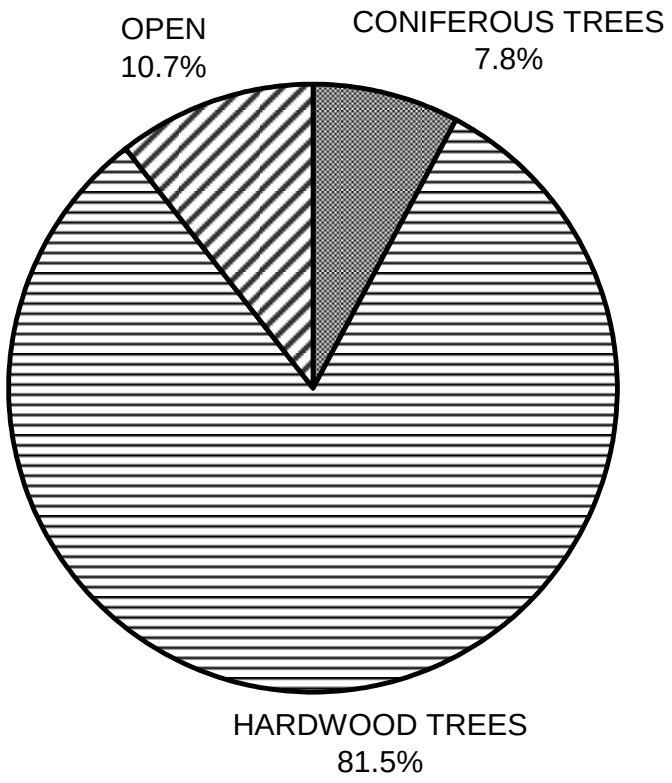
GRAPH 7

SUGAR CREEK 2005
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



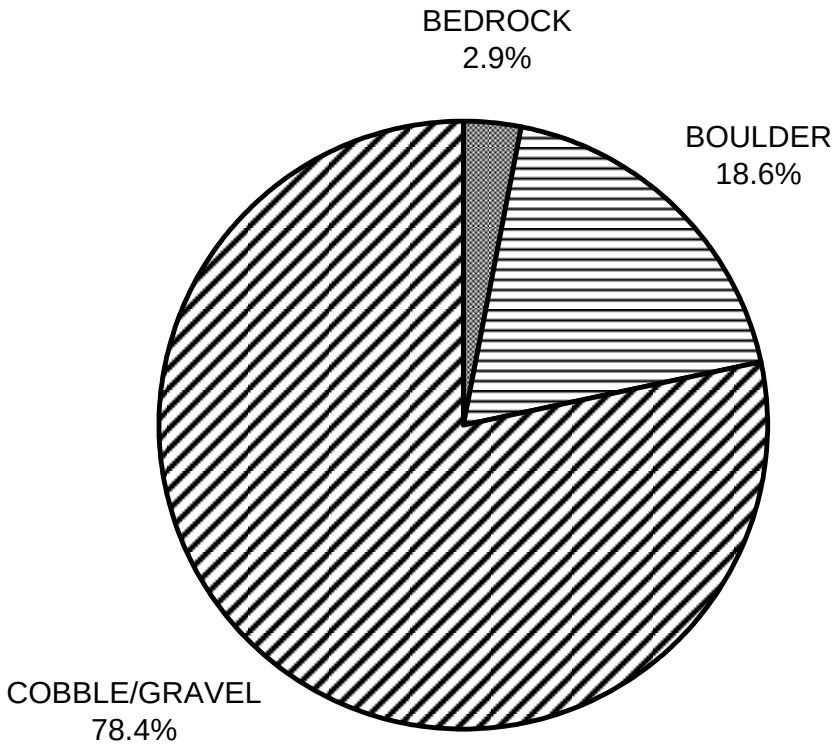
GRAPH 8

SUGAR CREEK 2005
MEAN PERCENT CANOPY



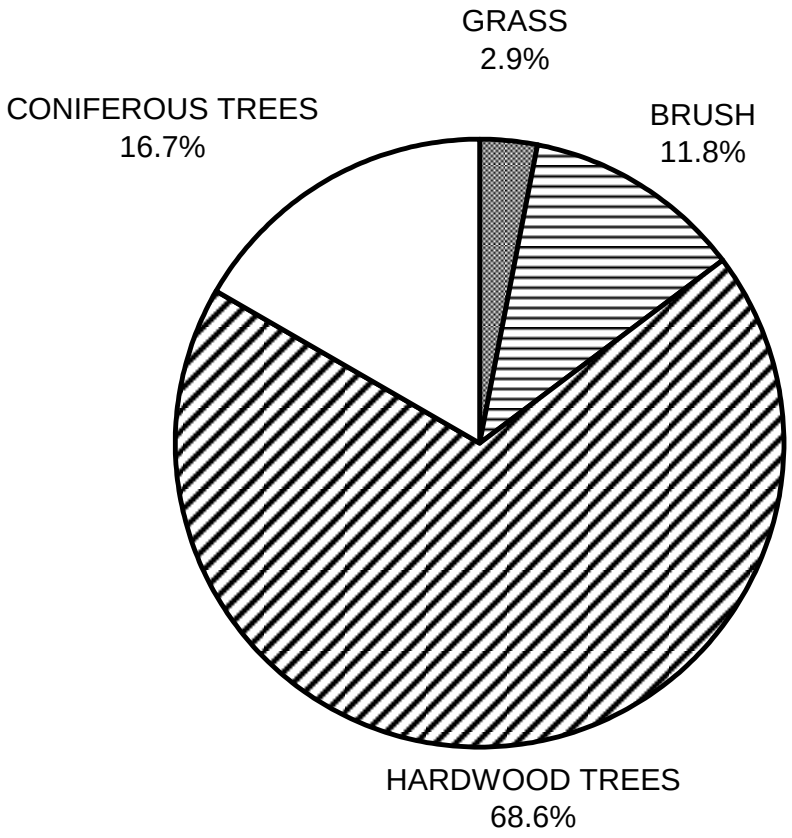
GRAPH 9

SUGAR CREEK 2005
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

SUGAR CREEK 2005
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

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

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad:** EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

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
51	10	FLATWATER	41.8	218	11094	57.7	15.7	0.7	1.5	4166	212449	3431	174967		72
2	0	NOSURVEY	1.6	1834	3667	19.1									
29	29	POOL	23.8	52	1504	7.8	18.3	1.2	2.4	990	28716	1765	51177	1487	87
40	13	RIFFLE	32.8	74	2958	15.4	16.2	0.5	0.9	645	25796	353	14105		41

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
122	52	19223	266960	240249

Table 2 - Summary of Habitat Types and Measured

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad**: EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (ft.)	Mean Length (ft.)	Total Length (%)	Total Length (ft.)	Mean Width (ft.)	Mean Depth Depth (ft.)	Mean Max (sq.ft.)	Mean Area (sq.ft.)	Estimated Total Area (cu.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume Pool Vol (cu.ft.)	Mean Residual Rating	Mean Shelter (%)	Mean Canopy (%)
37	11	LGR	30.3	76	2827	14.7	16.0	0.5	1.6	660	24410	360	13306		30	87
1	1	HGR	0.8	50	50	0.3	16.0	0.5	1.1	480	480	240	240		180	90
2	1	CAS	1.6	40	81	0.4	22.0	0.6	1.3	647	1294	388	776		20	95
10	5	RUN	8.2	146	1463	7.6	18.0	0.7	2.2	5804	58036	5080	50798		84	90
41	5	SRN	33.6	235	9631	50.1	13.0	0.7	1.9	2528	103635	1782	73049		60	87
25	25	MCP	20.5	49	1216	6.3	19.0	1.2	3.9	917	22926	1614	40357	1339	81	92
1	1	STP	0.8	198	198	1.0	23.0	1.8	4.2	4554	4554	9108	9108	8197	180	86
1	1	LSR	0.8	33	33	0.2	11.0	0.8	2.1	363	363	327	327	290	60	100
1	1	LSBo	0.8	37	37	0.2	18.0	0.7	2.0	633	633	569	569	443	40	100
1	1	PLP	0.8	20	20	0.1	12.0	2.9	3.7	240	240	816	816	696	210	82
2	0	NS	1.6	1834	3667	19.1										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
122	52	19223	216570	189346

Table 3 - Summary of Pools

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad:** EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

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
26	26	MAIN	90	54	1414	94	18.9	1.2	1057	27480	1603	41684	85
3	3	SCOUR	10	30	90	6	13.7	1.5	412	1236	476	1429	103

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
29	29	1504	28716	43113

Table 4 - Summary of Maximum Residual Pool Depths By

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad:** EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

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 Occurence	3 < 4 Feet Maximum Residual Depth	3 < 4 Feet Percent Occurrence	>= 4 Feet Maximum Residual Depth	>= 4 Feet Percent Occurrence
1	PLP	3	0	0	0	0	0	0	1	100	0	0
25	MCP	86	0	0	9	36	12	48	4	16	0	0
1	STP	3	0	0	0	0	0	0	0	0	1	100
1	LSBo	3	0	0	0	0	1	100	0	0	0	0
1	LSR	3	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 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
29	0	0	9	31	14	48	5	17	1	3

Mean Maximum Residual Pool Depth (ft.): 2

Table 5 - Summary of Mean Percent Cover By Habitat

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad:** EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

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
37	10	LGR	2	6	0	0	19	0	2	71	0
1	1	HGR	0	40	20	0	0	0	20	20	0
2	1	CAS	0	0	0	0	0	0	80	0	20
10	5	RUN	2	18	0	0	24	14	0	34	8
41	5	SRN	4	18	0	0	38	0	0	40	0
25	24	MCP	5	16	0	5	14	0	3	51	6
1	1	STP	0	0	0	0	0	0	10	20	70
1	1	LSR	0	0	0	70	0	0	10	20	0
1	1	LSBo	0	15	0	0	0	0	0	85	0
1	1	PLP	40	40	0	0	0	0	20	0	0
2	0	NS									

Table 6 - Summary of Dominant Substrates By Habitat

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad:** EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

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
37	11	LGR	0	0	9	27	36	18	9
1	1	HGR	0	0	0	0	0	0	100
2	1	CAS	0	0	0	0	0	0	100
10	5	RUN	0	20	0	20	40	0	20
41	5	SRN	0	0	20	40	20	20	0
25	24	MCP	0	25	8	25	17	13	13
1	1	STP	0	0	0	0	0	0	100
1	1	LSR	0	0	0	100	0	0	0
1	1	LSBo	0	0	0	100	0	0	0
1	1	PLP	0	0	0	100	0	0	0
2	0	NS	0	0	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: Quad: EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

Habitat Units	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
89	9	91	0	91	86

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 8 - Fish Habitat Inventory Data Summary

Stream Name: Sugar Creek | LLID: 1228222413435 | Drainage: Scott River
Survey Dates: 8/16/2005 to 8/17/2005 | Survey Length (ft.): 19223 | Main Channel (ft.): 18719 | Side Channel (ft.): 504
Confluence Location: Quad: EATON PEAK | Legal Description: T40NR09WS01 | Latitude: 41:20:37.0N | Longitude: 122:49:20.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: C4
Reach Length (ft.): 3832
Riffle/Flatwater Mean Width (ft.): 15.4
BFW:
Range (ft.): 21 to 23
Mean (ft.): 22
Std. Dev.: 1
Base Flow (cfs): 0
Water (F): 61 - 62 Air (F): 62 - 80
Dry Channel (ft.): 0

Canopy Density (%): 78.9
Coniferous Component (%): 1.2
Hardwood Component (%): 98.8
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 94.2
Dominant Shelter: Terrestrial Veg.
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 7.5
Pool Frequency (%): 23.8
Residual Pool Depth (%):
< 2 Feet Deep: 20.0
2 to 2.9 Feet Deep: 40.0
3 to 3.9 Feet Deep: 40.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.7
Mean Pool Shelter Rating: 140

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 20.0 Sm Cobble: 60.0 Lg Cobble: 20.0 Boulder: 0.0 Bedrock: 0.0
Embeddedness Values (%): 1. 0.0 2. 80.0 3. 20.0 4. 0.0 5. 0.0

STREAM REACH: 2

Channel Type: C3
Reach Length (ft.): 4849
Riffle/Flatwater Mean Width (ft.): 20.6
BFW:
Range (ft.): 23 to 24
Mean (ft.): 23
Std. Dev.: 0
Base Flow (cfs): 0
Water (F): 62 – 62 Air (F): 70 - 83
Dry Channel (ft.): 0

Canopy Density (%): 86.5
Coniferous Component (%): 22.1
Hardwood Component (%): 77.9
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 86.7
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 2
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 7.1
Pool Frequency (%): 21.1
Residual Pool Depth (%):
< 2 Feet Deep: 0.0
2 to 2.9 Feet Deep: 50.0
3 to 3.9 Feet Deep: 25.0
>= 4 Feet Deep: 25.0
Mean Max Residual Pool Depth (ft.): 3.2
Mean Pool Shelter Rating: 98

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 0.0 Sm Cobble: 25.0 Lg Cobble: 25.0 Boulder: 0.0 Bedrock: 50.0
Embeddedness Values (%): 1. 0.0 2. 50.0 3. 0.0 4. 0.0 5. 50.

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: B1
Reach Length (ft.): 4943
Riffle/Flatwater Mean Width (ft.): 14.6
BFW:
Range (ft.): 20 to 34
Mean (ft.): 27
Std. Dev.: 5
Base Flow (cfs): 0
Water (F): 55 – 58 Air (F): 61 - 76
Dry Channel (ft.): 0

Canopy Density (%): 93.4
Coniferous Component (%): 9.3
Hardwood Component (%): 90.7
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 85.1
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles: 0
Pools: 0
Flat: 0

Pools by Stream Length (%): 10.5
Pool Frequency (%): 22.0
Residual Pool Depth (%):
< 2 Feet Deep: 36.4
2 to 2.9 Feet Deep: 45.5
3 to 3.9 Feet Deep: 18.2
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.25
Mean Pool Shelter Rating: 73

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 9.1 Sm Cobble: 18.2 Lg Cobble: 63.6 Boulder: 9.1 Bedrock: 0.0

Embeddedness Values (%): 1. 18.2 2. 63.6 3. 18.2 4. 0.0 5. 0.0

STREAM REACH: 4

Channel Type: B3
Reach Length (ft.): 5095
Riffle/Flatwater Mean Width (ft.): 12.5
BFW:
Range (ft.): 25 to 40
Mean (ft.): 33
Std. Dev.: 5
Base Flow (cfs): 0
Water (F): 58 – 60 Air (F): 69 - 87
Dry Channel (ft.): 0

Canopy Density (%): 94.9
Coniferous Component (%): 6.1
Hardwood Component (%): 93.9
Dominant Bank Vegetation: Hardwood Trees
Vegetative Cover (%): 87.7
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 0.0
LWD per 100 ft.:
Riffles: 0
Pools: 1
Flat: 0

Pools by Stream Length (%): 6.2
Pool Frequency (%): 28.1
Residual Pool Depth (%):
< 2 Feet Deep: 44.4
2 to 2.9 Feet Deep: 55.6
3 to 3.9 Feet Deep:0.0
>= 4 Feet Deep: 0.0
Mean Max Residual Pool Depth (ft.): 2.01
Mean Pool Shelter Rating: 69

Pool Tail Substrate (%): Silt/Clay: 0.0 Sand: 0.0 Gravel: 0.0 Sm Cobble: 0.0 Lg Cobble: 33.3 Boulder: 66.7 Bedrock: 0.0

Embeddedness Values (%): 1. 11.1 2. 55.6 3. 22.2 4. 11.1 5.

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad:** EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

Mean Percentage of Dominant Stream Bank

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	1	2	2.9
Boulder	10	9	18.6
Cobble/Gravel	40	40	78.4
Sand/Silt/Clay	0	0	0.0

Mean Percentage of Dominant Stream Bank

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Grass	1	2	2.9
Brush	5	7	11.8
Hardwood Trees	38	32	68.6
Coniferous Trees	7	10	16.7
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness 2

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

Stream Name: Sugar Creek **LLID:** 1228222413435 **Drainage:** Scott River

Survey Dates: 8/16/2005 to 8/17/2005

Confluence Location: **Quad:** EATON PEAK **Legal Description:** T40NR09WS01 **Latitude:** 41:20:37.0N **Longitude:** 122:49:20.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	2	3	5
SMALL WOODY DEBRIS (%)	8	18	16
LARGE WOODY DEBRIS (%)	2	0	0
ROOT MASS (%)	0	0	7
TERRESTRIAL VEGETATION (%)	16	31	12
AQUATIC VEGETATION (%)	0	7	0
WHITEWATER (%)	10	0	4
BOULDERS (%)	61	37	48
BEDROCK LEDGES (%)	2	4	8