



CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

South Fork Hare Creek

INTRODUCTION

A stream inventory was conducted September 26 to September 28, 2016 on South Fork Hare Creek. The survey began at the confluence with Hare Creek and extended upstream one mile. A stream inventory and report was also completed for one tributary to South Fork Hare Creek.

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

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

South Fork Hare Creek is a tributary to Hare Creek, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). South Fork Hare Creek's legal description at the confluence with Hare Creek is T18N R17W S27. Its location is 39.3886° north latitude and 123.735° west longitude, LLID number 1237350393887. South Fork Hare Creek is a second order stream and has approximately 0.88 miles of blue line stream according to the USGS Noyo Hill 7.5 minute quadrangle. South Fork Hare Creek drains a watershed of approximately 1.4 square miles. Elevations range from about 175 feet at the mouth of the creek to 831 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely state forest and is managed for timber production. Vehicle access exists via Highway 20 near Fort Bragg.

METHODS

The habitat inventory conducted in South Fork Hare Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al. 1998). The California Department of Fish and Wildlife (CDFW) personnel and Watershed Stewards Project/AmeriCorps (WSP) members that conducted the inventory were trained in standardized habitat inventory methods by the CDFW. This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are 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 South Fork Hare 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:

Water and air temperatures are measured and recorded at every tenth habitat unit using a hand-held thermometer. Both temperatures are taken in degrees Fahrenheit and the time of the measurement is also recorded. Air temperatures are recorded within one foot of the water surface, while water temperatures are recorded (where possible) in flowing water within the habitat unit.

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". South Fork Hare 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 South Fork Hare 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. 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 South Fork Hare Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

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

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In South Fork Hare 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 South Fork Hare 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 South Fork Hare Creek. In addition, underwater mask and snorkel observations were made at 10 sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- Pool Types
- Maximum Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type
- Mean Percent Vegetative Cover for Entire Stream
- Fish Habitat Inventory Data Summary by Stream Reach (Table 8)
- Mean Percent Dominant Substrate / Dominant Vegetation Type for Entire Stream
- Mean Percent Shelter Cover Types for Entire Stream

Graphics are produced from the tables using Microsoft Excel. Graphics developed for South Fork Hare 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 IN APPENDIX I *

The habitat inventory of September 26 to September 28, 2016 was conducted by Brian Starks and Matt Rice (CDFW). The total length of the stream surveyed was 5,318 feet.

Stream flow was not measured on South Fork Hare Creek.

South Fork Hare Creek is a B3 channel type for 4,520 feet of the stream surveyed (Reach 1), and an A4 channel type for 798 feet of the stream surveyed (Reach 2). B3 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and cobble-dominant substrates. A4 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52° to 55° Fahrenheit. Air temperatures ranged from 50° to 69° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% flatwater units, 31% riffle, 20% pool units, and 12% dry units (Graph 1). Based on total length of Level II habitat types there were 46% flatwater units, 30% riffle units, 14% pool units, and 10% dry units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 31%; step run units, 19%; run units, 18% (Graph 3). Based on percent total length, step run units made up 32%, low gradient riffle units 29%, and run units 13%. A total of 41 pools were identified (Table 3). Main channel pools were the most frequently encountered at 83% (Graph 4), and comprised 80% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Five of the 41 pools (12%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 41 pool tail-outs measured, 31 had a value of 1 (75.6%); 8 had a value of 2 (19.5%); 2 had a value of 5 (4.9%) (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 shelter rating was calculated for each habitat unit and expressed as a mean value for each habitat type within the survey using a scale of 0-300. Riffle habitat types had a mean shelter rating of 0, flatwater habitat types had a mean shelter rating of 5, and pool habitats had a mean shelter rating of 33 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating of 33. Scour pools had a mean shelter rating of 33 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in South Fork Hare Creek. Graph 7 describes the pool cover in South Fork Hare Creek. Large woody debris is 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. Gravel was the dominant substrate observed in 70% of pool tail-outs. Small cobble was the next most frequently observed dominant substrate and occurred in 22% of pool tail-outs.

The mean percent canopy density for the surveyed length of South Fork Hare Creek was 97%. Three percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 45% and 55%, respectively. Graph 9 describes the mean percent canopy in South Fork Hare Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 98%. The mean percent left bank vegetated was 98%. The dominant elements composing the structure of the stream banks consisted of 61% sand/silt/clay, 33% cobble/gravel, and 6% bedrock (Graph 10).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a mask and snorkel survey at 11 sites for species composition and distribution in South Fork Hare Creek on October 25, 2016. The water temperature during the survey was 52° Fahrenheit. The air temperature was 53° Fahrenheit. The sites were sampled by Matt Rice and Maddie Hicks (CDFW).

In Reach 1, which comprised the first 1,572 feet of stream, 10 sites were sampled. The reach sites yielded 7 young-of-the-year (YOY) coho, and one 1+ coho.

During the survey, the upstream-most observation of juvenile coho salmon occurred at 39.3861° north latitude and -123.7378° west longitude, approximately 1,206 feet upstream from the confluence with Hare Creek. No juvenile steelhead were observed.

Table A. Summary of results for a fish composition and distribution survey within South Fork Hare Creek, October 25, 2016.

10/25/16

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	Steelhead Trout			Coho Salmon		Additional Aquatic Species Observed
					YOY	1+	2+	YOY	1+	
Reach 1: B3 Channel Type										
10/25/16	1	14	Pool	307	0	0	0	0	0	
	2	22	Pool	455	0	0	0	0	0	
	3	26	Pool	572	0	0	0	6	0	
	4	28	Pool	637	0	0	0	0	0	
	5	30	Pool	674	0	0	0	0	0	
	6	38	Pool	993	0	0	0	0	1	

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Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	Steelhead Trout			Coho Salmon		Additional Aquatic Species Observed
					YOY	1+	2+	YOY	1+	
	7	39	Pool	1004	0	0	0	0	0	
	8	045	Pool	1206	0	0	0	1	0	
	9	090	Pool	2378	0	0	0	0	0	
	10	092	Pool	2424	0	0	0	0	0	
	11	100	Pool	2557	0	0	0	0	0	

DISCUSSION

South Fork Hare Creek is a B3 channel type for the first 4,526 feet of stream surveyed and an A4 channel type for the next 798 feet. The suitability of B3 and A4 channel types for fish habitat improvement structures is as follows: B3 channel types are excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing-deflectors, and log cover. A4 channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days September 26 to September 28, 2016 and ranged from 52° to 55° Fahrenheit. Air temperatures ranged from 50° to 69° Fahrenheit. This is a suitable water temperature range for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 46% of the total length of this survey, riffles 30%, and pools 14%. Five of the 41 (12%) pools had a maximum residual depth greater than two 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.

Thirty-nine of the 41 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.

The mean shelter rating for pools is 33. The shelter rating in the flatwater habitats is 5. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in South Fork Hare Creek. Large woody debris is the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 97%. Reach 1 had a canopy density of

97%, Reach 2 had a canopy density of 97%. The percentage of right and left bank covered with vegetation was 98% and 98%, respectively.

RECOMMENDATIONS

South Fork Hare Creek should be managed as an anadromous, natural production stream. Recommendations for potential habitat improvement activities are based on target habitat values suitable for salmonids in California's north coast streams. Considering the results from this stream habitat inventory, factors that affect salmonid productivity and CDFW's professional judgment, the following list prioritizes habitat improvement activities in South Fork Hare Creek. Keep in mind, watershed and stream ecosystem processes, land use alterations, changes in land ownership, and other factors could potentially change the order of these recommendations or create the need to remove/add recommendations in the future.

- 1) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.
- 2) Suitable size spawning substrate on Sample Creek is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.
- 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 and August temperature extreme period should be performed for 3 to 5 years.

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 at the confluence with Hare Creek.
22	0003.00	Fish present.
1772	0069.00	Tributary #1 enters on the left bank. The water temperature of the tributary was 53 degrees Fahrenheit, the water temperature downstream of the confluence was 52 degrees Fahrenheit, and the water temperature upstream of the confluence was 52 degrees Fahrenheit. The slope of the tributary is 2%. The tributary accessible to salmonids due to good habitat, no blockades, and plenty of pools. Fish were not observed in the tributary.

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2378	0090.00	Log debris accumulation (LDA) #1 is 8' high x 16' wide x 4' long and contains 4 pieces of large woody debris (LWD). Water does not flow through the LDA and there are no visible gaps in it. Sediment is being retained in the approximate dimensions of 11' wide x 30' long x 4' deep. The sediment is gravel. The LDA is a possible barrier to salmonids as it is a 4ft plunge into 3ft pool with huge logs that won't move. Fish were not observed above the LDA.
2453	0094.00	There is a seep on the left bank.
2482	0096.00	There is a 2' plunge over LWD.
2726	0108.00	Steep banks with bedrock on side.
2776	0109.00	There is active erosion on the left bank measuring 15' high x 12' long.
3067	0118.00	Redwood tree had fallen across creek but did not qualify as barrier.
3524	0134.00	There is a dry right bank tributary.
3811	0144.00	Log across top of unit with a 1.5' plunge.
3925	0148.00	There is a right bank tributary.
4357	0165.00	LDA# 4 is 8' high x 24' wide x 14.5' long and contains 9 pieces of LWD. Water does not flow through and there are no visible gaps. Sediment is retained and ranges from gravel to small cobble. It is a possible barrier to salmonids because it is a 4' plunge into a shallow pool. The channel on the right bank is a series of 1' plunges into a dry patch. There were no fish spotted above.
4483	0171.00	There is a 3' plunge over an LWD.
4513	0173.00	Dry tributary on the right bank.
4520	0174.00	Channel type change. Channel narrows.
4564	0175.00	There is a 2.5' plunge over LWD.
4706	0180.00	Large log spanning channel.
4894	0189.00	There is a 2' plunge.
4919	0190.00	There is a 2' plunge that is over a small woody debris.

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4982	0192.00	LDA#5 is 3.3' high x 11' wide x 4' long with 1 piece of LWD. Water does not flow through it and there are no gaps visible. There is sediment that is being retained at the dimensions of 8' wide x 7' long x 2' deep. Size of the sediment ranges from sand to small cobble. It serves as a possible barrier to juveniles because there is a 3' plunge into minimal water with a single log spanning the channel. No fish were seen above.
5037	0195.00	There is a 1' plunge over and LWD.
5256	0201.00	There is a 3' plunge over LWD.
5309	0203.00	End of Survey. After this unit the creek goes dry for 200' as the gradient increases to 7-8%. It gets wet again but the gradient increases to 15-20% in a boulder section, where there is a 7' plunge over boulders onto bare rock. Habitat has been extremely limited, pools have been mostly absent, and fish have not been seen since near the beginning.

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.

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]	

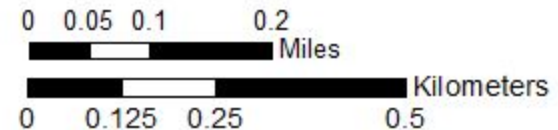
Map 1
South Fork Hare Creek
Hare Creek Watershed
Noyo Hill, Mendocino County

Start of Survey

End of Survey
River Mile 0.99*



— Reach 1: B3 Channel Type — South Fork Hare Creek
— Reach 2: A4 Channel Type



*River Mile indicates distance from confluence with Hare Creek

APPENDIX I

TABLES AND GRAPHS

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

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0

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
24	0	DRY	11.8	23	544	10.2									
74	12	FLATWATER	36.5	33	2430	45.7	4.7	0.3	0.7	156	11522	57	4203		5
1	0	NOSURVEY	0.5	20	20	0.4									
41	41	POOL	20.2	18	744	14.0	7.1	0.7	1.4	125	5135	99	3941	84	33
63	8	RIFFLE	31.0	25	1580	29.7	4.1	0.2	0.5	96	6039	16	1023		0
Total Units 203	Total Units Fully Measured 61			Total Length (ft.) 5318						Total Area (sq.ft.) 22696		Total Volume (cu.ft.) 9167			

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

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 (%)
62	7	LGR	30.5	25	1567	29.5	4	0.2	1	104	6447	18	1116		0	97
1	1	HGR	0.5	13	13	0.2	5	0.1		39	39	4	4		0	95
36	7	RUN	17.7	20	705	13.3	4	0.3	1.3	111	3980	45	1606		7	98
38	5	SRN	18.7	45	1725	32.4	5	0.3	0.9	219	8319	74	2807		1	97
33	33	MCP	16.3	18	587	11.0	7	0.7	3.6	125	4117	97	3199	82	34	97
1	1	CCP	0.5	7	7	0.1	12	0.4	1.2	84	84	50	50	34	15	93
4	4	LSL	2.0	19	75	1.4	8	1.0	3.1	142	567	162	487	141	49	97
1	1	LSR	0.5	21	21	0.4	6	0.4	0.9	126	126	63	63	50	30	95
2	2	LSBk	1.0	27	54	1.0	5	0.5	1.2	121	242	71	142	57	3	100
24	0	DRY	11.8	23	544	10.2										98
1	0	NS	0.5	20	20	0.4										

Total Units
203

Total Units Fully Measured
61

Total Length (ft.)
5318

Total Area (sq.ft.)
23919

Total Volume (cu.ft.)
9474

Table 3 - Summary of Pool Types

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

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
34	34	MAIN	83	17	594	80	7.1	0.7	124	4201	81	2754	33
7	7	SCOUR	17	21	150	20	6.8	0.7	134	935	98	588	33
Total Units	Total Units Fully Measured			Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)		
41	41			744					5135		3342		

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

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

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
33	MCP	80	3	9	27	82	2	6	1	3	0	0
1	CCP	2	0	0	1	100	0	0	0	0	0	0
4	LSL	10	0	0	2	50	1	25	1	25	0	0
1	LSR	2	1	100	0	0	0	0	0	0	0	0
2	LSBk	5	1	50	1	50	0	0	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
41	5	12	31	76	3	7	2	5	0	0

Mean Maximum Residual Pool Depth (ft.): 1.4

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Dry Units: 24

Confluence Location:

Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

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
62	7	LGR	0	0	0	0	0	0	0	0	0
1	1	HGR	0	0	0	0	0	0	0	0	0
63	8	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
36	7	RUN	50	50	0	0	0	0	0	0	0
38	5	SRN	0	0	100	0	0	0	0	0	0
74	12	TOTAL FLAT	33	33	34	0	0	0	0	0	0
33	33	MCP	14	28	57	2	0	0	0	0	0
1	1	CCP	0	0	100	0	0	0	0	0	0
4	4	LSL	0	23	77	0	0	0	0	0	0
1	1	LSR	0	75	25	0	0	0	0	0	0
2	2	LSBk	0	0	100	0	0	0	0	0	0
41	41	TOTAL POOL	11	26	63	0	0	0	0	0	0
2	0	NS	0	0	0	0	0	0	0	0	0
203	61	TOTAL	13	28	59	0	0	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Dry Units: 24

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

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
62	7	LGR	0	0	14	86	0	0	0
1	1	HGR	0	0	0	100	0	0	0
36	7	RUN	0	0	29	57	14	0	0
38	5	SRN	0	0	60	40	0	0	0
33	33	MCP	3	3	55	27	6	3	3
1	1	CCP	100	0	0	0	0	0	0
4	4	LSL	0	0	50	25	0	25	0
1	1	LSR	0	0	100	0	0	0	0
2	2	LSBk	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
97	55	45	0	98	98

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: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Survey Length (ft.): 5318

Main Channel (ft.): 5318

Side Channel (ft.): 0

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27 Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

Summary of Fish Habitat Elements By Stream Reach**STREAM REACH: 1**

Channel Type: B3

Canopy Density (%): 97.1

Pools by Stream Length (%): 16.2

Reach Length (ft.): 4520

Coniferous Component (%): 53.6

Pool Frequency (%): 23.1

Riffle/Flatwater Mean Width (ft.): 4.9

Hardwood Component (%): 46.4

Residual Pool Depth (%):

BFW:

Dominant Bank Vegetation: Hardwood Trees

< 2 Feet Deep: 88

Range (ft.): 5 to 19

Vegetative Cover (%): 97.7

2 to 2.9 Feet Deep: 8

Mean (ft.): 13

Dominant Shelter: Large Woody Debris

3 to 3.9 Feet Deep: 5

Std. Dev.: 3

Dominant Bank Substrate Type: Sand/Silt/Clay

>= 4 Feet Deep: 0

Base Flow (cfs.): 0.0

Occurrence of LWD (%): 36

Mean Max Residual Pool Depth (ft.): 1.4

Water (F): 52 - 55 Air (F): 50 - 69

LWD per 100 ft.:

Mean Pool Shelter Rating: 34

Dry Channel (ft): 426

Riffles: 1

Pools: 11

Flat: 3

Pool Tail Substrate (%): Silt/Clay: 3 Sand: 0 Gravel: 69 Sm Cobble: 23 Lg Cobble: 3 Boulder: 3 Bedrock: 0

Embeddedness Values (%): 1. 77.5 2. 17.5 3. 0.0 4. 0.0 5. 5.0

STREAM REACH: 2

Channel Type: A4

Canopy Density (%): 97.6

Pools by Stream Length (%): 1.6

Reach Length (ft.): 798

Coniferous Component (%): 63.8

Pool Frequency (%): 3.3

Riffle/Flatwater Mean Width (ft.): 3.0

Hardwood Component (%): 36.3

Residual Pool Depth (%):

BFW:

Dominant Bank Vegetation: Coniferous Trees

< 2 Feet Deep: 100

Range (ft.): 5 to 8

Vegetative Cover (%): 98.8

2 to 2.9 Feet Deep: 0

Mean (ft.): 7

Dominant Shelter:

3 to 3.9 Feet Deep: 0

Std. Dev.: 1

Dominant Bank Substrate Type: Sand/Silt/Clay

>= 4 Feet Deep: 0

Base Flow (cfs.): 0.0

Occurrence of LWD (%): 0

Mean Max Residual Pool Depth (ft.): 1.6

Water (F): 53 - 54 Air (F): 53 - 55

LWD per 100 ft.:

Mean Pool Shelter Rating: 0

Dry Channel (ft): 118

Riffles: 2

Pools: 8

Flat: 3

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 100 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 0.0 2. 100.0 3. 0.0 4. 0.0 5. 0.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Confluence Location: Quad: NOYO HILL

Legal Description: T18NR17WS27

Latitude: 39:23:19.0N

Longitude: 123:44:06.0W

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	4	3	5.7
Boulder	0	0	0.0
Cobble / Gravel	20	20	32.8
Sand / Silt / Clay	37	38	61.5

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	0	0	0.0
Brush	19	22	33.6
Hardwood Trees	18	21	32.0
Coniferous Trees	24	18	34.4
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 1

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

Stream Name: South Fork Hare Creek

LLID: 1237350393887

Drainage: Noyo River

Survey Dates: 9/26/2016 to 9/28/2016

Confluence Location:

Quad: NOYO HILL

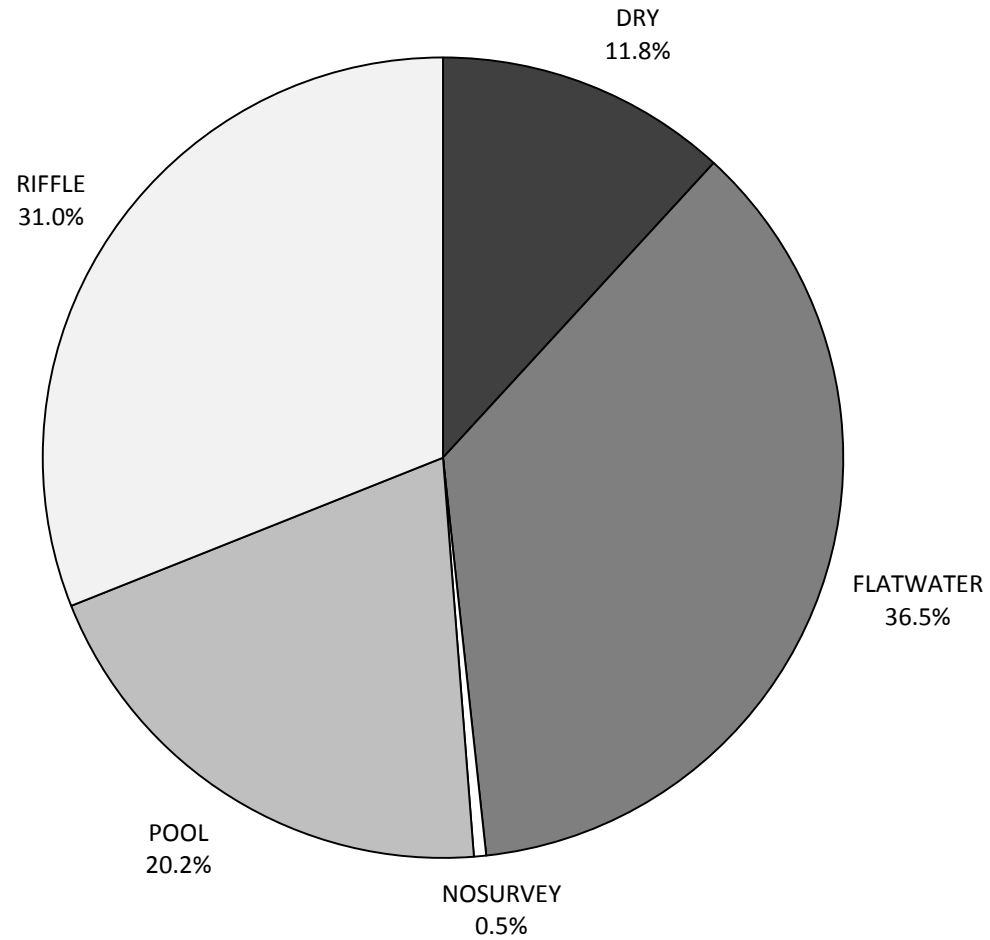
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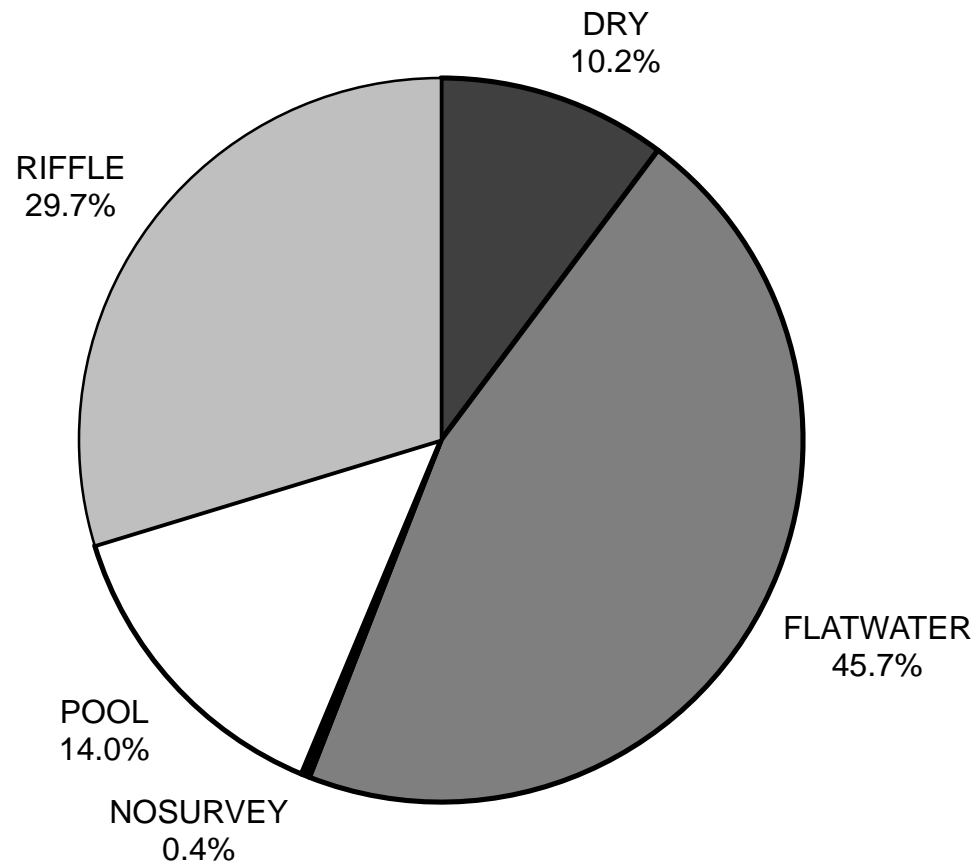
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	33	10
SMALL WOODY DEBRIS (%)	0	33	24
LARGE WOODY DEBRIS (%)	0	34	56
ROOT MASS (%)	0	0	10
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	0
BEDROCK LEDGES (%)	0	0	0

SOUTH FORK HARE CREEK 2016 HABITAT TYPES BY PERCENT OCCURRENCE



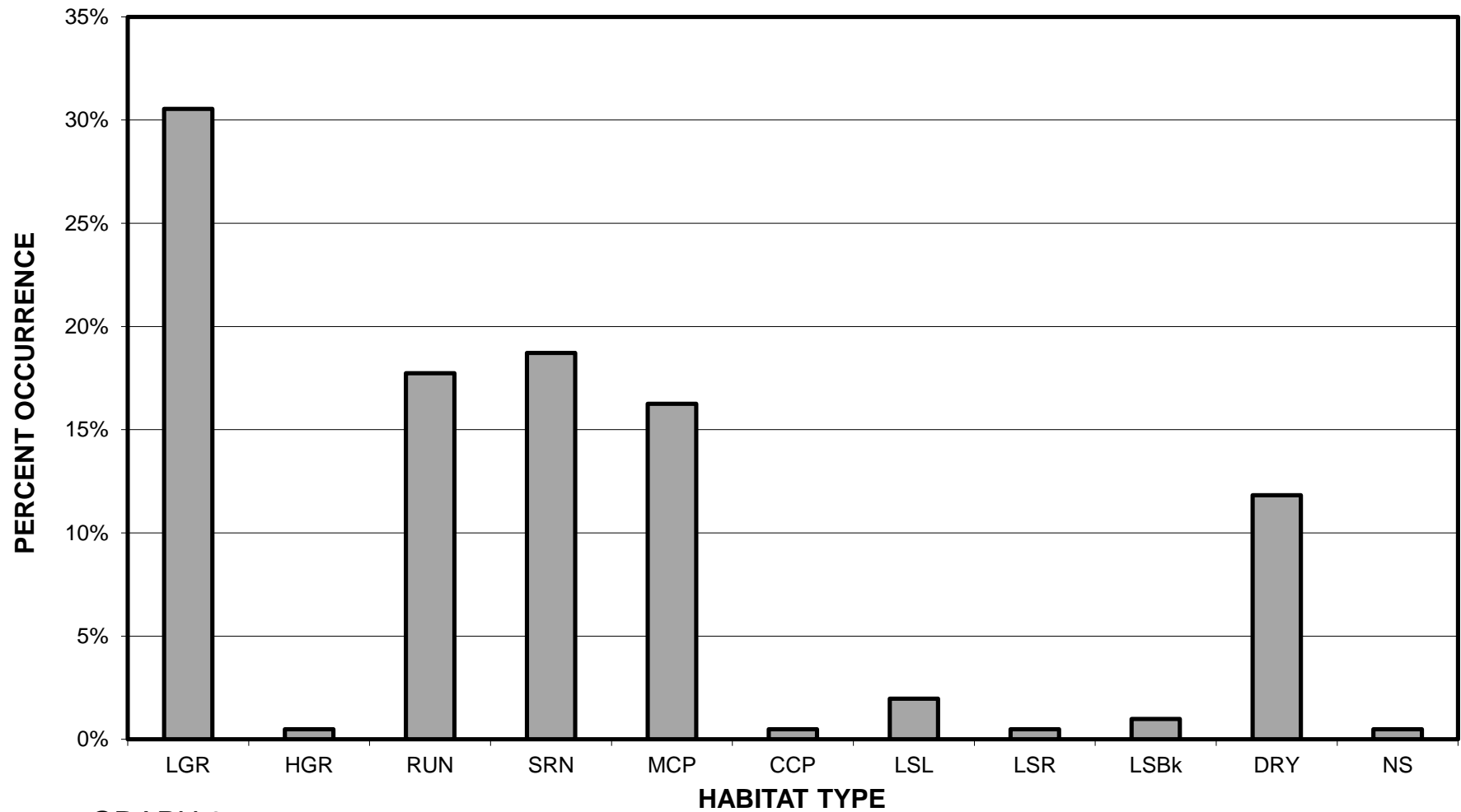
GRAPH 1

SOUTH FORK HARE CREEK 2016 HABITAT TYPES BY PERCENT TOTAL LENGTH



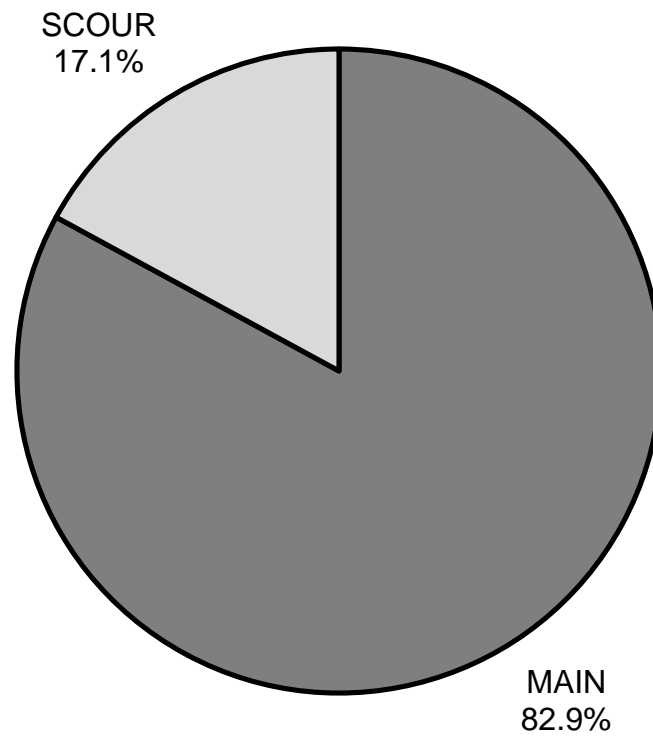
GRAPH 2

SOUTH FORK HARE CREEK 2016 **HABITAT TYPES BY PERCENT OCCURRENCE**



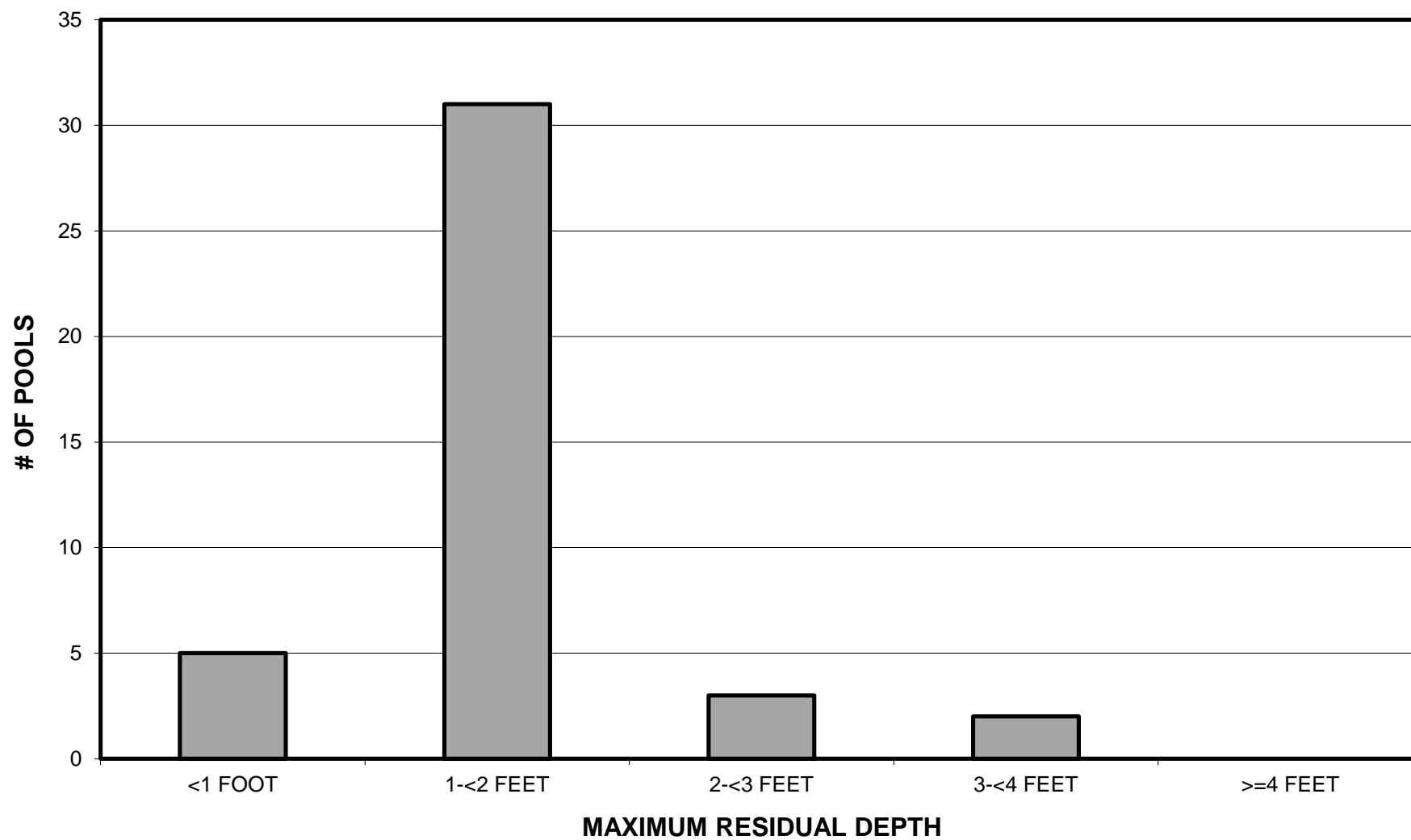
GRAPH 3

**SOUTH FORK HARE CREEK 2016
POOL TYPES BY PERCENT OCCURRENCE**



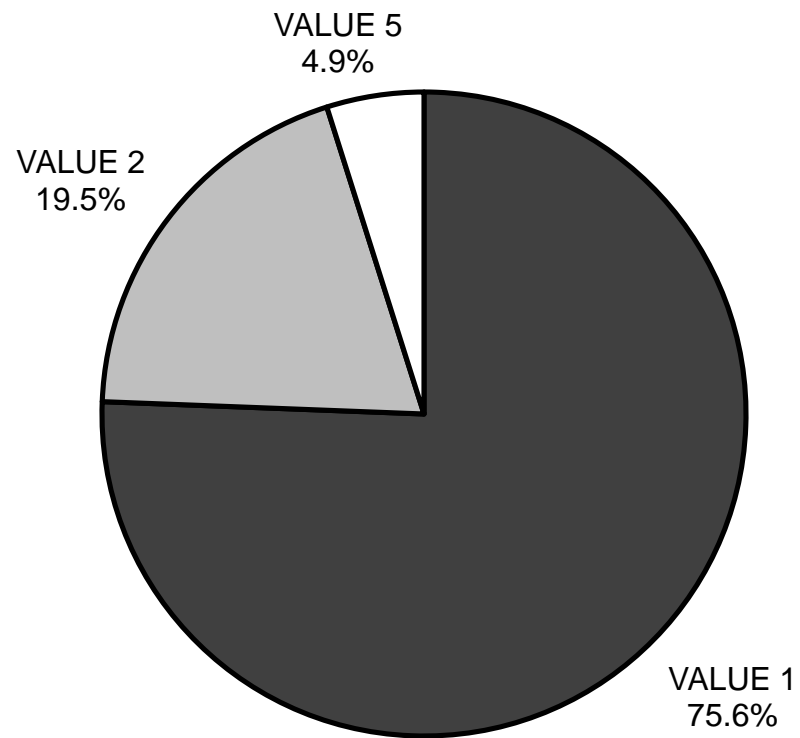
GRAPH 4

SOUTH FORK HARE CREEK 2016 MAXIMUM DEPTH IN POOLS



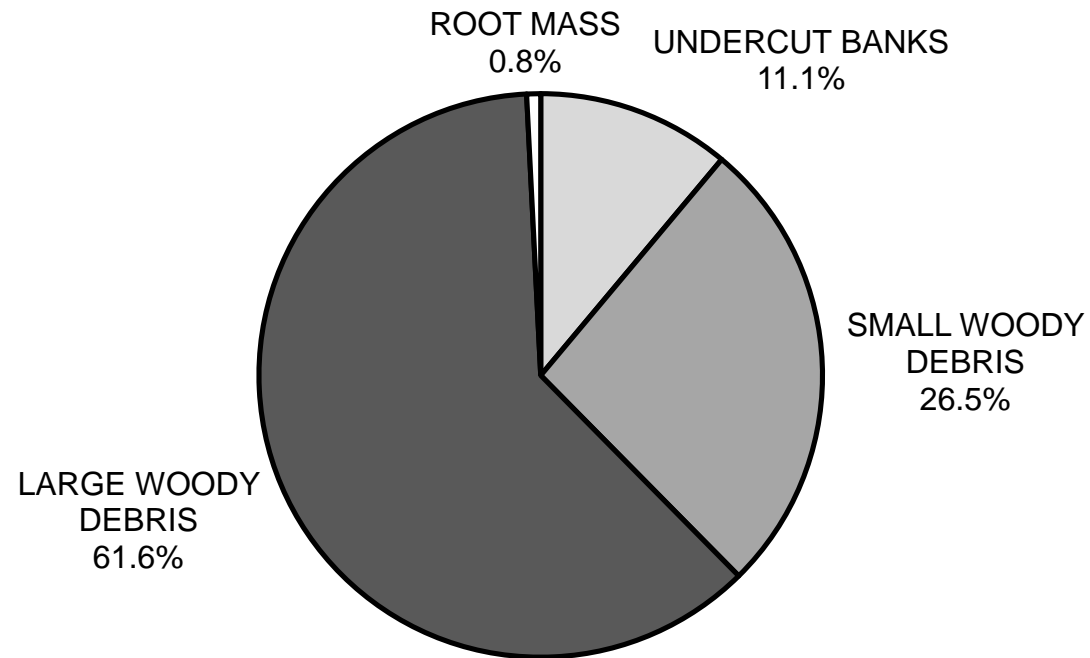
GRAPH 5

SOUTH FORK HARE CREEK 2016 PERCENT EMBEDDEDNESS



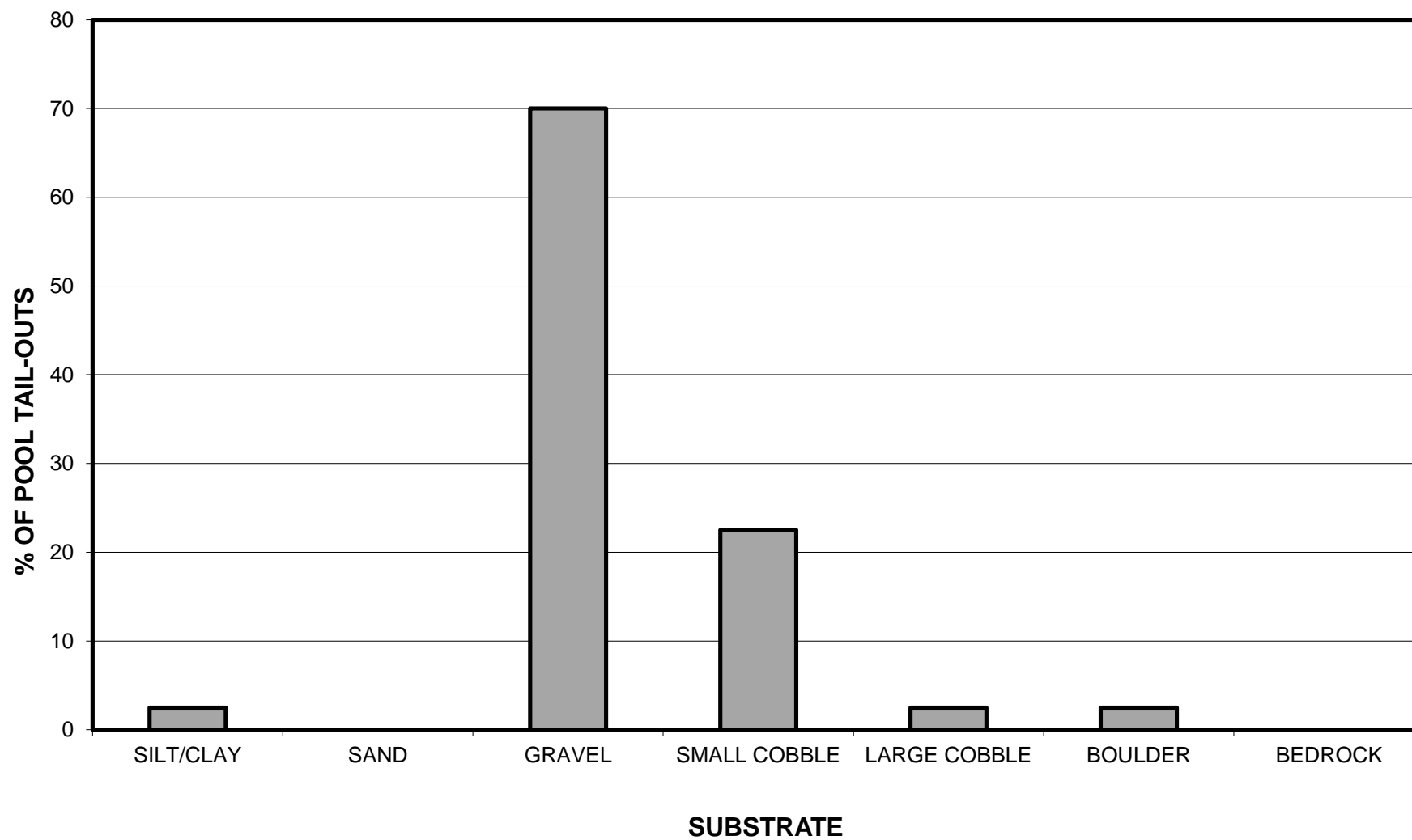
GRAPH 6

SOUTH FORK HARE CREEK 2016 MEAN PERCENT COVER TYPES IN POOLS



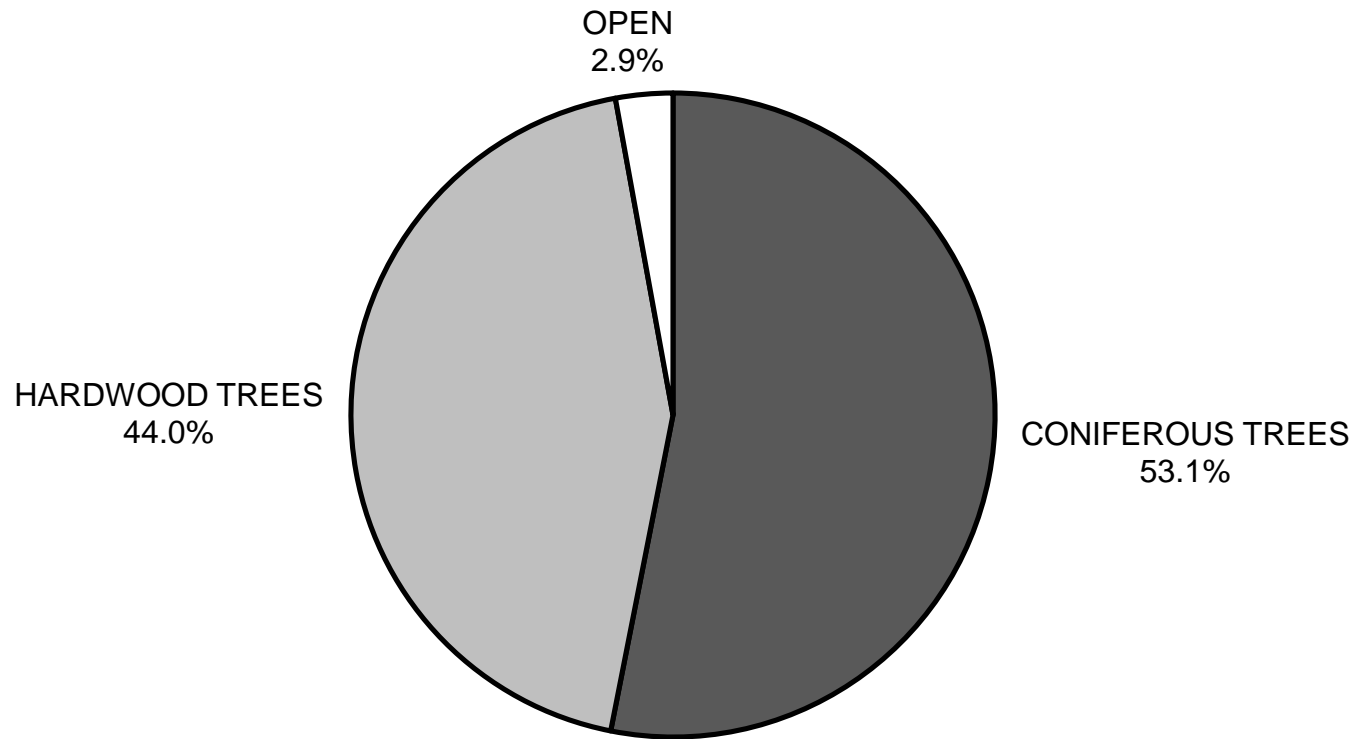
GRAPH 7

SOUTH FORK HARE CREEK 2016 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



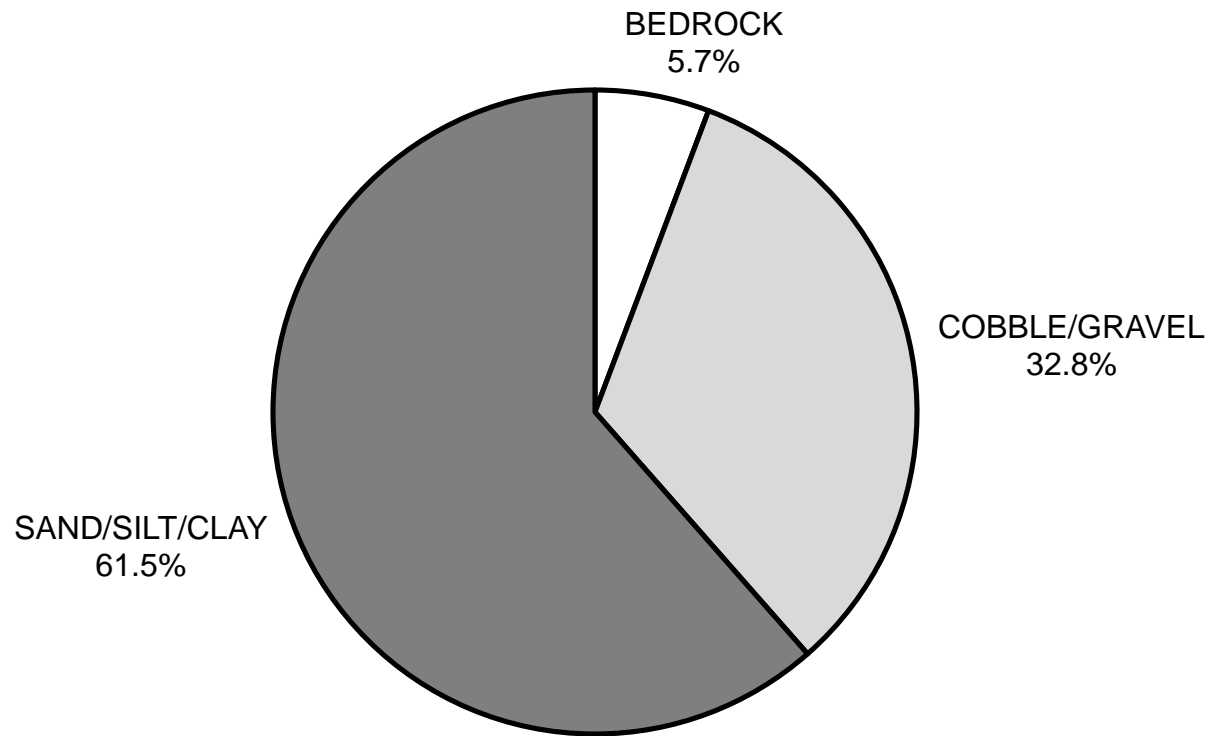
GRAPH 8

**SOUTH FORK HARE CREEK 2016
MEAN PERCENT CANOPY**



GRAPH 9

**SOUTH FORK HARE CREEK 2016
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

SOUTH FORK HARE CREEK 2016 DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11