

STREAM INVENTORY REPORT

Ten Mile Creek

INTRODUCTION

Adult carcass surveys were conducted on Ten Mile Creek by the California Department of Fish and Game (DFG) from 1987 through 1996. The table below describes the results of those surveys:

Ten Mile Creek Carcass Surveys 1987-1996

		Chinook Salmon				Other	
Year	# of Surveys	Live Fish	# of Carcass	AdiposeC lipCWT	Redds seen	Coho seen	SH/RT seen
1987	4	160	576	0	100	4	0
1988	5	51	291	4	69	0	0
1989	3	4	117	0	9	0	0
1996	1	2	6	0	0	0	0

Two carcasses found on the surveys of 1988 had adipose fin clips, but no coded wire tags (CWT) were found in the snouts. Two more adipose clipped carcasses were found on the surveys of 1988; one of those fish bore CWT # 06-05-23 and was from the Marshall Creek ponds on the South Fork Eel, brood year 1985. The other fish bore #H60701 and was from Hollow Tree Creek, reared at DFG's Silverado Hatchery. The drought related low flows during prime migration periods from 1989 through 1992 made Ten Mile Creek, typical of many Eel River tributaries, inaccessible to most chinook salmon. The objective of this report is to document the current habitat conditions in Ten Mile Creek, and recommend options for the enhancement of habitat for chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Ten Mile Creek is tributary to the South Fork Eel River, tributary to the Eel River, located in Mendocino County, California. Ten Mile Creek's legal description at the confluence with the Eel River is T22N R16W S16. Its location is 39°45'17" North latitude and 123°37'49" West longitude. Ten Mile Creek is a third order stream and has approximately 50.4 miles of blue line stream according to the USGS Leggett, Laytonville, Cahto Peak, Lincoln Ridge, Tan Oak Park, and Iron Peak 7.5 minute quadrangles. Ten Mile Creek drains a watershed of approximately 63.5 square miles. Summer base flow is approximately 3.5 cubic

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feet per second (cfs) at the mouth, but over 30 cfs is not unusual during winter storms. Elevations range from about 1,230 feet at the mouth of the creek to 2,900 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is privately owned and is managed for timber production, rangeland, and rural subdivision. Vehicle access exists via Highway 1 West past Branscomb to Wilderness Lodge Road. Follow the road to the Ambrosin Nature Preserve, managed by the Nature Conservancy. Ask the Preserve manager for permission and directions to the mouth of Ten Mile Creek.

METHODS

The habitat inventory conducted in Ten Mile Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The Pacific Coast Fisheries, Wildlife, and Wetlands Restoration Association (PCFWWRA) members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). Ten Mile Creek personnel were trained in May, 1996, by Scott Downie and Ruth Goodfield. 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 (Hopelain, 1994). 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. Habitat unit types encountered for the first time are further 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 Ten Mile Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of

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the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated.

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.

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 (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". Ten Mile 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. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were in feet to the nearest tenth.

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 Ten Mile 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), 76 - 100% (value 4). Additionally, a rating of "not

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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. 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 Ten Mile 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.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*, 1994. Canopy density relates to the amount of stream shaded from the sun. In Ten Mile 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 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 Ten Mile Creek, the dominant composition type (options 1-4) and the dominant vegetation type (options 5-9) of both the right and left banks for each fully-

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described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Ten Mile Creek fish presence was observed from the stream banks, and three sites were electrofished using one Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85 mm) (Valentine, 1995).

DATA ANALYSIS

Data from the habitat inventory form are entered into *Habitat*, a DBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Lotus 1,2,3. Graphics developed for Ten Mile Creek include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness

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- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

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

The habitat inventory of September 16 to October 3, 1996, was conducted by Greg Mullins and Frank Humphrey (PCFWWRA). The total length of the stream surveyed was 83,200 feet with an additional 8,557 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 3.9 cfs on September 18, 1996.

Ten Mile Creek is a B2 channel type for the first 9,616 feet of stream reach surveyed, a C3 for the following 22,977 feet, a C1 for the next 12,102 of stream reach surveyed, an F4 channel type for the next 23,934 feet, a B1 for 4,724 feet, and an F4 for the final 9,847 feet of stream surveyed. B2 and B1 channel types are moderately entrenched, moderate gradient, riffle-dominated channels with stable banks. B1 channels have a predominantly boulder substrate, and B2 channels have predominantly boulder substrates. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. C1 and C3 channels low gradient, meandering, alluvial streams with broad, well defined floodplains. C1 channels have a predominantly bedrock bottom and C3 channels have predominantly cobble substrates.

Water temperatures taken during the survey period ranged from 56 to 74° Fahrenheit. Air temperatures ranged from 51 to 85° F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 48% flatwater units, 25% riffle units, and 25% pool units (Graph 1).

Based on total **length** of Level II habitat types there were 65% flatwater units, 20% pool units, and 11% riffle units (Graph 2).

Sixteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent **occurrence** were runs, 25%; low gradient riffles, 23%; and mid-channel pools, 17% (Graph 3). Based on percent total **length**, step runs made up 30%, runs 28%, and mid-channel pools 14%.

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A total of one hundred thirty-one pools were identified (Table 3). Main channel pools were most frequently encountered at 69% and comprised 73% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. One hundred thirty of the 131 pools (99%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 131 pool tail-outs measured, 15 had a value of 1 (12%); 29 had a value of 2 (22%); 80 had a value of 3 (61%); and 7 had a value of 4 (5%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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. Pool habitat types had a mean shelter rating of 101, and flatwater habitats had a mean shelter rating of 75 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 106. Backwater pools had a mean shelter rating of 105 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Ten Mile Creek and are extensive. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Ten Mile Creek.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 10 of the 15 low gradient riffles measured (67%). Large and small cobble were the next most frequently observed dominant substrate types, and each occurred in 13% of the low gradient riffles (Graph 8).

The mean percent canopy density for the stream reach surveyed was 27%. The mean percentages of deciduous and coniferous trees were 86% and 14%, respectively. Graph 9 describes the canopy in Ten Mile Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 50%. The mean percent left bank vegetated was 44%.

The dominant elements composing the structure of the stream banks consisted of 14.7% bedrock, 31.6% boulder, 31.1% cobble/gravel, and 22.6% sand/silt/clay (Graph 10). Grass was the dominant vegetation type observed in 26% of the units surveyed. Additionally, 70.0% of the units surveyed had deciduous trees as the dominant vegetation type, and 0.5% had coniferous trees as the dominant vegetation, including down

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trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on September 18, 1996, in Ten Mile Creek. The sites were sampled by Ruth Goodfield (DFG), Frank Humphrey, and Dave Smith (PCFWWRA).

The first site sampled included habitat units 0030-0035, a riffle/run/pool sequence approximately 4410 feet from the confluence with South Fork Eel River. This site had an area of 3,750 sq ft and a volume of 3,375 cu ft. The site yielded thirty-two young-of-the-year (YOY) steelhead rainbow trout, four 1+ steelhead rainbow trout, and two 2+ steelhead rainbow trout. The site also yielded eight California Roach and two California suckers.

The second site sampled included habitat units 0115-0117, a riffle/run/pool sequence located approximately 15,932 feet above the creek mouth. The site had an area of 2,500 sq ft and a volume of 1,960 cu ft. The site yielded four YOY and two 1+ steelhead rainbow trout. The site also yielded four green sunfish, 15 California suckers, and approximately 100 California Roach.

The third site sampled included habitat units 0279-0280, a run/pool sequence located approximately 52,587 feet above the creek mouth. The site had an area of 1,340 sq ft and a volume of 1,235 cu ft. The site yielded five YOY and two 1+ steelhead rainbow trout, 70 California Roach, 15 suckers, one green sunfish, and four Lamprey ammocete.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Ten Mile Creek.

DISCUSSION

Ten Mile Creek is a B2 channel type for the first 9,616 feet of stream surveyed, a C3 for the next 22,977 feet, a C1 for the next 12,102 feet, an F4 for the following 23,934 feet, a B1 for the next 4,724 feet, and an F4 for the remaining 9,847 feet. The suitability of B1 and B2 channel types for fish habitat improvement structures is excellent for bank-placed boulders and bank cover. The suitability of C1 and C3 channel types for fish habitat structures is excellent for bank-placed boulders and log

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cover. The suitability of F4 channel types for fish habitat structures is good for bank-placed boulders; fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors, and log cover; and poor for medium-stage weirs and boulder clusters.

The water temperatures recorded on the survey days September 16 to October 3, 1996, ranged from 56 to 74 degrees Fahrenheit. Air temperatures ranged from 51 to 85 degrees Fahrenheit. This is a warm water temperature range for salmonids. Temperatures above 68° F, if sustained, are near the threshold stress level for salmonids. This does seem to be the case here, and Ten Mile Creek seems to have temperatures warmer than is optimum to salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 65% of the total **length** of this survey, riffles 11%, and pools 20%. The pools are relatively deep, with 124 of the 131 (100%) pools having a maximum 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 and fourth order streams, a primary pool is defined to have a maximum 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.

Eighty-seven of the 131 pool tail-outs measured had embeddedness ratings of 3 or 4. Only 15 had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Ten Mile Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was good with a rating of 101.

The shelter rating in the flatwater habitats was slightly lower at 75. A pool shelter rating of approximately 100 is desirable.

The relatively large amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, bedrock ledges contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats are needed to improve both summer and winter salmonid habitat. Log

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cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Twelve of the 15 low gradient riffles measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 27%. This is a low percentage of canopy. In general, re-vegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 50% and 44%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

- 1) Ten Mile Creek should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are above the optimum 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.
- 3) Increase the canopy on Ten Mile Creek by planting willow, alder, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.
- 4) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites, like the site at 65752', should then be treated to reduce the amount of fine sediments entering the stream.
- 5) The road system and other land use activities should be inventoried to identify present and potential sources of sediment yield. Problem sites should be treated.

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- 5) 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.
- 6) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable and in some areas the material is locally available.

PROBLEM SITES AND LANDMARKS

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

0' Begin survey at confluence with South Fork Eel River.
Channel type is a B2 for the first 9616' of stream surveyed.

421' Young-of-the-year salmonids observed by stream surveyors.

4410' Bioinventory site #1.

4423' Large cyprinidae, perhaps Sacramento squawfish, were observed from streambanks by surveyors.

4790' Spring on left bank (LB). Temperature is 55°F.

6635' Small tributary enters from right bank (RB). Temperature is 58°F.

7283' Spring on LB.

7403' Spring on LB.

7569' Small, steep tributary on RB - 53°F.

7828' Spring on LB.

8092' Spring on LB.

8494' Small, steep tributary on LB - 54°F.

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9617'Channel type changes to a C3 for the next 22977' of stream surveyed (reach #2).

11236'Spring on LB - 55°F.

12406'Lateral erosion occurring on LB. Needs some armor.

13597'Dry tributary on RB.

15932'Bioinventory site #2.

16325'Peterson Creek enters from LB - 55°F. Seven YOY steelhead rainbow trout were electrofished approximately 200' upstream on Peterson Creek by Ruth Goodfield and Frank Humphrey on 9/28/96.

22857'Grubb Creek enters from RB - dry at the mouth.

32593'Channel type changes to a C1 for the next 12102' of stream surveyed (reach #3).

38449'Railroad car bridge crosses stream.

40849'Small tributary on LB - 62°F.

42739'Small tributary on LB.

42789'Flatcar bridge crosses stream.

44696'Channel type changes to an F4 for the next 23934' of stream surveyed (reach #4).

45417'Spring on LB - 62°F.

46313'Streeter Creek enters from LB - 59°F.

46798' Dry tributary on RB.

50775' Lewis Creek enters from RB - 59°F.

52289' Big Rock Creek enters from LB - 65°F.

52587' Bioinventory site #3.

57106' Concrete bridge crosses stream.

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- 65658' Rip-rap project apparent on LB.
- 65752' Lateral erosion problems occurring on the RB. Could use some bank armoring.
- 68724' Channel type changes to a B1 for the next 4724' of stream surveyed (reach #5).
- 69968' Tributary enters on LB - 61°F.
- 71649' Mill Creek enters on LB - 55°F.
- 73756' Channel type changes to an F4 for the remaining 9847' of stream surveyed (reach #6).
- 74154' Spring on RB.
- 74892' Spring on RB.
- 78144' Spring on RB.
- 79644' Cahto Creek enters from LB - 59°F.
- 83200' Stream flow is intermittent. Surveyors hiked about 3000' further and saw no water or habitat. End of survey.

References

- Flosi, G., and F. Reynolds. 1994. California salmonid stream habitat restoration manual, 2nd edition. California Department of Fish and Game, Sacramento, California.
- Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.
- Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, California.

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5

Drainage: S.F. EEL RIVER

Table 1 SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES Survey Dates: 09/16/96 to 10/03/96

Confluence Location: QUAD: LEGGETT LEGAL DESCRIPTION: T22NR16WS16 LATITUDE: 39°45'17" LONGITUDE: 123°37'49"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq. ft.)	ESTIMATED TOTAL AREA (sq. ft.)	MEAN ESTIMATED VOLUME (cu. ft.)	ESTIMATED TOTAL VOLUME (cu. ft.)	MEAN RESIDUAL POOL VOL (cu. ft.)	MEAN SHELTER RATING
131	18	RIFFLE	25	77	10028	11	19.2	0.6	1239	162266	786	102958	0	66
248	42	FLATWATER	48	241	59740	65	32.8	1.3	6860	1701259	11302	*****	100	75
131	35	POOL	25	138	18104	20	37.1	3.1	4266	558843	16427	*****	14021	101
10	0	DRY	2	389	3885	4	0.0	0.0	0	0	0	0	0	0
TOTAL UNITS	TOTAL UNITS				TOTAL LENGTH (ft.)				TOTAL AREA (sq. ft.)		TOTAL VOL. (cu. ft.)			
520	95				91757				2422367		5057804			

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Drainage: S.F. BEL RIVER

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 09/16/96 to 10/03/96

Confluence Location: QUAD: LEGGETT LEGAL DESCRIPTION: T22NR16WS16 LATITUDE: 39°45'17" LONGITUDE: 123°37'49"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft.	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MEAN MAXIMUM DEPTH ft.	MEAN AREA sq.ft.	TOTAL AREA sq.ft.	MEAN VOLUME cu.ft.	TOTAL VOLUME cu.ft.	MEAN RESIDUAL POOL cu.ft.	MEAN SHELTER RATING	MEAN CANOPY %
121	15	LGR	23	78	9388	10	20	0.5	2.4	1314	159013	710	85922	0	51	24
9	2	HGR	2	70	627	1	19	1.3	3.3	1261	11346	1729	15561	0	210	20
1	1	CAS	0	13	13	0	6	0.6	1.4	62	62	37	37	0	0	35
34	4	POW	7	201	6821	7	34	1.5	5.1	2944	100095	4728	160752	0	154	11
128	21	RUN	25	198	25329	28	34	1.5	5.2	6581	842428	12332	*****	0	63	28
86	17	SRN	17	321	27590	30	31	1.1	22.0	8125	698773	11577	995649	247	73	25
87	15	MCP	17	143	12400	14	35	3.0	9.9	5147	447802	19039	*****	16574	99	38
1	1	CCP	0	45	45	0	25	1.6	2.9	1125	1125	1800	1800	1013	20	15
3	1	STP	1	233	699	1	45	2.6	3.9	9504	28512	24710	74131	16157	120	5
4	2	LSL	1	83	333	0	31	2.3	5.7	2508	10032	5141	20566	4389	135	32
3	2	LSR	1	68	204	0	17	1.7	5.0	1512	4537	3447	10342	2147	105	53
13	6	LSBk	3	145	1883	2	53	4.4	12.8	5407	70297	29208	379705	25584	100	16
18	6	LSBo	3	130	2340	3	36	2.9	5.7	2493	44875	6867	123604	5161	95	28
1	1	PLP	0	94	94	0	40	6.6	10.4	3008	3008	19853	19853	18349	150	60
1	1	SCP	0	106	106	0	30	3.1	6.0	3021	3021	9365	9365	9063	105	35
10	0	DRY	2	389	3885	4	0	0.0	0.0	0	0	0	0	0	0	17

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
520	95	91757	2424928	5132114

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Drainage: S.F. BEL RIVER

Table 2. SUMMARY OF POOL TYPES

Survey Dates: 09/16/96 to 10/03/96

Confluence Location: QUAD: LEGGETT LEGAL DESCRIPTION: T22NR16WS16 LATITUDE: 39°45'17" LONGITUDE: 123°37'49"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME (cu.ft.)	MEAN RESIDUAL POOL VOL. (cu.ft.)	MEAN SHBLTER RATING
91	17	MAIN	69	144	13144	73	35.4	2.9	5167	470183	18358	*****	15634	96
39	17	SCOUR	30	124	4854	27	39.3	3.4	3438	134095	14911	581513	12699	106
1	1	BACKWATER	1	106	106	1	30.0	3.1	3021	3021	9365	9365	9063	105
TOTAL UNITS	TOTAL UNITS				TOTAL LENGTH (ft.)				TOTAL AREA (sq.ft.)			TOTAL VOL. (cu.ft.)		
131	35				18104				607299			2261490		

TEN MILE CREEK

Drainage: S.F. BEL RIVER

Table 1 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES

Survey Dates: 09/16/96 to 10/03/96

Confluence Location: QUAD: LRGSETT LEGAL DESCRIPTION: T22NR16WS16 LATITUDE: 39°45'17" LONGITUDE: 123°37'49"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT		1-<2 FT.		2-<3 FT.		3-<4 FT.		>=4 FEET	
			MAXIMUM DEPTH	PERCENT OCCURRENCE	MAXIMUM DEPTH	PERCENT OCCURRENCE	MAXIMUM DEPTH	PERCENT OCCURRENCE	MAXIMUM DEPTH	PERCENT OCCURRENCE	MAXIMUM DEPTH	PERCENT OCCURRENCE
87	MCP	66	0	0	0	0	4	5	12	14	71	82
1	CCP	1	0	0	0	0	1	100	0	0	0	0
3	STP	2	0	0	0	0	0	0	1	33	2	67
4	LSL	3	0	0	0	0	1	25	1	25	2	50
3	LSR	2	0	0	1	33	0	0	0	0	2	67
13	LSBk	10	0	0	0	0	0	0	2	15	11	85
18	LSBo	14	0	0	0	0	0	0	4	22	14	78
1	PLP	1	0	0	0	0	0	0	0	0	1	100
1	SCP	1	0	0	0	0	0	0	0	0	1	100

TOTAL

UNITS

131

TEN MILE CREEK

Drainage: S.F. BEL RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 09/16/96 to 10/03/96

Confluence Location: QUAD: LEGGETT LEGAL DESCRIPTION: T22NR16WS16 LATITUDE: 39°45'17" LONGITUDE: 123°37'49"

TOTAL HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
121	15	LGR	0	0	67	13	13	0	7
9	2	HGR	0	0	0	0	0	100	0
1	1	CAS	0	0	0	0	0	100	0
34	4	POW	0	0	0	0	0	100	0
128	21	RUN	10	0	67	5	5	5	10
86	17	SRN	0	0	82	0	0	6	12
87	15	MCP	13	13	47	0	0	13	13
1	1	CCP	0	0	100	0	0	0	0
3	1	STP	0	0	100	0	0	0	0
4	2	LSL	0	0	100	0	0	0	0
3	2	LSR	0	50	50	0	0	0	0
13	6	LSBk	17	0	67	0	0	0	17
18	6	LSBo	17	0	50	0	0	17	17
1	1	PLP	0	0	0	0	0	100	0
1	1	SCP	0	0	100	0	0	0	0
10	0	DRY	0	0	0	0	0	0	0

BLE 8. FISH HABITAT INVENTORY DATA SUMMARY

REAM NAME: TEN MILE CREEK
 SAMPLE DATES: 09/16/96 to 10/03/96
 REAM LENGTH: 83200 ft.
 LOCATION OF STREAM MOUTH:
 USGS Quad Map: LEGGETT Latitude: 39°45'17"
 Legal Description: T22NR16WS16 Longitude: 123°37'49"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

REAM REACH 01

Channel Type: B2	Canopy Density: 12%
Channel Length: 9616 ft.	Coniferous Component: 19%
Riffle/Flatwater Mean Width: 47 ft.	Deciduous Component: 81%
Total Pool Mean Depth: 3.7 ft.	Pools by Stream Length: 25%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 100%
Water: 059- 067°F Air: 055- 071°F	Mean Pool Shelter Rtn: 105
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Vegetative Cover: 25%	Occurrence of LOD: 0%
Dom. Bank Substrate: Boulder	Dry Channel: 0 ft.

Embeddness Value: 1. 59% 2. 23% 3. 18% 4. 0%

REAM REACH 02

Channel Type: C3	Canopy Density: 15%
Channel Length: 22977 ft.	Coniferous Component: 2%
Riffle/flatwater Mean Width: 30 ft.	Deciduous Component: 98%
Total Pool Mean Depth: 2.8 ft.	Pools by Stream Length: 31%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 91%
Water: 061- 072°F Air: 068- 082°F	Mean Pool Shelter Rtn: 107
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Vegetative Cover: 38%	Occurrence of LOD: 4%
Dom. Bank Substrate: Boulder	Dry Channel: 0 ft.

Embeddness Value: 1. 3% 2. 16% 3. 82% 4. 0%

REAM REACH 03

Channel Type: C1	Canopy Density: 7%
Channel Length: 12102 ft.	Coniferous Component: 0%
Riffle/flatwater Mean Width: 34 ft.	Deciduous Component: 100%
Total Pool Mean Depth: 3.7 ft.	Pools by Stream Length: 9%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 100%
Water: 059- 074°F Air: 051- 085°F	Mean Pool Shelter Rtn: 98
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Boulders
Vegetative Cover: 42%	Occurrence of LOD: 0%
Dom. Bank Substrate: Boulder	Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 31% 3. 62% 4. 8%

REAM REACH 04

Channel Type: F4	Canopy Density: 34%
Channel Length: 23934 ft.	Coniferous Component: 4%
Riffle/flatwater Mean Width: 39 ft.	Deciduous Component: 96%
Total Pool Mean Depth: 3.0 ft.	Pools by Stream Length: 17%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 100%
Water: 058- 070°F Air: 051- 083°F	Mean Pool Shelter Rtn: 85
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Terrestrial Veg.

Vegetative Cover: 56%
Dom. Bank Substrate: Boulder

Occurrence of LOD: 9%
Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 14% 3. 72% 4. 14%

REAM REACH 05

Channel Type: B1
Channel Length: 4724 ft.
Riffle/flatwater Mean Width: 33 ft.
Total Pool Mean Depth: 5.2 ft.
Base Flow: 0.0 cfs
Water: 058- 061°F Air: 061- 080°F
Dom. Bank Veg.: Deciduous Trees
Vegetative Cover: 66%
Dom. Bank Substrate: Boulder

Canopy Density: 62%
Coniferous Component: 0%
Deciduous Component: 100%
Pools by Stream Length: 26%
Pools >=3 ft.deep: 100%
Mean Pool Shelter Rtn: 100
Dom. Shelter: Terrestrial Veg.
Occurrence of LOD: 2%
Dry Channel: 0 ft.

Embeddness Value: 1. 0% 2. 44% 3. 56% 4. 0%

REAM REACH 06

Channel Type: F4
Channel Length: 9847 ft.
Riffle/flatwater Mean Width: 28 ft.
Total Pool Mean Depth: 2.6 ft.
Base Flow: 0.0 cfs
Water: 056- 061°F Air: 065- 079°F
Dom. Bank Veg.: Deciduous Trees
Vegetative Cover: 71%
Dom. Bank Substrate: Boulder

Canopy Density: 63%
Coniferous Component: 2%
Deciduous Component: 98%
Pools by Stream Length: 16%
Pools >=3 ft.deep: 85%
Mean Pool Shelter Rtn: 78
Dom. Shelter: Small Woody Debris
Occurrence of LOD: 20%
Dry Channel: 3126 ft.

Embeddness Value: 1. 5% 2. 30% 3. 55% 4. 10%

an Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Bedrock	18	10	14.74
Boulder	29	31	31.58
Cobble/Gravel	22	37	31.05
Silt/clay	26	17	22.63

an Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Grass	24	26	26.32
Brush	4	2	3.16
Decid. Trees	66	67	70
Conif. Trees	1	0	0.53
No Vegetation	0	0	0

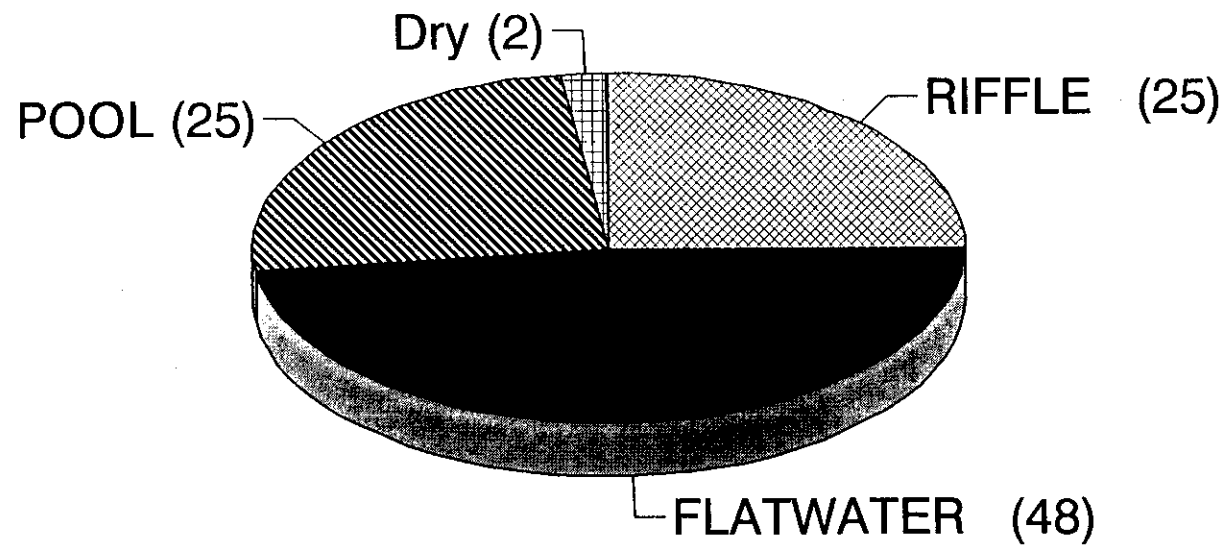
Summary of Mean Percent Vegetative Cover for Entire Stream

P	Mean Percent Conifer	Mean Percent Deciduous	Mean Percent Open units	Mean Right bank % Cover	Mean Left Bank % Cover
	5	95	20	49.7	44.4

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

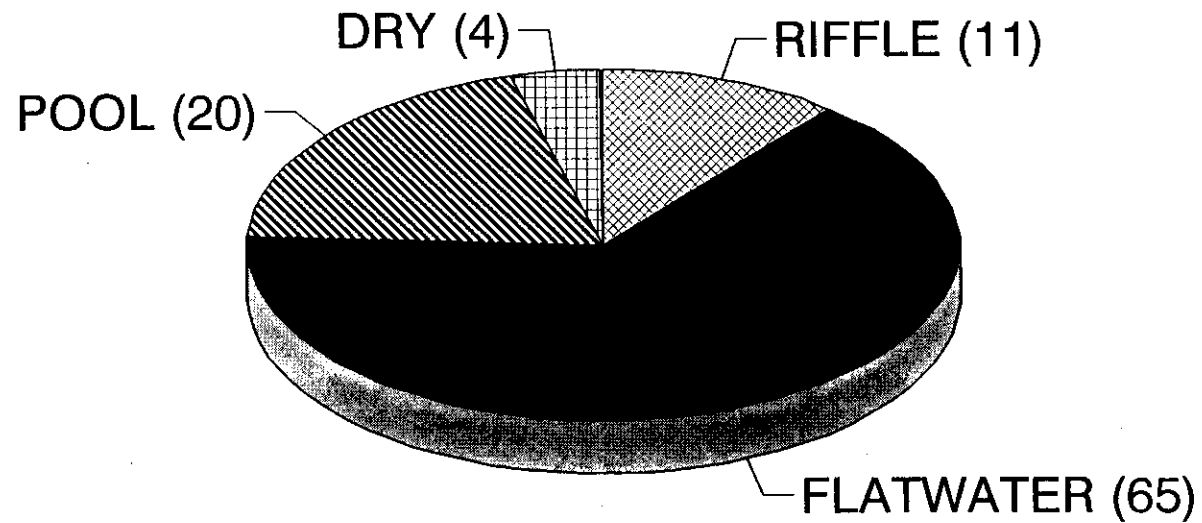
Open units represent habitat units with zero canopy cover.

TENT MILE CREEK HABITAT TYPES BY PERCENT OCCURRENCE



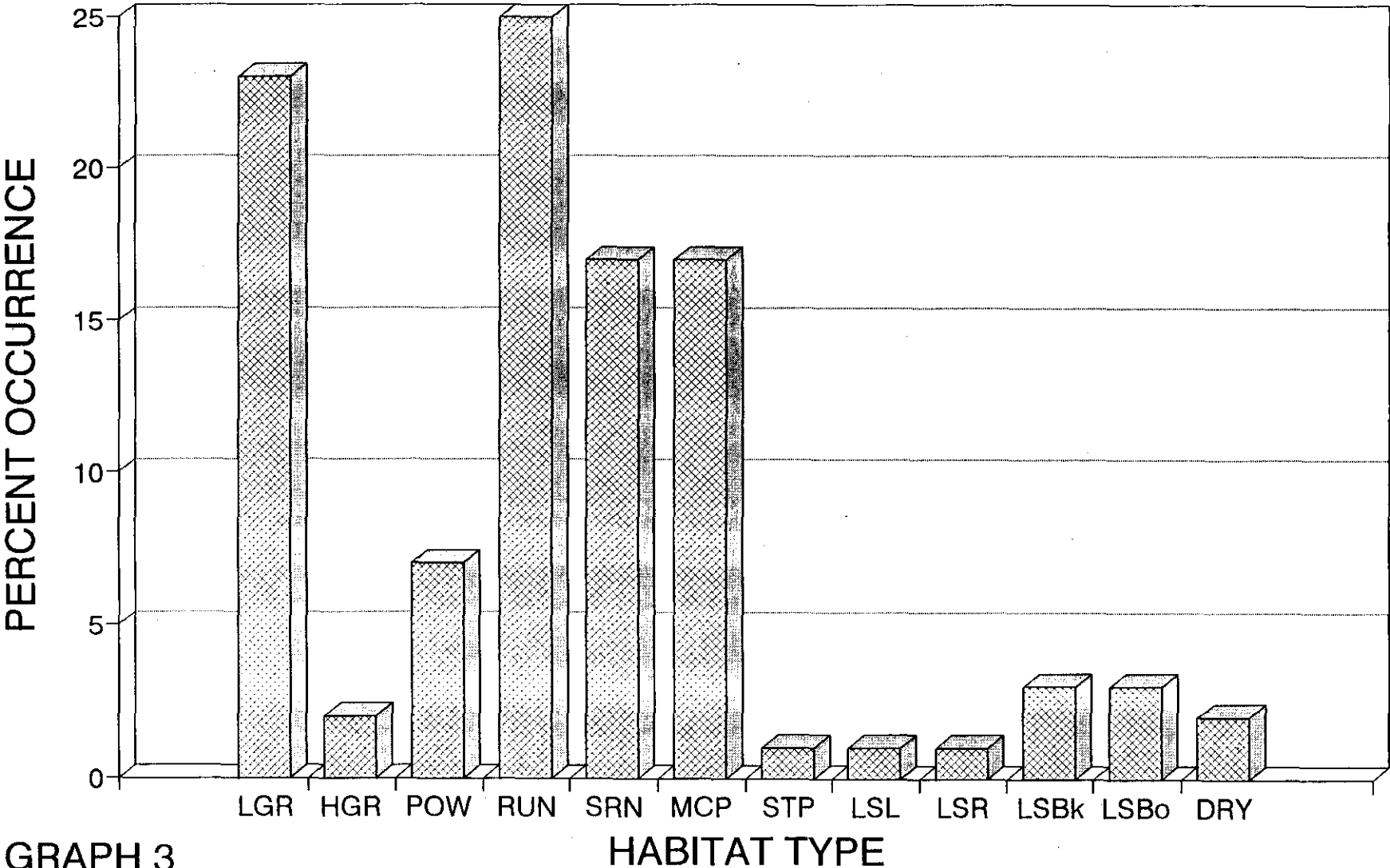
GRAPH 1

Ten Mile Creek HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

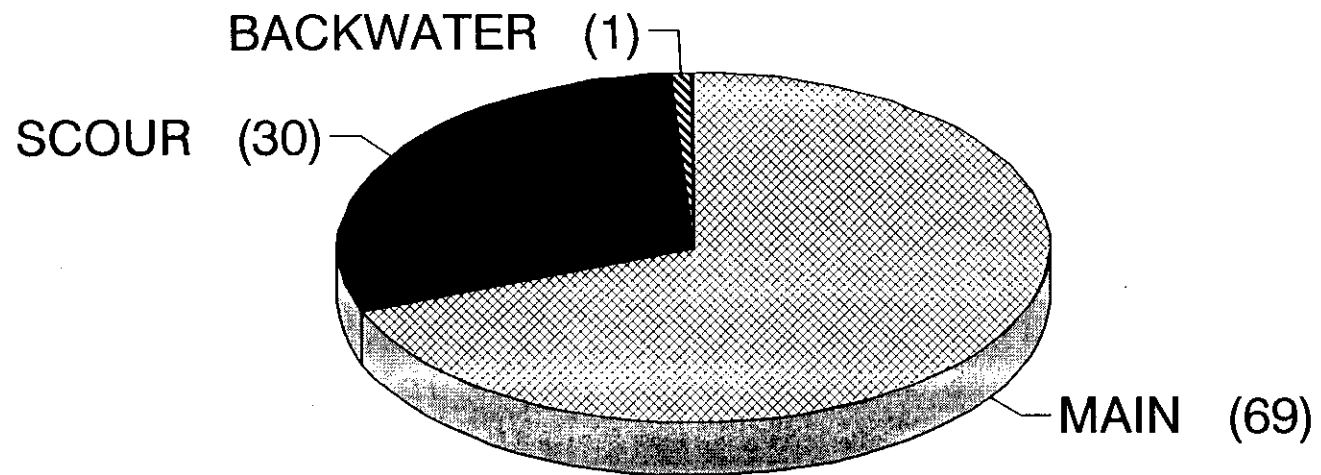
TENT MILE CREEK HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 3

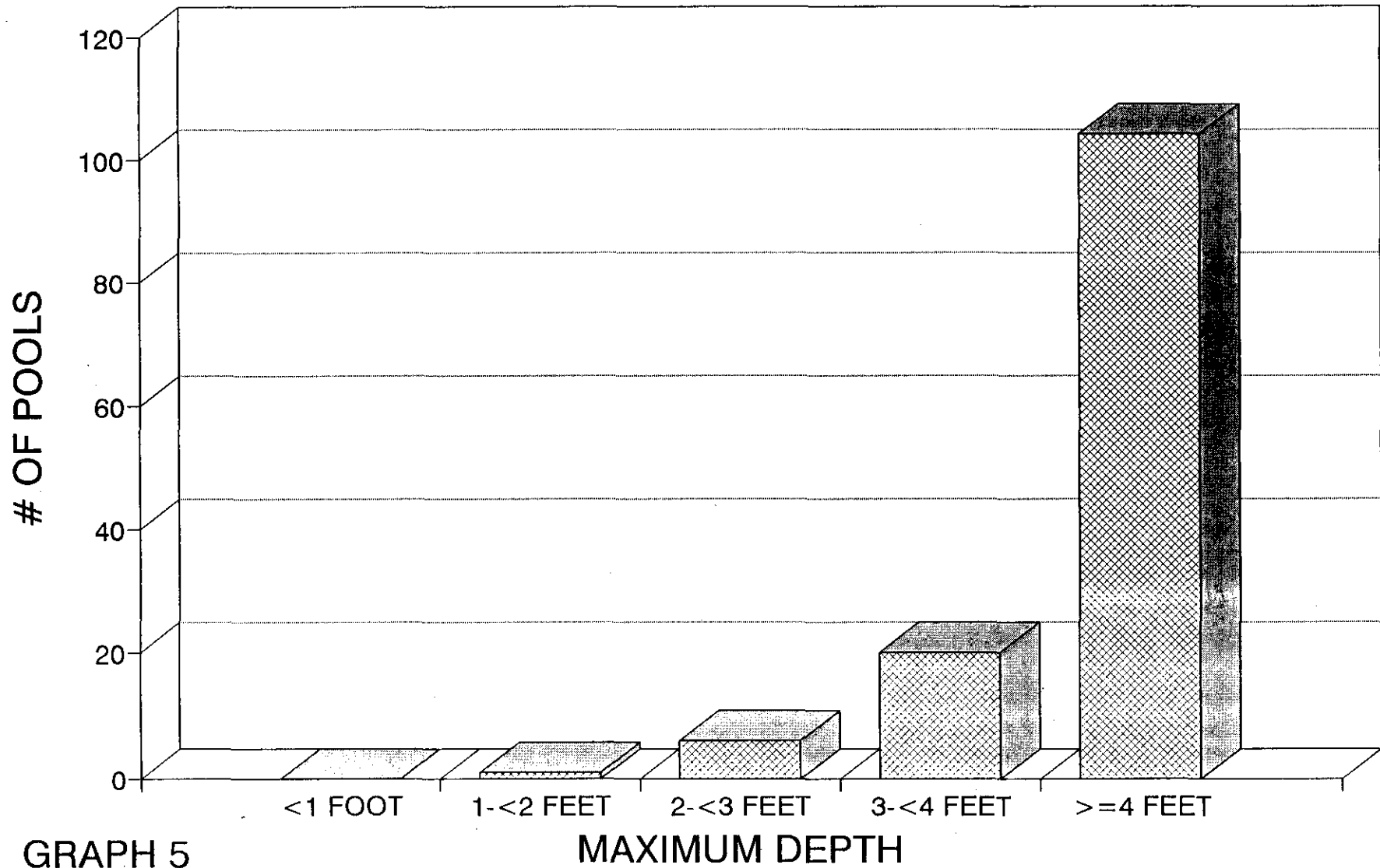
TEN MILE CREEK

Pool Habitats By Percent Occurrence



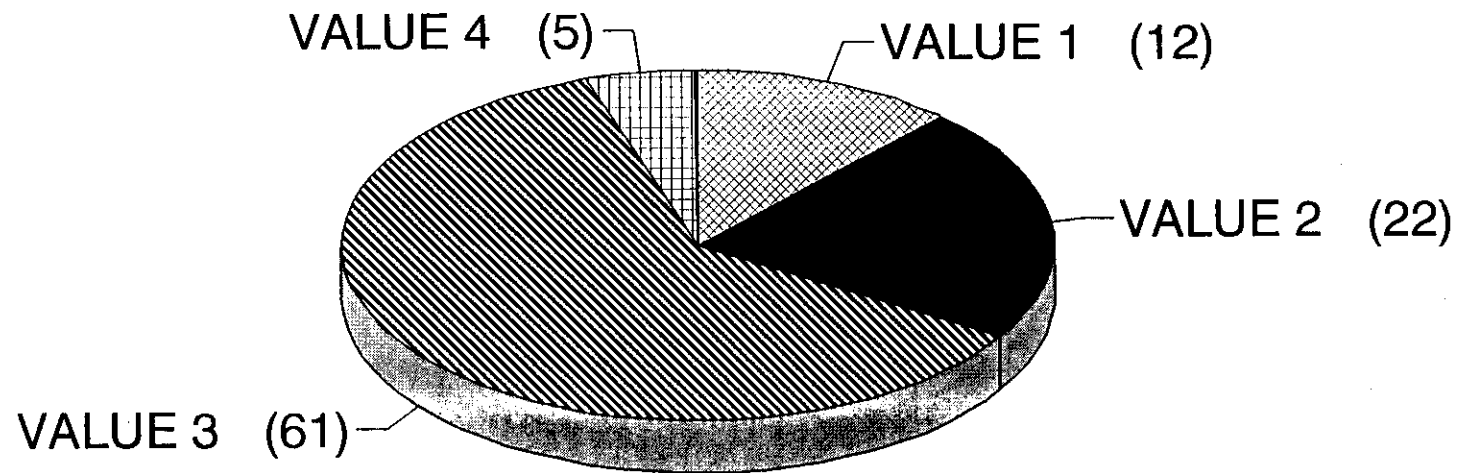
GRAPH 4

TEN MILE CREEK MAXIMUM POOL DEPTHS



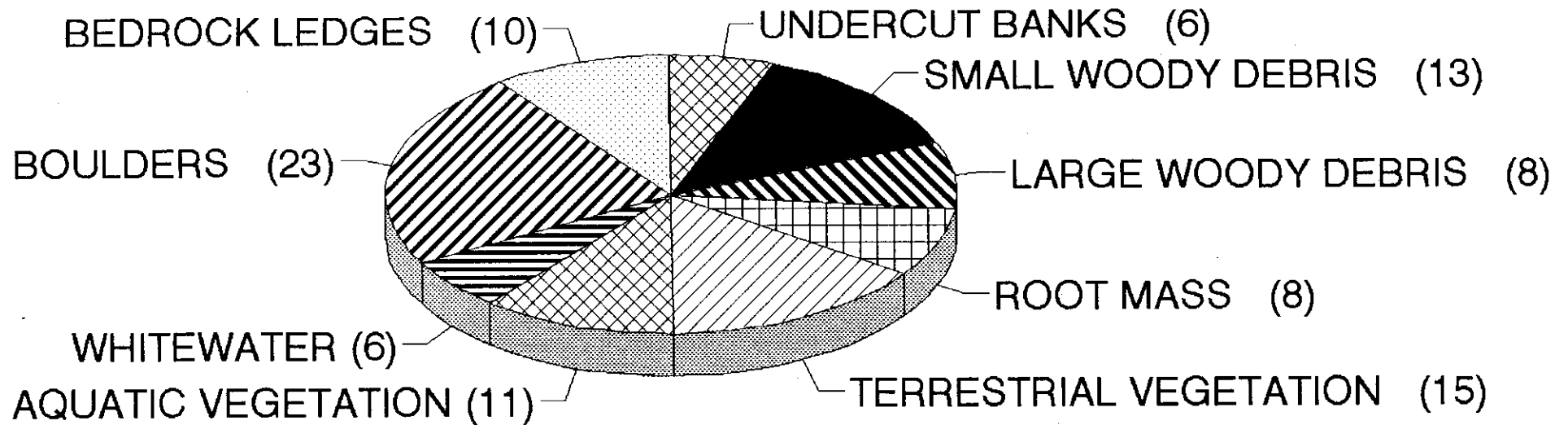
GRAPH 5

TEN MILE CREEK PERCENT EMBEDDEDNESS



GRAPH 6

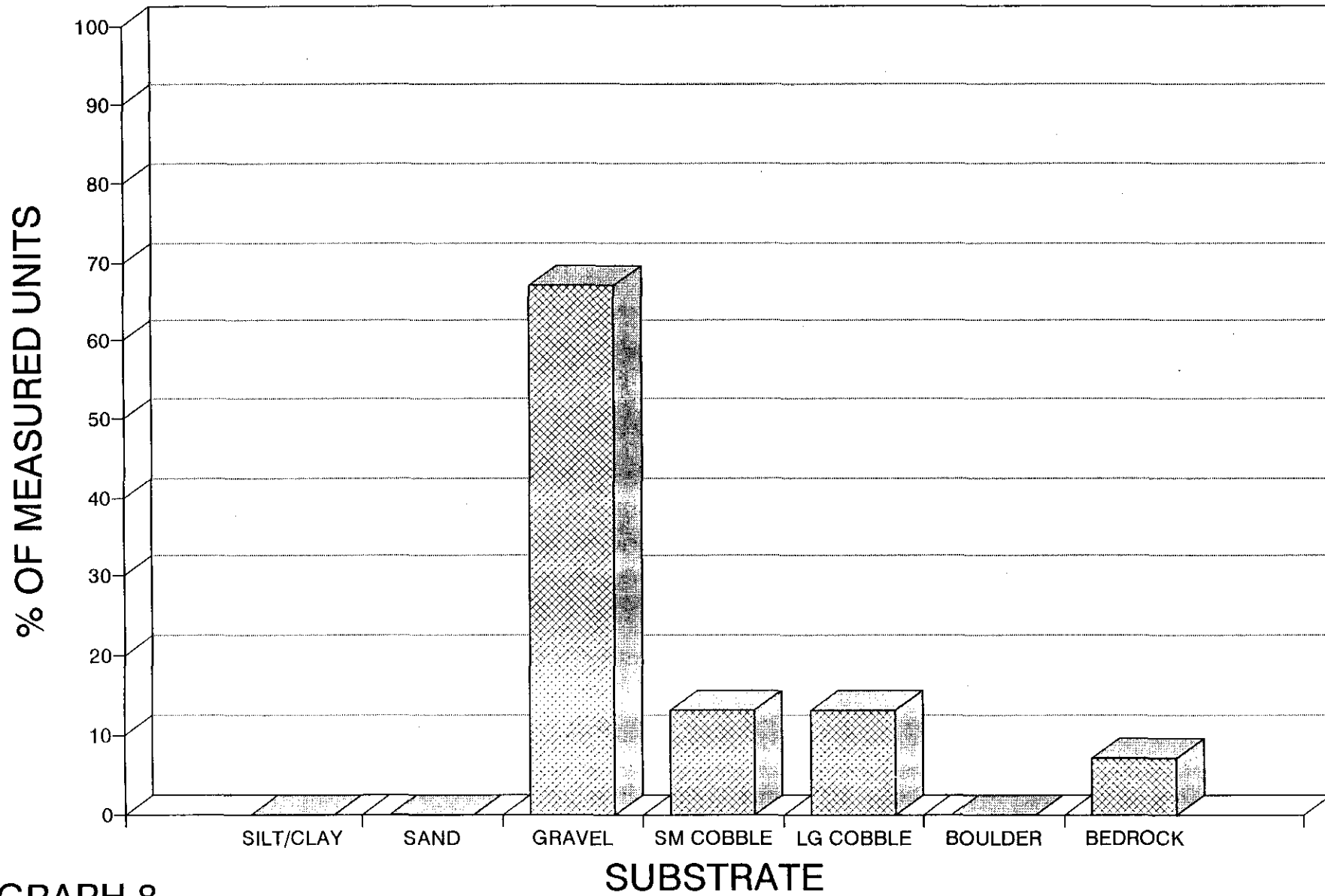
TEN MILE CREEK MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

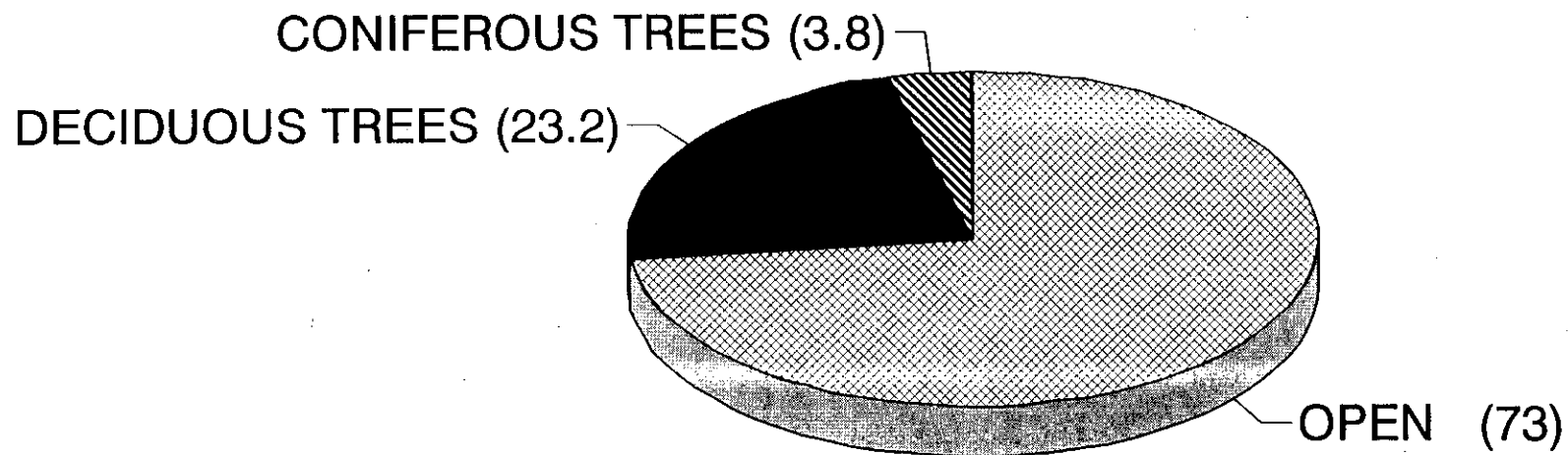
PERCENTAGE OF

SUBSTRATE COMPOSITION IN LOW GRADIENT RIFFLES



GRAPH 8

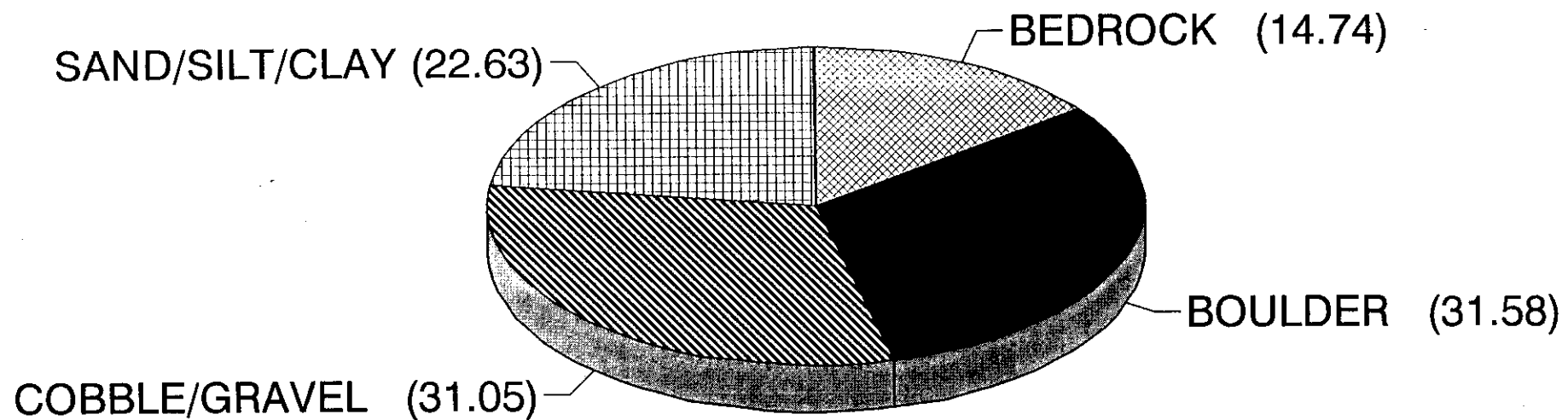
TEN MILE CREEK PERCENT CANOPY



GRAPH 9

10TH MILE CREEK

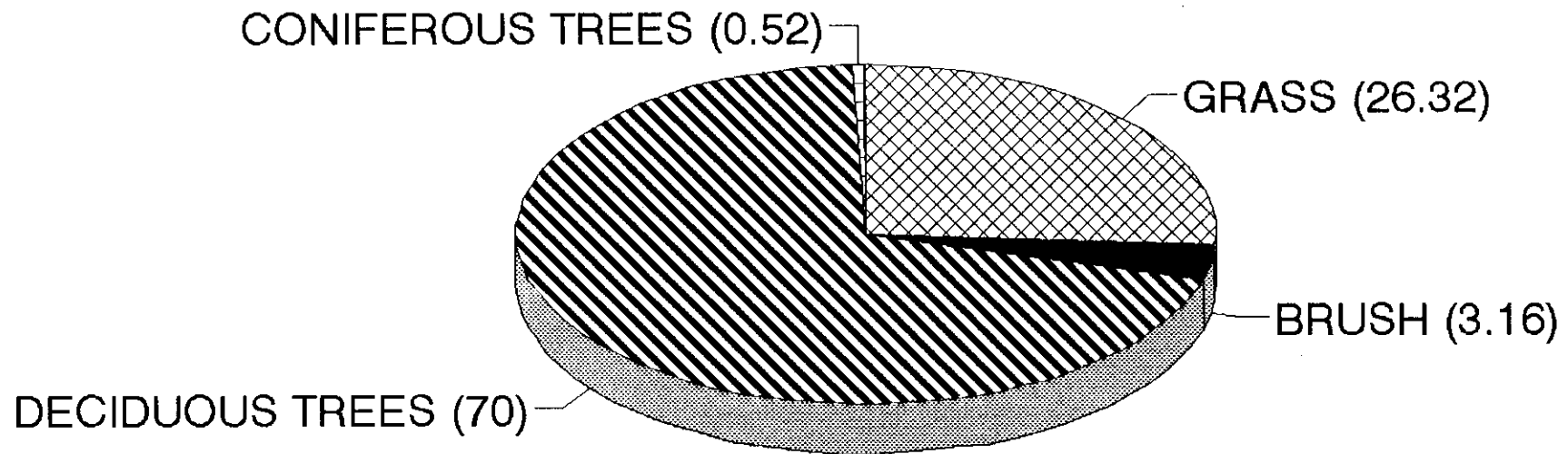
Dominant Bank Composition In Survey Reach



GRAPH 10

1611 MILE CREEK

Dominant Bank Vegetation In Survey Reach



GRAPH 11