CALIFORNIA DEPARTMENT OF FISH AND GAME

STREAM INVENTORY REPORT

Durphy Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1993 on Durphy Creek and its unnamed tributary to assess habitat conditions for anadromous salmonids. The 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 Durphy Creek. The objective of the biological inventory was to document the salmonid species present and their distribution. After analysis of the information and data gathered, stream restoration and enhancement recommendations are presented.

An adult carcass survey was conducted in Durphy Creek on December 28, 1987. No fish or redds were observed, although steelhead fry were sampled during 1993 summer electrofishing (DFG file data). The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for Chinook salmon, coho salmon and steelhead trout.

WATERSHED OVERVIEW

Durphy Creek is a tributary to the South Fork Eel River, tributary to the Eel River, which drains to the Pacific Ocean. It is located in Humboldt County, California. Durphy Creek's legal description at the confluence with the South Fork Eel River is T05S R03E S13. Its location is 40.0225 degrees north latitude and 123.7902 degrees west longitude, LLID number 1237902400225. Durphy Creek is a second order stream and has approximately 2.5 miles of blue line stream according to the USGS Garberville 7.5 minute quadrangle. Durphy Creek drains a watershed of approximately 2.3 square miles. Summer base runoff is approximately 0.8 cubic feet per second (cfs) in the main stem just above the forks, and 0.24 cfs in the tributary. Elevations range from about 400 feet at the mouth of the creek to 1,600 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is owned primarily by the State of California and is managed by Richardson Grove State Park. Vehicle access exists from U.S. Highway 101 at Richardson Grove State Park.

METHODS

The habitat inventory conducted in Durphy Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991). The California Conservation Corps (CCC) technical advisors 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.

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 Durphy 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 the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated. Flows should also be measured or estimated at major tributary confluences.

2. Channel Type:

Channel typing is conducted according to the classification system developed by David Rosgen (1985). 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 four measured parameters used to determine channel type: 1) water slope gradient, 2) channel confinement, 3) width/depth ratio, 4) substrate composition.

3. Temperatures:

Both water and air temperatures are measured and recorded at each tenth unit typed. The time of the measurement is also recorded. Both temperatures are taken in 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". Durphy 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. Unit measurements included mean length, mean width, mean depth, and maximum depth. Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were taken 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 Durphy 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).

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 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 Durphy 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 habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes.

8. Canopy:

Stream canopy is estimated using handheld spherical densiometers and is a measure of the water surface shaded during periods of high sun. In Durphy Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of each unit. The area of canopy was further analyzed to estimate its percentages of coniferous or deciduous trees, and the results recorded.

9. Bank Composition:

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 Durphy Creek, the dominant composition type in both the right and left banks was selected from a list of eight options on 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. Biological inventory is conducted using one or more of three basic methods: 1) stream bank observation, 2) underwater observation, 3) electrofishing. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual.*

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat Runtime, a dBASE 4.1 data entry program developed by the 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 Durphy 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
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Percent canopy
- Bank composition by composition type

HABITAT INVENTORY RESULTS, MAINSTEM DURPHY CREEK

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

The habitat inventory of June 21 to June 23, 1993 was conducted by C. Patton and B. Humphrey (CCC). The total length of the stream surveyed was 8,364 feet, with an additional 72 feet of side channel.

Flow was measured just above the forks with a Marsh-McBirney Model 2000 flowmeter at 0.8 cfs on June 23, 1993.

This section of Durphy Creek has three channel types: from the mouth to 5,914 feet a B2 (Reach 1); next 1,172 feet a B1 (Reach 2); and the upper 1,278 feet an A3 (Reach 3). B2 channels are moderate gradient (1.0-2.5%), moderately confined, large cobble/gravel channels. B1 channels are moderate gradient (2.5-4.0%), moderately confined boulder/large cobble channels. A3 types are high gradient (4-10%), well confined streams, with unstable stream banks.

Water temperatures ranged from 53 to 63 degrees Fahrenheit. Air temperatures ranged from 56 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. By percent occurrence, riffles made up 49%, pools 27%, and flatwater 24% (Graph 1). Riffle habitat types made up 83% of the total survey length, flatwater 10%, and pools 7% (Graph 2).

Thirteen Level IV habitat types were identified. The data are summarized in Table 2. The most frequent habitat types by percent occurrence were low gradient riffles, 39%; runs, 21%; and mid-channel pools, 11% (Graph 3). By percent total length, low gradient riffles made up 74%, high gradient riffles 10%, and runs 8%.

Forty-one pools were identified (Table 3). Main channel pools were encountered at 49%, and comprised 53% of the total length of pools. Scour pools were also encountered at 49%, and comprised 46% of total pool length (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Depth is an indicator of pool quality. Only nine of the 41 pools (22%) had a depth of less than two feet (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 40 pool tail-outs measured, one had a value of 1 (3%); seven had a value of 2 (18%); 14 had a value of 3 (35%); and 18 had a value of 4 (45%) (Graph 6). On this scale, a value of one indicates the best quality spawning substrate and a value of 4 the worst.

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 the highest shelter rating at 50. Flatwater habitats followed with a rating of 23 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 57. Main channel pools had a mean shelter rating of 41 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Durphy Creek and are extensive. White water is the next most common cover type (Graph 7).

Table 6 summarizes the dominant substrate by habitat type. Small cobble was the dominant substrate observed in 56 of the 59 low gradient riffles (95%). Graph 8 describes the substrates in Durphy Creek.

Thirty-nine percent of the survey reach lacked shade canopy. Of the 61% of the stream covered with canopy, 75% was composed of deciduous trees, and 25% was composed of coniferous trees. Graph 9 describes the canopy in Durphy Creek.

Table 2 summarizes the mean percentage of the right and left stream banks covered with vegetation by habitat type. For the stream reach surveyed, the mean percent right bank vegetated was 46%. The mean percent left bank vegetated was 34%. The dominant elements composing the structure of the stream banks consisted of 6% bedrock, 31% cobble/gravel, 8% bare soil, 5% grass, and 5% brush. An additional 39% of the banks were covered with deciduous trees, and 6% with coniferous trees, including downed trees, logs, and root wads (Graph 10).

BIOLOGICAL INVENTORY RESULTS, MAINSTEM DURPHY CREEK

Three sites were electrofished on July 9 and 14, 1993 in Durphy Creek. The units were sampled by C. Mesman, E. Elliot, and C. Coyle (CCC). All measurements are fork lengths (FL) unless noted otherwise.

The first site sampled included a plunge pool, riffle, plunge pool, run and pool, approximately 30 minutes walking time upstream from the forks. This site was just upstream of a left bank tributary, and was approximately 60 feet long. Seven steelhead were sampled, ranging from 40 to 94mm FL.

The second site included a high gradient riffle and a small pool, located approximately one hour walking distance upstream from the forks. The site was an 80-100' length of stream. No fish were found, and no fish were observed upstream of the boulder roughs.

The third site sampled included a low gradient riffle, run, and bedrock formed lateral scour pool, located approximately 150 feet upstream from the terrace near the Durphy Creek trail head. The unit yielded 26 steelhead, 39 to 70mm FL, and one coho salmon, 61mm FL.

DISCUSSION

Durphy Creek has three channel types: A3, B1, and B2. The high energy and steep gradient of the A3 channel type is generally not suitable for instream enhancement structures. Both B1 and B2 channel types are excellent for many types of low and medium stage instream enhancement structures. There are 7,086 feet of B1 and B2 channels in Durphy Creek. Many site specific projects can be designed within these channel types, especially to increase pool frequency, volume and pool cover.

The water temperatures recorded on the survey days June 21 to June 23, 1993 ranged from 53 to 63 degrees Fahrenheit. Air temperatures ranged from 56 to 72 degrees Fahrenheit. Sixty-three degrees Fahrenhiet, if sustained, is near the threshold stress level 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.

Riffle habitat types comprised 83% of the total length of this survey, flatwater 10%, and pools 7%. Nine of the 41 pools had a maximum depth greater than two feet. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat. In first and second order streams a primary pool is defined to have a maximum 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. Therefore, installing structures that will increase or deepen pool habitat is recommended.

Thirty-two of the 40 pool tail-outs measured had embeddedness ratings of 3 or 4. Only one had a 1 rating. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered best for the needs of salmon and steelhead. In Durphy Creek, sediment sources should be mapped and rated according to their potential sediment yields, and control measures taken.

The mean shelter rating for pools was moderate with a rating of 50. The shelter rating in the flatwater habitats was lower at 23. However, a pool shelter rating of approximately 100 is desirable. The cover that now exists is being provided primarily by boulders in all habitat types. Additionally, white water contributes a moderate amount. Log and root wad cover structures in the flatwater habitats are needed to improve 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.

Fifty-seven of the 59 low gradient riffles had small cobble or gravel as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy for the stream was 61%. Eighty percent canopy cover is generally considered optimum in north coast streams. In areas of stream bank erosion, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

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

2) 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.

3) Increase woody cover. Most of the existing cover is from boulders. Adding high quality complexity with woody cover is desirable and in some areas the material is at hand.

4) Inventory and map sources of stream bank erosion, and prioritize them according to present and potential sediment yield. Identified sites, like the one at 3377', should then be treated to reduce the amount of fine sediments entering the stream.

5) Increase the canopy on Durphy Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

PROBLEM SITES AND LANDMARKS

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

Position (ft):	Comments:
0'	Begin survey at confluence with the South Fork Eel River. Park road has an arched culvert measuring 9' wide x 5.5' high x 50' long. Channel type is B2 (Reach 1).
395'	Highway 101 crossing. Concrete culvert measures 11' wide x 6' high x 90' long.
620'	Culvert measures 4' diameter x 40' long.
1415'	Left cut bank contributing fines into the channel.
1533'	Log debris accumulation (LDA) measures 25' wide x 11' long x 5' high and is not retaining gravel.
3134'	Small tributary enters from the right bank.

3189' LDA measures 25' wide x 15' long x 8' tall and is retaining gravel measuring 4' long. Fish passage open along left bank of the channel.

3377' Right bank slide measures 50' high x 30' long. Left bank debris slide depositing massive amounts of sediment into the channel. Small tributary enters from the left bank.

3711' Right bank slide measures 80' high x 60' long and is depositing fines into the channel.

4147' Left cut bank contributing fines into the channel.

4294' Small tributary enters from the right bank; high gradient, not accessible to anadromous salmonids.

4314' Yellow-legged frog observed.

4984' Slide measures 40' high x 20' wide and is contributing fines into the channel.

5131' Young-of-the-year (YOY) salmonids observed.

5142' LDA measures 35' wide x 10' long x 5' high.

5330' Small tributary enters from the right bank.

5914' Channel type changes to a B1 (Reach 2).

5927' Fork enters from the left bank. 2.5' high plunge over log. Flow measured at 0.24 cfs in tributary. For more information, see the 1993 Unnamed Tributary to Durphy Creek Stream Habitat Inventory Report.

5943' Mainstem flow measured at 0.83 cfs.

6019' Small tributary enters from the right bank.

6504' Deciduous tree top in channel measures 20' wide x 20' long x 9' high and is heavily vegetated.

6786' Braided channel measures 20' wide x 30' long.

7086' Channel type changes to an A3 (Reach 3).

7141' Small tributary enters from the right bank, not accessible to anadromous fish.

7302' Slide measures 100' high x 45' long and is depositing fines into the channel.

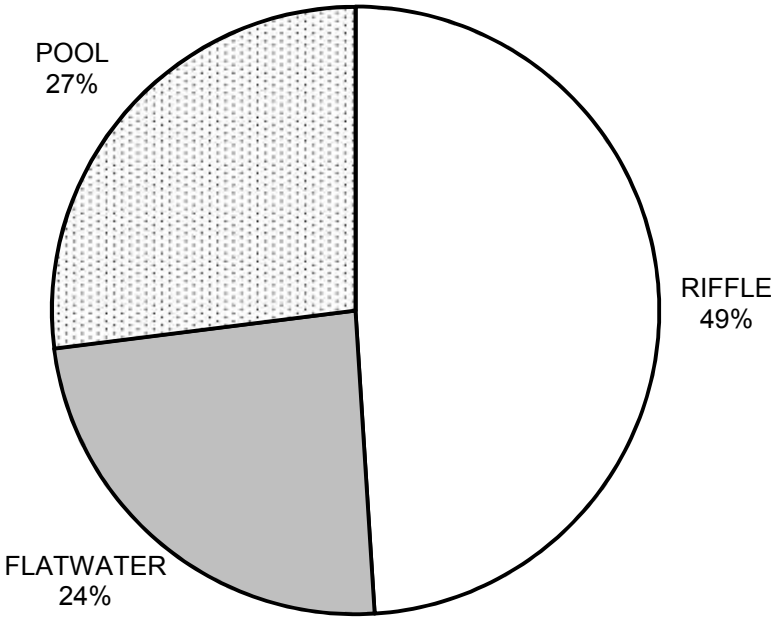
7440' Small tributary enters from the left bank, no access for anadromous salmonids.

7951' Small tributary enters from the left bank, no access for anadromous salmonids.

8080' Small tributary enters from the left bank, no access for anadromous salmonids.

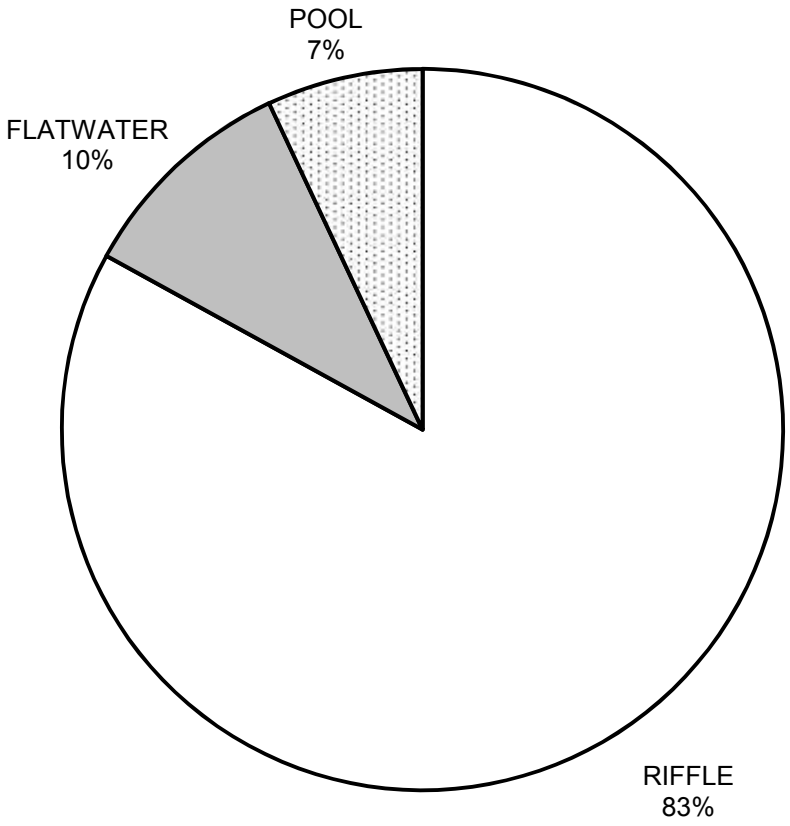
8364' Small tributary enters from the left bank, no access for anadromous salmonids. End of survey due to high gradient and no fish observed.

DURPHY CREEK
HABITAT TYPES BY PERCENT OCCURRENCE



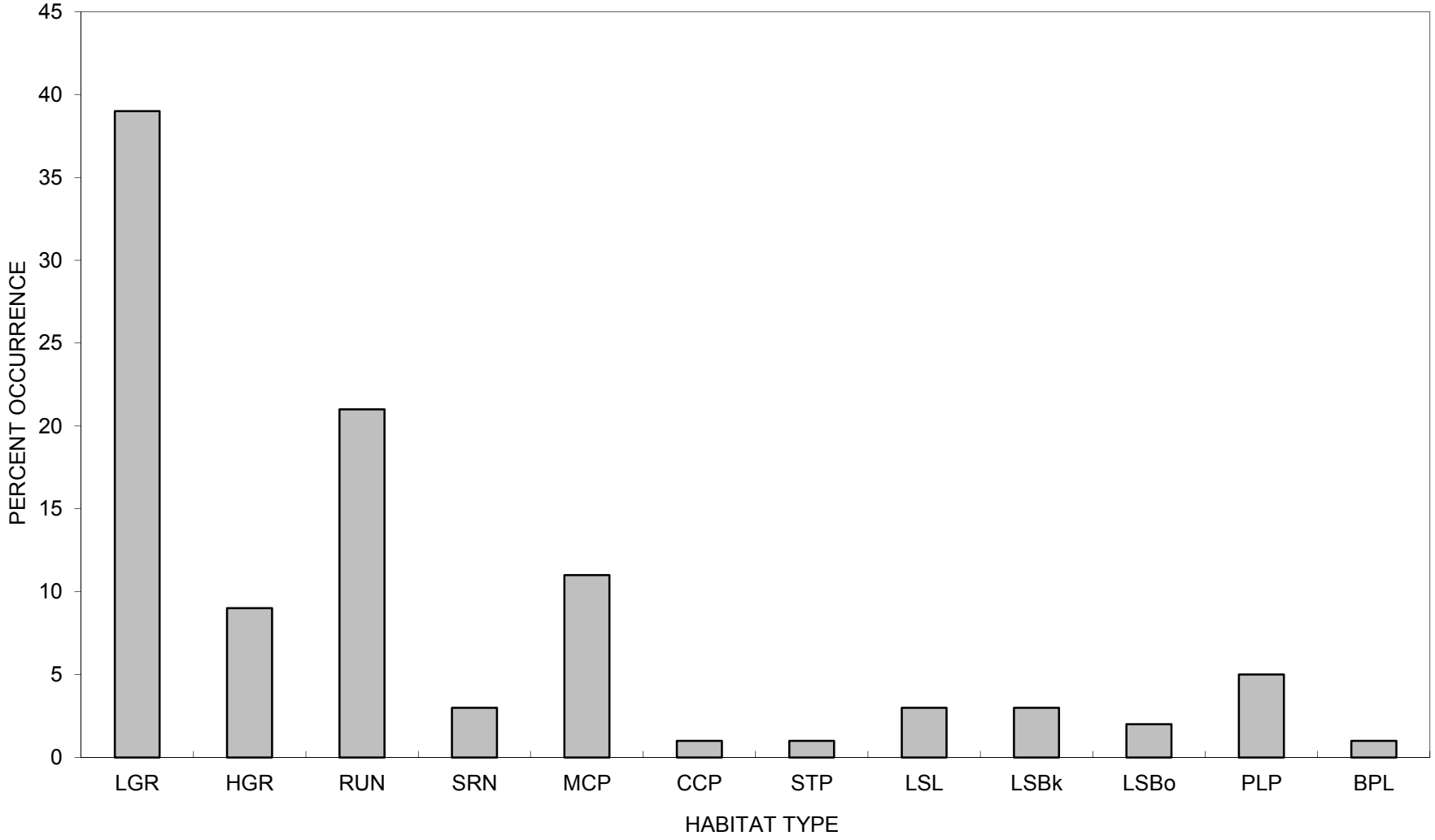
GRAPH 1

DURPHY CREEK
HABITAT TYPES BY PERCENT TOTAL LENGTH



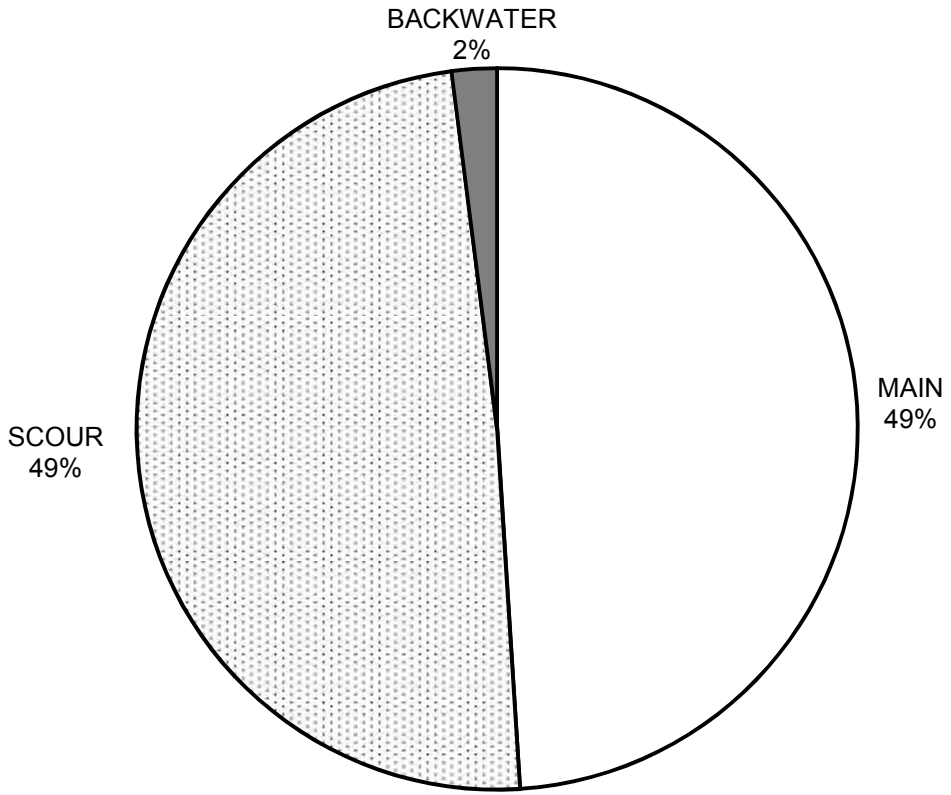
GRAPH 2

DURPHY CREEK
HABITAT TYPES BY PERCENT OCCURRENCE

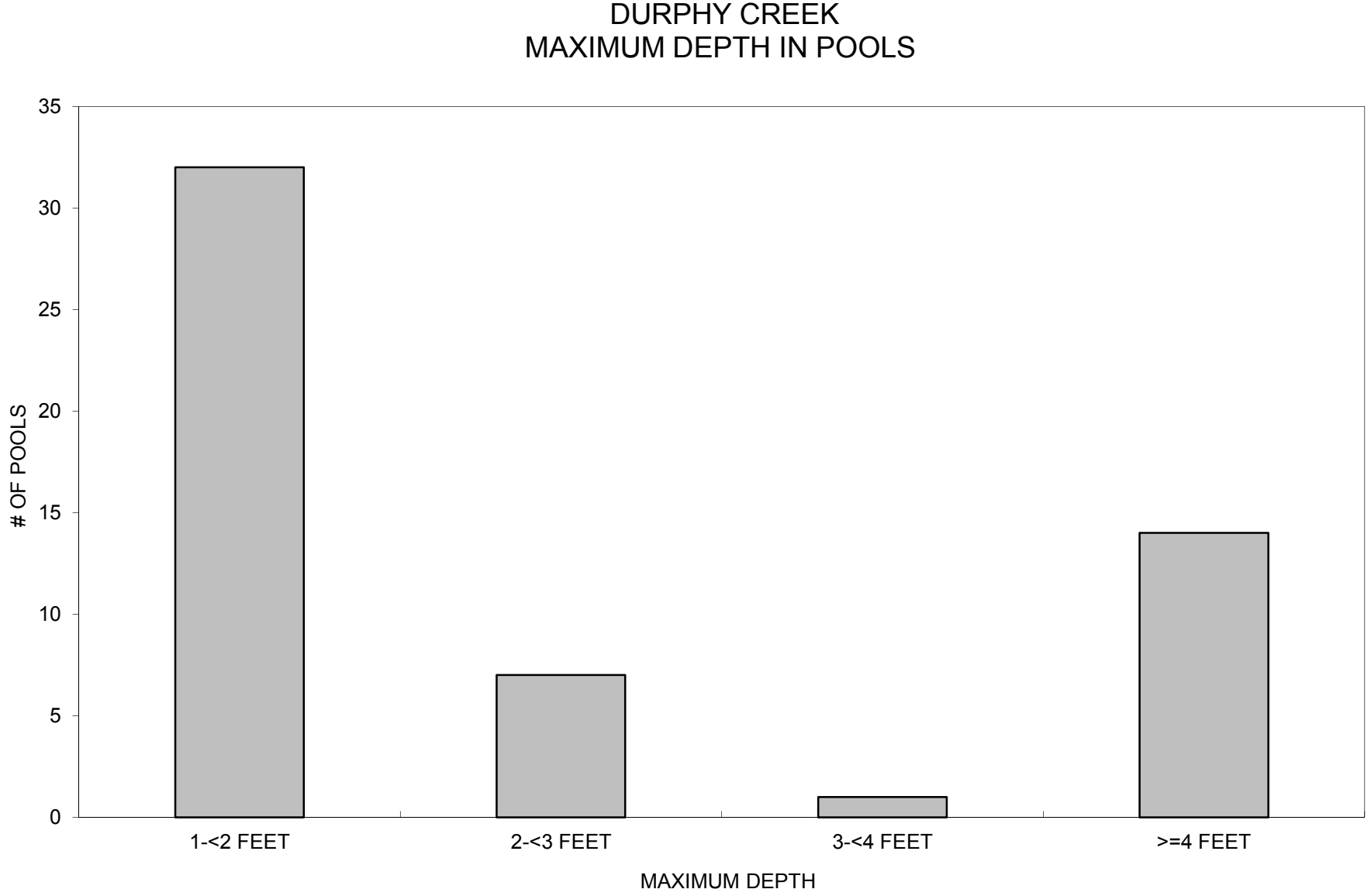


GRAPH 3

DURPHY CREEK
POOL HABITAT TYPES BY PERCENT OCCURRENCE

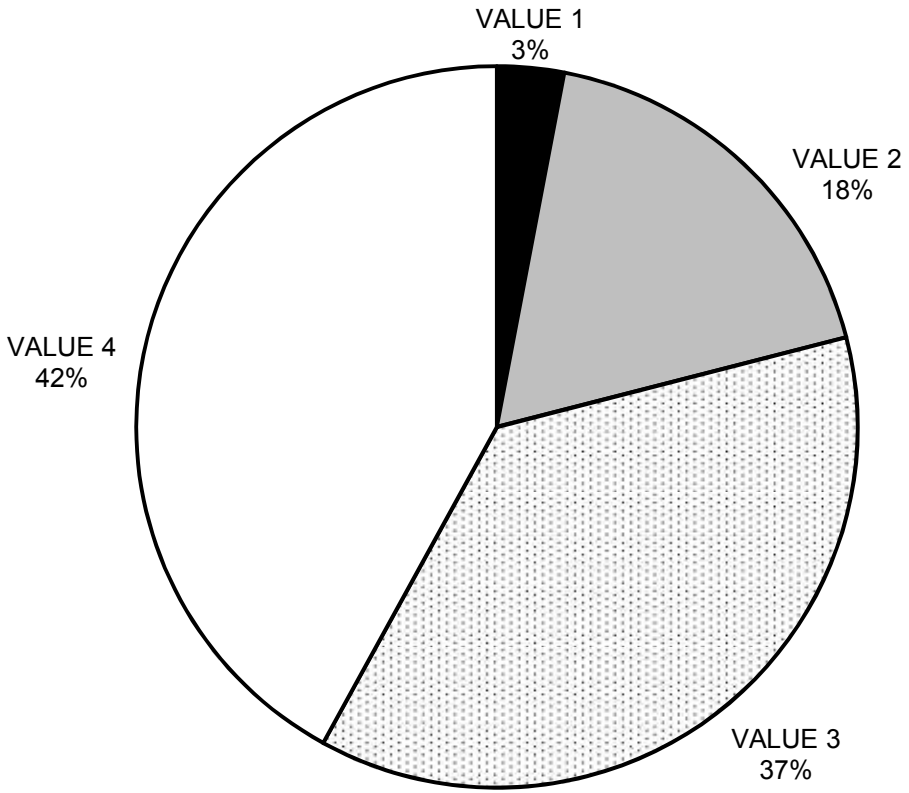


GRAPH 4


DURPHY CREEK
MAXIMUM DEPTH IN POOLS
35
30
25
20
15
10
5
0
OF POOLS
1-<2 FEET
2-<3 FEET
3-<4 FEET
>=4 FEET
MAXIMUM DEPTH

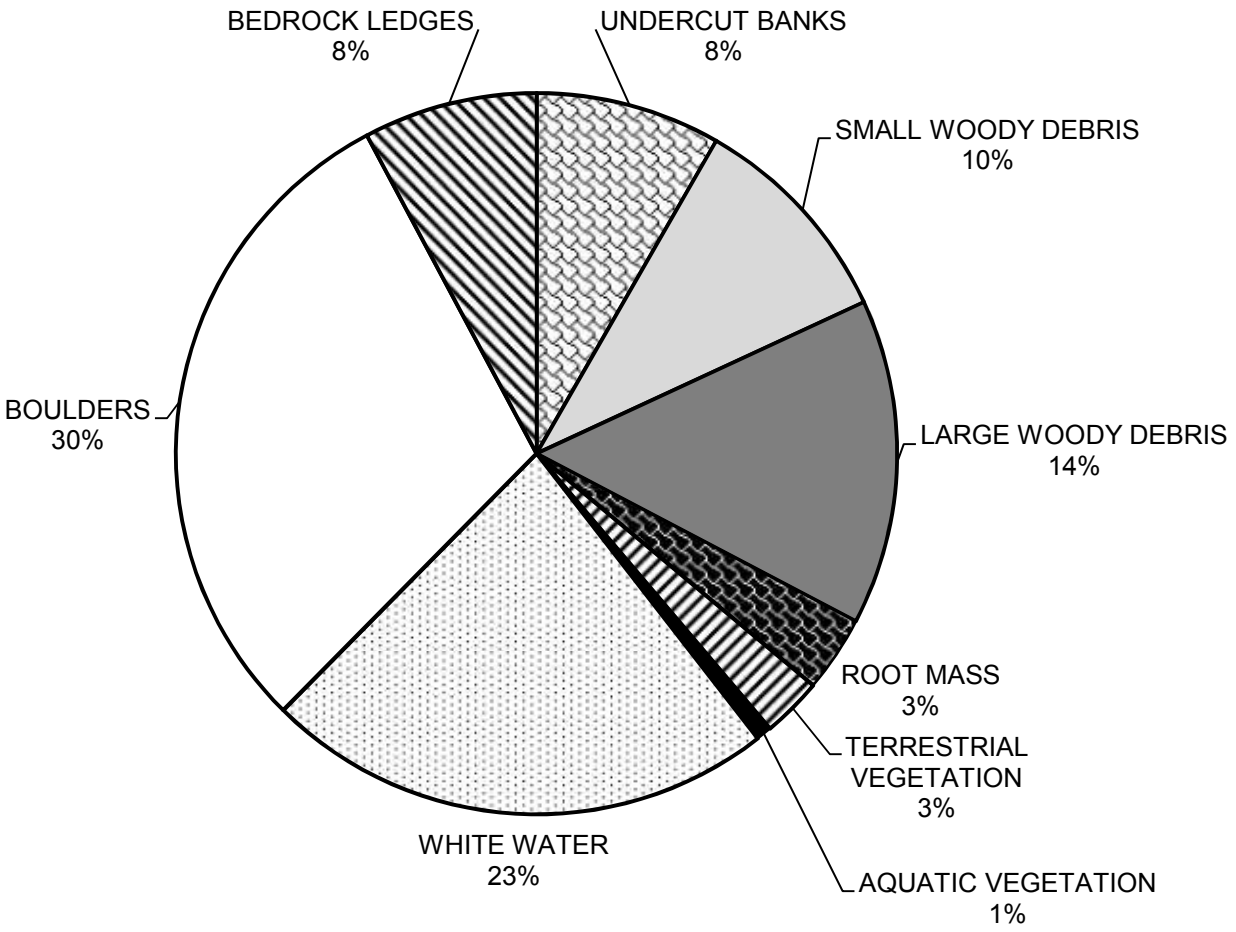
GRAPH 5

DURPHY CREEK
PERCENT EMBEDDEDNESS



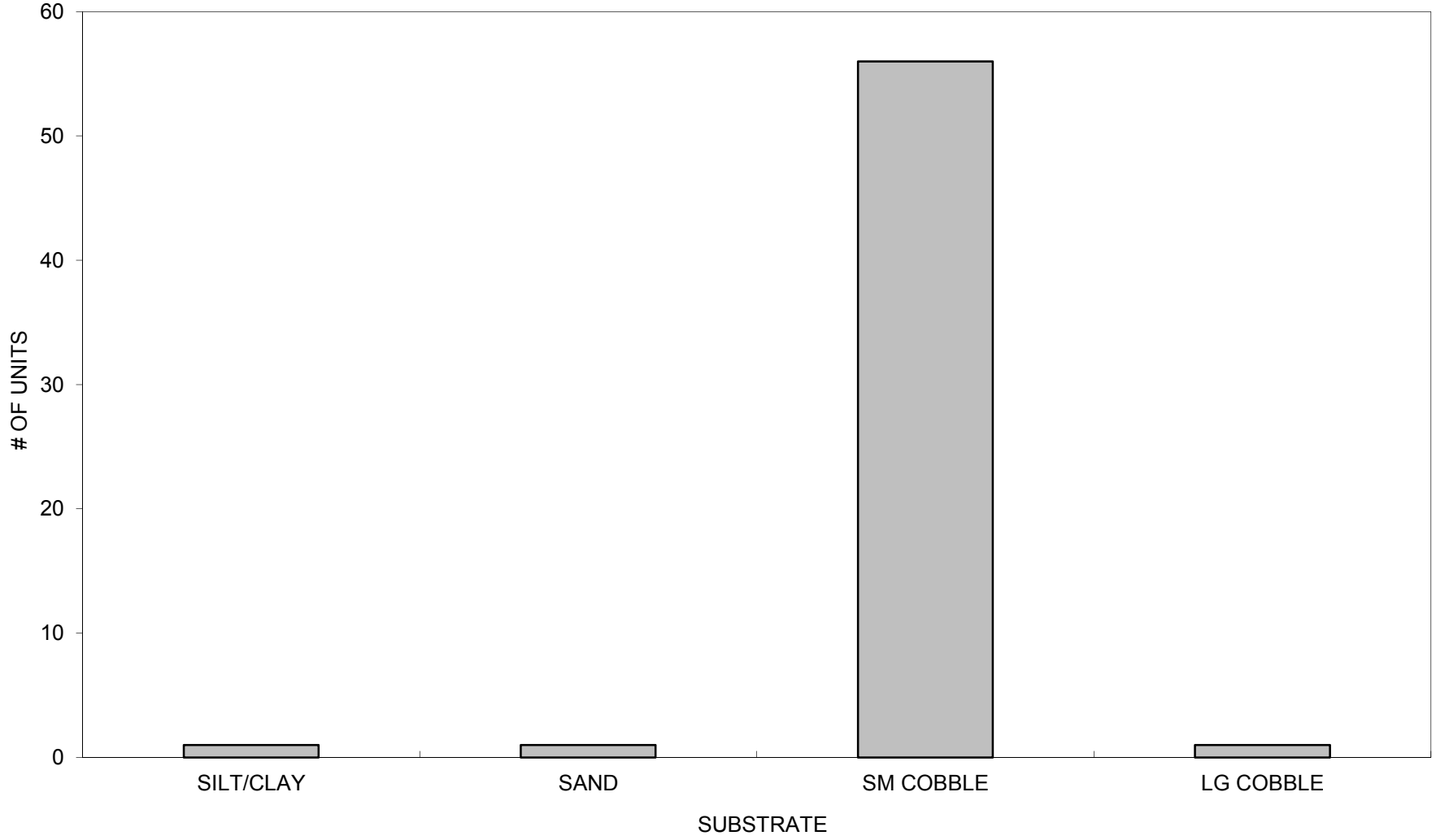
GRAPH 6

DURPHY CREEK
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

DURPHY CREEK
SUBSTRATE COMPOSITION IN LOW GRADIENT RIFFLES

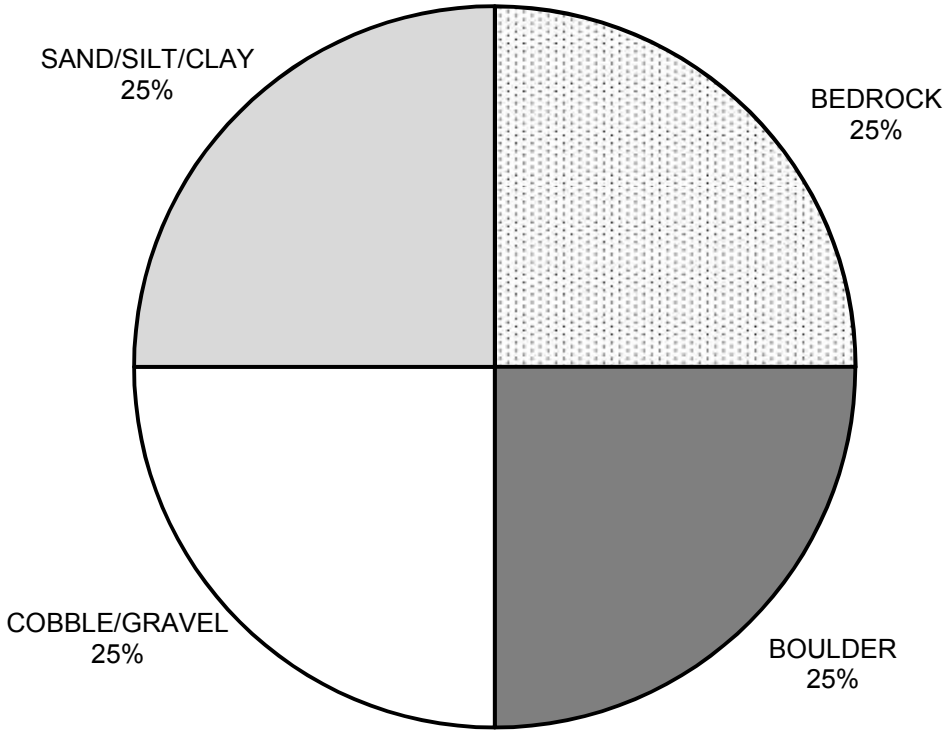


GRAPH 8

DURPHY CREEK
PERCENT CANOPY

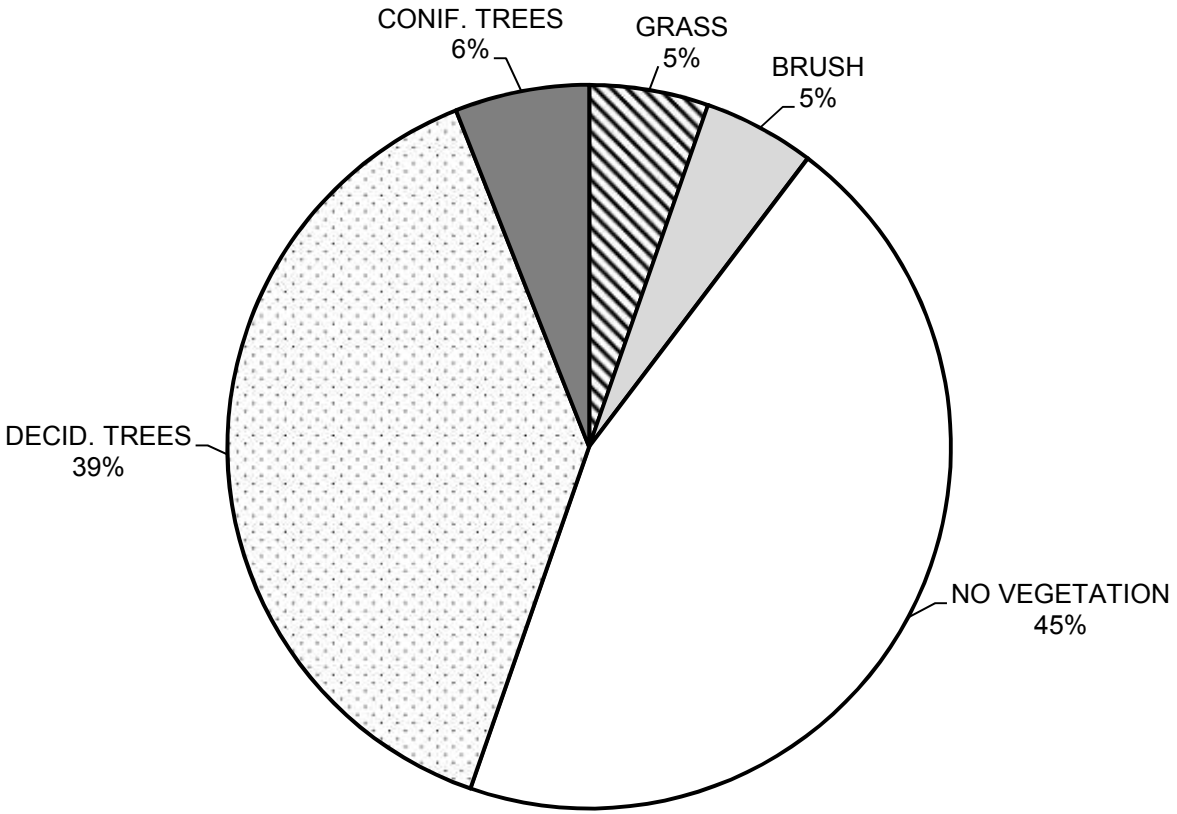
GRAPH 9

NORTH FORK ELK RIVER
PERCENT BANK COMPOSITION



GRAPH 10

NORTH FORK ELK RIVER
PERCENT BANK VEGETATION



GRAPH 11