

# STREAM INVENTORY REPORT

## “North Fork Berry Gulch”

### INTRODUCTION

A stream inventory was conducted on September 8, 2009 on an unnamed tributary to Berry Gulch commonly known as and hereinafter referred to as North Fork Berry Gulch. The survey began at the confluence with Berry Gulch and extended upstream 0.3 miles.

The North Fork Berry Gulch 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 North Fork Berry Gulch. 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

North Fork Berry Gulch is a tributary to Berry Gulch, tributary to Little North Fork Big River, a tributary to Big River, which drains to the Pacific Ocean, located in Mendocino County, California (Map 1). North Fork Berry Gulch's legal description at the confluence with Berry Gulch is T17N R16W S07. Its location is 39.3541 north latitude and 123.6836 west longitude, LLID number 1236823393542. North Fork Berry Gulch is a first order stream and has approximately 1.6 miles of blue line stream according to the USGS Mathison Peak 7.5 minute quadrangle. North Fork Berry Gulch drains a watershed of approximately 1.0 square miles. Elevations range from about 249 feet at the mouth of the creek to 788 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely owned by the Jackson Demonstration State Forest and is managed for timber production, research and recreation. Vehicle access exists via Highway 20 east of Highway 1 in Fort Bragg.

### METHODS

The habitat inventory conducted in North Fork Berry Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

### SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and

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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 North Fork Berry Gulch 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:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

#### 4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". North Fork Berry Gulch 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.

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### 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 North Fork Berry Gulch, 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 unsuited 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 North Fork Berry Gulch, 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 North Fork Berry Gulch, 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 North Fork Berry Gulch, 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.

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### 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 North Fork Berry Gulch. In addition, underwater observations were made at ten 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 Game. This program processes and summarizes the data, and produces the following ten tables:

- Riffle, Flatwater, and Pool Habitat Types
- Habitat Types and Measured Parameters
- 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

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Graphics are produced from the tables using Microsoft Excel. Graphics developed for North Fork Berry Gulch 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 AT THE END OF THE REPORT \*

The habitat inventory of September 8, 2009, was conducted by J. Ferreira and M. Groff (WSP). The total length of the stream surveyed was 1,640 feet.

Stream flow was not measured on North Fork Berry Gulch.

North Fork Berry Gulch is a G4 channel type for the entire 1,640 feet of the stream surveyed (Reach 1). G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 56 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 36% flatwater units, 32% pool units, and 30% riffle units (Graph 1). Based on total length of Level II habitat types there were 55% flatwater units, 21% pool units, and 20% riffle units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 30%; low gradient riffle units, 26%; and run units, 24% (Graph 3). Based on percent total length, step run units made up 31%, run units 23%, and mid-channel pool units 21%.

A total of 16 pools were identified (Table 3). Main channel pools were the most frequently encountered at 94% (Graph 4), and comprised 96% of the total length of all pools (Table 3).

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Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Two of the 16 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 16 pool tail-outs measured, 1 had a value of 1 (6.3%); 5 had a value of 2 (31.3%); 8 had a value of 3 (50%); 2 had a value of 5 (12.5%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate 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 33, flatwater habitat types had a mean shelter rating of 6, and pool habitats had a mean shelter rating of 39 (Table 1). Of the pool types, main channel pools had the highest mean shelter rating at 41. Scour pools had a mean shelter rating of 5 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in North Fork Berry Gulch. Graph 7 describes the pool cover in North Fork Berry Gulch. Large woody debris is the dominant pool cover type followed by undercut banks.

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 44% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 44% of the pool tail-outs.

The mean percent canopy density for the surveyed length of North Fork Berry Gulch was 95%. Five percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 19% and 81%, respectively. Graph 9 describes the mean percent canopy in North Fork Berry Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 93%. The mean percent left bank vegetated was 89%. The dominant elements composing the structure of the stream banks consisted of 96% sand/silt/clay, 2% bedrock, and 2% boulder (Graph 10). Coniferous trees were the dominant vegetation type observed in 72.9% of the units surveyed. Additionally, 22.9% of the units surveyed had brush as the dominant vegetation type, and 4.2% had hardwood as the dominant vegetation type (Graph 11).

## **BIOLOGICAL INVENTORY RESULTS**

Ten sites were snorkel surveyed for species composition and distribution in North Fork Berry Gulch on September 9, 2009. The sites were sampled by S. McSmith and I. Mikus (DFG). In reach 1, which comprised the first 1,640 feet of stream, ten sites were sampled. The reach sites yielded one young-of-the-year steelhead/rainbow trout (SH/RT), four age 1+ SH/RT and three age 2+ SH/RT.

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The following chart displays the information yielded from these sites:

2009 North Fork Berry Gulch underwater observations.

| Date                     | Survey Site # | Hab. Unit # | Hab. Type | Approx. Dist. from mouth (ft.) | SH/RT |    |    | Coho |    |
|--------------------------|---------------|-------------|-----------|--------------------------------|-------|----|----|------|----|
|                          |               |             |           |                                | YOY   | 1+ | 2+ | YOY  | 1+ |
| Reach 1: G4 Channel Type |               |             |           |                                |       |    |    |      |    |
| 09/09/09                 | 1             | 002         | 4.2       | 72                             | 0     | 1  | 1  | 0    | 0  |
|                          | 2             | 006         | 4.2       | 194                            | 0     | 0  | 2  | 0    | 0  |
|                          | 3             | 017         | 3.3       | 497                            | 0     | 1  | 0  | 0    | 0  |
|                          | 4             | 020         | 4.2       | 580                            | 0     | 0  | 0  | 0    | 0  |
|                          | 5             | 028         | 3.3       | 916                            | 0     | 0  | 0  | 0    | 0  |
|                          | 6             | 029         | 4.2       | 931                            | 0     | 1  | 0  | 0    | 0  |
|                          | 7             | 035         | 4.2       | 1,102                          | 0     | 0  | 0  | 0    | 0  |
|                          | 8             | 037         | 4.2       | 1,163                          | 0     | 1  | 0  | 0    | 0  |
|                          | 9             | 040         | 5.6       | 1,211                          | 1     | 0  | 0  | 0    | 0  |
|                          | 10            | 048         | 4.2       | 1,385                          | 0     | 0  | 0  | 0    | 0  |

## DISCUSSION

North Fork Berry Gulch is a G4 channel type for the entire 1,640 feet of the stream surveyed (Reach 1). The suitability of G4 channel types for fish habitat improvement structures is as follows: G4 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days September 8, 2009, ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 56 to 64 degrees Fahrenheit. To make any 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 55% of the total length of this survey, riffles 20%, pools 21%, and culvert 4%. Two of the 16 (12%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing large wood structures that will increase or deepen pool habitat is recommended.

Six of the 16 pool tail-outs measured had embeddedness ratings of 1 or 2. Eight 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

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considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in North Fork Berry Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Fourteen of the 16 pool tail-outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean shelter rating for pools was 39. The shelter rating in the flatwater habitats was 6. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in North Fork Berry Gulch. Large woody debris is the dominant cover type in pools followed by undercut banks. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 95%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 92% and 89%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

## **RECOMMENDATIONS**

- 1) North Fork Berry Gulch should be managed as an anadromous, natural production stream.
- 2) 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.
- 3) Conduct a fish passage assessment of the culvert at the confluence of North Fork Berry Creek and Berry Creek on Road 550.
- 4) 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.
- 5) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.



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

### 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<br>(ft): | Habitat<br>unit #: | Comment:   |
|-------------------|--------------------|--|
| 0                 | 0001.00            | Start of survey at the confluence with Berry Gulch. Road 550 crosses the channel. The corrugated metal pipe (CMP) culvert measures 6' high x 8' wide x 57' long. The culvert has no plunge and the maximum depth within 5' of the outlet is 0.1'. The slope of the culvert is less than one percent. It is in good condition, but is starting to rust on the bottom. The inside of the culvert is coated with tar or resin. The culvert is a possible barrier to juvenile and adult salmonids. |
| 563               | 0020.00            | Log debris accumulation (LDA) #01 contains four pieces of large woody debris (LWD) and measures 4.5' high x 16' wide x 7' long. Water flows through and there are visible gaps. Retained sediment ranges from fines to cobble and measures 8' wide x 15' long x 4.5' deep. Fish are present above the LDA.   |
| 1077              | 0034.00            | Erosion on the left bank measures 6' high and over 20' long and is actively eroding.   |
| 1114              | 0037.00            | Erosion on the left bank measures 6' high.   |
| 1163              | 0038.00            | A landslide on the right bank is contributing sediment ranging in size from fines to boulder and LWD.  |
| 1163              | 0038.00            | LDA #02 contains three pieces of LWD and measures 6.5' high x 14' wide x 6' long. Water flows through and there are no visible gaps. Retained sediment ranges from fines to boulders and measures 14' wide x 20' long x 4' deep. Fish are present above the LDA.   |
| 1211              | 0041.00            | LDA #03 contains five pieces of LWD and measures 4.5' high x 22' wide x 10' long. Water flows through and there are no visible gaps. Retained sediment ranges from fines to boulders and measures 15' wide x 12' long x 4' deep. Fish are present above the LDA.   |
| 1330              | 0046.00            | Left bank erosion.   |

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|      |         |  |
|------|---------|--|
| 1330 | 0046.00 | There is a debris accumulation consisting mostly of small wood.  |
| 1368 | 0048.00 | Severe erosion on both banks.  |
| 1416 | 0051.00 | Failures on both banks are contributing large wood and sediment.   |
| 1487 | 0053.00 | Total bank failure on both sides. The channel is blocked by rootwads, stumps, logs, small wood and sediment. Water has cut a path under the accumulation, but the gaps are very small and not visible. The gradient through the blockage is high, estimated to be over 10%.  |
| 1487 | 0053.00 | LDA #04 contains over 30 pieces of LWD and measures 14' high x 18' wide x 60' long. Water flows through and there are no visible gaps. Retained sediment ranges from fines to boulders and measures 10' wide x 20' long x 6' deep. It is a possible end of anadromy because of the 14' high blockage with no visible gaps and because of the over 10 percent gradient. Fish were not seen above the LDA. |
| 1640 | 0056.00 | End of survey due to LDA #04. Visual observations revealed over 400' of marsh above the barrier. The visible water is stagnant and orange with periphyton. The substrate is deep mud and the channel is overgrown with sedges.   |

## 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.

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### 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] |  |

|                      |                      |                    |               |            |              |
|----------------------|----------------------|--------------------|---------------|------------|--------------|
| Stream Name:         | 1236823393542        | LLID:              | 1236823393542 | Drainage:  | Big River    |
| Survey Dates:        | 9/8/2009 to 9/8/2009 |                    |               |            |              |
| Confluence Location: | Quad: MATHISON PEAK  | Legal Description: | T17NR16WS07   | Latitude:  | 39:21:15.0N  |
|                      |                      |                    |               | Longitude: | 123:40:56.0W |

| Habitat Units | Units Fully Measured       | Habitat Type | Habitat Occurrence (%) | Mean Length (ft.) | Total Length (ft.) | Total Length (%) | Mean Width (ft.) | Mean Depth (ft.) | Mean Max Depth (ft.) | Mean Area (sq.ft.) | Estimated Total Area (sq.ft.) | Mean Volume (cu.ft.) | Estimated Total Volume (cu.ft.) | Mean Residual Pool Vol (cu.ft.) | Mean Shelter Rating |
|---------------|----------------------------|--------------|------------------------|-------------------|--------------------|------------------|------------------|------------------|----------------------|--------------------|-------------------------------|----------------------|---------------------------------|---------------------------------|---------------------|
| 1             | 0                          | CULVERT      | 2.0                    | 57                | 57                 | 3.9              |                  |                  |                      |                    |                               |                      |                                 |                                 |                     |
| 18            | 5                          | FLATWATER    | 36.0                   | 44                | 795                | 54.6             | 5.0              | 0.5              | 0.8                  | 196                | 3530                          | 91                   | 1644                            |                                 | 6                   |
| 6             | 0                          | NOSURVEY     |                        | 31                | 184                |                  |                  |                  |                      |                    |                               |                      |                                 |                                 |                     |
| 16            | 16                         | POOL         | 32.0                   | 19                | 310                | 21.3             | 7.2              | 0.8              | 1.4                  | 137                | 2187                          | 127                  | 2027                            | 113                             | 39                  |
| 15            | 3                          | RIFFLE       | 30.0                   | 20                | 294                | 20.2             | 3.8              | 0.1              | 0.2                  | 41                 | 621                           | 4                    | 62                              |                                 | 33                  |
| Total Units   | Total Units Fully Measured |              |                        |                   | Total Length (ft.) |                  |                  |                  |                      |                    | Total Area (sq.ft.)           |                      | Total Volume (cu.ft.)           |                                 |                     |
| 56            | 24                         |              |                        |                   | 1640               |                  |                  |                  |                      |                    | 6338.36                       |                      | 3732.959                        |                                 |                     |

**Table 2 - Summary of Habitat Types and Measured Parameters**

Stream Name: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

Latitude: 39:21:15.0N

Longitude: 123:40:56.0W

| 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 (%) |
|---------------|----------------------|--------------|------------------------|-------------------|--------------------|------------------|------------------|------------------|-----------------|--------------------|-------------------------------|----------------------|---------------------------------|---------------------------------|---------------------|-----------------|
| 13            | 2                    | LGR          | 26.0                   | 20                | 264                | 18.1             | 4                | 0.1              | 0.2             | 43                 | 558                           | 4                    | 56                              |                                 | 0                   | 93              |
| 2             | 1                    | HGR          | 4.0                    | 15                | 30                 | 2.1              | 2                | 0.1              | 0.3             | 38                 | 77                            | 4                    | 8                               |                                 | 100                 | 99              |
| 12            | 4                    | RUN          | 24.0                   | 28                | 341                | 23.4             | 5                | 0.5              | 0.9             | 172                | 2064                          | 85                   | 1019                            |                                 | 6                   | 93              |
| 6             | 1                    | SRN          | 12.0                   | 76                | 454                | 31.2             | 4                | 0.4              | 0.9             | 293                | 1756                          | 117                  | 702                             |                                 | 5                   | 92              |
| 15            | 15                   | MCP          | 30.0                   | 20                | 299                | 20.5             | 7                | 0.8              | 2.9             | 139                | 2088                          | 129                  | 1938                            | 115                             | 41                  | 96              |
| 1             | 1                    | PLP          | 2.0                    | 11                | 11                 | 0.8              | 9                | 0.8              | 1.9             | 99                 | 99                            | 89                   | 89                              | 79                              | 5                   | 99              |
| 1             | 0                    | CUL          | 2.0                    | 57                | 57                 | 3.9              |                  |                  |                 |                    |                               |                      |                                 |                                 |                     |                 |
| 6             | 0                    | NS           |                        | 31                | 184                |                  |                  |                  |                 |                    |                               |                      |                                 |                                 |                     |                 |

Total Units  
56

Total Units Fully Measured  
24

Total Length (ft.)  
1640

Total Area (sq.ft.)  
6641.9

Total Volume (cu.ft.)  
3811.565

Table 3 - Summary of Pool Types

Stream Name: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

Latitude: 39:21:15.0N

Longitude: 123:40:56.0W

| 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 |
|---------------|----------------------------|--------------|------------------------|--------------------|--------------------|------------------|------------------|---------------------------|---------------------|-------------------------------|---------------------------------|-------------------------------------|---------------------|
| 15            | 15                         | MAIN         | 94                     | 20                 | 299                | 96               | 7.1              | 0.8                       | 139                 | 2088                          | 115                             | 1730                                | 41                  |
| 1             | 1                          | SCOUR        | 6                      | 11                 | 11                 | 4                | 9.0              | 0.8                       | 99                  | 99                            | 79                              | 79                                  | 5                   |
|               |                            |              |                        |                    |                    |                  |                  |                           |                     |                               |                                 |                                     |                     |
| Total Units   | Total Units Fully Measured |              |                        | Total Length (ft.) |                    |                  |                  |                           | Total Area (sq.ft.) |                               | Total Volume (cu.ft.)           |                                     |                     |
| 16            | 16                         |              |                        | 310                |                    |                  |                  |                           | 2187.45             |                               | 1809.295                        |                                     |                     |

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

Stream Name: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

Latitude: 39:21:15.0N

Longitude: 123:40:56.0W

| 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 |
|---------------|--------------|------------------------|---------------------------------|-----------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|-----------------------------------|-------------------------------|----------------------------------|------------------------------|
| 15            | MCP          | 94                     | 1                               | 7                           | 12                                | 80                            | 2                                 | 13                            | 0                                 | 0                             | 0                                | 0                            |
| 1             | PLP          | 6                      | 0                               | 0                           | 1                                 | 100                           | 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 |
|-------------|---------------------------------|-----------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|----------------------------------|------------------------------|
| 16          | 1                               | 6                           | 13                               | 81                           | 2                                | 12                           | 0                                | 0                            | 0                                | 0                            |

Mean Maximum Residual Pool Depth (ft.): 1.4

**Table 5 - Summary of Mean Percent Cover By Habitat Type**

Stream Name: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Dry Units: 0

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

Latitude: 39:21:15.0N

Longitude: 123:40:56.0W

| 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 |
|---------------|----------------------|--------------|-----------------------|------------|------------|------------------|-------------------------|---------------------------|--------------------|-----------------|-----------------------|
| 13            | 2                    | LGR          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 2             | 1                    | HGR          | 0                     | 40         | 60         | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 15            | 3                    | TOTAL RIFFLE | 0                     | 40         | 60         | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 12            | 4                    | RUN          | 70                    | 5          | 25         | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 6             | 1                    | SRN          | 100                   | 0          | 0          | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 18            | 5                    | TOTAL FLAT   | 78                    | 4          | 19         | 0                | 0                       | 0                         | 0                  | 0               | 0                     |
| 15            | 15                   | MCP          | 28                    | 10         | 32         | 14               | 8                       | 0                         | 0                  | 8               | 0                     |
| 1             | 1                    | PLP          | 0                     | 0          | 0          | 0                | 0                       | 0                         | 0                  | 100             | 0                     |
| 16            | 16                   | TOTAL POOL   | 26                    | 9          | 30         | 13               | 7                       | 0                         | 0                  | 14              | 0                     |
| 1             | 0                    | CUL          |                       |            |            |                  |                         |                           |                    |                 |                       |
| 6             | 0                    | NS           |                       |            |            |                  |                         |                           |                    |                 |                       |
| 56            | 24                   | TOTAL        | 36                    | 9          | 29         | 10               | 5                       | 0                         | 0                  | 11              | 0                     |



**Table 6 - Summary of Dominant Substrates By Habitat Type**

Stream Name: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Dry Units: 0

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

Latitude: 39:21:15.0N

Longitude: 123:40:56.0W

| 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 |
|---------------|----------------------|--------------|----------------------------|-----------------------|-------------------------|-------------------------------|-------------------------------|--------------------------|--------------------------|
| 13            | 2                    | LGR          | 0                          | 0                     | 50                      | 50                            | 0                             | 0                        | 0                        |
| 2             | 1                    | HGR          | 0                          | 0                     | 0                       | 100                           | 0                             | 0                        | 0                        |
| 12            | 4                    | RUN          | 25                         | 0                     | 50                      | 25                            | 0                             | 0                        | 0                        |
| 6             | 1                    | SRN          | 0                          | 0                     | 0                       | 100                           | 0                             | 0                        | 0                        |
| 15            | 15                   | MCP          | 27                         | 0                     | 47                      | 27                            | 0                             | 0                        | 0                        |
| 1             | 1                    | PLP          | 0                          | 0                     | 0                       | 0                             | 100                           | 0                        | 0                        |

**Table 7 - Summary of Mean Percent Canopy for Entire Stream**

Stream Name: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

Latitude: 39:21:15.0N

Longitude: 123:40:56.0W

| Mean<br>Percent<br>Canopy | Mean<br>Percent<br>Conifer | Mean<br>Percent<br>Hardwood | Mean<br>Percent<br>Open Units | Mean Right<br>Bank %<br>Cover | Mean Left<br>Bank %<br>Cover |
|---------------------------|----------------------------|-----------------------------|-------------------------------|-------------------------------|------------------------------|
| 95                        | 81                         | 19                          | 0                             | 93                            | 89                           |

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.

|                      |                      |                      |               |                     |             |                     |              |
|----------------------|----------------------|----------------------|---------------|---------------------|-------------|---------------------|--------------|
| Stream Name:         | 1236823393542        | LLID:                | 1236823393542 | Drainage:           | Big River   |                     |              |
| Survey Dates:        | 9/8/2009 to 9/8/2009 | Survey Length (ft.): | 1640          | Main Channel (ft.): | 1640        | Side Channel (ft.): | 0            |
| Confluence Location: | Quad: MATHISON PEAK  | Legal Description:   | T17NR16WS07   | Latitude:           | 39:21:15.0N | Longitude:          | 123:40:56.0W |

|                                    |              |          |            |               |              |                               |                 |  |                                     |      |
|------------------------------------|--------------|----------|------------|---------------|--------------|-------------------------------|-----------------|--|-------------------------------------|------|
| <b>STREAM REACH: 1</b>             |              |          |            |               |              |                               |                 |  |                                     |      |
| Channel Type:                      | G4           |          |            |               |              | Canopy Density (%):           | 95.3            |  | Pools by Stream Length (%):         | 18.9 |
| Reach Length (ft.):                | 1640         |          |            |               |              | Coniferous Component (%):     | 80.8            |  | Pool Frequency (%):                 | 28.6 |
| Riffle/Flatwater Mean Width (ft.): | 4.6          |          |            |               |              | Deciduous Component (%):      | 19.2            |  | Residual Pool Depth (%):            |      |
| BFW:                               |              |          |            |               |              | Dominant Bank Vegetation:     | Evergreen Trees |  | < 2 Feet Deep:                      | 88   |
| Range (ft.):                       | 8            | to       | 12         |               |              | Vegetative Cover (%):         | 90.7            |  | 2 to 2.9 Feet Deep:                 | 13   |
| Mean (ft.):                        | 10           |          |            |               |              | Dominant Shelter:             | Undercut Banks  |  | 3 to 3.9 Feet Deep:                 | 0    |
| Std. Dev.:                         | 2            |          |            |               |              | Dominant Bank Substrate Type: | Sand/Silt/Clay  |  | >= 4 Feet Deep:                     | 0    |
| Base Flow (cfs.):                  | 0.0          |          |            |               |              | Occurrence of LWD (%):        | 23              |  | Mean Max Residual Pool Depth (ft.): | 1.4  |
| Water (F):                         | 52 - 54      | Air (F): | 56 - 64    |               |              | LWD per 100 ft.:              |                 |  | Mean Pool Shelter Rating:           | 39   |
| Dry Channel (ft):                  | 0            |          |            |               |              | Riffles:                      | 3               |  |                                     |      |
|                                    |              |          |            |               |              | Pools:                        | 9               |  |                                     |      |
|                                    |              |          |            |               |              | Flat:                         | 3               |  |                                     |      |
| Pool Tail Substrate (%):           | Silt/Clay: 0 | Sand: 0  | Gravel: 44 | Sm Cobble: 44 | Lg Cobble: 6 | Boulder: 6                    | Bedrock: 0      |  |                                     |      |
| Embeddedness Values (%):           | 1. 6.3       | 2. 31.3  | 3. 50.0    | 4. 0.0        | 5. 12.5      |                               |                 |  |                                     |      |

**Table 9 - Mean Percentage of Dominant Substrate and Vegetation**

Stream Name: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

Latitude: 39:21:15.0N

Longitude: 123:40:56.0W

**Mean Percentage of Dominant Stream Bank Substrate**

| Dominant Class<br>of Substrate | Number of Units<br>Right Bank | Number of Units<br>Left Bank | Total Mean<br>Percent (%) |
|--------------------------------|-------------------------------|------------------------------|---------------------------|
| Bedrock                        | 1                             | 0                            | 2.08                      |
| Boulder                        | 1                             | 0                            | 2.08                      |
| Cobble / Gravel                | 0                             | 0                            | 0.00                      |
| Sand / Silt / Clay             | 22                            | 24                           | 95.83                     |

**Mean Percentage of Dominant Stream Bank Vegetation**

| Dominant Class<br>of Vegetation | Number of Units<br>Right Bank | Number of Units<br>Left Bank | Total Mean<br>Percent (%) |
|---------------------------------|-------------------------------|------------------------------|---------------------------|
| Grass                           | 0                             | 0                            | 0.00                      |
| Brush                           | 8                             | 3                            | 22.92                     |
| Hardwood Trees                  | 2                             | 0                            | 4.17                      |
| Coniferous Trees                | 14                            | 21                           | 72.92                     |
| No Vegetation                   | 0                             | 0                            | 0.00                      |

**Total Stream Cobble Embeddedness Values:**

3

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

StreamName: 1236823393542

LLID: 1236823393542

Drainage: Big River

Survey Dates: 9/8/2009 to 9/8/2009

Confluence Location: Quad: MATHISON PEAK

Legal Description: T17NR16WS07

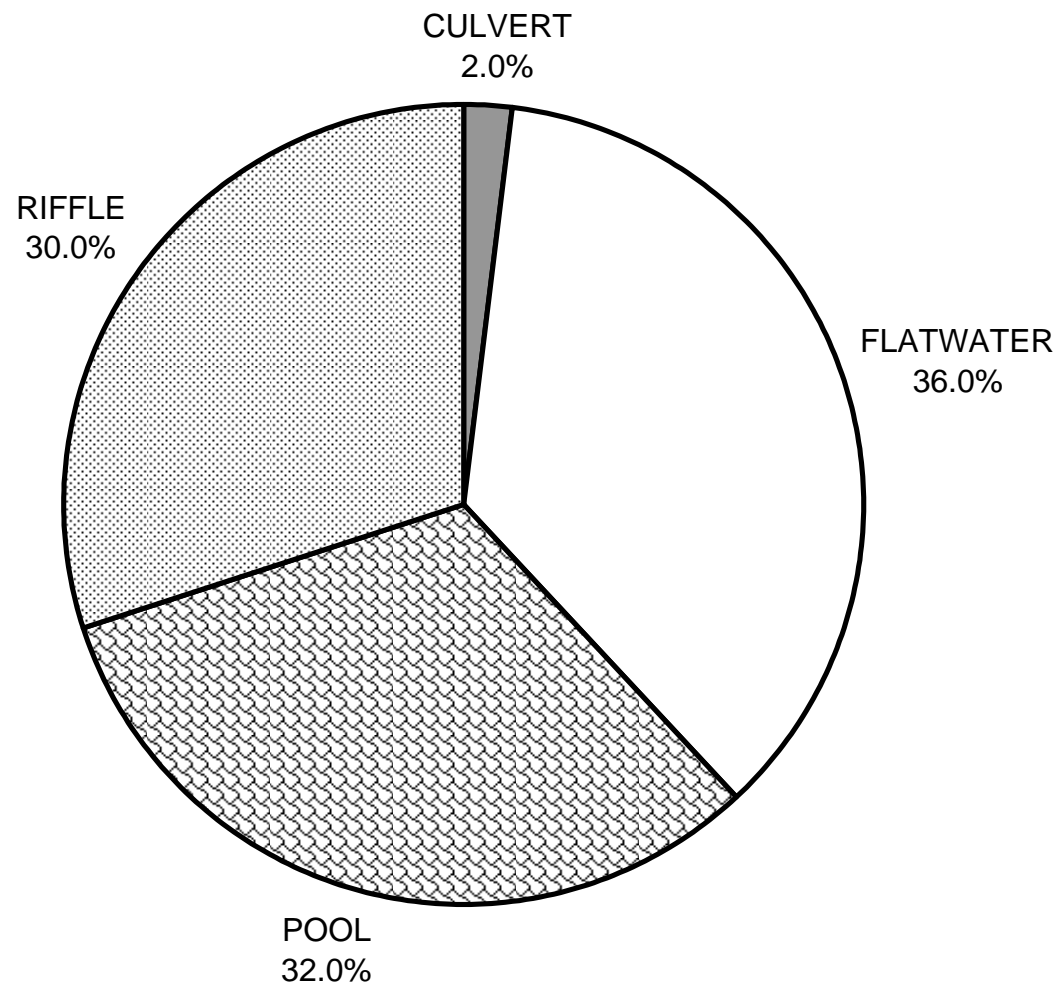
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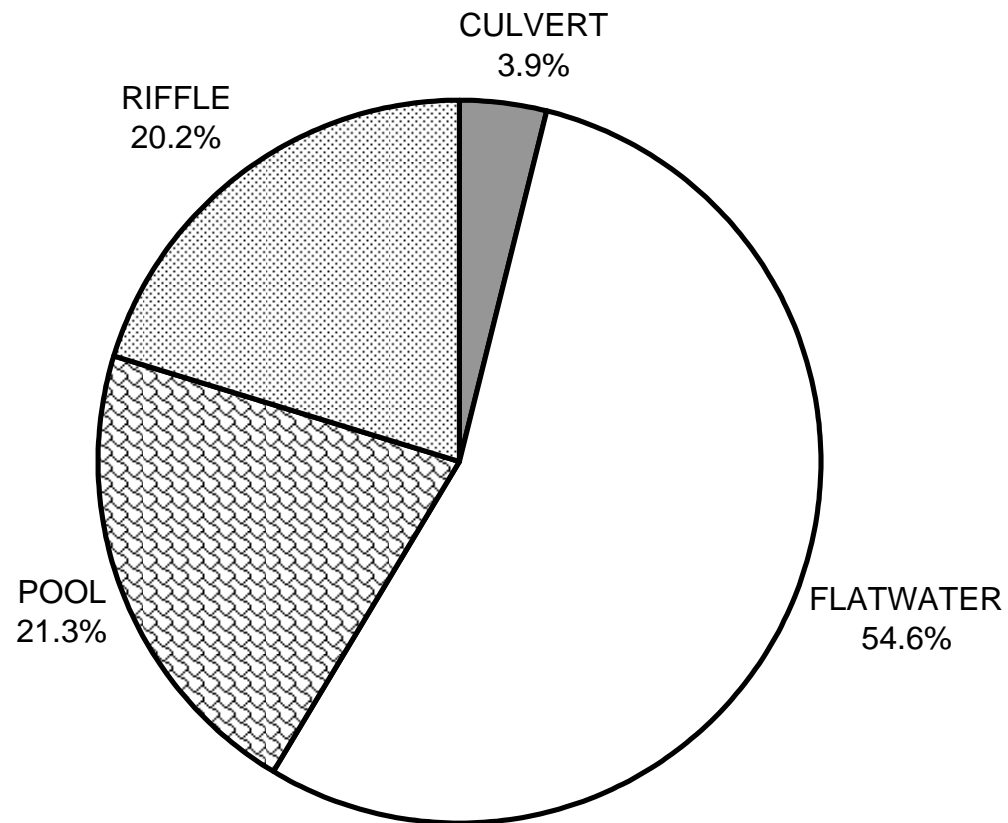
|                            | <b>Riffles</b> | <b>Flatwater</b> | <b>Pools</b> |
|----------------------------|----------------|------------------|--------------|
| <hr/>                      |                |                  |              |
| UNDERCUT BANKS (%)         | 0              | 78               | 26           |
| SMALL WOODY DEBRIS (%)     | 40             | 4                | 9            |
| LARGE WOODY DEBRIS (%)     | 60             | 19               | 30           |
| ROOT MASS (%)              | 0              | 0                | 13           |
| TERRESTRIAL VEGETATION (%) | 0              | 0                | 7            |
| AQUATIC VEGETATION (%)     | 0              | 0                | 0            |
| WHITEWATER (%)             | 0              | 0                | 0            |
| BOULDERS (%)               | 0              | 0                | 14           |
| BEDROCK LEDGES (%)         | 0              | 0                | 0            |

# **NORTH FORK BERRY GULCH 2009 HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 1

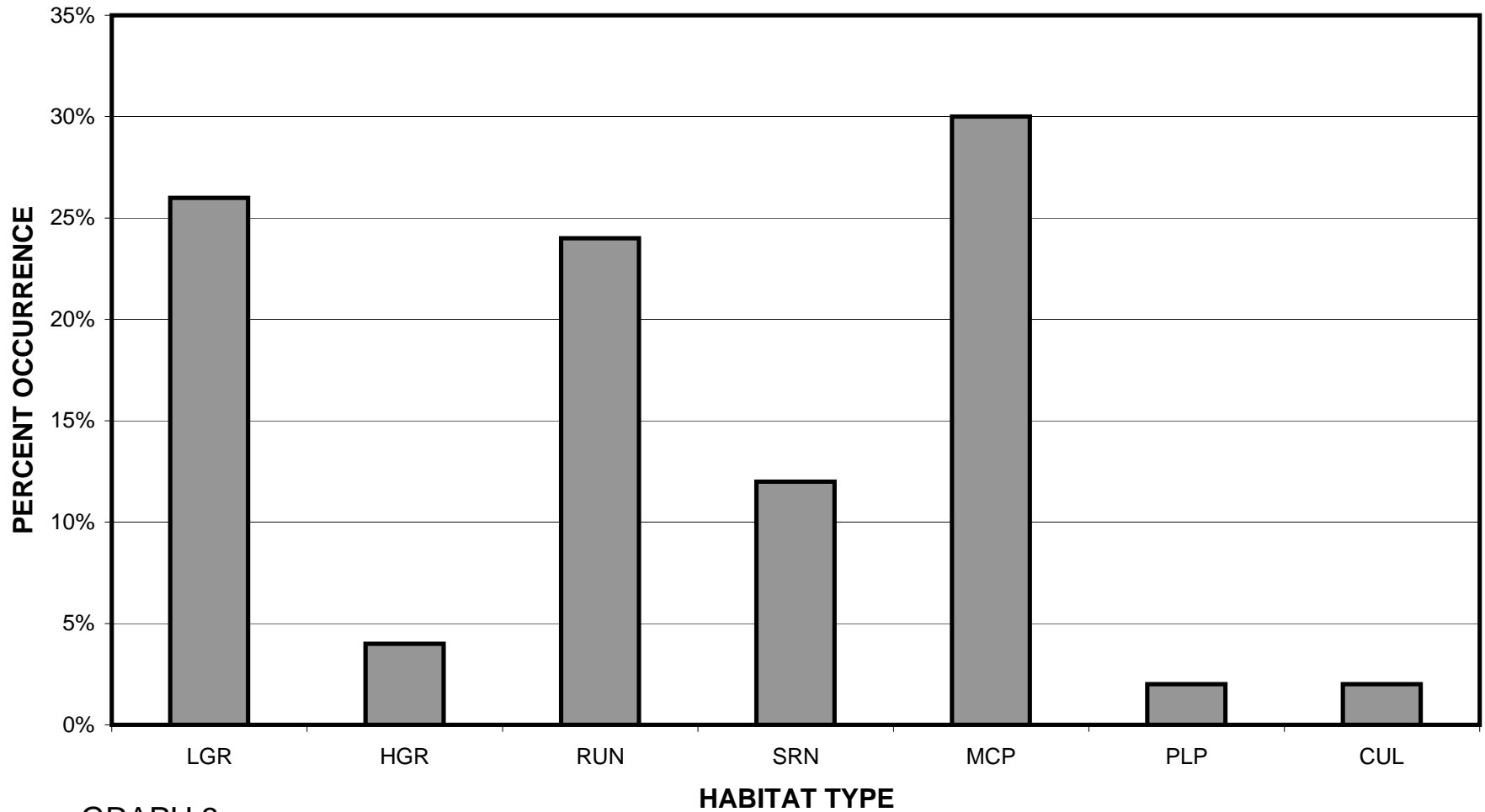
# **NORTH FORK BERRY GULCH 2009 HABITAT TYPES BY PERCENT TOTAL LENGTH**



GRAPH 2

# **NORTH FORK BERRY GULCH 2009**

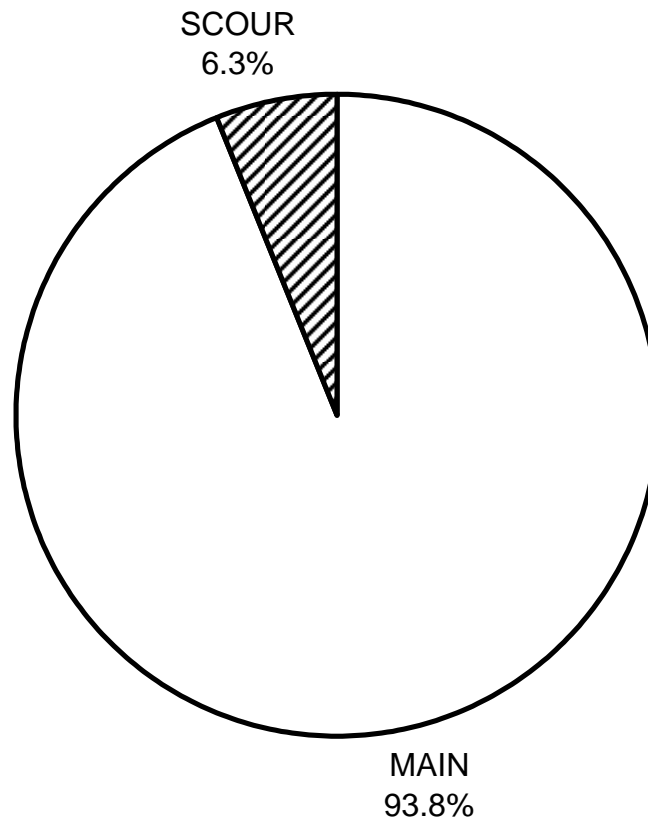
## **HABITAT TYPES BY PERCENT OCCURRENCE**



GRAPH 3



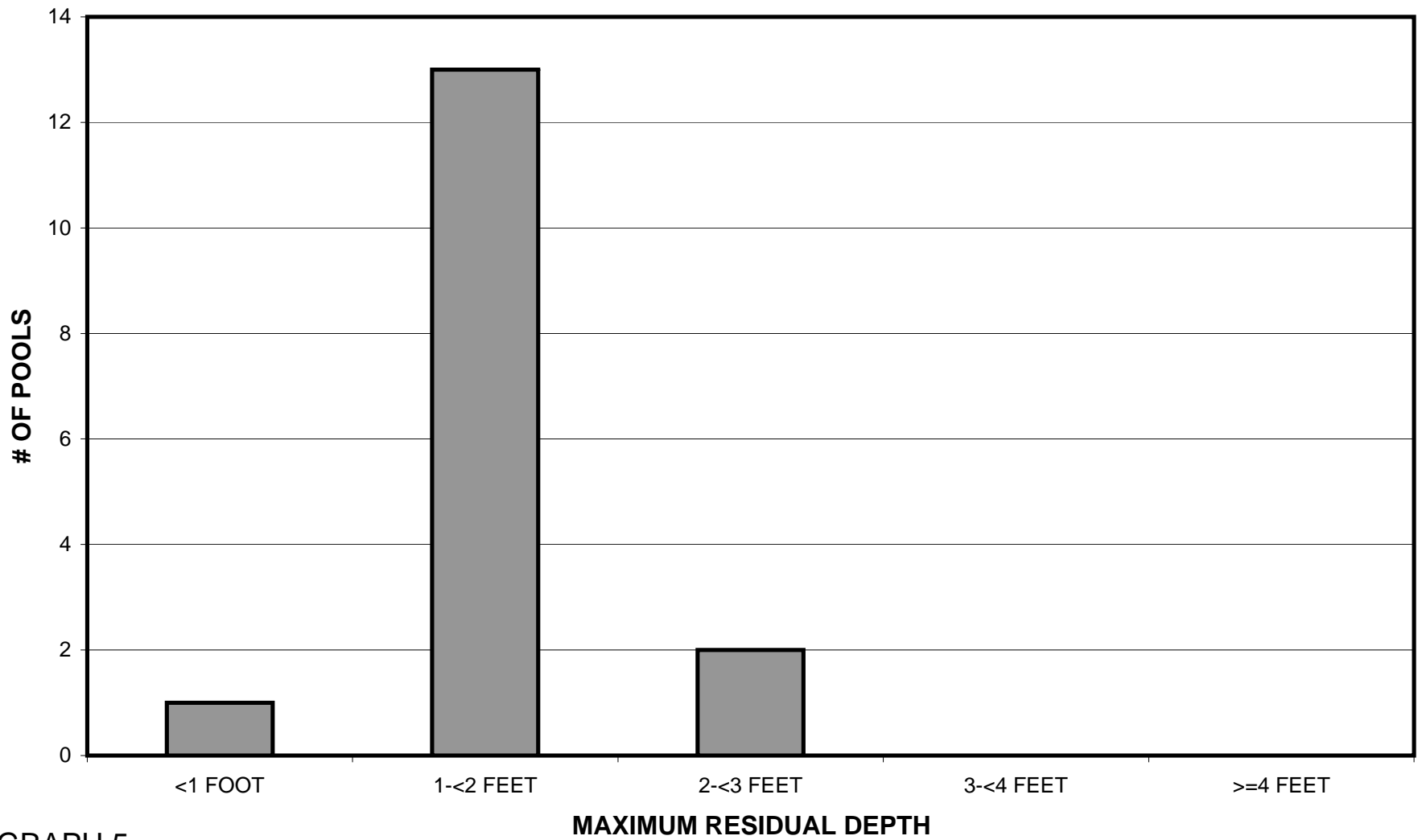
**NORTH FORK BERRY GULCH 2009  
POOL TYPES BY PERCENT OCCURRENCE**



GRAPH 4

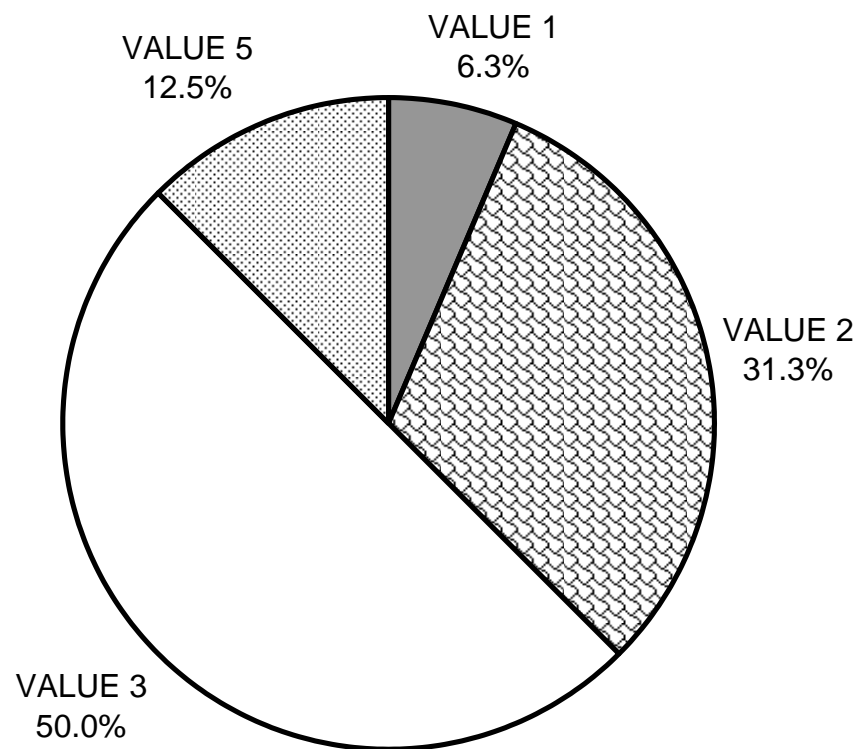
# **NORTH FORK BERRY GULCH 2009**

## **MAXIMUM DEPTH IN POOLS**



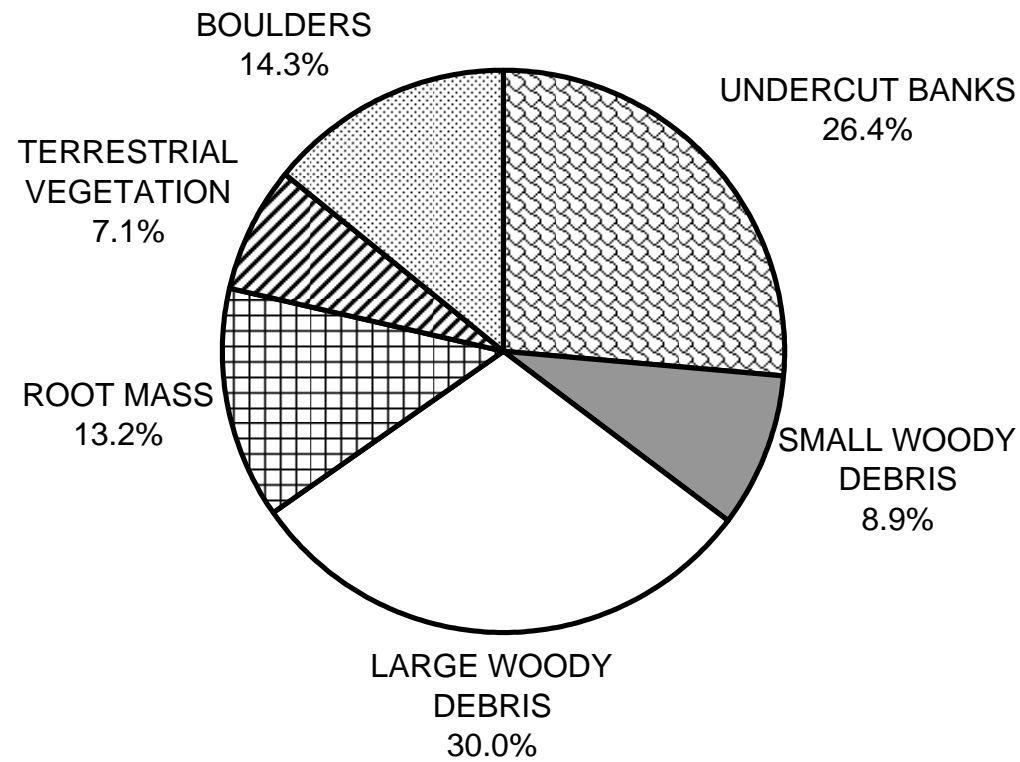
GRAPH 5

# **NORTH FORK BERRY GULCH 2009 PERCENT EMBEDDEDNESS**



GRAPH 6

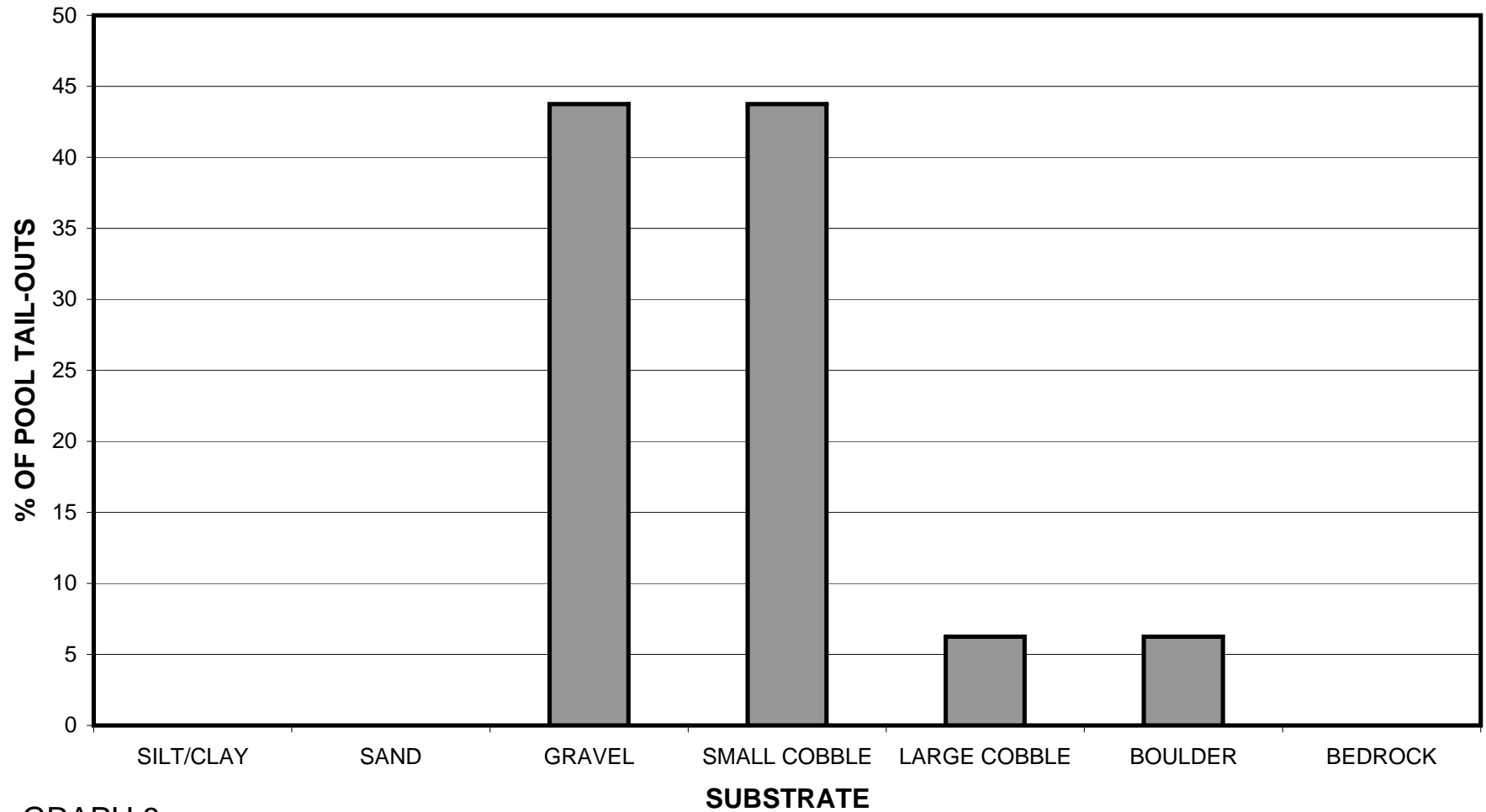
# **NORTH FORK BERRY GULCH 2009 MEAN PERCENT COVER TYPES IN POOLS**



GRAPH 7

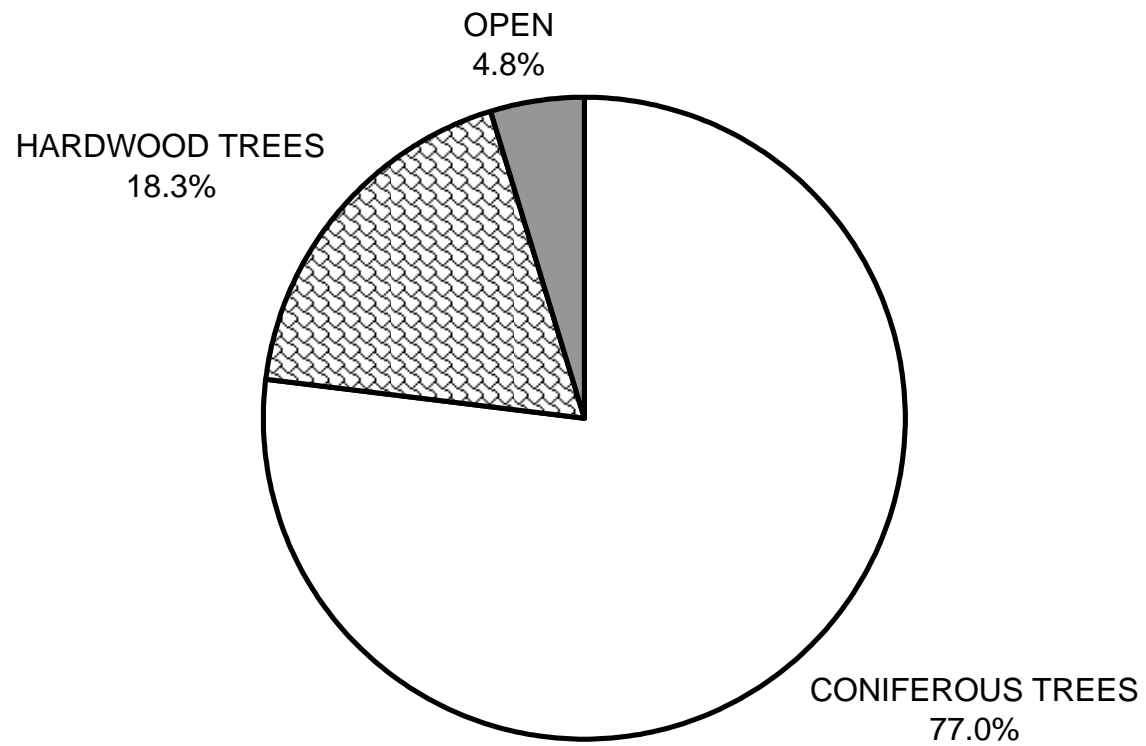
# **NORTH FORK BERRY GULCH 2009**

## **SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



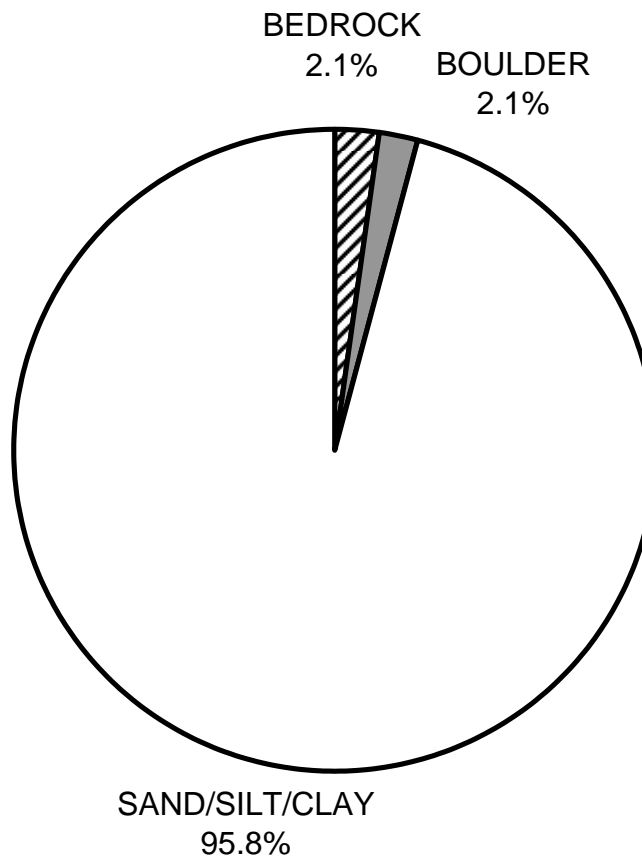
GRAPH 8

# **NORTH FORK BERRY GULCH 2009 MEAN PERCENT CANOPY**



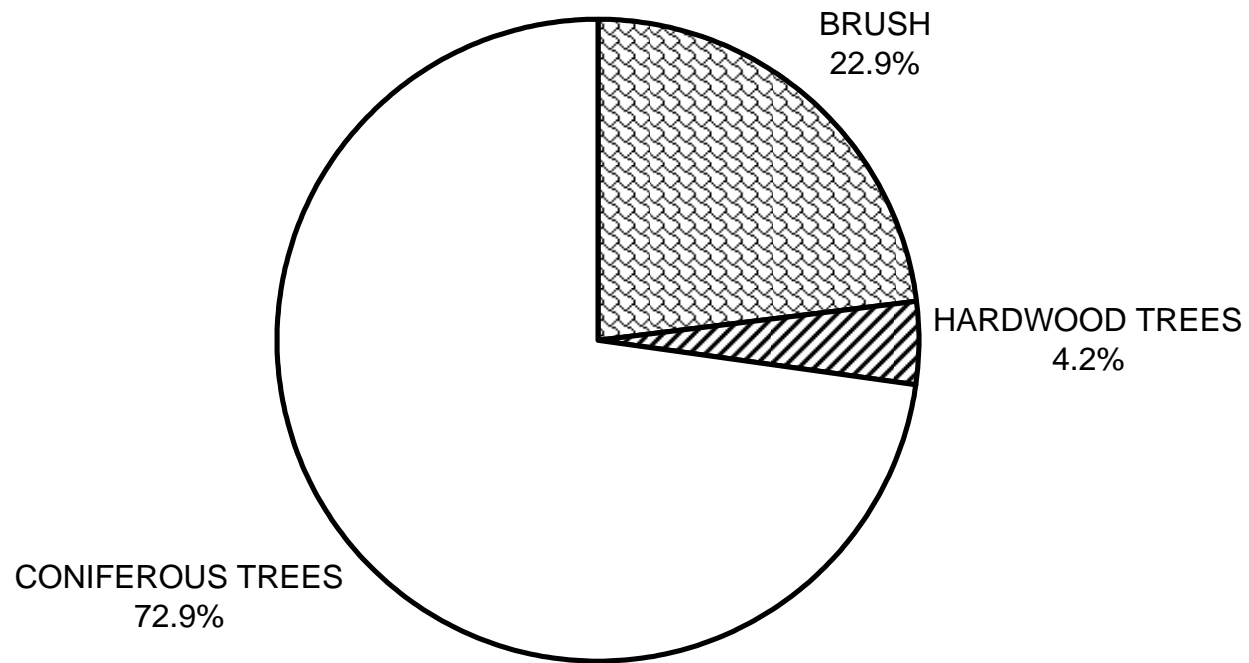
GRAPH 9

**NORTH FORK BERRY GULCH 2009  
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

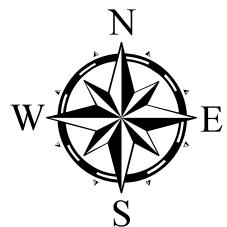
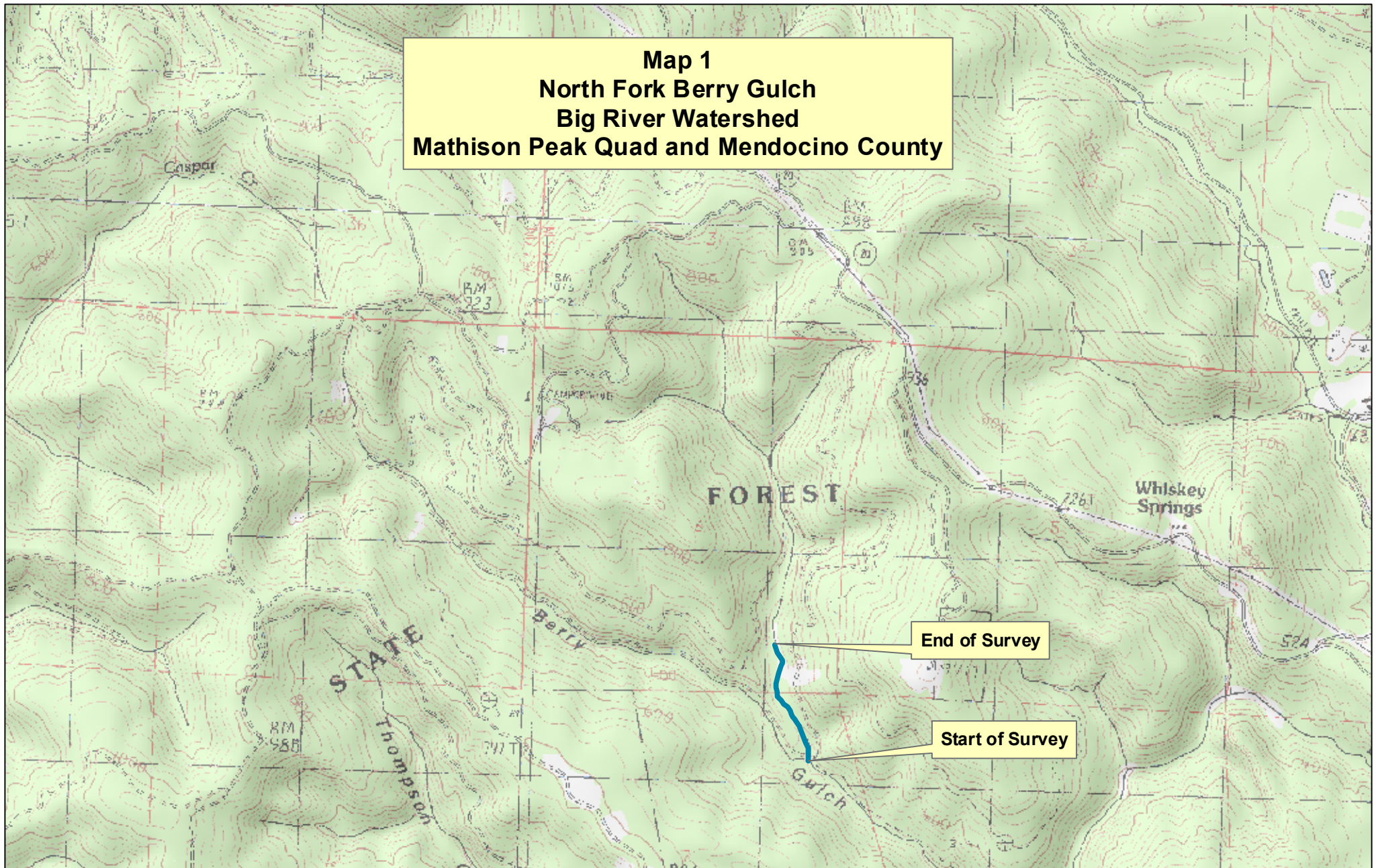
**NORTH FORK BERRY GULCH 2009  
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11



**Map 1**  
**North Fork Berry Gulch**  
**Big River Watershed**  
**Mathison Peak Quad and Mendocino County**



**Legend**

— Reach 1, G4 Channel Type

0 2,300 4,600 Feet

