

**CALIFORNIA DEPARTMENT OF FISH AND GAME
STREAM INVENTORY REPORT**

Peterson Creek

Report Revised April 14, 2006

Report Completed 2005

Assessment Completed 2001

INTRODUCTION

A stream inventory was conducted during the summer of 2001 on Peterson Creek. The inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the amount and condition of available habitat to fish and other aquatic species with an emphasis on anadromous salmonids in Peterson Creek. The objective of the biological inventory was to document the presence and distribution of salmonids and other aquatic species.

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. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Peterson Creek is a tributary of the Russian River, located in Sonoma County, California (see Peterson Creek map, Appendix A). The legal description at the confluence with the Russian River is T10N, R9W in the Sotoyome Rancheria. Its location is 38.698982989292 N. latitude and 122.87351409032 W. longitude. Year round vehicle access exists east of Highway 101 along levee access roads south of Geyserville.

Peterson Creek and its tributaries drain a basin of approximately 1.65 square miles. Peterson Creek is a third order stream and has approximately 3.18 miles of perennial stream, according to the USGS "Geyserville" 7.5 minute quadrangles. There are no major tributaries to this creek; however two minor tributaries are included in this report, in italics. Although, there were adequate pools to sustain large fish, there was not enough flowing water to get a flow meter reading. Elevations range from about 190 feet at the mouth of the creek to 860 feet in the headwaters. The lower reach has no canopy, since it is primarily agricultural land, while the mid-upper watershed is dominated by oak and hardwood species such as redwood, buckeye and bay laurel. The riparian zone includes alder, as well as the above. The upper watershed is dominated by mixed hardwoods and conifers, including grey pine. Fish as long as 8" were observed and salmonids exist in the pools. The watershed is owned primarily by private landowners, vineyard owners and a railroad and is managed primarily for rural living and vineyard development. No sensitive plants listed from the CNPS Inventory and DFG's Natural Diversity Database within the Peterson Creek watershed.

METHODS

The habitat inventory conducted in Peterson Creek follows the methodology presented in the California Salmonid Stream Habitat Restoration Manual (Flosi et al. 1998). The AmeriCorps Volunteers 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 and was supervised by Derek Acomb, Russian River Basin Planner (DFG).

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 (1998). This form was used in Peterson Creek to record measurements and observations. There are nine components to the inventory form: flow, channel type, temperatures, habitat type, embeddedness, shelter rating, substrate composition, canopy, and bank composition.

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 are also measured or estimated at major tributary confluences.

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 (1998). 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:

Water and air temperatures, and time, are measured by crew members with hand-held thermometers and recorded at each tenth unit typed. Temperatures are measured in Fahrenheit at the middle of the habitat unit and within one foot of the water surface. Temperatures are also recorded using remote temperature recorders which log temperature at set intervals, 24 hours/day.

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. De-watered units are labeled "DRY". Peterson Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width.

All unit lengths were measured. The first occurrence of each unit type and a randomly selected 10% subset of all units were completely sampled (Length, Mean Width, Mean Depth, Maximum Depth and Pool Tail Crest Depth). All measurements are 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 Peterson Creek, embeddedness was visually 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). "Not suitable" (value 5) is assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, absence of particulate substrate (e.g. bedrock), 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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All shelter is then classified according to a list of nine shelter types. In Peterson Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the shelter. The shelter rating is calculated for each habitat unit by multiplying shelter value and percent covered. Thus, shelter ratings can range from 0-300, and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

In all fully measured habitat units, dominant and sub-dominant substrate elements are visually estimated using a list of seven size classes: Silt/Clay, Sand, Gravel, Small Cobble, Large Cobble, Boulder, and Bedrock.

8. Canopy:

Stream canopy density is estimated using modified handheld spherical densiometers as described in the California Salmonid Stream Habitat Restoration Manual (1998). Canopy density relates to the amount of stream shaded from the sun. In Peterson 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. Finally, the total canopy over each habitat unit is visually divided into evergreen and deciduous, and the estimated percentages are recorded.

9. Bank Composition and Vegetation:

Banks may be composed primarily of (1) Bedrock, (2) Boulders, (3) Cobble/Gravel, or (4) Silt/Clay/Sand, and may be covered predominantly with (5) Grass, (6) Brush, (7) Deciduous Trees, (8) Coniferous Trees, or (9) No Vegetation at all. These factors influence the ability of stream

banks to withstand winter flows. For each fully measured habitat unit in Peterson Creek, the dominant Bank Composition Type and Vegetation Type of both the right and left banks were chosen from the options above. Additionally, the percentage of vegetal coverage was estimated and recorded for each bank.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species present 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, and 3) electro-fishing. These sampling techniques are discussed in the California Salmonid Stream Habitat Restoration Manual (1998).

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE IV data entry program developed by CDFG. This program processes and summarizes the data, and produces the following tables and appendices:

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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Peterson Creek include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools
- Percent Embeddedness
- Mean Percent Cover Types in Pools
- Substrate Composition in Pool Tail-outs
- Mean Percent Canopy
- Dominant Bank Composition by Composition Type
- Dominant Bank Vegetation by Vegetation Type

HISTORICAL STREAM SURVEYS:

There is no record of stream surveys conducted by the Department of Fish and Game on Peterson Creek prior to this year.

HABITAT INVENTORY RESULTS

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

The habitat inventory of Peterson Creek, June 27, 2001 - June 28, 2001, was conducted by J. Smith (DFG) and C. Sangiacomo (DFG) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with the Russian River and extended up Peterson Creek to the rock falls. The total length of stream surveyed was 12760 feet, with no additional length of side channel.

Flows were not measured on Peterson Creek.

This section of Peterson Creek has two reaches with two distinct channel types: from the mouth to 5343 feet a F3 and 7417 feet a F4.

F3 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly cobble substrate.

F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate.

Water temperatures ranged from 59°F to 62°F. Air temperatures ranged from 60°F to 71°F.

Summer temperatures were also measured using a remote temperature recorder placed in a pool (see Temperature Summary graph at end of report). A recorder in Reach Two, approximately 500 feet from the Geyserville Ave/Tzabaco Rd bridge, logged temperatures every two hours from July 12 - August 8, 2001, at which point the pool went dry and the recorder was moved to another pool, further upstream., where temperatures were logged every two hours from September 20 - October 28, 2001. The highest temperature recorded was 66°F in July and the lowest was 52°F in October. The mean of the daily highs was 62.4°F for the month of July, 57.4°F for September and 56.0°F for October.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of *occurrence* there were 31.0% Pool units, 29.9% Riffle units, 25.3% Flatwater units and 13.8% Dry units (Graph 1). Based on total *length* there were 46.6% Dry units, 32.9% Riffle units, 15.1% Flatwater units and 5.4% Pool units (Graph 2).

Of the 87 habitat units measured, 14% were completely sampled. Seven Level IV habitat types

were identified. The data is summarized in Table 2. The most frequent habitat types by percent *occurrence* were Low Gradient Riffle at 30%, Mid-Channel Pool at 25%, Run at 24% and Dry at 14% (Graph 3). By percent total *length*, Dry at 47%, Low Gradient Riffle at 33%, Run at 15% and Mid-Channel Pool at 4%.

Twenty-Seven pools were identified (Table 3). Mid-Channel Pool pools were most often encountered at 25%, and comprised 82% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fourteen of the 27 pools (52%) had a depth of two feet or greater (Graph 5). These deeper pools comprised 3% of the total length of stream habitat.

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. Flatwater units rated 50, Pools rated 28 and Riffles rated 10 (Table 1). Of the pool types, Lateral Scour Pool - Root Wad Enhanced rated 49, Mid-Channel Pool rated 23 and Lateral Scour Pool - Bedrock Formed rated 20 (Table 2).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were Undercut Banks at 38%, Small Wood at 28%, Boulders at 13%, Root Mass at 9% and Large Wood at 3%. Graph 7 describes the pool shelter in Peterson Creek.

Table 6 summarizes the dominant substrate by habitat type. In the 26 Low-Gradient Riffles surveyed, the dominant substrate was: Small Cobble in two riffles, Large Cobble in one riffle and Gravel in one riffle.

No mechanical gravel sampling was conducted in 2001 surveys due to inadequate staffing levels.

The depth of cobble embeddedness was estimated at pool tail-outs (Graph 8). Of the 27 pool tail-outs measured, 12 had a value of 1 (44%), 13 had a value of 2 (48%), one had a value of 3 (4%) and one had a value of 4 (4%). Riffles rated a 5 are unsuitable substrate type for spawning. On this scale, a value of 1 is best for fisheries. Small Cobble was the dominant substrate observed at pool tail-outs. Graph 6 describes percent embeddedness.

The mean percent canopy density for the stream reach surveyed was 87%. The mean percentages of deciduous and evergreen trees were 33% and 67%, respectively (Table 7). Graph 9 describes the canopy for the entire survey.

For the entire stream reach surveyed, the mean percent right bank vegetated was 61% and the mean percent left bank vegetated was 51% (Table 7). For the habitat units measured, the dominant vegetation types for the stream banks were: 42% Brush, 29% Evergreen Trees, 25% Deciduous Trees and 4% Grass (Graph 11, Table 9). The dominant substrate for the stream banks were: 38% Silt, Clay & Sand, 33% Cobble & Gravel and 29% Bedrock (Graph 10, Table 9).

PETERSON CREEK, UNNAMED TRIBUTARY #1

The habitat inventory of Peterson Creek, Trib 1, June 28, 2001, was conducted by

J. Smith(DFG)/C. Sangiacomo(DFG) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Peterson Creek and extended up Peterson Creek, Trib 1. The total length of stream surveyed was 1236 feet, with no additional length of side channel.

Flows were not measured on Peterson Creek, Trib 1.

This section of Peterson Creek, Trib 1 has one reach with one distinct channel type: from the mouth to 1236 feet a F4.

F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly gravel substrate.

Water temperatures ranged from 59°F to 61°F. Air temperatures ranged from 70°F to 72°F.

*Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 54.5% Riffle units, 27.3% Dry units and 18.2% Pool units (Graph 1). Based on total **length** there were 88.8% Riffle units, 10.1% Dry units and an extremely low 1.1% Pool units (Graph 2).*

*Eleven habitat units were measured and 27% were completely sampled. Four Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent **occurrence** were Low Gradient Riffle at 45%, Dry at 27%, Mid-Channel Pool at 18% and High Gradient Riffle at 9% (Graph 3). By percent total **length**, Low Gradient Riffle at 59%, High Gradient Riffle at 30%, Dry at 10% and an extremely low rating of 1% for mid-channel pools.*

Two pools were identified (Table 3). Mid-Channel Pool pools were most often encountered at 18%, and comprised 100% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Neither of the two pools (0%) had a depth of two feet or greater (Graph 5).

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. Pools rated 38 and Riffles rated 10 (Table 2). Of the pool types, Mid-Channel Pool rated 38 (Table 3).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were Undercut Banks at 50%, Small Wood at 25% and Large Wood at 25%. Graph 7 describes the pool shelter in Peterson Creek, Trib 1.

Table 6 summarizes the dominant substrate by habitat type. In the five Low-Gradient Riffles surveyed, the dominant substrate was: Small Cobble in one riffle).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the two pool tail-outs measured, one had a value of 1 (50%) and one had a value of 3 (50%). Riffles rated a 5 (unsuitable substrate type for spawning). On this scale, a value of one is best for fisheries. Gravel

was the dominant substrate observed at pool tail-outs. Graph 6 describes percent embeddedness by reach.

The mean percent canopy density for the stream reach surveyed was 94%. The mean percentages of deciduous and evergreen trees were 1% and 99%, respectively (Table 7). Graph 9 describes the canopy for the entire survey.

For the entire stream reach surveyed, the mean percent right bank vegetated was 53% and the mean percent left bank vegetated was 53% (Table 7). For the habitat units measured, the dominant vegetation types for the stream banks were: 83% Evergreen Trees and 17% Brush (Table 9, Graph 11). The dominant substrate for the stream banks were: 100% Silt, Clay & Sand (Table 9, Graph 10).

PETERSON CREEK, UNNAMED TRIBUTARY #2

The habitat inventory of Peterson Creek, Trib 2, July 2, 2001, was conducted by J. Smith (DFG) and C. Sangiacomo (DFG) with supervision and analysis by California Department of Fish and Game (DFG). The survey began at the confluence with Parent Stream and extended up Peterson Creek, Trib 2 to the end of survey. The total length of stream surveyed was 380 feet, with no additional length of side channel.

Flows were not measured on Peterson Creek, Trib 2.

This section of Peterson Creek, Trib 2 has one reach with one distinct channel type: from the mouth to 380 feet an F4.

F4 channel types are entrenched meandering riffle/pool channels on low gradients (<2%) with a high width/depth ratio and a predominantly bedrock/boulder, cobble/gravel/sand/silt/clay substrate.

Water temperatures ranged from 59°F to 59°F. Air temperatures ranged from 62°F to 62°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of **occurrence** there were 37.5% Riffle units, 25.0% Pool units, 25.0% Dry units and 12.5% Flatwater units. Based on total **length** there were 58.7% Riffle units, 20.0% Flatwater units, 17.6% Dry units and 3.7% Pool units (Graph 1).

Eight habitat units were measured and 38% were completely sampled. Four Level IV habitat types were identified. The data is summarized in Table 2. The most frequent habitat types by percent **occurrence** were Low Gradient Riffle at 38%, Mid-Channel Pool at 25%, Dry at 25% and Run at 13% (Graph 3). By percent total **length**, Low Gradient Riffle at 59%, Run at 20%, Dry at 18% and Mid-Channel Pool at 4% (Graph 2).

Two pools were identified (Table 3). Mid-Channel pools were most often encountered at 25%, and comprised 100% of the total length of pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Neither of the two pools (0%) had a depth of two feet or greater (Table 4, Graph 5).

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. Riffles rated 30 and Pools rated 10 (Table 2). Of the pool types, Mid-Channel Pools rated 10 (Table 2).

Table 5 summarizes fish shelter by habitat type. By percent area, the dominant pool shelter types were Undercut Banks at 100%. Graph 7 describes the pool shelter in Peterson Creek, Trib 2.

Table 6 summarizes the dominant substrate by habitat type. In the three Low-Gradient Riffles surveyed, the dominant substrate was gravel.

The mean percent canopy density for the stream reach surveyed was 93%. The mean percentages of deciduous and evergreen trees were 9% and 91%, respectively (Table 7). Graph 9 describes the canopy for the entire survey.

For the entire stream reach surveyed, the mean percent right bank vegetated was 40% and the mean percent left bank vegetated was 33%. For the habitat units measured, the dominant vegetation types for the stream banks were: 33% Deciduous Trees, 33% Brush, 17% Grass and 17% Evergreen Trees (Table 9, Graph 11). The dominant substrate for the stream banks were: 83% Silt, Clay & Sand and 17% Bedrock (Table 9, Graph 10).

BIOLOGICAL INVENTORY

JUVENILE SURVEYS:

On September 19, 2001, a biological inventory was conducted in Peterson Creek to document the fish species composition and distribution at one location. This site was single-pass electro-fished using one Smith Root Model 12 electro-fisher. Fish from this site were counted by species and returned to the stream. A random sample of fish were selected from this reach and tissues from salmonids from each available year class were taken for genetic analysis. Air temperatures ranged from 58° to 76°F and water temperatures ranged from 56° to 57° F.

The inventory of Site 1 started at habitat unit #039, 30 feet upstream from the culvert/crossing and ended approximately 1600 feet upstream. In run, pool and riffle habitats, ten steelhead (ranging from 100-215 mm) were observed along with two crayfish and three pacific giant salamanders.

During the habitat inventory, no salmonids/anadromous salmonids were observed upstream of unit #074, 10,796 feet above the confluence with the Russian River. This last sighting of steelhead was not associated with a fish barrier. Resident rainbow trout were not observed above this point.

A summary of historical and recent data collected appears in the table below.

Table 1. Species Observed in Historical and Recent Surveys

YEARS	SPECIES	SOURCE	Native/Introduced
2001	Steelhead	DFG	N
2001	Coho (YOY)	DFG	N
2001	Pacific Giant Salamander	DFG	N
2001	Crayfish	DFG	N

There is no record of hatchery stocking or fish rescue/transfer operations in Peterson Creek.

ADULT SURVEYS:

No data exists within the DFG files concerning either carcass surveys or spawning surveys on Peterson Creek.

DISCUSSION

Peterson Creek has two reaches: 5343 feet a F3 and 7417 feet a F4.

There are 5343 feet of F3 channel type in Reach One. According to the DFG Salmonid Stream Habitat Restoration Manual, F3 channel types are good for bank-placed boulders as well as single and opposing wing-deflectors. They are fair for low-stage weirs, boulder clusters, channel constrictors and log cover. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

There are 7417 feet of F4 channel type in Reach Two. F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors, channel constrictors and log cover. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

The water temperatures recorded on the survey days June 27, 2001 - June 28, 2001 ranged from 59°F to 62°F. Air temperatures ranged from 60°F to 71°F. The warmest water temperatures were recorded in Reach Two. This temperature regime is favorable to salmonids.

Summer temperatures measured using a remote temperature recorder placed in a pool ranged from 52°to 66°F for Reach Two. The Temperature Summary graph shows that for much of the summer

(July through August) the middle watershed exhibited temperatures at the optimal for salmonids.

It is unknown if this thermal regime is typical. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and/or more extensive biological sampling conducted.

Pools comprised 5% of the total length of this survey. 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. In Peterson Creek, the pools are relatively deep with 52% having a maximum depth of at least two feet. These pools comprised 3% of the total length of stream habitat. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 28. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by Undercut Banks at 33%, Small Wood at 30%, Large Wood at 11%, Root Mass at 9% and Boulders at 8%. Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

Three of the four low gradient riffles measured (75%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Seven percent of the pool tail-outs measured had embeddedness ratings of either 3 or 4. Forty four percent of the pool tail-outs had a rating of 1. Cobble embeddedness measured to be 25% or less (a rating of 1) is considered best for the needs of salmon and steelhead.

The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence. In Peterson Creek, the amount of fine sediment in potential spawning habitat seems to be minimal.

The mean percent canopy for the survey was 87%. This is a good percentage of canopy, since 80 percent is generally considered desirable

However, the riparian buffer is thin or nearly absent in areas with agriculture/urban development. Riparian removal/vineyard development within the riparian corridor could all lead to less stream canopy and channel incision causing bank erosion and higher water temperatures.

PETERSON CREEK, UNNAMED TRIBUTARY #1

Peterson Creek, Trib 1 has one reach: 1236 feet a F4.

According to the DFG Salmonid Stream Habitat Restoration Manual, F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors,

channel constrictors and log cover. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

The water temperatures recorded on the survey day June 28, 2001 ranged from 59°F to 61°F. Air temperatures ranged from 70°F to 72°F.

This temperature regime is favorable to salmonids, **though** it is unknown if it is typical. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and/or more extensive biological sampling conducted.

Pools comprised 1% of the total **length** of this survey. 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. In Peterson Creek, Trib 1, the pools are extremely shallow with no pools having a maximum depth of at least two feet. In coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.

The mean shelter rating for pools was 38. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by Undercut Banks at 35%, Small Wood at 33% and Large Wood at 33%. Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The one low gradient riffle measured for substrate (100%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

Of the pool tail-outs measured, 50% had embeddedness ratings of either 3 or 4. Only 50% had a rating of 1. Cobble embeddedness measured to be 25% or less (a rating of 1) is considered best for the needs of salmon and steelhead.

The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence. In Peterson Creek, Trib 1, the amount of fine sediment in potential spawning habitat seems to be minimal.

The mean percent canopy for the survey was 94%. This is very good, since 80 percent is generally considered desirable.

PETERSON CREEK, UNNAMED TRIBUTARY #2

Peterson Creek, Trib 2 has one reach: 380 feet a F4.

According to the DFG Salmonid Stream Habitat Restoration Manual, F4 channel types are good for bank-placed boulders and fair for low-stage weirs, single and opposing wing-deflectors,

channel constrictors and log cover. Many site specific projects can be designed within this channel type, especially to increase pool frequency, volume and shelter. Any work considered will require careful design, placement, and construction that must include protection for any unstable banks.

The water temperatures recorded on the survey day July 2, 2001 ranged from 59°F to 59°F. Air temperatures ranged from 62°F to 62°F.

This temperature regime is favorable to salmonids.

It is unknown if this thermal regime is typical. To make any further conclusions, temperatures need to be monitored for a longer period of time through the critical summer months, and/or more extensive biological sampling conducted.

*Pools comprised 4% of the total **length** of this survey. 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. In Peterson Creek, Trib 2, the pools are extremely shallow with no pools having a maximum depth of at least two feet. However, in coastal coho and steelhead streams, it is generally desirable to have primary pools comprise approximately 50% of total habitat length.*

The mean shelter rating for pools was 10. However, a pool shelter rating of approximately 80 is desirable. The relatively small amount of pool shelter that now exists is being provided primarily by Undercut Banks at 100%. Log and root wad cover in the pool and flatwater habitats would improve both summer and winter salmonid habitat. Log cover provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The one low gradient riffle measured (100%) had either gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

None of the pool tail-outs measured had embeddedness ratings of either 3 or 4. None had a rating of 1. Cobble embeddedness measured to be 25% or less (a rating of 1) is considered best for the needs of salmon and steelhead.

The higher the percent of fine sediment, the lower the probability that eggs will survive to hatch. This is due to the reduced quantity of oxygenated water able to percolate through the gravel, or because of fine sediment capping the redd and preventing fry emergence. In Peterson Creek, Trib 2, the amount of fine sediment in potential spawning habitat seems to be minimal.

The mean percent canopy for the survey was 93%. This is very good, since 80 percent is generally considered desirable.

GENERAL MANAGEMENT RECOMMENDATIONS

Peterson Creek should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

PRIORITY FISHERY ENHANCEMENT OPPORTUNITIES

- 1) Access for migrating salmonids is an ongoing potential problem Peterson Creek, therefore, fish passage should be monitored and improved where possible. Baffles should be installed in several culverts to facilitate easier fish access.
- 2) Map sources of upslope and in-channel 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. Near-stream riparian planting along any portion of the stream should be encouraged to provide bank stability and a buffering against agricultural, grazing and urban runoff.
- 3) In Peterson Creek, active and potential sediment sources related to the road system need to be mapped, and treated according to their potential for sediment yield to the stream and its tributaries.
- 4) Peterson Creek would benefit from the utilizing bio-technical vegetative techniques to re-establish floodplain benches and a defined low flow channel. This would discourage lateral migration of the base flow channel and decrease bank erosion.
- 5) Where feasible, increase woody cover in the pool and flatwater habitat units along the entire stream. Most of the existing shelter is from vegetation and undercut banks. Adding high quality complexity with larger woody cover is desirable. Combination cover/scour structures constructed with boulders and woody debris would be effective in many flatwater and pool locations in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion. In some areas the material is at hand.
- 6) Where feasible, design and engineer pool enhancement structures to increase the number of pools in the upper reaches. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

Peterson Creek Mainstem

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.

Peterson Creek

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	WP# 070: N 38-41' 33.2", W 122-53' 7.5" No canopy on east side of Hwy. 101.
5266	0008.00	One 1" non-salmonid.
5291	0009.00	One dead fish. 2-3" rainbow trout.
6100	0020.00	No GPS.
6552	0029.00	Culvert RB.
6971	0033.00	Boulders for bank control.
7061	0036.00	Small black snails.
7525	0041.00	BA, 3.5, 10, C
7618	0043.00	In-stream culvert: see form. No GPS.
7645	0044.00	Old road crossing, wet road LB.
8123	0051.00	One 4" dark & fast non-salmonid. Retaining wall on RB.
8477	0059.00	Fewer than 5 fish in pool: No ID available.
8515	0060.00	In-stream culvert: see form.
8582	0062.00	Dry trib at 200' RB.

8792	0063.00	Wet trib RB culvert.
8815	0064.00	Road crosses to LB. Small culvert LB. No GPS.
8903	0065.00	Culvert 100' LB.
9329	0067.00	GPS: N 38-41' 21.3", W 122-53' 49.5"
9694	0070.00	Dry trib LB. Old road RB.
10687	0076.00	Fewer than 5 YOY.
10704	0077.00	Instream culvert at beginning of unit. Dry trib LB.
11733	0080.00	Dry trib RB at 15'.
11788	0081.00	BA, 2.0, 15, C. Fewer than five 4-6" fish: dark, eating larvae.
12320	0087.00	End of survey.

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.

Peterson Creek, Trib 1

<i>Position (ft.)</i>	<i>Habitat Unit #</i>	<i>Comments:</i>
0	0001.00	Mouth in HU #044 of Peterson Creek;N38°41'25.3"/W122°53'32.8"
418	0007.00	Spring LB at 340' in HU
956	0010.00	Dry Trib LB
973	0011.00	End of Survey.

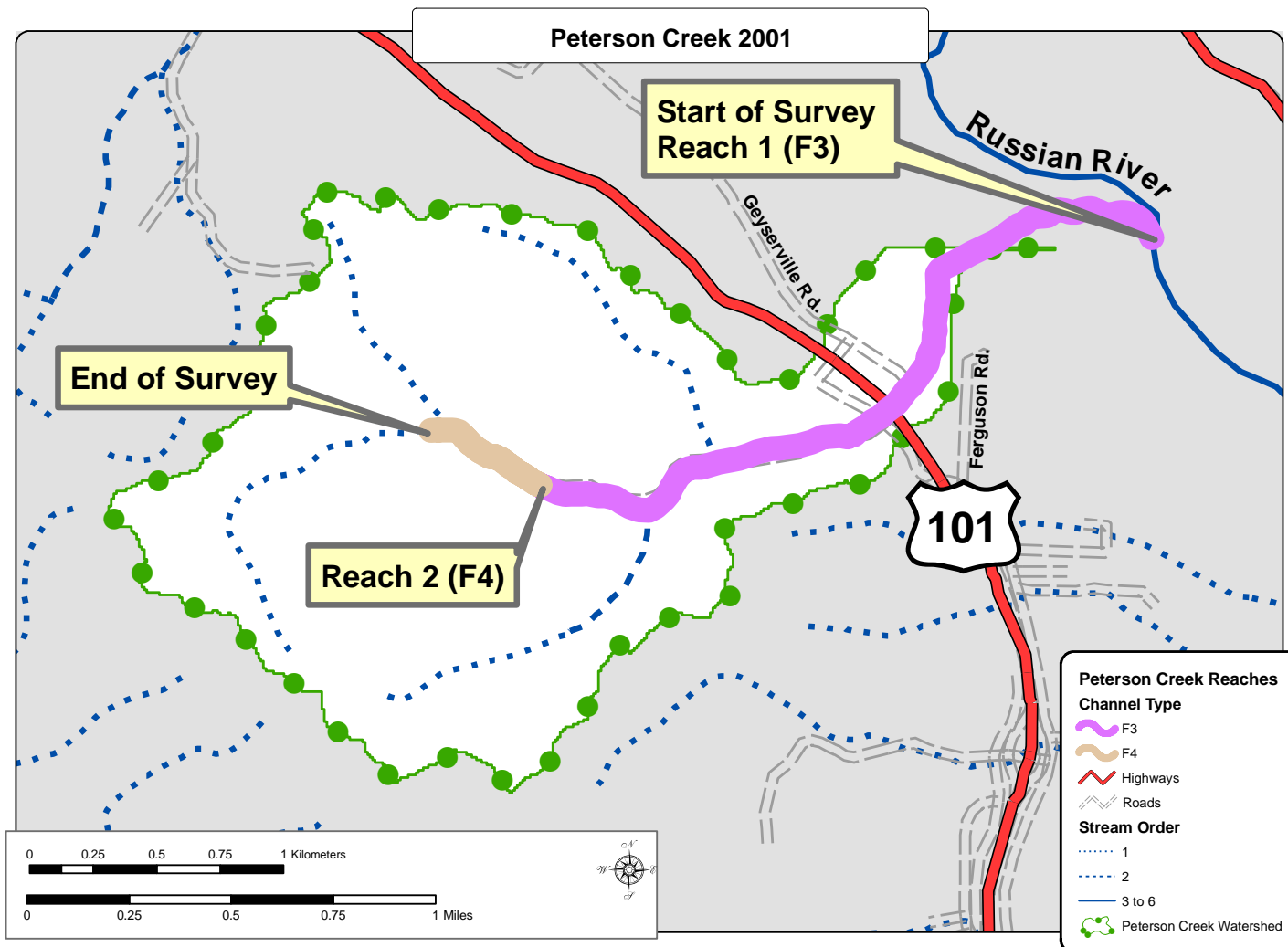
COMMENTS AND LANDMARKS

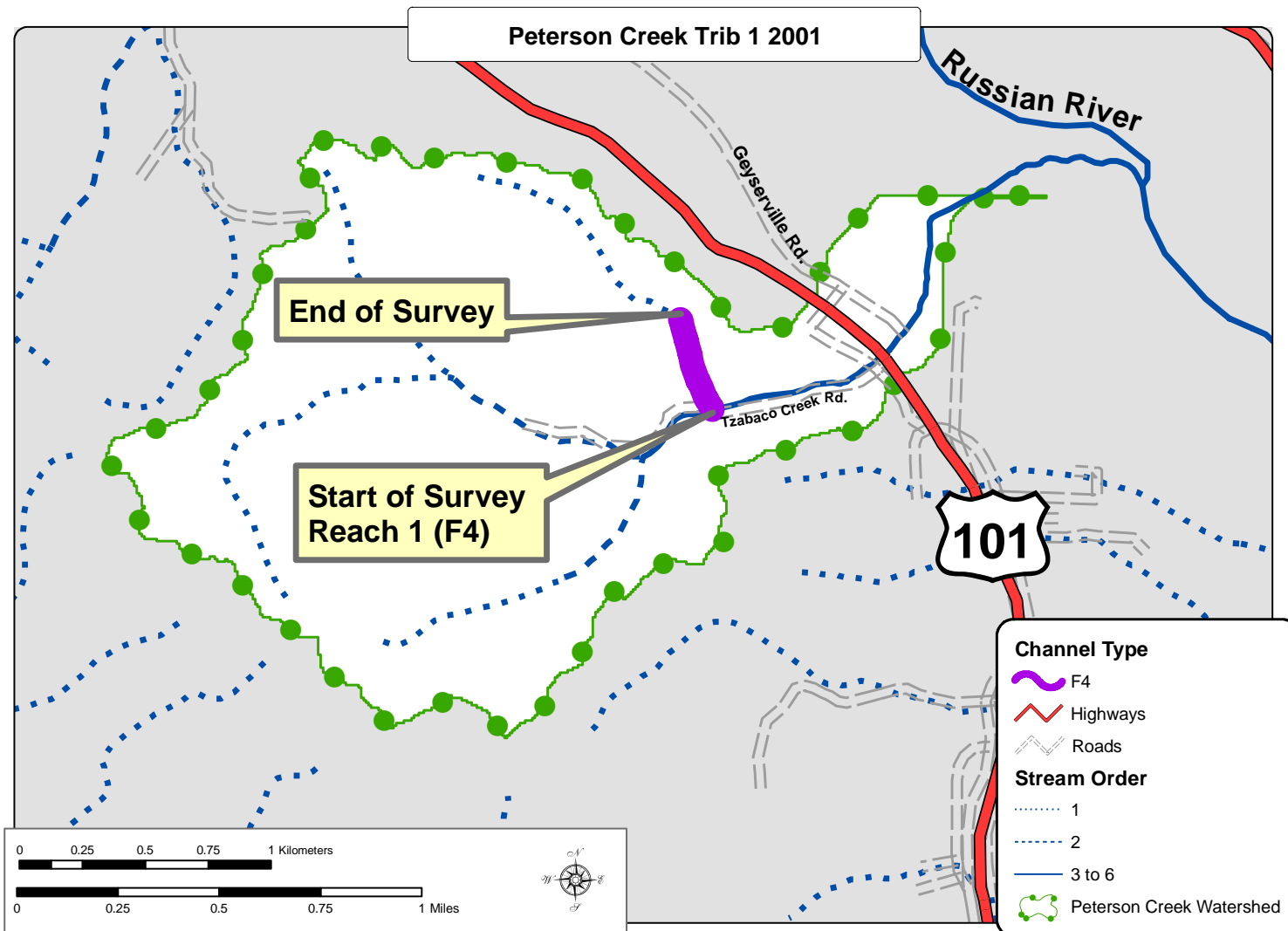
The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey reach.

Peterson Creek, Trib 2

<i>Position (ft.)</i>	<i>Habitat Unit #</i>	<i>Comments:</i>
221	0005.00	In stream culvert
304	0008.00	End of water; RB has rip rap and retaining wall due to Road.

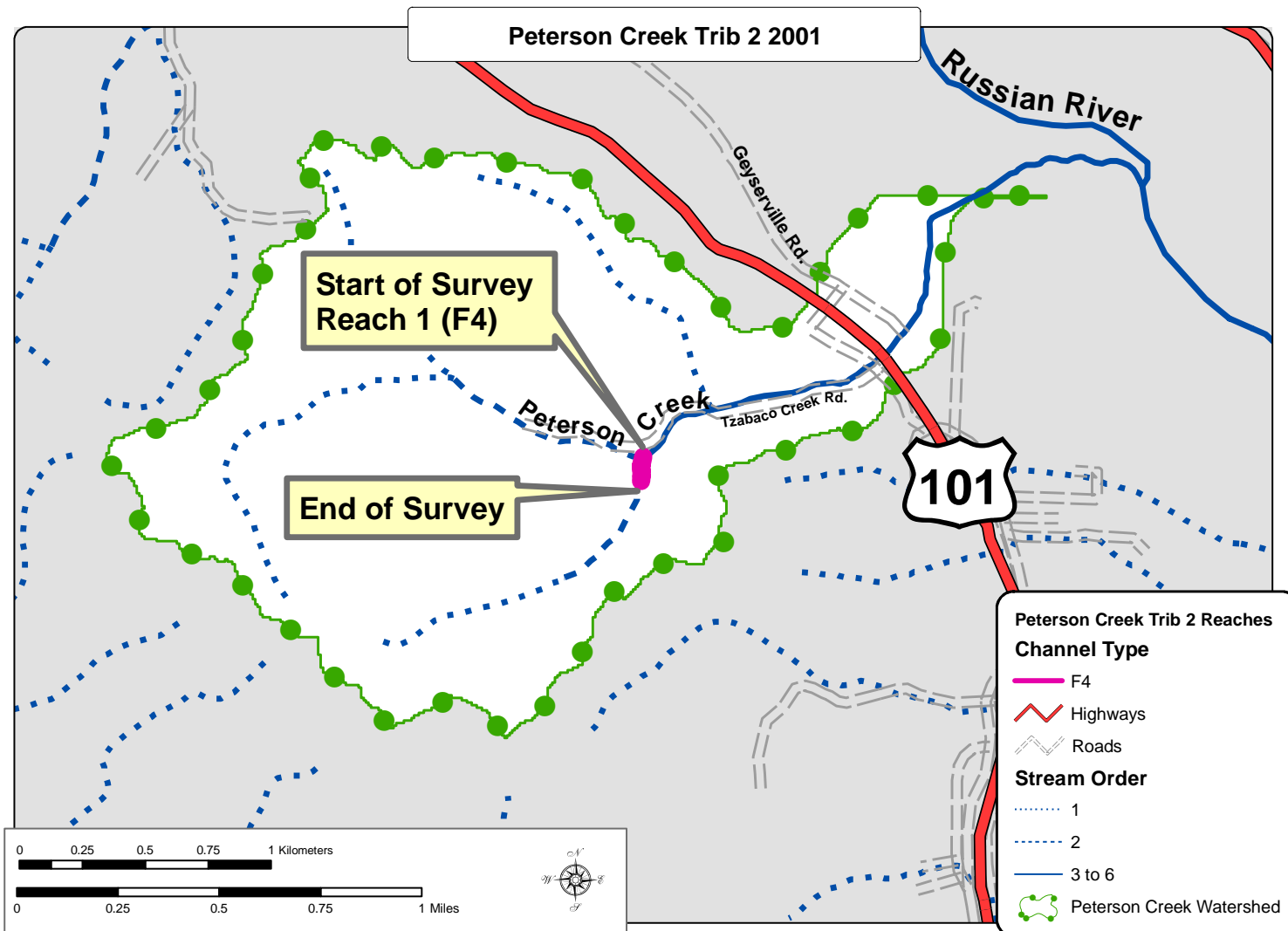
APPENDIX A: MAP





L:\mondo3\data\stream-maps\PetersonCreekT12001.mxd

Prepared by: Celeste Dodge and Colin Brooks, March 28, 2005



L:\mondo3\data\stream-maps\PetersonCreekT22001.mxd

Prepared by: Celeste Dodge and Colin Brooks, March 28, 2005

APPENDIX B: MAINSTEM TABLES

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

Stream Name: Peterson Creek

LLID:

1228735386989

Drainage:

Russian River - Middle

Survey Dates: 6/27/2001 to 6/28/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:56.0N

Longitude: 122:52:25.0W

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
12	1	DRY	13.8	495	5942	46.6	92.0								
22	3	FLATWATER	25.3	88	1931	15.1	5.3	0.6	1.0	310	6824	212	4655		50
27	27	POOL	31.0	25	683	5.4	9.6	1.2	1.9	261	7045	366	9873	333	28
26	4	RIFFLE	29.9	162	4204	32.9	4.4	0.3	0.4	260	6767	74	1911		10
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
87	35				12760					20635			16440		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Peterson Creek LLID: Russian River - Middle
 1228735386989 Drainage:
 Survey Dates: 6/27/2001 to 6/28/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:56.0N Longitude: 122:52:25.0W

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 (%)
26	4	LGR	29.9	162	4204	32.9	4	0.3	0.5	260	6767	74	1911		10	85
1	1	GLD	1.1	59	59	0.5	7	0.6	0.8	413	413	248	248		50	95
21	2	RUN	24.1	89	1872	14.7	4	0.6	1.6	259	5434	194	4064			89
22	22	MCP	25.3	25	559	4.4	10	1.2	3.4	262	5772	385	8465	355	23	90
4	4	LSR	4.6	27	107	0.8	10	1.1	2.2	296	1184	316	1266	267	49	90
1	1	LSBk	1.1	17	17	0.1	6	1.4	2.6	89	89	142	142	124	20	95
12	1	DRY	13.8	495	5942	46.6	92			0	0					40
<hr/>																
<hr/>																
Total Units		Total Units Fully Measured		Total Length (ft.)			Total Area (sq.ft.)			Total Volume (cu.ft.)						
87		35		12760			19658			16096						

Table 3 - Summary of Pool Types

Stream Name: Peterson Creek LLID: 1228735386989 Drainage: Russian River - Middle
 Survey Dates: 6/27/2001 to 6/28/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:56.0N Longitude: 122:52:25.0W

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
22	22	MAIN	81	25	559	82	9.7	1.2	262	5772	355	7808	23
5	5	SCOUR	19	25	124	18	8.9	1.1	255	1273	239	1193	43
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
27	27				683					7045		9001	

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

Stream Name: Peterson Creek LLID: 1228735386989
 Drainage: Russian River - Middle

Survey Dates: 6/27/2001 to 6/28/2001

Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:56.0N Longitude: 122:52:25.0W

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
22	MCP	81	1	5	9	41	11	50	1	5	0	0
4	LSR	15	0	0	3	75	1	25	0	0	0	0
1	LSBk	4	0	0	0	0	1	100	0	0	0	0

Total Units

	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1 < 2 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
27	1	4	12	44	13	48	1	4	0	0

Mean Maximum Residual Pool Depth (ft.): 1.9

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Peterson Creek LLID: 1228735386989 Drainage: Russian River - Middle
 Survey Dates: 6/27/2001 to 6/28/2001 Dry Units: 12
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:56.0N Longitude: 122:52:25.0W

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
26	1	LGR	0	100	0	0	0	0	0	0	0
26	1	TOTAL RIFFLE	0	100	0	0	0	0	0	0	0
1	1	GLD	100	0	0	0	0	0	0	0	0
21	0	RUN									
22	1	TOTAL FLAT	100	0	0	0	0	0	0	0	0
22	17	MCP	42	29	2	4	3	0	1	12	6
4	4	LSR	30	29	10	31	0	0	0	0	0
1	1	LSBk	0	0	0	0	0	0	20	80	0
27	22	TOTAL POOL	38	28	3	9	2	0	2	13	5
87	24	TOTAL	39	30	3	8	2	0	2	12	4

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Peterson Creek LLID: 1228735386989 Drainage: Russian River - Middle
 Survey Dates: 6/27/2001 to 6/28/2001 Dry Units: 12
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:56.0N Longitude: 122:52:25.0W

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
26	4	LGR	0	0	25	50	25	0	0
1	1	GLD	0	0	100	0	0	0	0
21	2	RUN	0	0	0	100	0	0	0
22	4	MCP	0	0	75	0	0	0	25
4	1	LSR	0	0	100	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Peterson Creek

LLID:

1228735386989

Drainage: Russian River - Middle

Survey Dates: 6/27/2001 to 6/28/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:56.0N

Longitude: 122:52:25.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
87	67	33	0	61	51

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

Open units represent habitat units with zero canopy cover.

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Peterson Creek LLID: 1228735386989 Drainage: Russian River - Middle
 Survey Dates: 6/27/2001 to 6/28/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:56.0N Longitude: 122:52:25.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	2	5	29.2
Boulder	0	0	0.0
Cobble / Gravel	3	5	33.3
Sand / Silt / Clay	7	2	37.5

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	1	4.2
Brush	5	5	41.7
Hardwood Trees	4	2	25.0
Coniferous Trees	3	4	29.2
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Peterson Creek LLID: 1228735386989 Drainage: Russian River - Middle
 Survey Dates: 6/27/2001 to 6/28/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:56.0N Longitude: 122:52:25.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	100	38
SMALL WOODY DEBRIS (%)	100	0	28
LARGE WOODY DEBRIS (%)	0	0	3
ROOT MASS (%)	0	0	9
TERRESTRIAL VEGETATION (%)	0	0	2
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	2
BOULDERS (%)	0	0	13
BEDROCK LEDGES (%)	0	0	5

UNNAMED TRIBUTARY #1: TABLES

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

Stream Name: Peterson Creek, Trib 1

LLID:

1228928386905

Drainage:

Russian River - Middle

Survey Dates: 6/28/2001 to 6/28/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00 Latitude: 38:41:26.0N

Longitude: 122:53:34.0W

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
3	0	DRY	27.3	42	125	10.1									
2	2	POOL	18.2	7	14	1.1	5.7	1.0	1.0	40	79	44	88	40	38
6	2	RIFFLE	54.5	183	1097	88.8	4.0	0.3	0.5	336	2015	130	779		10
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
11	4				1236					2094			867		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Peterson Creek, Trib 1

LLID:

1228928386905

Drainage: Russian River - Middle

Survey Dates: 6/28/2001 to 6/28/2001

Confluence Location:

Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:26.0N

Longitude 122:53:34.0W

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 (%)
5	1	LGR	45.5	146	730	59.1	4	0.1	0.1	29	146	3	15			95
1	1	HGR	9.1	367	367	29.7	4	0.4	0.8	642	642	257	257		10	90
2	2	MCP	18.2	7	14	1.1	6	1.0	1.1	40	79	44	88	40	38	95
3	0	DRY	27.3	42	125	10.1										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
11	4	1236	868	359

Table 3 - Summary of Pool Types

Stream Name: Peterson Creek, Trib 1

LLID:

1228928386905

Drainage:

Russian River - Middle

Survey Dates: 6/28/2001 to 6/28/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:26.0N

Longitude: 122:53:34.0W

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
2	2	MAIN	100	7	14	100	5.7	1.0	40	79	40	80	38
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
2	2				14					79		80	

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

Stream Name: Peterson Creek, Trib 1 LLID: 1228928386905
 Drainage: Russian River - Middle
 Survey Dates: 6/28/2001 to 6/28/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:26.0N Longitude: 122:53:34.0W

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
2	MCP	100	1	50	1	50	0	0	0	0	0	0

Total Units												
	Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence		
2	1	50	1	50	0	0	0	0	0	0		

Mean Maximum Residual Pool Depth (ft.): 1

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Peterson Creek, Trib 1

LLID:

1228928386905

Drainage:

Russian River - Middle

Survey Dates: 6/28/2001 to 6/28/2001

Dry Units: 3

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:26.0N

Longitude: 122:53:34.0
W

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
5	0	LGR									
1	1	HGR	0	45	50	0	5	0	0	0	0
6	1	TOTAL RIFFLE	0	45	50	0	5	0	0	0	0
0	0	TOTAL FLAT									
2	2	MCP	50	25	25	0	0	0	0	0	0
2	2	TOTAL POOL	50	25	25	0	0	0	0	0	0
11	3	TOTAL	33	32	33	0	2	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Peterson Creek, Trib 1

LLID:

1228928386905 Drainage: Russian River - Middle

Survey Dates: 6/28/2001 to 6/28/2001

Dry Units: 3

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:26.0N

Longitude: 122:53:34.0W

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
5	1	LGR	0	0	0	100	0	0	0
1	1	HGR	0	0	100	0	0	0	0
2	1	MCP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Peterson Creek, Trib 1

LLID:

1228928386905

Drainage: Russian River - Middle

Survey Dates: 6/28/2001 to 6/28/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:26.0N

Longitude: 122:53:34.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
94	99	1	0	53	53

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

Open units represent habitat units with zero canopy cover.

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Peterson Creek, Trib 1 LLID: 1228928386905 Drainage: Russian River - Middle
 Survey Dates: 6/28/2001 to 6/28/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:26.0N Longitude: 122:53:34.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	0	0	0.0
Boulder	0	0	0.0
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	3	3	100.0

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	0	0.0
Brush	0	1	16.7
Hardwood Trees	0	0	0.0
Coniferous Trees	3	2	83.3
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

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

StreamName: Peterson Creek, Trib 1

LLID:

1228928386905

Drainage: Russian River - Middle

Survey Dates: 6/28/2001 to 6/28/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:26.0N

Longitude: 122:53:34.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0		50
SMALL WOODY DEBRIS (%)	45		25
LARGE WOODY DEBRIS (%)	50		25
ROOT MASS (%)	0		0
TERRESTRIAL VEGETATION (%)	5		0
AQUATIC VEGETATION (%)	0		0
WHITewater (%)	0		0
BOULDERS (%)	0		0
BEDROCK LEDGES (%)	0		0

UNNAMED TRIBUTARY #2: TABLES

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

Stream Name: Peterson Creek, Trib 2

LLID:

1228959386887

Drainage:

Russian River - Middle

Survey Dates: 7/2/2001 to 7/2/2001

Confluence Location:

Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:19.0N

Longitude: 122:53:45.0W

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
2	0	DRY	25.0	34	67	17.6									
1	1	FLATWATER	12.5	76	76	20.0	3.5	0.3	0.5	213	213	64	64		
2	2	POOL	25.0	7	14	3.7	5.0	0.8	1.6	35	70	30	60	28	10
3	1	RIFFLE	37.5	74	223	58.7	3.5	0.2	0.8	215	646	43	129		30
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
8	4				380					929			253		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Peterson Creek, Trib 2

LLID:

1228959386887

Drainage: Russian River - Middle

Survey Dates: 7/2/2001 to 7/2/2001

Confluence Location:

Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:19.0N

Longitude 122:53:45.0W

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 (%)
3	1	LGR	37.5	74	223	58.7	4	0.2	0.8	215	646	43	129		30	95
1	1	RUN	12.5	76	76	20.0	4	0.3	0.5	213	213	64	64			95
2	2	MCP	25.0	7	14	3.7	5	0.8	1.7	35	70	30	60	28	10	90
2	0	DRY	25.0	34	67	17.6										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
8	4	380	929	253

Table 3 - Summary of Pool Types

Stream Name: Peterson Creek, Trib 2

LLID:

1228959386887

Drainage: Russian River - Middle

Survey Dates: 7/2/2001 to 7/2/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude 38:41:19.0N

Longitude: 122:53:45.0W

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
2	2	MAIN	100	7	14	100	5.0	0.8	35	70	28	56	10
Total Units	Total Units Fully Measured				Total Length (ft.)				Total Area (sq.ft.)			Total Volume (cu.ft.)	
2	2				14				70			56	

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

Stream Name: Peterson Creek, Trib 2 LLID: 1228959386887
 Drainage: Russian River - Middle
 Survey Dates: 7/2/2001 to 7/2/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:19.0N Longitude: 122:53:45.0W

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
2	MCP	100	0	0	2	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
2		0	0	2	100	0	0	0	0	0	0

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Peterson Creek, Trib 2 LLID: 1228959386887 Drainage: Russian River - Middle
 Survey Dates: 7/2/2001 to 7/2/2001 Dry Units: 2
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:19.0N Longitude: 122:53:45.0W

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
3	1	LGR	0	0	0	0	100	0	0	0	0
3	1	TOTAL RIFFLE	0	0	0	0	100	0	0	0	0
1	0	RUN									
1	0	TOTAL FLAT									
2	1	MCP	100	0	0	0	0	0	0	0	0
2	1	TOTAL POOL	100	0	0	0	0	0	0	0	0
8	2	TOTAL	50	0	0	0	50	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Peterson Creek, Trib 2

LLID:

1228959386887

Drainage: Russian River - Middle

Survey Dates: 7/2/2001 to 7/2/2001

Dry Units: 2

Confluence Location: Quad:

GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:19.0N

Longitude: 122:53:45.0W

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
3	1	LGR	0	0	100	0	0	0	0
1	1	RUN	0	0	100	0	0	0	0
2	1	MCP	0	0	0	100	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Peterson Creek, Trib 2

LLID:

1228959386887

Drainage: Russian River - Middle

Survey Dates: 7/2/2001 to 7/2/2001

Confluence Location: Quad: GEYSERVILLE

Legal Description: T000R000S00

Latitude: 38:41:19.0N

Longitude: 122:53:45.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
93	91	9	0	40	33

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

Open units represent habitat units with zero canopy cover.

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Peterson Creek, Trib 2 LLID: 1228959386887 Drainage: Russian River - Middle
 Survey Dates: 7/2/2001 to 7/2/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:19.0N Longitude: 122:53:45.0W

Mean Percentage of Dominant Stream Bank Substrate

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Bedrock	1	0	16.7
Boulder	0	0	0.0
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	2	3	83.3

Mean Percentage of Dominant Stream Bank Vegetation

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percent (%)
Grass	0	1	16.7
Brush	1	1	33.3
Hardwood Trees	2	0	33.3
Coniferous Trees	0	1	16.7
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 2

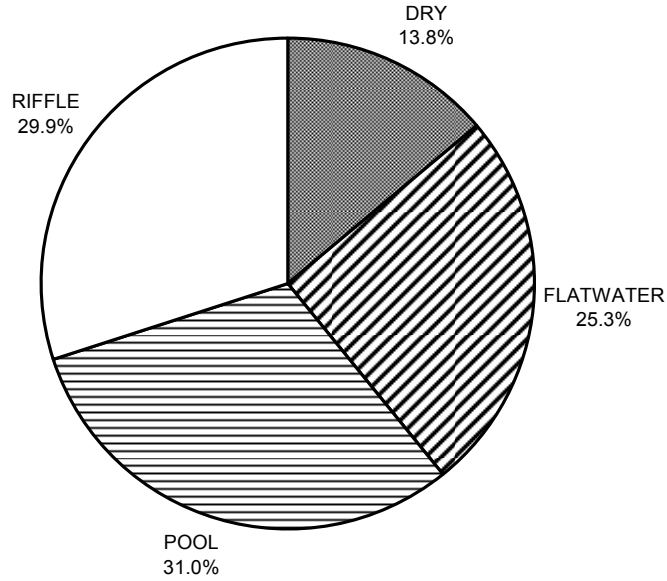
Table 10 - Mean Percent of Shelter Cover Types For Entire Stream

StreamName: Peterson Creek, Trib 2 LLID: 1228959386887 Drainage: Russian River - Middle
 Survey Dates: 7/2/2001 to 7/2/2001
 Confluence Location: Quad: GEYSERVILLE Legal Description: T000R000S00 Latitude: 38:41:19.0N Longitude: 122:53:45.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0		100
SMALL WOODY DEBRIS (%)	0		0
LARGE WOODY DEBRIS (%)	0		0
ROOT MASS (%)	0		0
TERRESTRIAL VEGETATION (%)	100		0
AQUATIC VEGETATION (%)	0		0
WHITEWATER (%)	0		0
BOULDERS (%)	0		0
BEDROCK LEDGES (%)	0		0

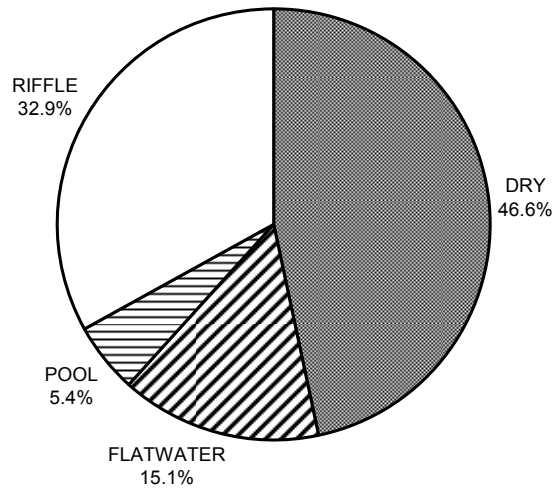
APPENDIX D: MAINSTEM GRAPHS

**PETERSON CREEK 2001
HABITAT TYPES BY PERCENT OCCURRENCE**



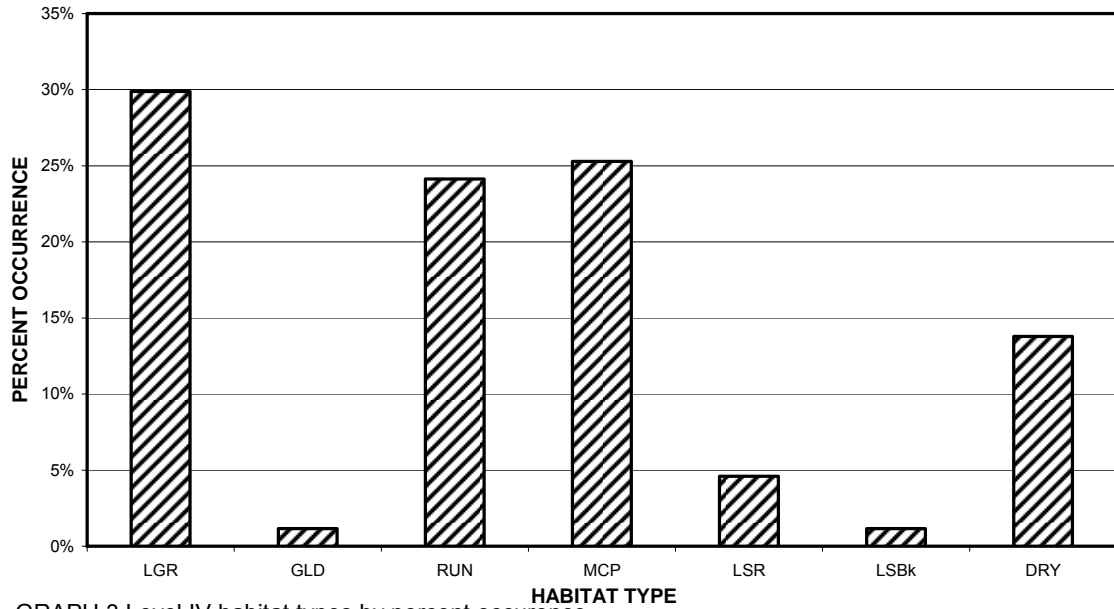
GRAPH 1 Level II habitat types by percent occurrence

**PETERSON CREEK 2001
HABITAT TYPES BY PERCENT TOTAL LENGTH**



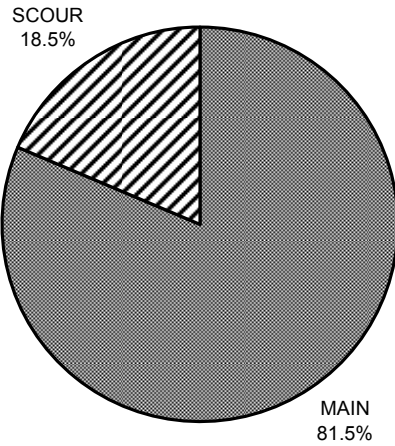
GRAPH 2 Level II habitat types by percent total length

**PETERSON CREEK 2001
HABITAT TYPES BY PERCENT OCCURRENCE**



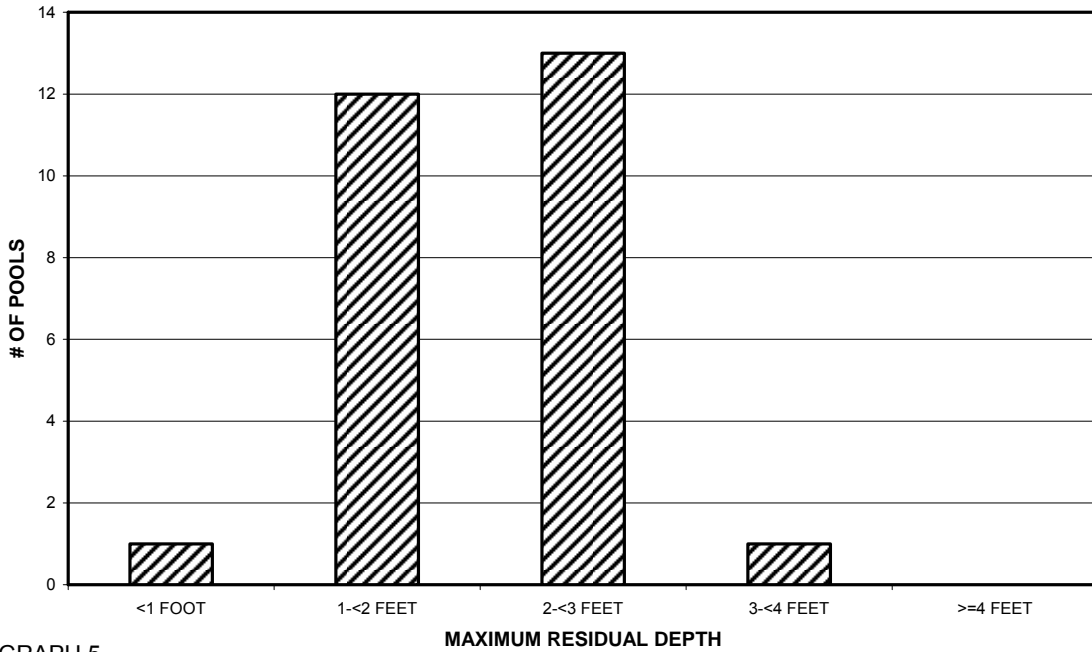
GRAPH 3 Level IV habitat types by percent occurrence

**PETERSON CREEK 2001
POOL TYPES BY PERCENT OCCURRENCE**



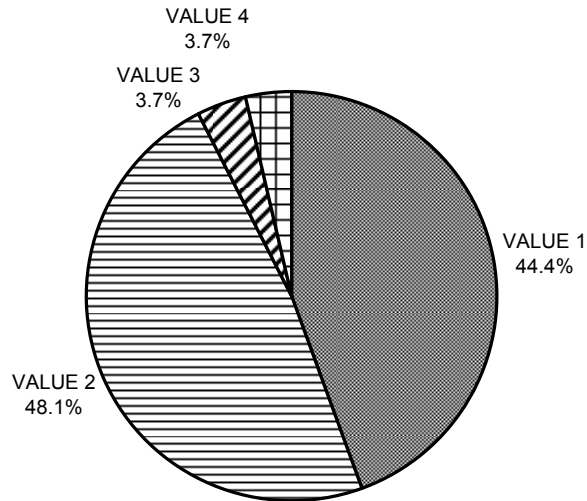
GRAPH 4 Level I pool types by percent occurrence

**PETERSON CREEK 2001
MAXIMUM DEPTH IN POOLS**



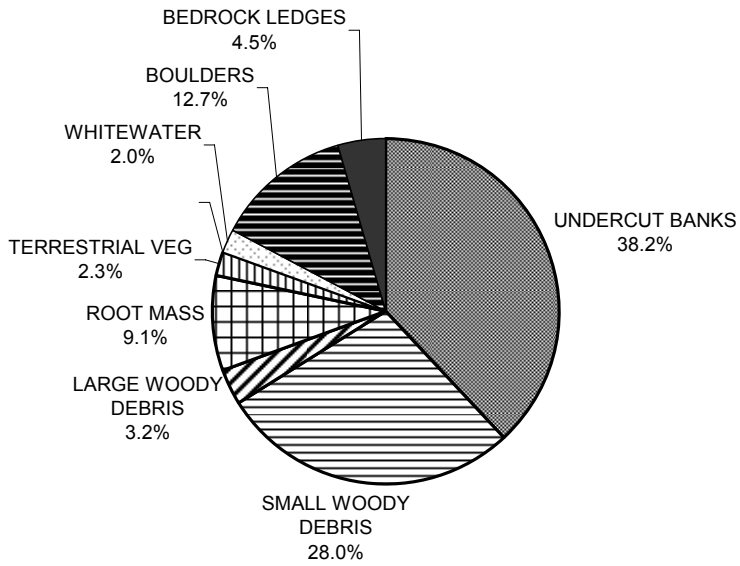
GRAPH 5

**PETERSON CREEK 2001
PERCENT EMBEDDEDNESS**



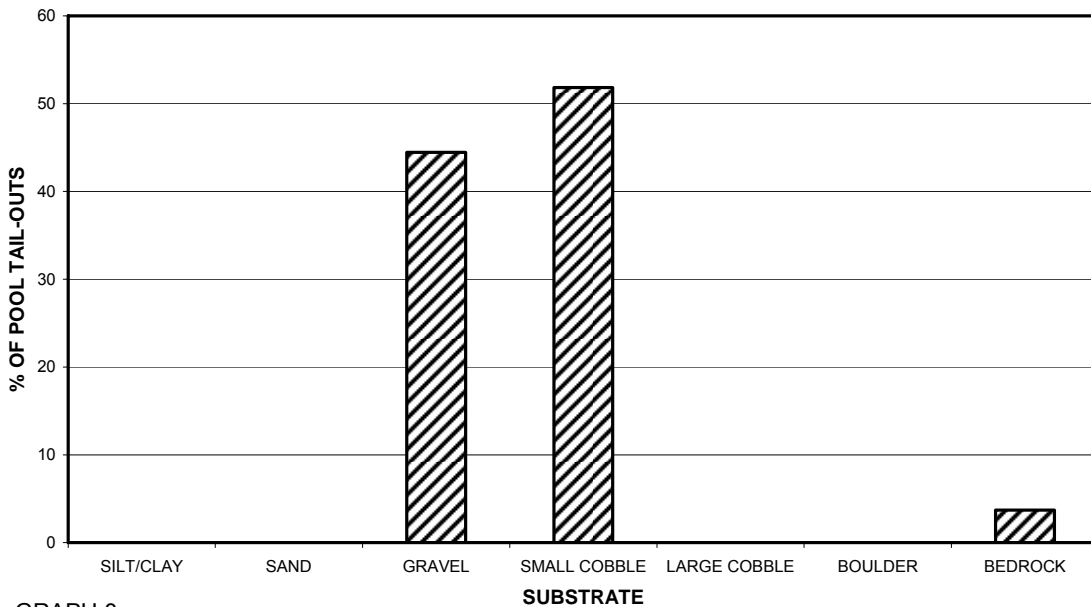
GRAPH 6

**PETERSON CREEK 2001
MEAN PERCENT COVER TYPES IN POOLS**



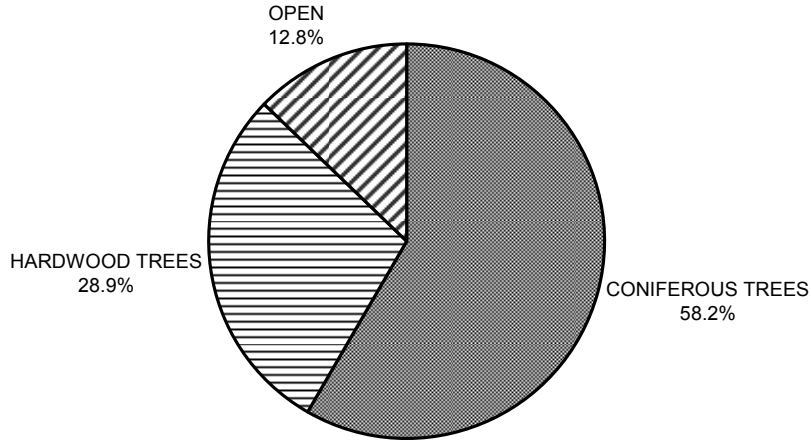
GRAPH 7

**PETERSON CREEK 2001
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



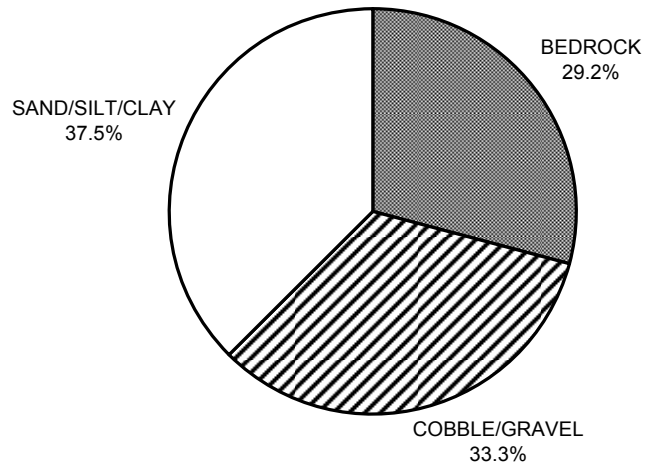
GRAPH 8

**PETERSON CREEK 2001
MEAN PERCENT CANOPY**



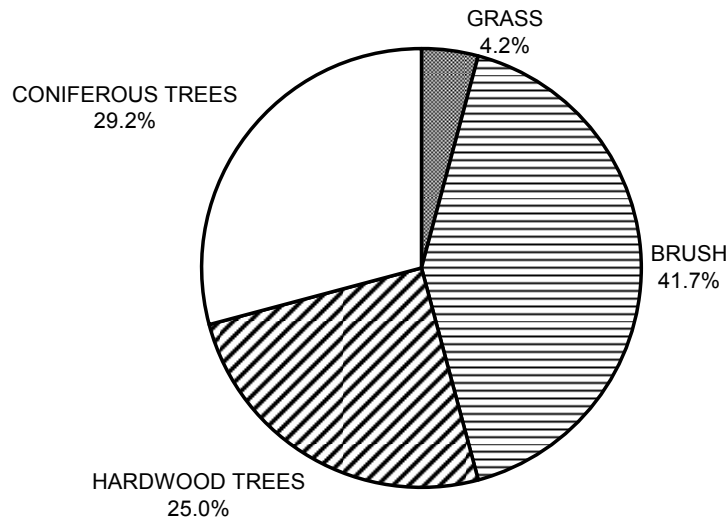
GRAPH 9

**PETERSON CREEK 2001
DOMINANT BANK COMPOSITION**



GRAPH 10

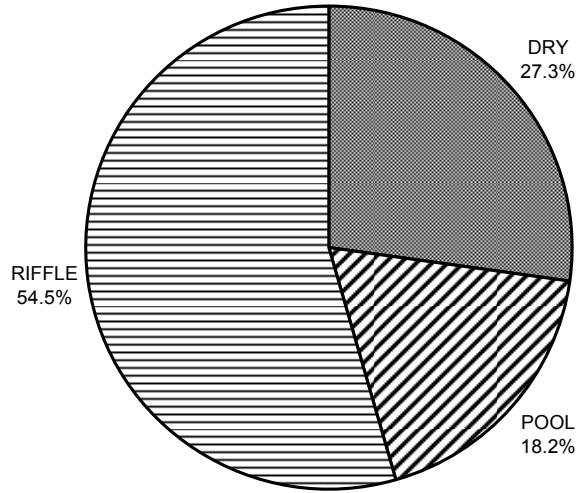
**PETERSON CREEK 2001
DOMINANT BANK VEGETATION**



GRAPH 11

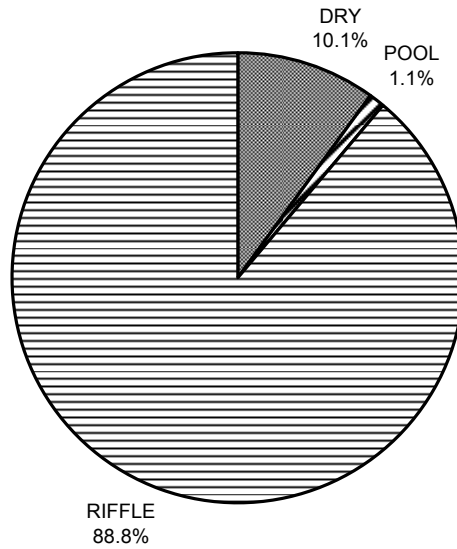
UNNAMED TRIBUTARY #1: GRAPHS

**PETERSON CREEK, TRIB 1 2001
HABITAT TYPES BY PERCENT OCCURRENCE**



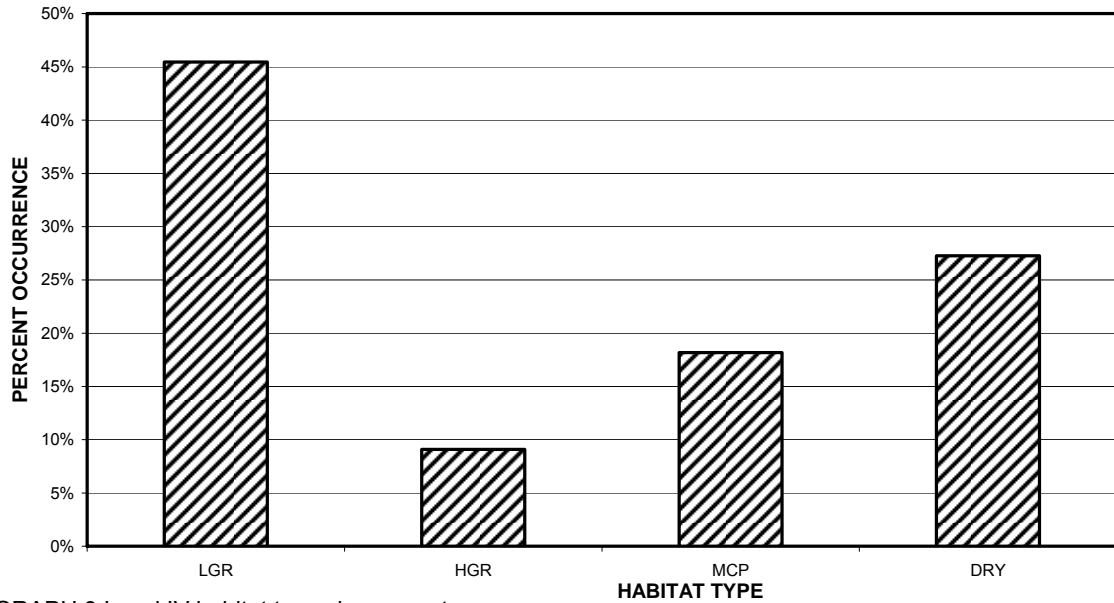
GRAPH 1 Level II habitat types by percent occurrence

**PETERSON CREEK, TRIB 1 2001
HABITAT TYPES BY PERCENT TOTAL LENGTH**



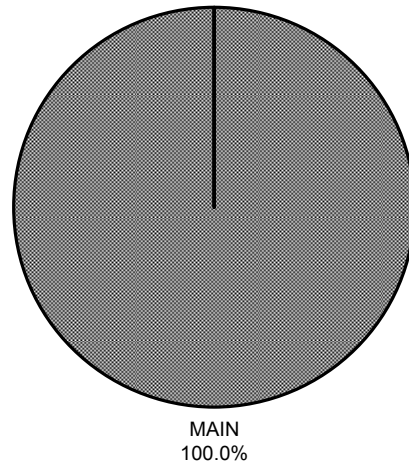
GRAPH 2 Level II habitat types by percent total length

**PETERSON CREEK, TRIB 1 2001
HABITAT TYPES BY PERCENT OCCURRENCE**



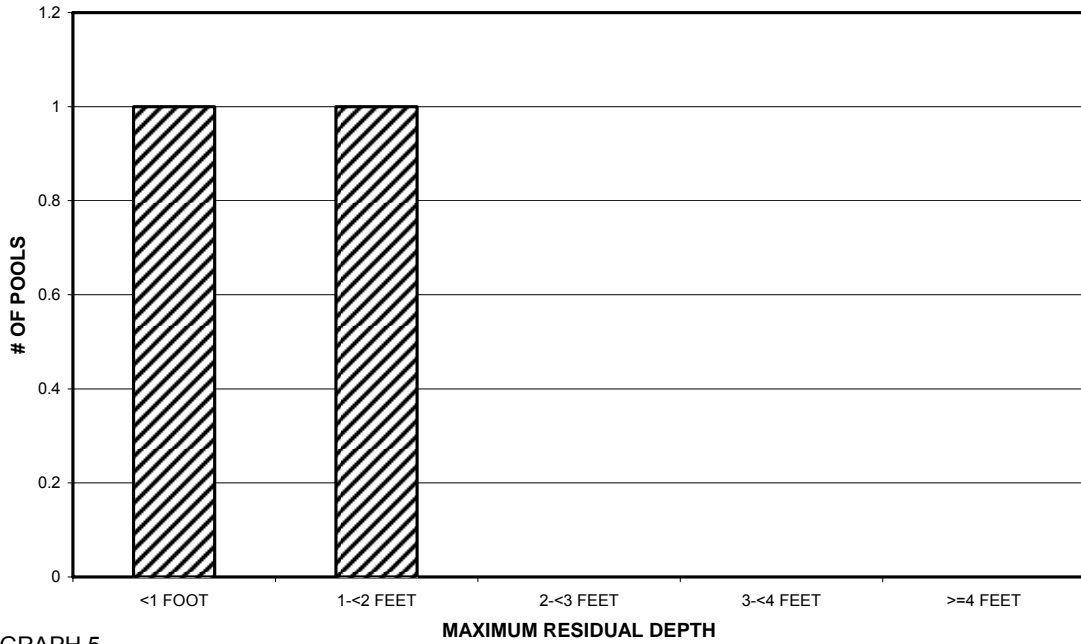
GRAPH 3 Level IV habitat types by percent occurrence

**PETERSON CREEK, TRIB 1 2001
POOL TYPES BY PERCENT OCCURRENCE**



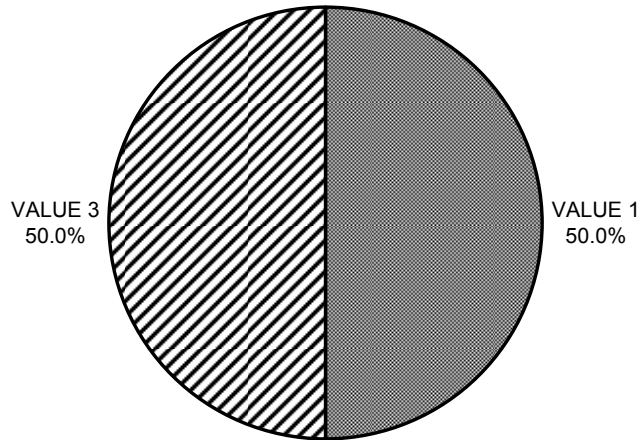
GRAPH 4 Level I pool types by percent occurrence

**PETERSON CREEK, TRIB 1 2001
MAXIMUM DEPTH IN POOLS**



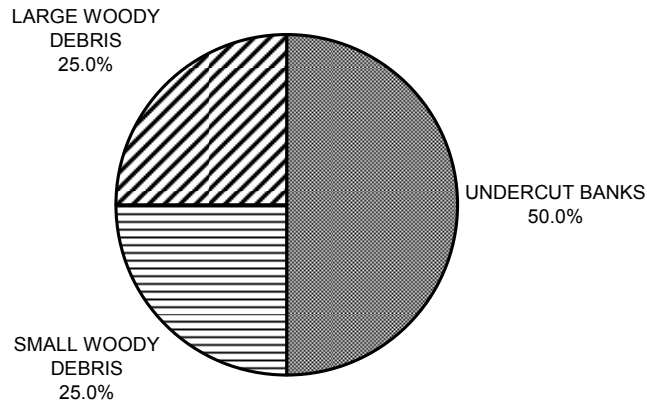
GRAPH 5

**PETERSON CREEK, TRIB 1 2001
PERCENT EMBEDDEDNESS**



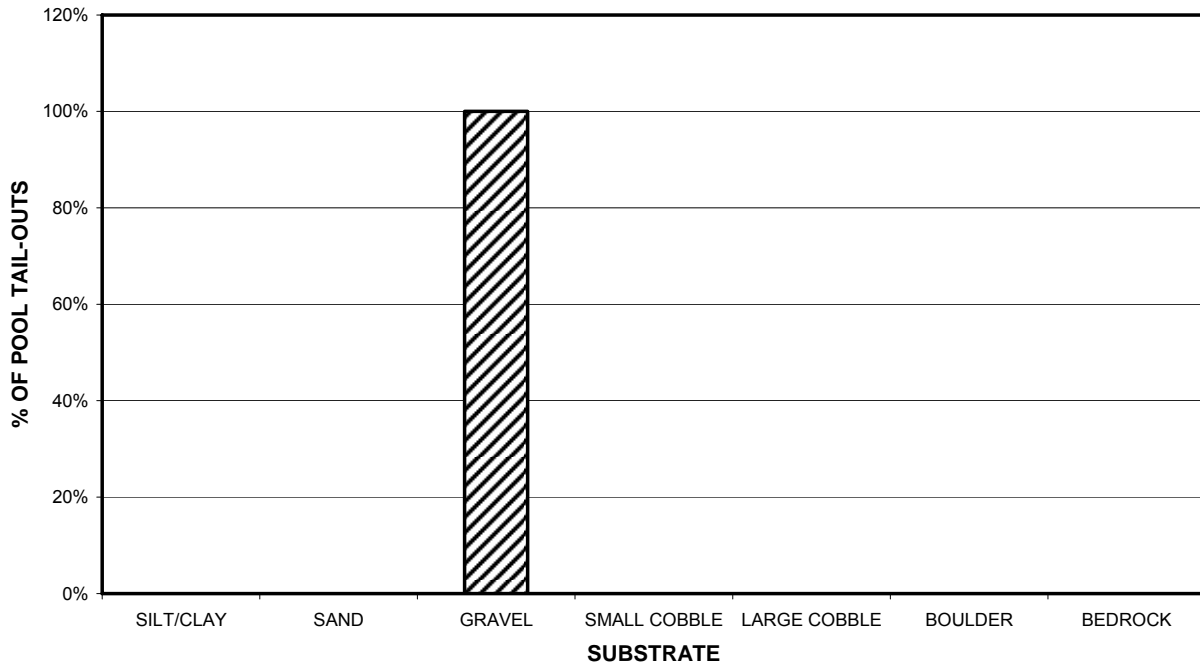
GRAPH 6

**PETERSON CREEK, TRIB 1 2001
MEAN PERCENT COVER TYPES IN POOLS**



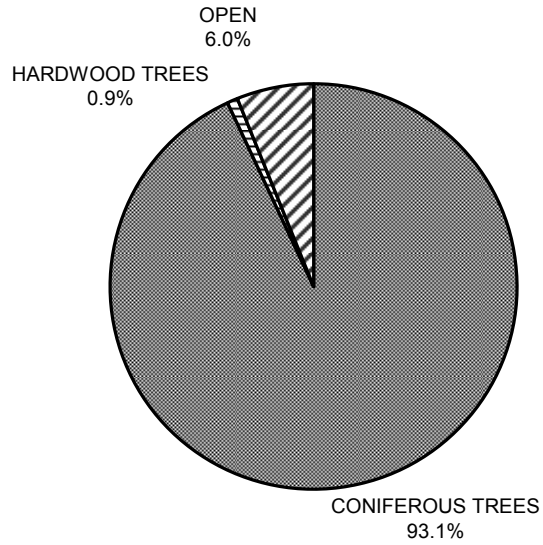
GRAPH 7

**PETERSON CREEK, TRIB 1 2001
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



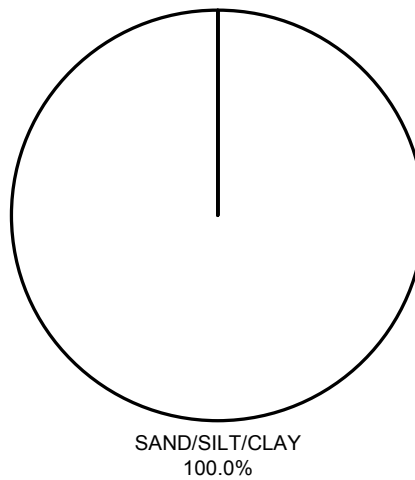
GRAPH 8

**PETERSON CREEK, TRIB 1 2001
MEAN PERCENT CANOPY**



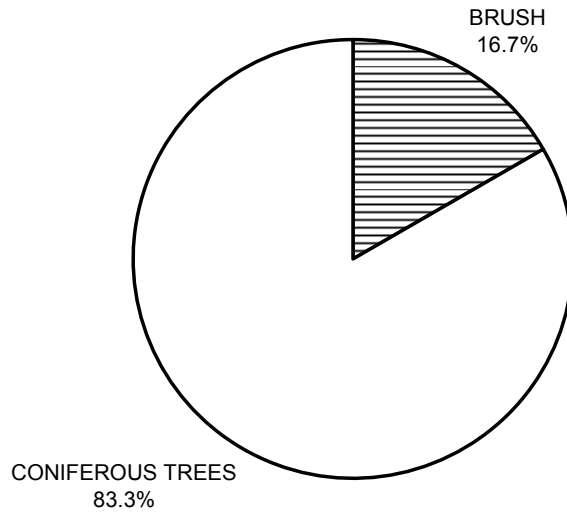
GRAPH 9

**PETERSON CREEK, TRIB 1 2001
DOMINANT BANK COMPOSITION**



GRAPH 10

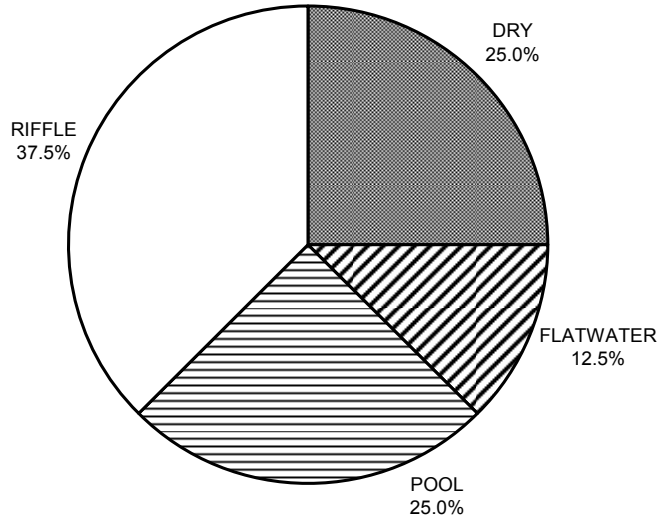
**PETERSON CREEK, TRIB 1 2001
DOMINANT BANK VEGETATION**



GRAPH 11

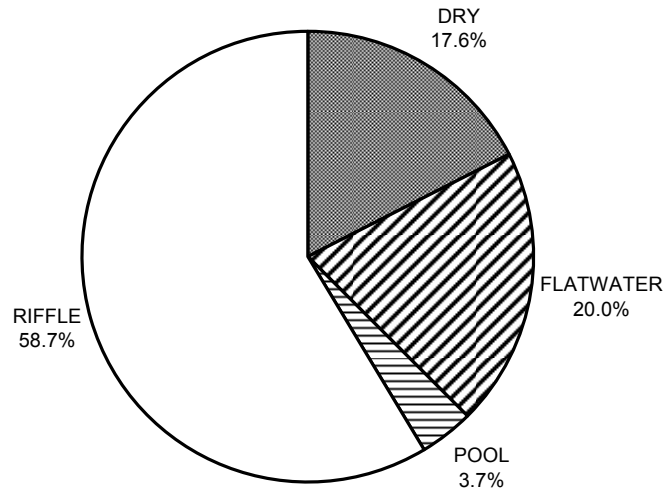
UNNAMED TRIBUTARY #2: GRAPHS

**PETERSON CREEK, TRIB 2 2001
HABITAT TYPES BY PERCENT OCCURRENCE**



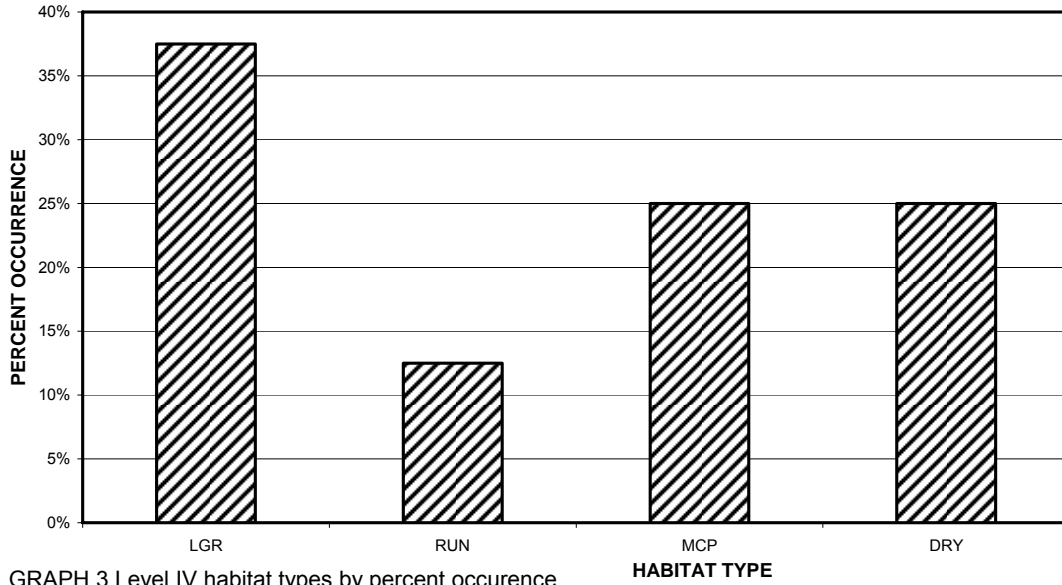
GRAPH 1 Level II habitat types by percent occurrence

**PETERSON CREEK, TRIB 2 2001
HABITAT TYPES BY PERCENT TOTAL LENGTH**



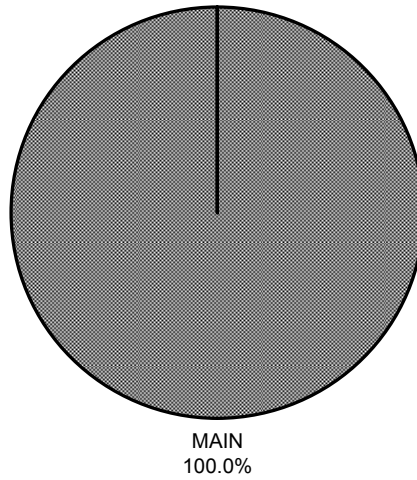
GRAPH 2 Level II habitat types by percent total length

**PETERSON CREEK, TRIB 2 2001
HABITAT TYPES BY PERCENT OCCURRENCE**



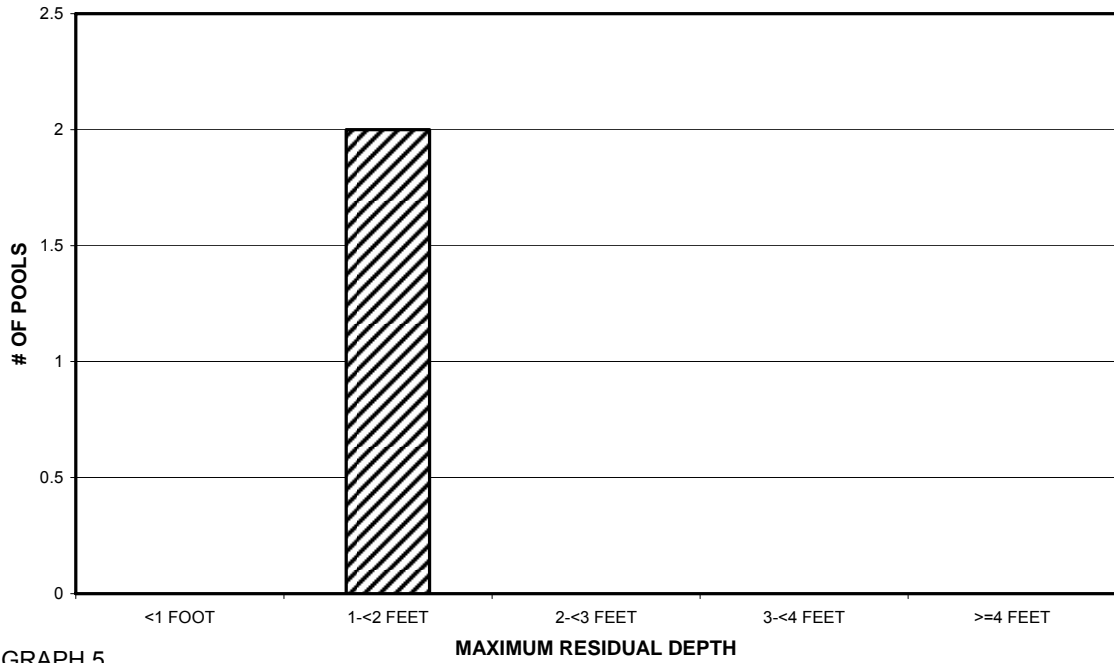
GRAPH 3 Level IV habitat types by percent occurrence

**PETERSON CREEK, TRIB 2 2001
POOL TYPES BY PERCENT OCCURRENCE**



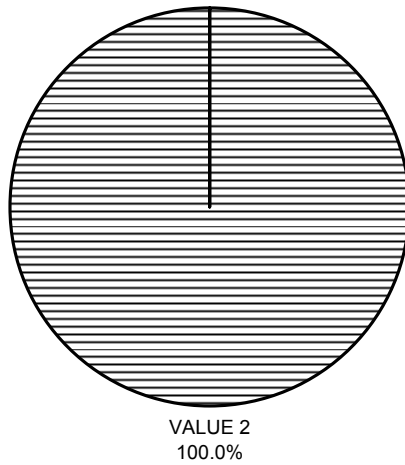
GRAPH 4 Level I pool types by percent occurrence

**PETERSON CREEK, TRIB 2 2001
MAXIMUM DEPTH IN POOLS**



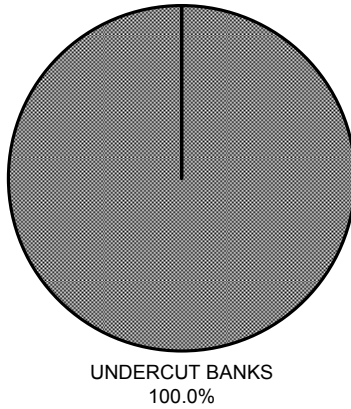
GRAPH 5

**PETERSON CREEK, TRIB 2 2001
PERCENT EMBEDDEDNESS**



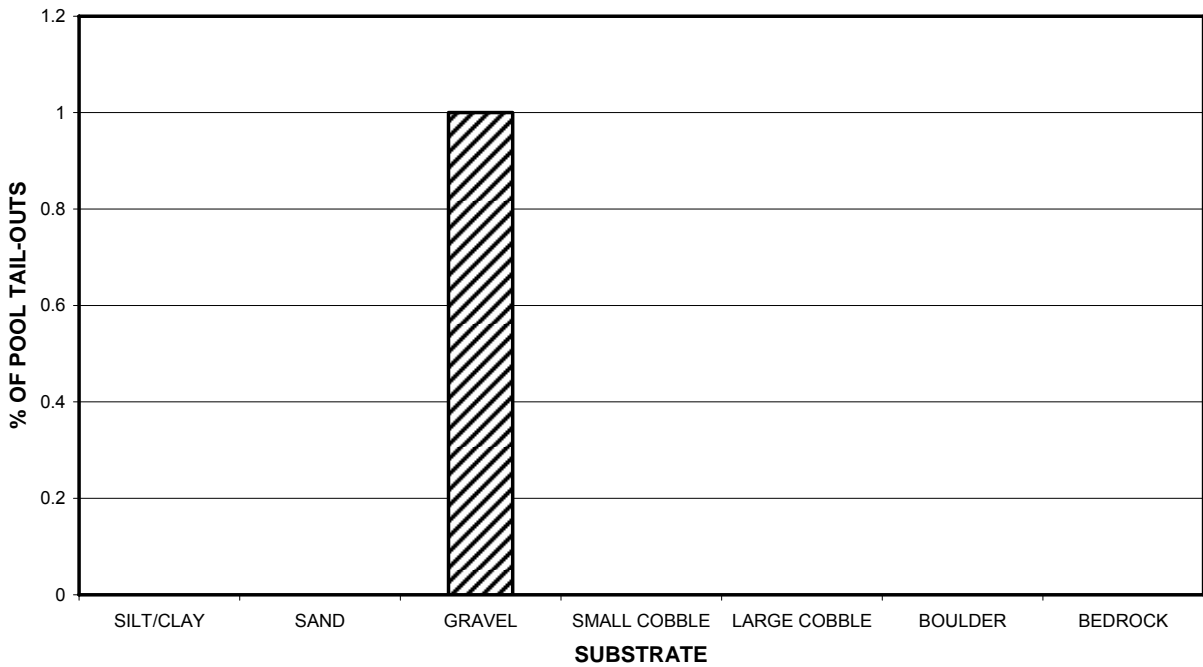
GRAPH 6

**PETERSON CREEK, TRIB 2 2001
MEAN PERCENT COVER TYPES IN POOLS**



GRAPH 7

**PETERSON CREEK, TRIB 2 2001
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



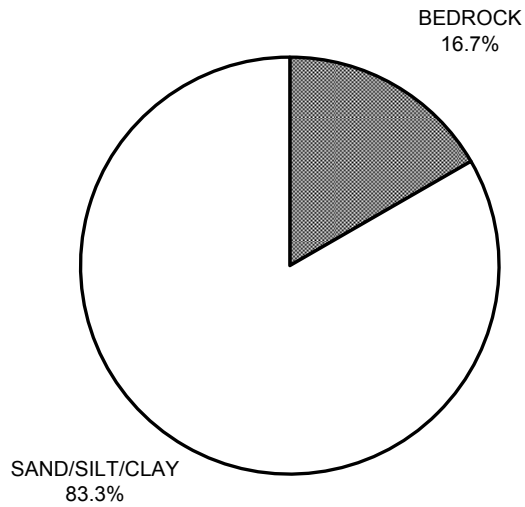
GRAPH 8

**PETERSON CREEK, TRIB 2 2001
MEAN PERCENT CANOPY**



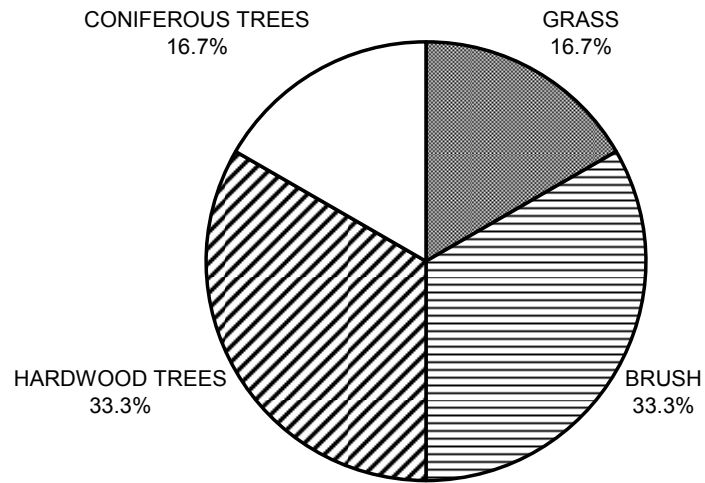
GRAPH 9

**PETERSON CREEK, TRIB 2 2001
DOMINANT BANK COMPOSITION**



GRAPH 10

**PETERSON CREEK, TRIB 2 2001
DOMINANT BANK VEGETATION**



GRAPH 11

Peterson Creek Water Temperatures

