CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Gates Creek

INTRODUCTION

A stream inventory was conducted from July 7 to July 14, 2015 on Gates Creek. The survey began at the confluence with Daugherty Creek and extended upstream three miles.

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

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Gates Creek is a tributary to Daugherty Creek, tributary to South Fork Big River, tributary to Big River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Gates Creek's legal description at the confluence with Daugherty Creek is T16N R14W S32. Its location is 39.2057 degrees north latitude and 123.4352 degrees west longitude, LLID number 1234340392057. Gates Creek is a second order stream and has approximately 2.7 miles of blue line stream according to the USGS Bailey Ridge 7.5 minute quadrangle. Gates Creek drains a watershed of approximately 5.3 square miles. Elevations range from about 590 feet at the mouth of the creek to 1,800 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production and rural development. Vehicle access exists via a private logging road off of Comptche-Ukiah Road, east of Comptche, CA.

METHODS

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

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each

field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Gates Creek to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) near the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a 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". Gates Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Gates Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuitable 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. 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 Gates Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. The shelter rating is then calculated by multiplying the qualitative shelter value by the percent of the unit covered. 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 densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Gates Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Gates Creek, the dominant composition type and the dominant vegetation type of both the right and left banks for each fully-described unit were selected from the habitat inventory form. Additionally, the percent of each bank covered by vegetation (including downed trees, logs, and rootwads) was estimated and recorded.

10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests

(velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Gates Creek. 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 2.0.18, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and Wildlife. This program processes and summarizes the data, and produces the following ten tables:

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

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

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

HABITAT INVENTORY RESULTS

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

The habitat inventory of July 7 to July 14, 2015 was conducted by T. Brown, J. Lee, and J. Murphrey (WSP). The total length of the stream surveyed was 15,659 feet.

Stream flow was too low to measure on Gates Creek.

Gates Creek is an E4 channel type for 2,206 feet of the stream surveyed (Reach 1), a B4 channel type for 2,920 feet of the stream surveyed (Reach 2), and an E4 channel type for 10,533 feet of the stream surveyed (Reach 3). E4 channels are low gradient, meandering riffle/pool streams with low width/depth ratios and little deposition. They are very efficient and stable with a high meander width ratio and gravel-dominant substrates. B4 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 59 to 70 degrees Fahrenheit. Air temperatures ranged from 63 to 78 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% riffle units, 31% flatwater units, 28% pool units, and 4% dry units (Graph 1). Based on total length of Level II habitat types there were 44% riffle units, 32% flatwater units, 18% pool units, and 6% dry units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle units, 37%; mid-channel pool units, 27%; and run units, 22% (Graph 3). Based on percent total length, low gradient riffle units made up 44%, run units 20%, and mid-channel pool units 17%.

A total of 96 pools were identified (Table 3). Main channel pools were the most frequently encountered at 98% (Graph 4), and comprised 99% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Thirty-three of the 96 pools (34%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 96 pool tail-outs measured, 23 had a value of 2 (24%); 47 had a value of 3 (49%); 20 had a value of 4 (20.8%); six had a value of 5 (6.3%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate. Additionally, a value of 5 was assigned to tail-outs deemed unsuitable 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 16, flatwater habitat types had a mean shelter rating of 1, and pool habitats had a mean shelter rating of 32 (Table 1). Of the pool types, the main channel pools had the highest mean

shelter rating at 33. Scour pools had a mean shelter rating of 3 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in Gates Creek. Graph 7 describes the pool cover in Gates Creek. Large woody debris is the dominant pool cover type followed by boulders.

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 68% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 23% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Gates Creek was 92%. Eight percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 23% and 77%, respectively. Graph 9 describes the mean percent canopy in Gates Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 97%. The mean percent left bank vegetated was 98%. The dominant elements composing the structure of the stream banks consisted of 51% sand/silt/clay, 32% cobble/gravel, and 16% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 58% of the units surveyed. Additionally, 16% of the units surveyed had brush as the dominant vegetation type, and 16% had hardwood trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at 10 sites for species composition and distribution in Gates Creek on September 3, 2015 (Table A). The sites were sampled by B. Starks and D. Lam (CDFW).

In Reach 1, which comprised the first 2,206 feet of stream, one site was sampled. The reach site yielded 10 young-of-the-year (YOY) steelhead trout (SH), 10 YOY coho salmon, and approximately 30 stickleback.

In Reach 2, nine sites were sampled starting approximately 2,746 feet from the confluence with Daugherty Creek and continuing upstream 2,052 feet. The reach sites yielded 16 YOY SH, one age 1+ SH, one age 2+ SH, 21 YOY coho salmon, approximately 450 stickleback, and seven crayfish.

During the survey, the upstream-most observation of juvenile coho salmon occurred at 39.2065 degrees north latitude, 123.4261 degrees west longitude, approximately 3,300 feet upstream from the confluence with Daugherty Creek.

Table A. Summary of results for a fish composition and distribution survey within Gates Creek, 2015.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	Steelhead			Coho Salmon		Additional Aquatic Species Observed
					YOY	1+	2+	YOY	1+	
Reach 1: E4 Channel Type										
09/03/15	1	050	Pool	2,134	10	0	0	10	0	STB
Reach 2: B4 Channel Type										
09/03/15	2	063	Pool	2,776	1	0	0	18	0	STB, CF
09/03/15	3	076	Pool	3,300	0	0	0	3	0	
09/03/15	4	082	Pool	3,608	2	0	1	0	0	STB, CF
09/03/15	5	083	Pool	3,677	6	0	0	0	0	STB, CF
09/03/15	6	087	Pool	3,859	0	0	0	0	0	STB, CF
09/03/15	7	092	Pool	4,079	1	0	0	0	0	
09/03/15	8	104	Pool	4,577	0	1	0	0	0	STB
09/03/15	9	108	Pool	4,749	3	0	0	0	0	STB
09/03/15	10	109	Run	4,798	3	0	0	0	0	STB

Species Abbreviations: CF=Crayfish; STB=Stickleback (Unidentified Species)

DISCUSSION

Gates Creek is an E4 channel type for the first 2,206 feet of stream surveyed, a B4 channel type for the next 2,920 feet, and an E4 channel type for the remaining 10,533 feet. The suitability of E4 and B4 channel types for fish habitat improvement structures is as follows: E4 channels are good for bank-placed boulders and fair for opposing wing-deflectors. B4 channels are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days July 7 to July 14, 2015 ranged from 59 to 70 degrees Fahrenheit. Air temperatures ranged from 63 to 78 degrees Fahrenheit. This is a suitable water temperature range for salmonids. However, 70 degrees Fahrenheit, if sustained, is above the threshold stress level for salmonids. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 32% of the total length of this survey, riffles 44%, and pools 18%. Thirty-three of the 96 (34%) pools had a maximum residual depth greater than two feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Twenty-three of the 96 pool tail-outs measured had embeddedness ratings of 1 or 2. Sixty-seven of the pool tail-outs had embeddedness ratings of 3 or 4. Six of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Gates Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Eighty-seven of the 96 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 is 32. The shelter rating in the flatwater habitats is one. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in Gates Creek. Large woody debris is the dominant cover type in pools followed by boulders. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 92%. Reach 1 had a canopy density of 92%. Reach 2 had a canopy density of 88%. Reach 3 had a canopy density of 93%. The percentage of right and left bank covered with vegetation was 97% and 98%, respectively.

RECOMMENDATIONS

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

1) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools is desirable.

2) 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.

3) 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.

4) The limited water temperature data available suggest that maximum temperatures are above 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 three to five years.

COMMENTS AND LANDMARKS

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

Position (ft):	Habitat unit #:	Comments:
0	0001.00	Start of survey at confluence with Daugherty Creek. The channel is an E4.
451	0009.00	There is a 2' high plunge.
1576	0034.00	Dry right bank tributary.
1726	0039.00	There is a 0.5' high plunge.
2206	0054.00	The channel changes from an E4 to a B4.
2328	0056.00	There is a 1' high plunge.
3212	0074.00	Landslide on the left bank.
3271	0076.00	Log debris accumulation (LDA) #01 contains 13 pieces of large woody debris (LWD) and measures approximately 12.5' high x 35' wide x 40' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to cobble and measures approximately 30' wide x 80' long x 12' deep. There is a 9' high plunge over the LDA. Fish were observed above it.
4408	0101.00	Dry right bank tributary.
5104	0120.00	There is a 2' high plunge.
5126	0121.00	The channel changes from a B4 to an E4.
6539	0156.00	Erosion site on left bank measures 15' high.
7169	0175.00	Erosion site on the left bank.
7249	0178.00	LDA #02 contains nine pieces of LWD and measures approximately 6.5' high x 20' wide x 10' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to cobble and measures approximately 15' wide x 45' long x 3' deep. There is a 3' high plunge over the LDA. Fish were observed above it.

7998	0187.00	A logging road crosses the channel. The crossing is a 14' wide x 36' long x 6' high bridge.
8584	0198.00	Johnson Creek (Tributary #01) enters on the left bank. The water temperature of the tributary was 62 degrees Fahrenheit, the water temperature downstream of the confluence was 62 degrees Fahrenheit, and the water temperature upstream of the confluence was 63 degrees Fahrenheit. For more information, see the 2014 Johnson Creek Stream Habitat Inventory Report.
9048	0211.00	Dry right bank tributary.
9333	0216.00	There is a 6' high plunge over bedrock.
9743	0228.00	Dry right bank tributary.
11119	0263.00	There is a 3.5' high plunge over boulders.
11306	0269.00	Old road crossing.
11768	0274.00	LDA #03 contains four pieces of LWD and measures approximately 8' high x 14' wide x 5' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to cobble and measures approximately 10' wide x 50' long x 6' deep. There is a 6.5' high plunge over the LDA. Fish were not observed above it.
12077	0282.00	LDA #04 contains six pieces of LWD and measures approximately 8' high x 16' wide x 4.5' long. Water flows through the LDA and there are no visible gaps in it. Retained sediment ranges from gravel to cobble and measures approximately 10' wide x 45' long x 3' deep. There is a 4.5' high plunge over the LDA.
12428	0285.00	LDA #05 contains nine pieces of LWD and measures approximately 8' high x 24' wide x 4' long. Water does not flow through the LDA and there are no visible gaps in it. Retained sediment ranges from silt to gravel and measures approximately 20' wide x 100' long x 8' deep. There is a 5' high plunge over the LDA.
13832	0314.00	Dry left bank tributary.
14106	0317.00	There is a 1' high plunge over log.
14167	0319.00	There is a 1' high plunge over log.
15207	0332.00	There is a 1' high plunge over boulders.

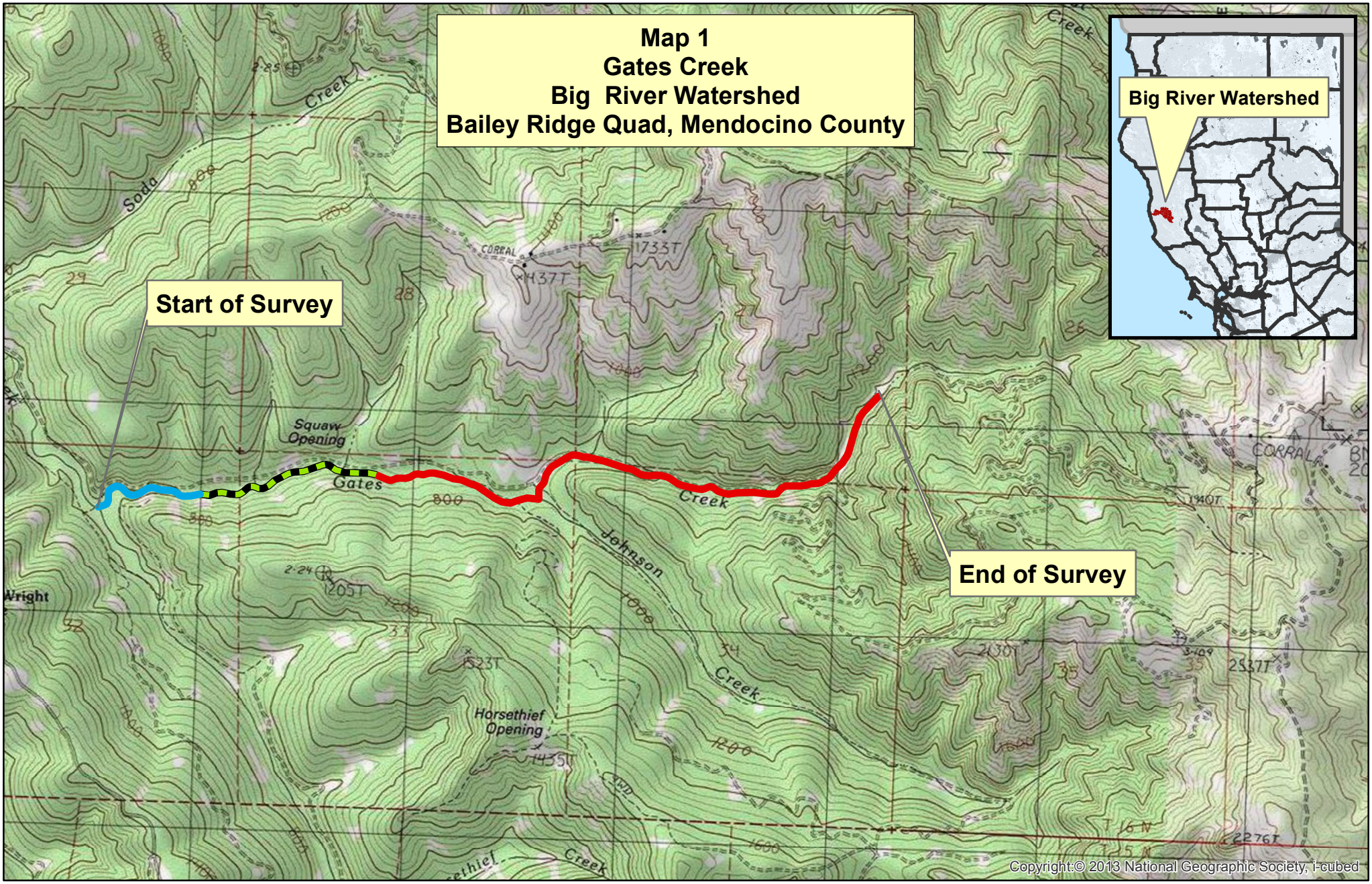
15315	0334.00	There is a 3' high plunge over log.
15340	0336.00	LDA #06 contains four pieces of LWD and measures approximately 6' high x 12' wide x 8' long. Water flows through the LDA and there are no visible gaps in it. The LDA is not retaining sediment.
15601	0338.00	End of survey at end of landowner access. No fish were observed above LDA #03 (HU#274) and no salmonids were observed above LDA #01 (HU#076).

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE			
Low Gradient Riffle	(LGR)	[1.1]	{ 1}
High Gradient Riffle	(HGR)	[1.2]	{ 2}
CASCADE			
Cascade	(CAS)	[2.1]	{ 3}
Bedrock Sheet	(BRS)	[2.2]	{24}
FLATWATER			
Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}
MAIN CHANNEL POOLS			
Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}
SCOUR POOLS			
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }
BACKWATER POOLS			
Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}
ADDITIONAL UNIT DESIGNATIONS			
Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	



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Reach 1: E4 Channel Type

Reach 2: B4 Channel Type

Reach 3: E4 Channel Type

0 0.3 0.6 1.2 Miles

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE

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

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
13	0	DRY	3.8	68	879	5.6									
103	13	FLATWATER	30.5	49	5076	32.4	6.5	0.4	0.7	318	32775	131	13528		1
1	0	NOSURVEY	0.3	20	20	0.1									
96	96	POOL	28.4	28	2735	17.5	10.0	0.8	2.0	295	28349	330	31699	287	32
125	16	RIFFLE	37.0	56	6949	44.4	7.7	0.2	0.4	185	23157	34	4253		16

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
338	125	15659	84280	49480

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

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 (%)
124	15	LGR	36.7	56	6905	44.1	7	0.2	0.7	187	23139	35	4364		18	92
1	1	HGR	0.3	44	44	0.3	15	0.1	0.2	165	165	17	17		0	76
74	8	RUN	21.9	42	3078	19.7	7	0.4	1.3	216	15962	103	7636		1	94
29	5	SRN	8.6	69	1998	12.8	6	0.4	1.2	482	13984	176	5115		2	96
90	90	MCP	26.6	29	2594	16.6	10	0.8	6.8	300	27032	336	30265	292	33	91
1	1	CCP	0.3	22	22	0.1	20	1.9	3.9	440	440	880	880	836	45	
3	3	STP	0.9	30	89	0.6	10	0.6	1.9	243	728	140	420	116	15	87
2	2	PLP	0.6	15	30	0.2	6	0.7	1.3	75	150	67	135	51	3	90
13	0	DRY	3.8	68	879	5.6										94
1	0	NS	0.3	20	20	0.1										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
338	125	15659	81599	48831

Table 3 - Summary of Pool Types

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

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
94	94	MAIN	98	29	2705	99	10.1	0.8	300	28199	292	26869	33
2	2	SCOUR	2	15	30	1	5.8	0.7	75	150	51	102	3

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
96	96	2735	28349	26971

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

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

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
90	MCP	94	8	9	50	56	21	23	6	7	5	6
1	CCP	1	0	0	0	0	0	0	1	100	0	0
3	STP	3	1	33	2	67	0	0	0	0	0	0
2	PLP	2	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
96	9	9	54	56	21	22	7	7	5	5

Mean Maximum Residual Pool Depth (ft.): 2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015 Dry Units: 13

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

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
124	16	LGR	0	0	0	0	67	0	0	33	0
1	1	HGR	0	0	0	0	0	0	0	0	0
125	17	TOTAL RIFFLE	0	0	0	0	67	0	0	33	0
74	8	RUN	0	100	0	0	0	0	0	0	0
29	5	SRN	0	13	0	0	0	0	0	88	0
103	13	TOTAL FLAT	0	42	0	0	0	0	0	58	0
90	90	MCP	12	18	39	2	1	3	0	19	5
1	1	CCP	0	25	50	10	0	0	0	15	0
3	3	STP	18	0	0	0	18	0	0	15	50
2	2	PLP	0	0	0	0	0	0	0	100	0
96	96	TOTAL POOL	12	18	38	2	1	3	0	20	6
1	0	NS									
338	126	TOTAL	11	18	36	2	3	3	0	22	5

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015 Dry Units: 13

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

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
124	16	LGR	0	0	50	31	13	0	6
1	1	HGR	0	0	0	0	100	0	0
74	8	RUN	0	13	38	13	25	0	13
29	5	SRN	20	0	60	0	0	0	20
90	89	MCP	15	6	38	15	12	2	12
1	1	CCP	0	100	0	0	0	0	0
3	3	STP	0	33	0	0	0	33	33
2	2	PLP	50	0	50	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
92	77	23	0	97	98

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

Open units represent habitat units with zero canopy cover.

Table 8 - Fish Habitat Inventory Data Summary

Stream Name: Gates Creek | LLID: 1234340392057 | Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015 | Survey Length (ft.): 15659 | Main Channel (ft.): 15659 | Side Channel (ft.): 0

Confluence Location: Quad: BAILEY RIDGE | Legal Description: T16NR14WS32 | Latitude: 39:12:21.0N | Longitude: 123:26:02.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: E4
Reach Length (ft.): 2206
Riffle/Flatwater Mean Width (ft.): 8.2
BFW:
Range (ft.): 12 to 30
Mean (ft.): 21
Std. Dev.: 7
Base Flow (cfs.): 0.0
Water (F): 60 - 65 Air (F): 63 - 76
Dry Channel (ft): 0

Canopy Density (%): 92.1
Coniferous Component (%): 62.1
Hardwood Component (%): 37.9
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 99.7
Dominant Shelter: Boulders
Dominant Bank Substrate Type: Bedrock
Occurrence of LWD (%): 22
LWD per 100 ft.:
Riffles: 2
Pools: 6
Flat: 1

Pools by Stream Length (%): 26.2
Pool Frequency (%): 30.2
Residual Pool Depth (%):
< 2 Feet Deep: 56
2 to 2.9 Feet Deep: 25
3 to 3.9 Feet Deep: 6
>= 4 Feet Deep: 13
Mean Max Residual Pool Depth (ft.): 2.3
Mean Pool Shelter Rating: 24

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 56 Sm Cobble: 19 Lg Cobble: 0 Boulder: 0 Bedrock: 25

Embeddedness Values (%): 1. 0.0 2. 18.8 3. 56.3 4. 0.0 5. 25.0

STREAM REACH: 2

Channel Type: B4
Reach Length (ft.): 2920
Riffle/Flatwater Mean Width (ft.): 9.0
BFW:
Range (ft.): 16 to 26
Mean (ft.): 22
Std. Dev.: 3
Base Flow (cfs.): 0.0
Water (F): 62 - 64 Air (F): 64 - 76
Dry Channel (ft): 85

Canopy Density (%): 87.6
Coniferous Component (%): 83.0
Hardwood Component (%): 17.0
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 99.2
Dominant Shelter: Large Woody Debris
Dominant Bank Substrate Type: Cobble/Gravel
Occurrence of LWD (%): 30
LWD per 100 ft.:
Riffles: 1
Pools: 9
Flat: 2

Pools by Stream Length (%): 27.6
Pool Frequency (%): 35.8
Residual Pool Depth (%):
< 2 Feet Deep: 54
2 to 2.9 Feet Deep: 29
3 to 3.9 Feet Deep: 13
>= 4 Feet Deep: 4
Mean Max Residual Pool Depth (ft.): 2.2
Mean Pool Shelter Rating: 46

Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 63 Sm Cobble: 29 Lg Cobble: 0 Boulder: 4 Bedrock: 4

Embeddedness Values (%): 1. 0.0 2. 41.7 3. 37.5 4. 16.7 5. 4.2

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: E4

Reach Length (ft.): 10533

Riffle/Flatwater Mean Width (ft.): 5.5

BFW:

Range (ft.): 10 to 30

Mean (ft.): 18

Std. Dev.: 5

Base Flow (cfs.): 0.0

Water (F): 59 - 70 Air (F): 64 - 78

Dry Channel (ft): 794

Canopy Density (%): 93.0

Coniferous Component (%): 79.3

Hardwood Component (%): 20.7

Dominant Bank Vegetation: Coniferous Trees

Vegetative Cover (%): 96.0

Dominant Shelter: Large Woody Debris

Dominant Bank Substrate Type: Sand/Silt/Clay

Occurrence of LWD (%): 29

LWD per 100 ft.:

Riffles: 2

Pools: 9

Flat: 2

Pools by Stream Length (%): 12.8

Pool Frequency (%): 25.7

Residual Pool Depth (%):

< 2 Feet Deep: 73

2 to 2.9 Feet Deep: 18

3 to 3.9 Feet Deep: 5

>= 4 Feet Deep: 4

Mean Max Residual Pool Depth (ft.): 1.8

Mean Pool Shelter Rating: 28

Pool Tail Substrate (%): Silt/Clay: 2 Sand: 2 Gravel: 73 Sm Cobble: 21 Lg Cobble: 2 Boulder: 0 Bedrock: 0

Embeddedness Values (%): 1. 0.0 2. 17.9 3. 51.8 4. 28.6 5. 1.8

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

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	20	20	16.0
Boulder	1	0	0.4
Cobble / Gravel	39	42	32.4
Sand / Silt / Clay	65	63	51.2

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	17	8	10.0
Brush	14	27	16.4
Hardwood Trees	25	15	16.0
Coniferous Trees	69	75	57.6
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

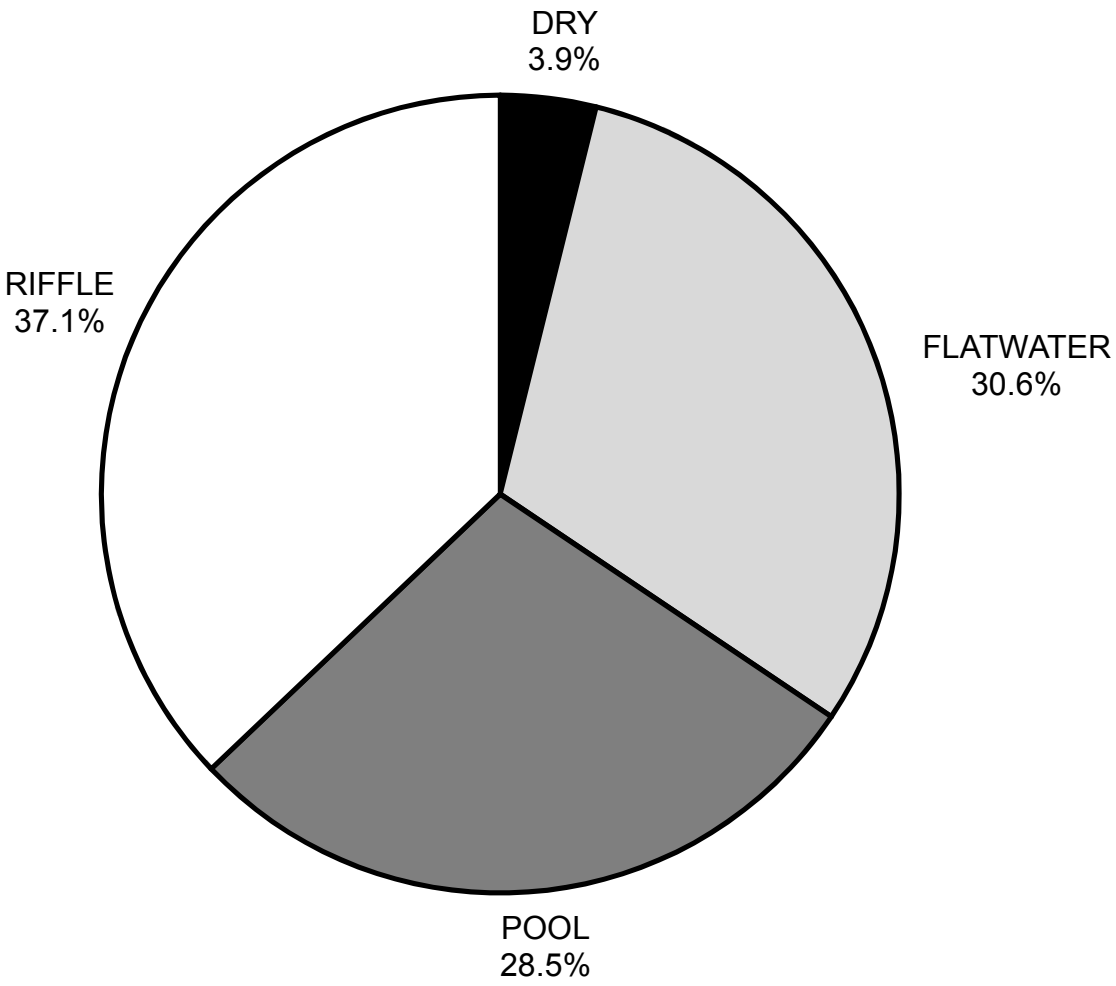
StreamName: Gates Creek LLID: 1234340392057 Drainage: Big River

Survey Dates: 7/7/2015 to 7/14/2015

Confluence Location: Quad: BAILEY RIDGE Legal Description: T16NR14WS32 Latitude: 39:12:21.0N Longitude: 123:26:02.0W

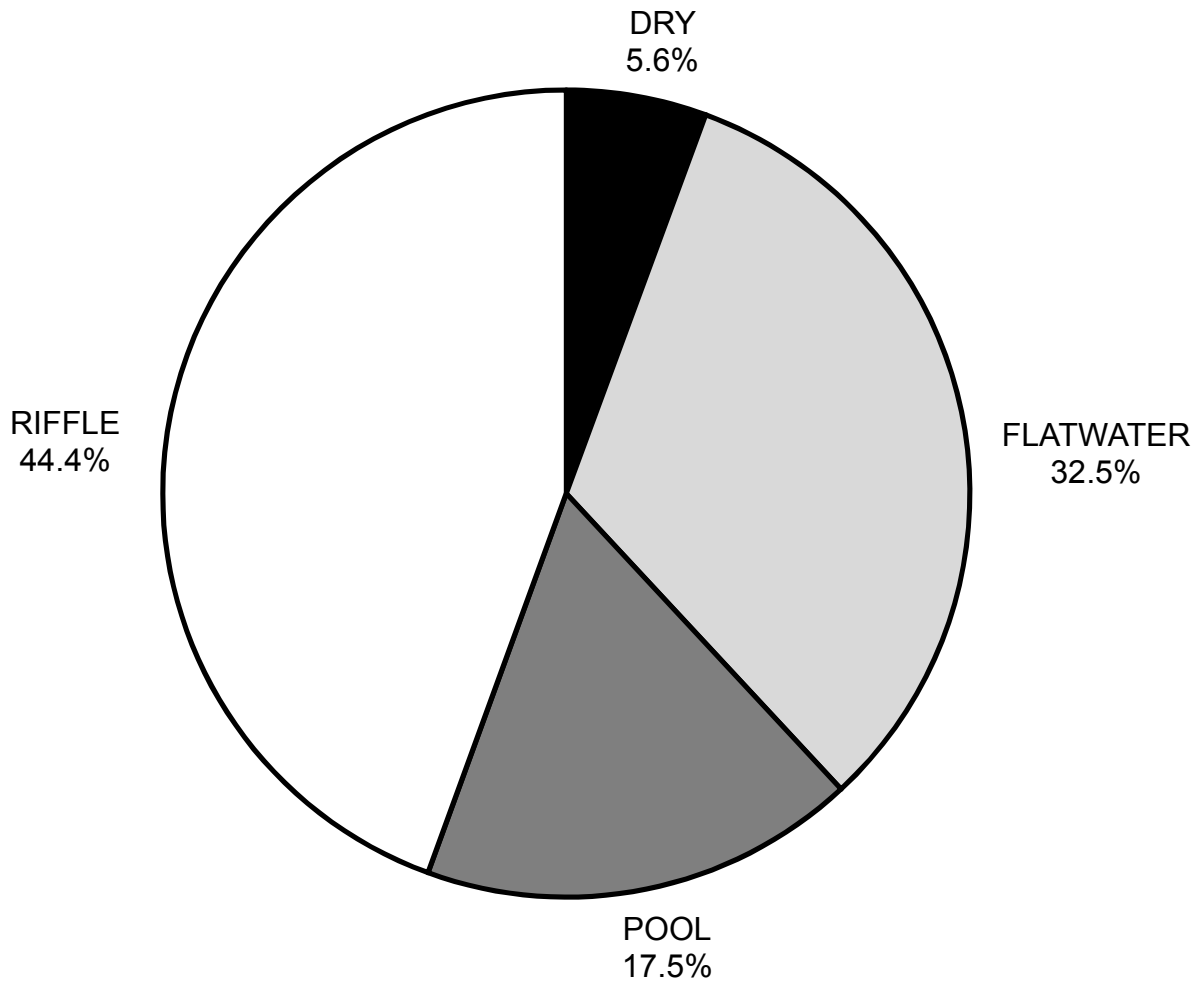
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	12
SMALL WOODY DEBRIS (%)	0	42	18
LARGE WOODY DEBRIS (%)	0	0	38
ROOT MASS (%)	0	0	2
TERRESTRIAL VEGETATION (%)	67	0	1
AQUATIC VEGETATION (%)	0	0	3
WHITEWATER (%)	0	0	0
BOULDERS (%)	33	58	20
BEDROCK LEDGES (%)	0	0	6

GATES CREEK 2015
HABITAT TYPES BY PERCENT OCCURRENCE



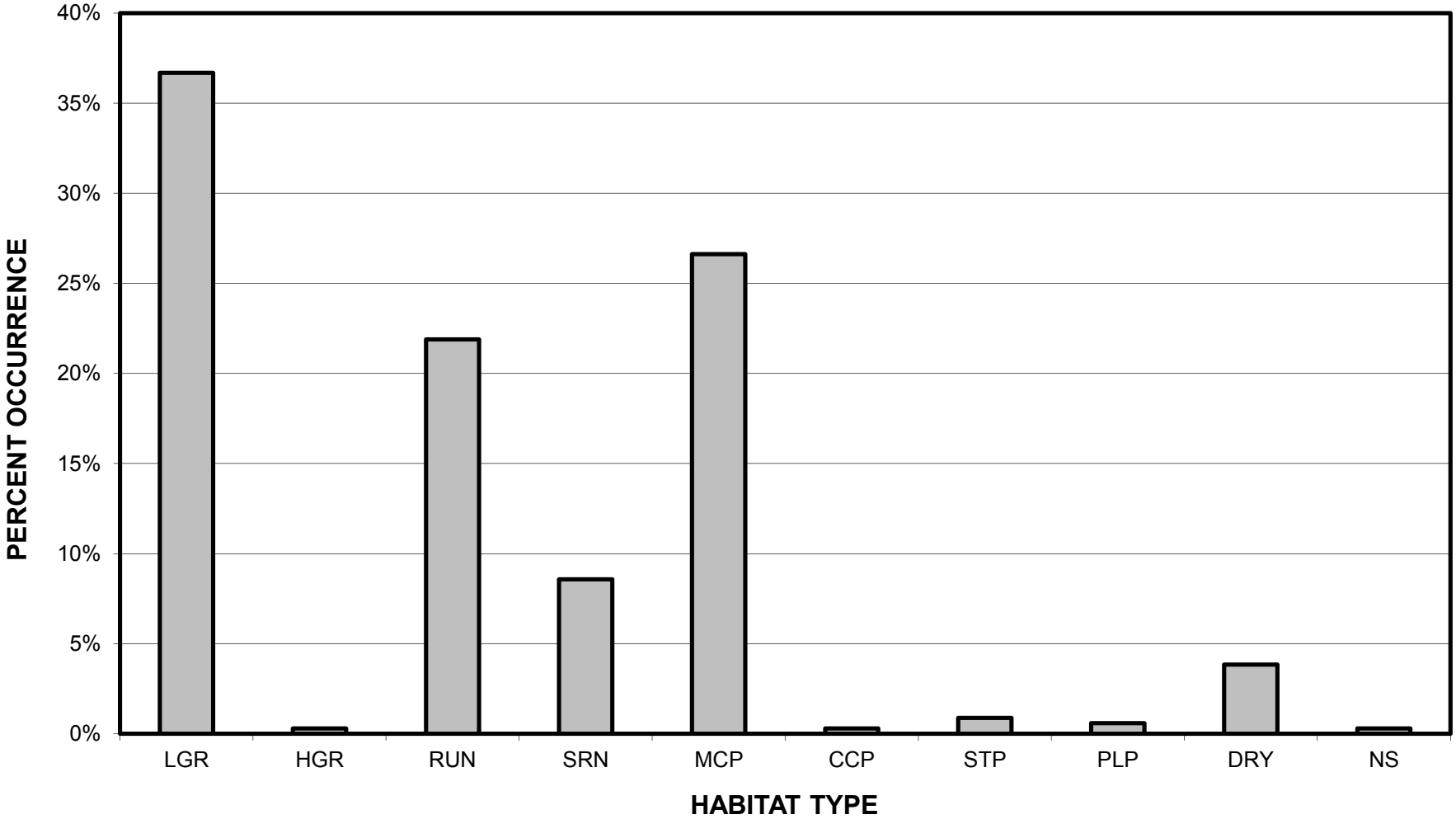
GRAPH 1

GATES CREEK 2015
HABITAT TYPES BY PERCENT TOTAL LENGTH



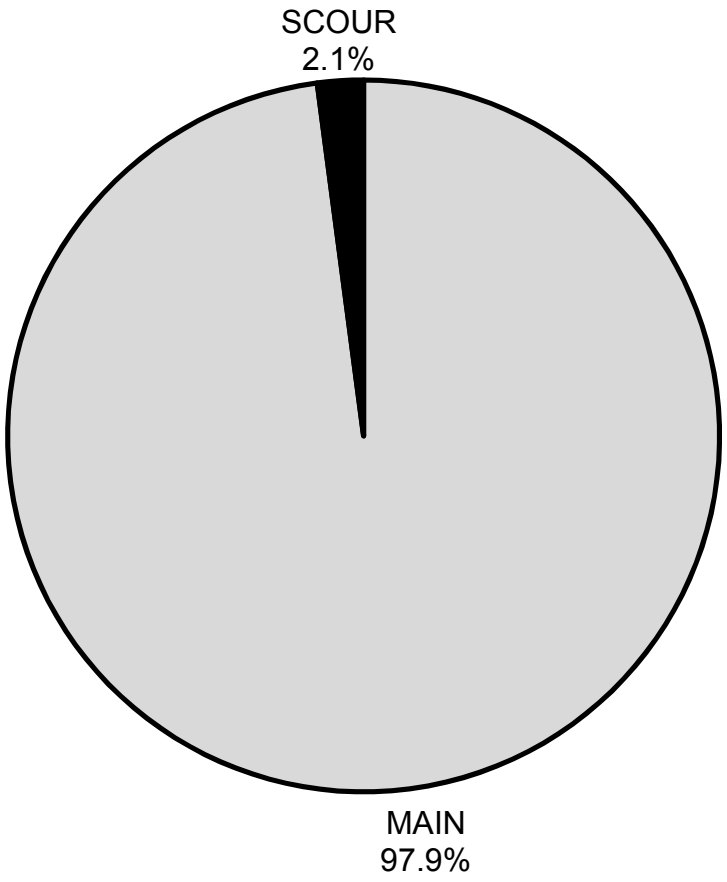
GRAPH 2

GATES CREEK 2015
HABITAT TYPES BY PERCENT OCCURRENCE

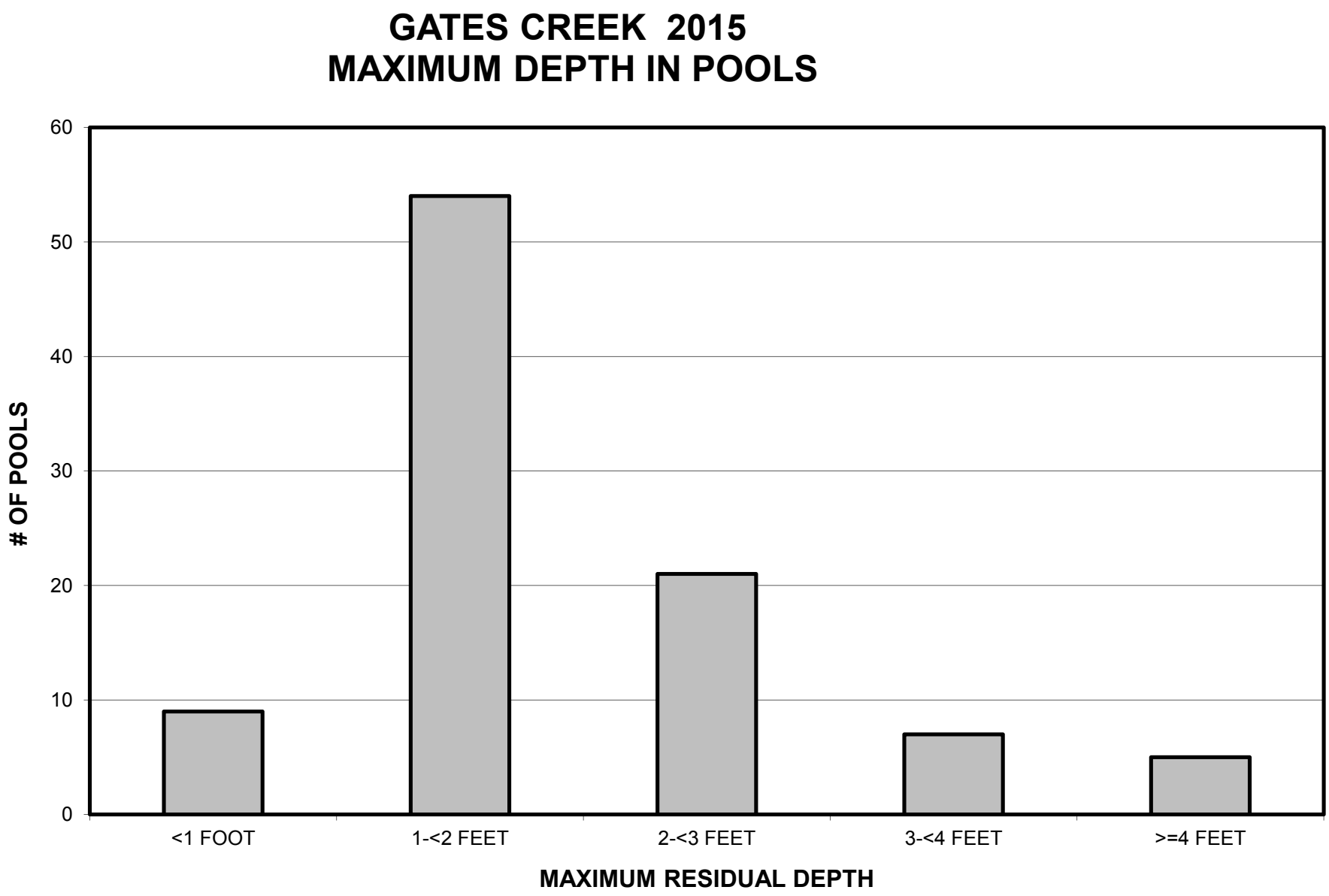


GRAPH 3

GATES CREEK 2015
POOL TYPES BY PERCENT OCCURRENCE

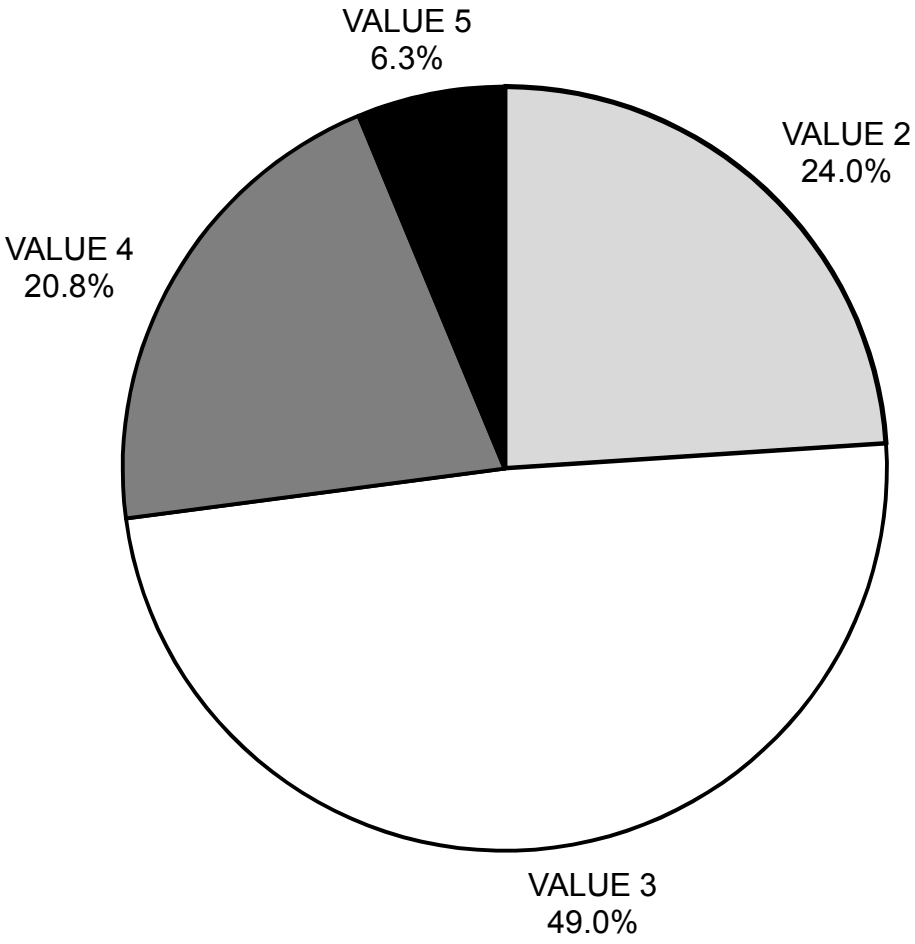


GRAPH 4


GATES CREEK 2015
MAXIMUM DEPTH IN POOLS
OF POOLS
60
50
40
30
20
10
0
<1 FOOT
1-<2 FEET
2-<3 FEET
3-<4 FEET
>=4 FEET
MAXIMUM RESIDUAL DEPTH

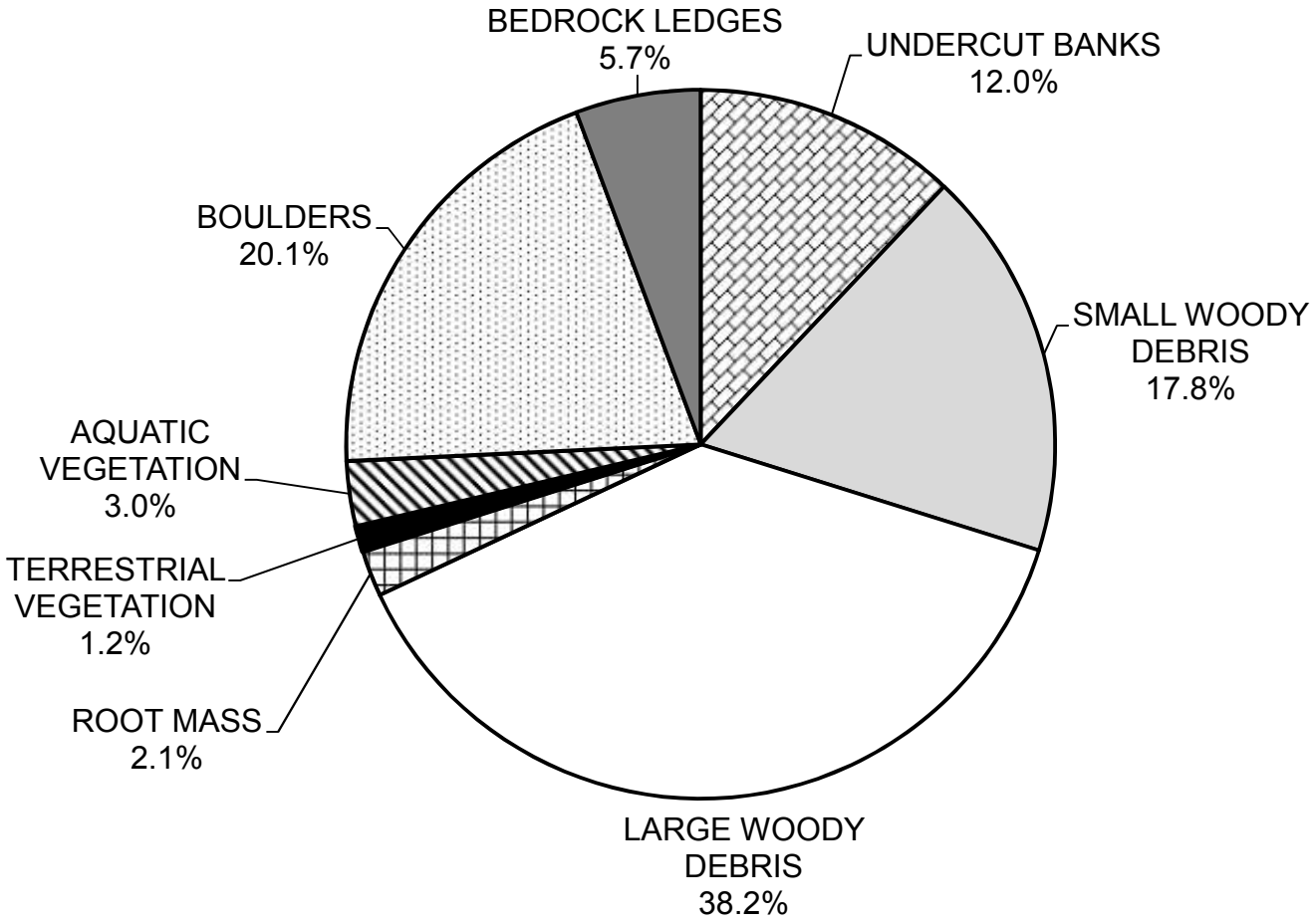
GRAPH 5

GATES CREEK 2015
PERCENT EMBEDDEDNESS



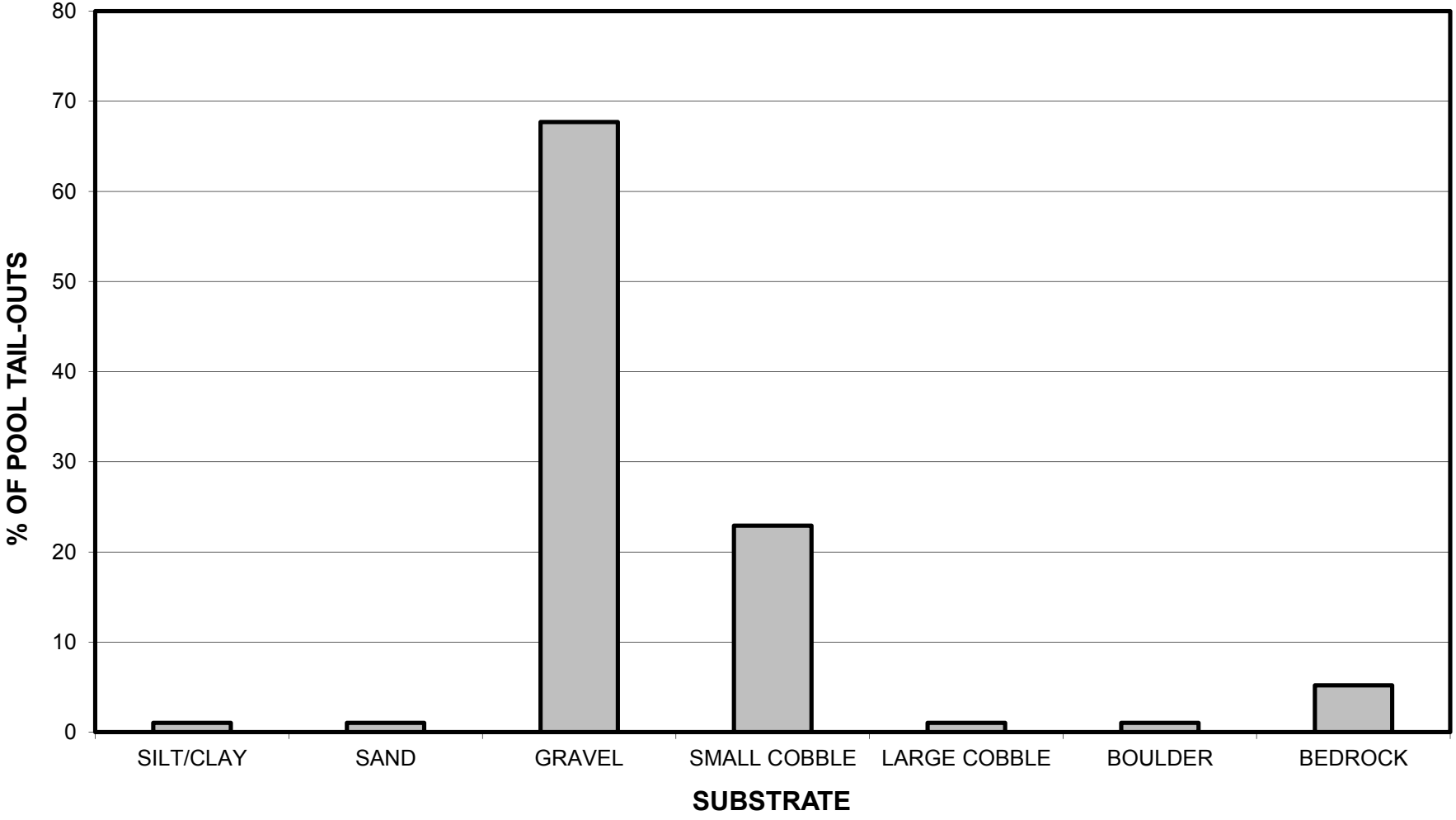
GRAPH 6

GATES CREEK 2015
MEAN PERCENT COVER TYPES IN POOLS



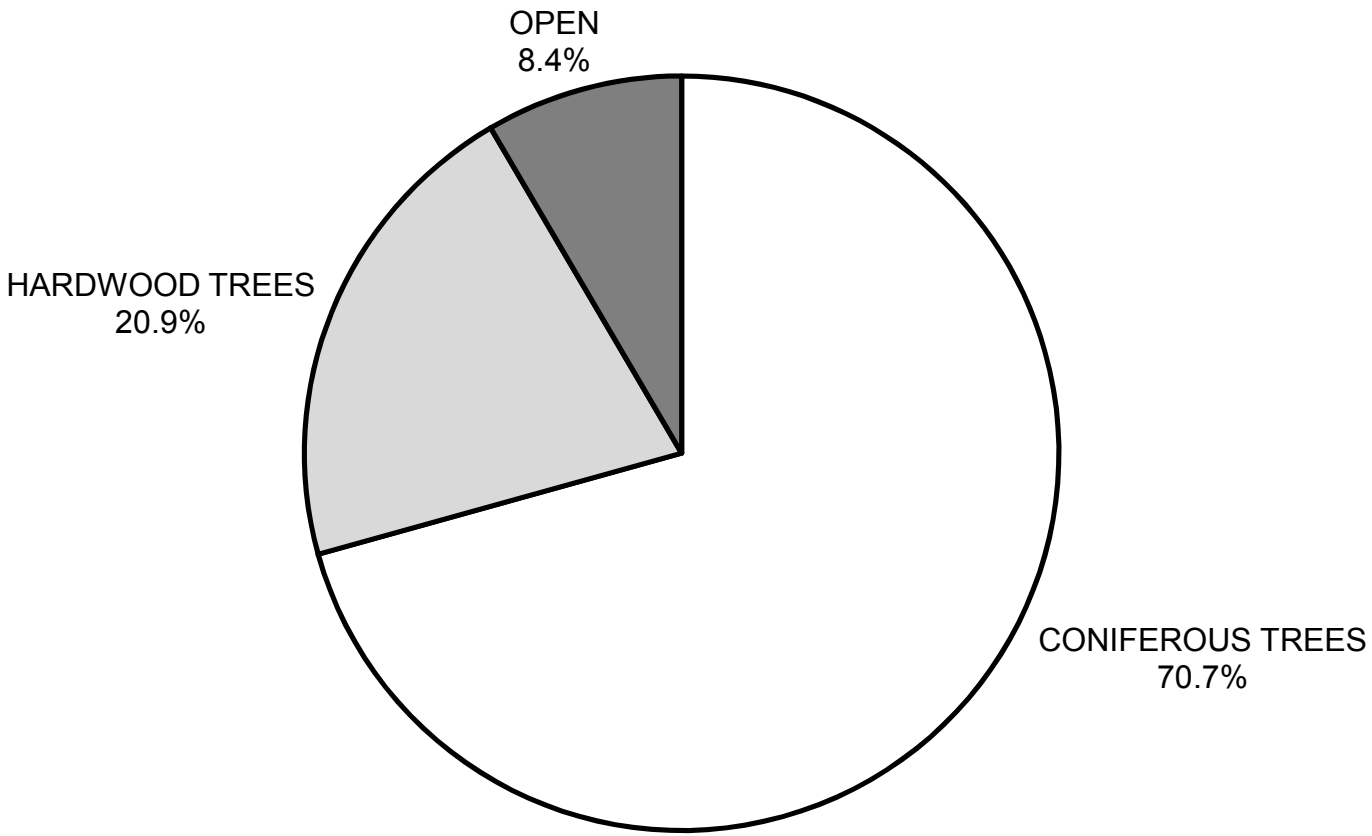
GRAPH 7

GATES CREEK 2015
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



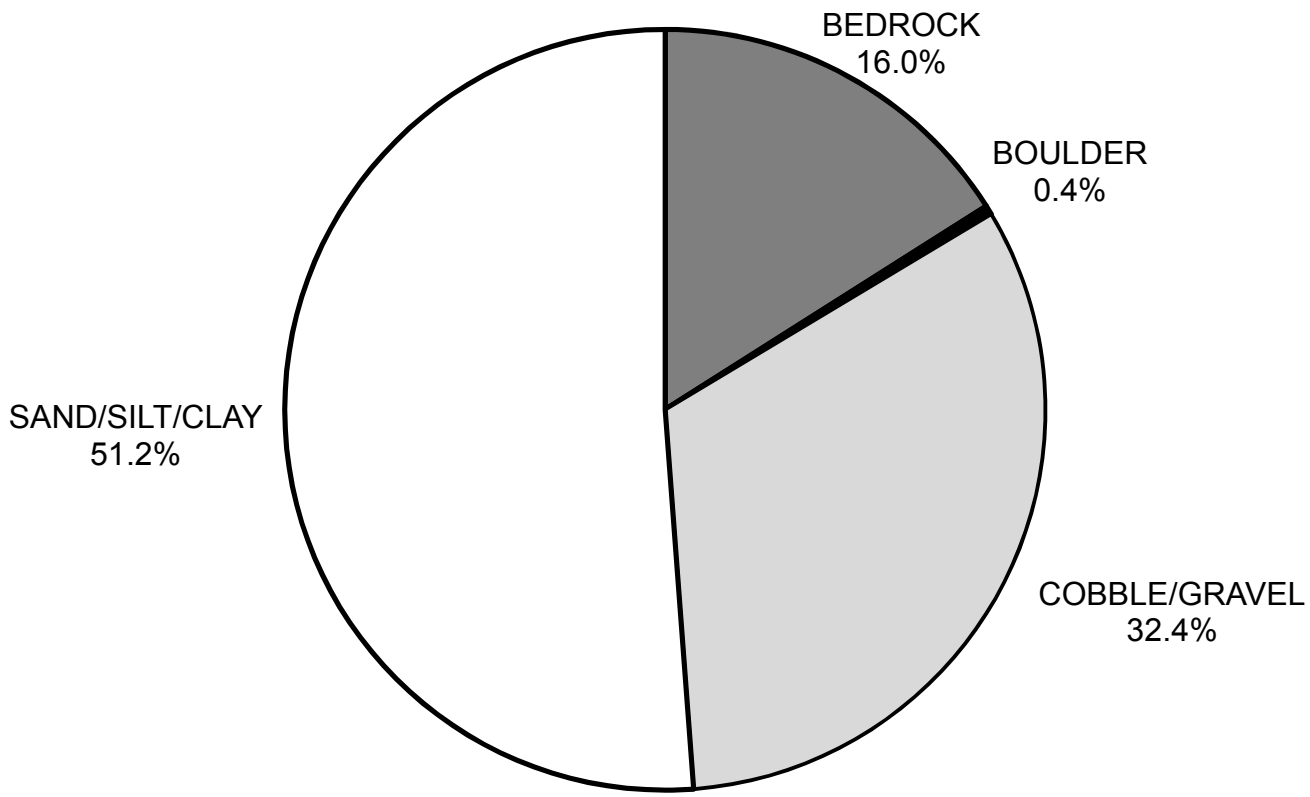
GRAPH 8

GATES CREEK 2015
MEAN PERCENT CANOPY



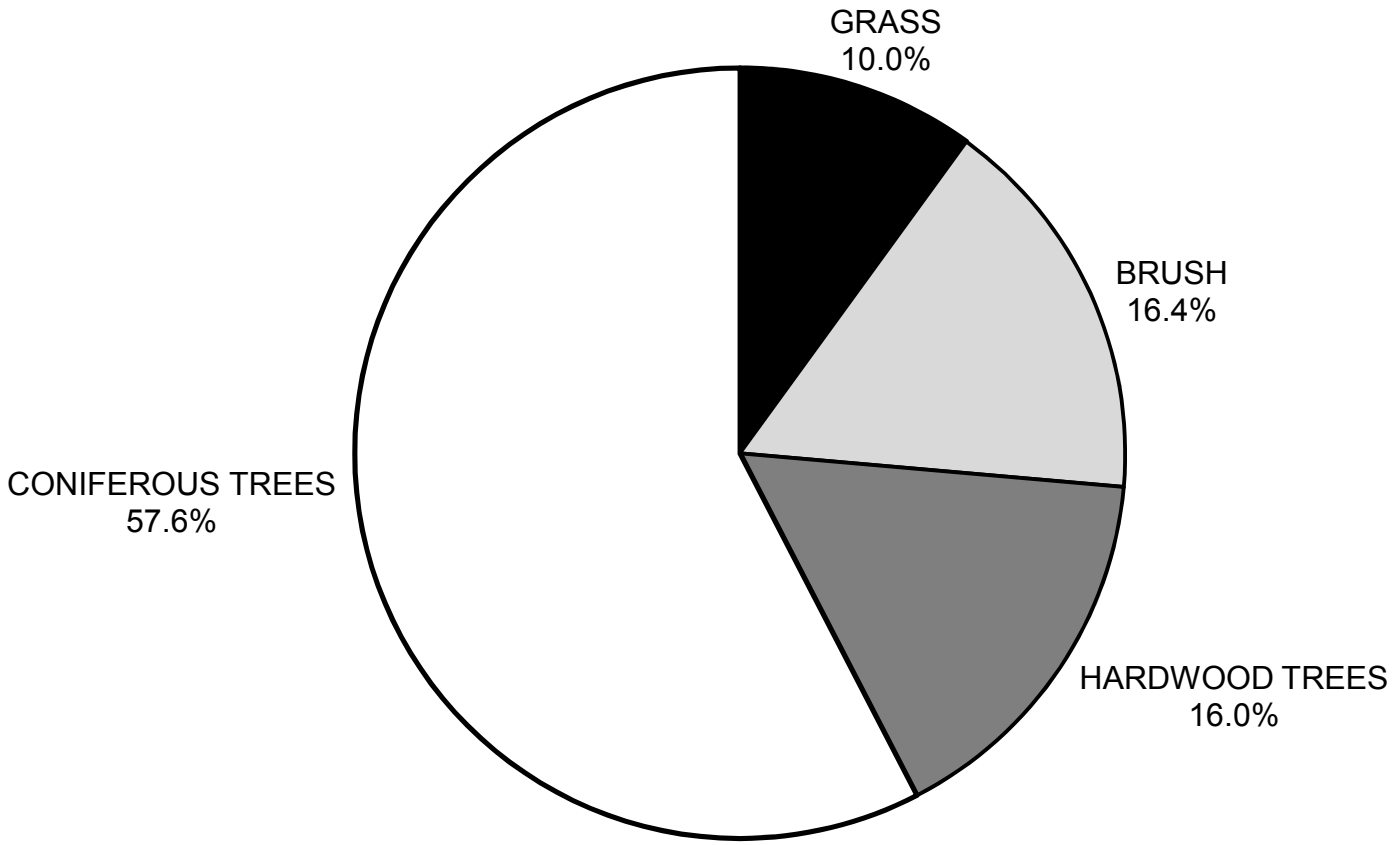
GRAPH 9

GATES CREEK 2015
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

GATES CREEK 2015
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11