CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

STREAM INVENTORY REPORT

Buck Gulch

INTRODUCTION

A stream inventory was conducted August 28 to August 30, 2017 on Buck Gulch. The survey began at the confluence with Miller Creek and extended upstream 0.9 miles.

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

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for Chinook and 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. This report was finalized in March, 2018.

WATERSHED OVERVIEW

Buck Gulch, located in northern Humboldt County, is a tributary to Miller Creek, which is a tributary to Redwood Creek, which is a tributary to South Fork Eel River, a tributary to the Eel River which drains into the Pacific Ocean in northern California (Map 1). Buck Gulch's legal description at the confluence with Miller Creek is T04S R02E S12. Its location is 40.0717° north latitude and -123.5454° west longitude, LLID number 1239150401214. Buck Gulch is a first order stream and has approximately 0.79 miles of blue line stream according to the USGS Briceland 7.5 minute quadrangle. Buck Gulch drains a watershed of approximately 0.885 square miles. Elevations range from about 770 feet at the mouth of the creek to 1,200 feet in the headwater areas. Grasslands and Douglas fir/oak forest dominate the watershed. The watershed is privately owned, subdivided, and provides private residences for several families. Vehicle access exists west from Redway via the Shelter Cove Road to Briceland Road, to Miller Creek Road.

METHODS

The habitat inventory conducted in Buck Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) members and California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by CDFW. This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and 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 Buck Gulch to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

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

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

Water and air temperatures are measured and recorded at every tenth habitat unit using a hand-held thermometer. Both temperatures are taken in degrees (°) Fahrenheit and the time of the measurement is also recorded. Air temperatures are recorded within one foot of the water surface, while water temperatures are recorded (where possible) in flowing water within the habitat unit.

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". Buck Gulch habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

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 Buck Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed 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 Buck Gulch, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. 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 Buck Gulch, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

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

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 Buck Gulch. In addition, underwater mask and snorkel observations were made at 12 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 Buck Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length

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

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED IN APPENDIX I *

The habitat inventory of August 28 to August 29, 2017 was conducted by Nicole Bejar (CDFW) and Chris Tevini (CCC). The total length of the stream surveyed was 4,691 feet.

Stream flow measurement of 0.04 cfs was recorded on August 29, 2017 near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter.

Buck Gulch is a G3 channel type for 1,099 feet of the stream surveyed (Reach 1), and an A3 channel type for 3,592 feet of the stream surveyed (Reach2). G3 channels are entrenched "gully" step-pool channels on moderate gradients with low width/depth ratios and with cobble-dominant substrates. A3 channels are steep, narrow, cascading, step-pool, high energy debris transporting channels associated with depositional soils, with cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 58° to 62° Fahrenheit. Air temperatures ranged from 67° to 88° Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% flatwater units, 25% pool units, 24% riffle units, 10% dry units, and 1% culvert units (Graph 1). Based on total length of Level II habitat types there were 77% flatwater units, 9% pool units, and 1% culvert units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step run units, 30%; mid-channel pool, 18%; and dry units, 10%. (Graph 3). Based on percent total length, step run units made up 74%, mid-channel pool units 7%, and low gradient riffle units 7%.

A total of 20 pools were identified (Table 3). Main channel pools were the most frequently encountered at 70% (Graph 4), and comprised 81% 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. Three of the 20 pools (15%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 20 pool tail-outs measured, 4 had a value of 1 (20%); 6 had a value of 2 (30%); 3 had a value of 3 (15%); 7 had a

value of 5 (35%) (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 0, flatwater habitat types had a mean shelter rating of 2, and pool habitats had a mean shelter rating of 9 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating of 12. Main channel pools had a mean shelter rating of 8 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Buck Gulch. Graph 7 describes the pool cover in Buck Gulch. Boulders are the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Small cobble was the dominate substrate observed in 45% of pool tail-outs. Boulders were the next most frequent observed dominate substrate and occurred in 30% of pool tail-outs.

The mean percent canopy density for the surveyed length of Buck Gulch was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 75% and 25%, respectively. Graph 9 describes the mean percent canopy in Buck Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 98%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 79% sand/silt/clay, 16% cobble/gravel, 4% boulder, and 2% bedrock (Graph 10). Brush was the dominant vegetation type observed in 73.2% of the units surveyed. Additionally, 21.4% of the units surveyed had hardwood trees as the dominant vegetation type, and 5.4% had coniferous trees as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a mask and snorkel survey for species composition and distribution in Buck Gulch on August 30, 2017 (Table A). Water temperatures taken during the survey period of 1130 to 1330 was 59° Fahrenheit. Air temperatures ranged from 67° to 76° Fahrenheit. The sites were sampled by Nicole Bejar (CDFW) and Chris Tevini (CCC).

In Reach 1, which comprised the first 1,099 feet of stream, nine sites were sampled. The reach sites yielded 16 young-of-the-year (YOY) steelhead trout (SH), 11 age 1+ SH, 5 age 2+ SH.

In Reach 2, three sites were sampled starting approximately 3,389 feet from the confluence with Miller Creek and continuing upstream 313 feet. The reach sites yielded 2 age 1+ SH, 3 age 2+ SH.

During the survey, the upstream-most observation of juvenile steelhead trout occurred at 40.12956° northlatitude, -123.91004° west longitude, approximately 3,702 feet upstream from the confluencewith Miller Creek (Map 1). No coho salmon were observed during the biological or habitat inventory.

Table A. Summary of results for a fish composition and distribution survey within Buck Gulch, August, 30, 2017.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	Steelhead Trout			Coho Salmon		Additional Aquatic Species Observed
					YOY	1+	2+	YOY	1+	
Reach 1: G3 Channel Type										
08/28/17	1	006	Run	227	0	0	0	0	0	
	2	008	Pool	294	0	0	0	0	0	
	3	013	Pool	433	2	1	1	0	0	
	4	017	Pool	532	3	2	1	0	0	
	5	019	Pool	587	8	2	0	0	0	
	6	020	Pool	635	1	0	1	0	0	
	7	022	Pool	666	0	5	0	0	0	
	8	024	Pool	743	3	0	2	0	0	
	9	026	Pool	787	0	0	0	0	0	
Reach 2: A3 Channel Type										
08/28/17	10	066	Pool	3,389	0	0	1	0	0	
	11	068	Pool	3,502	0	2	2	0	0	
	12	072	Pool	3,702	0	0	0	0	0	

DISCUSSION

Buck Gulch is a G3 channel type for the first 1,099 feet of stream surveyed and an A3 channel type for the remaining 3,952 feet. The suitability of G3 and A3 channel types for fish habitat improvement structures is as follows: G3 channels are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover. A3 channels are generally not suitable for fish habitat improvement projects.

The water temperatures recorded on the survey days August 28 to August 29, 2017, ranged from 58° to 62° Fahrenheit. Air temperatures ranged from 67° to 88° Fahrenheit. This is a suitable water temperature range 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 77% of the total length of this survey, riffles 8%, and pools 5%. Three of the 20 (15%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Ten of the 20 pool tail-outs measured had embeddedness ratings of 1 or 2. Three of the pool tail-

outs had embeddedness ratings of 3 or 4. Seven 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.

Thirteen of the 20 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 9. The shelter rating in the flatwater habitats is 2. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in Buck Gulch. Boulders are the dominant cover type in pools followed by small woody debris. Log and rootwad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 98%. Reach 1 had a canopy density of 98.3%, Reach 2 had a canopy density of 98.5%. The percentage of right and left bank covered with vegetation was 98% and 100%, respectively.

RECOMMENDATIONS

Buck Gulch 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 Buck Gulch. 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 or 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 boulders. Adding high quality complexity with woody cover in the pools is desirable.

2) Due to the culvert located at 709 feet and 3,502 feet, access for migrating salmonids is an ongoing potential problem. A fish passage assessment should be conducted at these sites. If the assessment finds the culverts to be barriers to fish passage they should be replaced with structures that provide unimpeded fish passage. Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish.

3) Suitable size spawning substrate on Buck Gulch is limited to relatively few reaches. Projects should be designed at suitable sites to trap and sort spawning gravel.

4) 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.

5) The limited water temperature data available suggest that maximum temperatures are

within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

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 the confluence with Miller Creek.
85	0004.00	Bridge #1 is the crossing for an unnamed road and is 4' high x 4' wide x 23.5' long. It is a foot bridge made of wood and is not a barrier to salmonids.
206	0006.00	There is active erosion on the right bank, it measures 10.5' high x 47' long. Five salmonid YOY observed.
499	0017.00	Habitat restoration project.
544	0019.00	Habitat restoration project.
587	0020.00	Boulder rip rap at top of unit.
651	0022.00	Constructed log weir.
709	0024.00	Approximately eight 1+ steelhead-trout observed. Culvert #1 is under Miller Creek Road, and is 7.2' high x 6.8' width x 26' long and made of corrugated metal. The outlet plunge height is 2.7'. It is a possible barrier to juvenile and adult salmonids.
829	0028.00	Old landslide on left bank.
1126	0030.00	There is an increase in gradient.
1362	0041.00	There is active erosion on the left bank. A landslide has filled in channel and water is tricking from the bottom. Sediment from young trees has filled in the channel.
2080	0053.00	Landslide and erosion on right bank and left bank with downed hardwoods and conifers in channel.
2124	0056.00	There is active erosion on the left bank and it measures 50' long x 14' high at approximately 70' into unit.
3378	0066.00	There were a 2+ salmonid present.

3502	0069.00	Culvert #2 is under Miller Creek Road, and is 6.1' high x 5.9' wide x 39' long. It is composed of 1 culvert is made of CMP. The culvert's diameter is 6', its plunge height is 5.9', and it has a maximum depth of 1.5' within 5' of the outlet. The slope is 2%, and its condition is slightly rusted. It is a possible barrier to juveniles. Adult salmonids could get through but would have a hard time jumping.
4256	0076.00	Bridge #2 is the crossing for an unknown road (possibly Miller Creek Road), and is 3' high x 10' wide x 18' long. It is a vehicle bridge (made of wood with metal underside) and is not a barrier to salmonids.
4521	0079.00	End of survey due to steep, incised boulder field. Increasing, consistent, steep slope with no pools. Most likely end of anadromy for salmonids. There is very little flow at this time of year. Last salmonid observed at HU#066.

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.

REPORT CONTACT INFORMATION

California Department of Fish and Wildlife
Coastal Watershed Planning and Assessment Program
1487 Sandy Prairie ct., Suite A
Fortuna, CA 95540
www.coastalwatersheds.ca.gov

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 - Rootwad 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 - Rootwad 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]

Map 1
Buck Gulch
South Fork Eel River Watershed
Briceland Quad, Humboldt County

End of Survey
*River Mile 0.89

*River Mile 0.64

Start of Survey

South Fork Eel River Watershed

Humboldt County

Buck Gulch

Pacific Ocean

Mendocino County
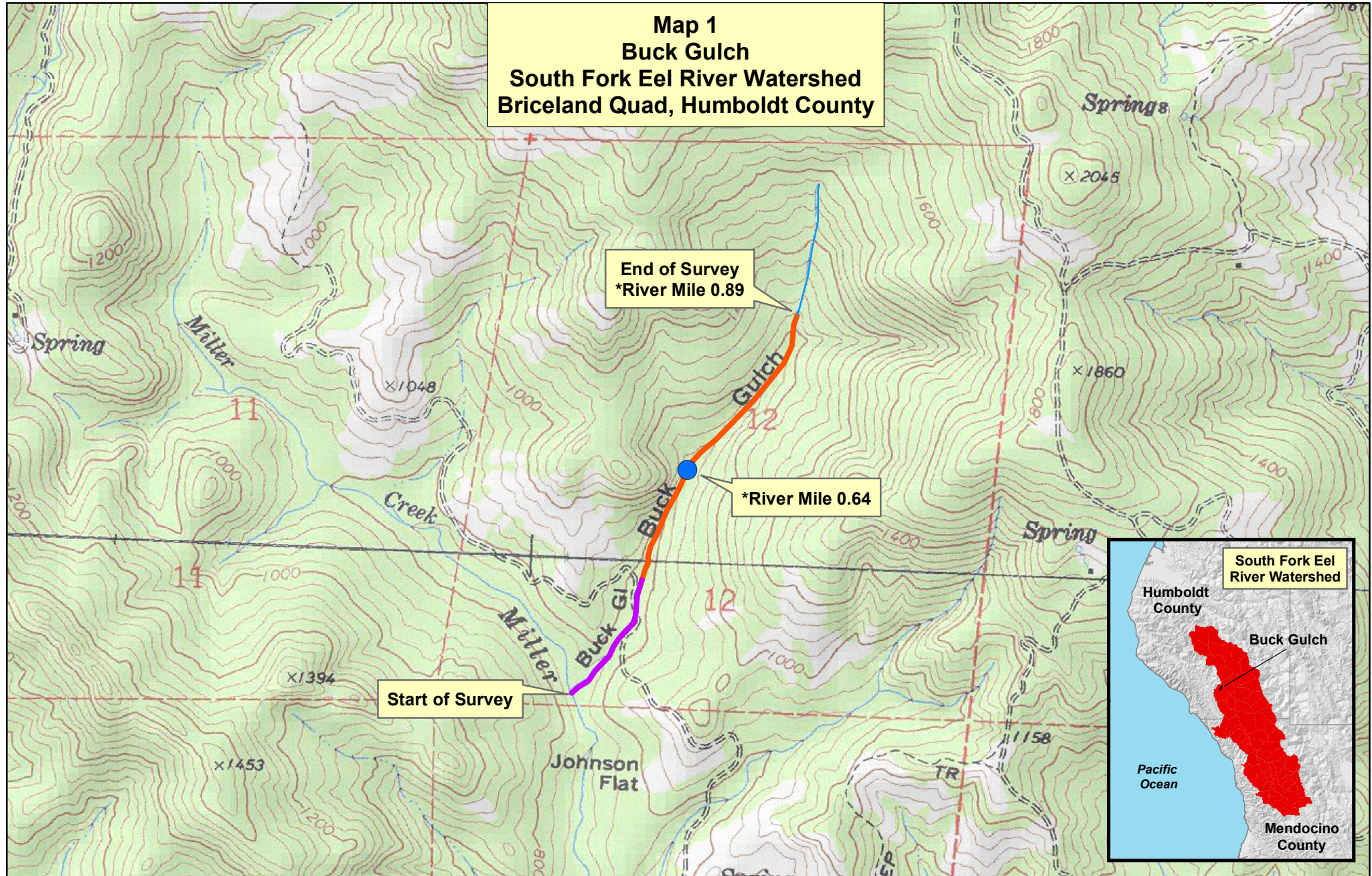
Reach 1: G3 Channel Type

Reach 2: A3 Channel Type

Buck Gulch

Last observed juvenile steelhead trout

0   0.075 0.15   0.3
Miles

0   0.175   0.35   0.7
Kilometers

Coordinate System: NAD 1983 California Teale Albers
Data Sources: CDFW, USGS, CalWater 2.21, CDF 24k

*River Mile indicates distance from confluence with Miller Creek
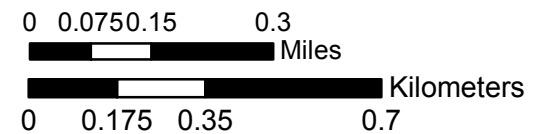
APPENDIX I

TABLES AND GRAPHS

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

Stream Name: Buck Gulch　　　　　　　　　　　　　　　　　LLID: 1239150401214　　　Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017

Confluence Location:　　Quad: ETTERSBURG　　　　Legal Description: T04SR02ES12　　Latitude: 40:07:17.0N　　　Longitude: 123:54:54.0

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
1	0	CULVERT	1.3	39	39	0.8									
8	0	DRY	10.1	28	228	4.9									
31	5	FLATWATER	39.2	117	3632	77.4	5.6	0.5	0.9	280	8668	146	4539		2
20	20	POOL	25.3	20	399	8.5	8.2	0.7	1.5	172	3437	222	4448	179	9
19	3	RIFFLE	24.1	21	393	8.4	5.2	0.3	0.5	40	758	12	235		0

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
79	28	4691	12863	9222

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Buck Gulch   LLID: 1239150401214   Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude: 40:07:17.0N   Longitude: 123:54:54.0W

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 (%)
14	2	LGR	17.7	23	316	6.7	4	0.4	0.6	46	647	14	202			98
5	1	HGR	6.3	15	77	1.6	7	0.3	0.4	27	137	8	41		0	91
7	1	RUN	8.9	20	138	2.9	7	0.5	1.1	132	926	66	463		5	100
24	4	SRN	30.4	146	3494	74.5	5	0.5	1.1	316	7595	166	3996		0	100
14	14	MCP	17.7	23	325	6.9	9	0.7	4.3	214	2992	290	4059	236	8	98
5	5	LSBo	6.3	12	59	1.3	5	0.8	1.7	56	280	55	273	42	11	98
1	1	PLP	1.3	15	15	0.3	11	0.4	1.2	165	165	116	116	66	20	100
8	0	DRY	10.1	28	228	4.9										
1	0	CUL	1.3	39	39	0.8										

Total Units	Total Units Fully Measured		Total Length (ft.)				Total Area (sq.ft.)		Total Volume (cu.ft.)
79	28		4691				12741		9150

Table 3 - Summary of Pool Types

Stream Name: Buck Gulch   LLID: 1239150401214   Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude: 40:07:17.0N   Longitude: 123:54:54.0W

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
14	14	MAIN	70	23	325	81	8.9	0.7	214	2992	236	3307	8
6	6	SCOUR	30	12	74	19	6.3	0.7	74	445	46	277	13

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
20	20	399	3437	3584

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

Stream Name: Buck Gulch   LLID: 1239150401214   Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude: 40:07:17.0N   Longitude: 123:54:54.0W

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
14	MCP	70	5	36	6	43	2	14	0	0	1	7
5	LSBo	25	0	0	5	100	0	0	0	0	0	0
1	PLP	5	0	0	1	100	0	0	0	0	0	0

Total Units			Total < 1 Foot Max Resid. Depth	Total < 1 Foot % Occurrence	Total 1< 2 Foot Max Resid. Depth	Total 1< 2 Foot % Occurrence	Total 2< 3 Foot Max Resid. Depth	Total 2< 3 Foot % Occurrence	Total 3< 4 Foot Max Resid. Depth	Total 3< 4 Foot % Occurrence	Total >= 4 Foot Max Resid. Depth	Total >= 4 Foot % Occurrence
20			5	25	12	60	2	10	0	0	1	5

Mean Maximum Residual Pool Depth (ft.): 1.5

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Buck Gulch

LLID: 1239150401214   Drainage: Eel River-South Fork

Survey Dates: 8/28/2017 to 8/29/2017   Dry Units: 8

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude:40:07:17.0N   Longitude: 123:54:54.0W

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
14	0	LGR									
5	1	HGR	0	0	0	0	0	0	0	0	0
19	1	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
7	1	RUN	0	100	0	0	0	0	0	0	0
24	2	SRN	0	0	0	0	0	0	0	0	0
31	3	TOTAL FLAT	0	100	0	0	0	0	0	0	0
14	13	MCP	0	41	30	0	0	0	0	29	0
5	5	LSBo	0	8	0	0	0	0	0	92	0
1	1	PLP	0	40	60	0	0	0	0	0	0
20	19	TOTAL POOL	0	30	22	0	0	0	0	48	0
1	0	CUL									
79	23	TOTAL	0	35	20	0	0	0	0	45	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Buck Gulch   LLID: 1239150401214   Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017   Dry Units: 8

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude: 40:07:17.0N   Longitude: 123:54:54.0W

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
14	2	LGR	0	0	0	0	100	0	0
5	1	HGR	0	0	0	0	0	100	0
7	1	RUN	0	0	100	0	0	0	0
24	4	SRN	0	0	0	0	25	75	0
14	14	MCP	7	0	43	0	7	36	7
5	5	LSBo	0	0	40	0	0	60	0
1	1	PLP	0	0	0	100	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Buck Gulch   LLID: 1239150401214   Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude: 40:07:17.0N   Longitude: 123:54:54.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	25	75	0	98	100

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: Buck Gulch   LLID: 1239150401214   Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017   Survey Length (ft.): 4691   Main Channel (ft.): 4691   Side Channel (ft.): 0

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude: 40:07:17.0N   Longitude: 123:54:54.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: A3	Canopy Density (%): 98.4	Pools by Stream Length (%): 8.5
Reach Length (ft.): 4691	Coniferous Component (%): 24.8	Pool Frequency (%): 25.3
Riffle/Flatwater Mean Width (ft.): 5.4	Hardwood Component (%): 75.2	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep: 85
Range (ft.): 11 to 53	Vegetative Cover (%): 99.1	2 to 2.9 Feet Deep: 10
Mean (ft.): 20	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 0
Std. Dev.: 12	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 5
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 14	Mean Max Residual Pool Depth (ft.): 1.5
Water (F): 58 - 62 Air (F): 67 - 88	LWD per 100 ft.:	Mean Pool Shelter Rating: 9
Dry Channel (ft.): 228	Riffles: 1	
	Pools: 3	
	Flat: 1	

Pool Tail Substrate (%):   Silt/Clay: 0   Sand: 0   Gravel: 20   Sm Cobble: 45   Lg Cobble: 0   Boulder: 30   Bedrock: 5

Embeddedness Values (%):   1. 20.0   2. 30.0   3. 15.0   4. 0.0   5. 35.0

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Buck Gulch   LLID: 1239150401214   Drainage: Eel River - South Fork

Survey Dates: 8/28/2017 to 8/29/2017

Confluence Location: Quad: ETTERSBURG   Legal Description: T04SR02ES12   Latitude: 40:07:17.0N   Longitude: 123:54:54.0W

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	1.8
Boulder	1	1	3.6
Cobble / Gravel	5	4	16.1
Sand / Silt / Clay	21	23	78.6

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	17	24	73.2
Hardwood Trees	9	3	21.4
Coniferous Trees	2	1	5.4
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

StreamName: Buck Gulch LLID: 1239150401214 Drainage: Eel River-South Fork

Survey Dates: 8/28/2017 to 8/29/2017

Confluence Location: Quad: Briceland Legal Description: T04SR02ES12 Latitude: 40:07:17.0N Longitude: 123:54:54.0W

	Riffles	Flatwater	Pools
UNDERCUT BANKS(%)	0	0	0
SMALL WOODY DEBRIS (%)	0	100	30
LARGE WOODY DEBRIS (%)	0	0	22
ROOT MASS (%)	0	0	0
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	48
BEDROCK LEDGES (%)	0	0	0

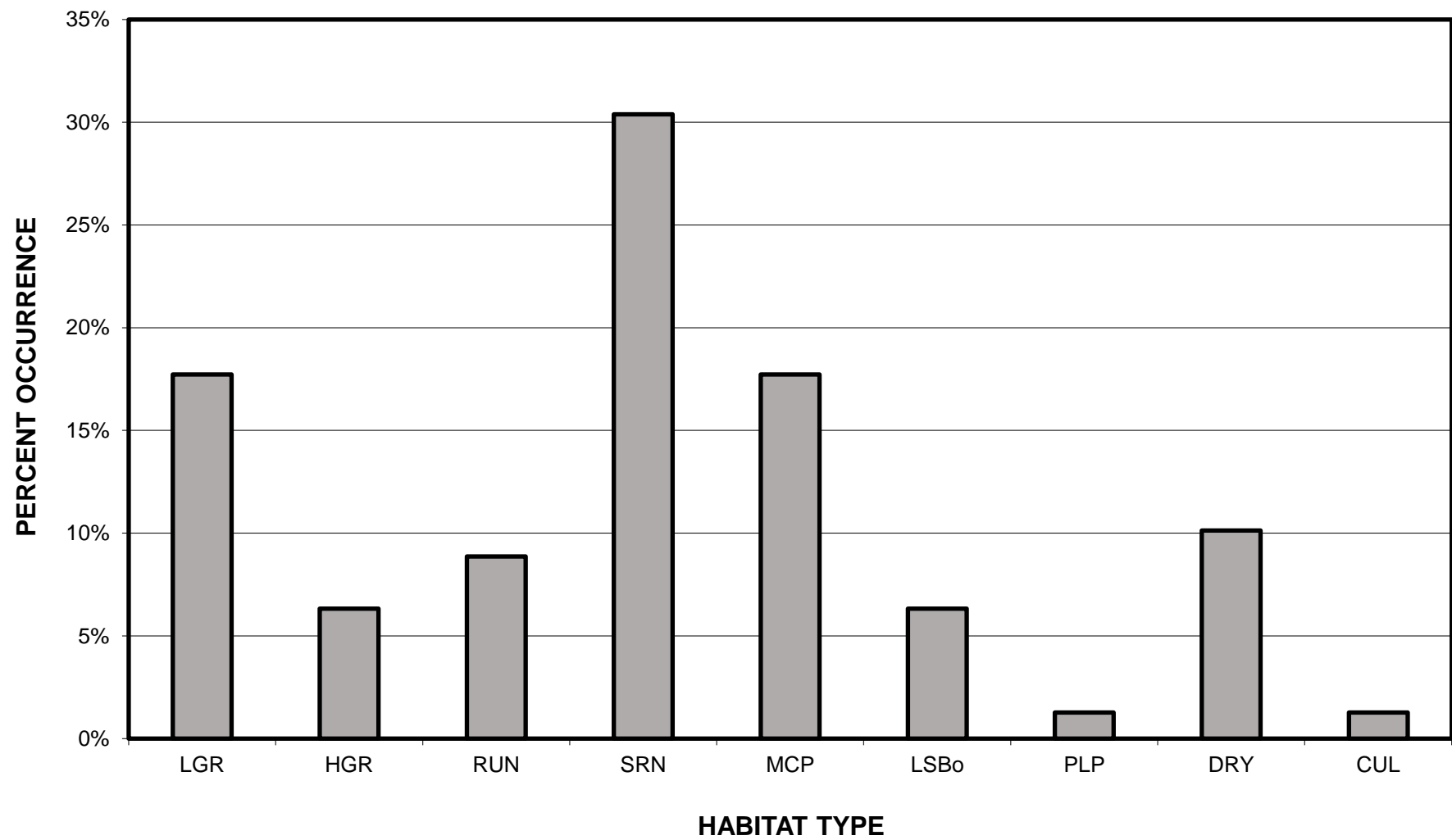# BUCK GULCH 2017
HABITAT TYPES BY PERCENT OCCURRENCE

CULVERT
1.3%

DRY
10.1%

RIFFLE
24.1%

FLATWATER
39.2%
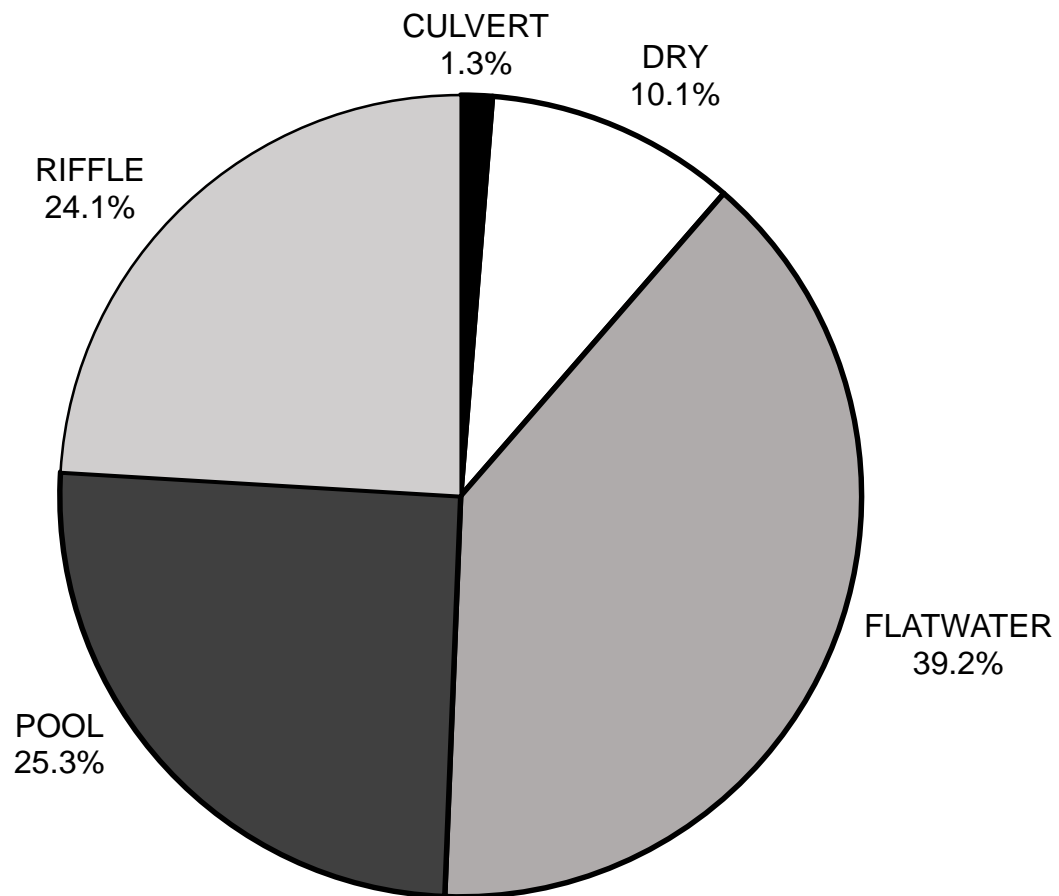
POOL
25.3%

GRAPH 1

BUCK GULCH 2017
HABITAT TYPES BY PERCENT TOTAL LENGTH

CULVERT
0.8%

RIFFLE
8.4%

DRY
4.9%

POOL
8.5%

FLATWATER
77.4%
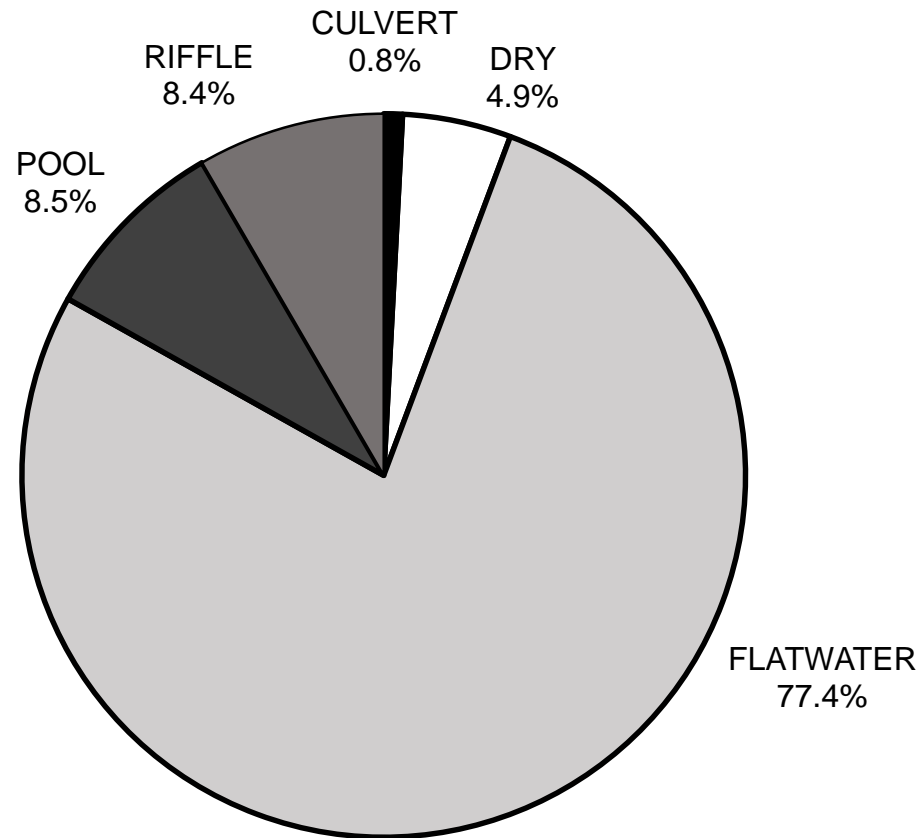
GRAPH 2

BUCK GULCH 2017
HABITAT TYPES BY PERCENT OCCURRENCE

GRAPH 3

BUCK GULCH 2017
POOL TYPES BY PERCENT OCCURRENCE

SCOUR
30%

MAIN
70%
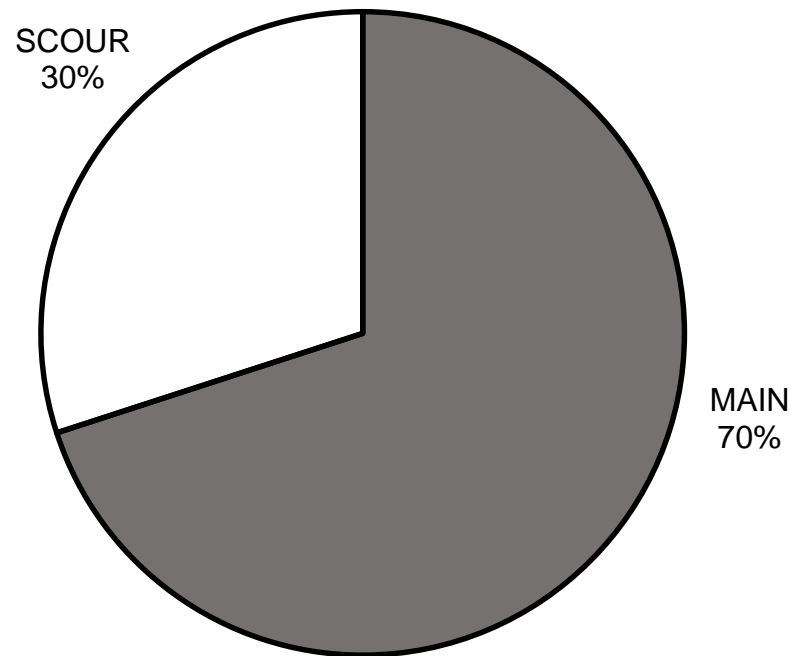
GRAPH 4

BUCK GULCH 2017
MAXIMUM DEPTH IN POOLS
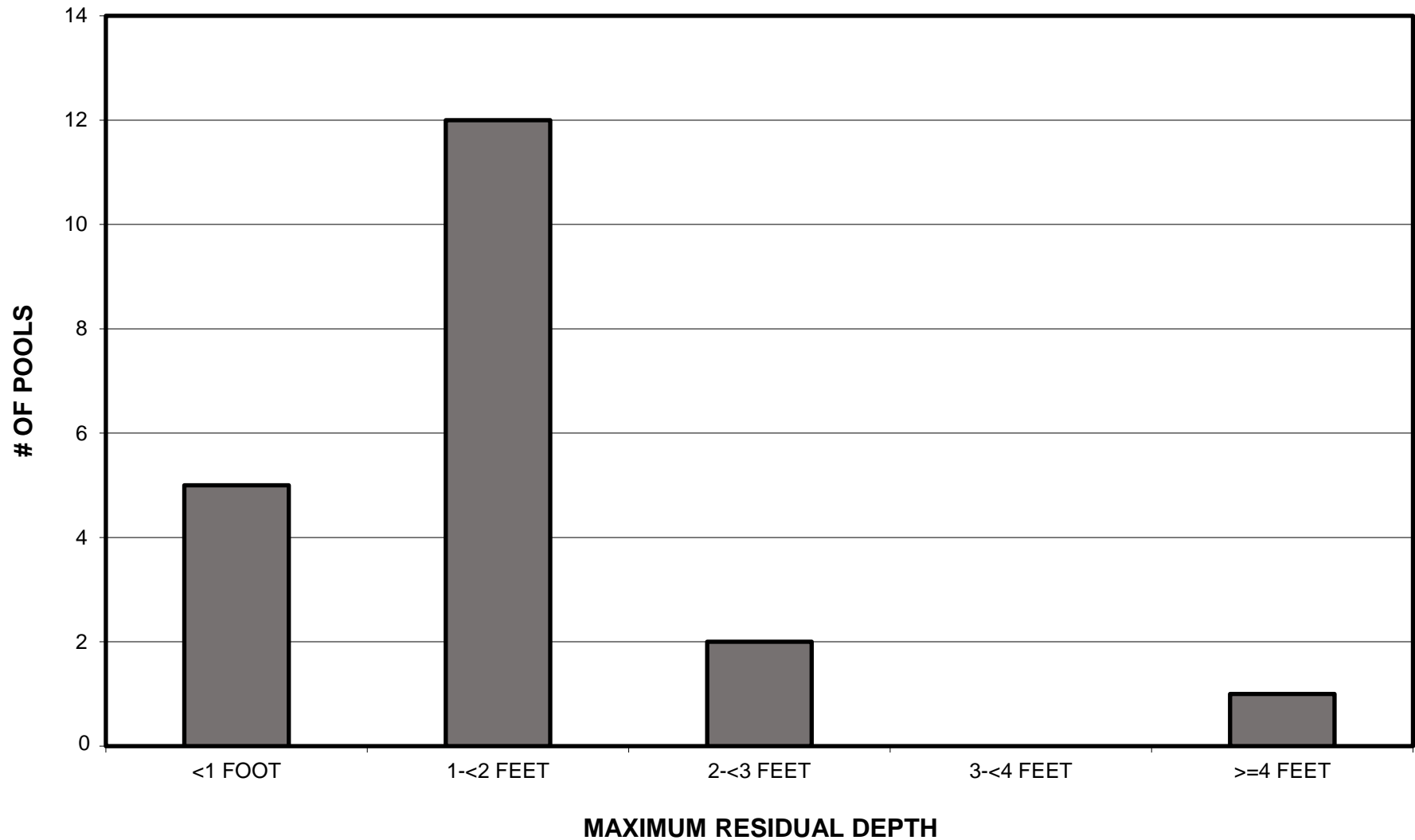
GRAPH 5

BUCK GULCH 2017
PERCENT EMBEDDEDNESS

VALUE 1
20%

VALUE 2
30%

VALUE 3
15%

VALUE 5
35%
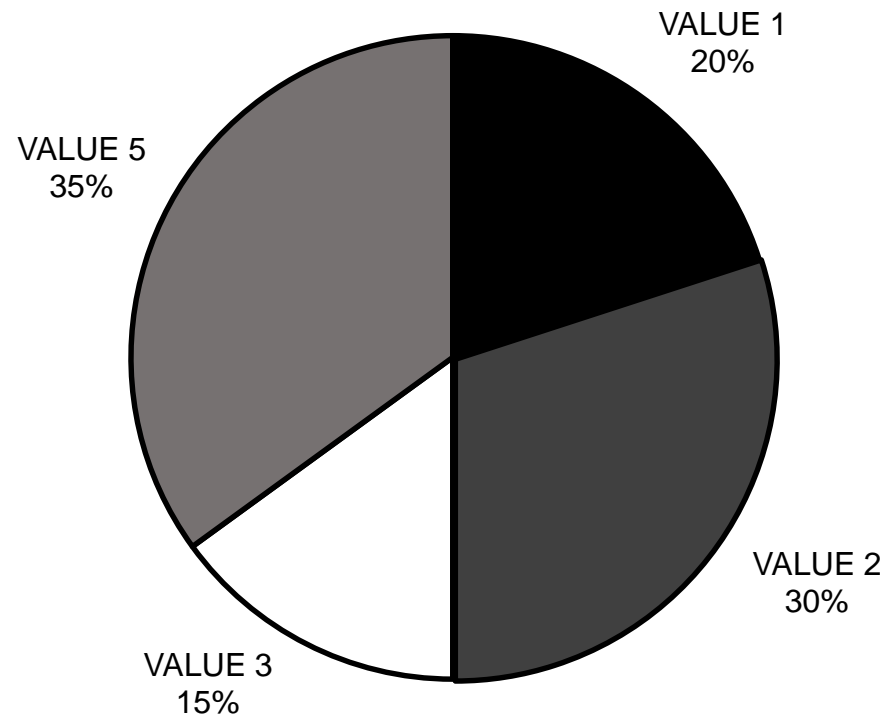
GRAPH 6

BUCK GULCH 2017
MEAN PERCENT COVER TYPES IN POOLS

SMALL WOODY
DEBRIS
30%

BOULDERS
48%

LARGE WOODY
DEBRIS
22%
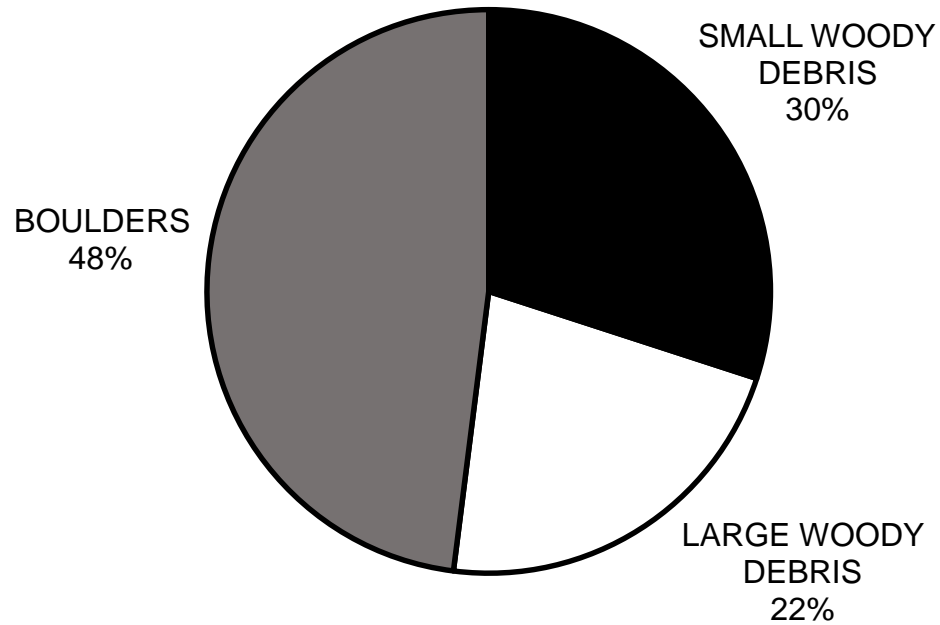
GRAPH 7

BUCK GULCH 2017
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS
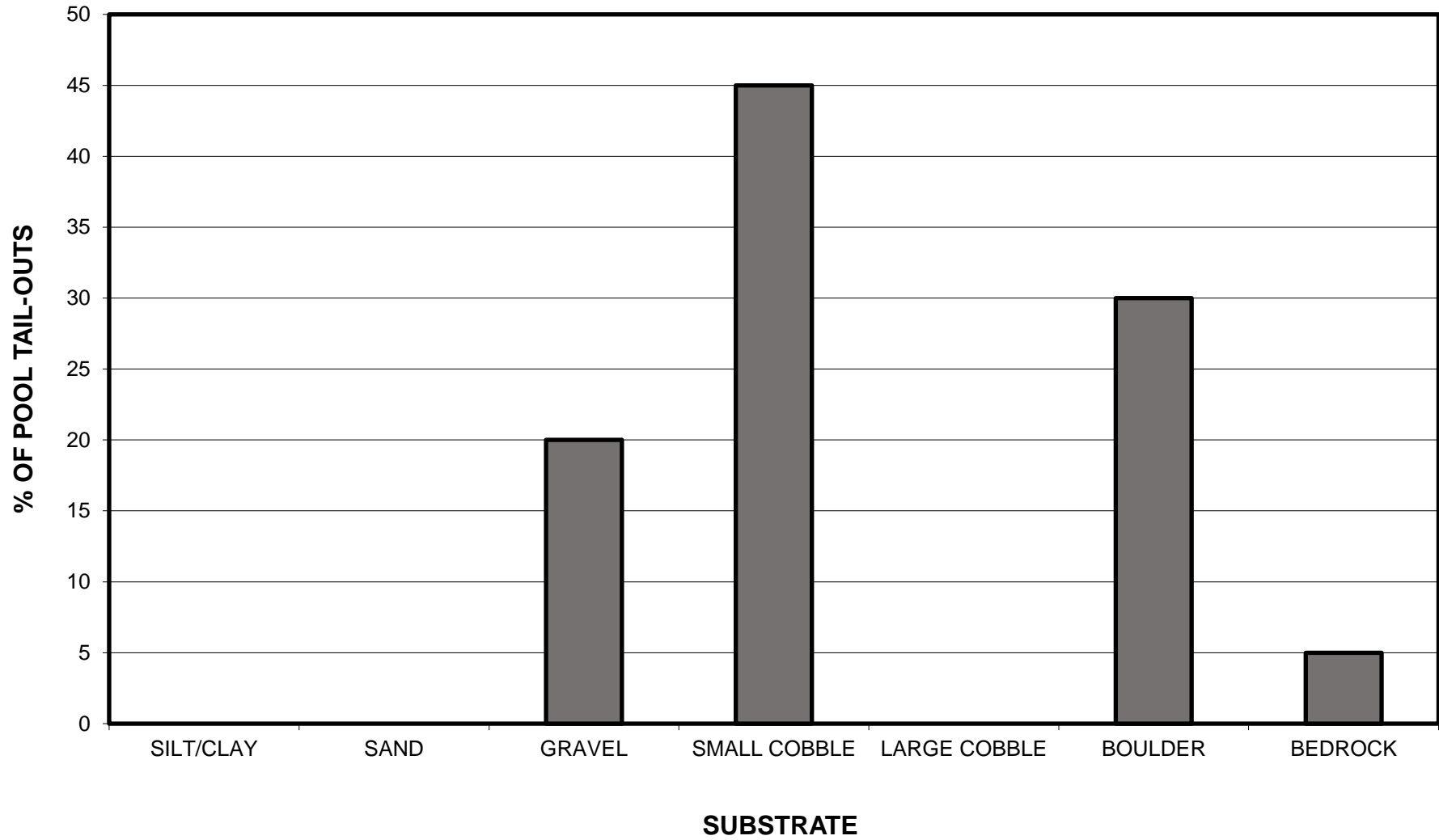
GRAPH 8

BUCK GULCH 2017
MEAN PERCENT CANOPY

OPEN
1.6%

CONIFEROUS TREES
24.4%

HARDWOOD TREES
74%
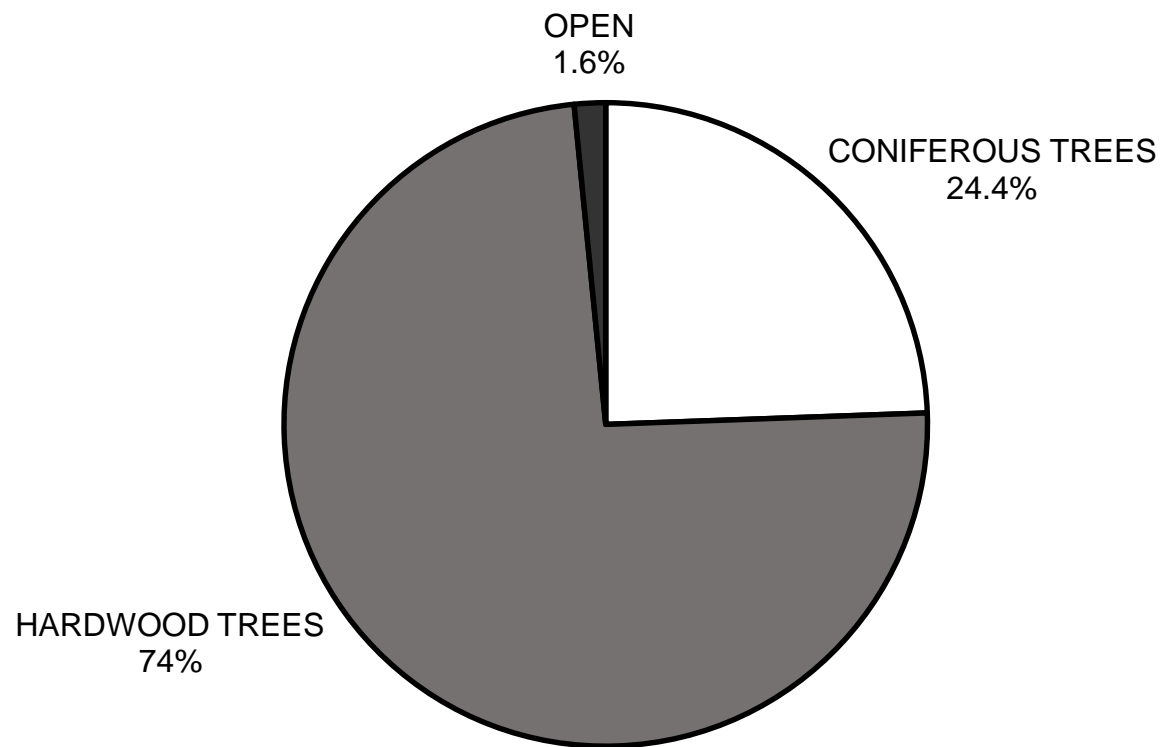
GRAPH 9

BUCK GULCH 2017
DOMINANT BANK COMPOSITION IN SURVEY REACH

BEDROCK
1.8%

BOULDER
3.6%

COBBLE/GRAVEL
16.1%

SAND/SILT/CLAY
78.6%

GRAPH 10
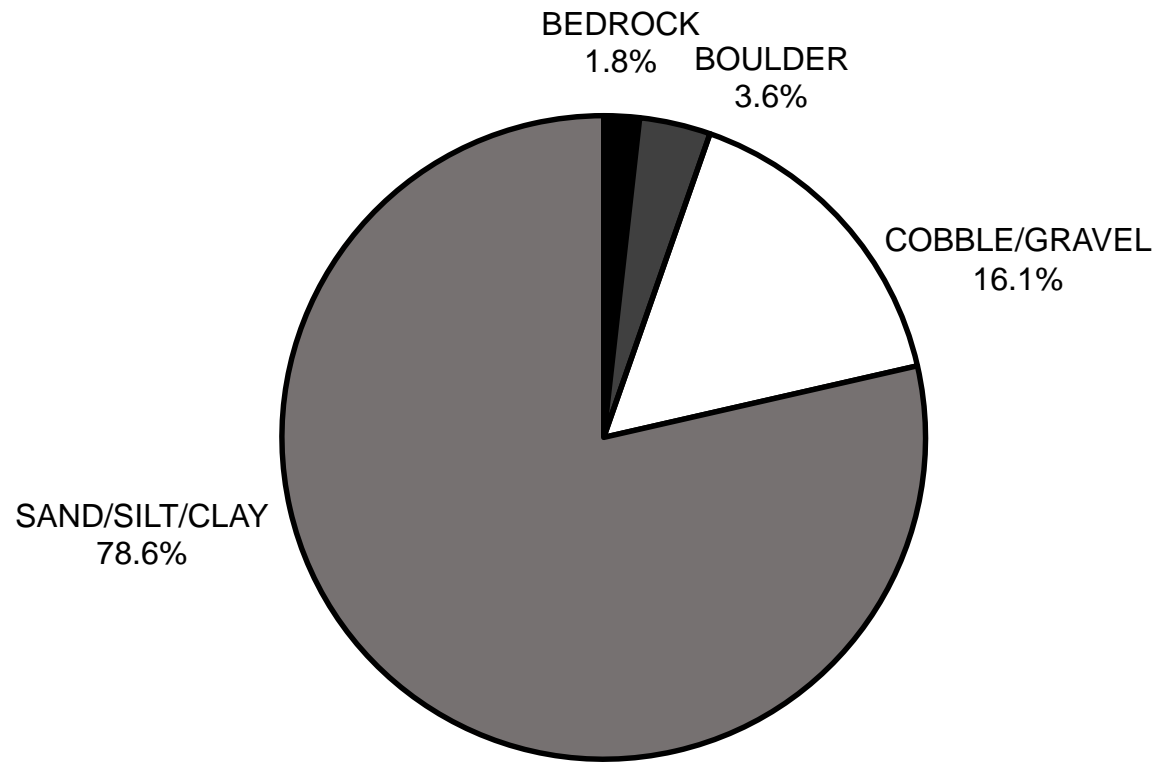
BUCK GULCH 2017
DOMINANT BANK VEGETATION IN SURVEY REACH

CONIFEROUS TREES
5.4%

HARDWOOD TREES
21.4%

BRUSH
73.2%

GRAPH 11