STREAM INVENTORY REPORT

Johnson Creek

INTRODUCTION

A stream inventory was conducted May 23 to May 30, 2012 on Johnson Creek. The survey began at the confluence with John Smith Creek and extended upstream one mile. A stream inventory and report was also completed for an unnamed tributary to Johnson Creek.

The Johnson 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 Johnson 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

Johnson Creek is a tributary to John Smith Creek, a tributary to North Branch North Fork Navarro River, a tributary to North Fork Navarro River, a tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Johnson Creek's legal description at the confluence with John Smith Creek is T16N R15W S21. Its location is 39.2274 degrees north latitude and 123.5367 degrees west longitude, LLID number 1235354392274. Johnson Creek is a second order stream and has approximately 2.7 miles of blue line stream according to the USGS Navarro 7.5 minute quadrangle. Johnson Creek drains a watershed of approximately 2.3 square miles. Elevations range from about 385 feet at the mouth of the creek to 1,000 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production, rangeland and rural development. Vehicle access exists via a logging road off of Masonite Industrial Road.

METHODS

The habitat inventory conducted in Johnson Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Wildlife (CDFW) personnel that conducted the inventory were trained in standardized habitat inventory methods by the DFW. 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 Johnson 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 clinometer, hand level, hip chain, tape measure, and a stadia rod.

3. Temperatures:

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

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1990). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Johnson 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 Johnson 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 not suitable for spawning due to inappropriate substrate like bedrock, log sills, boulders or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide juvenile salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition for prey. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Johnson Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all 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 Johnson 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 Johnson 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 Johnson Creek. In addition, underwater observations were made at sixteen sites using techniques discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, a Visual Basic data entry program developed by Karen Wilson, Pacific States Marine Fisheries Commission in conjunction with the California Department of Fish and 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

Johnson Creek

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Johnson 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 May 23 to May 30, 2012 was conducted by I. Mikus and M. Groff, (CDFW). The total length of the stream surveyed was 5,257 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.26 cfs on June 4, 2012.

Johnson Creek is an F4 channel type for 5,257 feet of the stream surveyed. F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 51 to 54 degrees Fahrenheit. Air temperatures ranged from 46 to 64 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 52% pool units, 26% flatwater units, 18% riffle units, 2% dry units, and 2% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 64% pool units, 26% flatwater units, 9% riffle units, 1% dry units, and 1% unsurveyed units (Graph 2).

Eight Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 51%; run units, 16%; and low gradient riffle units, 14% (Graph 3). Based on percent total length, mid-channel pool units made up 63%, step run units 16%, and run units 10%.

Johnson Creek

A total of 94 pools were identified (Table 3). Main channel pools were the most frequently encountered at 99% (Graph 4), and comprised 100% 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-five of the 94 pools (37%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 94 pool tail-outs measured, seven had a value of 1 (7%); 46 had a value of 2 (49%); 29 had a value of 3 (31%); nine had a value of 4 (10%); three had a value of 5 (3%); (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a value of 5 was assigned to tail-outs deemed not suitable 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 7, flatwater habitat types had a mean shelter rating of 10, and pool habitats had a mean shelter rating of 20 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 21. Scour pools had a mean shelter rating of 5 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Johnson Creek. Graph 7 describes the pool cover in Johnson Creek. Undercut banks 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. Gravel was the dominant substrate observed in 77% of the pool tail-outs. Bedrock was the next most frequently observed dominant substrate type and occurred in 11% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Johnson Creek was 96%. Four percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 32% and 68%, respectively. Graph 9 describes the mean percent canopy in Johnson Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 99%. The dominant elements composing the structure of the stream banks consisted of 95% sand/silt/clay, 4% bedrock, and 1% boulders (Graph 10). Coniferous trees were the dominant vegetation type observed in 52% of the units surveyed. Additionally, 29% of the units surveyed had deciduous trees as the dominant vegetation type, and 17% had brush as the dominant vegetation type (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at sixteen sites for species composition and distribution in Johnson Creek on June 5, 2012. The sites were sampled by I. Mikus and M. Groff (CDFW). The sixteen sites were sampled within the first 5,257 feet of Johnson Creek. The reach sites

yielded three young-of-the-year steelhead/rainbow trout (SH/RT), five age 1+ SH/RT, two age 2+ SH/RT, and two sculpin.

The following chart displays the information yielded from these sites:

2012 Johnson Creek underwater observations.

Date	Survey Site #	Habitat Unit #	Habitat Type	Approx. Dist. from mouth (ft.)	SH/RT			Coho	
					YOY	1+	2+	YOY	1+
F4 Channel Type									
06/05/12	1		002	40	0	1	0	0	0
	2		005	153	1	0	0	0	0
	3		007	230	1	0	0	0	0
	4		012	367	1	0	0	0	0
	5		015	446	0	1	0	0	0
	6		019	640	0	1	0	0	0
	7		026	872	0	0	0	0	0
	8		028	1,020	0	0	0	0	0
	9		044	1,606	0	0	0	0	0
	10		055	2,045	0	1	0	0	0
	11		056	2,136	0	0	1	0	0
	12		064	2,421	0	0	1	0	0
	13		070	2,562	0	0	0	0	0
	14		078	2,869	0	0	0	0	0
	15		087	3,075	0	0	0	0	0
	16		095	3,365	0	1	0	0	0

DISCUSSION

Johnson Creek is an F4 channel type for the entire length of the survey, 5,257 feet. The suitability of F4 channel types for fish habitat improvement structures is as follows: F4 channel types are good for bank-placed boulders and fair for plunge weirs, single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperatures recorded on the survey days May 23 to May 30, 2012 ranged from 51 to 54 degrees Fahrenheit. Air temperatures ranged from 46 to 64 degrees Fahrenheit. This is a good water temperature range for salmonids. To make any conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Johnson Creek

Flatwater habitat types comprised 26% of the total length of this survey, riffles 9%, and pools 64%. Thirty-five of the 94 (37%) 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.

Fifty-three of the 94 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty-eight of the pool tail-outs had embeddedness ratings of 3 or 4. Three of the pool tail-outs had a rating of 5, which is considered not suitable 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 Johnson Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Seventy-six of the 94 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 20. The shelter rating in the flatwater habitats is 10. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Johnson Creek. Undercut banks are the dominant cover type in pools followed by small woody debris. 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 96%. The percentage of right and left bank covered with vegetation was 100% and 99%, respectively.

RECOMMENDATIONS

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

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from undercut banks. Adding high quality complexity with woody cover in the pools is desirable.

4) 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.

Johnson Creek

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 John Smith Creek. The channel is an F4 for the entire length of the survey.
962	0028.00	Left bank erosion on outside bend of pool measures approximately 20' long x 7' high. It is contributing sediment ranging in size from silt to gravel to the channel.
1656	0047.00	There is a 1.8' high plunge over a log.
2961	0084.00	Log debris accumulation (LDA) #01 contains six pieces of large woody debris (LWD) and measures 4' high x 16' wide x 16' long. Water flows through the LDA and there are no visible gaps in it. The LDA is not retaining sediment. There is a high flow side channel on the right bank around the LDA. Fish were observed above the LDA.
3325	0095.00	Tributary #01 enters on the right bank. It contributes approximately 25% to Johnson Creek's flow. The water temperature of the tributary was 53 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 54 degrees Fahrenheit. For more information, see the 2012 Unnamed Tributary to Johnson Creek Stream Habitat Inventory Report.
3458	0099.00	A private road crosses the channel. The crossing is a 10.2' wide x 47' long x 6.7' high railcar bridge.
3523	0101.00	Small woody debris accumulating in the channel.
3667	0109.00	A 1+ salmonid was observed.
3917	0117.00	Right bank seep.
4148	0126.00	LDA #02 contains 10 pieces of LWD and measures 5' high x 22' wide x 13' long. Water does not flow through the LDA; it is currently dry above it. There are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 9' wide x 25' long x 2' deep. Fish were observed above the LDA.
4227	0130.00	LDA #03 contains one piece of LWD and measures 5' high x 27' wide x 4' long. Water flows through the LDA and there are no visible gaps in it.

		Retained sediment ranges from silt to gravel and measures 8' wide x 40' long x 2' deep. There is a 2.5' high plunge over the LDA. During higher flows, the plunge increases to 4' high. Fish were observed above the LDA.
4571	0147.00	Tributary #02 enters on the right bank. It contributes approximately 5% to Johnson Creek's flow. The water temperature of the tributary was 54 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 51 degrees Fahrenheit. The slope of the tributary is approximately 8%. The tributary is not accessible to salmonids; it is small and has little flow.
4655	0152.00	LDA #04 contains 10 pieces of LWD and measures 8' high x 19' wide x 22' long. Water does not flow through the LDA; it is currently dry above it. There are no visible gaps in it. Retained sediment ranges from silt to gravel and measures 6' wide x 50' long x 1' deep. Fish were observed above the LDA.
4749	0157.00	Dry left bank tributary.
4804	0160.00	There is a 2' high plunge over bedrock, root mass, and LWD.
4935	0169.00	Two 1+ salmonids observed.
4968	0170.00	LDA #05 contains four pieces of LWD and measures 4' high x 22' wide x 4' long. Water flows through the LDA and there are visible gaps in it. Retained sediment ranges from silt to sand and measures 8' wide x 10' long x 2' deep. There is a 3' high plunge over the LDA. Fish were observed above the LDA.
5014	0172.00	A 1+ salmonid observed.
5121	0174.00	LDA #06 contains six pieces of LWD and measures 6' high x 18' wide x 11' long. Water flows through the LDA and there are no visible gaps in it. The LDA is retaining sediment. There is a 4.5' high plunge over the LDA. Fish were observed above the LDA.
5149	0176.00	A salmonid greater than 6” was observed.
5228	0180.00	End of survey due to end of access.

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.

Johnson Creek

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]	

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

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0

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
3	0	DRY	1.7	14	42	0.8									
47	7	FLATWATER	26.1	29	1374	26.1	5.3	0.4	0.8	158	7410	72	3366		10
3	0	NOSURVEY	1.7	12	37	0.7									
94	94	POOL	52.2	36	3350	63.7	8.4	0.9	1.8	302	28355	371	34845	313	20
33	6	RIFFLE	18.3	14	454	8.6	4.0	0.2	0.5	46	1502	9	300		7

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
180	107	5257	37268	38511

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

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	3	LGR	14.4	14	353	6.7	4	0.2	0.5	51	1329	10	266		0	98
7	3	HGR	3.9	14	101	1.9	4	0.2	0.6	40	280	8	56		13	99
28	5	RUN	15.6	19	540	10.3	5	0.4	1.1	90	2508	39	1091		13	93
19	2	SRN	10.6	44	834	15.9	6	0.5	0.8	328	6230	153	2911		3	99
92	92	MCP	51.1	36	3300	62.8	8	0.9	4	299	27495	366	33665	309	20	96
1	1	CCP	0.6	40	40	0.8	16	1.3	2.7	640	640	960	960	832	90	79
1	1	PLP	0.6	10	10	0.2	22	0.8	1.8	220	220	220	220	176	5	94
3	0	DRY	1.7	14	42	0.8										
3	0	NS	1.7	12	37	0.7										

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
180	107	5257	38702	39169

Table 3 - Summary of Pool Types

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

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
93	93	MAIN	99	36	3340	100	8.3	0.9	303	28135	314	29236	21
1	1	SCOUR	1	10	10	0	22.0	0.8	220	220	176	176	5

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
94	94	3350	28355	29412

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

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

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
92	MCP	98	6	7	52	57	29	32	4	4	1	1
1	CCP	1	0	0	0	0	1	100	0	0	0	0
1	PLP	1	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
94	6	6	53	56	30	32	4	4	1	1

Mean Maximum Residual Pool Depth (ft.): 1.8

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012 Dry Units: 3

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

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	3	LGR	0	0	0	0	0	0	0	0	0
7	3	HGR	0	3	30	0	2	32	33	0	0
33	6	TOTAL RIFFLE	0	3	30	0	2	32	33	0	0
28	5	RUN	20	46	14	0	20	0	0	0	0
19	2	SRN	100	0	0	0	0	0	0	0	0
47	7	TOTAL FLAT	33	38	12	0	17	0	0	0	0
92	92	MCP	55	19	19	1	3	0	0	3	0
1	1	CCP	0	0	0	0	10	90	0	0	0
1	1	PLP	0	40	60	0	0	0	0	0	0
94	94	TOTAL POOL	54	19	19	1	3	2	0	2	0
3	0	NS									
180	107	TOTAL	51	20	19	1	3	2	1	2	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012 Dry Units: 3

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

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	3	LGR	0	0	100	0	0	0	0
7	3	HGR	0	0	33	33	0	0	33
28	5	RUN	0	0	80	0	0	0	20
19	2	SRN	0	0	100	0	0	0	0
92	92	MCP	3	4	86	1	3	0	2
1	1	CCP	0	0	100	0	0	0	0
1	1	PLP	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
96	68	32	0	100	99

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: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012 Survey Length (ft.): 5257 Main Channel (ft.): 5257 Side Channel (ft.): 0

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4
Reach Length (ft.): 5257
Riffle/Flatwater Mean Width (ft.): 4.7
BFW:
Range (ft.): 9 to 20
Mean (ft.): 13
Std. Dev.: 3
Base Flow (cfs.): 0.3
Water (F): 51 - 54 Air (F): 46 - 64
Dry Channel (ft): 42

Canopy Density (%): 96.1
Coniferous Component (%): 67.6
Hardwood Component (%): 32.4
Dominant Bank Vegetation: Coniferous Trees
Vegetative Cover (%): 99.2
Dominant Shelter: Undercut Banks
Dominant Bank Substrate Type: Sand/Silt/Clay
Occurrence of LWD (%): 17
LWD per 100 ft.:
Riffles: 0
Pools: 3
Flat: 1

Pools by Stream Length (%): 63.7
Pool Frequency (%): 52.2
Residual Pool Depth (%):
< 2 Feet Deep: 63
2 to 2.9 Feet Deep: 32
3 to 3.9 Feet Deep: 4
>= 4 Feet Deep: 1
Mean Max Residual Pool Depth (ft.): 1.8
Mean Pool Shelter Rating: 20

Pool Tail Substrate (%): Silt/Clay: 1 Sand: 3 Gravel: 77 Sm Cobble: 4 Lg Cobble: 2 Boulder: 2 Bedrock: 11

Embeddedness Values (%): 1. 7.4 2. 48.9 3. 30.9 4. 9.6 5. 3.2

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

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	4	4	3.7
Boulder	2	1	1.4
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	101	102	94.9

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	1	2	1.4
Brush	19	18	17.3
Hardwood Trees	33	30	29.4
Coniferous Trees	54	57	51.9
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

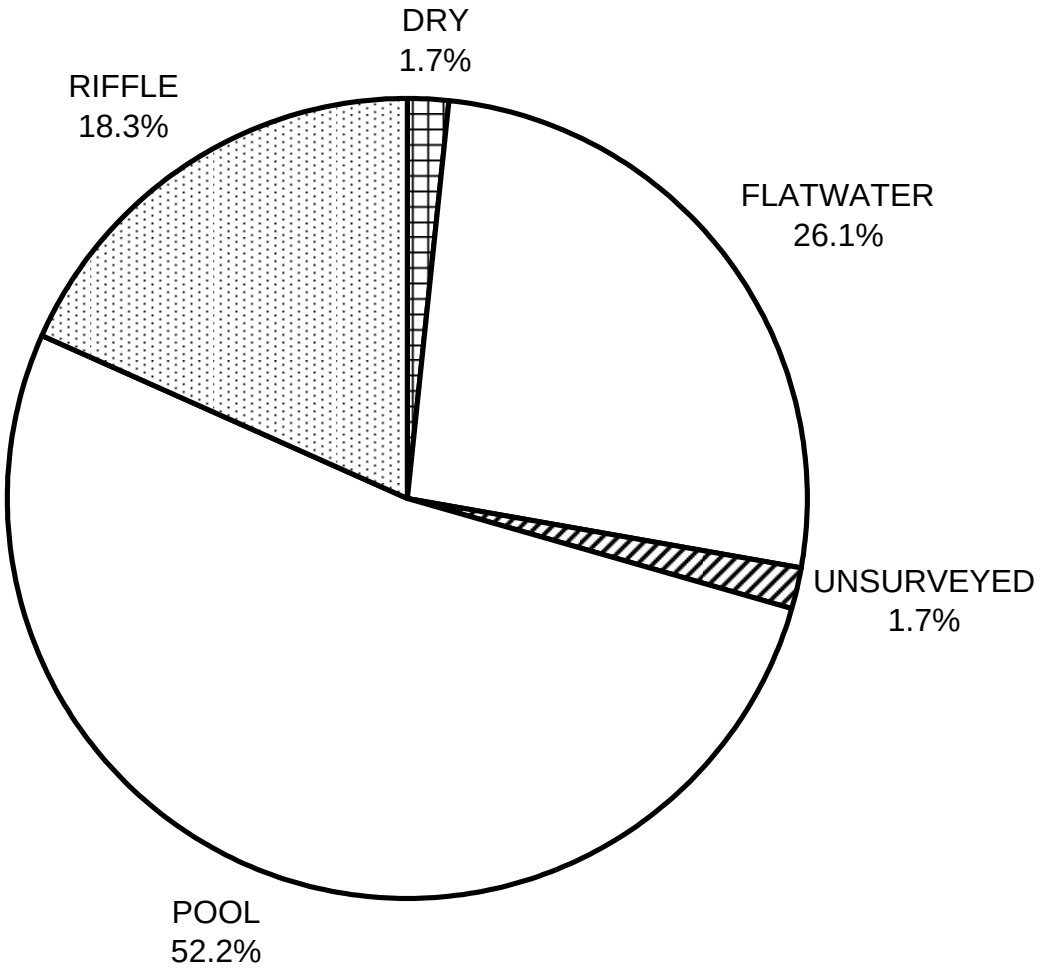
StreamName: Johnson Creek LLID: 1235354392274 Drainage: Navarro River

Survey Dates: 5/23/2012 to 5/30/2012

Confluence Location: Quad: NAVARRO Legal Description: T16NR15WS21 Latitude: 39:13:39.0N Longitude: 123:32:07.0W

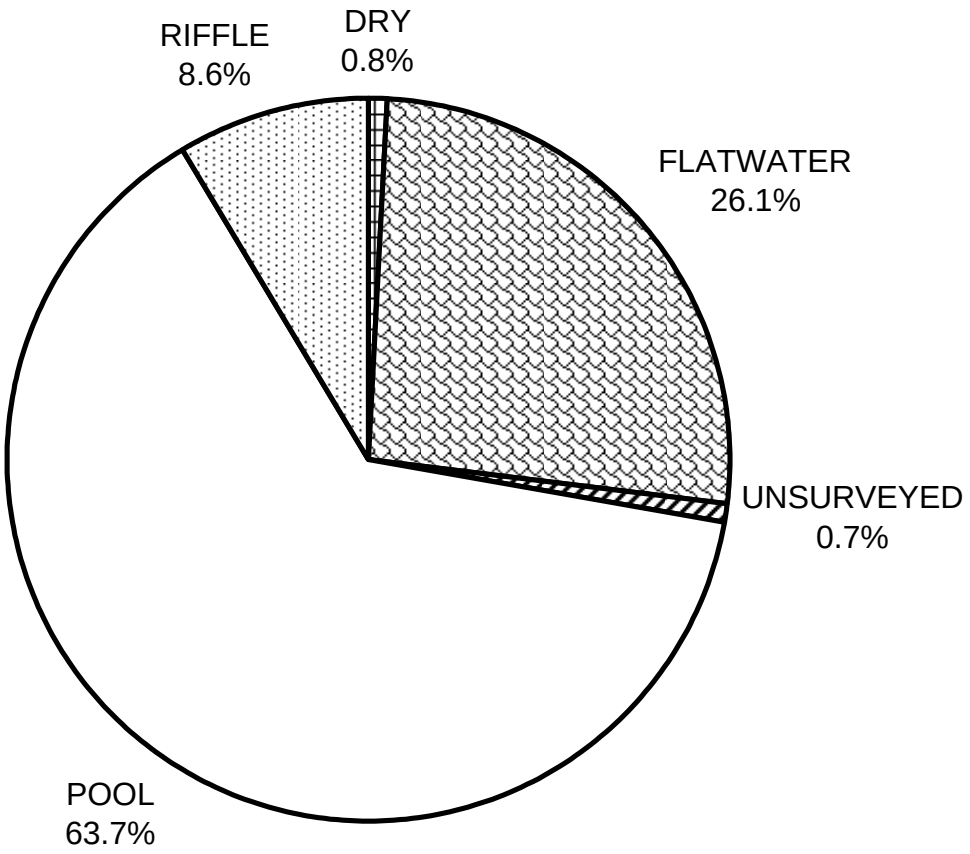
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	33	54
SMALL WOODY DEBRIS (%)	3	38	19
LARGE WOODY DEBRIS (%)	30	12	19
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	2	17	3
AQUATIC VEGETATION (%)	32	0	2
WHITEWATER (%)	33	0	0
BOULDERS (%)	0	0	2
BEDROCK LEDGES (%)	0	0	0

JOHNSON CREEK 2012
HABITAT TYPES BY PERCENT OCCURRENCE



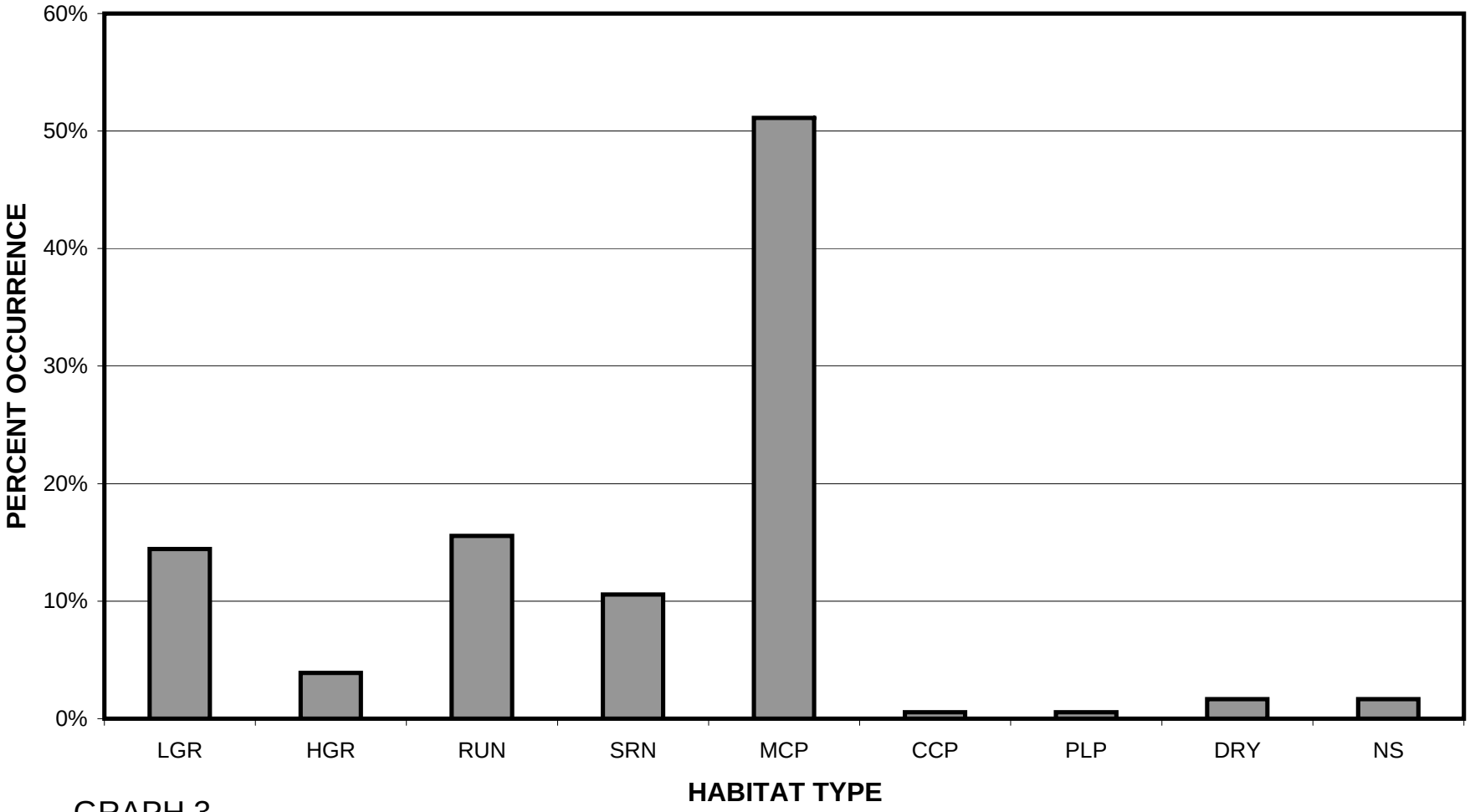
GRAPH 1

JOHNSON CREEK 2012
HABITAT TYPES BY PERCENT TOTAL LENGTH



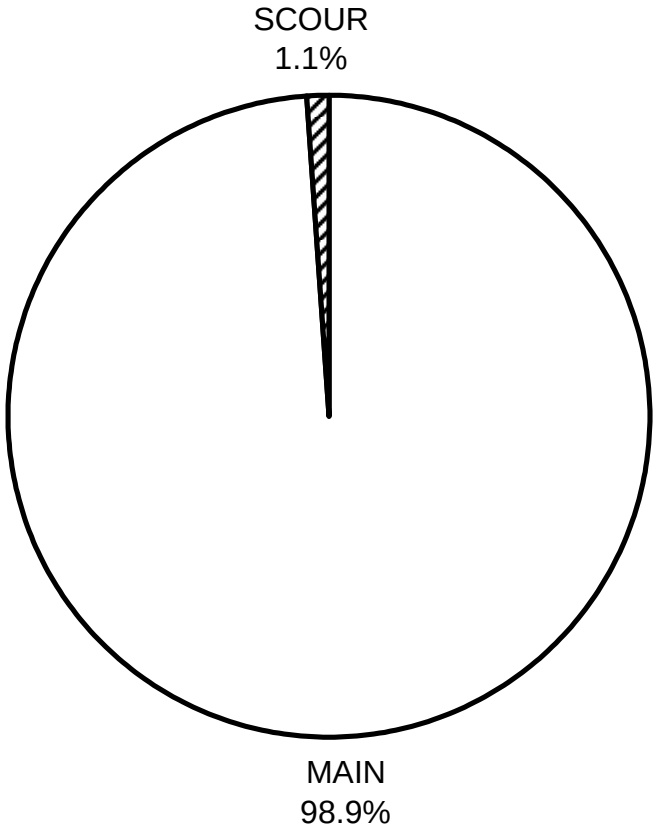
GRAPH 2

JOHNSON CREEK 2012
HABITAT TYPES BY PERCENT OCCURRENCE



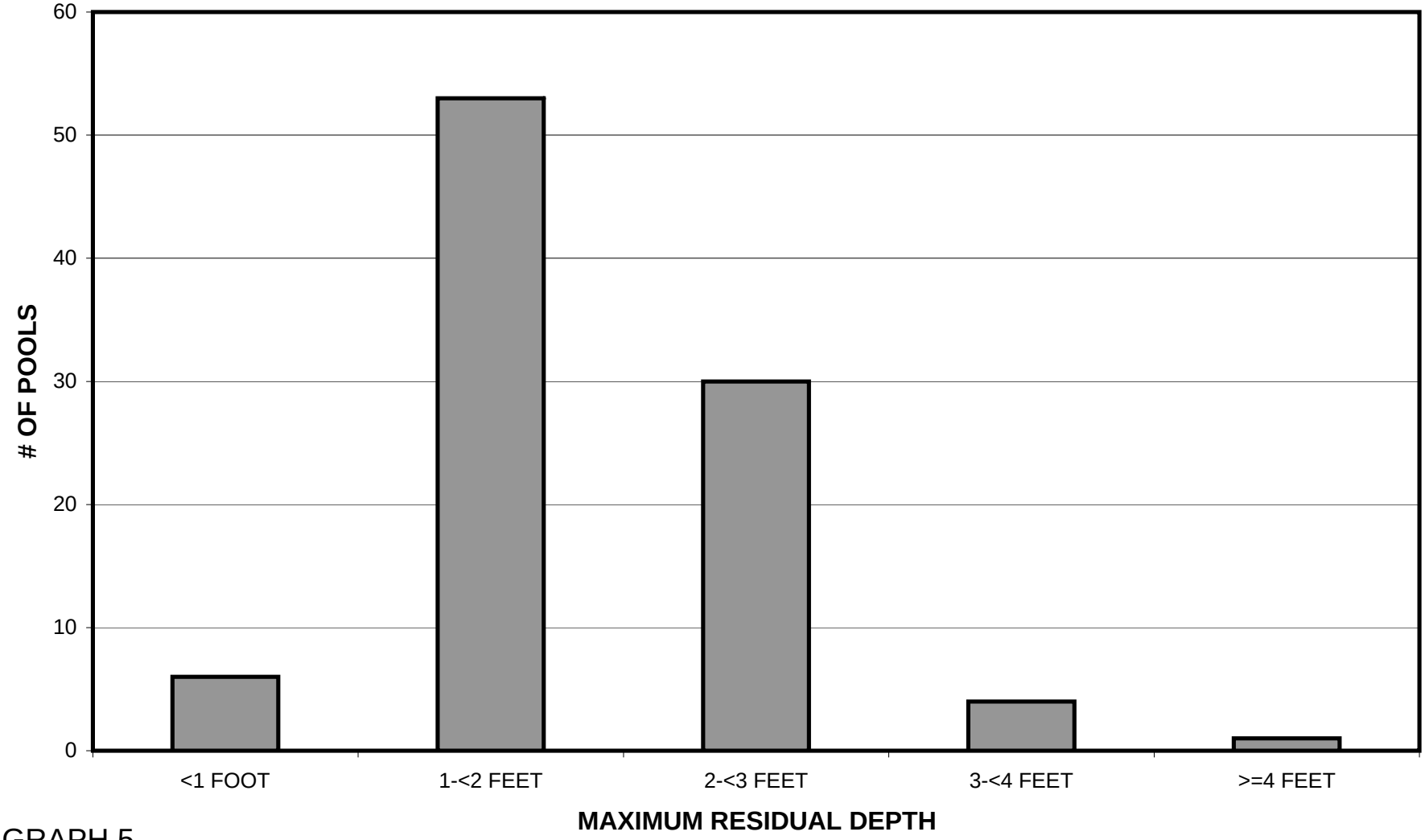
GRAPH 3

JOHNSON CREEK 2012
POOL TYPES BY PERCENT OCCURRENCE



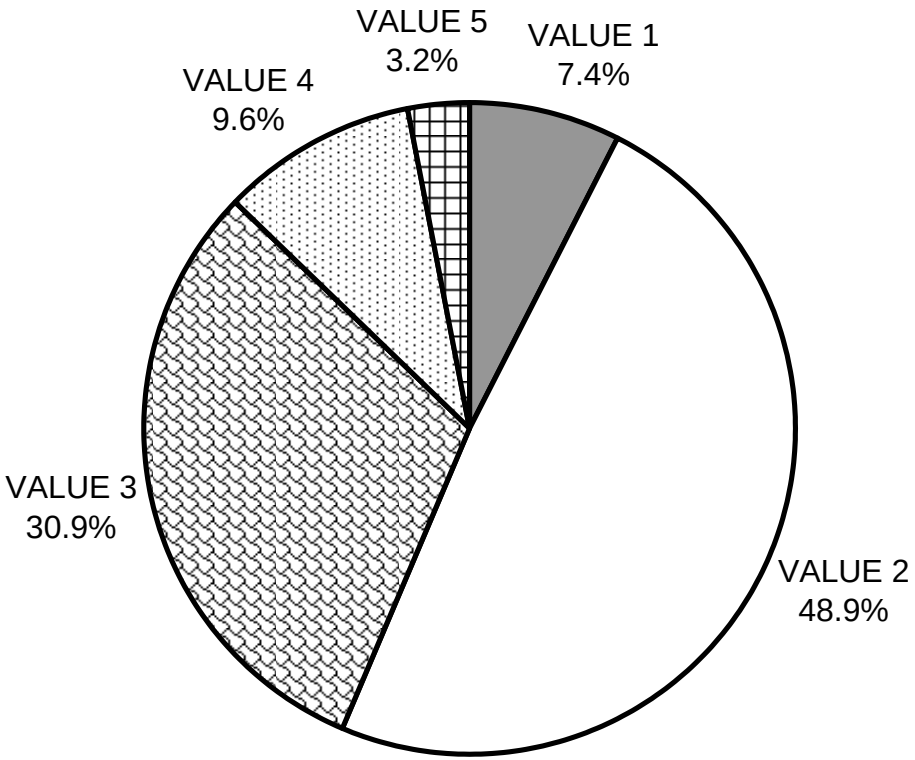
GRAPH 4

JOHNSON CREEK 2012
MAXIMUM DEPTH IN POOLS



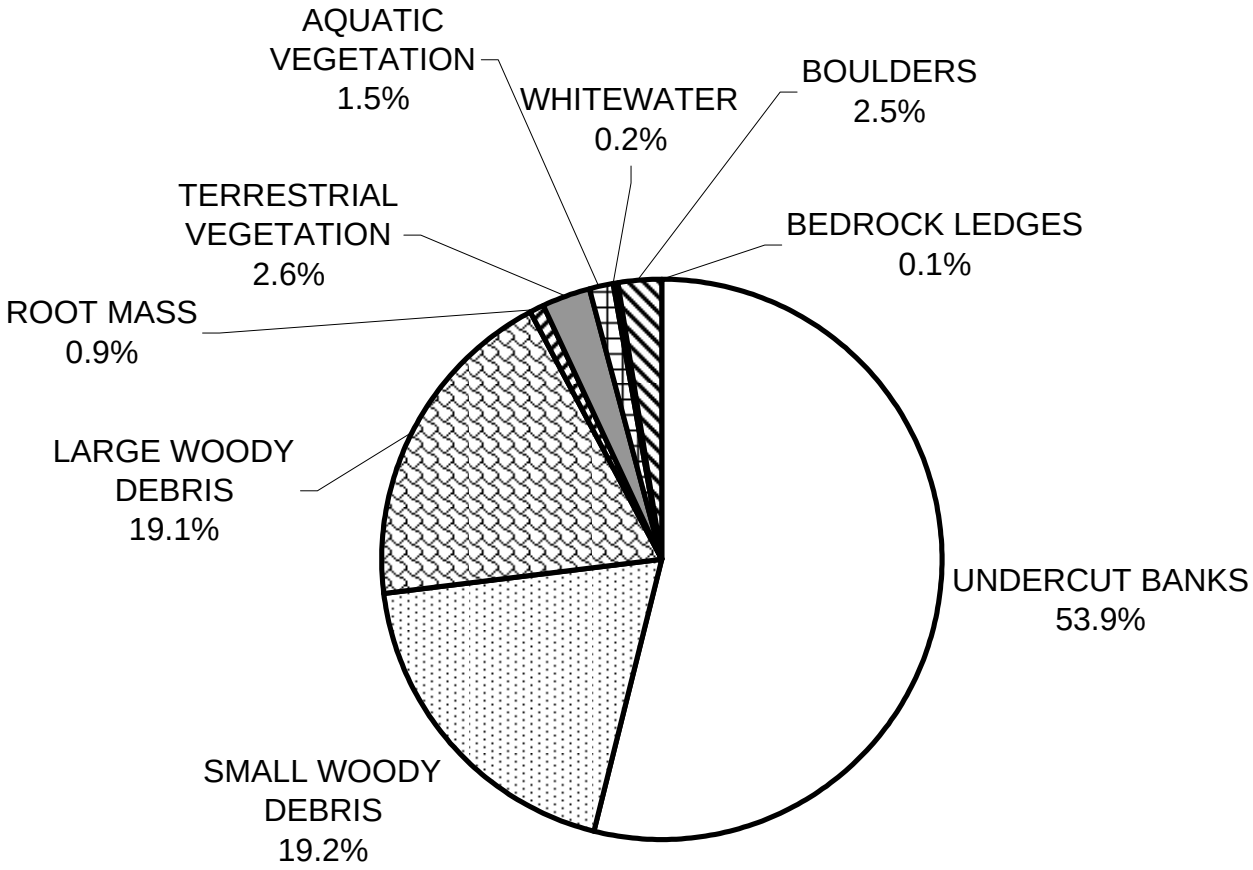
GRAPH 5

JOHNSON CREEK 2012
PERCENT EMBEDDEDNESS



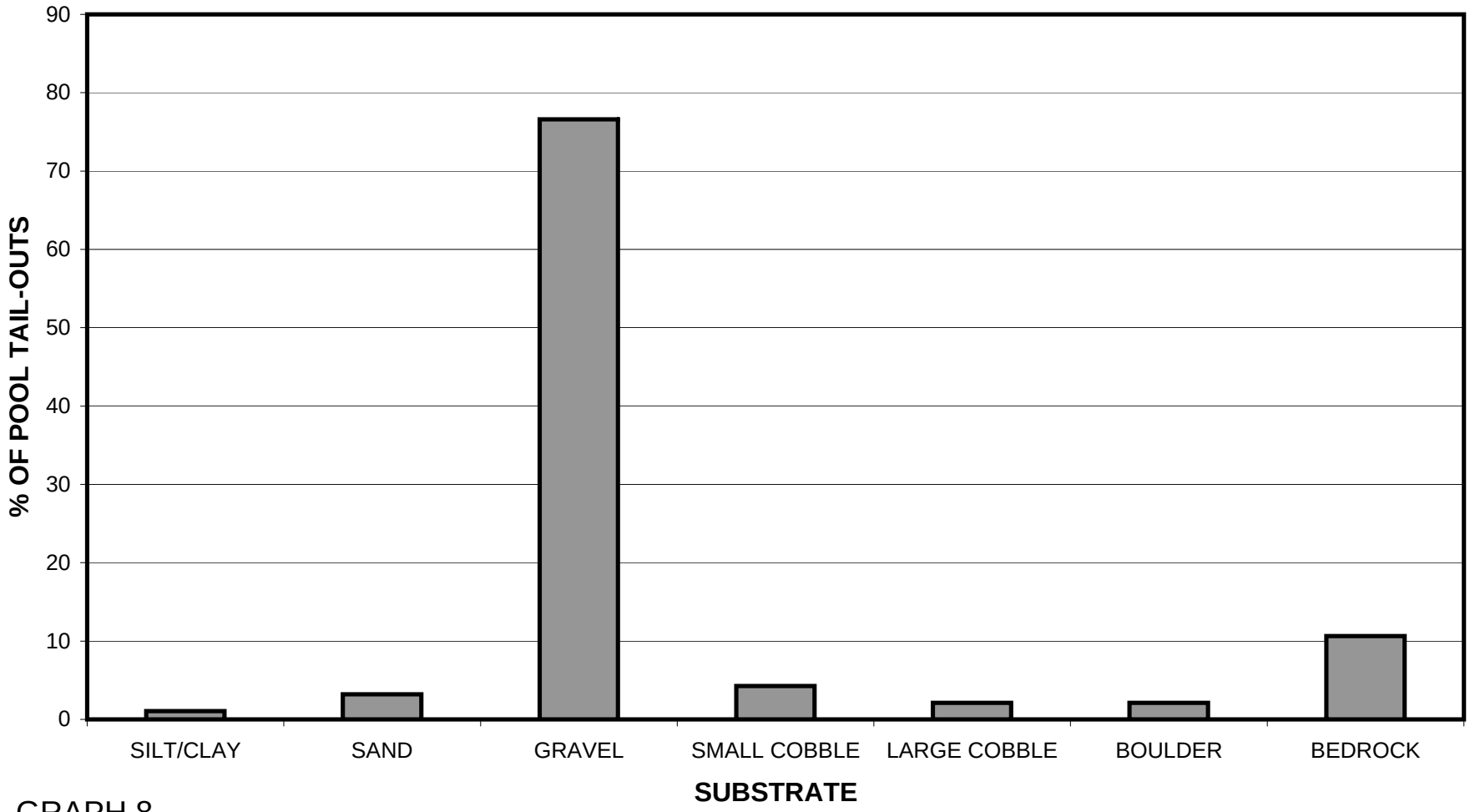
GRAPH 6

JOHNSON CREEK 2012
MEAN PERCENT COVER TYPES IN POOLS



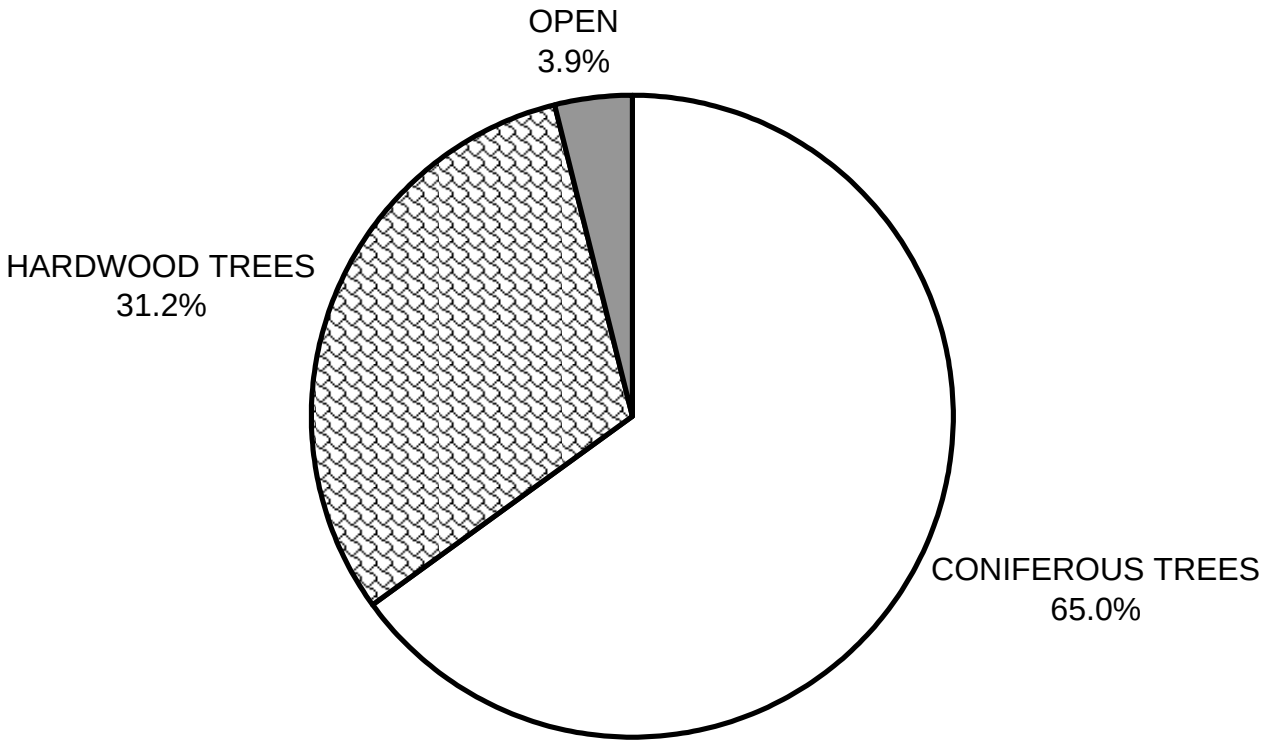
GRAPH 7

JOHNSON CREEK 2012
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



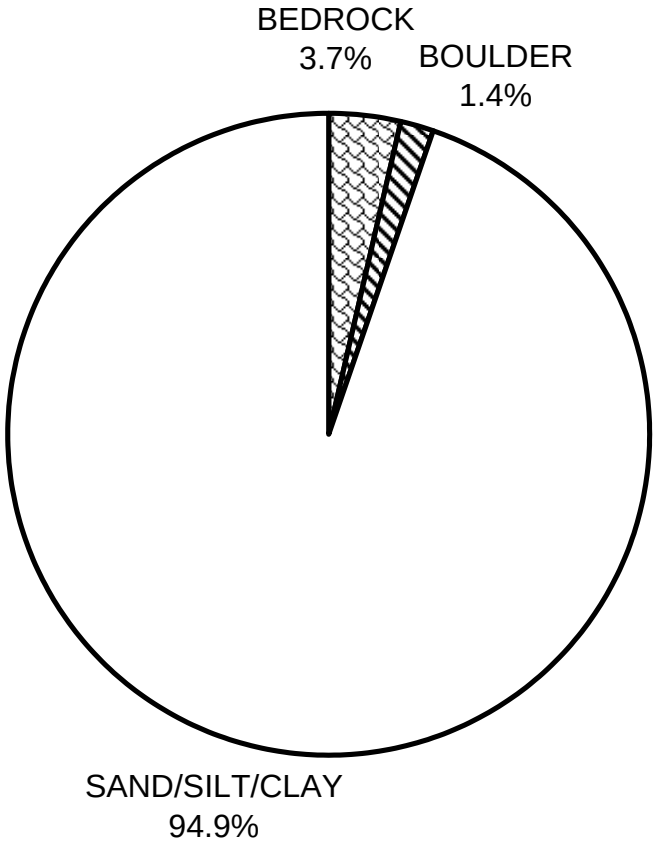
GRAPH 8

JOHNSON CREEK 2012
MEAN PERCENT CANOPY



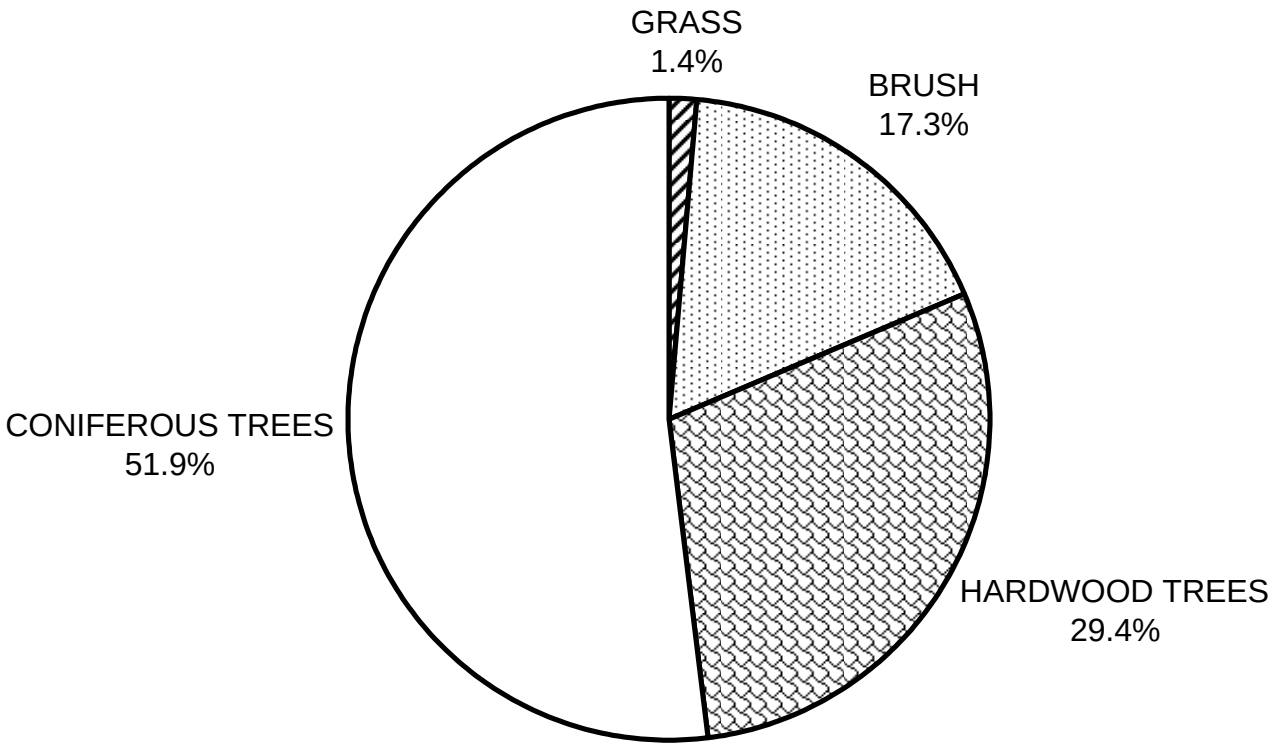
GRAPH 9

JOHNSON CREEK 2012
DOMINANT BANK COMPOSITION IN SURVEY REACH

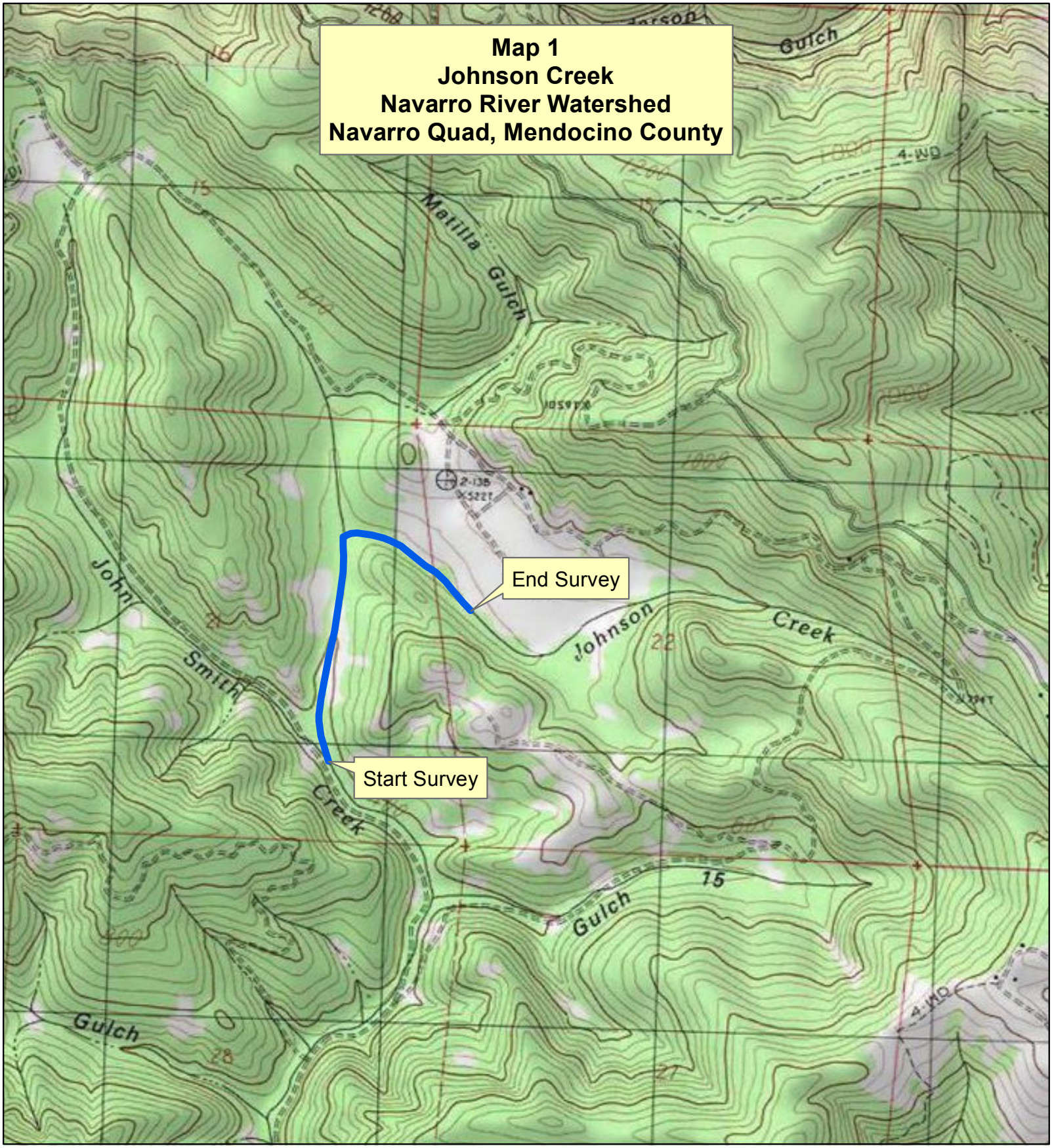


GRAPH 10

JOHNSON CREEK 2012
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11



N
W E
S

Channel Type F4

0 1,000 2,000 Feet

CALIFORNIA DEPARTMENT OF FISH & WILDLIFE