

STREAM INVENTORY REPORT

North Branch North Fork Navarro River

INTRODUCTION

A stream inventory was conducted from July 17 to July 23, 2012 on North Branch North Fork Navarro River. The survey began at the confluence with North Fork Navarro River and extended upstream 4.6 miles.

The North Branch North Fork Navarro River inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in North Branch North Fork Navarro River. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

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

WATERSHED OVERVIEW

North Branch North Fork Navarro River is a tributary to North Fork Navarro River, tributary to the Navarro River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). North Branch North Fork Navarro River's legal description at the confluence with North Fork Navarro River is T15N R15W S07. Its location is 39.1713 degrees north latitude and 123.5609 degrees west longitude, LLID number 1235596391713. North Branch North Fork Navarro River is a third order stream and has approximately 4.5 miles of blue line stream according to the USGS Navarro 7.5 minute quadrangle. North Branch North Fork Navarro River drains a watershed of approximately 28.1 square miles. Elevations range from about 90 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 and rural development. Vehicle access exists via Masonite Industrial Road.

METHODS

The habitat inventory conducted in North Branch North Fork Navarro River 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 CDFW. This inventory was conducted by a two-person team.

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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 North Branch North Fork Navarro River to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

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

2. Channel Type:

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

3. Temperatures:

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

4. Habitat Type:

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

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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 North Branch North Fork Navarro River, 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 North Branch North Fork Navarro River, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In North Branch North Fork Navarro River, 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

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withstand winter flows. In North Branch North Fork Navarro River, 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 North Branch North Fork Navarro River. In addition, underwater observations were made at three 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

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- 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 North Branch North Fork Navarro River 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 17 to July 23, 2012 was conducted by M. Groff and I. Mikus (CDFW). The total length of the stream surveyed was 24,424 feet.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.98 cfs on July 18, 2012.

North Branch North Fork Navarro River is an F4 channel type for 24,424 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 57 to 66 degrees Fahrenheit. Air temperatures ranged from 50 to 73 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 40% pool units, 37% flatwater units, 16% riffle units, and 7% dry units (Graph 1). Based on total length of Level II habitat types there were 42% pool units, 40% flatwater units, 13% dry units, and 5% riffle units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pool units, 35%; step run units, 21%; and run units, 14% (Graph 3). Based on percent total length, mid-channel pool units made up 39%, step run units 29%, and dry units 13%.

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A total of 83 pools were identified (Table 3). Main channel pools were the most frequently encountered at 89% (Graph 4), and comprised 93% 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. Forty of the 83 pools (48%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 83 pool tail-outs measured, 61 had a value of 1 (73.5%); 19 had a value of 2 (22.9%); one had a value of 3 (1.2%); two had a value of 5 (2.4%) (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 0, flatwater habitat types had a mean shelter rating of 3, and pool habitats had a mean shelter rating of 2 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 3. Main channel pools had a mean shelter rating of 2 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in North Branch North Fork Navarro River. Graph 7 describes the pool cover in North Branch North Fork Navarro River. Small woody debris is the dominant pool cover type followed by large 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 82% of the pool tail-outs. Small cobble and boulders were the next most frequently observed dominant substrate types; each occurring in 7% of the pool tail-outs.

The mean percent canopy density for the surveyed length of North Branch North Fork Navarro River was 85%. Fifteen percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 50% and 50%, respectively. Graph 9 describes the mean percent canopy in North Branch North Fork Navarro River.

For the stream reach surveyed, the mean percent right bank vegetated was 99%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 53% sand/silt/clay, 34% cobble/gravel, 8% bedrock, and 5% boulder (Graph 10). Coniferous trees were the dominant vegetation type observed in 57% of the units surveyed. Additionally, 41% of the units surveyed had deciduous trees as the dominant vegetation type, and 1% had no vegetation (Graph 11).

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BIOLOGICAL INVENTORY RESULTS

Survey teams conducted a snorkel survey at two sites for species composition and distribution in North Branch North Fork Navarro River on July 30, 2012. The sites were sampled by I. Mikus and M. Groff (CDFW).

Three sites were sampled within the first 24,365 feet of North Branch North Fork Navarro River. The sites yielded thirty-four young-of-the-year (YOY) steelhead/rainbow trout (SH/RT), ten age 1+ SH/RT, one age 2+ SH/RT, seven YOY coho salmon, five age 1+ coho salmon, 12 California roach, one sculpin, and ten stickleback.

The following chart displays the information yielded from these sites:

2012 North Branch North Fork Navarro River 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									
07/30/12	1	076	Pool	10,895	25	6	0	2	0
	2	198	Pool	23,788	2	3	0	2	5
	3	207	Pool	24,365	7	1	1	3	0

DISCUSSION

North Branch North Fork Navarro River is an F4 channel type for the entire length of the survey, 24,424 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 July 17 to July 23, 2012 ranged from 57 to 66 degrees Fahrenheit. Air temperatures ranged from 50 to 73 degrees Fahrenheit. This is a suitable water temperature range for salmonids. However, 60° F, if sustained, is near the threshold stress level 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.

Flatwater habitat types comprised 40% of the total length of this survey, riffles 5%, and pools 42%. Forty of the 83 (48%) pools had a maximum residual depth greater than three feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In third and fourth order streams, a primary pool is defined to have a maximum residual depth of at least three feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

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Eighty of the 83 pool tail-outs measured had embeddedness ratings of 1 or 2. One of the pool tail-outs had embeddedness ratings of 3 or 4. Two of the pool tail-outs had a rating of 5, which is 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.

Seventy-four of the 83 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 2. The shelter rating in the flatwater habitats is 3. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by small woody debris in North Branch North Fork Navarro River. Small woody debris is the dominant cover type in pools followed by large 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 85%. The percentage of right and left bank covered with vegetation was 99% and 100%, respectively.

RECOMMENDATIONS

- 1) North Branch North Fork Navarro River 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 small woody debris. Adding high quality complexity with woody cover in the pools is desirable.

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 South Branch North Fork Navarro River. The channel is an F4 for the entire length of the survey.

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869	0009.00	A logging road crosses the channel. The crossing is an 18' wide x 81' long x 14.5' high railcar bridge with a redwood log abutment on the left bank.
1166	0010.00	Dry tributary on the right bank.
6221	0047.00	Left bank seep.
7891	0056.00	Deer Creek (tributary #01) enters on the left bank. It contributes less than 5% to North Branch North Fork Navarro River's flow. The water temperature of the tributary was 56 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 62 degrees Fahrenheit. The slope of the tributary is approximately 8%. The tributary is flowing into a pool that is disconnected from the mainstem North Branch North Fork Navarro River. There is a possible barrier approximately 150' upstream from the mouth.
10766	0076.00	Cook Creek (tributary #02) enters on the left bank. It contributes approximately 10% to North Fork North Branch Navarro River's flow. The water temperature of the tributary was 58 degrees Fahrenheit, the water temperature downstream of the tributary was 59 degrees Fahrenheit, and the water temperature upstream of the confluence was 60 degrees Fahrenheit. For more information, see the 2012 Cook Creek Stream Habitat Inventory Report.
10895	0077.00	An erosion site on the right bank measures approximately 50' long x 12' high. It is contributing sediment ranging in size from silt to gravel to the channel.
11685	0084.00	A landslide on the right bank measures approximately 90' long x 70' high. It is contributing sediment ranging in size from silt to gravel and woody debris to the channel. The landslide reaches Masonite Road.
11870	0086.00	Dry tributary on the right bank.
12937	0093.00	Dry tributary on the right bank.
14441	0107.00	An erosion site on the left bank measures approximately 60' long x 15' high. It is contributing sediment ranging in size from silt to gravel to the channel.
15414	0114.00	Dutch Henry Creek (tributary #03) enters on the right bank. The first 500 feet of the tributary are dry. The water temperature of the tributary was 58 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 61 degrees Fahrenheit. The slope of the tributary is approximately 3%. The culvert at the mouth of the creek,

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under Masonite Road, is in poor condition. The culvert is perched and large sections of the bottom are rusted through. Salmonids were observed in the tributary.

16387	0127.00	LWD structure on left bank.
16467	0128.00	LWD structure on right bank.
16687	0129.00	LWD structure on the left bank. Dry tributary on the right bank.
17267	0136.00	LWD structure on the left bank.
17471	0138.00	Dry tributary on the left bank.
17955	0141.00	LWD structure on the left bank. Dry tributary on the right bank.
18060	0142.00	LWD structure on the right bank.
18283	0143.00	LWD structure on the left bank.
19134	0153.00	LWD structure on the left bank.
19173	0154.00	LWD structure on the right bank.
19371	0156.00	Two LWD structures on the left bank.
20291	0165.00	LWD structure on the right bank.
20344	0166.00	Tributary #04 enters on the right bank. The first 5 feet of the tributary are dry. It contributes approximately 5% to North Branch North Fork Navarro River's flow. The water temperature of the tributary was 57 degrees Fahrenheit; the water temperature downstream and upstream of the tributary was 58 degrees Fahrenheit. The slope of the tributary is approximately 3%. The tributary is accessible to salmonids, but no fish were observed.
20629	0167.00	LWD structure on the left bank.
20919	0170.00	LWD structure spans the channel.
21035	0171.00	LWD structure on the left bank.
21212	0173.00	Tributary #05 enters on the left bank. It contributes approximately 5% to North Branch North Fork Navarro River's flow. The water temperature of the tributary was 57 degrees Fahrenheit; the water temperatures downstream and upstream of the tributary were 66 degrees

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Fahrenheit. The slope of the tributary is approximately 6%. The tributary is accessible to salmonids, but no fish were observed.

21230	0174.00	LWD structure on the left bank.
21592	0178.00	LWD structure on the right bank.
22277	0185.00	LWD structure on the right bank.
22379	0186.00	LWD structure on the right bank.
22592	0189.00	LWD structure on the left bank.
22701	0190.00	Dry tributary on the right bank.
22999	0193.00	LWD structure on the right bank.
23320	0195.00	LWD structures on both banks.
23629	0198.00	A logging road crosses the channel. The crossing is a 14' wide x 53' long x 9.5' high railcar bridge.
23839	0200.00	LWD structure on the right bank.
23991	0202.00	LWD structure on the left bank.
24139	0204.00	LWD structure on the right bank.
24289	0207.00	LWD structure on the left bank.
24365	0208.00	End of survey at the confluence with John Smith Creek and Little North Fork Navarro River.

REFERENCES

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

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LEVEL III and LEVEL IV HABITAT TYPES

RIFFLE

Low Gradient Riffle	(LGR)	[1.1]	{ 1 }
High Gradient Riffle	(HGR)	[1.2]	{ 2 }

CASCADE

Cascade	(CAS)	[2.1]	{ 3 }
Bedrock Sheet	(BRS)	[2.2]	{24}

FLATWATER

Pocket Water	(POW)	[3.1]	{21}
Glide	(GLD)	[3.2]	{14}
Run	(RUN)	[3.3]	{15}
Step Run	(SRN)	[3.4]	{16}
Edgewater	(EDW)	[3.5]	{18}

MAIN CHANNEL POOLS

Trench Pool	(TRP)	[4.1]	{ 8 }
Mid-Channel Pool	(MCP)	[4.2]	{17}
Channel Confluence Pool	(CCP)	[4.3]	{19}
Step Pool	(STP)	[4.4]	{23}

SCOUR POOLS

Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

BACKWATER POOLS

Secondary Channel Pool	(SCP)	[6.1]	{ 4 }
Backwater Pool - Boulder Formed	(BPB)	[6.2]	{ 5 }
Backwater Pool - Root Wad Formed	(BPR)	[6.3]	{ 6 }
Backwater Pool - Log Formed	(BPL)	[6.4]	{ 7 }
Dammed Pool	(DPL)	[6.5]	{13}

ADDITIONAL UNIT DESIGNATIONS

Dry	(DRY)	[7.0]	
Culvert	(CUL)	[8.0]	
Not Surveyed	(NS)	[9.0]	
Not Surveyed due to a marsh	(MAR)	[9.1]	

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

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713 Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:17.0N

Longitude: 123:33:35.0

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
15	0	DRY	7.2	215	3218	13.2									
77	10	FLATWATER	37.0	128	9862	40.4	13.6	0.5	1.3	2354	181244	1406	108295		3
83	83	POOL	39.9	123	10228	41.9	18.1	1.4	3.3	2287	189819	3767	312667	3202	2
33	3	RIFFLE	15.9	34	1116	4.6	7.3	0.2	0.5	321	10608	83	2734		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
208	96				24424					381671			423695		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:17.0N

Longitude: 123:33:35.0W

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 (%)
25	2	LGR	12.0	36	889	3.6	6	0.2	0.6	417	10435	105	2621		0	88
8	1	HGR	3.8	28	227	0.9	9	0.3	0.5	130	1037	39	311		0	73
6	1	GLD	2.9	182	1094	4.5	30	0.6	2.1	9420	56520	5652	33912		10	91
28	3	RUN	13.5	63	1771	7.3	8	0.5	1.3	602	16851	355	9933		3	69
43	6	SRN	20.7	163	6997	28.6	14	0.6	1.7	2052	88241	1225	52661		2	88
73	73	MCP	35.1	130	9516	39.0	18	1.4	8.4	2427	177144	4006	292460	3404	2	85
1	1	CCP	0.5	38	38	0.2	36	2.9	4.5	1368	1368	4378	4378	3967	0	95
1	1	CRP	0.5	38	38	0.2	23	3.0	5.9	874	874	2622	2622	2622	0	68
2	2	LSL	1.0	78	155	0.6	18	1.1	2.1	1393	2786	1908	3816	1490	5	94
1	1	LSR	0.5	70	70	0.3	18	1.2	2.9	1260	1260	1890	1890	1512	10	80
3	3	LSBk	1.4	106	318	1.3	17	0.9	3.3	1738	5213	1935	5805	1641	0	93
2	2	LSBo	1.0	46	93	0.4	14	1.1	3	587	1174	848	1696	645	5	85
15	0	DRY	7.2	215	3218	13.2										

Total Units
208

Total Units Fully Measured
96

Total Length (ft.)
24424

Total Area (sq.ft.)
362903

Total Volume (cu.ft.)
412104

Table 3 - Summary of Pool Types

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:17.0N

Longitude: 123:33:35.0W

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
74	74	MAIN	89	129	9554	93	18.3	1.4	2412	178512	3411	252446	2
9	9	SCOUR	11	75	674	7	17.1	1.3	1256	11307	1481	13329	3

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
83	83	10228	189819	265775

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

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:17.0N

Longitude: 123:33:35.0W

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
73	MCP	88	0	0	5	7	32	44	18	25	18	25
1	CCP	1	0	0	0	0	0	0	0	0	1	100
1	CRP	1	0	0	0	0	0	0	0	0	1	100
2	LSL	2	0	0	0	0	2	100	0	0	0	0
1	LSR	1	0	0	0	0	1	100	0	0	0	0
3	LSBk	4	0	0	0	0	2	67	1	33	0	0
2	LSBo	2	0	0	0	0	1	50	1	50	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
83	0	0	5	6	38	46	20	24	20	24

Mean Maximum Residual Pool Depth (ft.): 3.3

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Dry Units: 15

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:17.0N

Longitude: 123:33:35.0W

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
25	2	LGR	0	0	0	0	0	0	0	0	0
8	1	HGR	0	0	0	0	0	0	0	0	0
33	3	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
6	1	GLD	0	0	0	0	100	0	0	0	0
28	3	RUN	0	0	0	0	100	0	0	0	0
43	6	SRN	0	30	0	0	70	0	0	0	0
77	10	TOTAL FLAT	0	10	0	0	90	0	0	0	0
73	73	MCP	3	41	27	1	5	11	0	13	0
1	1	CCP	0	0	0	0	0	0	0	0	0
1	1	CRP	0	0	0	0	0	0	0	0	0
2	2	LSL	0	10	90	0	0	0	0	0	0
1	1	LSR	0	80	15	0	5	0	0	0	0
3	3	LSBk	0	0	0	0	0	0	0	0	0
2	2	LSBo	0	0	0	0	0	0	0	100	0
83	83	TOTAL POOL	3	39	28	1	5	9	0	16	0
208	96	TOTAL	2	35	24	0	17	8	0	14	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Dry Units: 15

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07 Latitude: 39:10:17.0N

Longitude: 123:33:35.0W

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
25	2	LGR	0	0	100	0	0	0	0
8	1	HGR	0	0	0	100	0	0	0
6	1	GLD	0	0	100	0	0	0	0
28	3	RUN	0	0	100	0	0	0	0
43	6	SRN	0	0	100	0	0	0	0
73	73	MCP	0	0	100	0	0	0	0
1	1	CCP	0	0	100	0	0	0	0
1	1	CRP	0	0	100	0	0	0	0
2	2	LSL	0	0	100	0	0	0	0
1	1	LSR	0	0	100	0	0	0	0
3	3	LSBk	0	0	100	0	0	0	0
2	2	LSBo	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:17.0N

Longitude: 123:33:35.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
85	50	50	0	99	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: North Branch North Fork Navarro River LLID: 1235596391713 Drainage: Navarro River
 Survey Dates: 7/17/2012 to 7/23/2012 Survey Length (ft.): 24424 Main Channel (ft.): 24424 Side Channel (ft.): 0
 Confluence Location: Quad: NAVARRO Legal Description: T15NR15WS07 Latitude: 39:10:17.0N Longitude: 123:33:35.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 85.1	Pools by Stream Length (%): 41.9
Reach Length (ft.): 24424	Coniferous Component (%): 50.1	Pool Frequency (%): 39.9
Riffle/Flatwater Mean Width (ft.): 12.1	Hardwood Component (%): 49.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Coniferous Trees	< 2 Feet Deep: 6
Range (ft.): 38 to 72	Vegetative Cover (%): 99.6	2 to 2.9 Feet Deep: 46
Mean (ft.): 49	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 24
Std. Dev.: 9	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 24
Base Flow (cfs.): 1.0	Occurrence of LWD (%): 5	Mean Max Residual Pool Depth (ft.): 3.3
Water (F): 57 - 66 Air (F): 50 - 73	LWD per 100 ft.:	Mean Pool Shelter Rating: 2
Dry Channel (ft): 3218	Riffles: 1	
	Pools: 3	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 82 Sm Cobble: 7 Lg Cobble: 4 Boulder: 7 Bedrock: 0		
Embeddedness Values (%): 1. 73.5 2. 22.9 3. 1.2 4. 0.0 5. 2.4		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Confluence Location: Quad: NAVARRO

Legal Description: T15NR15WS07

Latitude: 39:10:17.0N

Longitude: 123:33:35.0W

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	6	10	8.3
Boulder	4	5	4.7
Cobble / Gravel	37	29	34.4
Sand / Silt / Clay	49	52	52.6

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	1	0	0.5
Hardwood Trees	40	39	41.1
Coniferous Trees	53	57	57.3
No Vegetation	2	0	1.0

Total Stream Cobble Embeddedness Values: 1

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

StreamName: North Branch North Fork Navarro River

LLID: 1235596391713

Drainage: Navarro River

Survey Dates: 7/17/2012 to 7/23/2012

Confluence Location: Quad: NAVARRO

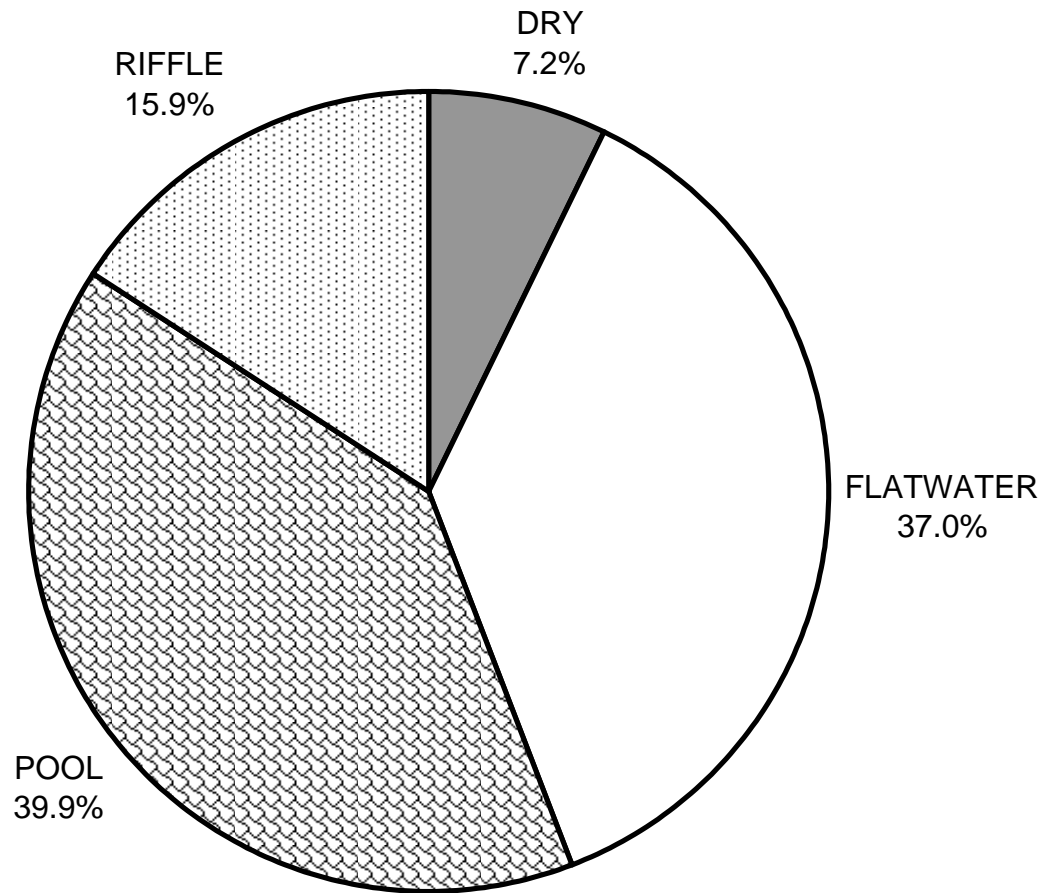
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Longitude: 123:33:35.0W

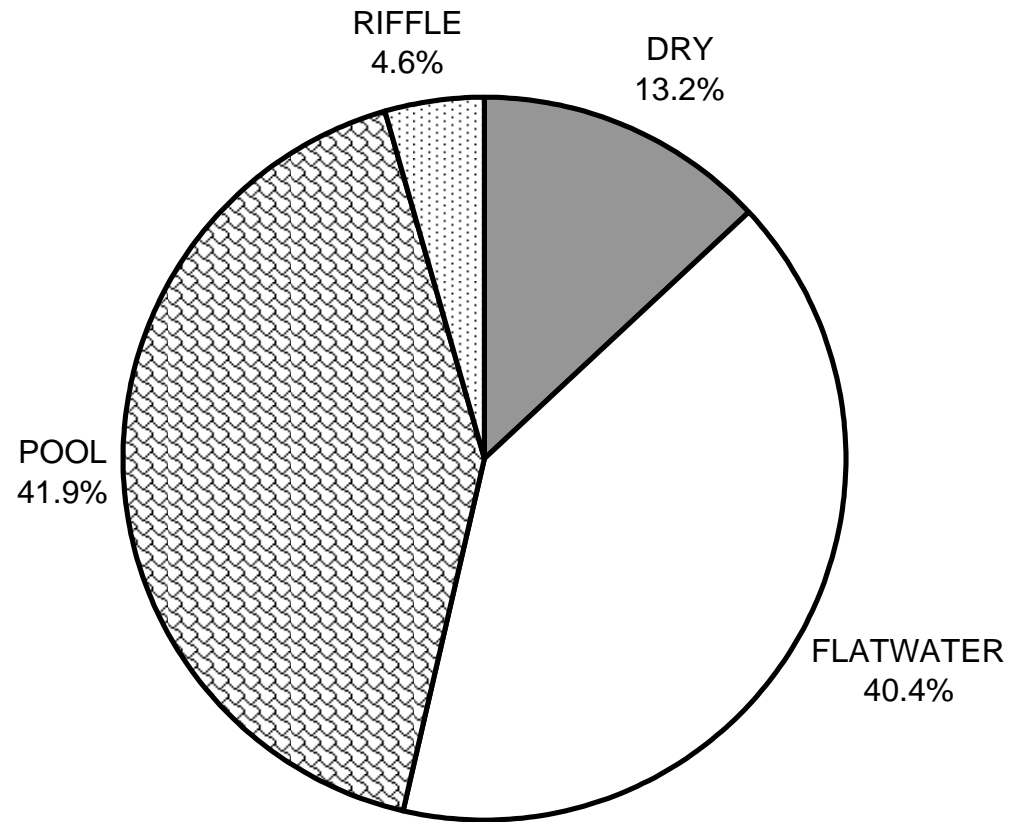
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	3
SMALL WOODY DEBRIS (%)	0	10	39
LARGE WOODY DEBRIS (%)	0	0	28
ROOT MASS (%)	0	0	1
TERRESTRIAL VEGETATION (%)	0	90	5
AQUATIC VEGETATION (%)	0	0	9
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	16
BEDROCK LEDGES (%)	0	0	0

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 HABITAT TYPES BY PERCENT OCCURRENCE



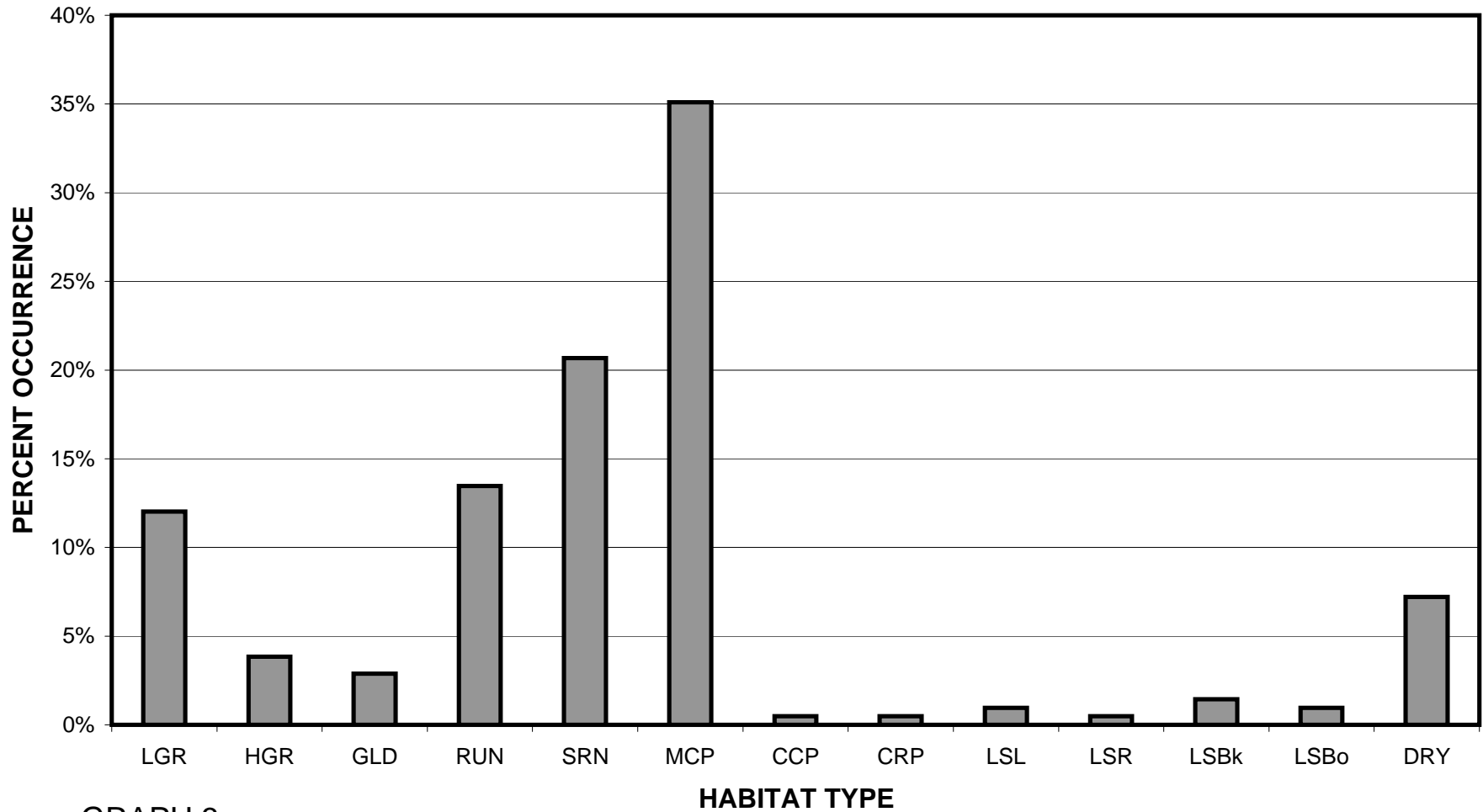
GRAPH 1

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



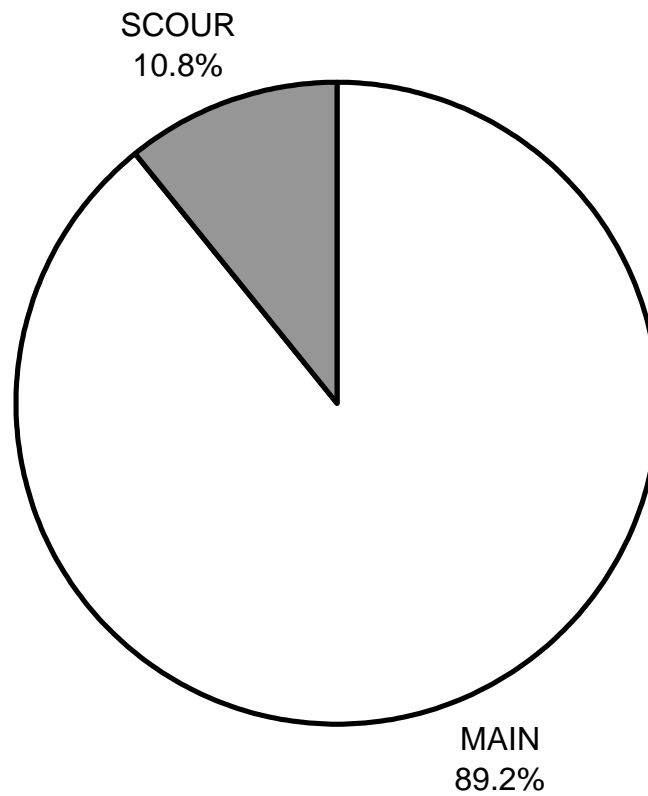
GRAPH 2

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 HABITAT TYPES BY PERCENT OCCURRENCE



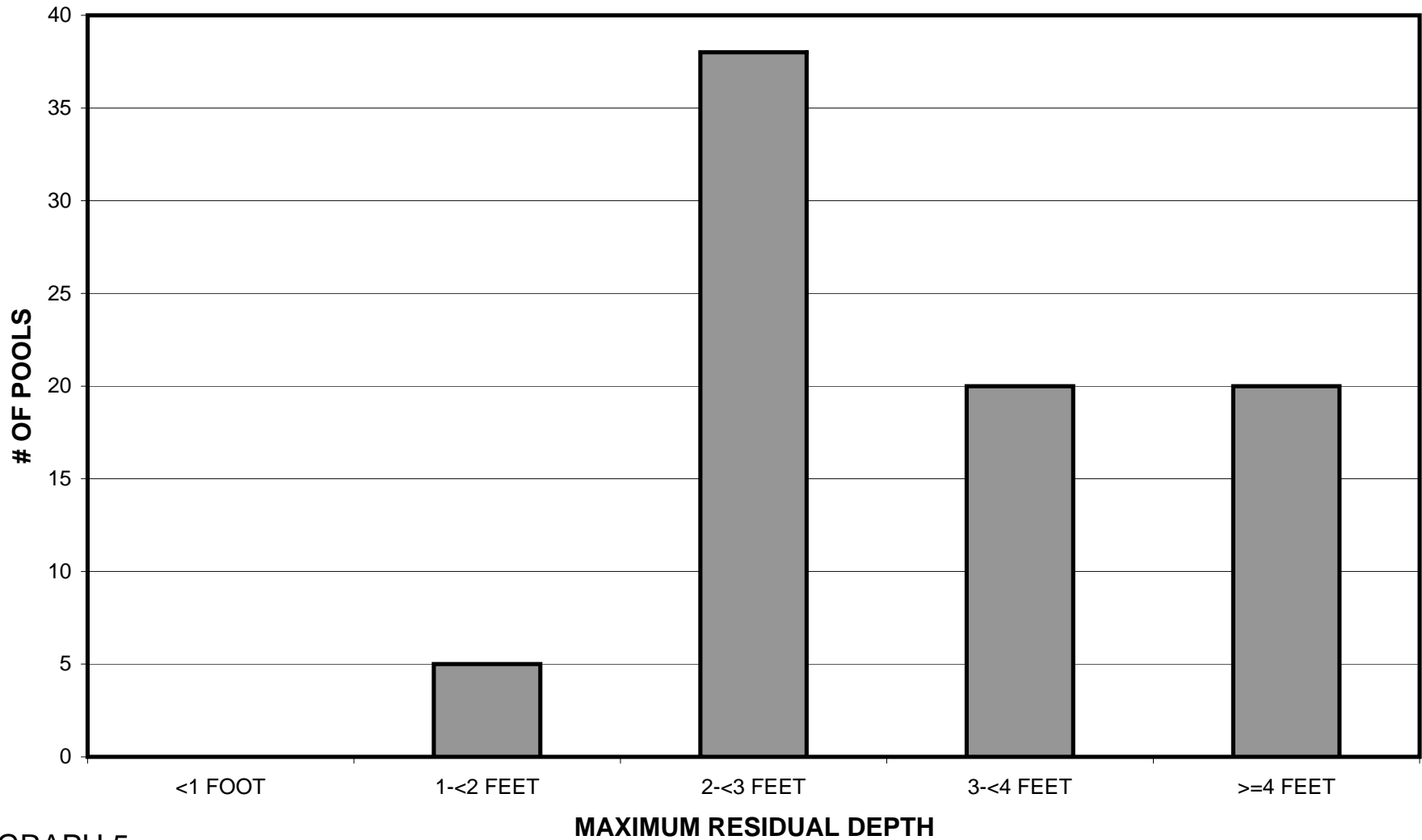
GRAPH 3

**NORTH BRANCH NORTH FORK NAVARRO RIVER 2012
POOL TYPES BY PERCENT OCCURRENCE**



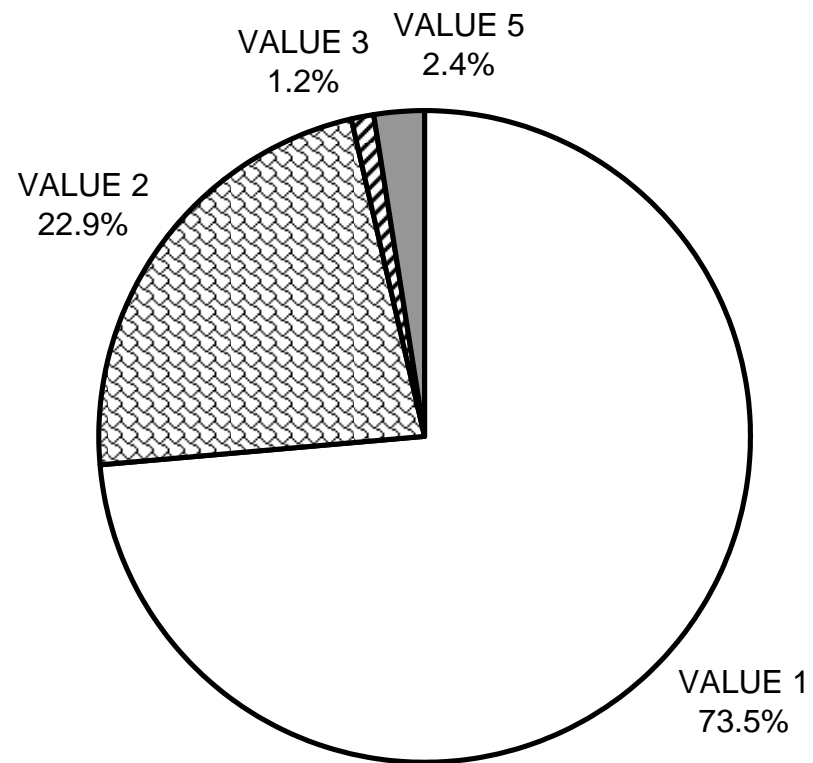
GRAPH 4

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 MAXIMUM DEPTH IN POOLS



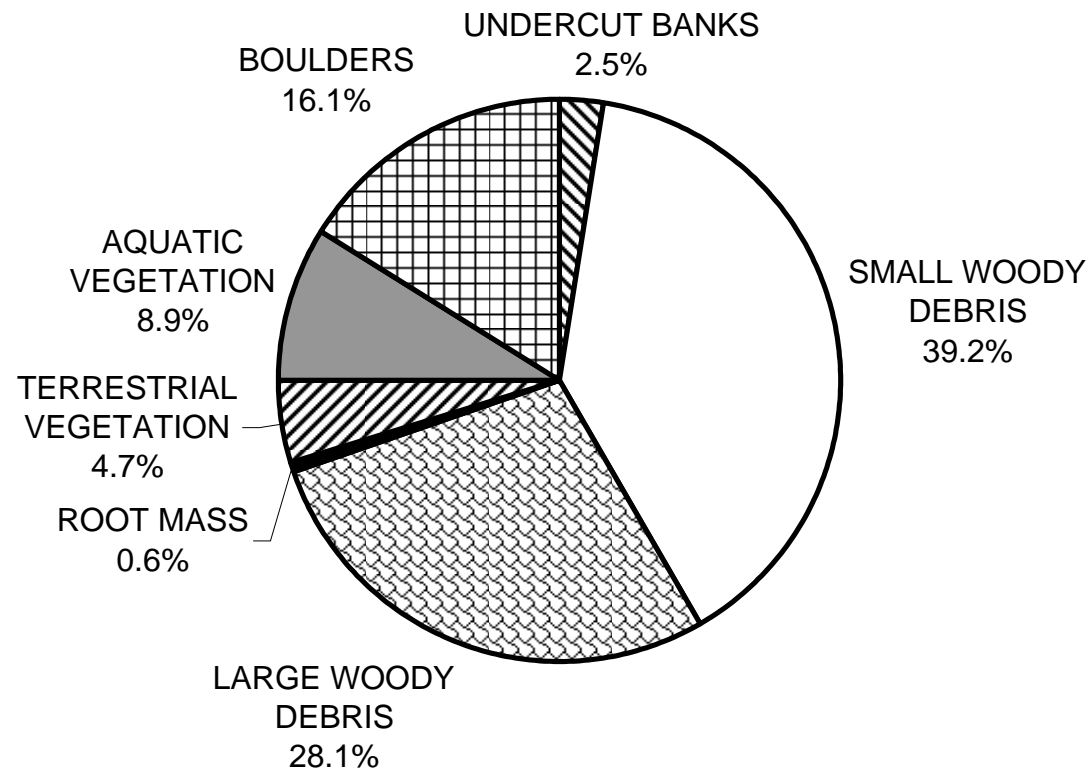
GRAPH 5

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 PERCENT EMBEDDEDNESS



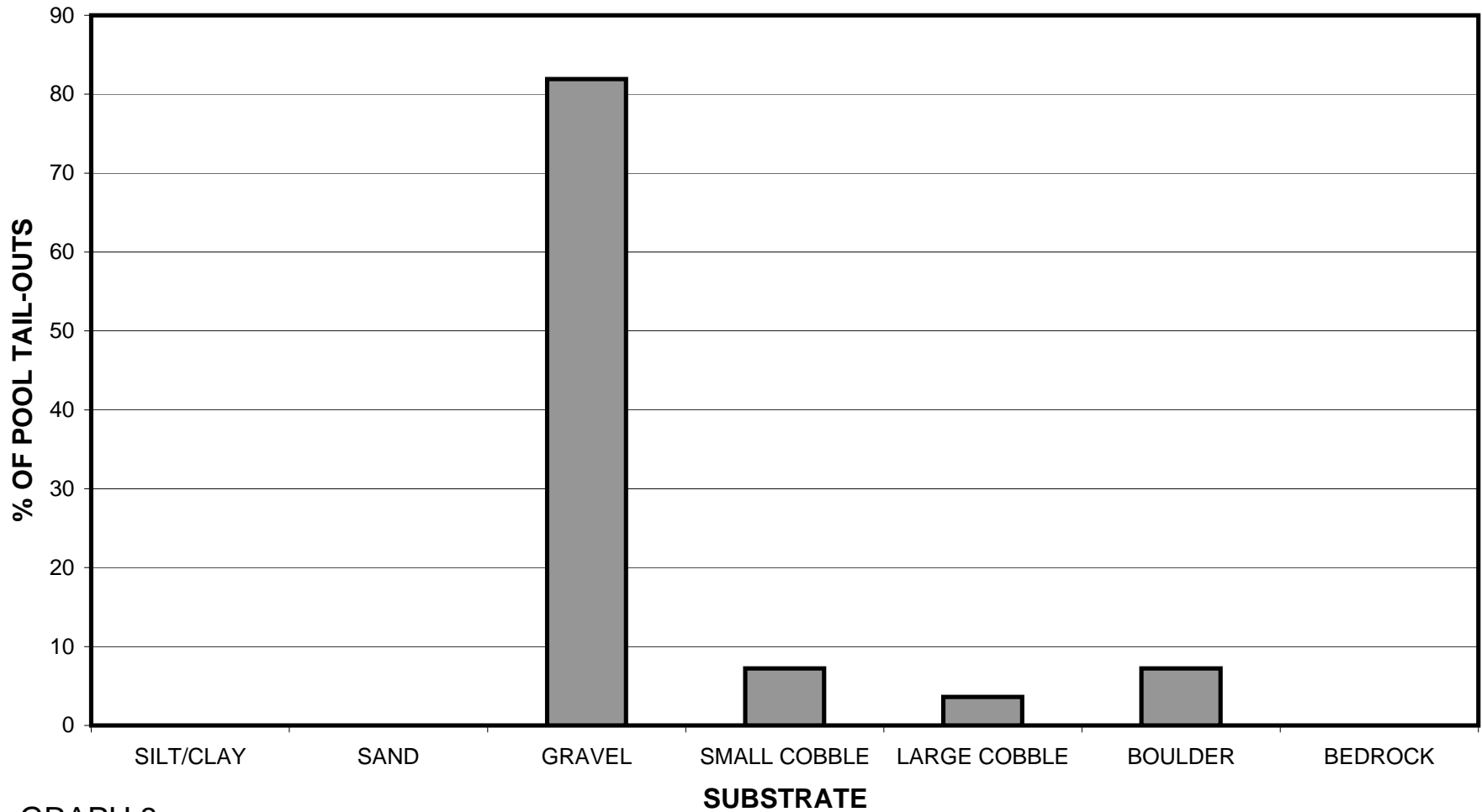
GRAPH 6

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 MEAN PERCENT COVER TYPES IN POOLS



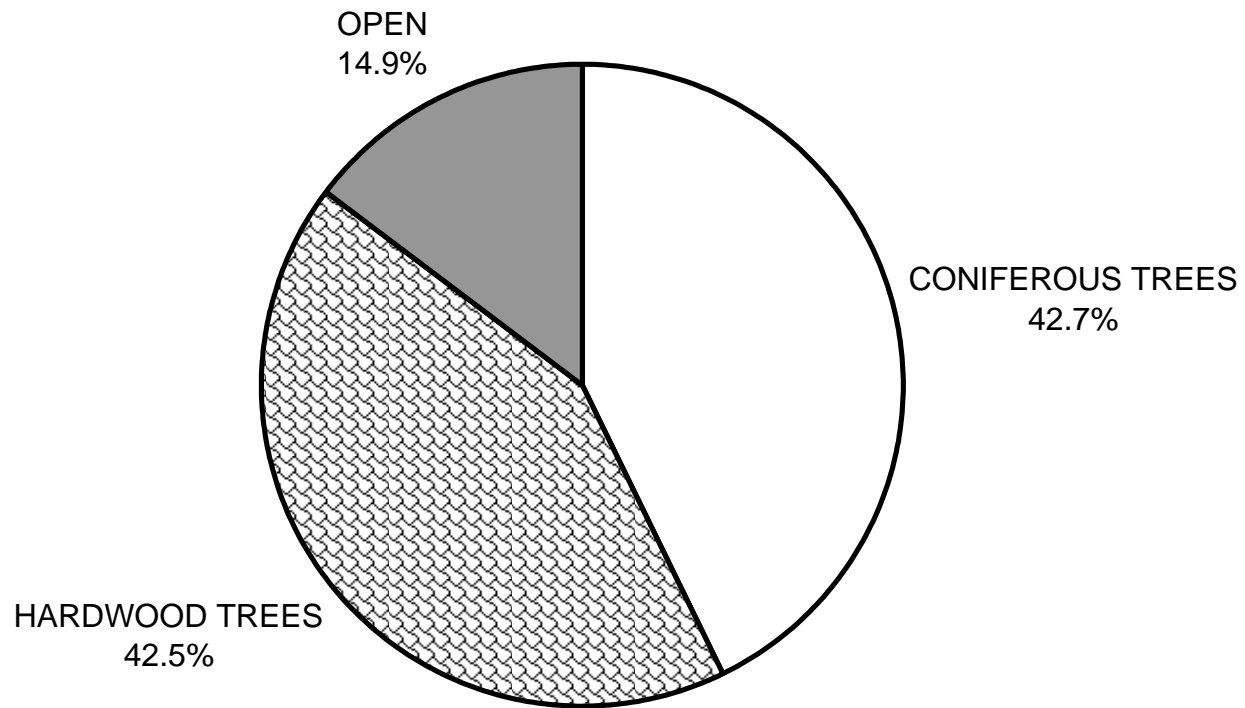
GRAPH 7

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



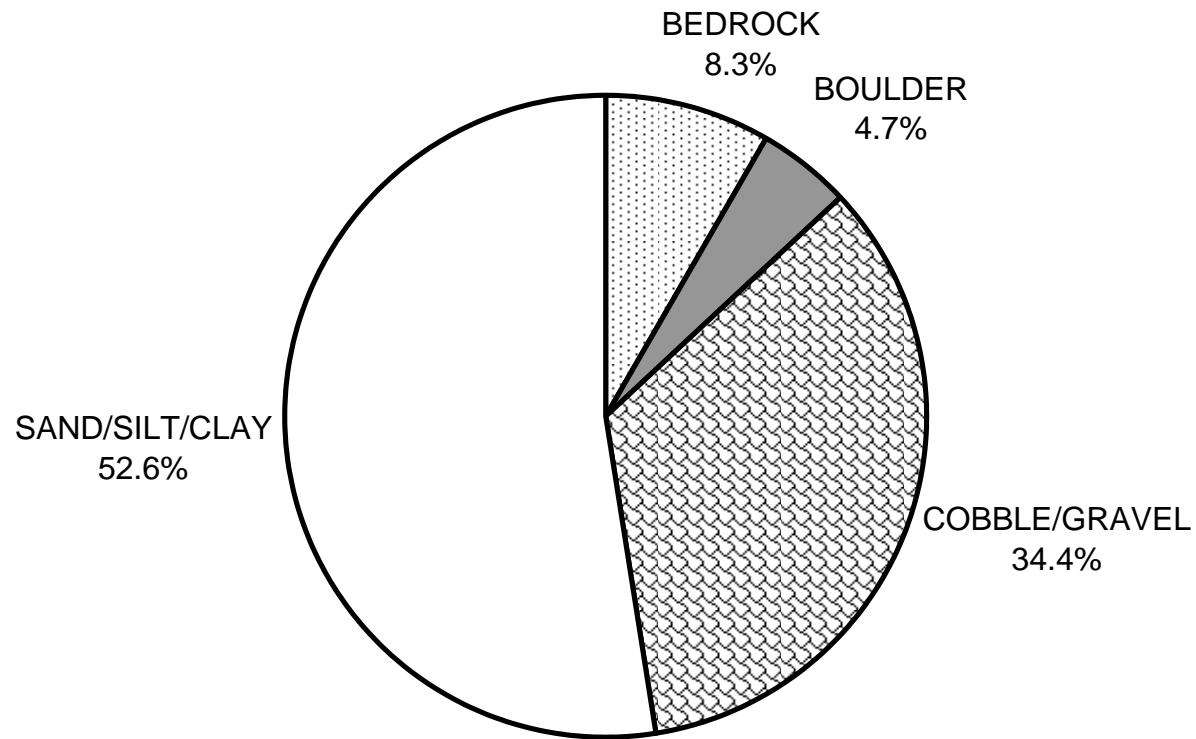
GRAPH 8

**NORTH BRANCH NORTH FORK NAVARRO RIVER 2012
MEAN PERCENT CANOPY**



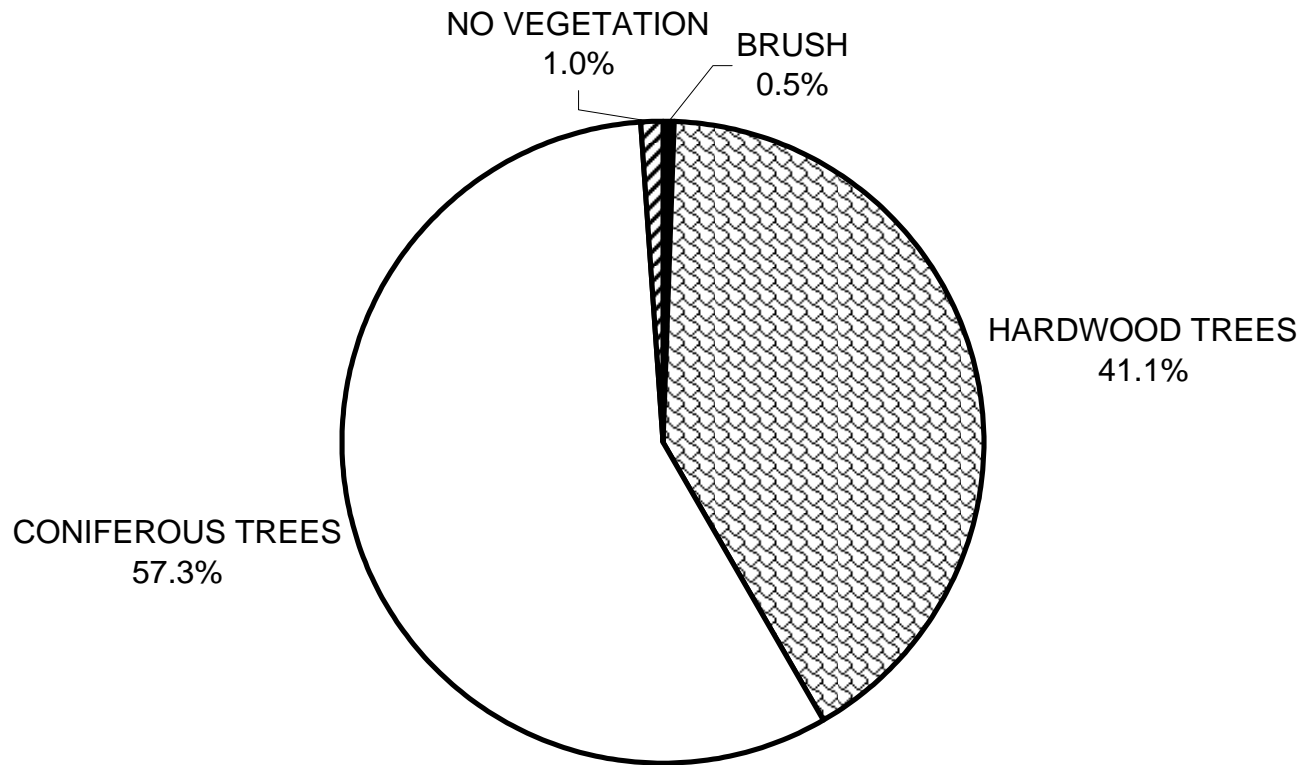
GRAPH 9

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

NORTH BRANCH NORTH FORK NAVARRO RIVER 2012 DOMINANT BANK VEGETATION IN SURVEY REACH

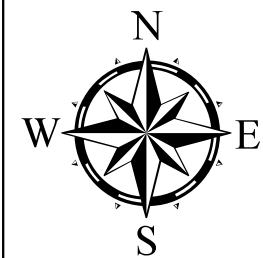


GRAPH 11

Map 1
North Branch North Fork Navarro River
Navarro River Watershed
Navarro Quad, Mendocino County

End Survey

Start Survey



— Channel Type F4

