

STREAM INVENTORY REPORT

Tom Bell Creek

INTRODUCTION

A stream inventory was conducted from July 24 to July 25, 2012 on Tom Bell Creek. The survey began at the confluence with the Albion River and extended upstream 1.2 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Tom Bell Creek.

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

Tom Bell Creek is a tributary to the Albion River, which drains to the Pacific Ocean. It is located in Mendocino County, California (Map 1). Tom Bell Creek's legal description at the confluence with the Albion River is T16N R16W S09. Its location is 39.2677 degrees north latitude and 123.6426 degrees west longitude, LLID number 1236414392677. Tom Bell Creek is an intermittent stream according to the USGS Mathison Peak 7.5 minute quadrangle. Tom Bell Creek drains a watershed of approximately 1.6 square miles. Elevations range from about 100 feet at the mouth of the creek to 920 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 Comptche-Ukiah Road outside of Comptche.

METHODS

The habitat inventory conducted in Tom Bell 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 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

Tom Bell Creek

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 Tom Bell 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". Tom Bell 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.

Tom Bell Creek

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 Tom Bell 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. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is classified according to a list of nine cover types. In Tom Bell Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. The shelter rating is then calculated for each fully-described habitat unit by multiplying shelter value and percent 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 Tom Bell 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 Tom Bell 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.

Tom Bell Creek

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.

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

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Tom Bell 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

Tom Bell Creek

- 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 24 to July 25, 2012 was conducted by M. Groff and I. Mikus, (CDFW). The total length of the stream surveyed was 6,339 feet.

Stream flow was not measured on Tom Bell Creek.

Tom Bell Creek is an E4 channel type for the entire length of the survey, 6,339feet. E4 channels are low gradient, meandering riffle/pool streams with low width/depth ratios and little deposition. They are very efficient and stable with a high meander width ratio and gravel-dominant substrates.

Water temperatures taken during the survey period ranged from 55 to 56 degrees Fahrenheit. Air temperatures ranged from 54 to 60 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% pool units, 38% dry units, 16% flatwater units, and 1% riffle units (Graph 1). Based on total length of Level II habitat types there were 53% pool units, 38% dry units, and 9% flatwater 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, 44%; dry units, 38%; and run units, 14% (Graph 3). Based on percent total length, mid-channel pool units made up 51%, dry units 38%, and run units 6%.

A total of 82 pools were identified (Table 3). Main channel pools were the most frequently encountered at 98% (Graph 4), and comprised 99% of the total length of all pools (Table 3).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Forty-two of the 82 pools (51%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 82 pool tail-outs measured, seven had a value of 1 (8.5%); 16 had a value of 2 (19.5%); 18 had a value of 3 (22%); 12 had a value of 4 (14.6%); 29 had a value of 5 (35.4%) (Graph 6). On this scale, a value of 1 indicates the best spawning conditions and a value of 4 the worst. Additionally, a

Tom Bell Creek

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 0, and pool habitats had a mean shelter rating of 3 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 3. Scour pools had a mean shelter rating of 0 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut banks are the dominant cover type in Tom Bell Creek. Graph 7 describes the pool cover in Tom Bell 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 59% of the pool tail-outs. Silt/clay was the next most frequently observed dominant substrate type and occurred in 37% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Tom Bell Creek was 98%. Two percent of the canopy was open. Of the canopy present, the mean percentages of hardwood and coniferous trees were 30% and 70%, respectively. Graph 9 describes the mean percent canopy in Tom Bell Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 100%. The mean percent left bank vegetated was 100%. The dominant elements composing the structure of the stream banks consisted of 99% sand/silt/clay, 0.5% bedrock, and 0.5% boulders (Graph 10). Coniferous trees were the dominant vegetation type observed in 64% of the units surveyed. Additionally, 31% of the units surveyed had deciduous trees as the dominant vegetation type, and 6% had brush as the dominant vegetation type (Graph 11).

DISCUSSION

Tom Bell Creek is an E4 channel type. The suitability of E4 channel types for fish habitat improvement structures is as follows: E4 channel types are good for bank-placed boulders and fair for opposing wing-deflectors.

The water temperatures recorded on the survey days July 24 to July 25, 2012 ranged from 55 to 56 degrees Fahrenheit. Air temperatures ranged from 54 to 60 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.

Flatwater habitat types comprised 9% of the total length of this survey, riffles less than 1%, and pools 53%. Forty-two of the 82 (51%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than

Tom Bell Creek

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.

Twenty-three of the 82 pool tail-outs measured had embeddedness ratings of 1 or 2. Thirty of the pool tail-outs had embeddedness ratings of 3 or 4. Twenty-nine of the pool tail-outs had a rating of 5, which is considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. Sediment sources in Tom Bell Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Forty-eight of the 82 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 3. The shelter rating in the flatwater habitats is 0. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by undercut banks in Tom Bell 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 98%. The percentage of right and left bank covered with vegetation was 100% and 100%, respectively.

RECOMMENDATIONS

- 1) Tom Bell 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.

Tom Bell 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 the South Fork Albion River. The channel is an E4 for the entire length of the survey.
334	0008.00	Fish observed.
460	0013.00	A logging road crosses the channel. The crossing is a 14' wide x 47' long x 7.7' high railcar bridge. Boulder rip-rap lines both banks below the bridge (35' long x 5' high). There is a boulder weir structure 30' downstream from bridge. The boulder weir is in a 145' long dry section.
1073	0036.00	Log debris accumulation (LDA) #01 contains 10 pieces of large woody debris (LWD) and measures 6' high x 25' wide x 8' long. Water flows does not flow through the LDA; the channel is dry for 70' above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 10' wide x 60' long x 1' deep. Fish were observed above the LDA.
1215	0038.00	There was a 1+ salmonid observed.
1582	0050.00	LDA #02 contains seven pieces of LWD and measures 5' high x 17' wide x 10' long. Water does not flow through the LDA; the channel is dry for 12' above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 10' wide x 60' long x 1.5' deep. Fish were observed above the LDA.
1985	0065.00	LDA #03 contains 11 pieces of LWD and measures 6' high x 25' wide x 11' long. Water does not flow through the LDA; the channel is dry for 21' above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 12' wide x 70' long x 2' deep. Fish were observed above the LDA.
2312	0075.00	Fish observed.
2580	0081.00	LDA #04 contains 18 pieces of LWD and measures 6' high x 27' wide x 12' long. Water does not flow through the LDA; the channel is dry for 117' feet above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 15' wide x 100' long x 1' deep. Fish were observed above the LDA.

Tom Bell Creek

3127	0090.00	LDA #05 contains two pieces of LWD and measures 4' high x 13' wide x 4' long. Water does not flow through the LDA; the channel is dry for 52' feet above it. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 12' wide x 60' long x 0.5' deep. Fish were observed above the LDA.
3397	0100.00	Fish observed.
3980	0111.00	There is a 1.6' high plunge over accumulated silt. LDA #06 contains 10 pieces of LWD and measures 6' high x 20' wide x 16' long. Water flows through the LDA and there are no visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.
4276	0117.00	Fish observed.
4498	0127.00	LDA #07 contains 12 pieces of LWD and measures 4' high x 21' wide x 8' long. Water does not flow through the LDA; it is in a 54' long dry section. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 5' wide x 20' long x 1' deep. There is a dry side-channel around the LDA on the right bank. Fish were observed above the LDA.
4632	0133.00	LDA #08 contains 13 pieces of LWD and measures 5' high x 25' wide x 22' long. Water does not flow through the LDA; it is in a 43' long dry section. There are no visible gaps in the LDA. Retained sediment ranges from silt to gravel and measures 10' wide x 60' long x 2' deep. Fish were not observed above the LDA.
5355	0148.00	LDA #08 contains 17 pieces of LWD and measures 6' high x 28' wide x 23' long. Water does not flow through the LDA; the channel is dry for 13' above it. There are no visible gaps in the LDA. The LDA is not retaining sediment.
6313	0178.00	End of survey due to landowner access. Not the end of anadromous fish habitat.

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.

Tom Bell 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: Tom Bell Creek

LLID: 1236414392677 Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Confluence Location: Quad: MATHISON PEAK Legal Description: T16NR16WS04 Latitude: 39:16:04.0N Longitude: 123:38:29.0W

Habitat Units	Units Fully Measured	Habitat Type	Habitat Occurrence (%)	Mean Length (ft.)	Total Length (ft.)	Total Length (%)	Mean Width (ft.)	Mean Depth (ft.)	Mean Max Depth (ft.)	Mean Area (sq.ft.)	Estimated Total Area (sq.ft.)	Mean Volume (cu.ft.)	Estimated Total Volume (cu.ft.)	Mean Residual Pool Vol (cu.ft.)	Mean Shelter Rating
67	0	DRY	37.6	36	2420	38.2									
28	8	FLATWATER	15.7	20	570	9.0	3.9	0.5	0.8	80	2240	42	1183		0
82	82	POOL	46.1	41	3340	52.7	6.6	1.2	2.2	276	22670	393	32210	387	3
1	1	RIFFLE	0.6	9	9	0.1	2.0	0.1	0.3	16	16	2	2		0
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
178	91				6339					24926			33394		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS04

Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

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 (%)
1	1	LGR	0.6	9	9	0.1	2	0.1	0.3	16	16	2	2		0	100
24	7	RUN	13.5	17	403	6.4	4	0.5	0.9	78	1869	43	1028		0	97
4	1	SRN	2.2	42	167	2.6	4	0.4	0.8	95	380	38	152		0	99
79	79	MCP	44.4	41	3250	51.3	7	1.2	4.9	281	22166	403	31815	397	3	98
1	1	STP	0.6	44	44	0.7	5	0.8	3.3	220	220	176	176	176	0	99
1	1	CRP	0.6	15	15	0.2	6	1.1	1.6	98	98	107	107	107	0	99
1	1	LSBk	0.6	31	31	0.5	6	0.6	1.1	186	186	112	112	112	0	97
67	0	DRY	37.6	36	2420	38.2										

Total Units
178

Total Units Fully Measured
91

Total Length (ft.)
6339

Total Area (sq.ft.)
24934

Total Volume (cu.ft.)
33392

Table 3 - Summary of Pool Types

Stream Name: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS04

Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

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
80	80	MAIN	98	41	3294	99	6.7	1.2	280	22386	394	31501	3
2	2	SCOUR	2	23	46	1	6.3	0.9	142	284	109	219	0

Total Units	Total Units Fully Measured	Total Length (ft.)	Total Area (sq.ft.)	Total Volume (cu.ft.)
82	82	3340	22670	31720

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

Stream Name: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS04

Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

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
79	MCP	96	0	0	38	48	25	32	13	16	3	4
1	STP	1	0	0	0	0	0	0	1	100	0	0
1	CRP	1	0	0	1	100	0	0	0	0	0	0
1	LSBk	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
82	0	0	40	49	25	30	14	17	3	4

Mean Maximum Residual Pool Depth (ft.): 2.2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Dry Units: 67

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS04

Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

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
1	1	LGR	0	0	0	0	0	0	0	0	0
1	1	TOTAL RIFFLE	0	0	0	0	0	0	0	0	0
24	7	RUN	0	0	0	0	0	0	0	0	0
4	1	SRN	0	0	0	0	0	0	0	0	0
28	8	TOTAL FLAT	0	0	0	0	0	0	0	0	0
79	79	MCP	35	30	29	5	0	0	0	0	0
1	1	STP	0	0	0	0	0	0	0	0	0
1	1	CRP	0	0	0	0	0	0	0	0	0
1	1	LSBk	0	0	0	0	0	0	0	0	0
82	82	TOTAL POOL	35	30	29	5	0	0	0	0	0
178	91	TOTAL	35	30	29	5	0	0	0	0	0

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Dry Units: 67

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS04

Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

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
1	1	LGR	0	0	100	0	0	0	0
24	7	RUN	71	0	29	0	0	0	0
4	1	SRN	0	0	100	0	0	0	0
79	79	MCP	71	0	25	0	0	0	4
1	1	STP	100	0	0	0	0	0	0
1	1	CRP	100	0	0	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS04

Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
98	70	30	0	100	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 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Confluence Location: Quad: MATHISON PEAK

Legal Description: T16NR16WS04

Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

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	0.5
Boulder	0	1	0.5
Cobble / Gravel	0	0	0.0
Sand / Silt / Clay	90	90	98.9

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	0	0	0.0
Brush	6	4	5.5
Hardwood Trees	27	29	30.8
Coniferous Trees	58	58	63.7
No Vegetation	0	0	0.0

Total Stream Cobble Embeddedness Values: 3

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

StreamName: Tom Bell Creek

LLID: 1236414392677

Drainage: Albion River

Survey Dates: 7/24/2012 to 7/25/2012

Confluence Location: Quad: MATHISON PEAK

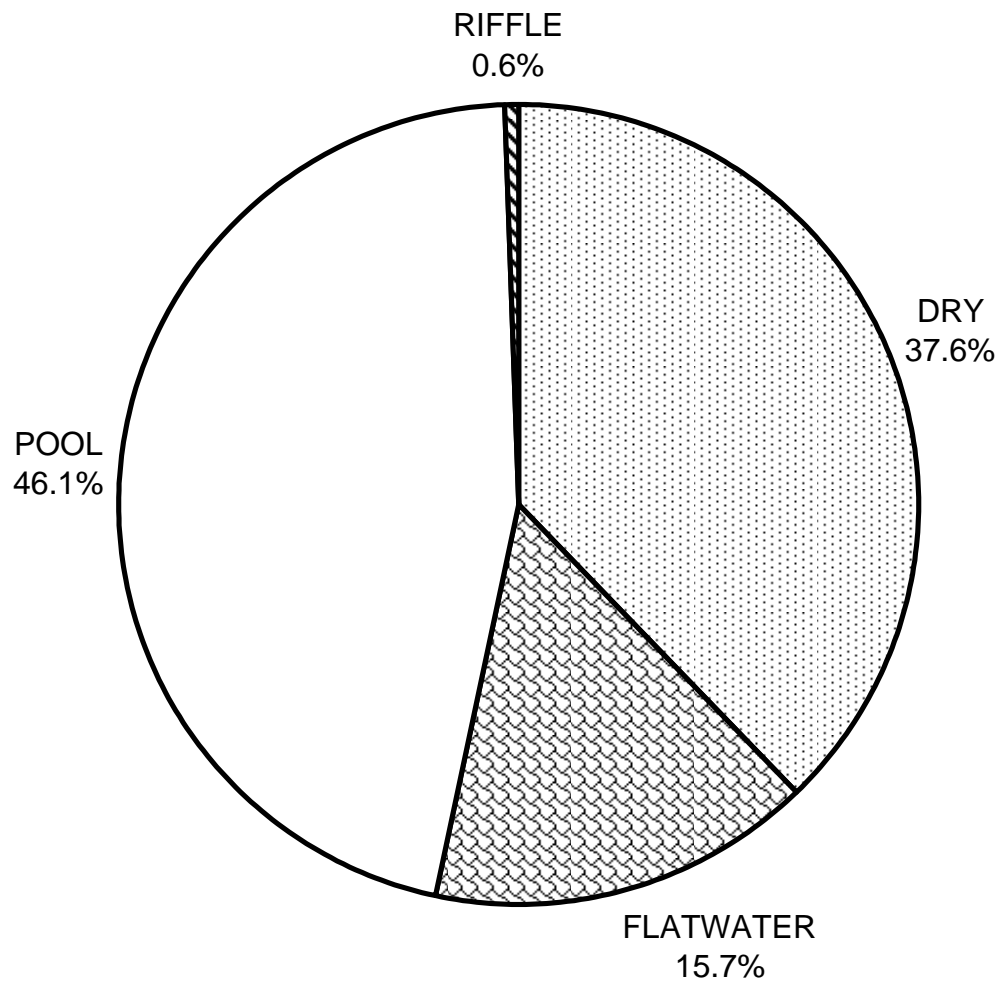
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Latitude: 39:16:04.0N

Longitude: 123:38:29.0W

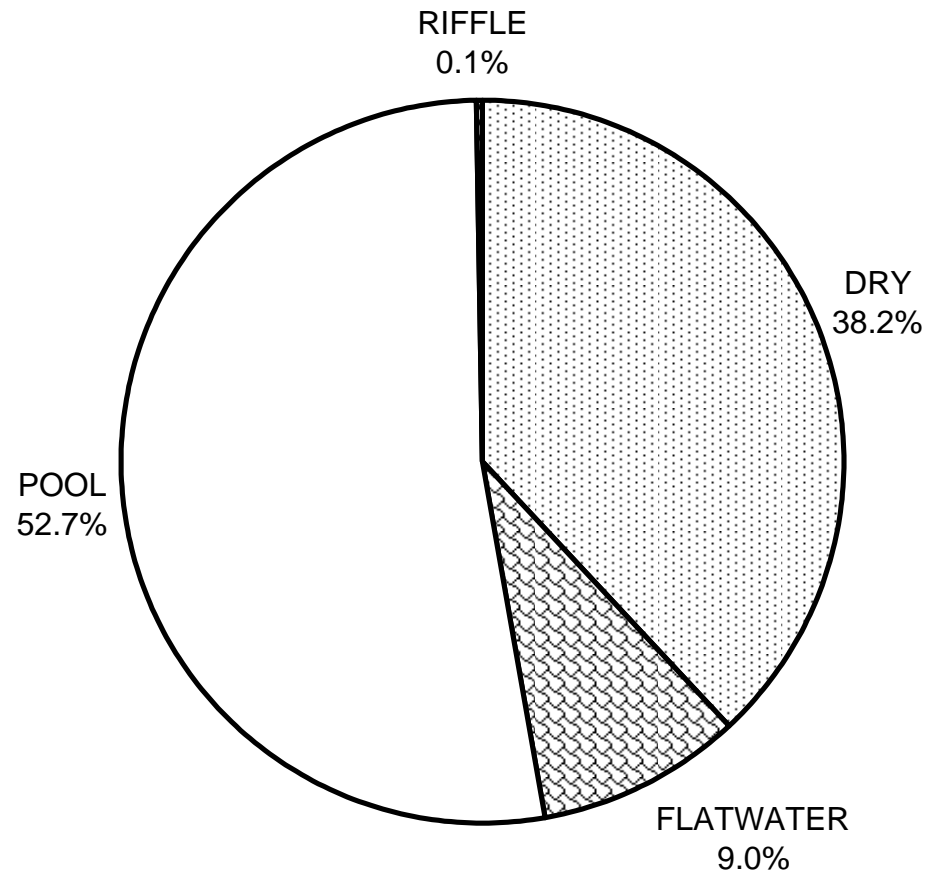
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	0	0	35
SMALL WOODY DEBRIS (%)	0	0	30
LARGE WOODY DEBRIS (%)	0	0	29
ROOT MASS (%)	0	0	5
TERRESTRIAL VEGETATION (%)	0	0	0
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	0	0	0
BEDROCK LEDGES (%)	0	0	0

TOM BELL CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



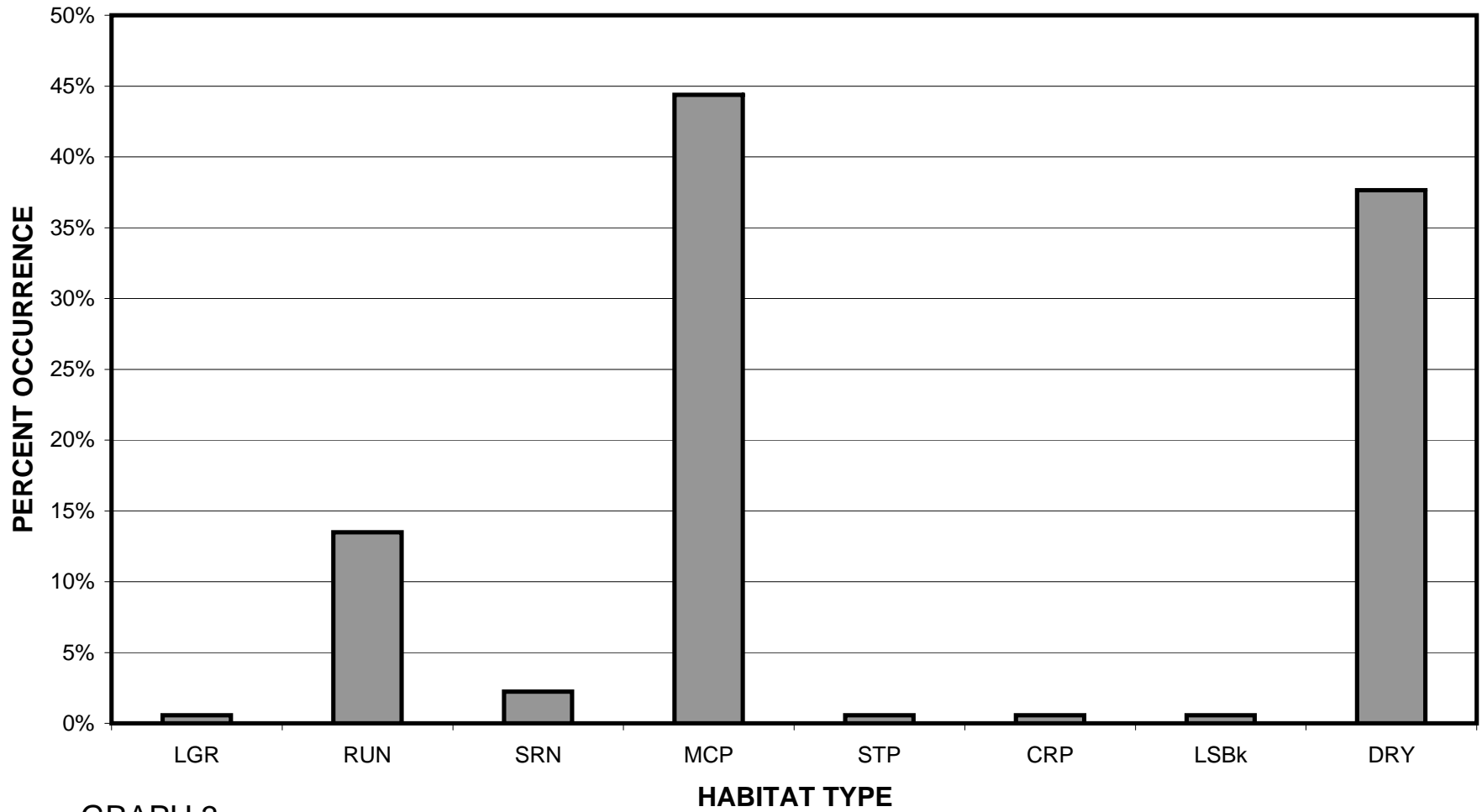
GRAPH 1

TOM BELL CREEK 2012 HABITAT TYPES BY PERCENT TOTAL LENGTH



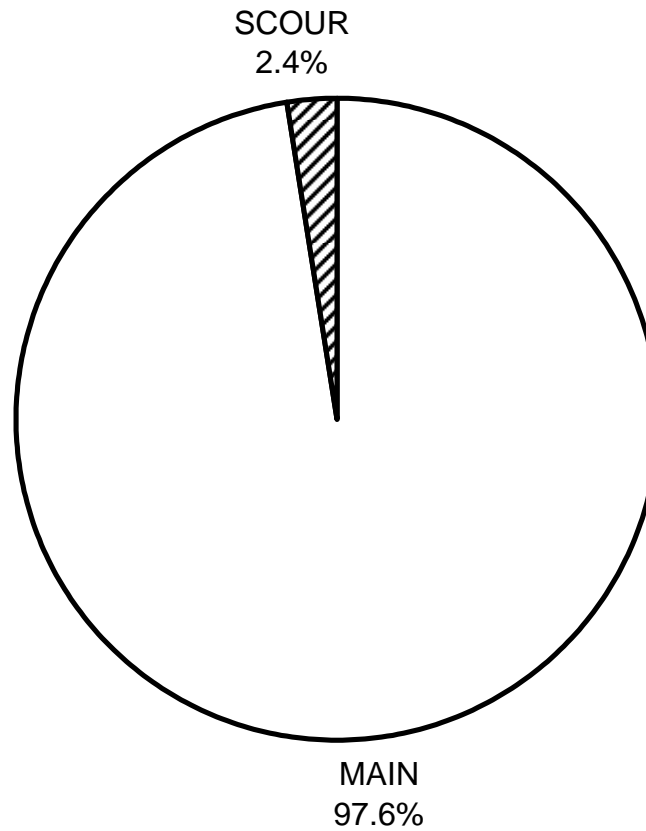
GRAPH 2

TOM BELL CREEK 2012 HABITAT TYPES BY PERCENT OCCURRENCE



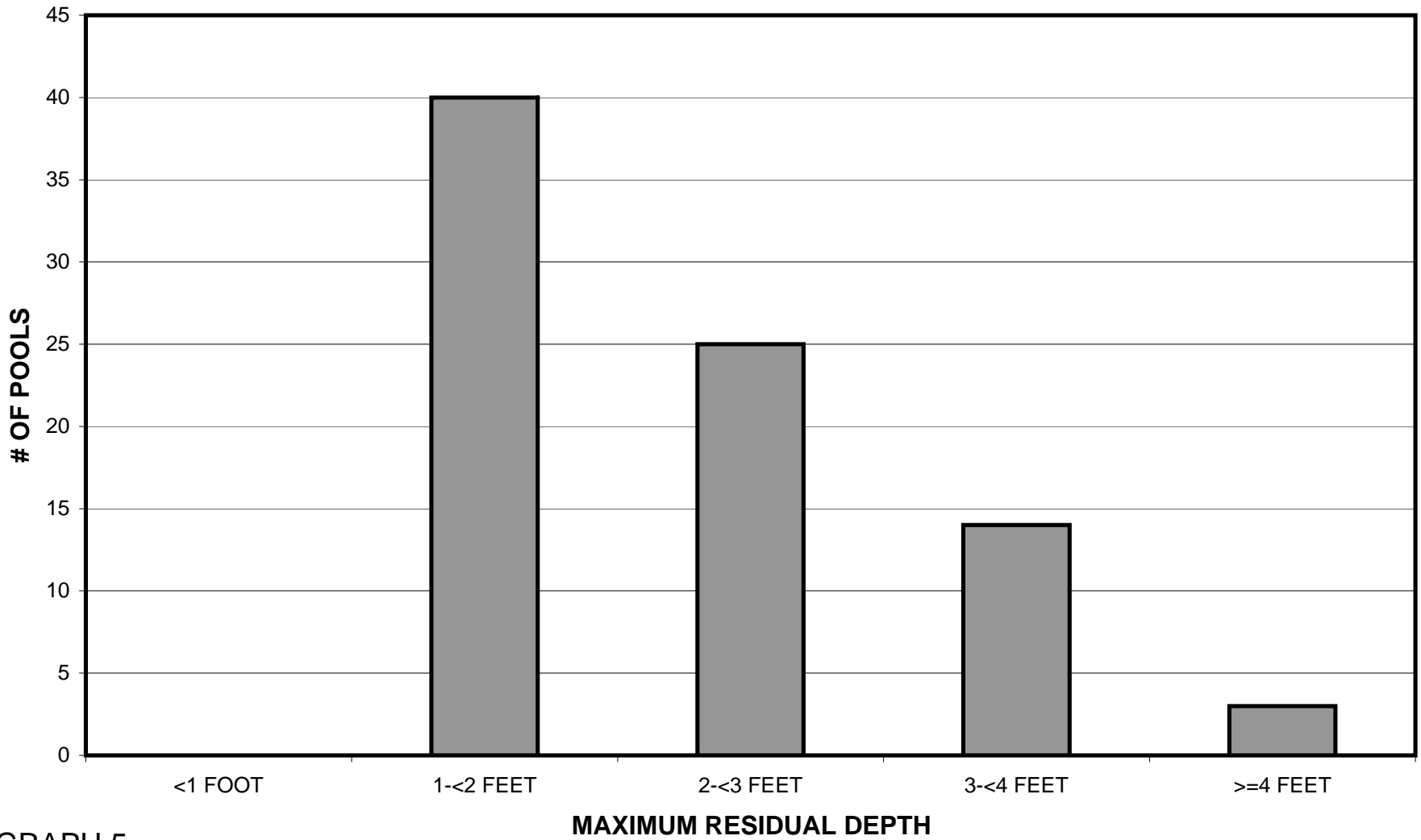
GRAPH 3

**TOM BELL CREEK 2012
POOL TYPES BY PERCENT OCCURRENCE**



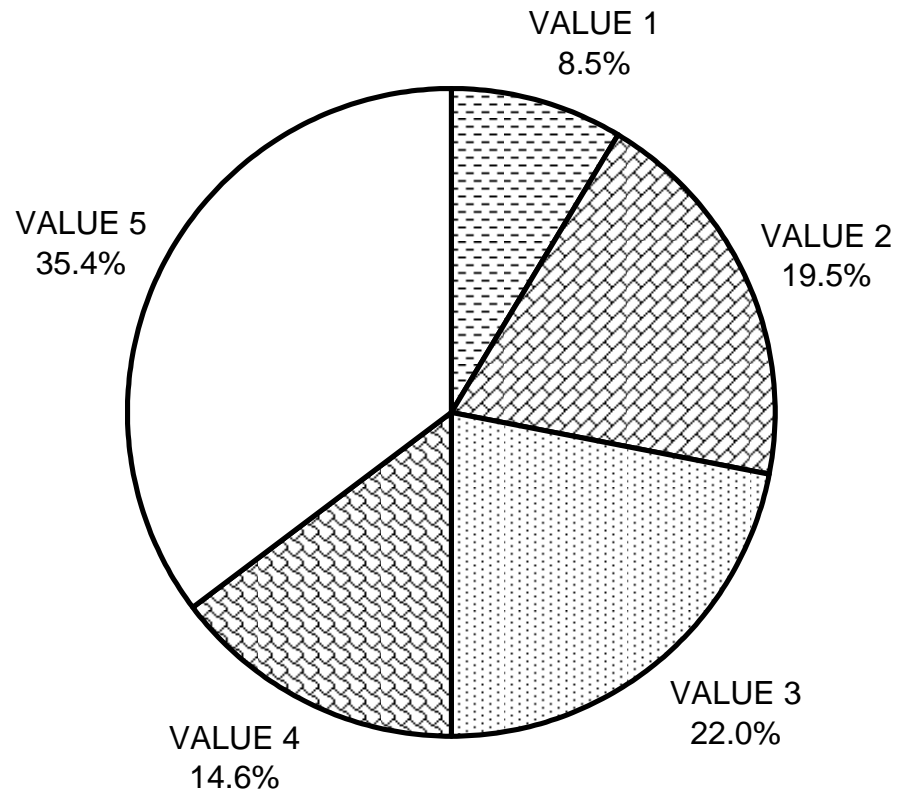
GRAPH 4

TOM BELL CREEK 2012 MAXIMUM DEPTH IN POOLS



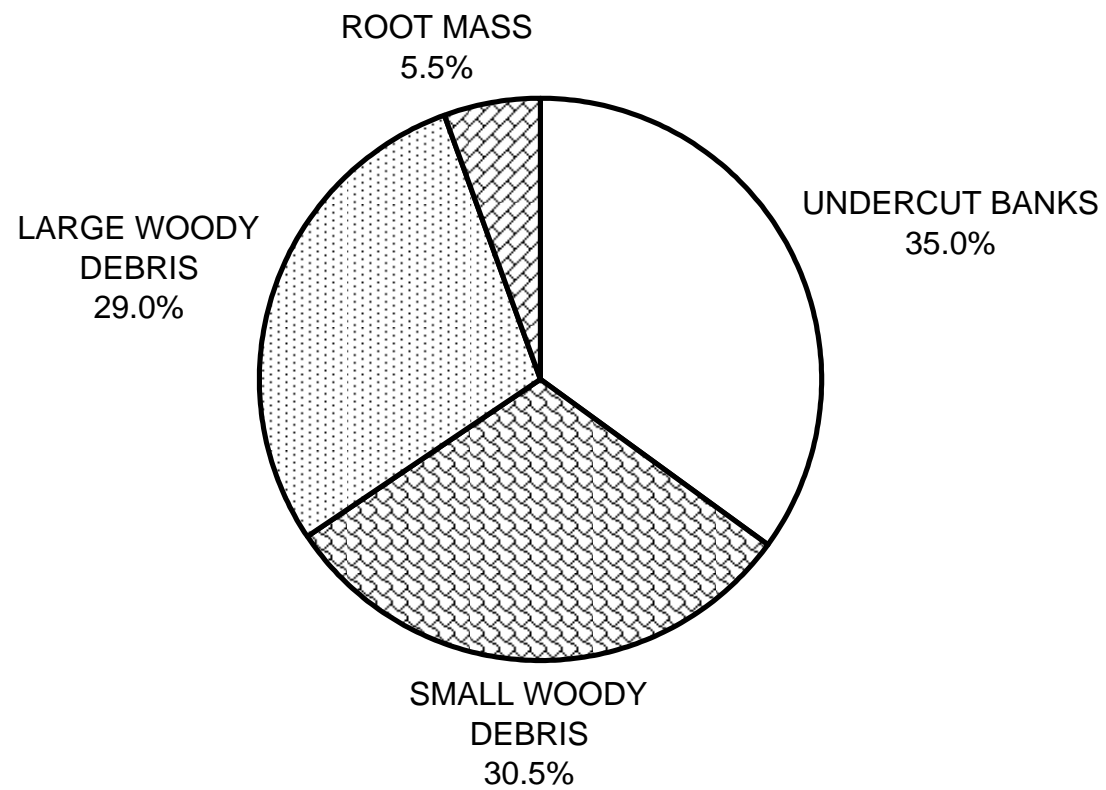
GRAPH 5

TOM BELL CREEK 2012 PERCENT EMBEDDEDNESS



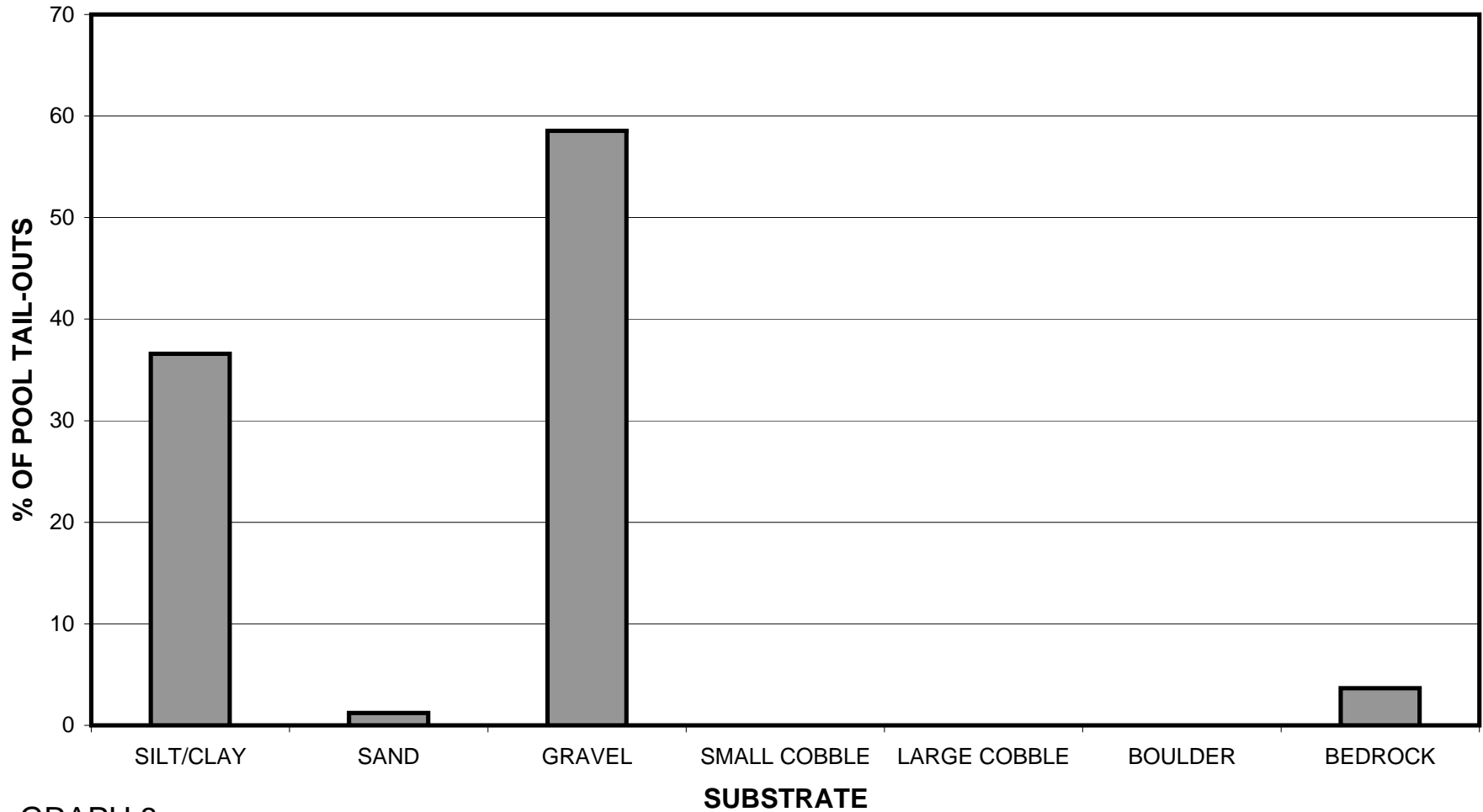
GRAPH 6

TOM BELL CREEK 2012 MEAN PERCENT COVER TYPES IN POOLS



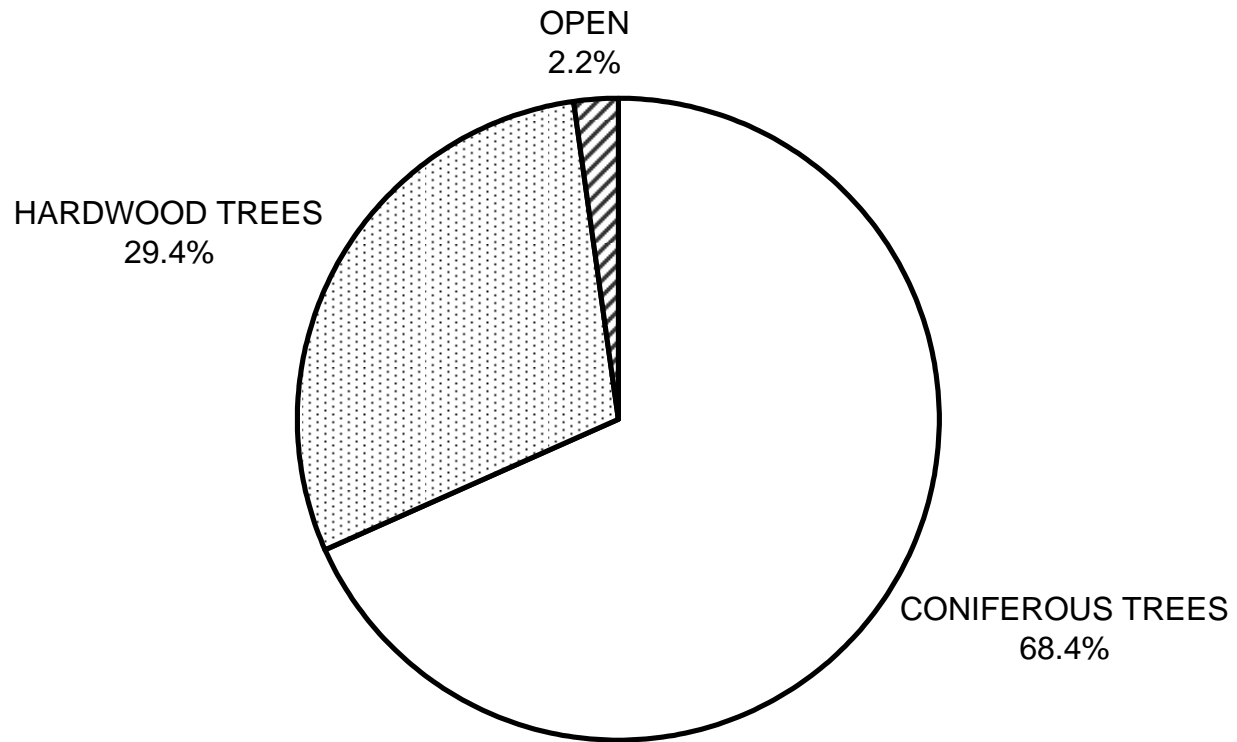
GRAPH 7

TOM BELL CREEK 2012 SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



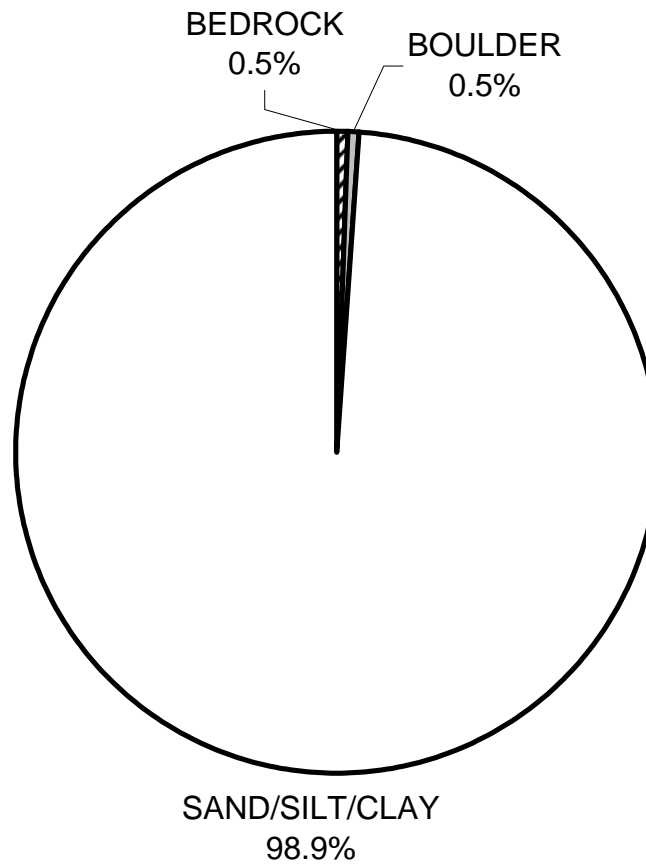
GRAPH 8

TOM BELL CREEK 2012 MEAN PERCENT CANOPY



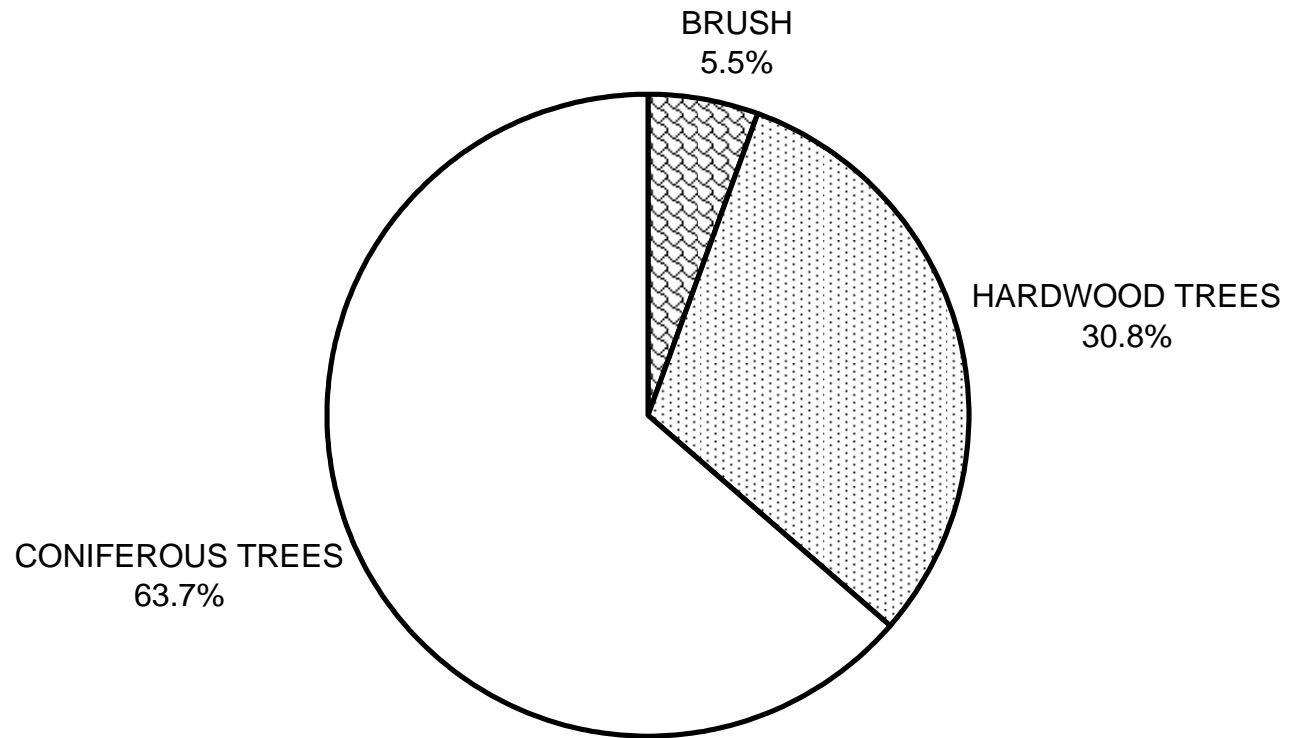
GRAPH 9

**TOM BELL CREEK 2012
DOMINANT BANK COMPOSITION IN SURVEY REACH**



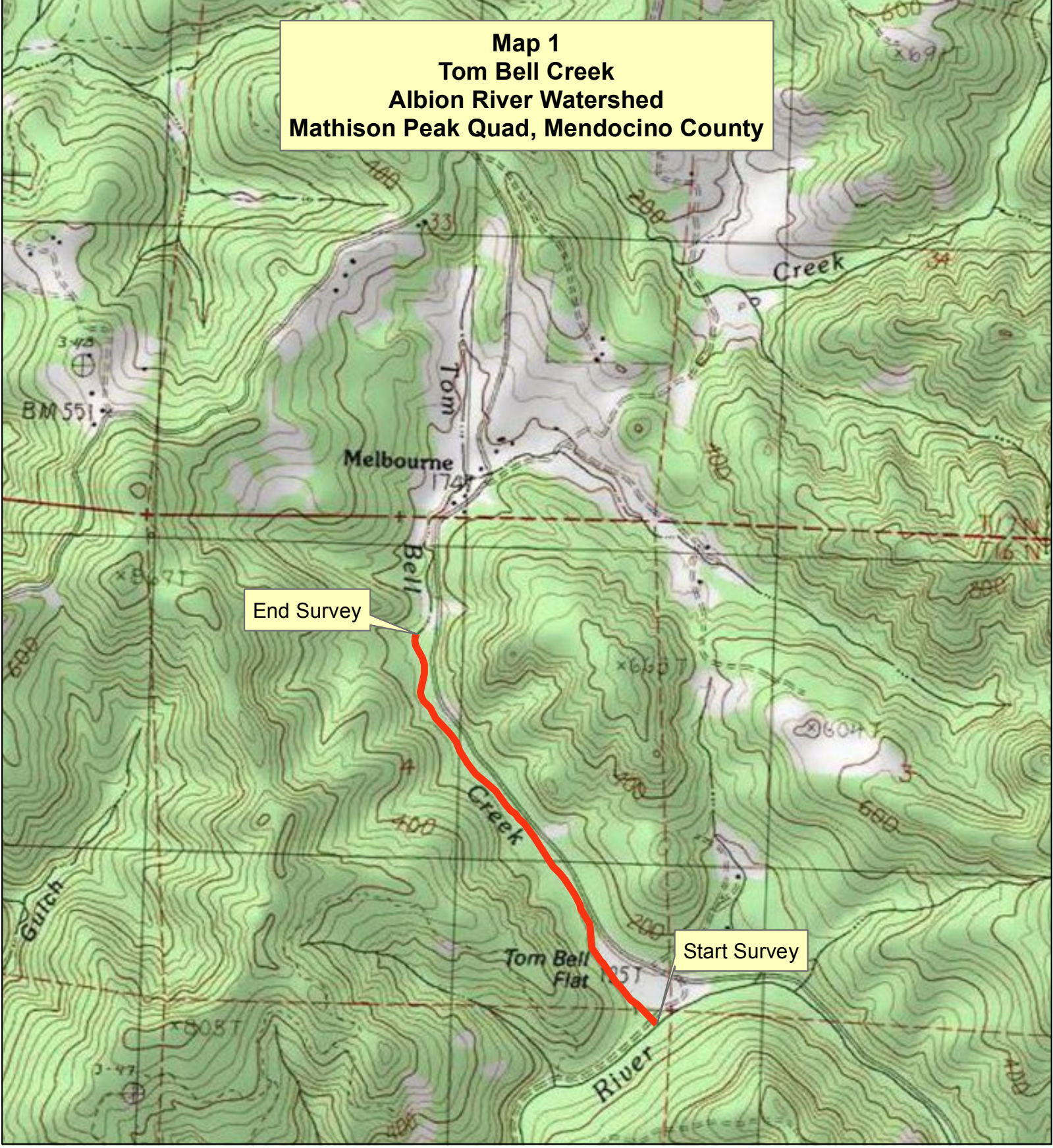
GRAPH 10

**TOM BELL CREEK 2012
DOMINANT BANK VEGETATION IN SURVEY REACH**



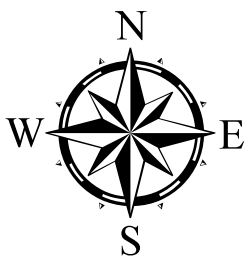
GRAPH 11

Map 1
Tom Bell Creek
Albion River Watershed
Mathison Peak Quad, Mendocino County



End Survey

Start Survey



— Channel Type E4

0 1,000 2,000 Feet

