

STREAM INVENTORY REPORT

Hazel Gulch

INTRODUCTION

A stream inventory was conducted from June 19 to June 26, 2007 on Hazel Gulch. The survey began at the confluence with Big Salmon Creek and extended upstream 2.6 miles. A stream inventory and subsection to this report was also completed for one tributary to Hazel Gulch.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Hazel Gulch.

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

Hazel Gulch is a tributary to Big Salmon Creek, which drains to the Pacific Ocean. Hazel Gulch is located in Mendocino County, California (Map 1). Hazel Gulch's legal description at the confluence with Big Salmon Creek is T16N R16W S32. Its location is 39.2033 north latitude and 123.6679 west longitude, LLID number 1236667392033. Hazel Gulch is a first order stream and has approximately 2.3 miles of blue line stream according to the USGS Elk 7.5 minute quadrangle. Hazel Gulch drains a watershed of approximately 3.4 square miles. Elevations range from about 220 feet at the mouth of the creek to 800 feet in the headwater. Redwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists off of Albion Ridge Road.

METHODS

The habitat inventory conducted in Hazel Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Pacific States Marine Fisheries Commission (PSMFC) Fisheries Technicians and Watershed Stewards Project/AmeriCorps (WSP) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). 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

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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 Hazel Gulch to record measurements and observations. There are eleven components to the inventory form.

1. Flow:

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

2. Channel Type:

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

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Hazel Gulch, embeddedness was

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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 unsuited 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 Hazel Gulch, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. 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 Hazel Gulch, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or hardwood trees.

9. Bank Composition and Vegetation:

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

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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 Game. 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 Hazel Gulch include:

- Riffle, Flatwater, Pool Habitat Types by Percent Occurrence
- Riffle, Flatwater, Pool Habitat Types by Total Length
- Total Habitat Types by Percent Occurrence
- Pool Types by Percent Occurrence
- Maximum Residual Depth in Pools

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- 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 June 19 to June 26, 2007 was conducted by C. Navarro (WSP) and M. Reneski (PSMFC). The total length of the stream surveyed was 13,982 feet with an additional 60 feet of side channel.

Stream flow was measured near the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.03 cfs on June 20, 2007.

Hazel Gulch is an F4 channel type for 3,631 feet of the stream surveyed (Reach 1), an E3 channel type for 6,457 feet of the stream surveyed (Reach 2), a G3 channel type for 1,128 feet of the stream surveyed (Reach 3), and an E3 channel type for 2,826 feet of the stream surveyed (Reach 4). F4 channel types are entrenched meandering riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. E3 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 cobble-dominant substrates. G3 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios, very stable with cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 52 to 63 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 50% pool units, 40% flatwater units, 9% riffle units and 1% dry units (Graph 1). Based on total length of Level II habitat types there were 62% flatwater units, 32% pool units, 6% riffle units and less than 1% dry units (Graph 2).

Sixteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were run units, 23%; mid-channel pool units, 20%; and step run units, 17% (Graph 3). Based on percent total length, step run units made up 34%; run units 28%; and mid-channel pool units 13%.

A total of 117 pools were identified (Table 3). Main channel pools were the most frequently encountered at 61% (Graph 4), and comprised 71% of the total length of all pools (Table 3).

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Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Fifty-four of the 117 pools (46%) had a residual depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 117 pool tail-outs measured, 9 had a value of 1 (7.7%); 32 had a value of 2 (27.4%); 35 had a value of 3 (29.9%); 33 had a value of 4 (28.2%); 8 had a value of 5 (6.8%) (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 unsuited 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 23, flatwater habitat types had a mean shelter rating of 16, and pool habitats had a mean shelter rating of 54 (Table 1). Of the pool types, backwater pools had the highest mean shelter rating of 136. Scour pools had a mean shelter rating of 63 and main channel pools had a mean shelter rating of 45 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Hazel Gulch. Graph 7 describes the pool cover in Hazel Gulch. 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 83% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 12% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Hazel Gulch was 92%. Eight 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 Hazel Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 71%. The mean percent left bank vegetated was 74%. The dominant elements composing the structure of the stream banks consisted of 94% sand/silt/clay, 3% bedrock and 3% cobble/gravel (Graph 10). Deciduous trees were the dominant vegetation type observed in 68% of the units surveyed. Additionally, 20% of the units surveyed had coniferous trees as the dominant vegetation type, 10% had brush as the dominant vegetation type and 2% had grass as the dominant vegetation type (Graph 11).

DISCUSSION

Hazel Gulch is an F4 channel type for the first 3,631 feet of stream surveyed, an E3 channel type for the next 6,457 feet, a G3 channel type for the next 1,128 feet, and an E3 channel type for the remaining 2,826 feet. The suitability of F4, E3 and G3 channel types for fish habitat

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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. E3 channel types are good for bank-placed boulders and fair for opposing wing-deflectors. G3 channel types are good for bank-placed boulders and fair for plunge weirs, opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days June 19 to June 26, 2007 ranged from 52 to 54 degrees Fahrenheit. Air temperatures ranged from 52 to 63 degrees Fahrenheit. To make any conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 62% of the total length of this survey, riffles 6%, and pools 32%. Fifty-four of the 117 (46%) pools had a maximum residual depth greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum residual depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing large wood structures that will increase or deepen pool habitat is recommended.

Forty-one of the 117 pool tail-outs measured had embeddedness ratings of 1 or 2. Sixty-eight of the pool tail-outs had embeddedness ratings of 3 or 4. Eight 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 Hazel Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One hundred eleven of the 117 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 54. The shelter rating in the flatwater habitats is 16. 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 Hazel Gulch. 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 structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 92%. Reach 1 had a canopy density of 91.8%, Reach 2 had a canopy density of 92.0%, Reach 3 had a canopy density of 90.8% and Reach 4 had a canopy density of 91.1%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 71% and 74%, respectively. In areas of stream bank erosion or where bank vegetation is sparse, planting endemic species of coniferous and hardwood trees, in conjunction with bank stabilization, is recommended.

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RECOMMENDATIONS

- 1) Hazel Gulch 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.
- 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.

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 Big Salmon Creek.
25	0002.00	Bridge #01 is an unnamed road, and is 6.6' high x 10.5' wide x 36.6' long. It is a car bridge made of metal and redwood timber and is not a barrier to salmonids.
2531	0053.00	Log debris accumulation (LDA) #01 contains 3 pieces of large woody debris (LWD) and measures 4' high x 14.5' wide x 20' long. Water flows through though there are no visible gaps. Retained sediment ranges from sand to gravel and measures 12.5' wide x 26' long x 1.5' deep.
3010	0062.00	This is the last positive identification of a coho young-of-the-year (YOY) in this survey. Until this point they have been present throughout the survey. Steelhead juveniles are still present.
5852	0108.00	Tributary #01, "Hardell Gulch", enters on the left bank. It contributes roughly 5% of the flow to Hazel Gulch. The water temperature downstream of the tributary is 51 degrees Fahrenheit, the water temperature of the tributary is 51 degrees Fahrenheit, and the water

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temperature upstream of the confluence is 52 degrees Fahrenheit. The slope of the tributary is 33% and fish are not observed in the 300 feet explored. There is a potential barrier to salmonids near the mouth.

- | | | |
|-------|---------|--|
| 6073 | 0112.00 | LDA #02 contains 8 pieces of LWD and measures 5' high x 16' wide x 20' long. Water flows through visible gaps. |
| 6526 | 0121.00 | LDA #03 contains 13 pieces of LWD and measures 7.5' high x 18' wide x 20' long. Water flows through visible gaps. Retained sediment ranges from silt to sand and measures 11' wide x 10' long x 1.5' deep. Fish are present above the LDA. |
| 7067 | 0132.00 | LDA #04 contains 2 pieces of LWD and measures 5' high x 11.5' wide x 6.5' long. Water flows through visible gaps. Retained sediment ranges from sand to gravel and measures 11.5' wide x 5' long x 2' deep. Fish are present above the LDA. |
| 7754 | 0140.00 | LDA #05 contains two pieces of LWD and measures 2' high x 15' wide x 4' long. Water flows through and there are visible gaps. Retained sediment ranges from sand to gravel and measures 8' wide x 2' long x 1.2' deep. Fish are present above the LDA. |
| 8229 | 0148.00 | Tributary #02, "West Branch Hazel Gulch" enters on the right bank. It contributes approximately 20 percent to the flow of Hazel Gulch. The water temperature downstream and upstream of the tributary is 51 degrees Fahrenheit, and the water temperature of the tributary is 52 degrees Fahrenheit. The slope of the tributary is 20%. Steelhead young of the year (YOY) are present. For further information reference the sub-section report. |
| 8457 | 0150.00 | An all terrain vehicle trail is causing erosion. |
| 9629 | 0169.00 | LDA #06 contains one piece of LWD and measures 4' high x 13' wide x 12' long. Water flows through and there are visible gaps. Retained sediment ranges from clay to gravel and measures 8' wide x 6' long x 2' deep. Fish are present above the LDA. |
| 10132 | 0178.00 | LDA #07 contains 10 pieces of LWD and measures 5' high x 9' wide x 17' long. Water flows through and there are visible gaps. Retained sediment ranges from sand to gravel and measures 4.5' wide x 9' long x 1.8' deep. Fish are present above the LDA. |
| 12620 | 0216.00 | Tributary #03 enters on the right bank. It contributes approximately one percent to the flow of Hazel Gulch. The water temperature downstream and upstream of the tributary is 54 degrees Fahrenheit, and the water temperature of the tributary is 52 degrees Fahrenheit. The slope of the |

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tributary is 10%. No fish are present. The channel is dry 50 feet upstream from the mouth.

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|-------|---------|---|
| 12696 | 0218.00 | This is the last observation of steelhead YOY and a steelhead 1+. Until now steelhead YOY have been abundant through out the survey. |
| 13362 | 0225.00 | LDA #08 contains five pieces of LWD and measures 4.2' high x 13' wide x 6.7' long. Water flows through and there are visible gaps. Retained sediment ranges from sand to gravel and measures 7' wide x 3' long x 2' deep. It is a possible barrier to juvenile and adult salmonids. Fish are not present above the LDA. |
| 13685 | 0229.00 | LDA #09 contains nine pieces of LWD and measures 5' high x 11.5' wide x 24.5' long. Water flows through and there are visible gaps. Retained sediment ranges from sand to cobble and measures 8' wide x 35' long x 3' deep. It is a possible barrier to juvenile and adult salmonids. Fish are not present above the LDA. |
| 13753 | 0230.00 | LDA #10 contains four pieces of LWD and measures 4' high x 15' wide x 16' long. Water does not flow through and there are no visible gaps. Retained sediment ranges from silt to gravel and measures 18' wide x 17' long x 3' deep. It is a possible barrier to juvenile and adult salmonids. Fish are not present above the LDA. |
| 13982 | 0233.00 | End of Survey. |

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: Hazel Gulch

LLID: 1236667392033 Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

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
2	0	DRY	0.9	26	53	0.4									
94	16	FLATWATER	40.0	93	8697	61.9	9.8	0.5	1.1	591	55554	364	34209		16
117	117	POOL	49.8	38	4438	31.6	11.3	1.2	2.0	361	42277	508	59444	426	54
22	7	RIFFLE	9.4	39	854	6.1	11.8	0.4	0.8	381	8373	134	2944		23
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)			Total Volume (cu.ft.)		
235	140				14042					106204			96597		

Table 2 - Summary of Habitat Types and Measured Parameters

Stream Name: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

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 (%)
18	3	LGR	7.7	32	584	4.2	11	0.3	0.8	140	2511	46	825		27	92
1	1	CAS	0.4	55	55	0.4	11	0.4	0.8	121	121	48	48		5	98
3	3	BRS	1.3	72	215	1.5	13	0.4	1.3	708	2125	250	751		28	96
55	9	RUN	23.4	71	3914	27.9	9	0.5	4	444	24435	308	16954		17	90
39	7	SRN	16.6	123	4783	34.1	10	0.5	1.3	780	30406	436	16985		16	92
48	48	MCP	20.4	37	1798	12.8	10	1.2	3.9	352	16900	499	23948	426	41	92
9	9	CCP	3.8	31	277	2.0	12	1.2	2.9	325	2927	436	3927	378	37	87
14	14	STP	6.0	76	1063	7.6	11	1.0	3.4	606	8491	755	10566	582	65	94
4	4	CRP	1.7	24	98	0.7	12	1.4	2.7	198	793	325	1300	291	24	90
26	26	LSL	11.1	29	746	5.3	12	1.2	4.2	307	7984	470	12210	395	81	91
4	4	LSR	1.7	29	115	0.8	10	1.1	2	250	1001	315	1262	265	75	92
7	7	LSBk	3.0	30	208	1.5	13	1.2	2.8	379	2650	562	3936	483	18	93
1	1	PLP	0.4	18	18	0.1	16	0.7	1.8	265	265	371	371	186	10	92
3	3	BPL	1.3	33	98	0.7	12	1.4	3.3	379	1137	577	1731	521	152	95
1	1	DPL	0.4	17	17	0.1	8	1.3	2.7	129	129	194	194	168	90	98
2	0	DRY	0.9	26	53	0.4										84

Total Units
235

Total Units Fully Measured
140

Total Length (ft.)
14042

Total Area (sq.ft.)
101875

Total Volume (cu.ft.)
95006

Table 3 - Summary of Pool Types

Stream Name: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

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
71	71	MAIN	61	44	3138	71	10.7	1.1	399	28317	451	32023	45
42	42	SCOUR	36	28	1185	27	12.3	1.2	302	12694	382	16047	63
4	4	BACKWATER	3	29	115	3	11.3	1.4	317	1267	432	1730	136
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
117	117				4438					42277		49800	

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

Stream Name: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

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
48	MCP	41	1	2	23	48	20	42	4	8	0	0
9	CCP	8	0	0	5	56	4	44	0	0	0	0
14	STP	12	0	0	9	64	3	21	2	14	0	0
4	CRP	3	0	0	1	25	3	75	0	0	0	0
26	LSL	22	0	0	15	58	8	31	2	8	1	4
4	LSR	3	0	0	3	75	1	25	0	0	0	0
7	LSBk	6	1	14	3	43	3	43	0	0	0	0
1	PLP	1	0	0	1	100	0	0	0	0	0	0
3	BPL	3	0	0	1	33	1	33	1	33	0	0
1	DPL	1	0	0	0	0	1	100	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
117			2	2	61	52	44	38	9	8	1	1

Mean Maximum Residual Pool Depth (ft.): 2

Table 5 - Summary of Mean Percent Cover By Habitat Type

Stream Name: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Dry Units: 2

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

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
18	3	LGR	0	35	7	0	25	0	0	33	0
1	1	CAS	0	0	0	0	0	0	0	0	100
3	2	BRS	18	38	15	25	0	0	5	0	0
22	6	TOTAL RIFFLE	6	30	8	8	13	0	2	17	17
55	9	RUN	14	63	11	0	1	0	0	11	0
39	7	SRN	9	41	4	0	20	0	0	24	2
94	16	TOTAL FLAT	12	54	8	0	9	0	0	17	1
48	48	MCP	25	48	19	2	1	0	0	2	2
9	9	CCP	39	29	13	8	7	0	0	0	2
14	14	STP	20	23	27	7	2	0	0	8	14
4	4	CRP	28	47	25	0	0	0	0	0	0
26	26	LSL	14	32	52	0	1	0	0	1	0
4	4	LSR	25	14	11	50	0	0	0	0	0
7	7	LSBk	39	28	10	0	2	0	0	15	6
1	1	PLP	15	20	65	0	0	0	0	0	0
3	3	BPL	17	40	42	0	2	0	0	0	0
1	1	DPL	20	50	30	0	0	0	0	0	0
117	117	TOTAL POOL	24	37	27	4	2	0	0	3	3
235	139	TOTAL	21	39	24	4	3	0	0	5	3

Table 6 - Summary of Dominant Substrates By Habitat Type

Stream Name: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Dry Units: 2

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

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
18	17	LGR	0	0	53	29	18	0	0
1	1	CAS	0	0	0	0	0	0	100
3	3	BRS	0	0	0	0	0	0	100
55	54	RUN	2	11	72	2	2	2	9
39	38	SRN	0	0	61	21	13	0	5
48	48	MCP	2	40	42	2	0	0	15
9	9	CCP	0	11	78	0	0	0	11
14	14	STP	0	21	29	14	7	14	14
4	4	CRP	0	25	75	0	0	0	0
26	26	LSL	0	35	46	8	8	0	4
4	4	LSR	0	50	50	0	0	0	0
7	7	LSBk	0	0	29	29	14	14	14
1	1	PLP	0	0	100	0	0	0	0
3	3	BPL	0	67	33	0	0	0	0
1	1	DPL	0	100	0	0	0	0	0

Table 7 - Summary of Mean Percent Canopy for Entire Stream

Stream Name: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
92	70	30	0	71	74

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: Hazel Gulch LLID: 1236667392033 Drainage: Albion River
 Survey Dates: 6/19/2007 to 6/26/2007 Survey Length (ft.): 14042 Main Channel (ft.): 13982 Side Channel (ft.): 60
 Confluence Location: Quad: ELK Legal Description: T16NR16WS32 Latitude: 39:12:12.0N Longitude: 123:40:00.0W

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 1

Channel Type: F4	Canopy Density (%): 91.8	Pools by Stream Length (%): 32.9
Reach Length (ft.): 3631	Coniferous Component (%): 62.6	Pool Frequency (%): 53.5
Riffle/Flatwater Mean Width (ft.): 10.3	Hardwood Component (%): 37.4	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 53
Range (ft.): 12 to 19	Vegetative Cover (%): 62.3	2 to 2.9 Feet Deep: 45
Mean (ft.): 16	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 3
Std. Dev.: 3	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 16	Mean Max Residual Pool Depth (ft.): 2.0
Water (F): 52 - 54 Air (F): 52 - 58	LWD per 100 ft.:	Mean Pool Shelter Rating: 62
Dry Channel (ft): 0	Riffles: 0	
	Pools: 3	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 100 Sm Cobble: 0 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 15.8 2. 28.9 3. 31.6 4. 23.7 5. 0.0		

STREAM REACH: 2

Channel Type: E3	Canopy Density (%): 92.0	Pools by Stream Length (%): 29.1
Reach Length (ft.): 6457	Coniferous Component (%): 68.0	Pool Frequency (%): 49.0
Riffle/Flatwater Mean Width (ft.): 11.0	Hardwood Component (%): 32.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 51
Range (ft.): 10 to 18	Vegetative Cover (%): 77.8	2 to 2.9 Feet Deep: 37
Mean (ft.): 13	Dominant Shelter: Large Woody Debris	3 to 3.9 Feet Deep: 10
Std. Dev.: 2	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 2
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 32	Mean Max Residual Pool Depth (ft.): 2.1
Water (F): 52 - 54 Air (F): 53 - 63	LWD per 100 ft.:	Mean Pool Shelter Rating: 54
Dry Channel (ft): 0	Riffles: 1	
	Pools: 4	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 2 Gravel: 80 Sm Cobble: 8 Lg Cobble: 0 Boulder: 0 Bedrock: 10		
Embeddedness Values (%): 1. 2.0 2. 25.5 3. 23.5 4. 35.3 5. 13.7		

Summary of Fish Habitat Elements By Stream Reach

STREAM REACH: 3

Channel Type: G3	Canopy Density (%): 90.8	Pools by Stream Length (%): 25.6
Reach Length (ft.): 1068	Coniferous Component (%): 80.0	Pool Frequency (%): 45.0
Riffle/Flatwater Mean Width (ft.): 12.0	Hardwood Component (%): 20.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 89
Range (ft.): 15 to 16	Vegetative Cover (%): 86.5	2 to 2.9 Feet Deep: 0
Mean (ft.): 15	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 11
Std. Dev.: 1	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 27	Mean Max Residual Pool Depth (ft.): 1.8
Water (F): 53 - 53 Air (F): 63 - 63	LWD per 100 ft.:	Mean Pool Shelter Rating: 60
Dry Channel (ft): 34	Riffles: 0	
	Pools: 4	
	Flat: 2	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 56 Sm Cobble: 44 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 11.1 2. 55.6 3. 22.2 4. 0.0 5. 11.1		

STREAM REACH: 4

Channel Type: E3	Canopy Density (%): 91.1	Pools by Stream Length (%): 38.0
Reach Length (ft.): 2826	Coniferous Component (%): 81.1	Pool Frequency (%): 47.5
Riffle/Flatwater Mean Width (ft.): 9.9	Hardwood Component (%): 18.9	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 47
Range (ft.): 14 to 25	Vegetative Cover (%): 75.2	2 to 2.9 Feet Deep: 42
Mean (ft.): 17	Dominant Shelter: Boulders	3 to 3.9 Feet Deep: 11
Std. Dev.: 4	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0
Base Flow (cfs.): 0.0	Occurrence of LWD (%): 20	Mean Max Residual Pool Depth (ft.): 2.0
Water (F): 53 - 54 Air (F): 59 - 63	LWD per 100 ft.:	Mean Pool Shelter Rating: 39
Dry Channel (ft): 19	Riffles: 1	
	Pools: 4	
	Flat: 1	
Pool Tail Substrate (%): Silt/Clay: 0 Sand: 0 Gravel: 68 Sm Cobble: 32 Lg Cobble: 0 Boulder: 0 Bedrock: 0		
Embeddedness Values (%): 1. 5.3 2. 15.8 3. 47.4 4. 31.6 5. 0.0		

Table 9 - Mean Percentage of Dominant Substrate and Vegetation

Stream Name: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Confluence Location: Quad: ELK

Legal Description: T16NR16WS32

Latitude: 39:12:12.0N

Longitude: 123:40:00.0W

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	3	5	2.8
Boulder	0	0	0.0
Cobble / Gravel	5	4	3.1
Sand / Silt / Clay	136	135	94.1

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	2	3	1.7
Brush	6	23	10.1
Hardwood Trees	107	88	67.7
Coniferous Trees	28	30	20.1
No Vegetation	1	0	0.3

Total Stream Cobble Embeddedness Values: 3

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

StreamName: Hazel Gulch

LLID: 1236667392033

Drainage: Albion River

Survey Dates: 6/19/2007 to 6/26/2007

Confluence Location: Quad: ELK

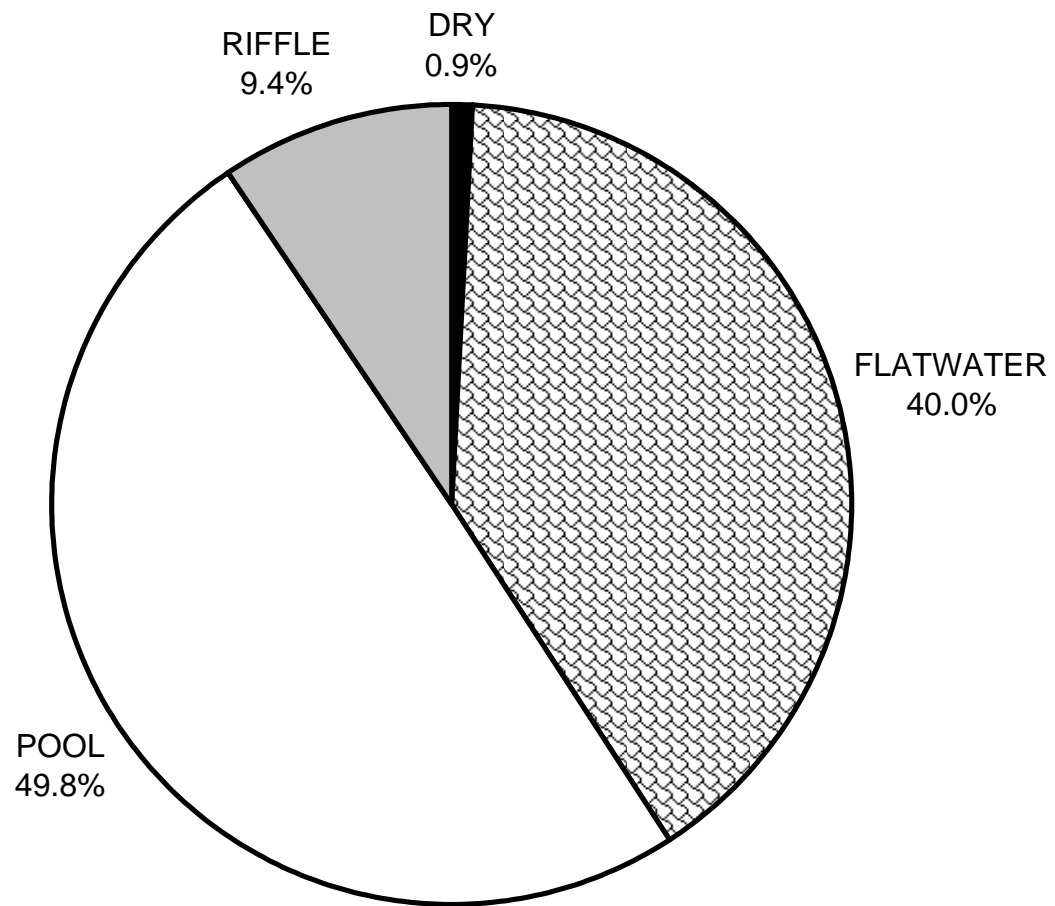
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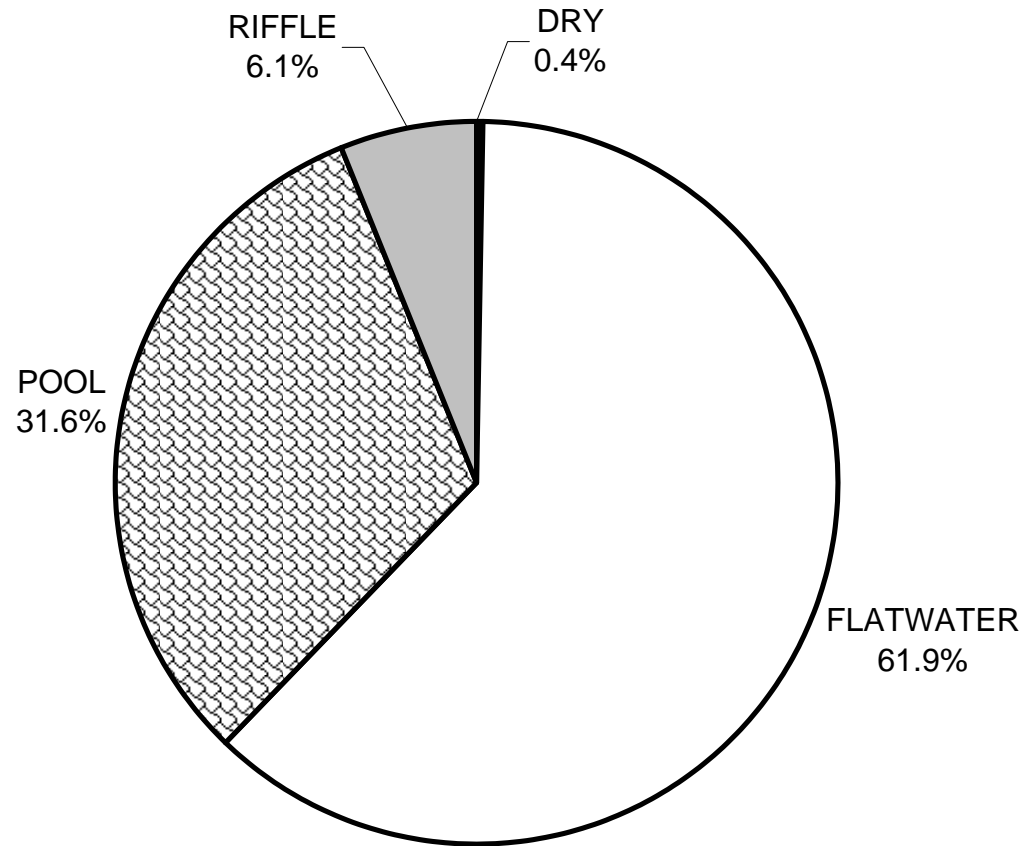
	Riffles	Flatwater	Pools
UNDERCUT BANKS (%)	6	12	24
SMALL WOODY DEBRIS (%)	30	54	37
LARGE WOODY DEBRIS (%)	8	8	27
ROOT MASS (%)	8	0	4
TERRESTRIAL VEGETATION (%)	13	9	2
AQUATIC VEGETATION (%)	0	0	0
WHITEWATER (%)	2	0	0
BOULDERS (%)	17	17	3
BEDROCK LEDGES (%)	17	1	3

HAZEL GULCH 2007 HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

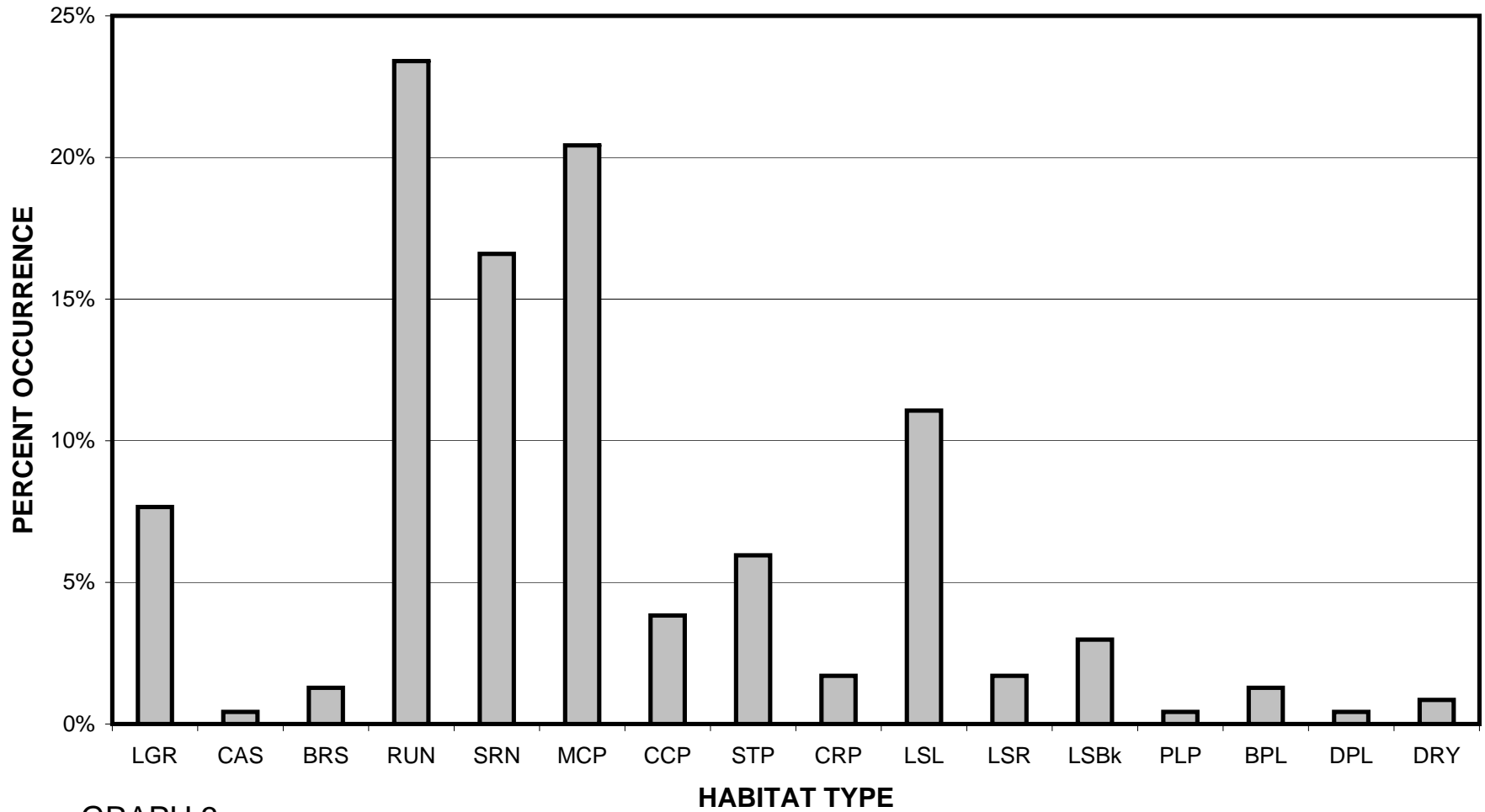
HAZEL GULCH 2007 HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

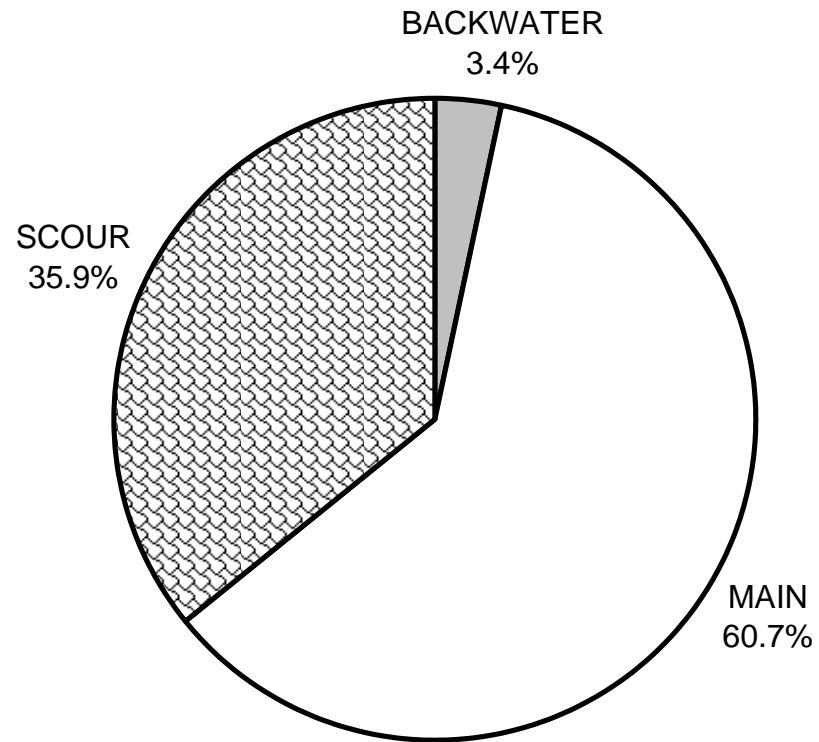
HAZEL GULCH 2007

HABITAT TYPES BY PERCENT OCCURRENCE



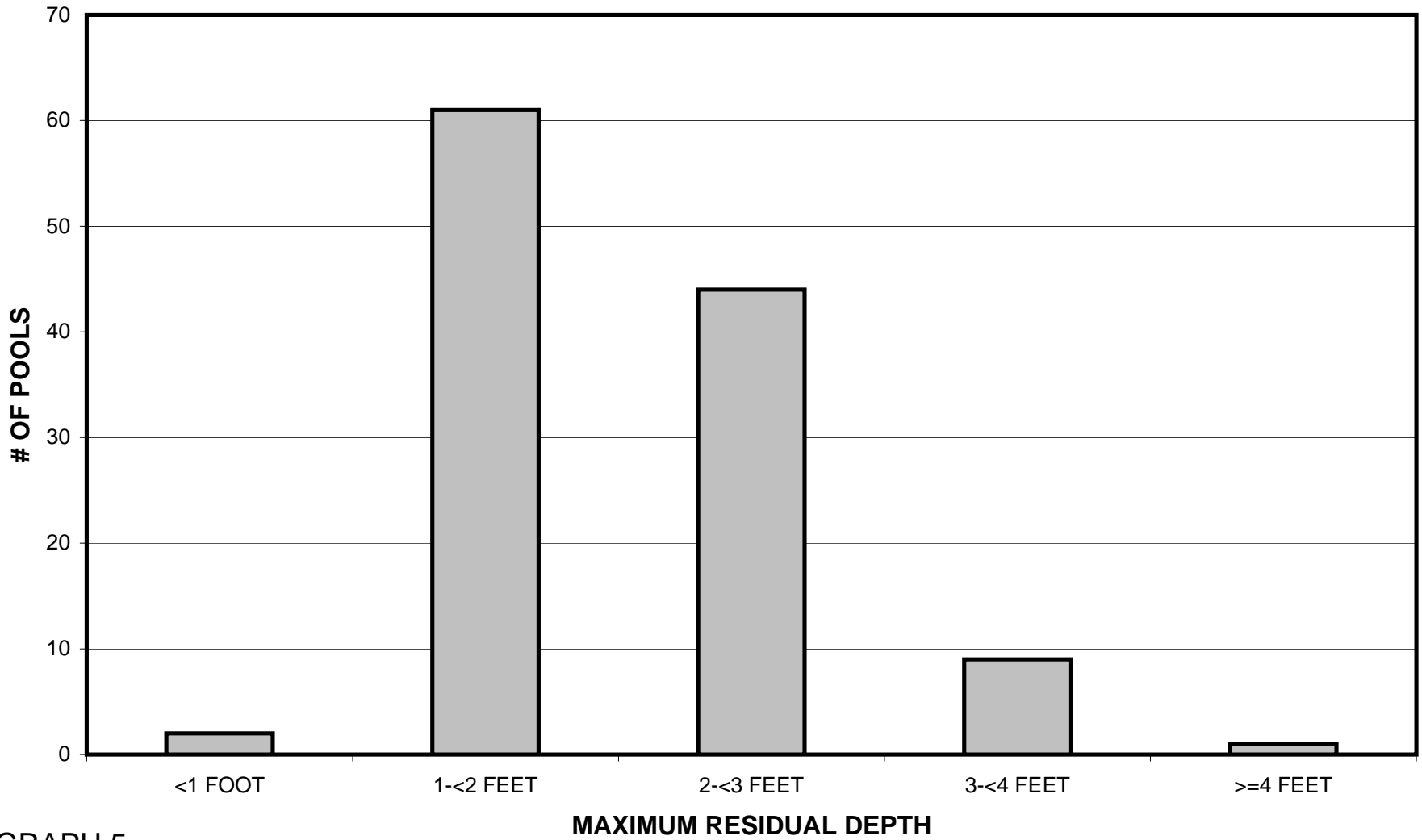
GRAPH 3

HAZEL GULCH 2007 POOL TYPES BY PERCENT OCCURRENCE



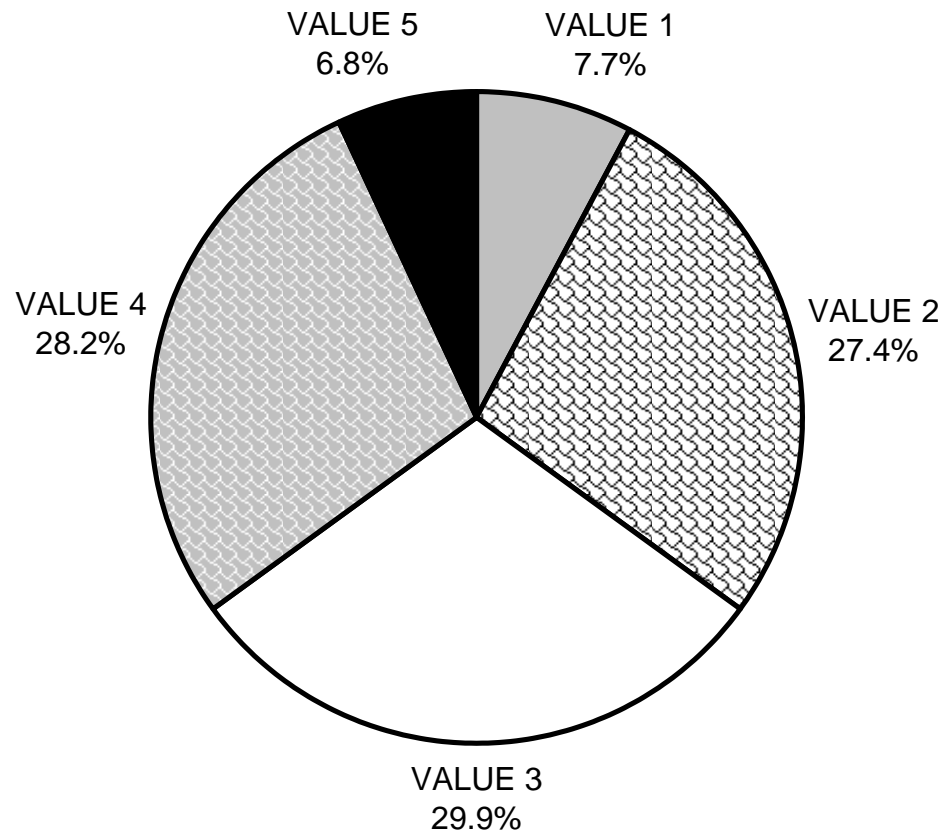
GRAPH 4

HAZEL GULCH 2007 MAXIMUM DEPTH IN POOLS



GRAPH 5

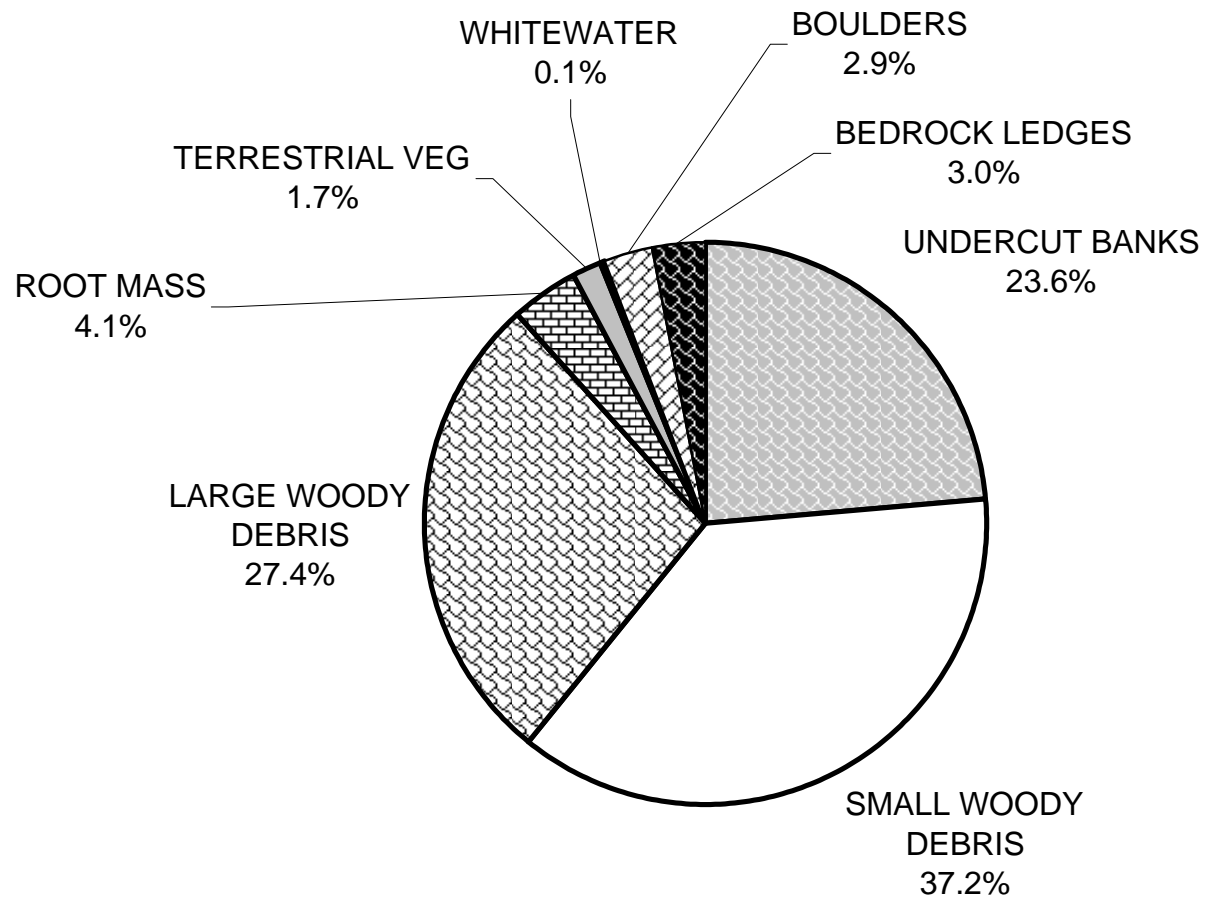
HAZEL GULCH 2007 PERCENT EMBEDDEDNESS



GRAPH 6

HAZEL GULCH 2007

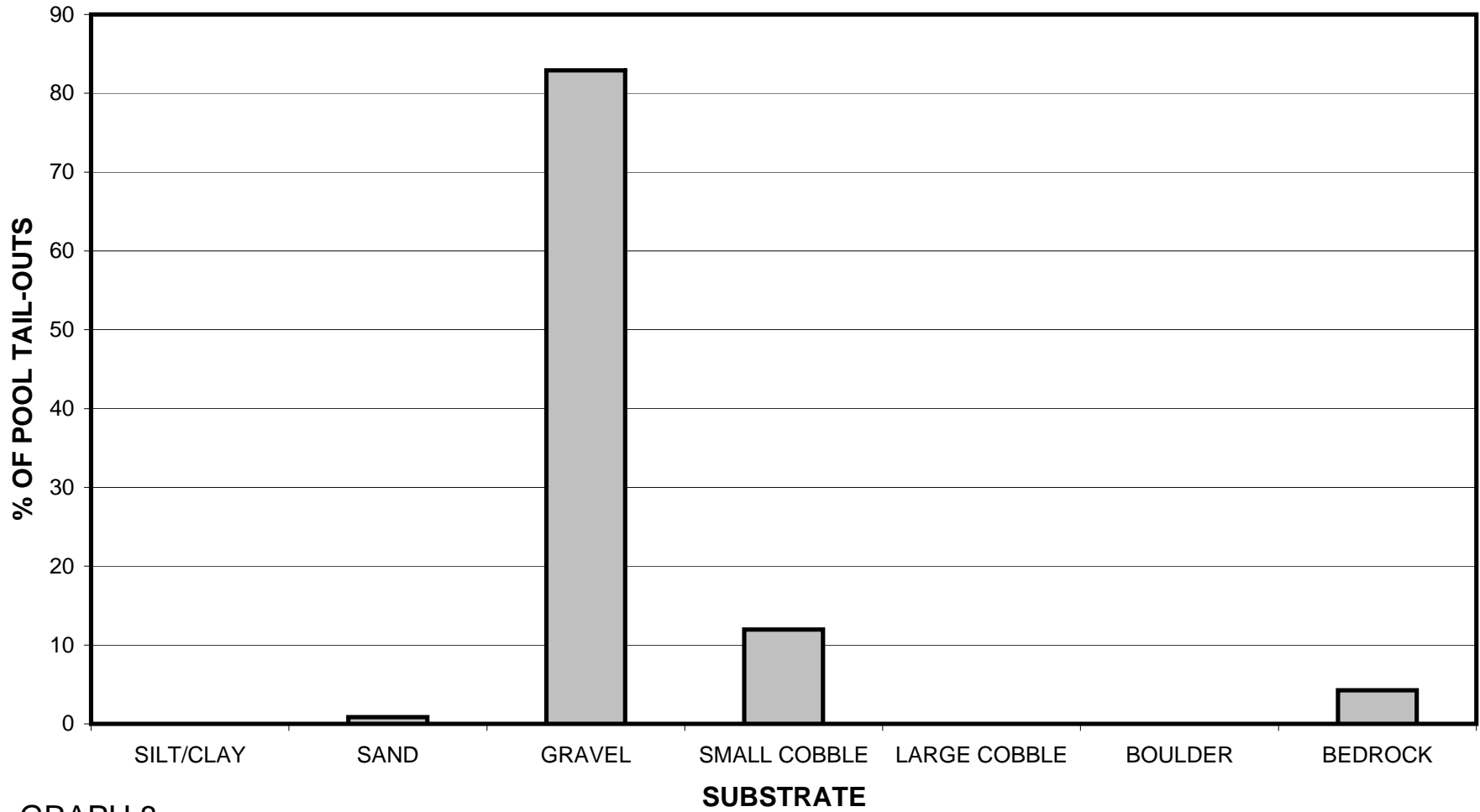
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

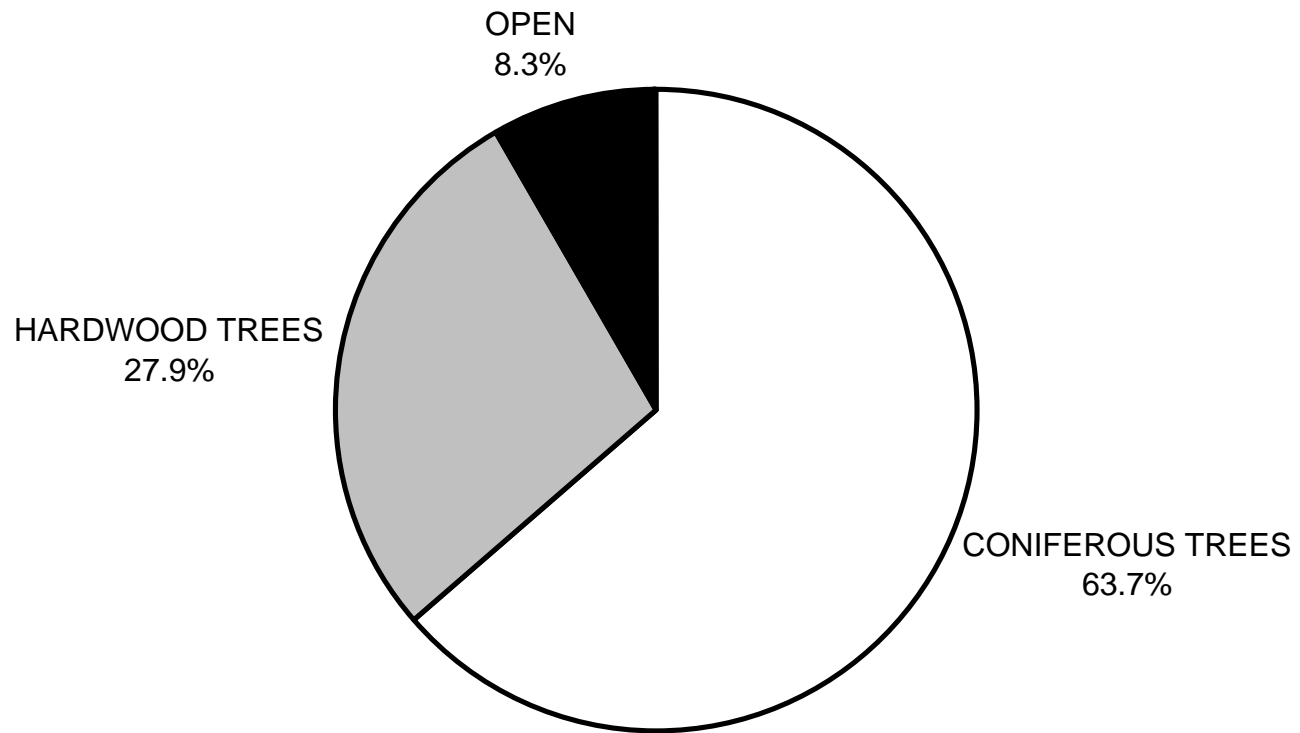
HAZEL GULCH 2007

SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



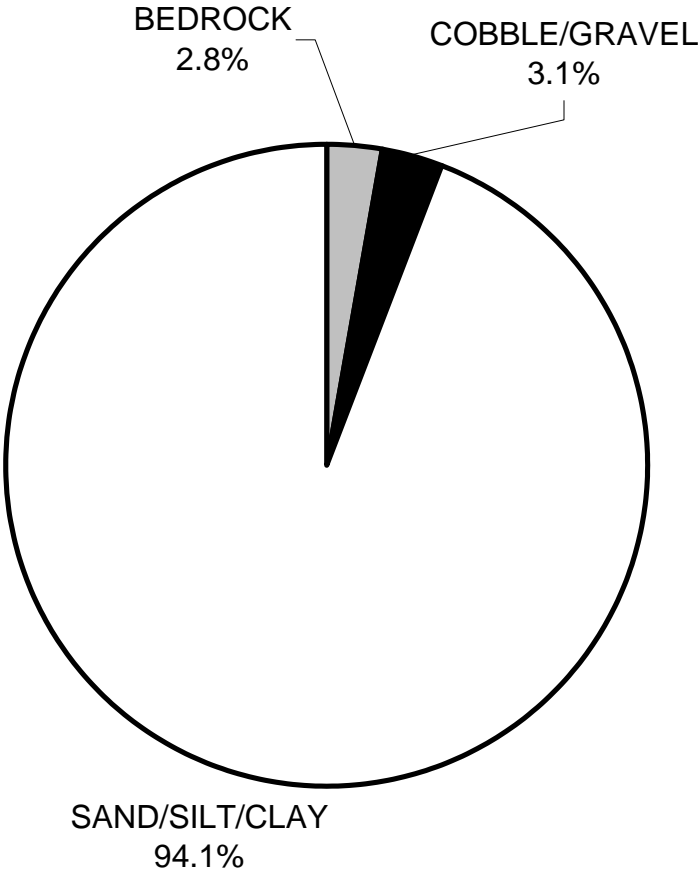
GRAPH 8

**HAZEL GULCH 2007
MEAN PERCENT CANOPY**



GRAPH 9

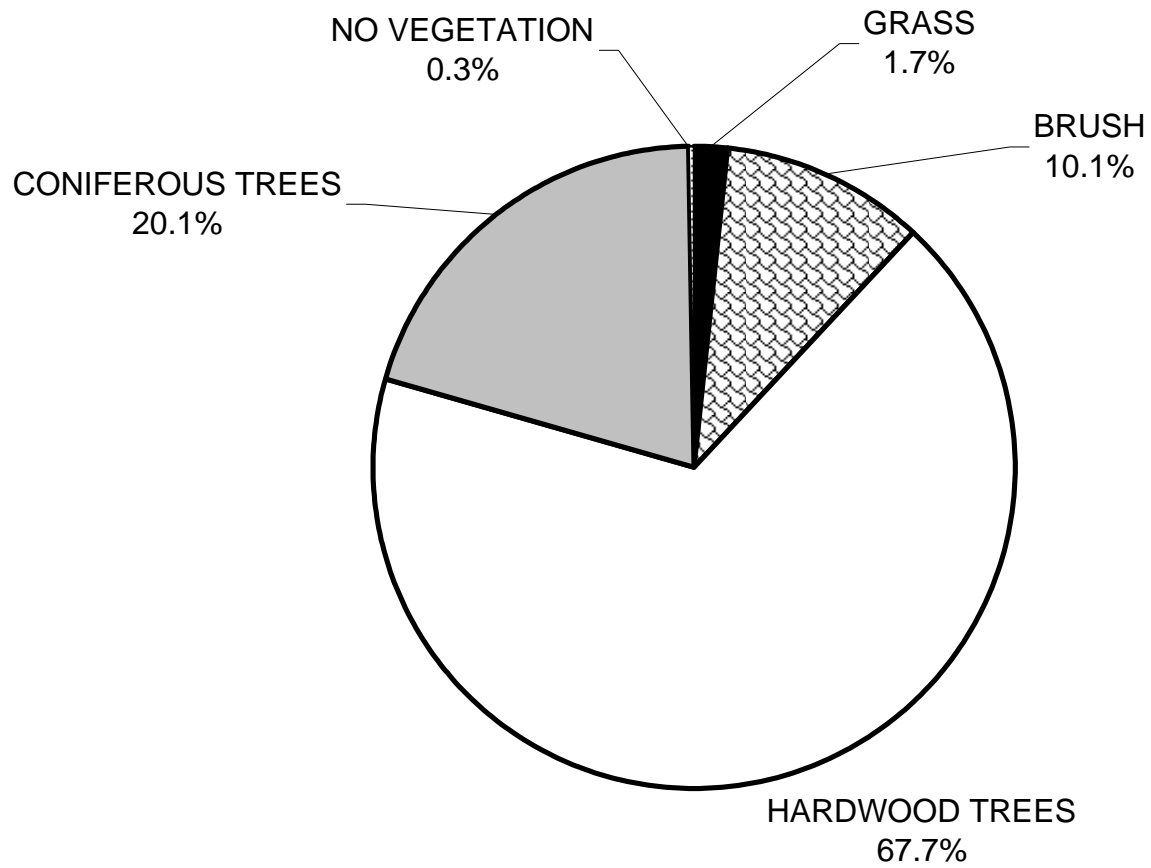
**HAZEL GULCH 2007
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

HAZEL GULCH 2007

DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11

