STREAM INVENTORY REPORT

WOLVERTON GULCH, 1997

INTRODUCTION

A stream inventory was conducted during the summer of 1997 on Wolverton Gulch. The survey began at the culvert on Highway 36 due to lack of access across private property downstream. Highway 36 is approximately 3,000' above the stream's mouth. The 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 Wolverton Gulch. The objective of the biological inventory was to document the presence and distribution of juvenile salmonids.

The objective of this report is to document the current habitat conditions, and recommend options for the potential enhancement of habitat for chinook salmon, 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

Wolverton Gulch is tributary to Barber Creek, tributary to the Van Duzen River, tributary to the Eel River, located in Humboldt County, California. Wolverton Gulch's legal description at the confluence with Barber Creek is T2N R1E S19. Its location is 40°32'18" North latitude and 124°06'39" West longitude. Wolverton Gulch is a first order stream and has approximately 3.7 miles of blue line stream according to the USGS Hydesville 7.5 minute quadrangle. Wolverton Gulch drains a watershed of approximately 2.8 square miles. Elevations range from about 40 feet at the mouth of the creek to 1000 feet in the headwater areas. Redwood forest and grassland dominate the watershed. The watershed is primarily held in private ownership. Vehicle access exists via Hwy 36 and also on Rohnerville Road west of Hydesville.

METHODS

The habitat inventory conducted in Wolverton Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi and Reynolds, 1991 rev. 1994). The California Conservation Corps (CCC) Technical Advisors and AmeriCorps Watershed Stewards Project/ (WSP/AmeriCorps) 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 (Hopelain, 1994). 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, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further 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 Wolverton Gulch to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using standard flow measuring equipment, if available. In some cases flows are estimated.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 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.

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 (1988). 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". Wolverton 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. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Wolverton Gulch, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size,

having a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide 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. 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 Wolverton 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 Wolverton 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 deciduous 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 Wolverton 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 was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Wolverton Gulch fish presence was observed from the stream banks, and three sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85 mm)(Valentine, 1995).

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

Graphics are produced from the tables using Quattro Pro. Graphics developed for Wolverton Gulch include:

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in the pool tail outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of October 27, 28, and 30, 1997, was conducted by Jesse Robertson, Stewart McMorrow and Kelley Turner (AmeriCorps WSP). The total length of the stream surveyed was 12,981 feet with an additional 316 feet of side channel.

Flows were not measured on Wolverton Gulch.

Wolverton Gulch is an F4 channel type for the entire 13,297 feet of stream reach surveyed. F4 channels 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 48 to 55 degrees Fahrenheit. Air temperatures ranged from 52 to 70 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 11% riffle units, 40% flatwater units, and 47% pool units (Graph 1). Based on total length of Level II habitat types there were 4% riffle units, 64% flatwater units, and 30% pool units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step runs, 31%; main channel pools, 24%; and corner pools, 16% (Graph 3). Based on percent total length, step runs made up 57%, main channel pools 14%, and corner pools 16%.

A total of 111 pools were identified (Table 3). Main channel pools were most frequently encountered at 52% and comprised 47% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Thirty-five of the 111 pools (32%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 110 pool tail-outs measured, zero had a value of 1 (0.0%); nine had a value of 2 (8%); thirty-seven had a value of 3 (34.0%); fifty-six had a value of 4 (51.0%) and eight had a value of 5 (7.0%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning. In Wolverton Gulch, six of the eight pool tail-outs which had a five value had substrate composed of sand which was too small to be suitable for successful spawning. The other three were unsuitable for spawning due to the tail-outs being comprised of large boulder or bedrock.

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 13, flatwater habitat types had a mean shelter rating of 18, and pool habitats had a mean shelter rating of 25 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 28. Scour pools had a mean shelter rating of 26 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Terrestrial vegetation is the dominant cover type in Wolverton Gulch. Large and small woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Wolverton Gulch.

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 101 of the 110 pool tail outs measured (92%). Sand was the next most frequently observed dominant substrate type and occurred in 4% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 89%. The mean

percentages of deciduous and coniferous trees were 92% and 8%, respectively. Graph 9 describes the canopy in Wolverton Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 77.6%. The mean percent left bank vegetated was 80%. The dominant elements composing the structure of the stream banks consisted of 4.7% bedrock, 20.9% cobble/gravel, and 74.4% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 57% of the units surveyed. Additionally, 29.1% of the units surveyed had brush as the dominant vegetation type, and 3.5% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Two sites were electrofished on May 8, 1997, in Wolverton Gulch. The sites were sampled by Ruth Goodfield and Jesse Robertson (DFG/AmeriCorps).

The first site sampled included habitat units 104-106, a low gradient riffle, main channel pool and glide located just downstream from the Rohnerville Road culvert. The site had an area of 488 sq ft and a volume of 240 cu ft. The site yielded four 1+ steelhead rainbow trout.

The second site sampled included habitat units 121-123, a run, main channel pool and low gradient riffle located approximately 500 feet upstream from the Rohnerville Road culvert. The site had an area of 800 sq ft and a volume of 400 cu ft. The site yielded six 1+ steelhead rainbow trout and one 2+ steelhead rainbow trout.

Four sites were electrofished on November 3, 1997, in Wolverton Gulch. The sites were sampled by Ruth Goodfield, Jesse Robertson, Stewart McMorrow and Kelley Turner (DFG/AmeriCorps).

The first site sampled included habitat units downstream of Highway 36 below the start of the survey, approximately thirty feet from 355 Riverbar road. This site had an area of 530 sq ft and a volume of 265 cu ft. The site yielded eight 3-spined stickleback, one steelhead young of the year (YOY), and one frog.

The second site included habitat unit 71, a step run located approximately 3839 feet above the creek mouth. This site had an area of 438 sq ft and a volume of 219 cu ft. The site yielded one steelhead trout YOY, seven 3-spined sticklebacks, two pacific giant salamanders and five Pacific lamprey ammocoetes.

The third site sampled included habitat units 189, a main channel pool located approximately 10,462 feet above the creek mouth. The site had an area of 402 sq ft and a volume of 241 cu ft. The site yielded three, 3-spined sticklebacks and one steelhead rainbow trout 6.5mm fork length.

The fourth site sampled was above the end of the survey, a step run located approximately 13062 feet above the creek mouth. The site had an area of 588 sq ft and a volume of 353 cu ft. The site yielded one pacific giant salamander.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Wolverton Gulch.

DISCUSSION

Wolverton Gulch is a F4 channel type for the entire 13,297 feet of stream surveyed. F4 channel types are suitable for some fish habitat improvement structures. They are good for bank-placed boulders, and fair for plunge weirs, single and opposing wing deflectors, channel constrictors, and log cover. They are poor for boulder clusters.

The water temperatures recorded on the survey days October 27, 28 and 30, 1997, ranged from 48 to 55 degrees Fahrenheit. Air temperatures ranged from 52 to 70 degrees Fahrenheit. This is a good water temperature range for salmonids and Wolverton Gulch seems to have temperatures favorable to salmonids. To make any further 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 64% of the total length of this survey, riffles 4%, and pools 30%. The pools are relatively shallow, with only 35 of the 111 (32%) pools having a maximum 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 depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width.

Installing structures that will increase or deepen pool habitat is recommended for locations where their installation will not be threatened by high stream energy, or where their installation will not conflict with the modification of the numerous log debris accumulations (LDA's) in the stream. The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

None of the 110 pool tail-outs measured had an embeddedness rating of 1. Nine rated two, and ninety-three of them had embeddedness ratings of 3 or 4. Eight of the pool tail-outs had a rating of 5 and were 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. In Wolverton Gulch, sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was low with a rating of 25. The shelter rating in the flatwater habitats was slightly lower at 18. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by terrestrial vegetation in all habitat types. Additionally, roots contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats are needed to improve 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.

101 of the 110 pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 89%. This is a relatively moderate percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 77.6% and 80%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Wolverton Gulch should be managed as an anadromous, natural production stream.

2) Inventory and map sources of stream bank erosion and prioritize them according to present and potential sediment yield. Identified sites should then be treated to reduce the amount of fine sediments entering the stream.

3) 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.

4) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from terrestrial vegetation. Adding high quality complexity with woody cover is desirable.

5) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

6) 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 warm temperature period should be performed for 3 to 5 years.

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

8) There are several log debris accumulations present on Wolverton Gulch. Some are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

9) There are sections where the stream is being impacted from stock trampling the riparian zone. These impacted areas are downstream from our survey reach where our inventory team did not have permission to survey. However, this area is readily observable from the State and County roads along the stream. It appears that selective migration barriers could also be occurring. Permission to access this reach should continue to be sought from the landowners.

COMMENT AND LANDMARK SITES

The following landmarks and potential project sites were noted. All distances are approximate and taken from the beginning of the survey reach.

0'	Begin survey at the culvert under Hwy 36. Bioinventory site one is just downstream from this point. Channel type is F4.
1894'	Bank failure.
2679'	The stream channel is diverted and the original stream branches around the diversion 145' into the unit.
3839'	Bioinventory site number two.
3822'	Bank failure.
6224'	Corrugated metal pipe at Rohnerville Road. 6.5' dia. x 94' long.
6846'	Corrugated metal pipe with concrete spillway. 7.5' dia. x 22' long.
7354'	Channel type measured and determined to be an F4.
8115'	A road parallels the stream, and has tires, rebar and fence stakes at its base.
8436'	Slide failure 12' high and 15' long.
8927'	Tire weir, which is failing.
10462'	Bioinventory site three.
10997'	Large debris accumulation (LDA) 20' long and 10' wide.
11586'	An eight inch pipe drains into the creek.
11656'	A side channel enters the creek.
10973'	LDA with logs 24-30" dia., and 2 logs 18' long.
12143'	LDA consisting of three logs 28" dia. and 20' long.

12265' LDA, 15' long and 20' wide.

12553' 60' long LDA; sub-surface flow; a likely fish barrier.

12981' LDA 35' long, and a fish barrier at this time. There is a 2' vertical plunge into a shallow 1.6' pool below the jam; flow is sub-surface for 2.5' at the top of the LDA and provides no passage. Electrofishing site four is above this point at 13062'. End of survey.

REFERENCES

Flosi, Gary., et al. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3d edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, California.

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3

Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5

WOLVERTON GULCH

Drainage: VAN DUZEN

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES

Survey Dates: 10/28/97 to 10/30/97

Confluence Location: QUAD: HYDESVILLE LEGAL DESCRIPTION: T02NR01ES19 LATITUDE:40°32'18" LONGITUDE:124°6'39"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN 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
25	4	RIFFLE	11	24	588	4	4.5	0.2	71	1769	13	329	0	13
96	17	FLATWATER	40	89	8543	64	5.9	0.5	487	46725	251	24053	0	18
111	22	POOL	47	35	3929	30	8.8	1.0	338	37505	336	37254	275	25
4	0	DRY	2	30	121	1	0.0	0.0	0	0	0	0	0	0
2	2	CULVERT	1	58	116	1	6.5	0.4	431	862	103	205	0	3

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
238	45	13297	86862	61841

WOLVERTON GULCH

Drainage: VAN DUZEN

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS

Survey Dates: 10/28/97 to 10/30/97

Confluence Location: QUAD: HYDESVILLE LEGAL DESCRIPTION: T02NR01ES19 LATITUDE:40°32'18" LONGITUDE:124°6'39"

HABITAT UNITS #	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT OCCURRENCE %	MEAN LENGTH ft.	TOTAL LENGTH ft.	TOTAL LENGTH %	MEAN WIDTH ft.	MEAN DEPTH ft.	MAXIMUM DEPTH ft.	MEAN AREA sq.ft.	TOTAL AREA EST. sq.ft.	MEAN VOLUME cu.ft.	TOTAL VOLUME EST. cu.ft.	MEAN RESIDUAL POOL VOL cu.ft.	MEAN SHELTER RATING	MEAN CANOPY %
24	3	LGR	10	24	579	4	5	0.2	0.5	86	2058	16	380	0	15	84
1	1	BRS	0	9	9	0	3	0.2	0.4	26	26	5	5	0	5	95
23	4	RUN	10	41	946	7	6	0.4	1.0	179	4106	79	1822	0	23	98
73	13	SRN	31	104	7597	57	6	0.5	1.2	582	42454	303	22139	0	17	91
58	6	MCP	24	32	1830	14	9	1.1	2.5	285	16525	297	17208	253	28	85
38	8	CRP	16	42	1599	12	9	1.0	2.1	414	15718	415	15756	313	26	88
3	1	LSL	1	32	96	1	13	0.6	2.1	546	1638	328	983	273	45	75
8	3	LSR	3	35	278	2	7	1.0	2.2	257	2053	244	1955	208	28	88
1	1	LSBk	0	10	10	0	8	0.8	2.1	80	80	64	64	56	5	80
1	1	LSBo	0	51	51	0	8	0.7	1.6	408	408	286	286	245	20	66
1	1	PLP	0	26	26	0	13	1.3	2.1	338	338	439	439	406	20	75
1	1	SCP	0	39	39	0	7	1.6	2.0	273	273	437	437	437	5	100
4	0	DRY	2	30	121	1	0	0.0	0.0	0	0	0	0	0	0	88
2	2	CUL	1	58	116	1	7	0.4	0.8	431	862	103	205	0	3	100

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
238	45	13297	86539	61678

WOLVERTON GULCH

Drainage: VAN DUZEN

Table 3 - SUMMARY OF POOL TYPES

Survey Dates: 10/28/97 to 10/30/97

Confluence Location: QUAD: HYDESVILLE LEGAL DESCRIPTION: T02NR01ES19 LATITUDE:40°32'18" LONGITUDE:124°6'39"

HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	MEAN LENGTH (ft.)	TOTAL LENGTH (ft.)	PERCENT TOTAL LENGTH	MEAN WIDTH (ft.)	MEAN DEPTH (ft.)	MEAN AREA (sq.ft.)	TOTAL AREA EST. (sq.ft.)	MEAN VOLUME (cu.ft.)	TOTAL VOLUME EST. (cu.ft.)	MEAN RESIDUAL POOL VOL. (cu.ft.)	MEAN SHELTER RATING
58	6	MAIN	52	32	1830	47	8.5	1.1	285	16525	297	17208	253	28
52	15	SCOUR	47	40	2060	52	9.1	0.9	363	18897	344	17912	274	26
1	1	BACKWATER	1	39	39	1	7.0	1.6	273	273	437	437	437	5

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
111	22	3929	35695	35556

WOLVERTON GULCH Drainage: VAN DUZEN

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES Survey Dates: 10/28/97 to 10/30/97

Confluence Location: QUAD: HYDESVILLE LEGAL DESCRIPTION: T02NR01ES19 LATITUDE:40°32'18" LONGITUDE:124°6'39"

UNITS MEASURED	HABITAT TYPE	HABITAT PERCENT OCCURRENCE	<1 FOOT MAXIMUM DEPTH	<1 FOOT PERCENT OCCURRENCE	1-<2 FT. MAXIMUM DEPTH	1-<2 FOOT PERCENT OCCURRENCE	2-<3 FT. MAXIMUM DEPTH	2-<3 FOOT PERCENT OCCURRENCE	3-<4 FT. MAXIMUM DEPTH	3-<4 FOOT PERCENT OCCURRENCE	>=4 FEET MAXIMUM DEPTH	>=4 FEET PERCENT OCCURRENCE
58	MCP	52	0	0	45	78	10	17	2	3	1	2
38	CRP	34	0	0	22	58	15	39	1	3	0	0
3	LSL	3	0	0	1	33	2	67	0	0	0	0
8	LSR	7	0	0	7	88	1	13	0	0	0	0
1	LSBk	1	0	0	0	0	1	100	0	0	0	0
1	LSBo	1	0	0	1	100	0	0	0	0	0	0
1	PLP	1	0	0	0	0	1	100	0	0	0	0
1	SCP	1	0	0	0	0	1	100	0	0	0	0

TOTAL UNITS
111

WOLVERTON GULCH

Drainage: VAN DUZEN

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE

Survey Dates: 10/28/97 to 10/30/97

Confluence Location: QUAD: HYDESVILLE LEGAL DESCRIPTION: T02NR01ES19 LATITUDE:40°32'18" LONGITUDE:124°6'39"

UNITS MEASURED	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
24	3	LGR	0	13	0	0	63	0	13	10	0
1	1	BRS	0	40	0	0	30	0	0	30	0
23	4	RUN	18	13	0	20	31	0	13	6	0
73	12	SRN	0	11	3	5	56	5	0	11	0
58	6	MCP	23	38	15	13	9	0	0	2	0
38	8	CRP	20	11	0	46	17	3	0	3	0
3	1	LSL	10	0	60	0	30	0	0	0	0
8	3	LSR	20	17	0	50	13	0	0	0	0
1	1	LSBk	0	0	0	0	50	0	0	50	0
1	1	LSBo	0	0	0	0	70	20	0	0	10
1	1	PLP	0	0	40	0	20	0	40	0	0
1	1	SCP	0	0	0	0	100	0	0	0	0
4	0	DRY	0	0	0	0	0	0	0	0	0
2	1	CUL	0	0	50	0	0	0	0	50	0

WOLVERTON GULCH

Drainage: VAN DUZEN

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE

Survey Dates: 10/28/97 to 10/30/97

Confluence Location: QUAD: HYDESVILLE LEGAL DESCRIPTION: T02NR01ES19 LATITUDE:40°32'18" LONGITUDE:124°6'39"

TOTAL HABITAT UNITS	UNITS FULLY MEASURED	HABITAT TYPE	% TOTAL SILT/CLAY DOMINANT	% TOTAL SAND DOMINANT	% TOTAL GRAVEL DOMINANT	% TOTAL SM COBBLE DOMINANT	% TOTAL LG COBBLE DOMINANT	% TOTAL BOULDER DOMINANT	% TOTAL BEDROCK DOMINANT
24	3	LGR	0	0	67	33	0	0	0
1	1	BRS	0	0	0	0	0	0	100
23	4	RUN	25	0	75	0	0	0	0
73	13	SRN	23	8	69	0	0	0	0
58	6	MCP	17	17	67	0	0	0	0
38	8	CRP	75	25	0	0	0	0	0
3	1	LSL	0	0	100	0	0	0	0
8	3	LSR	0	33	67	0	0	0	0
1	1	LSBk	0	0	100	0	0	0	0
1	1	LSBo	0	100	0	0	0	0	0
1	1	PLP	100	0	0	0	0	0	0
1	1	SCP	100	0	0	0	0	0	0
4	1	DRY	0	0	100	0	0	0	0
2	2	CUL	0	0	50	0	0	0	50

Table 7.

Summary of Mean Percent Vegetative Cover for Entire Stream

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Deciduous	Mean Percent Open units	Mean Right bank % Cover	Mean Left Bank % Cover
89	8	92	0	77.6	80.0

Note: Mean percent conifer and deciduous 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: WOLVERTON GULCH
SAMPLE DATES: 10/28/97 to 10/30/97
STREAM LENGTH: 12981 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: HYDESVILLE — Latitude: 40°32'18"
Legal Description: T02NR01ES19 — Longitude: 124°6'39"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 1

Channel Type: F4	Canopy Density: 89%
Channel Length: 12981 ft.	Coniferous Component: 8%
Riffle/flatwater Mean Width: 6 ft.	Deciduous Component: 92%
Total Pool Mean Depth: 1.0 ft.	Pools by Stream Length: 30%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 4%
Water: 048- 055°F Air: 052-070°F	Mean Pool Shelter Rtn: 26
Dom. Bank Veg.: Deciduous Trees	Dom. Shelter: Terrestrial Veg.
Vegetative Cover: 82%	Occurrence of LOD: 7%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 10 ft.

Embeddness Value: 1. 0% 2.9% 3. 33% 4. 51% 5. 6%

TABLE 9.

Mean Percentage of Dominant Substrate

Dominant Class of Substrate	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Bedrock	1	3	4.7
Boulder	0	0	0
Cobble/Gravel	11	7	20.9
Silt/clay	31	33	74.4

Mean Percentage of Dominant Vegetation

Dominant Class of Vegetation	Number Units Right Bank	Number Units Left Bank	Total Mean Percent
Grass	2	7	10.5
Brush	11	14	29.1
Decid. Trees	27	22	57.0
Conif. Trees	3	0	3.5
No Vegetation	0	0	0

Total stream average embeddedness value for pool 3.6

TABLE 10. MEAN PERCENT OF SHELTER COVER TYPES FOR ENTIRE STREAM

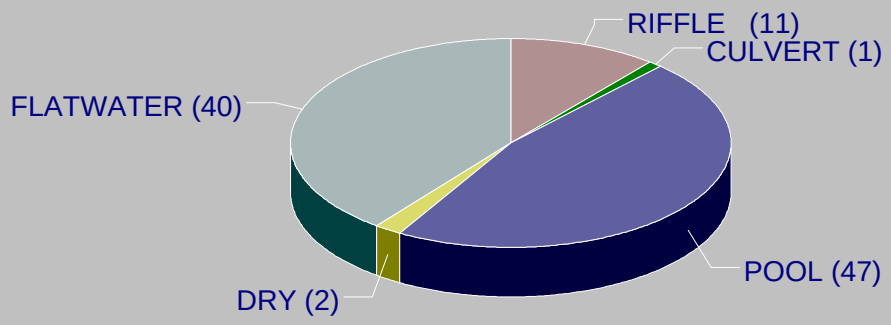
Stream: WOLVERTON GULCH Drainage: VAN DUZEN

Survey Date: 10/28/97 to 10/30/97

	RIFFLES	FLATWATER	POOLS
UNDERCUT BANKS	9.9	3.7	19.8
SMALL WOODY DEBRIS	14.4	12.4	16.1
LARGE WOODY DEBRIS	6.4	2.1	8.3
ROOTS	16.8	7.6	26.3
TERRESTRIAL VEG	34.4	41.8	21.7
AQUATIC VEG	2.4	3.2	2.0
WHITEWATER	3.0	5.3	1.7
BOULDERS	8.0	8.2	3.7
BEDROCK LEDGES	0.2	0	0.4

WOLVERTON GULCH

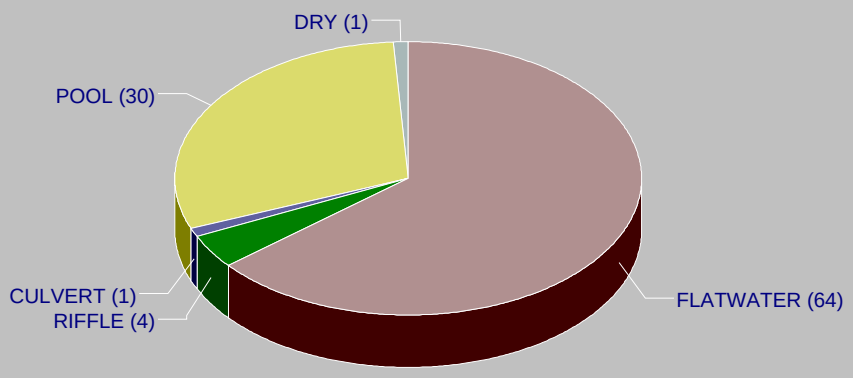
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 1

WOLVERTON GULCH

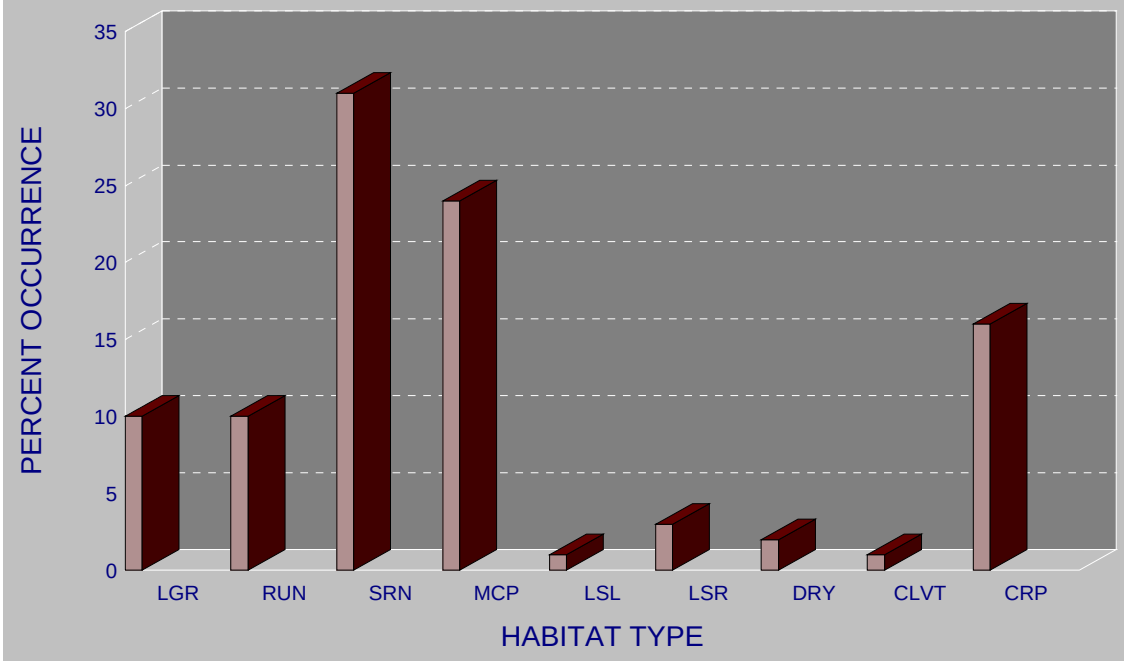
HABITAT TYPES BY PERCENT TOTAL LENGTH



GRAPH 2

WOLVERTON GULCH

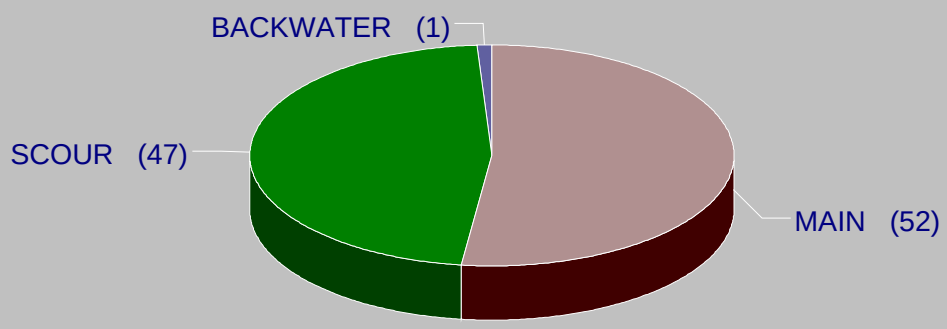
HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 3

WOLVERTON GULCH

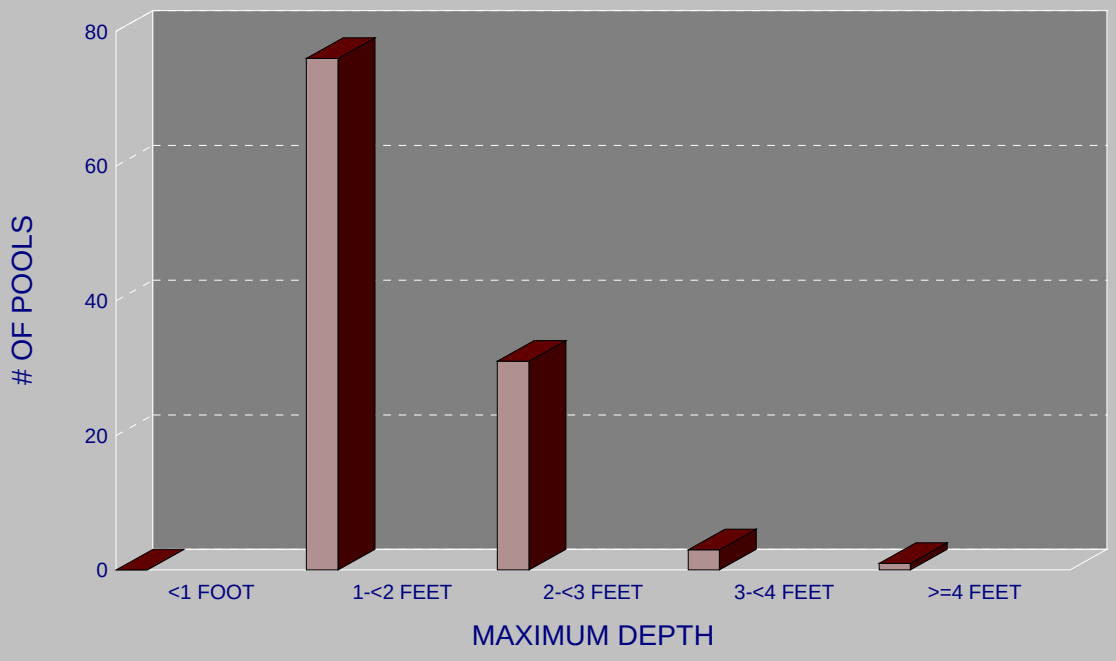
POOL HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 4

WOLVERTON GULCH

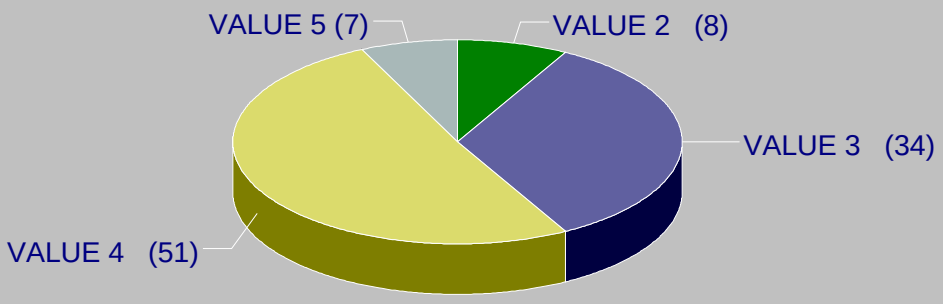
MAXIMUM POOL DEPTHS



GRAPH 5

WOLVERTON GULCH

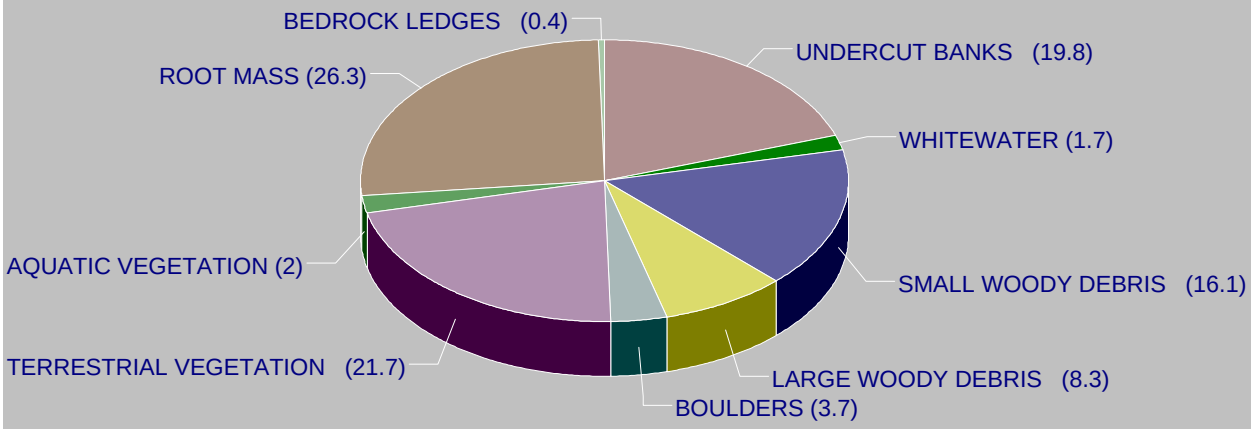
PERCENT EMBEDDEDNESS



GRAPH 6

WOLVERTON GULCH

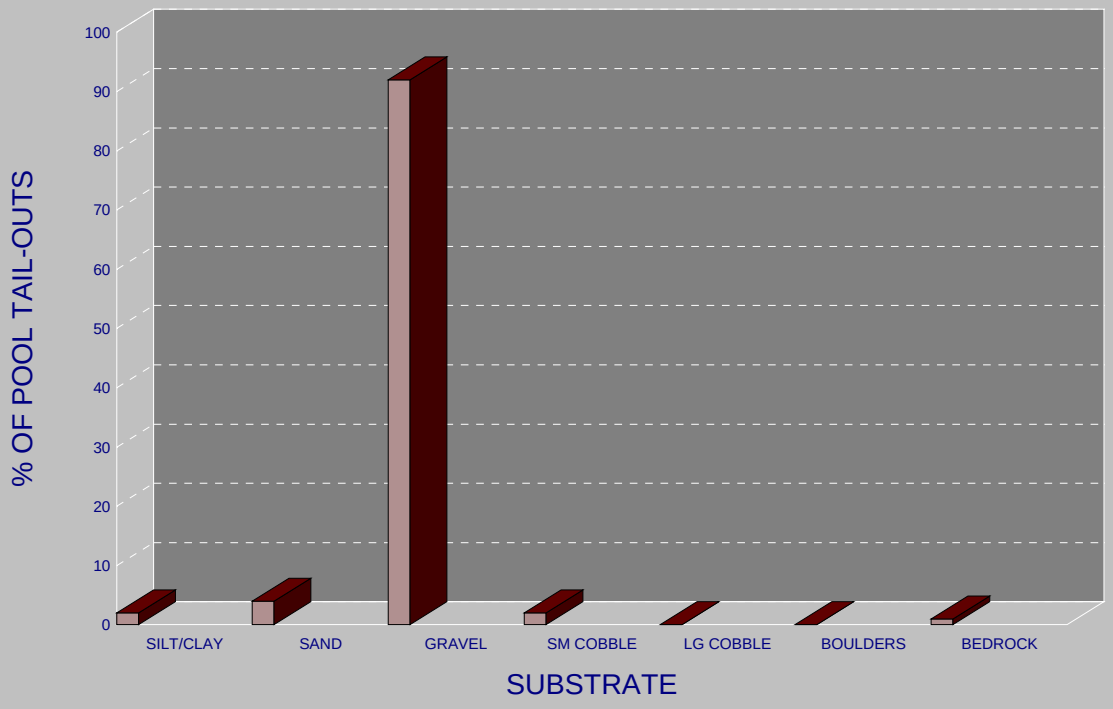
MEAN PERCENT COVER TYPES IN POOLS



GRAPH 7

WOLVERTON GULCH

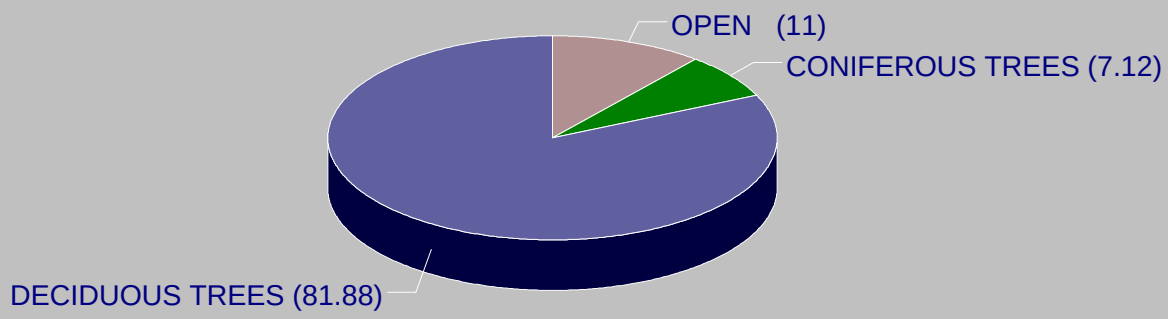
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



GRAPH 8

WOLVERTON GULCH

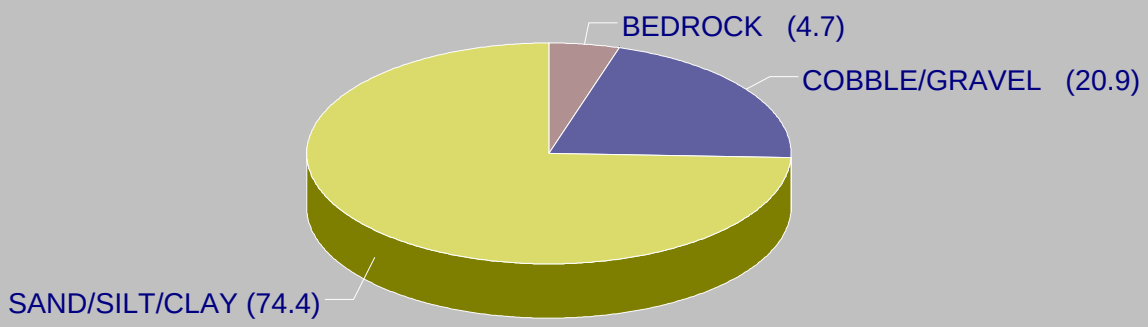
PERCENT CANOPY



GRAPH 9

WOLVERTON GULCH

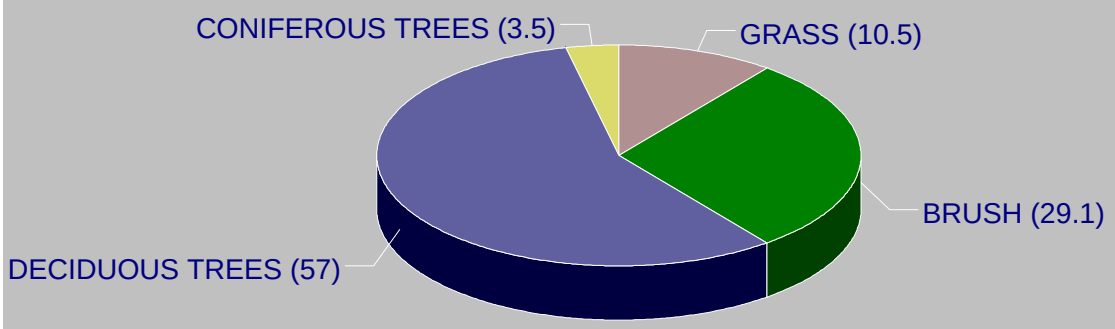
DOMINANT BANK COMPOSITION IN SURVEY REACH



GRAPH 10

WOLVERTON GULCH

DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11