STREAM INVENTORY REPORT

Boardman Creek

INTRODUCTION

A stream inventory was conducted from June 25 to June 27, 2002 on Boardman Gulch. The survey began at the confluence with South Fork Big River and extended upstream 1.3 miles.

The Boardman Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Boardman Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

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

WATERSHED OVERVIEW

Boardman Gulch is a tributary to the South Fork Big River, a tributary to the Big River, tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Boardman Gulch's legal description at the confluence with South Fork Big River is T16N R15W S14. Its location is 39°29′56″ north latitude and 123°53′26″ west longitude. Boardman Gulch is a first order stream and has approximately 11,062 feet of solid blue line stream and 1,025 feet of dashed blue line stream according to the USGS Greenough Ridge 7.5 minute quadrangle. Boardman Gulch drains a watershed of approximately 1.24 square miles. Elevations range from about 400 feet at the mouth of the creek to 1362 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists east of Fort Bragg via Highway 20, at mile marker 17.55 miles. Mendocino Redwood Company logging roads are used to access the stream from Highway 20.

METHODS

The habitat inventory conducted in Boardman Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Department of Fish and Game Scientific Aides and Watershed Stewards Project/AmeriCorps (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. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Boardman Creek 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 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 (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. 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 (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". Boardman Creek habitat typing used standard basin level measurement criteria. These parameters require that the minimum length of a described habitat unit must be equal to or greater than the stream's mean

wetted width. All measurements are in feet to the nearest tenth. Habitat characteristics are measured using a clinometer, hip chain, and stadia rod.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out areas is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Boardman 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 unsuited for spawning due to inappropriate substrate particle size, bedrock, 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 Boardman Creek, a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

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

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Boardman 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 evergreen 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 Boardman 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.

BIOLOGICAL INVENTORY

Biological sampling during the stream inventory is used to determine fish species and their distribution in the stream. Fish presence was observed from the stream banks in Boardman Gulch. This sampling technique is discussed in the *California Salmonid Stream Habitat Restoration Manual*.

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat 8.4, 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 seven tables:

- Summary of riffle, flatwater, and pool habitat types
- Summary of habitat types and measured parameters
- Summary of pool types
- Summary of maximum pool depths by pool habitat types
- Summary of shelter by habitat types
- Summary of dominant substrates by habitat types
- Summary of fish habitat elements by stream reach

Graphics are produced from the tables using Microsoft Excel. Graphics developed for Boardman Creek include:

- Level II habitat types by % occurrence
- Level II habitat types by % total length
- Level IV habitat types by % occurrence
- Level I pool habitat types by % occurrence
- Maximum depth in pools
- Percent embeddedness estimated in pool tail-outs
- Mean percent cover types in pools
- Substrate composition in pool tail-outs
- Mean percent canopy
- Dominant bank composition in survey reach
- Dominant bank vegetation in survey reach

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HABITAT INVENTORY RESULTS

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

The habitat inventory of June 25 through June 27, 2002, was conducted by M. McNeil and K. Knecthle (DFG). The total length of the stream surveyed was 6,759 feet.

Stream flow was not measured on Boardman Gulch.

Boardman Gulch is a B4 channel type for the first 6,588 feet of the stream (Reach 1), and B3 for 171 feet of the stream surveyed (Reach 2). B4 channel are classified as moderately entrenched, moderate gradient, riffle dominated channels with frequently spaced pools; very stable plan and profile, stable banks, and gravel-dominant substrates. B3 channels are moderately entrenched, moderate gradient, riffle dominated channels with frequently spaced pools; very stable plan and profile, stable banks and cobble-dominant substrates.

Water temperatures taken during the survey period ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 57 to 77 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 44% pool units, 41% flatwater units, and 15% riffle units (Graph 1). Based on total length of Level II habitat types there were 81% flatwater units, 10% pool units, and 9% riffle units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were step runs units, 35%; mid-channel pool units, 28%; and low gradient riffle units, 14% (Graph 3). Based on percent total length, step run units made up 78%, low gradient riffle units 9%, and mid-channel pool units 7%.

A total of 44 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 66%, and comprised 70% 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. Fourteen of the 44 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 44 pool tail-outs measured, 0 had a value of 1 (0%); 7 had a value of 2 (16%); 21 had a value of 3 (48%); 5 had a value of 4 (11%); and 11 had a value of 5 (25%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate.

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. Pool habitats had a mean shelter rating of 23, flatwater habitat types had a mean shelter rating of 13, and riffle habitat types had a mean shelter rating of 6 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 25. Scour pools had a mean shelter rating of 19 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover types in Boardman Gulch. Graph 7 describes the pool cover in Boardman 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 59% of the pool tail-outs. Small cobble was the next most frequently observed dominant substrate type and occurred in 23% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Boardman Gulch was 87%. In the closed canopy, the mean percentages of deciduous and coniferous trees were 10% and 90%, respectively. Graph 9 describes the mean percent canopy in Boardman Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 60%. The mean percent left bank vegetated was 64%. The dominant elements composing the structure of the stream banks consisted of 82% sand/silt/clay and 18% bedrock (Graph 10). Coniferous trees were the dominant vegetation type observed in 43% of the units surveyed. Additionally, 29% of the units surveyed had deciduous trees as the dominant vegetation type, and 29% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

No biological inventory was conducted on Boardman Gulch. Young-of-the-year salmonid presence was observed from the stream banks in Boardman Gulch up to 5,863 feet.

DISCUSSION

Boardman Gulch is a B4 channel type for the first 6,588 feet of stream surveyed and a B3 for the remaining 171 feet of stream surveyed. The suitability of B4 and B3 channel types for fish habitat improvement structures is as follows: B4 channel types are excellent for low-stage plunge weirs, boulder clusters, bank placed boulders, single and opposing wing-deflectors, and log cover. B3 channel types are excellent for plunge weirs, boulder clusters and bank-placed boulders, single and opposing wing-deflectors, and log cover.

The water temperatures recorded on the survey days June 25 through 27, 2002 ranged from 55 to 62 degrees Fahrenheit. Air temperatures ranged from 57 to 77 degrees Fahrenheit. The recorded water temperatures of 60 degrees Fahrenheit and below are suitable for 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 81% of the total length of this survey, pools 10%, and riffles 9%. The pools are relatively shallow, with only 14 of the 44 (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.

Seven of the 44 pool tail-outs measured had embeddedness ratings of 1 or 2. Twenty-Six of the pool tail-outs had embeddedness ratings of 3 or 4. Eleven 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 Boardman Gulch should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Thirty-six of the 44 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 was 23. The shelter rating in the flatwater habitats was 13. 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 all habitat types. Additionally, large woody debris contributes a small amount. Increased amounts of 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 87%.

The percentage of right and left bank covered with vegetation was moderate at 60% and 64%, 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) Boardman Gulch should be managed as an anadromous, natural production stream.

2) 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.

3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover is from small woody debris. Adding high quality complexity with large woody debris and root wad cover is desirable.

4) 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.

5) 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.

6) There are several log debris accumulations present on Boardman Gulch that 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.

7) Good water temperature and flow regimes exist in the stream and it offers good conditions for rearing fish. Fish passage should be monitored and improved where possible.

COMMENTS AND LANDMARKS

The following landmarks and possible problem sites were noted. All distances are approximate and taken from the beginning of the survey.

Position (ft.):	Comments:
0'	Begin survey 50’ upstream from the confluence with South Fork Big River. Channel type is B4. Passed a 2.1’ cascade plunge over bedrock before beginning full sampling.
48'	Salmonid yoy observed.
110'	Short cascade into pool.
311'	1.5 foot plunge.
427'	Channel overgrown with vegetation.
683'	Steelhead 1+, Right bank tributary at 683’.
940'	High gradient left bank trib at 940’.
959'	Four foot plunge into pool.
1363'	Plunge over log at top of pool.
1587'	Channel type taken in the unit; B4 channel type.

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1630'	LDA over pool, 7’ high x 15’ wide x 10’ long and retaining sediment. Subsurface flow.
1866'	There is a 1+ steelhead.
1887'	Log debris accumulation (LDA) is 5’ high x 15’ wide x 15’ long and is retaining sediment.
2185'	LDA includes 4 to 6 pieces of large woody debris (LWD).
2209'	Dry left bank tributary.
2281'	Left bank erosion is 10’ high x 20’ wide and it is contributing fines.
2289'	LDA is 25’ wide x 7’ high x 15’ long.
2650'	Left bank erosion is 60’ high x 30’ wide.
2718'	Dry left bank tributary.
3175'	Left bank erosion is 40’ high x 50’ wide and is contributing fines.
3324'	LDA retaining sediment 4’ high.
3350'	LWD in channel.
3396'	Right bank erosion.
3553'	There is a 1+ steelhead.
3565'	Culvert under road fill at 3,565’. Estimated length of culvert is 50’.
3808'	There is a 1+ steelhead.
3987'	Left bank erosion contributing fines.
4120'	LDA at top of unit retaining sediment.
4190'	Two foot cascade into plunge pool. Yellow legged frog.
4609'	Left bank tributary at 24’.
5021'	Dry right bank tributary.
5520'	Culvert in channel. Dry left bank tributary at 312’.

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5863' There are 2, 1+ steelhead.

5945' LDA creating a 7’ cascade and retaining sediment.

6128' Dry right bank tributary.

6140' Right and left bank erosion contributing fines.

6195' LDA retaining sediment.

6208' Channel overgrown with vegetation. There is an old Humboldt crossing over the channel and falling apart.

6302' LDA at top of pool.

6316' Right bank culvert is 4’ in diameter at 125’ into unit.

6547' Right bank erosion is 15’ high x 20’ long and is contributing fines.

6588' Channel type changes to B3.

6662' End of survey due to large slide on left and right banks which have filled the streambed with sediment/mud blocking passage. Complete loss of habitat for salmonids for 80’ in unit. Sink hole at 6662’ very low flow. Walked above slide but did not 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.

Boardman Gulch

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]	

Boardman Gulch

TABLES AND GRAPHS

BOARDMAN GULCH — Drainage: SF BIG RIVER

Table 1 - SUMMARY OF RIFFLE, FLATWATER, AND POOL HABITAT TYPES — Survey Dates: 06/25/02 to 06/27/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

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
15	5	RIFFLE	15	40	605	9	2.9	0.2	72	1079	12	177	0	6
41	9	FLATWATER	41	133	5459	81	3.6	0.3	239	9804	64	2610	0	13
44	44	POOL	44	16	695	10	7.3	0.9	114	5004	107	4688	85	23

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq. ft.)	TOTAL VOL. (cu. ft.)
100	58	6759	15886	7475

BOARDMAN GULCH — Drainage: SF BIG RIVER

Table 2 - SUMMARY OF HABITAT TYPES AND MEASURED PARAMETERS — Survey Dates: 06/25/02 to 06/27/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

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 %
14	4	LGR	14	42	588	9	3	0.2	1.6	78	1089	12	173	0	6	86
1	1	HGR	1	17	17	0	3	0.2	0.9	49	49	10	10	0	5	85
6	4	RUN	6	34	201	3	4	0.3	0.9	141	845	36	216	0	13	90
35	5	SRN	35	150	5258	78	4	0.3	1.2	318	11123	86	3005	0	14	87
28	28	MCP	28	17	468	7	7	0.9	3.5	118	3301	116	3251	95	25	88
1	1	CCP	1	18	18	0	9	1.0	2.1	162	162	162	162	113	20	75
2	2	CRP	2	12	23	0	7	0.9	1.7	77	154	66	132	51	20	83
1	1	LSL	1	12	12	0	5	0.9	1.7	60	60	54	54	42	5	85
2	2	LSBk	2	22	44	1	6	0.6	1.7	119	238	66	132	48	5	95
10	10	PLP	10	13	130	2	9	0.9	2.5	109	1088	96	957	72	23	89

TOTAL UNITS	TOTAL UNITS	LENGTH (ft.)	AREA (sq.ft)	TOTAL VOL. (cu.ft)
100	58	6759	18109	8091

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Table 3 - SUMMARY OF POOL TYPES — Survey Dates: 06/25/02 to 06/27/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

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
29	29	MAIN	66	17	486	70	7.0	0.9	119	3463	118	3413	96	25
15	15	SCOUR	34	14	209	30	7.9	0.8	103	1540	85	1275	64	19

TOTAL UNITS	TOTAL UNITS	TOTAL LENGTH (ft.)	TOTAL AREA (sq.ft.)	TOTAL VOL. (cu.ft.)
44	44	695	5004	4688

BOARDMAN GULCH — Drainage: SF BIG RIVER

Table 4 - SUMMARY OF MAXIMUM POOL DEPTHS BY POOL HABITAT TYPES — Survey Dates: 06/25/02 to 06/27/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

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
28	MCP	64	0	0	18	64	9	32	1	4	0	0
1	CCP	2	0	0	0	0	1	100	0	0	0	0
2	CRP	5	0	0	2	100	0	0	0	0	0	0
1	LSL	2	0	0	1	100	0	0	0	0	0	0
2	LSBk	5	0	0	2	100	0	0	0	0	0	0
10	PLP	23	0	0	7	70	3	30	0	0	0	0

TOTAL UNITS
44

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BOARDMAN GULCH — Drainage: SF BIG RIVER

Table 5 - SUMMARY OF MEAN PERCENT COVER BY HABITAT TYPE — Survey Dates: 06/25/02 to 06/27/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

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
14	4	LGR	0	35	0	5	6	8	0	41	5
1	1	HGR	0	0	0	50	0	0	0	0	50
6	4	RUN	29	18	20	0	18	0	0	16	0
35	5	SRN	13	28	2	17	14	1	0	25	0
28	28	MCP	18	23	24	10	10	0	3	4	8
1	1	CCP	5	10	75	0	5	5	0	0	0
2	2	CRP	10	48	3	0	38	0	0	3	0
1	1	LSL	0	50	0	0	50	0	0	0	0
2	2	LSBk	20	0	0	0	0	0	0	10	70
10	10	PLP	6	20	15	34	4	1	9	3	11

BOARDMAN GULCH — Drainage: SF BIG RIVER

Table 6 - SUMMARY OF DOMINANT SUBSTRATES BY HABITAT TYPE — Survey Dates: 06/25/02 to 06/27/02

Confluence Location: QUAD: GREENOUGH LEGAL DESCRIPTION: T16NR15WS14 LATITUDE:39°29'56" LONGITUDE:123°53'26"

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
14	4	LGR	0	0	25	25	25	0	25
1	1	HGR	0	0	0	0	0	0	100
6	4	RUN	25	0	75	0	0	0	0
35	5	SRN	20	0	60	20	0	0	0
28	6	MCP	33	67	0	0	0	0	0
1	1	CCP	100	0	0	0	0	0	0
2	2	CRP	50	0	50	0	0	0	0
1	1	LSL	100	0	0	0	0	0	0
2	1	LSBk	0	100	0	0	0	0	0
10	4	PLP	50	25	25	0	0	0	0

TABLE 8. FISH HABITAT INVENTORY DATA SUMMARY

STREAM NAME: BOARDMAN GULCH
SAMPLE DATES: 06/25/02 to 06/27/02
STREAM LENGTH: 6759 ft.
LOCATION OF STREAM MOUTH:
USGS Quad Map: GREENOUGH — Latitude: 39°29'56"
Legal Description: T16NR15WS14 — Longitude: 123°53'26"

SUMMARY OF FISH HABITAT ELEMENTS BY STREAM REACH

STREAM REACH 01

Channel Type: B4	Canopy Density: 87%
Channel Length: 6588 ft.	Coniferous Component: 90%
Riffle/flatwater Mean Width: 3 ft.	Deciduous Component: 10%
Total Pool Mean Depth: 0.9 ft.	Pools by Stream Length: 10%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 2%
Water: 055- 062°F Air: 057-077°F	Mean Pool Shelter Rtn: 22
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Small Woody Debris
Vegetative Cover: 62%	Occurrence of LOD: 17%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

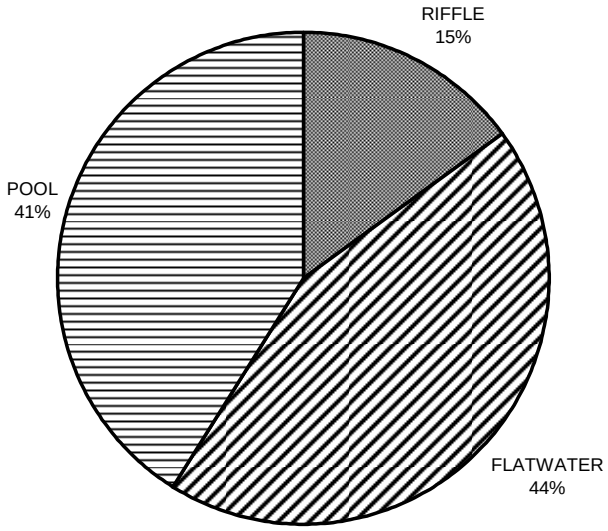
Embeddness Value: 1. 0% 2.16% 3. 47% 4. 12% 5. 26%

STREAM REACH 02

Channel Type: B3	Canopy Density: 95%
Channel Length: 171 ft.	Coniferous Component: 100%
Riffle/flatwater Mean Width: *********	Deciduous Component: 0%
Total Pool Mean Depth: 1.0 ft.	Pools by Stream Length: 12%
Base Flow: 0.0 cfs	Pools >=3 ft.deep: 0%
Water: 055- 055°F Air: 057-057°F	Mean Pool Shelter Rtn: 80
Dom. Bank Veg.: Coniferous Trees	Dom. Shelter: Undercut Banks
Vegetative Cover: **********%	Occurrence of LOD: 20%
Dom. Bank Substrate: Silt/Clay/Sand	Dry Channel: 0 ft.

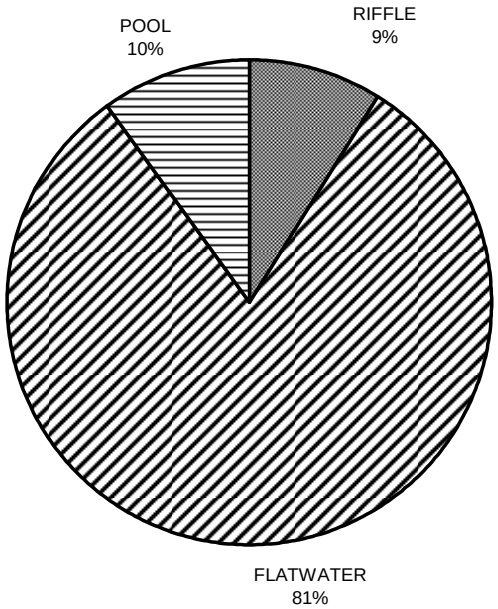
Embeddness Value: 1. 0% 2.0% 3. 100% 4. 0% 5. 0%

BOARDMAN GULCH
HABITAT TYPES BY PERCENT OCCURRENCE



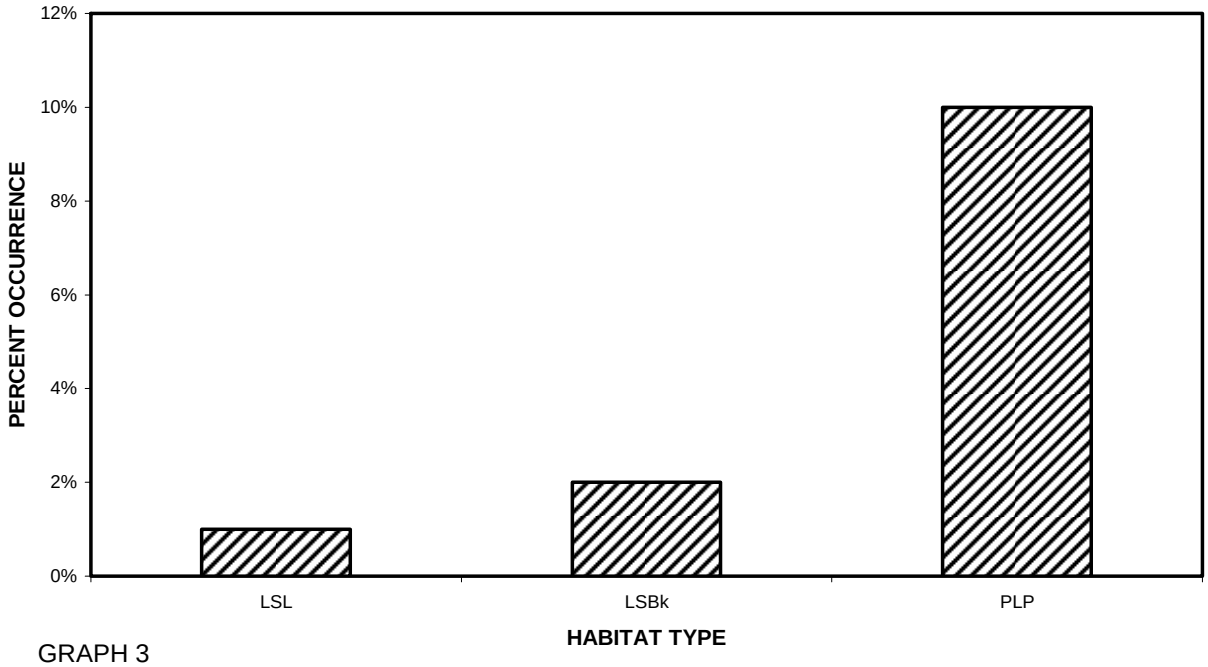
GRAPH 1

BOARDMAN GULCH
HABITAT TYPES BY PERCENT TOTAL LENGTH



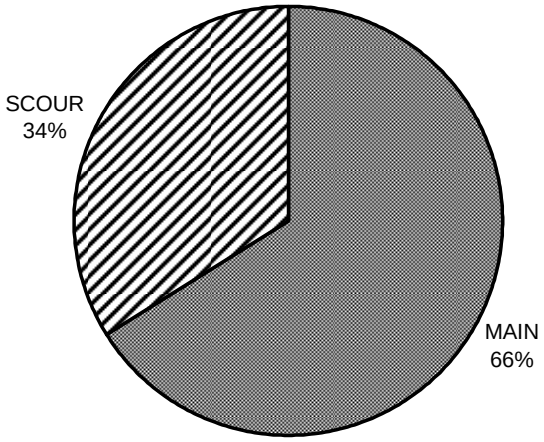
GRAPH 2

BOARDMAN GULCH
HABITAT UNIT TYPES BY PERCENT OCCURRENCE

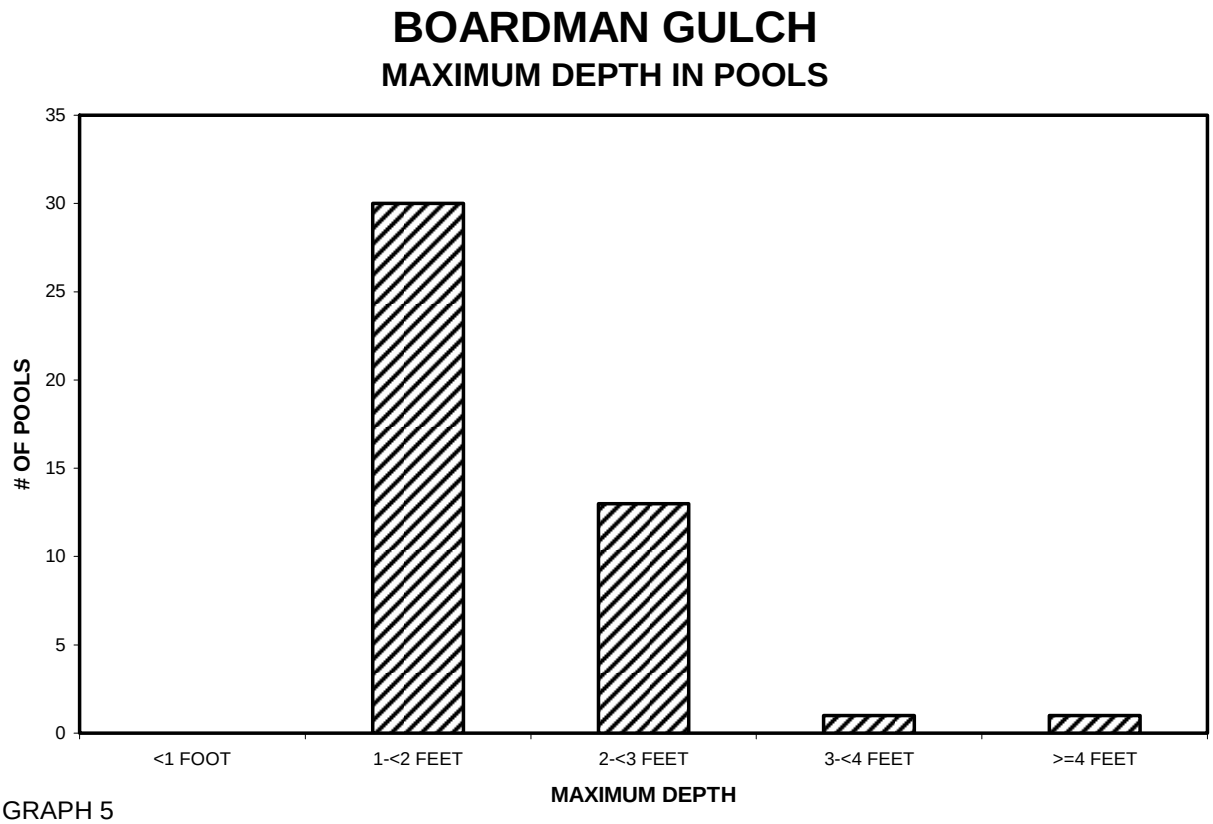


GRAPH 3

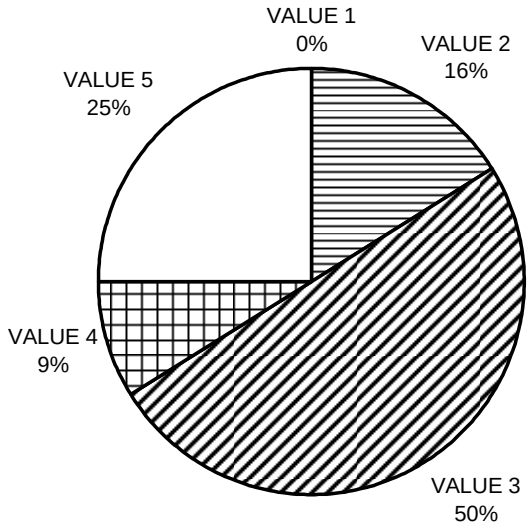
BOARDMAN GULCH
POOL HABITAT TYPES BY PERCENT OCCURRENCE



GRAPH 4

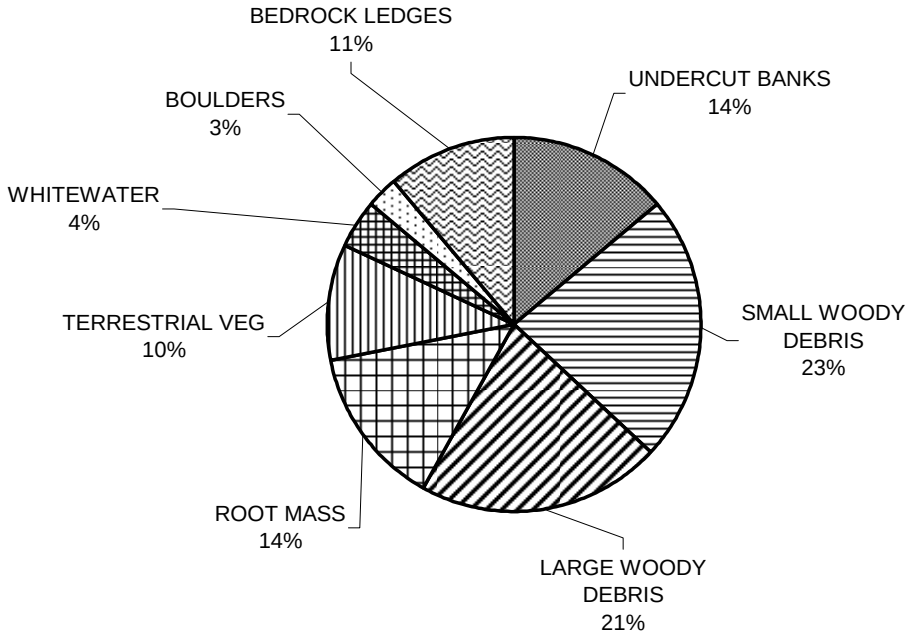


GRAPH 5



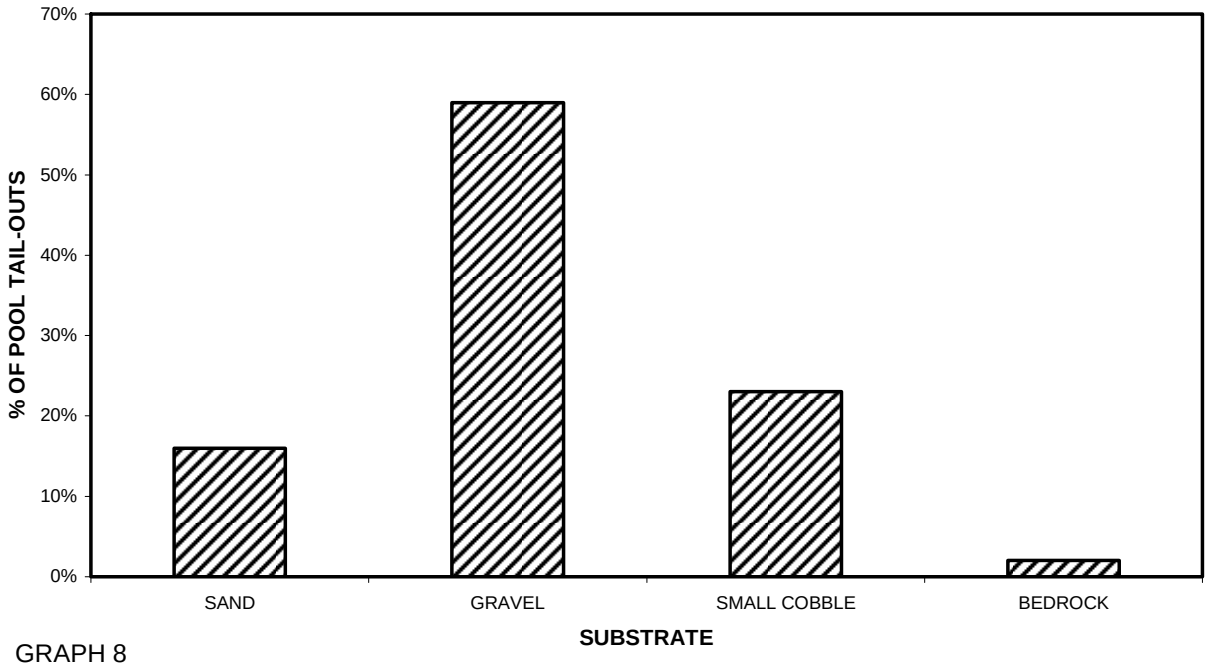
GRAPH 6

BOARDMAN GULCH
MEAN PERCENT COVER TYPES IN POOLS



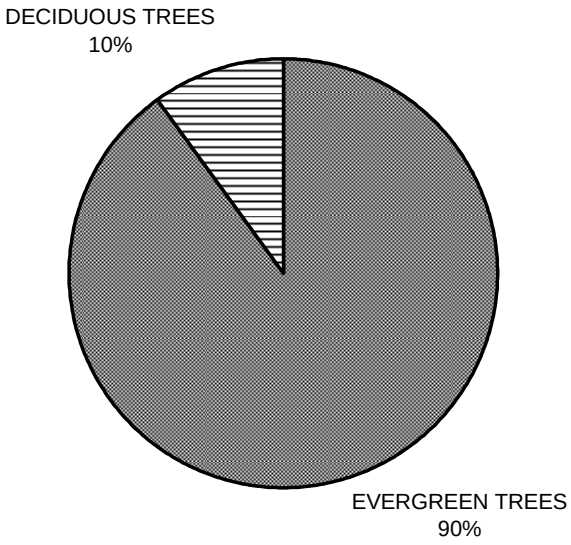
GRAPH 7

BOARDMAN GULCH
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS



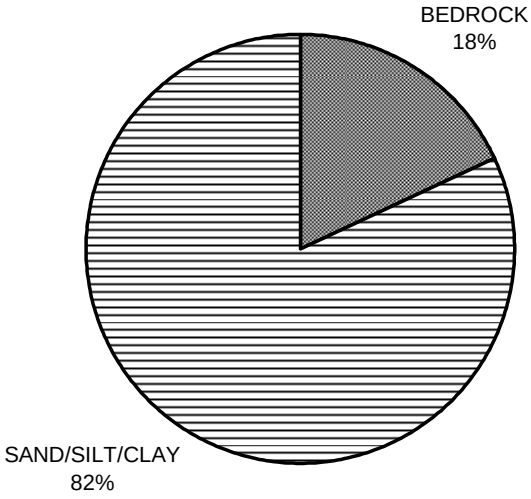
GRAPH 8

BOARDMAN GULCH
MEAN PERCENT CANOPY



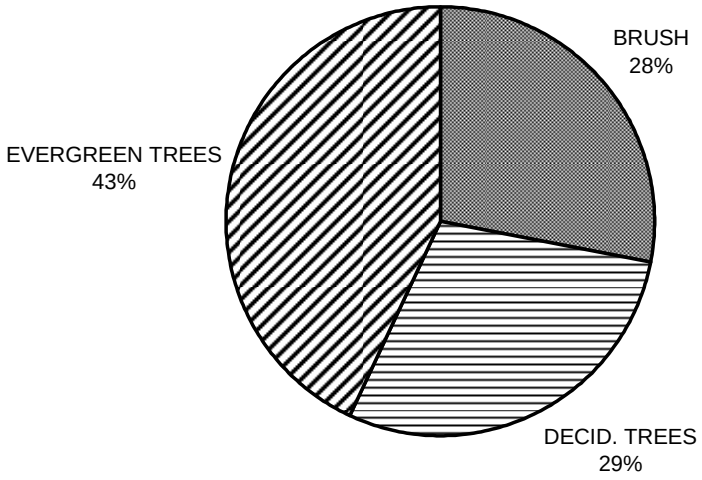
GRAPH 9

BOARDMAN GULCH
DOMINANT BANK COMPOSITION IN SURVEY REACH

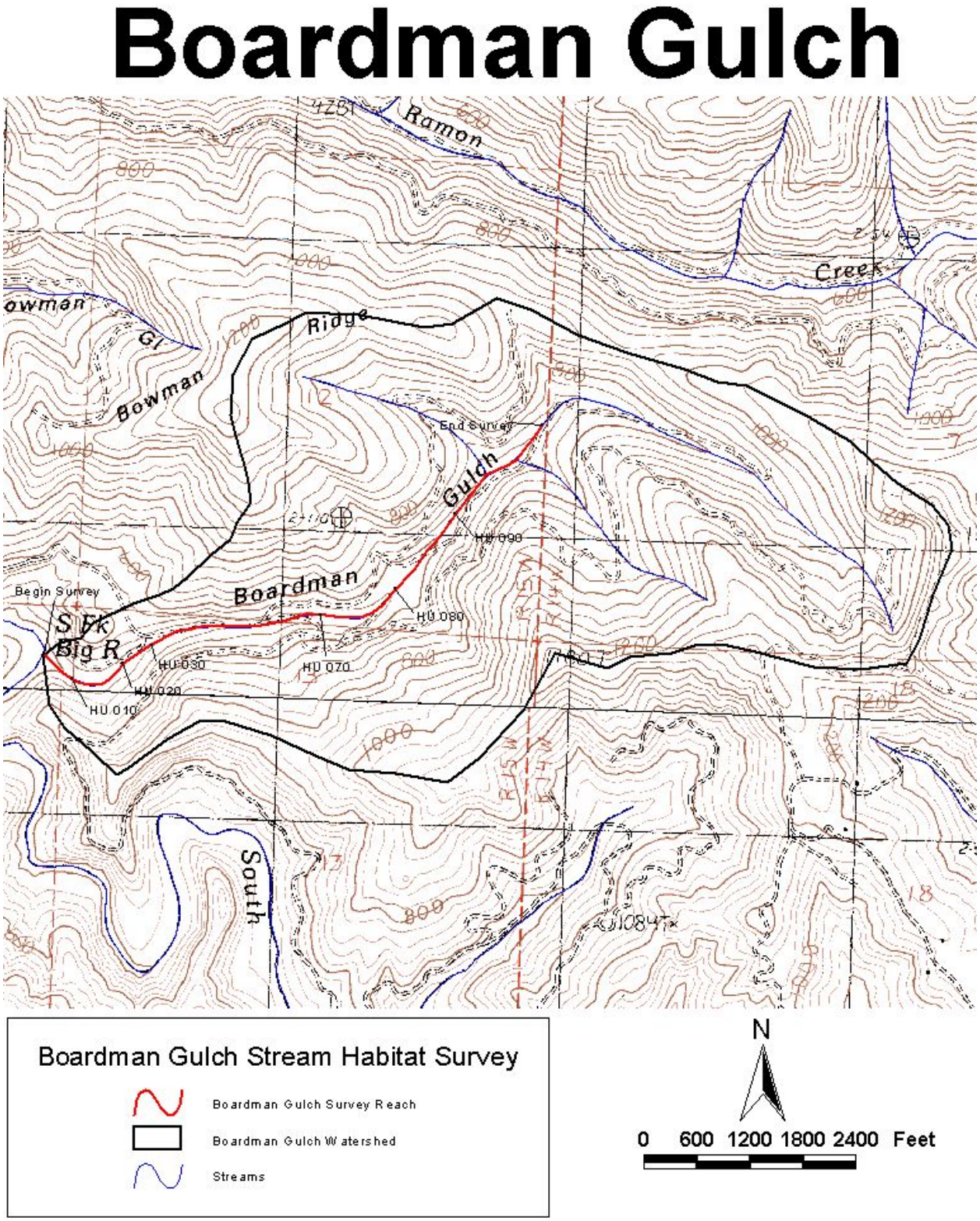


GRAPH 10

BOARDMAN GULCH
DOMINANT BANK VEGETATION IN SURVEY REACH



GRAPH 11



Map 1. Map showing Boardman Gulch stream habitat survey reach and watershed.