



**California Department of Fish and Game  
Marin Coastal Watershed  
Stream Habitat Assessment Reports  
Green Gulch**



## STREAM INVENTORY REPORT

*Surveyed Summer 2008*

*Report Completed April 2009*

### Green Gulch

#### INTRODUCTION

A stream inventory was conducted during 6/4/2008 to 6/19/2008 on Green Gulch. The survey began at the confluence with Redwood Creek and extended upstream 1.2 miles.

The Green Gulch 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 Green Gulch. 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 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

Green Gulch is a tributary to Redwood Creek, a tributary to the Pacific Ocean, located in Marin County, California (Map 1). Green Gulch's legal description at the confluence with Redwood Creek is T01S R07W S1. Its location is 37°51'38.0" north latitude and 122°34'24.0" west longitude, LLID number 1225734378606. Green Gulch is a second order stream and has approximately 3.3 miles of blue line stream according to the USGS National Hydrography Datasheet (NHD). Green Gulch drains a watershed of approximately 1.22 square miles. Elevations range from about 16 feet at the mouth of the creek to 1,020 feet in the headwater areas. Grassland and Shrub forest dominates the watershed. The watershed is primarily national park at 68.4%, State park at 15.7% and privately owned at 15.9% and is primarily managed for recreation. Vehicle access exists via Highway 1 near Mill Valley.

#### METHODS

The habitat inventory conducted in Green Gulch follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The California Conservation Corps (CCC) Technical Advisors 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

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survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are fully measured. 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. All pools except are fully sampled.

## 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 Green 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". Green 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:

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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 Green 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 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 Green 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 densimeters as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Green 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 Green 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.

#### 10. Large Woody Debris Count:

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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 2.0.18, 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 Green 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 6/4/2008 to 6/19/2008 was conducted by Hannah Colton (WSP) and Taylor Pool (WSP). The total length of the stream surveyed was 6,429 feet with an additional 41 feet of side channel.

Stream flow was not measured on Green Gulch.

Green Gulch is an E4 channel type for the first 145 feet of the stream surveyed (Reach 1), a NA channel type for the next 100 feet (Reach 2), an E4 channel type for the next 615 feet (Reach 3), a G4 channel type for the next 2,369 feet (Reach 4), a NA channel type for the next 200 feet (Reach 5), a G4 channel type for the next 449 feet (Reach 6), a NA channel type for the next 67 feet (Reach 7), a G4 channel type for the next 37 feet (Reach 8), a NA channel type for the next 57 feet (Reach 9), a G4 channel type for the next 36 feet (Reach 10), a NA channel type for the next 260 feet (Reach 11), a G4 channel type for final 2,144 feet of the stream surveyed (Reach 12).

E4 channels are low gradient, meandering riffle/pool channels with low width/depth ratios, little deposition, very efficient and stable with gravel-dominant substrates. G4 channels are entrenched “gully” step-pool channels on moderate gradients with low width /depth ratios and gravel dominant substrates.

NA channel types are reaches that were not surveyed due to depth, dense vegetation, or other considerations.

Water temperatures taken during the survey period ranged from 49 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 74 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 32% pool units, 26% flatwater units, 15% dry units, 15% riffle units, 7% culvert units and 4% no-survey marsh units (Graph 1). Based on total length of Level II habitat types there were, 31% flatwater units, 21% pool units, 20% dry units, 11% no-survey marsh units, 11% riffle units and 7% culvert units (Graph 2).

Eleven Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 25% Mid-Channel Pool units, 15% Dry units and 15% Run units (Graph 3). Based on percent total length there were 20% Dry units, 17% Run units and 12% Mid-

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Channel Pool units.

A total of 44 pools were identified (Table 3). Main Channel pools were the most frequently encountered, at 91%, and comprised 87% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum residual pool depths by pool habitat types. Pool quality for salmonids increases with depth. Thirteen of the 44 pools (30%) had a residual 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, 11 had a value of 2 (25%); 12 had a value of 3 (27.3%); 20 had a value of 4 (45.5%); and 1 had a value of 5 (2.3%) (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 8, flatwater habitat types had a mean shelter rating of 20, and pool habitats had a mean shelter rating of 11 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 10, scour pools had a mean shelter rating of 50, and backwater pools had a mean shelter rating of 13 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Undercut Banks are the dominant cover type in Green Gulch. Graph 7 describes the pool cover in Green Gulch. Undercut banks are the dominant pool cover type followed by small woody debris.

Table 6 summarizes the dominant substrate by habitat type. Graph 8 depicts the dominant substrate observed in pool tail-outs. Gravel was observed in 39% of pool tail-outs and a silt/clay substrate type was observed in 36% of pool tail-outs.

The mean percent canopy density for the surveyed length of Green Gulch was 85%. The mean percentages of hardwood and coniferous trees were 95% and 5%, respectively. Fifteen percent of the canopy was open. Graph 9 describes the mean percent canopy in Green Gulch.

For the stream reach surveyed, the mean percent right bank vegetated was 88%. The mean percent left bank vegetated was 89%. The dominant elements composing the structure of the stream banks consisted of 87% sand/silt/clay, 6% boulder, 4% bedrock and 4% cobble/gravel (Graph 10). Deciduous trees were the dominant vegetation type observed in 47% of the units surveyed. Additionally, 44% of the units surveyed had grass as the dominant vegetation type, and 8% had brush as the dominant vegetation (Graph 11).

## DISCUSSION

Green Gulch is an E4 channel type for the first 145 feet of the stream surveyed (Reach 1), a NA channel type for the next 100 feet (Reach 2), an E4 channel type for the next 615 feet (Reach 3), a G4 channel type for the next 2,369 feet (Reach 4), a NA channel type for the next 200 feet

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(Reach 5), a G4 channel type for the next 449 feet (Reach 6), a NA channel type for the next 67 feet (Reach 7), a G4 channel type for the next 37 feet (Reach 8), a NA channel type for the next 57 feet (Reach 9), a G4 channel type for the next 36 feet (Reach 10), a NA channel type for the next 260 feet (Reach 11), a G4 channel type for final 2,144 feet of the stream surveyed (Reach 12).

The suitability of E4 channel types for fish habitat improvement structures is as follows: Good for bank placed boulders. Fair for opposing wing-deflectors; Poor for plunge weirs; boulder clusters; single wing-deflectors. The suitability of G4 channel types for fish habitat improvement structures is as follows: Good for bank-placed boulders. Fair for plunge weirs; opposing wing-deflectors and log cover; Poor for boulder clusters and single wing deflectors.

The water temperatures recorded on the survey days 6/4/2008 to 6/19/2008, ranged from 49 to 58 degrees Fahrenheit. Air temperatures ranged from 54 to 74 degrees Fahrenheit. 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 31% of the total length of this survey, riffles 11%, pools 21%, dry units 21%, culvert units 7%, and no-survey marsh units 11%. The pools are relatively shallow with only 13 of the 44 (30%) pools having 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 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.

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

Twenty two 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 11. The shelter rating in the flatwater habitats was 20. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by Undercut Banks in Green Gulch. Undercut Banks are the dominant cover type in pools followed by small woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover 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 86%. Reach 3 had a canopy density of



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89%, Reach 4 had a canopy density of 87%, Reach 6 had a canopy density of 27%, Reach 8 had a canopy density of 68%, Reach 10 had a canopy density of 20%, Reach 12 had a canopy density of 90%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was high at 88% and 89%, 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.

### GENERAL RECOMMENDATIONS

Green Gulch should be managed as an anadromous, natural production stream.

Winter storms often bring down large trees and other woody debris into the stream, which increases the number and quality of pools. This woody debris, if left undisturbed, will provide fish shelter and rearing habitat, and offset channel incision. Landowners should be sensitive about the natural and positive role woody debris plays in the system, and encouraged not to remove woody debris from the stream, except under extreme buildup and only under guidance by a fishery professional.

### RECOMMENDATIONS

- 1) The spillway 3,179 feet into survey at habitat unit number 83 is a complete barrier to fish passage. Alternative sources of water and water storage facilities should be explored with the landowner and fish passage should be monitored and improved where possible.
- 2) There are several old dam structures present on Green Gulch that are retaining large quantities of fine sediment and present possible fish passage problems. The modification of these dam structures is desirable, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.
- 3) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from undercut banks. Adding high quality complexity with woody cover in the pools is desirable.
- 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.
- 5) Increase the canopy on Green Gulch by planting appropriate native vegetation like willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The riparian zone is thin in some areas and should be increased where appropriate. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is affected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects. There are also sections where the stream is being impacted from horses

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trampling the riparian zone. Alternatives to keep the horses out of the riparian zone should be explored with the land owner and developed where possible.

- 6) 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.

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	Habitat Unit #	Comments:
0	0001	Start of Survey: Started at confluence with Redwood Creek. Channel type is an E4 (Reach 1)
12	0002	Fish Passage: (Culvert) Culvert was corrugated metal pipe (CMP), was 2.5 H, 5W and 30 ft long. It has a diameter of 5ft and had about a 1% slope. It was partially flattened. It was not a barrier to fish. It has about 1.6ft rust line and was retaining sediment of about 0.3ft.
145	0005	General Comment: Channel type change E4 to NA, Reach 1 to Reach 2. No access due to marshy conditions and dense vegetation such as cattails and reeds.
245	0006	Channel Type Change NA to E4, Reach 2 to Reach 3. Structures: 118 ft into unit wire fence across creek. Bankfull width taken. Barbed wire fence about 300 ft into unit.
576	0007	Bio Sample: About 25 non-salmonids observed in pool that were about 25 mm long.
638	0011	General Comment: Channel type cross section was taken.
768	0017	Bio Sample: (Other) Unknown fish observed in pool.
803	0020	General Comment: Channel Type Change E4 to G4, Reach 3 to Reach 4.
819	0021	Access Points / Location: (Culvert) Bridge #1, was a crossing for a path used by horses, people and cars. The width was 3.6ft at bottom and 6.8ft at the top. The height was 4.1ft and the length was 14.3 ft. It was made out of wood and concrete and was not a barrier.
967	0028	General Comment: Channel type cross section taken.
1056	0031	Fish Passage: (Dam) Dam was 4 ft wide and 1.7 height. There is stored sediment and it is not a barrier to fish. It is a spillway for an old pond and the creek was dry directly upstream of the structure.
1187	0033	Bio Sample: (Other) Unknown fish observed.
1247	0037	Fish Passage: (Dam) 20 ft into unit another spillway (dam#2). Not retaining sediment. It was 2 ft in width and 1.7 ft tall.

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Position	Habitat Unit #	Comments:
1308	0039	Fish Passage: (Dam) 15ft into the unit spillway.
1372	0042	Fish Passage: (Dam) Dam structure 3. Creating a pool upstream and is retaining sediment. The structure is 6 ft tall, from the top of dam to water level is 4.9ft tall and is 7.3 ft wide. Possible barrier to fish passage.
1530	0046	Fish Passage: (Dam) Dam 4 at top of unit in middle of creek. Dam was 1.6 tall and was 4.3ft from top of dam to the top of water surface. It was 4.5ft wide. There was a plunge pool downstream with average depth of 1.5 ft. The left bank was starting to scour around spillway.
1567	0047	Fish Passage: (Dam) Dam 5 top of unit had water flowing over it. It was 4.7 ft wide and 1.5 ft tall. From the top of dam to water level was 4.3ft.
1640	0048	Tributaries: 25ft into unit right bank dry tributary 1.
1987	0058	Access Points / Location: (Bridge) Bridge 2 was a footbridge. It was not retaining gravel. It was 15ft wide, 3.6ft high and 4.3 ft long. It was made out of wood and was not a barrier to fish.
2057	0060	Fish Passage: (Dam) Dam 6 was 14.3ft long, 57.3t wide (water width), 12.9ft wide (total width) and 5.3ft tall. It had flash boards and was downcutting. It could be a possible barrier to juvenile fish, but was not a barrier to adult fish.
2079	0061	General Comment: Silt accumulation from old dam.
2264	0065	Erosion Site: (Bank) Right bank erosion site. Some erosion control measures have been implemented such as planting.
2336	0066	Fish Passage: (LDA) Large woody debris accumulation (LDA) was forcing flow to left bank and there was some bank erosion.
2372	0067	Bio Sample: (Other) Unknown fish observed
2425	0068	Erosion Site: (Bank) Right bank erosion control observed.
2461	0070	General Comment: Short A2 channel type section, not long enough to break out into own reach.
2483	0071	Fish Passage: (Dam) Dam 7 was 17.5ft long, 10.3ft wide (width of water), 12.5 ft wide (width of whole dam) and 5.6ft tall. It had flashboards and there was no downcutting and is a possible barrier for fish. Dam is no longer functioning and the spillway started 23 feet into unit and was 15 ft long. A ferret was observed on the right bank.
2548	0073	Erosion Site: (Bank) Right bank erosion, Planted willow starting to grow.
2763	0079	Erosion Site: (Bank) Right bank retaining wall.
2834	0081	General Comment: Glide at end of dam spillway and current end of anadromy. Left bank erosion.
2869	0082	General Comment: Spillway of about 12% slope. 82ft into unit footbridge.
2869	0082	Fish Passage: (Dam) Dam 8 was 20.5 long, 14.5ft wide and 3.2 tall. There were flashboards and there was not downcutting. It is retaining gravel and was a barrier to fish passage.

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Position	Habitat Unit #	Comments:
3179	0083	General Comment: Channel Type Change G4 to NA, Reach 4 to Reach 5. General Comment: Main agriculture pond for property. Stickleback and other unidentified fish were observed.
3379	0084	General Comment: Channel Type Change NA to G4, Reach 5 to Reach 6. General Comment: Culvert under road/ house area.
3559	0085	Structures: Creek turns into a concrete channel. The top width was 9ft, bottom width was 3ft and 4ft tall. 110ft into unit was power-line pipe.
3559	0085	Access Points / Location: (Culvert) 59 ft into unit culvert on right bank
3796	0086	Access Points / Location: (Bridge) Bridge 3 was a footbridge. It was 14.5 ft wide, 3.7ft tall and 5.5 long. It was not retaining gravel and was not downcutting. It was not a barrier to fish.
3828	0088	General Comment: Channel Type Change G4 to NA, Reach 6 to Reach 7. Bio Sample: (Other) Stickleback observed.
3895	0089	General Comment: Channel Type Change NA to G4, Reach 7 to Reach 8.
3932	0090	General Comment: Channel Type Change G4 to NA, Reach 8 to Reach 9.
3989	0091	General Comment: Channel Type Change NA to G4, Reach 9 to Reach 10.
3999	0092	Fish Passage: (Dam) Dam 9 was 26 ft long, 3.8ft wide (width of water), 5.4 (width of dam) and 5.4ft tall. There were flashboards and was not retaining gravel. It was a possible barrier for fish.
4025	0093	General Comment: Channel Type Change G4 to NA, Reach 10 to Reach 11.
4285	0094	General Comment: Channel Type Change NA to G4, Reach 11 to Reach 12.
4365	0096	General Comment: Orange algal film on water.
4433	0098	Access Points / Location: (Culvert 3) Possible barrier at top of unit. Failed culvert to side of concrete channel (new culvert 3.6ft in diameter), water drops about 8ft into deep pool. Broken concrete through out pool. Concrete channel was 4.7ft high, 3.6ft wide and 17ft long.
4623	0104	Access Points / Location: (Culvert) CMP Culvert 4 was 3.8ft high, 3.8ft wide and 21ft long. It had a diameter of 3.8ft. Plunge height of 0.5ft and a slope of 3%. It was in good condition. It was a possible barrier to salmonids and was retaining gravel.
4767	0106	Tributaries: 18ft into unit dry tributary.
4928	0108	General Comment: Pacific Giant Salamander observed.
5099	0111	General Comment: Unknown fish observed. Old bridge that has collapsed into stream. Cement retaining wall on right bank about 5 ft tall.
5099	0111	Fish Passage: (LDA) LDA was 6.1ft high, 12ft wide and 7.5ft long. There was about 20 pieces of wood. There was water flowing through and there were gaps. There was sediment retention of cobble and sand. There were no fish observed about LDA.

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Position	Habitat Unit #	Comments:
5485	0120	Vegetation becoming very dense
6429	0135	End of Survey: End of Survey due to creek physically inaccessible because of very thick vegetation.

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.

McCain, M., D. Fuller, L. Decker and K. Overton. 1990. Stream habitat classification and inventory procedures for northern California. FHC Currents. No.1. U.S. Department of Agriculture. Forest Service, Pacific Southwest Region.

Rosgen, D.L., 1994. A Classification of Natural Rivers. *Catena*, Vol 22: 169-199, Elsevier Science, B. V. Amsterdam.

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

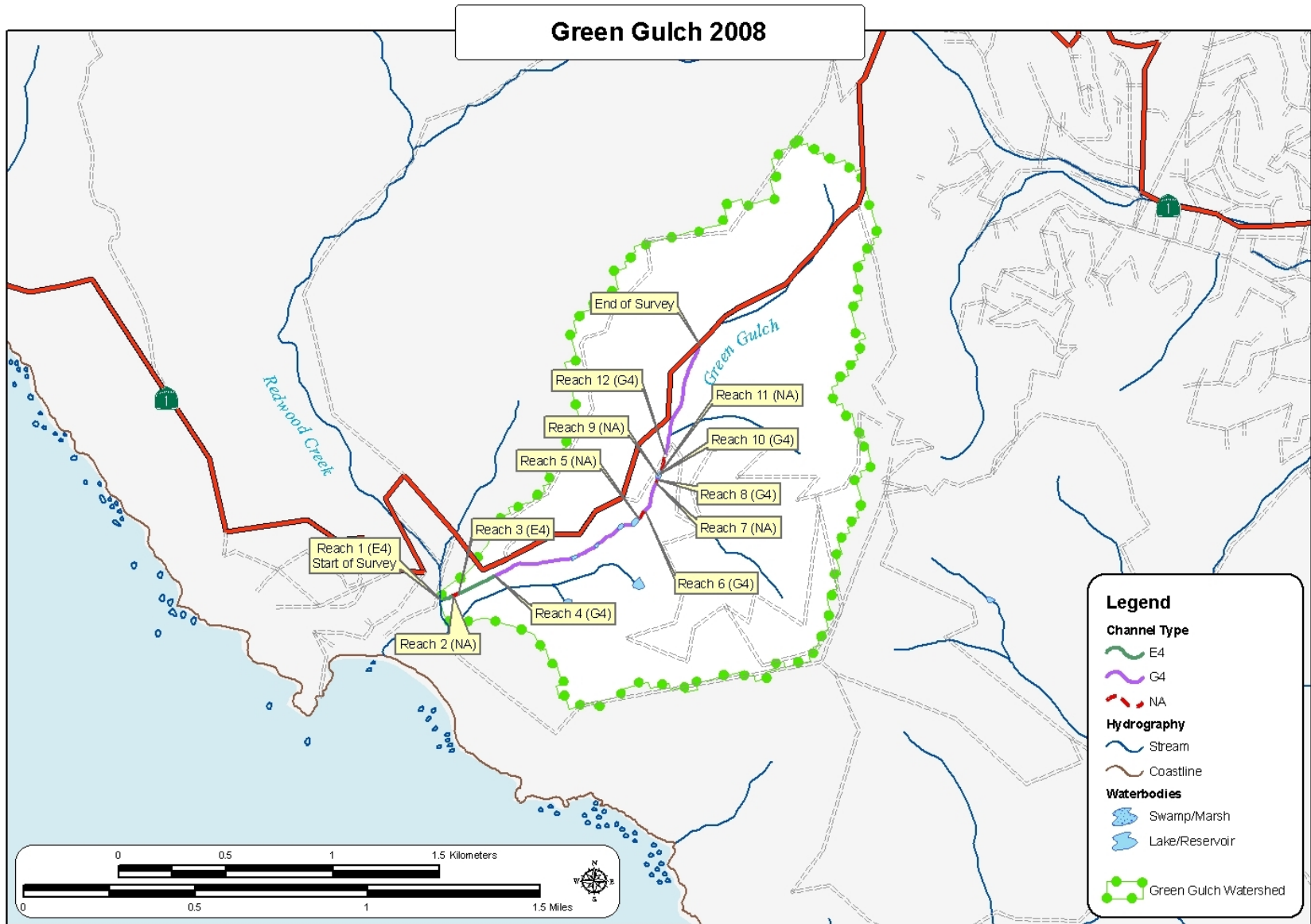
Corner Pool	(CRP)	[5.1]	{22}
Lateral Scour Pool - Log Enhanced	(LSL)	[5.2]	{10}
Lateral Scour Pool - Root Wad Enhanced	(LSR)	[5.3]	{11}
Lateral Scour Pool - Bedrock Formed	(LSBk)	[5.4]	{12}
Lateral Scour Pool - Boulder Formed	(LSBo)	[5.5]	{20}
Plunge Pool	(PLP)	[5.6]	{ 9 }

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:** Green Gulch

**LLID:** 1225734378606

**Drainage:** Bolinas

**Survey** 6/4/2008 to 6/19/2008

**Confluence Location: Quad:** SAN RAFAEL

**Legal Description:** T01SR07WS1

**Latitude:** 37:51:38.0N

**Longitude:** 122:34:24.0W

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
10	0	CULVERT	7.4	45	445	6.9									
20	0	DRY	14.7	64	1279	19.8									
36	11	FLATWATER	26.5	56	2017	31.2	4.1	0.5	0.7	172	6208	104	3744		20
5	0	NOSURVEY_	3.7	137	684	10.6									
44	44	POOL	32.4	31	1356	21.0	6.1	1.0	1.7	165	7271	194	8546	170	11
21	7	RIFFLE	15.4	33	689	10.6	2.8	0.2	0.6	99	2086	23	477		8
Total Units	Total Units Fully Measured				Total Length (ft.)						Total Area (sq.ft.)		Total Volume (cu.ft.)		
136	62				6470						15565		12767		



**Table 2 - Summary of Habitat Types and Measured Parameters**

**Stream Name:** Green Gulch

**LLID:** 1225734378606

**Drainage:** Bolinas

**Survey** 6/4/2008 to 6/19/2008

**Confluence Location: Quad:** SAN RAFAEL

**Legal Description:** T01SR07WS1

**Latitude:** 37:51:38.0N

**Longitude:** 122:34:24.0W

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	Mean Canopy (%)
16	5	LGR	11.8	31	499	7.7	3.0	0.2	0.8	111	1781	22	347		8	90
4	1	HGR	2.9	36	145	2.2	1.0	0.3	1.3	49	196	15	59		5	88
1	1	CAS	0.7	45	45	0.7	2.0	0.4	1.0	90	90	36	36			89
11	6	GLD	8.1	57	628	9.7	4.0	0.5	1.3	163	1796	123	1355		26	66
21	4	RUN	15.4	53	1120	17.3	4.0	0.5	0.8	199	4182	92	1935		14	84
4	1	SRN	2.9	67	269	4.2	3.0	0.3	0.9	121	483	36	145		5	94
34	34	MCP	25.0	23	784	12.1	6.0	1.0	5.0	135	4593	175	5946	157	10	85
6	6	STP	4.4	66	399	6.2	5.0	0.7	2.0	300	1798	245	1470	219	9	86
1	1	PLP	0.7	8	8	0.1	4.0	1.3	2.1	32	32	42	42	42	50	86
3	3	DPL	2.2	55	165	2.6	5.0	0.9	2.3	283	849	363	1089	259	13	95
20	0	DRY	14.7	64	1279	19.8										86
10	0	CUL	7.4	45	445	6.9										
5	0	MAR	3.7	137	684	10.6										
<b>Total Units</b>	<b>Total Units Fully Measured</b>				<b>Total Length (ft.)</b>						<b>Total Area (sq.ft.)</b>		<b>Total Volume (cu.ft.)</b>			
136	62				6470						15799		12423			

**Table 3 - Summary of Pool Habitat Types**

**Stream Name:** Green Gulch

**LLID:** 1225734378606

**Drainage:** Bolinas

**Survey** 6/4/2008 to 6/19/2008

**Confluence Location: Quad:** SAN RAFAEL

**Legal Description:** T01SR07WS1

**Latitude:** 37:51:38.0N

**Longitude:** 122:34:24.0W

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
40	40	MAIN	91	30	1183	87	6.2	1.0	160	6390	167	6668	10
1	1	SCOUR	2	8	8	1	4.0	1.3	32	32	42	42	50
3	3	BACKWATER	7	55	165	12	5.1	0.9	283	849	259	776	13
Total Units	Total Units Fully Measured				Total Length (ft.)					Total Area (sq.ft.)		Total Volume (cu.ft.)	
44	44				1356					7271		7485	

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

**Stream Name:** Green Gulch

**LLID:** 1225734378606

**Drainage:** Bolinas

**Survey** 6/4/2008 to 6/19/2008

**Confluence Location: Quad:** SAN RAFAEL

**Legal Description:** T01SR07WS1

**Latitude:** 37:51:38.0N

**Longitude:** 122:34:24.0W

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
34	MCP	77	7	21	17	50	7	21	0	0	3	9
6	STP	14	1	17	4	67	1	17	0	0	0	0
1	PLP	2	0	0	0	0	1	100	0	0	0	0
3	DPL	7	1	33	1	33	1	33	0	0	0	0
<b>Total Units</b>			<b>Total &lt; 1 Foot Max Resid. Depth</b>	<b>Total &lt; 1 Foot % Occurrence</b>	<b>Total 1 &lt; 2 Feet Max Resid. Depth</b>	<b>Total 1 &lt; 2 Feet % Occurrence</b>	<b>Total 2 &lt; 3 Feet Max Resid. Depth</b>	<b>Total 2 &lt; 3 Feet % Occurrence</b>	<b>Total 3 &lt; 4 Feet Max Resid. Depth</b>	<b>Total 3 &lt; 4 Feet % Occurrence</b>	<b>Total &gt;= 4 Feet Max Resid. Depth</b>	<b>Total &gt;= 4 Feet % Occurrence</b>
44			9	20	22	50	10	23	0	0	3	7
Mean Maximum Residual Pool Depth (ft.):			2									

Green Gulch

**Table 5 - Summary of Mean Percent Cover By Habitat Type**

Stream Name:		Green Gulch		Dry Units:		20		LLID:		1225734378606		Drainage:		Bolinás	
Survey		6/4/2008 to 6/19/2008		Legal Description:		T01SR07WS1		Latitude:		37:51:38.0N		Longitude:		122:34:24.0W	
Confluence Location:		Quad: SAN RAFAEL		Legal Description:		T01SR07WS1		Latitude:		37:51:38.0N		Longitude:		122:34:24.0W	
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				
16	5	LGR	0	18	0	22	50	10	0	0	0				
4	1	HGR	0	0	0	0	50	0	0	50	0				
1	0	CAS													
21	6	TOTAL RIFFLE	0	15	0	18	50	8	0	8	0				
11	6	GLD	8	50	0	0	8	17	0	0	0				
21	4	RUN	13	35	0	13	13	25	0	3	0				
4	1	SRN	50	0	0	0	50	0	0	0	0				
36	11	TOTAL FLAT	14	40	0	5	14	18	0	1	0				
34	34	MCP	31	22	2	9	19	0	0	4	5				
6	6	STP	20	5	8	30	15	0	0	22	0				
1	1	PLP	100	0	0	0	0	0	0	0	0				
3	3	DPL	62	32	0	3	3	0	0	0	0				
44	44	TOTAL POOL	33	20	3	11	17	0	0	6	4				
10	0	CUL													
5	0	MAR													
136	61	TOTAL	26	23	2	10	20	4	0	5	3				

**Table 6 - Summary of Dominant Substrates By Habitat Type**

**Stream Name:** Green Gulch      **Dry Units:** 20      **LLID:** 1225734378606      **Drainage:** Bolinas  
**Survey** 6/4/2008 to 6/19/2008

**Confluence Location: Quad:** SAN RAFAEL      **Legal Description:** T01SR07WS1      **Latitude:** 37:51:38.0N      **Longitude:** 122:34:24.0W

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
16	5	LGR	0	20	60	20	0	0	0
4	1	HGR	0	0	0	0	0	100	0
1	1	CAS	0	0	0	0	0	100	0
11	6	GLD	33	17	33	0	0	0	17
21	4	RUN	0	0	75	25	0	0	0
4	1	SRN	0	0	100	0	0	0	0
34	34	MCP	24	18	44	3	6	6	0
6	6	STP	0	0	50	17	0	33	0
1	1	PLP	0	0	0	0	0	0	100
3	3	DPL	67	33	0	0	0	0	0
10	0	CUL	0	0	0	0	0	0	0
5	0	MAR	0	0	0	0	0	0	0

**Table 7 - Summary of Mean Percent Canopy for Entire Stream**

**Stream Name:** Green Gulch

**LLID:** 1225734378606

**Drainage:** Bolinas

**Survey** 6/4/2008 to 6/19/2008

**Confluence Location: Quad:** SAN RAFAEL

**Legal Description:** T01SR07WS1

**Latitude:** 37:51:38.0N

**Longitude:** 122:34:24.0W

Mean Percent Canopy	Mean Percent Conifer	Mean Percent Hardwood	Mean Percent Open Units	Mean Right Bank % Cover	Mean Left Bank % Cover
85	5	95	2	88	89

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: Green Gulch LLID: 1225734378606 Drainage: Bolinas  
 Survey Dates: 6/4/2008 to 6/19/2008 Survey Length (ft.): 6470.3 Main Channel (ft.): 6429.3 Side Channel (ft.): 41  
 Confluence Location: Quad: SAN RAFAEL Legal Description: T01SR07WS1 Latitude: 37:51:38.0N Longitude: 122:34:24.0W

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 1**

Channel Type: E4	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 145	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.): 11.2	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Brush	< 2 Feet Deep:
Range (ft.): 8.00 to 8.00	Vegetative Cover (%): 100.0	2 to 2.9 Feet Deep:
Mean (ft.): 8.00	Dominant Shelter: Aquatic Vegetation	3 to 3.9 Feet Deep:
Std. Dev.: 0.00	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep:
Base Flow (cfs):	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth (ft.):
Water (F): 0 - 0 Air (F): 74 - 74	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft.): 69	Riffles:	
	Pools:	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

**STREAM REACH: 2**

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 100	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): 8.00 to 8.00	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.): 8.00	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.: 0.00	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs):	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 0 - 0 Air (F): 74 - 74	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft.): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 3**

Channel Type: E4	Canopy Density (%): 89.4	Pools by Stream Length (%): 21.0
Reach Length (ft.): 574	Coniferous Component (%): 5.0	Pool Frequency (%): 37.5
Riffle/Flatwater Mean Width (ft.): 4.8	Hardwood Component (%): 95.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Grass	< 2 Feet Deep: 100.0
Range (ft.): 7.00 to 8.00	Vegetative Cover (%): 94.4	2 to 2.9 Feet Deep: 0.0
Mean (ft.): 7.94	Dominant Shelter: Terrestrial Veg.	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 0.24	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs):	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth (ft.): 0.88
Water (F): 0 - 58 Air (F): 64 - 74	LWD per 100 ft.:	Mean Pool Shelter Rating: 7
Dry Channel (ft.): 437.6	Riffles: 0	
	Pools: 0	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 50.0 Sand: 16.7 Gravel: 33.3 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 0.0 2. 16.7 3. 16.7 4. 66.7 5. 0.0		

**STREAM REACH: 4**

Channel Type: G4	Canopy Density (%): 87.3	Pools by Stream Length (%): 37.2
Reach Length (ft.): 2360	Coniferous Component (%): 2.7	Pool Frequency (%): 38.7
Riffle/Flatwater Mean Width (ft.): 2.7	Hardwood Component (%): 97.3	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 62.5
Range (ft.): 4.20 to 7.60	Vegetative Cover (%): 90.7	2 to 2.9 Feet Deep: 29.2
Mean (ft.): 6.51	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 1.37	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 8.3
Base Flow (cfs): 0	Occurrence of LWD (%): 2.1	Mean Max Residual Pool Depth (ft.): 1.84
Water (F): 49 - 56 Air (F): 54 - 68	LWD per 100 ft.:	Mean Pool Shelter Rating: 13
Dry Channel (ft.): 649.5	Riffles: 0	
	Pools: 0	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 37.5 Sand: 8.3 Gravel: 45.8 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 8.3		
Embeddedness Values (%): 1. 0.0 2. 8.3 3. 37.5 4. 50.0 5. 4.2		

**STREAM REACH: 5**

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 200	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): to	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.:	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs): 0	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 52 - 52 Air (F): 64 - 64	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft.): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: Sand: Gravel: Sm Cobble: Lg Cobble: Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		



Summary of Fish Habitat Elements By Stream Reach

**STREAM REACH: 6**

Channel Type: G4	Canopy Density (%): 27.0	Pools by Stream Length (%): 0.0
Reach Length (ft.): 449	Coniferous Component (%): 80.0	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.): 5.0	Hardwood Component (%): 20.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Grass	< 2 Feet Deep:
Range (ft.): to	Vegetative Cover (%): 30.0	2 to 2.9 Feet Deep:
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.:	Dominant Bank Substrate Type: Bedrock	>= 4 Feet Deep:
Base Flow (cfs): 0	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth (ft.):
Water (F): 52 - 52	Air (F): 64 - 64	LWD per 100 ft.:
Dry Channel (ft.): 0	Riffles:	Mean Pool Shelter Rating:
	Pools:	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 1.	Sand: 2.	Gravel: 3.
Embeddedness Values (%):	Sm Cobble: 4.	Lg Cobble: 5. 0.0
	Boulder:	Bedrock:

**STREAM REACH: 7**

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 67	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): to	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.:	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs): 0	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 52 - 52	Air (F): 64 - 64	LWD per 100 ft.:
Dry Channel (ft.): 0	Riffles:	Mean Pool Shelter Rating:
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 1.	Sand: 2.	Gravel: 3.
Embeddedness Values (%):	Sm Cobble: 4.	Lg Cobble: 5. 0.0
	Boulder:	Bedrock:

**STREAM REACH: 8**

Channel Type: G4	Canopy Density (%): 68.0	Pools by Stream Length (%): 100.0
Reach Length (ft.): 37	Coniferous Component (%): 0.0	Pool Frequency (%): 100.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%): 100.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 0.0
Range (ft.): to	Vegetative Cover (%): 95.0	2 to 2.9 Feet Deep: 100.0
Mean (ft.):	Dominant Shelter: Small Woody Debris	3 to 3.9 Feet Deep: 0.0
Std. Dev.:	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth (ft.): 2
Water (F): 52 - 52	Air (F): 64 - 64	LWD per 100 ft.:
Dry Channel (ft.): 0	Riffles:	Mean Pool Shelter Rating: 20
	Pools: 0	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 100.	Sand: 0.0	Gravel: 0.0
Embeddedness Values (%):	Sm Cobble: 0.0	Lg Cobble: 0.0
	Boulder: 0.0	Bedrock: 0.0

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 9**

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 57	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): to	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.:	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs): 0	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 55 - 55 Air (F): 70 - 70	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft.): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 1. Sand: 2. Gravel: 3. Sm Cobble: 4. Lg Cobble: 5. Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

**STREAM REACH: 10**

Channel Type: G4	Canopy Density (%): 20.0	Pools by Stream Length (%): 27.8
Reach Length (ft.): 36	Coniferous Component (%): 0.0	Pool Frequency (%): 50.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%): 100.0	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Grass	< 2 Feet Deep: 0.0
Range (ft.): to	Vegetative Cover (%): 90.0	2 to 2.9 Feet Deep: 100.0
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep: 0.0
Std. Dev.:	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 0.0
Base Flow (cfs): 0	Occurrence of LWD (%): 0.0	Mean Max Residual Pool Depth (ft.): 2
Water (F): 55 - 55 Air (F): 70 - 70	LWD per 100 ft.:	Mean Pool Shelter Rating: 5
Dry Channel (ft.): 0	Riffles:	
	Pools: 0	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 100. Sand: 0.0 Gravel: 0.0 Sm Cobble: 0.0 Lg Cobble: 0.0 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 0.0 2. 0.0 3. 0.0 4. 100.0 5. 0.0		

**STREAM REACH: 11**

Channel Type: NA	Canopy Density (%):	Pools by Stream Length (%): 0.0
Reach Length (ft.): 260	Coniferous Component (%):	Pool Frequency (%): 0.0
Riffle/Flatwater Mean Width (ft.):	Hardwood Component (%):	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation:	< 2 Feet Deep:
Range (ft.): to	Vegetative Cover (%): 0.0	2 to 2.9 Feet Deep:
Mean (ft.):	Dominant Shelter:	3 to 3.9 Feet Deep:
Std. Dev.:	Dominant Bank Substrate Type:	>= 4 Feet Deep:
Base Flow (cfs): 0	Occurrence of LWD (%):	Mean Max Residual Pool Depth (ft.):
Water (F): 55 - 55 Air (F): 70 - 70	LWD per 100 ft.:	Mean Pool Shelter Rating:
Dry Channel (ft.): 0	Riffles:	
	Pools:	
	Flat:	
Pool Tail Substrate (%): Silt/Clay: 1. Sand: 2. Gravel: 3. Sm Cobble: 4. Lg Cobble: 5. Boulder: Bedrock:		
Embeddedness Values (%): 1. 2. 3. 4. 5. 0.0		

**Summary of Fish Habitat Elements By Stream Reach**

**STREAM REACH: 12**

Channel Type: G4	Canopy Density (%): 89.9	Pools by Stream Length (%): 14.1
Reach Length (ft.): 2144	Coniferous Component (%): 6.5	Pool Frequency (%): 28.6
Riffle/Flatwater Mean Width (ft.): 3.0	Hardwood Component (%): 93.5	Residual Pool Depth (%):
BFW:	Dominant Bank Vegetation: Hardwood Trees	< 2 Feet Deep: 83.3
Range (ft.): 6.80 to 12.00	Vegetative Cover (%): 82.9	2 to 2.9 Feet Deep: 8.3
Mean (ft.): 9.17	Dominant Shelter: Undercut Banks	3 to 3.9 Feet Deep: 0.0
Std. Dev.: 2.37	Dominant Bank Substrate Type: Sand/Silt/Clay	>= 4 Feet Deep: 8.3
Base Flow (cfs): 0	Occurrence of LWD (%): 2.9	Mean Max Residual Pool Depth (ft.): 1.63
Water (F): 50 - 50 Air (F): 55 - 65	LWD per 100 ft.:	Mean Pool Shelter Rating: 8
Dry Channel (ft.): 123	Riffles: 0	
	Pools: 0	
	Flat: 0	
Pool Tail Substrate (%): Silt/Clay: 16.7 Sand: 0.0 Gravel: 33.3 Sm Cobble: 41.7 Lg Cobble: 8.3 Boulder: 0.0 Bedrock: 0.0		
Embeddedness Values (%): 1. 0.0 2. 66.7 3. 16.7 4. 16.7 5. 0.0		

**Table 9 -Mean Percentage of Dominant Substrate and Vegetation**

**Stream Name:** Green Gulch **LLID:** 1225734378606 **Drainage:** Bolinas  
**Survey** 6/4/2008 to 6/19/2008  
**Confluence Location: Quad:** SAN RAFAEL **Legal Description:** T01SR07WS1 **Latitude:** 37:51:38.0N **Longitude:** 122:34:24.0W

**Mean Percentage of Dominant Stream Bank Substrate**

Dominant Class of Substrate	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage (%)
Bedrock	4	1	4.0
Boulder	2	5	5.6
Cobble/Gravel	4	1	4.0
Sand/Silt/Clay	53	56	86.5

**Mean Percentage of Dominant Stream Bank Vegetation**

Dominant Class of Vegetation	Number of Units Right Bank	Number of Units Left Bank	Total Mean Percentage
Grass	27	29	44.4
Brush	6	4	7.9
Hardwood	29	30	46.8
Coniferous	0	0	0.0
No Vegetation	1	0	0.8

**Total Stream Cobble Embeddedness Values:** 3

**Table 10 - Mean Percent of Shelter Cover Types For Entire System**

**Stream Name:** Green Gulch

**LLID:** 1225734378606

**Drainage:** Bolinas

**Survey** 6/4/2008 to 6/19/2008

**Confluence Location: Quad:** SAN RAFAEL

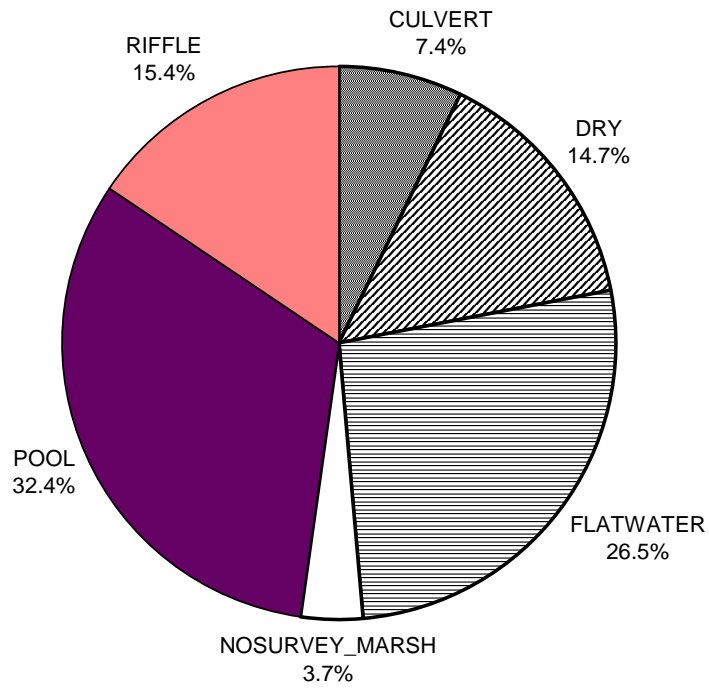
**Legal Description:** T01SR07WS1

**Latitude:** 37:51:38.0N

**Longitude:** 122:34:24.0W

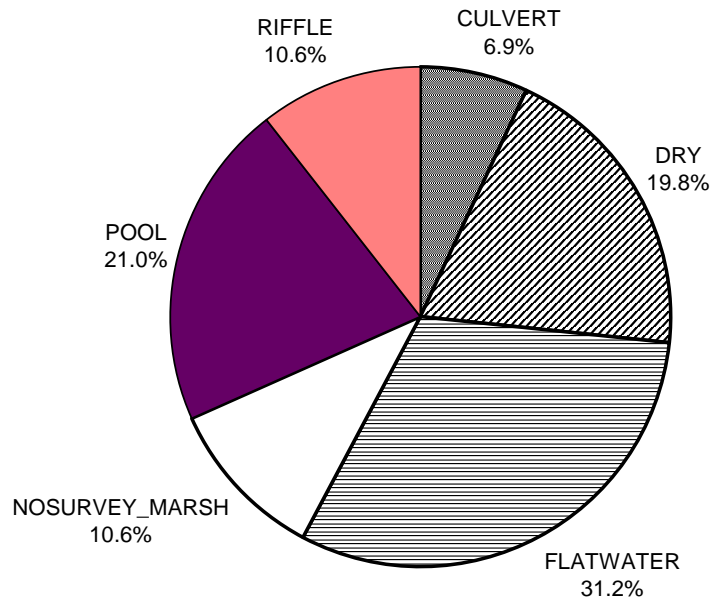
	<b>Riffles</b>	<b>Flatwater</b>	<b>Pools</b>
UNDERCUT BANKS (%)	0	14	33
SMALL WOODY DEBRIS (%)	15	40	20
LARGE WOODY DEBRIS (%)	0	0	3
ROOT MASS (%)	18	5	11
TERRESTRIAL VEGETATION	50	14	17
AQUATIC VEGETATION (%)	8	18	0
WHITEWATER (%)	0	0	0
BOULDERS (%)	8	1	6
BEDROCK LEDGES (%)	0	0	4

### Green Gulch 2008 HABITAT TYPES BY PERCENT OCCURRENCE



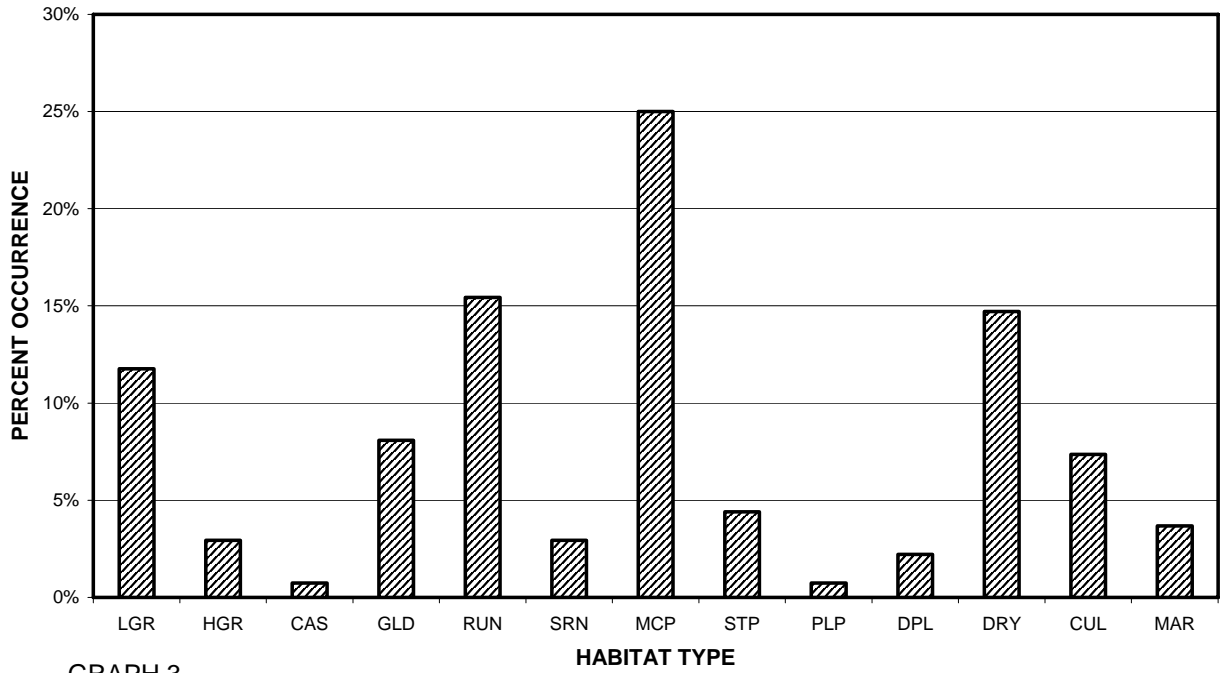
GRAPH 1

### Green Gulch 2008 HABITAT TYPES BY PERCENT TOTAL LENGTH



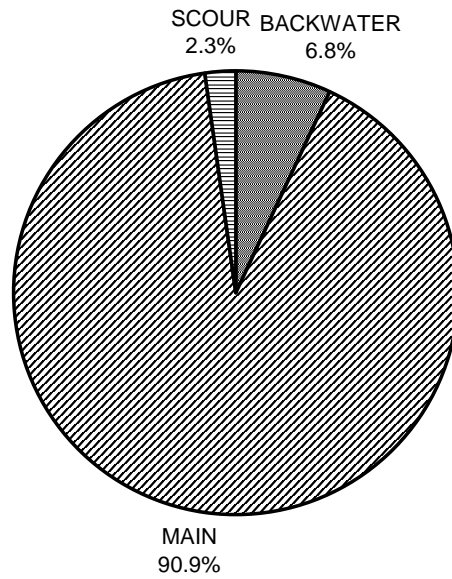
GRAPH 2

### Green Gulch 2008 HABITAT TYPES BY PERCENT OCCURRENCE



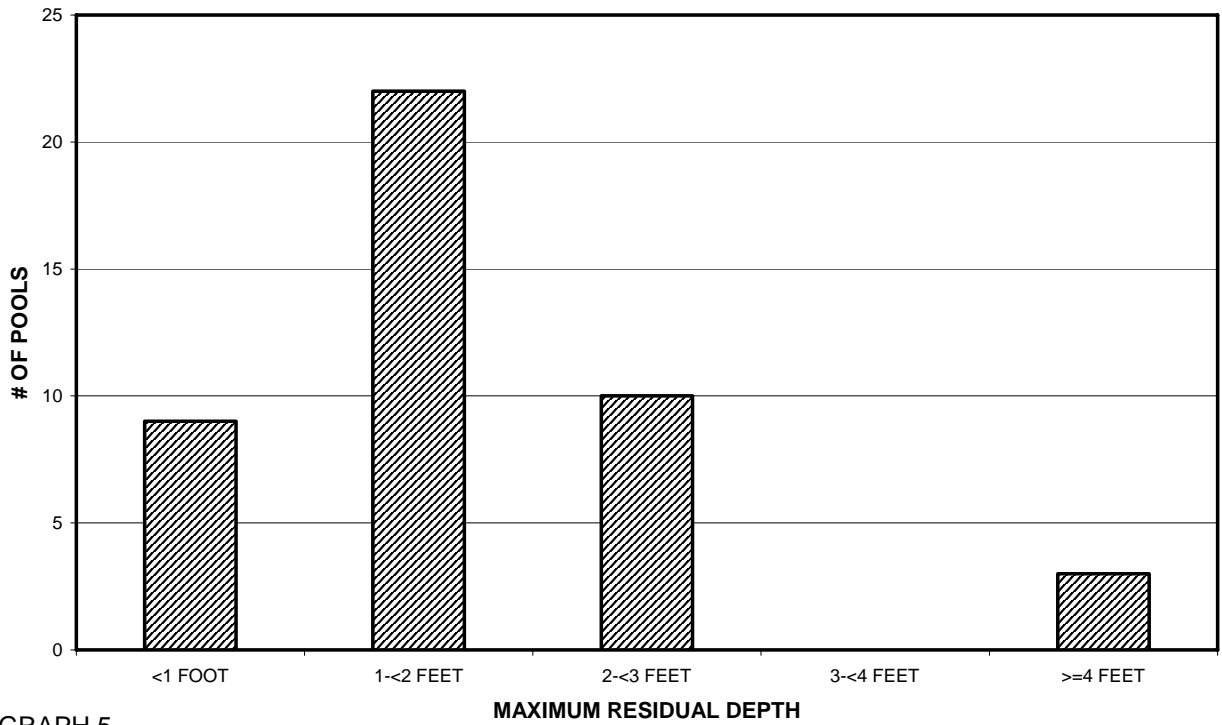
GRAPH 3

### Green Gulch 2008 POOL TYPES BY PERCENT OCCURRENCE



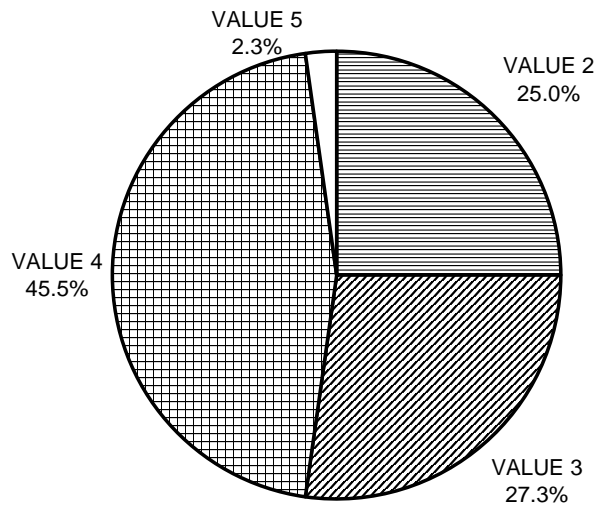
GRAPH 4

### Green Gulch 2008 MAXIMUM DEPTH IN POOLS



GRAPH 5

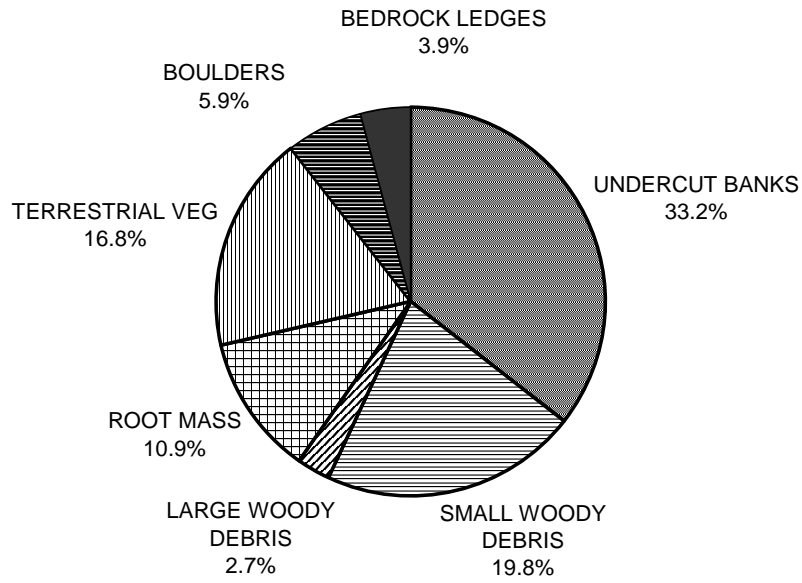
### Green Gulch 2008 PERCENT EMBEDDEDNESS



GRAPH 6

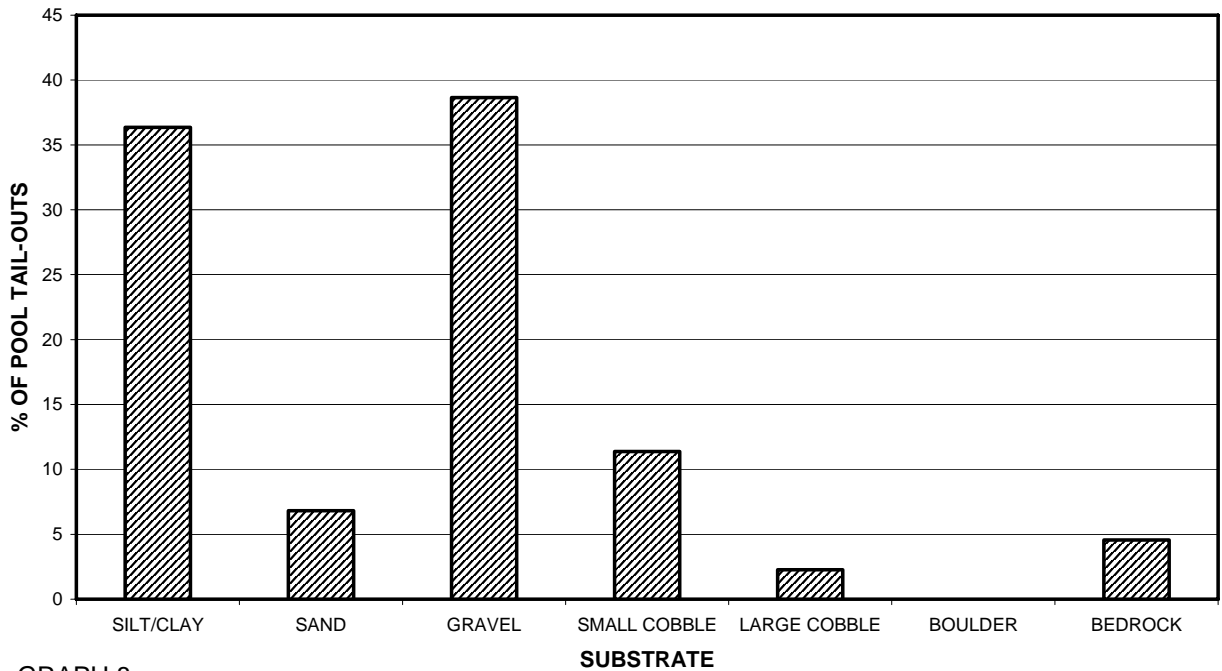


**Green Gulch 2008  
MEAN PERCENT COVER TYPES IN POOLS**



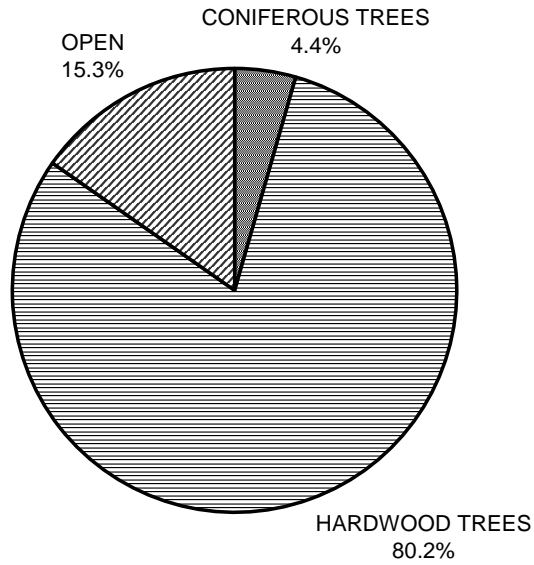
GRAPH 7

**Green Gulch 2008  
SUBSTRATE COMPOSITION IN POOL TAIL-OUTS**



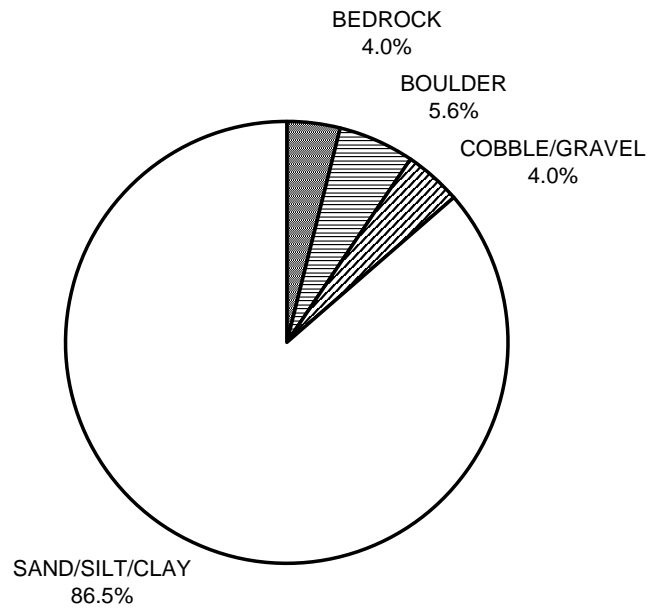
GRAPH 8

**Green Gulch 2008  
MEAN PERCENT CANOPY**



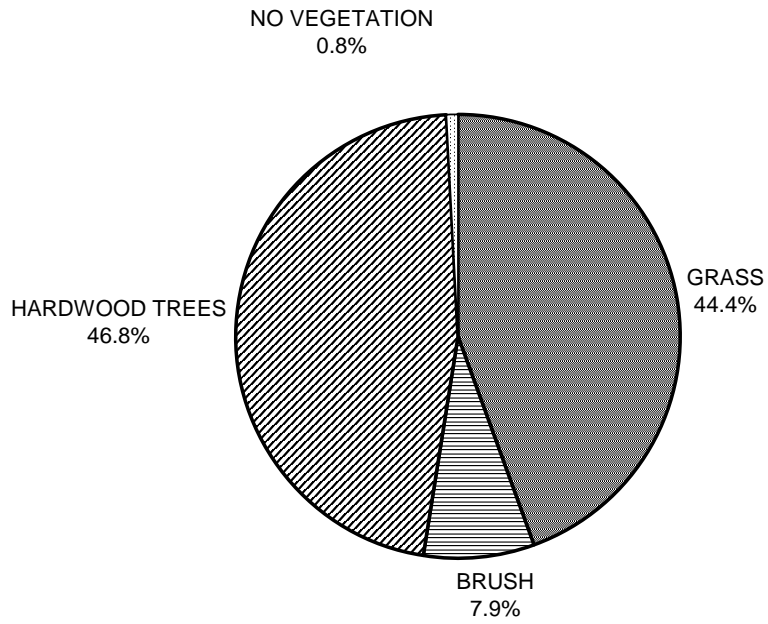
GRAPH 9

**Green Gulch 2008  
DOMINANT BANK COMPOSITION IN SURVEY REACH**



GRAPH 10

**Green Gulch 2008  
DOMINANT BANK VEGETATION IN SURVEY REACH**



GRAPH 11