# STREAM INVENTORY REPORT

## Johnson Creek

## INTRODUCTION

A stream inventory was conducted during the summer of 2002 on Johnson Creek. The survey began at the confluence with Gates Creek and extended upstream 1.2 miles.

The Johnson 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 Johnson 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

Johnson Creek is a tributary to Gates Creek, tributary to Daugherty Creek, tributary to South Fork Big River, located in Mendocino County, California (Map 1). Johnson Creek's legal description at the confluence with Gates Creek is T16N R14W S33. Its location is 39E12N36O north latitude and 123E24N36O west longitude. Johnson Creek is a first order stream and has approximately 1.7 miles of blue line stream according to the USGS Bailey Ridge 7.5 minute quadrangle. Johnson Creek drains a watershed of approximately 1.7 square miles. Elevations range from about 800 feet at the mouth of the creek to 2,300 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 via Masonite Road.

## METHODS

The habitat inventory conducted in Johnson Creek 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/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 Johnson 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". Johnson 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 Johnson 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 Johnson 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 Johnson Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or 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 Johnson 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.

**Johnson Creek**

## 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 Johnson Creek. In addition, 28 sites were electrofished using a Smith-Root Model 12 electrofisher. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

## 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 Residual Pool Depths by Habitat Types
- Mean Percent Cover by Habitat Type
- Dominant Substrates by Habitat Type

Graphics are produced from the tables using Quattro Pro. Graphics developed for Johnson Creek include:

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

The habitat inventory of May 20-31, 2002, was conducted by Matt Davis (CCC), Trevor Tollefson (DFG), and Morguine Flynn Sousa (WSP). The total length of the stream surveyed was 6,270 feet with an additional 10 feet of side channel.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.36 cfs on May 22, 2002.

**Johnson Creek**

Johnson Creek is a B4 channel type for the first 2,228 feet of the stream surveyed, an F4 channel type for the next 672 feet, and a G4 channel type for the remaining 3,370 feet. B4 channels are moderately entrenched, moderate gradient, riffle dominated channels with infrequent spaced pools, very stable plan and profile, and gravel dominated substrate. F4 channels are entrenched, meandering, riffle/pool channel on low gradients with high width/depth ratios and gravel-dominant substrates. G4 channels are entrenched Agully@ step-pool channel with low width/depth ratios on a moderate gradient and gravel dominated substrate.

Water temperatures taken during the survey period ranged from 49E to 60E Fahrenheit. Air temperatures ranged from 47E to 76E Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% riffle units, 33% flatwater units, and 20% pool units (Graph 1). Based on total length of Level II habitat types there were 57% riffle units, 28% flatwater units, and 14% pool units (Graph 2).

Ten Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffle, 36%; run, 29%; and mid-channel pool, 18% (Graph 3). Based on percent total length, low gradient riffles made up 45%, runs 22%, and mid-channel pools 13%.

A total of 59 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 88%, and comprised 91% 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. Eighteen of the 59 pools (30%) had a depth of two feet or greater.

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 59 pool tail-outs measured, 4 had a value of 1 (6.8%); 34 had a value of 2 (55.9%); 15 had a value of 3 (25.4%); 3 had a value of 4 (5.2%); and 4 had a value of 5 (6.8%) (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. Riffle habitat types had a mean shelter rating of 9, flatwater habitat types had a mean shelter rating of 21, and pool habitats had a mean shelter rating of 44 (Table 1). Of the pool types, the main channel pools had the highest mean shelter rating at 55. The scour pools had a mean shelter rating of 25 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders and small woody debris are the dominant cover types in Johnson Creek. Graph 7 describes the pool cover in Johnson Creek. Boulders 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/cobble was the dominant substrate observed in 88% of the pool tail-outs.

The mean percent canopy density for the surveyed length of Johnson Creek was 92%. The mean percentages of deciduous and coniferous trees were 20% and 80%, respectively. Graph 9 describes the mean percent canopy in Johnson Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 82.9%. The mean percent left bank vegetated was 90.3%. The dominant elements composing the structure of the stream banks consisted of 2.1% bedrock, 1.1% boulder, 1.1% cobble/gravel, and 95.7% sand/silt/clay (Graph 10). Coniferous trees was the dominant vegetation type observed in 53.2% of the units surveyed. Additionally, 21.3% of the units surveyed had brush as the dominant vegetation type, and 16.0% had grass as the dominant vegetation (Graph 11).

## BIOLOGICAL INVENTORY RESULTS

Twenty-eight sites were electrofished for species composition and distribution in Johnson Creek on July 22 and 23, 2002. Water temperatures taken during the electrofishing period ranged from 60E to 64E degrees F. The sites were sampled by Trevor Tollefson (DFG) and Matt Davis (CCC).
The first site sampled included habitat unit 0006, a lateral scour pool-root wad enhanced, approximately 176 feet from the confluence with Gates Creek. The site yielded one young-of-year (YOY) steelhead.

The second site included habitat unit 0016, a mid-channel pool located approximately 386 feet above the creek mouth. The site yielded two YOY steelhead .

The third site included habitat unit 0025, a mid-channel pool located approximately 615 feet above the creek mouth. The site yielded three YOY steelhead .

The forth site included habitat unit 0033, a mid-channel pool located approximately 783 feet above the creek mouth. The site yielded one YOY steelhead, one age one-plus steelhead, and one age two-plus steelhead.

The fifth site sampled included habitat unit 0046, a mid-channel pool located approximately 1,061 feet above the creek mouth. The site yielded no fish.

The sixth site sampled included habitat unit 0050, a mid-channel pool located approximately 1,166 feet above the creek mouth. The site yielded one age one-plus steelhead.

The seventh site sampled included habitat unit 0058, a lateral scour pool-log enhanced, located approximately 1,441 feet above the creek mouth. The site yielded no fish.

The eighth site included habitat unit 0067, a mid-channel pool located approximately 1,561 feet above the creek mouth. The site yielded no fish.

**Johnson Creek**

The ninth site included habitat unit 0071, a mid-channel pool located approximately 1,644 feet above the creek mouth. The site yielded no fish.

The tenth site included habitat unit 0077, a mid-channel pool located approximately 1,915 feet above the creek mouth. The site yielded no fish.

The eleventh site sampled included habitat unit 0090, a mid-channel pool located approximately 2,240 feet above the creek mouth. The site yielded no fish.

The twelve site sampled included habitat unit 0094, a mid-channel pool located approximately 2,311 feet above the creek mouth. The site yielded no fish.

The thirteenth site included habitat unit 0102, a mid-channel pool located approximately 2,505 feet above the creek mouth. The site yielded one age one-plus steelhead.

The fourteenth site included habitat unit 0106, a mid-channel pool located approximately 2,615 feet above the creek mouth. The site yielded one age two-plus steelhead.

The fifteenth forth site included habitat unit 0110, a mid-channel pool located approximately 2,716 feet above the creek mouth. The site one age one-plus steelhead.

The sixteenth site sampled included habitat unit 0153, a mid-channel pool located approximately 3,694 feet above the creek mouth. The site yielded no fish.

The seventeenth site sampled included habitat unit 0191, a mid-channel pool located approximately 4,517 feet above the creek mouth. The site yielded no fish.

The eighteenth site included habitat unit 0194, a mid-channel pool located approximately 4,597 feet above the creek mouth. The site yielded no fish.

The nineteenth site included habitat unit 0251, a step run located approximately 5,676 feet above the creek mouth. The site yielded one YOY steelhead.

The 20th site included habitat unit 0255, a mid-channel pool located approximately 5,738 feet above the creek mouth. The site yielded one YOY steelhead, and one age two-plus steelhead.

The 21$^{st}$ site sampled included habitat unit 0266, a mid-channel pool located approximately 5,888 feet above the creek mouth. The site yielded 2 YOY steelhead.

The 22$^{nd}$ site sampled included habitat unit 0272, a mid-channel pool located approximately 5,990 feet above the creek mouth. The site yielded no fish.

The 23$^{rd}$ site sampled included habitat unit 0279, a mid-channel pool located approximately 6,146 feet above the creek mouth. The site yielded no fish.

**Johnson Creek**

The 24th site included habitat unit 0281, a mid-channel pool located approximately 6,165 feet above the creek mouth. The site yielded no fish.

The 25th site included habitat unit 0285, a mid-channel pool located approximately 6,202 feet above the creek mouth. The site yielded no fish.

The 26th site, a mid-channel pool located above the end of survey and yielded no fish.

The 27th site, a mid-channel pool located above the end of survey and yielded no fish.

The 28th site, a mid-channel pool located above the end of survey and yielded no fish.

The following chart displays the information yielded from these sites:

| Date | Approx. Dist. from mouth (ft.) | Hab. Unit # | Hab. Type | Reach # | Channel type | Steelhead | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | YOY | 1+ | 2+ |
| 7/22/02 | 176 | 0006 | 5.3 | 1 | B4 | 1 | 0 | 0 |
| 7/22/02 | 386 | 0016 | 4.2 | 1 | B4 | 2 | 0 | 0 |
| 7/22/02 | 615 | 0025 | 4.2 | 1 | B4 | 3 | 0 | 0 |
| 7/22/02 | 783 | 0033 | 4.2 | 1 | B4 | 1 | 1 | 1 |
| 7/22/02 | 1061 | 0046 | 4.2 | 1 | B4 | 0 | 0 | 0 |
| 7/22/02 | 1166 | 0050 | 4.2 | 1 | B4 | 0 | 1 | 0 |
| 7/22/02 | 1441 | 0058 | 5.2 | 1 | B4 | 0 | 0 | 0 |
| 7/22/02 | 1561 | 0067 | 4.2 | 1 | B4 | 0 | 0 | 0 |
| 7/22/02 | 1644 | 0071 | 4.2 | 1 | B4 | 0 | 0 | 0 |
| 7/22/02 | 1915 | 0077 | 4.2 | 1 | B4 | 0 | 0 | 0 |
| 7/22/02 | 2240 | 0090 | 4.2 | 2 | F4 | 0 | 0 | 0 |
| 7/22/02 | 2311 | 0094 | 4.2 | 2 | F4 | 0 | 0 | 0 |
| 7/22/02 | 2505 | 0102 | 4.2 | 2 | F4 | 0 | 1 | 0 |
| 7/22/02 | 2615 | 0106 | 4.2 | 2 | F4 | 0 | 0 | 1 |

**Johnson Creek**

| Date | Approx. Dist. from mouth (ft.) | Hab. Unit # | Hab. Type | Reach # | Channel type | Steelhead | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | | YOY | 1+ | 2+ |
| 7/22/02 | 2716 | 0110 | 4.2 | 2 | F4 | 0 | 1 | 0 |
| 7/22/02 | 3694 | 0153 | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | 4517 | 0191 | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | 4597 | 0194 | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | 5676 | 0251 | 3.4 | 3 | G4 | 1 | 0 | 0 |
| 7/22/02 | 5738 | 0255 | 4.2 | 3 | G4 | 1 | 0 | 1 |
| 7/22/02 | 5888 | 0266 | 3.3 | 3 | G4 | 2 | 0 | 0 |
| 7/22/02 | 5990 | 0272 | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | 6145 | 0279 | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | 6165 | 0281 | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | 6202 | 0285 | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | upstream | u/s | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | upstream | u/s | 4.2 | 3 | G4 | 0 | 0 | 0 |
| 7/22/02 | upstream | u/s | 4.2 | 3 | G4 | 0 | 0 | 0 |

DISCUSSION

Johnson Creek is a B4 channel type for the first 2,228 feet of the stream surveyed, an F4 channel type for the next 672 feet, and a G4 channel type for the remaining 3,370 feet. The suitability of B4 channel types for fish habitat improvement structures is as follows: B4 channels are excellent for low-stage plunge weirs, boulder clusters, bank-placed boulders, single and opposing wing-deflectors, and log cover. An F4 channel type is good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors and log cover; poor for boulder clusters. G4 channel types are good for bank-placed boulders; fair for plunge weirs; opposing wing-deflectors; and log cover; poor for boulder clusters, and single wing-deflectors.

**Johnson Creek**

The water temperatures recorded on the survey days June 20-31, 2002, ranged from 49E to 60E Fahrenheit. Air temperatures ranged from 47E to 76E Fahrenheit. This is a suitable water temperature 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 28% of the total length of this survey, riffles 57%, and pools 14%. The pools are relatively shallow, with only 18 of the 59 (31%) 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.

Thirty-eight of the 59 pool tail-outs measured had embeddedness ratings of 1 or 2. Eighteen of the pool tail-outs had embeddedness ratings of 3 or 4. Four 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.

Fifty-two of the 59 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 44. The shelter rating in the flatwater habitats was 21. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, small woody debris contribute a small amount. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 92%. Reach 1 had a canopy density of 89% while Reaches 2 and 3 had canopy densities of 92% and 93%, respectively. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 83% and 90%, 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) Johnson Creek should be managed as an anadromous, natural production stream.

2) The limited water temperature data available suggest that maximum temperatures are within the acceptable range for juvenile salmonids. To establish more complete and meaningful temperature regime information, 24-hour monitoring during the July and August temperature extreme period should be performed for 3 to 5 years.

3) 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.

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

5) 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.

## COMMENTS AND LANDMARKS

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

| Position (ft): | Comments: |
|---|---|
| 0' | Begin survey at confluence with Gates Creek. Channel type is B4. |
| 72' | Left bank erosion, 10' high x 96' long. |
| 176' | Electrofishing site #1. |
| 206' | Left bank erosion, 12' high x 20' long. |
| 269' | Right bank erosion, 10' high x 50' long. |
| 370' | Left bank erosion, 8' high x 30' long. |
| 386' | Electrofishing site #2. |
| 536' | Right bank erosion, 8' high x 60' long. |
| 615' | Electrofishing site #3. |
| 783' | Electrofishing site #4. |
| 947' | Tributary enters on left bank: highly entrenched with 8 foot plunge 70 feet upstream. |

| | |
|---|---|
| 961' | Log debris accumulation (LDA) of 5 pieces, 20' wide x 15' long x 7' high, not retaining sediment. |
| 1,061' | Electrofishing site #5. |
| 1,166' | Electrofishing site #6. |
| 1,441' | Electrofishing site #7. |
| 1,561' | Electrofishing site #8. |
| 1,644' | Electrofishing site #9. |
| 1,915' | Electrofishing site #10. |
| 2,228' | Channel type changes from B4 to F4. |
| 2,240' | Electrofishing site #11. |
| 2,311' | Electrofishing site #12. |
| 2,505 | Tributary enters on left bank, dry at time of survey. Electrofishing site #13. |
| 2,615' | Electrofishing site #14. |
| 2,716' | Electrofishing site #15. |
| 2,900' | Channel type changes from F4 to G4. |
| 3,294 | Tributary enters on left bank, dry at time of survey. |
| 3,576' | Tributary enters on right bank, dry at time of survey. |
| 3,694' | Electrofishing site #16. |
| 3,836' | Spring enters on right bank. |
| 4,149' | Tributary enters on left bank. |
| 4,517' | Electrofishing site #17. |
| 4,597' | Electrofishing site #18. |
| 5,264' | Tributary enters on right bank, dry at time of survey. |

**Johnson Creek**

| | |
|---|---|
| 5,531' | LDA of 4 pieces, 25' wide x 3' long x 5' high, retaining sediment 5 feet deep. |
| 5,676' | Electrofishing site #19. |
| 5,738 | Old logging road, contributing sediment. Electrofishing site #20. |
| 5,805' | Culvert on right bank. |
| 5,888' | Electrofishing site #21. |
| 5,990' | Electrofishing site #22. |
| 5,995' | LDA of 4 pieces, 20' wide x 9' long x 6' high, retaining 5' deep. During low flows LDA may be a barrier to juvenile/adult salmonids. Possible barrier. |
| 6,145' | Electrofishing site #23. |
| 6,165' | Electrofishing site #24. |
| 6,202' | Electrofishing site #25. |
| 6,270' | End of survey due to dry channel. |

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.

**Johnson Creek**

LEVEL III and LEVEL IV HABITAT TYPES

| | | | |
|---|---|---|---|
| RIFFLE | | | |
| Low Gradient Riffle | (LGR) | [1.1] | { 1} |
| High Gradient Riffle | (HGR) | [1.2] | { 2} |
| CASCADE | | | |
| Cascade | (CAS) | [2.1] | { 3} |
| Bedrock Sheet | (BRS) | [2.2] | {24} |
| FLATWATER | | | |
| Pocket Water | (POW) | [3.1] | {21} |
| Glide | (GLD) | [3.2] | {14} |
| Run | (RUN) | [3.3] | {15} |
| Step Run | (SRN) | [3.4] | {16} |
| Edgewater | (EDW) | [3.5] | {18} |
| MAIN CHANNEL POOLS | | | |
| Trench Pool | (TRP) | [4.1] | { 8} |
| Mid-Channel Pool | (MCP) | [4.2] | {17} |
| Channel Confluence Pool | (CCP) | [4.3] | {19} |
| Step Pool | (STP) | [4.4] | {23} |
| SCOUR POOLS | | | |
| Corner Pool | (CRP) | [5.1] | {22} |
| Lateral Scour Pool - Log Enhanced | (LSL) | [5.2] | {10} |
| Lateral Scour Pool - Root Wad Enhanced | (LSR) | [5.3] | {11} |
| Lateral Scour Pool - Bedrock Formed | (LSBk) | [5.4] | {12} |
| Lateral Scour Pool - Boulder Formed | (LSBo) | [5.5] | {20} |
| Plunge Pool | (PLP) | [5.6] | { 9} |
| BACKWATER POOLS | | | |
| Secondary Channel Pool | (SCP) | [6.1] | { 4} |
| Backwater Pool - Boulder Formed | (BPB) | [6.2] | { 5} |
| Backwater Pool - Root Wad Formed | (BPR) | [6.3] | { 6} |
| Backwater Pool - Log Formed | (BPL) | [6.4] | { 7} |
| Dammed Pool | (DPL) | [6.5] | {13} |
| ADDITIONAL UNIT DESIGNATIONS | | | |
| Dry | (DRY) | [7.0] | |
| Culvert | (CUL) | [8.0] | |
| Not Surveyed | (NS) | [9.0] | |
| Not Surveyed due to a marsh | (MAR) | [9.1] | |