

# STREAM INVENTORY REPORT

## Doctors Creek

### INTRODUCTION

A stream inventory of Doctors Creek was conducted on 7/16/2003. The survey began at the confluence with Michaels Creek and extended upstream 0.3 miles. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Doctors Creek.

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

Doctors Creek is a tributary to Michaels Creek, a tributary to Hollow Tree Creek, a tributary to South Fork Eel River, a tributary to the Pacific Ocean, located in Mendocino County, California (Map 1). Doctors Creek's legal description at the confluence with Michaels Creek is T22N R17W S14. Its location is 39:45:52.0N latitude and 123:42:58.0W longitude, LLID number 1237162397644. Doctors Creek is a second order stream and has approximately one mile of blue line stream according to the USGS Leggett 7.5 minute quadrangle. Doctors Creek drains a watershed of approximately 1.68 square miles. Elevations range from about 1,388 feet at the mouth of the creek to 1,959 feet in the headwater areas. Mixed hardwood/mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via a locked gate on Hales Grove Road off of Highway 1.

### METHODS

The habitat inventory conducted in Doctors Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/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. All pools except step-pools 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 Doctors Creek 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". Doctors 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 Doctors 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 like bedrock, log sills, boulders or other considerations.

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

### 10. Large Woody Debris Count:

Large woody debris (LWD) is an important component of fish habitat and an element in channel forming processes. In each habitat unit all pieces of LWD partially or entirely below the elevation of bankfull discharge are counted and recorded. The minimum size to be considered is twelve inches in diameter and six feet in length. The LWD count is presented by reach and is expressed as an average per 100 feet.

## 11. Average Bankfull Width:

Bankfull width can vary greatly in the course of a channel type stream reach. This is especially true in very long reaches. Bankfull width can be a factor in habitat components like canopy density, water temperature, and pool depths. Frequent measurements taken at riffle crests (velocity crossovers) are needed to accurately describe reach widths. At the first appropriate velocity crossover that occurs after the beginning of a new stream survey page (ten habitat units), bankfull width is measured and recorded in the appropriate header block of the page. These widths are presented as an average for the channel type reach.

## 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 Doctors Creek.

## DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.3, 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 Doctors 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

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- 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 7/16/2003 was conducted by Lindsay Selvaggio and Corby Hines (WSP). The total length of the stream surveyed was 1,603 feet.

Stream flow was not measured on Doctors Creek.

Doctors Creek is a F3 channel type for 1,603 feet of the stream surveyed (Reach 1). F3 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and cobble-dominant substrates.

Water temperatures taken during the survey period held constant at 58 degrees Fahrenheit. Air temperatures ranged from 61 to 63 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 32% riffle units, 35% flatwater units, and 33% pool units (Graph 1). Based on total length of Level II habitat types there were 24% riffle units, 53% flatwater units, and 23% pool units (Graph 2).

Nine Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 22% mid-channel pool units, 18% run units, 17% step run units (Graph 3). Based on percent total length, there were 30% step run units, 23% run units, and 15% mid-channel pool units.

A total of 20 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 65%, and comprised 66% 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. Six of the 20 pools (30%) had a residual depth of two feet or greater (Graph 5). One of the 20 pools (5%) had a residual depth of three feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 20 pool tail-outs measured, 16 had a value of 1 (80%); 4 had a value of 5 (20%); (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 like bedrock, log sills, boulders, etc.

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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 16, flatwater habitat types had a mean shelter rating of 13, and pool habitats had a mean shelter rating of 56 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 62, scour pools had a mean shelter rating of 46 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Doctors Creek. Graph 7 describes the pool cover in Doctors Creek. Boulders are also 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. Small cobble was observed in 40% of pool tail-outs and gravel was observed in 25% of pool tail-outs.

The mean percent canopy density for the surveyed length of Doctors Creek was 97%. The mean percentages of hardwood and coniferous trees were 94% and 6%, respectively. Three percent of the canopy was open. Graph 9 describes the mean percent canopy in Doctors Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 83%. The mean percent left bank vegetated was 87%. The dominant elements composing the structure of the stream banks consisted of 50% bedrock and 26% cobble/gravel (Graph 10). Forty-five percent of the units surveyed had hardwood trees as the dominant vegetation type, and 6% had coniferous trees as the dominant vegetation (Graph 11). Additionally, grass was the dominant vegetation type observed in 27% of the units surveyed.

## BIOLOGICAL INVENTORY RESULTS

Salmonids were observed throughout the survey up to 1,300 feet into the stream reach. No fish were observed past the 37% slope at 1,300 feet.

## DISCUSSION

Doctors Creek is a F3 channel type for the entire 1,603 feet of stream surveyed. The suitability of F3 channel types for fish habitat improvement structures is as follows: Good for bank-placed boulders and single and opposing wing-deflectors; fair for plunge weirs, boulder clusters, channel constrictors, and log cover.

The water temperatures recorded on the survey day 7/16/2003 stayed constant at 58 degrees Fahrenheit. Air temperatures ranged from 61 to 63 degrees Fahrenheit. This is a good water temperature for juvenile 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 53% of the total length of this survey, riffles 24%, and pools 23%. The pools are relatively shallow with only 6 of the 20 (30%) pools having a maximum

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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.

Sixteen of the 20 pool tail-outs measured had embeddedness ratings of 1 or 2. None 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.

Thirteen of the 20 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 56. 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 boulders in Doctors Creek. Boulders are the dominant cover type in pools followed by large woody debris. Log and root wad cover structures in the pool and flatwater habitats would enhance both summer and winter salmonid habitat. Log cover structure provides rearing fry with protection from predation, rest from water velocity, and also divides territorial units to reduce density related competition.

The mean percent canopy density for the stream was 97%. 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 87%, 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.

## RECOMMENDATIONS

- 1) Doctors 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.

**COMMENTS AND LANDMARKS**

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

Position (ft.)	Habitat Unit #	Comments:
0	0001.00	Start of survey. Doctors Creek habitat inventory survey begins at the confluence with Michaels Creek.
174	0010.00	Salmonids observed.
702	0027.00	Log debris accumulation (LDA) 10' high x 25' wide x 35' long, composed of twenty pieces of large wood. Water flows through visible gaps. The LDA is retaining 3' of sand and gravel. Not a barrier to salmonids, fish observed upstream.
1073	0040.00	Salmonids observed.
1300	0049.00	Bedrock sheet, 37% channel slope. Possible barrier. No salmonids observed above.
1432	0052.00	Lynch Creek enters from the left bank. Flow estimated (0.5 cfs). Channel slope measured (5%). The temperature of Doctors Creek above and below Lynch Creek was 60° F and 58° F, respectively. The temperature of Lynch Creek was 58° F.
1595	0060.00	LDA, 8' high x 20' wide x 30' long, composed of 10 pieces of large wood. Gaps present in LDA, allowing very little water to flow through. The LDA is retaining 2' of sand and gravel.
1603	0060.00	End of survey. No salmonids observed above bedrock sheet at 1300'.



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.

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]	