

STREAM INVENTORY REPORT

North Fork Elk River

INTRODUCTION

A stream inventory was conducted from June 30 to October 19, 2005 on North Fork Elk River. The survey began at the confluence with Elk River and extended upstream 14.3 miles.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in North Fork Elk River.

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

North Fork Elk River is a tributary to Elk River, a tributary to the Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). North Fork Elk River's legal description at the confluence with Elk River is T04N R01W S26. Its location is 40.7025 degrees north latitude and 124.1511 degrees west longitude, LLID number 1241512407026. North Fork Elk River is a second order stream and has approximately 12.1 miles of blue line stream according to the USGS McWhinney Creek 7.5 minute quadrangle. North Fork Elk River drains a watershed of approximately 22.6 square miles. Elevations range from about 40 feet at the mouth of the creek to 600 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is primarily privately owned and is managed for timber production. Vehicle access exists via highway 101 to Elk River Road exit in Eureka (exit 702), head South East on Elk River Road. Go 2.4 miles past Elk River School, park and briefly hike south to confluence (make sure you are at right one!).

METHODS

The habitat inventory conducted in North Fork Elk River 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 survey reach. All habitat units included in the survey are classified according to habitat type and

North Fork Elk River

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 North Fork Elk River 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". North Fork Elk River 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.

North Fork Elk River

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 North Fork Elk River, 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 not suitable 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 North Fork Elk River, 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 North Fork Elk River, 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 North Fork Elk River, 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.

North Fork Elk River

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.

DATA ANALYSIS

Data from the habitat inventory form are entered into Stream Habitat 2.0.19, 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 North Fork Elk River 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

North Fork Elk River

- 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 June 30 to October 19, 2005 was conducted by J. Freewoman, M. Erkel, C. Marston, M. Liggett, S. Wilson, C. Pollastrini (WSP). The total length of the stream surveyed was 75,455 feet with an additional 1,589 feet of side channel.

Stream flow was not measured on North Fork Elk River.

North Fork Elk River is a B6 channel type for 4,927 feet of the stream surveyed (Reach 1), an F4 channel type for 16,923 feet of the stream surveyed (Reach 2), a C4 channel type for 27,207 feet of the stream surveyed (Reach 3), an F4 channel type for 5,692 feet of the stream surveyed (Reach 4), and a C3 channel type for 22,295 feet of the stream surveyed (Reach 5). B6 channels are moderately entrenched, moderate gradient, riffle dominated channel with infrequently spaced pools, very stable plan and profile, stable banks, silt/clay channel. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. C4 channels are low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplains, gravel channel. C3 channels are low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplains, cobble channel.

Water temperatures taken during the survey period ranged from 48 to 67 degrees Fahrenheit. Air temperatures ranged from 41 to 72 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 37% pool units, 35% flatwater units, 26% riffle units, and 2% dry units (Graph 1). Based on total length of Level II habitat types there were 46% flatwater units, 32% pool units, 21% riffle units, and 1% dry units (Graph 2).

Fifteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 34% mid-channel pool units, 28% run units, and 25% low gradient riffle units (Graph 3). Based on percent total length 35% were run units, 30% mid-channel pool units and 20% low gradient riffle units.

A total of 355 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 95%, and comprised 96% 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. Two hundred fifty-one of the 352 pools (71%) had a residual

North Fork Elk River

depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 357 pool tail-outs measured, 38 had a value of 1 (11%); 92 had a value of 2 (26%); 89 had a value of 3 (25%); 130 had a value of 4 (36%); eight had a value of 5 (2%); (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 not suitable 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 26, flatwater habitat types had a mean shelter rating of 30, and pool habitats had a mean shelter rating of 46 (Table 1). Of the pool types, the main channel pools had a mean shelter rating of 46, scour pools had a mean shelter rating of 38, backwater pools had a mean shelter rating of 20 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover types in North Fork Elk River. Graph 7 describes the pool cover in North Fork Elk River. Large woody debris is 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. A gravel substrate type was observed in 57% of pool tail-outs and the second most dominant substrate was sand observed in 17% of pool tail-outs.

The mean percent canopy density for the surveyed length of North Fork Elk River was 90%. The mean percentages of hardwood and coniferous trees were 74% and 26%, respectively. Ten percent of the canopy was open. Graph 9 describes the mean percent canopy in North Fork Elk River.

For the stream reach surveyed, the mean percent right bank vegetated was 90%. The mean percent left bank vegetated was 90%. The dominant elements composing the structure of the stream banks consisted of 59% sand/silt/clay, 32% cobble/gravel, 8% bedrock and 1% boulder (Graph 10). Grass was the dominant vegetation type observed in 73% of the units surveyed. Additionally, 18% of the units surveyed had deciduous trees as the dominant vegetation type, and 5% had coniferous trees as the dominant vegetation (Graph 11).

DISCUSSION

North Fork Elk River is a B6 channel type for the first 4,927 feet of stream surveyed, an F4 channel type for the next 16,923 feet, a C4 channel type for the next 27,207 feet, an F4 channel type for the next 5,692 feet, and a C3 channel type for the remaining 22,295 feet. The suitability of B6 channel types for fish habitat improvement structures is as follows: Excellent for bank-placed boulders and log cover; good for plunge weirs, single and opposing wing-deflectors and channel constrictors; fair for boulder clusters. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-place boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors and log cover; poor for boulder clusters. The

North Fork Elk River

suitability of C4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for plunge weirs, single and opposing wing-deflectors, channel constrictors and log cover. The suitability of C3 channel types for fish habitat improvement structures is as follows: excellent for bank-placed boulders; good for plunge-weirs, boulder clusters, single and opposing wing deflectors and log cover.

The water temperatures recorded on the survey days June 30 to October 19, 2005 ranged from 48 to 67 degrees Fahrenheit. Air temperatures ranged from 41 to 72 degrees Fahrenheit. To make any further conclusions, temperatures need to be monitored throughout the warm summer months, and more extensive biological sampling needs to be conducted.

Flatwater habitat types comprised 46% of the total length of this survey, pools 32%, and riffles 21. The pools are relatively deep, with 251 of the 352 (71%) pools having a maximum residual depth greater than two 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.

One hundred thirty of the 357 pool tail-outs measured had embeddedness ratings of 1 or 2. Two hundred nineteen of the pool tail-outs had embeddedness ratings of 3 or 4. Eight of the pool tail-outs had a rating of 5, which is considered not suitable 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 North Fork Elk River should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Two hundred thirty eight of the 353 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 46. The shelter rating in the flatwater habitats was 30. A pool shelter rating of approximately 100 is desirable. The amount of cover that now exists is being provided primarily by large woody debris in North Fork Elk River. Large woody debris is 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 structures provide rearing fry with protection from predation, rest from water velocity, and also divide territorial units to reduce density related competition.

The mean percent canopy density for the stream was 90%. Reach 1 had a canopy density of 86%, Reach 2 had a canopy density of 87%, Reach 3 had a canopy density of 84%, Reach 4 had a canopy density of 87%, and Reach 5 had a canopy density of 98%. 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 90% and 90%, 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

North Fork Elk River

recommended.

RECOMMENDATIONS

- 1) North Fork Elk River should be managed as an anadromous, natural production stream.
- 2) The limited water temperature data available suggest that maximum temperatures are within/above 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) 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.
- 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.

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 in influence of Elk River.
123	0003.00	Out of influence of Elk River.
664	0011.00	Channel type taken.
1328	0016.00	Tributary enters on the right bank with a flow of approximately 0.1 cfs. The water temperature of the tributary was 55 degrees Fahrenheit. The temperature of North Fork Elk River downstream and upstream of the tributary was 61 degrees Fahrenheit. The tributary is not accessible to fish.
1790	0022.00	Cement cone on right bank partially in stream.
1853	0023.00	Elk River Road crosses the channel. The crossing is a 207' wide x 20' long x 15' high cement bridge.
3413	0041.00	4-5 inch fish observed.

North Fork Elk River

3776	0048.00	Log debris accumulation (LDA) measures 5' high x 20' wide x 20' long and contains two pieces of large woody debris (LWD). Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
4178	0053.00	4-5 inch fish and young-of-the-year (YOY) salmonid observed.
4270	0055.00	LDA measures 3.5' high x 30' wide x 20' long and contains one piece of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of silt measuring 10' wide x 10' long x 1' deep. Fish were observed above the LDA.
4325	0056.00	Coho observed. LDA measures 5' high x 40' wide x 95' long and contains 14 pieces of LWD. Water is flowing through the LDA and there are no visible gaps in its. The LDA is not retaining sediment. Fish were observed above it.
4549	0059.00	LDA measures 4' high x 25' wide x 45' long. Water flows through the LDA and there are visible gaps of it. The LDA is not retaining sediment. Fish were observed above it.
5096	0070.00	Coho observed. LDA measures 10' high x 35' wide x 122' long and contains 25 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
5456	0075.00	Hydrology station. Log across half channel.
5501	0076.00	LDA measures 5' high x 20' wide x 80' long and contains 40 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
5662	0079.00	Coho and lamprey observed.
6502	0093.00	LDA measures 6' high x 30' wide x 20' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
6950	0097.00	LDA measures 5' high x 30' long x 10' wide and contains five pieces of LWD. Water flows through the LDA. It is not retaining sediment. Fish were observed above the LDA.
7233	0099.00	1+ observed, YOY observed.
7233	0099.00	LDA measures 3' high x 15' wide x 7' long and contains five pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining sediment. Fish were observed above it.

North Fork Elk River

7409	0101.00	LDA measures 2' high x 20' wide x 10' long and contains seven pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
7497	0103.00	LDA measures 5' high x 35' wide x 15' long and contains 10 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
7939	0110.00	LDA measures 5' high x 20' wide x 15' long and contains six pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.
7994	0111.00	Road.
8444	0118.00	Droughty monitoring station.
8966	0124.00	Old growth log, causing scour.
9417	0131.00	Road Access trail.
9688	0133.00	LDA measures 1' high x 20' wide x 15' long and contains five pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
10907	0141.00	Right bank tributary.
11321	0144.00	LDA measures 8' high x 12' wide x 20' long and contains 15 pieces of LWD. Water flows through the LDA and there are visible gaps in it. Fish were observed above the LDA.
12384	0156.00	Submerged manhole opening.
12876	0160.00	Right bank tributary.
13225	0163.00	LDA measures 5' high x 20' wide x 25' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gap in it. The LDA is not retaining sediment. Fish were observed above it.
14201	0171.00	Side channel.
15731	0190.00	LDA measures 20' high x 30' wide x 25' long and contains 12 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
15786	0190.01	LDA measures 10' high x 5' wide x 35' long and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it.

North Fork Elk River

		The LDA is retaining a volume of silt, sand, and gravel measuring 10' wide x 15' long x 2' deep. Fish were observed above the LDA.
16993	0203.00	Dunlap Gulch enters on the right bank; it goes dry 30' upstream from the confluence with North Fork Elk River. The water temperature of the tributary was 58 degrees Fahrenheit. The temperature of North Fork Elk River downstream and upstream of the tributary was 63 degree Fahrenheit. The tributary has a slope of approximately 3%. It is not accessible to fish.
17247	0206.00	LDA measures 5' high x 15' wide x 5' long and contains two pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of silt, sand, and gravel measuring 2' wide x 4' long x 1' deep. Fish were observed above the LDA.
17629	0212.00	Side channel.
19288	0228.00	2 + observed. LDA measures 5' high x 10' wide x 5' long and contains six pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
19870	0237.00	LDA measures 5' high x 15' wide x 5' long and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
20136	0238.00	Tributary enters on the right bank. The water temperature of the tributary was 64 degrees Fahrenheit. The temperature of North Fork Elk River downstream and upstream of the tributary was 65 degree Fahrenheit. The slope of the tributary is approximately 4%. Fish were observed in it.
20199	0239.00	LDA measures 3' high x 25' wide x 7' long and contains seven pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
20254	0240.00	LDA measures 5' high x 30' wide x 3' long and contains six pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of silt, sand, and gravel measuring 10' wide x 15' long x 5' deep. Fish were observed above the LDA.
20286	0241.00	YOY observed.
20314	0242.00	End of lower North Fork Elk River spawner survey reach.

North Fork Elk River

20507	0243.04	LDA measures 10' high x 20' wide x 40' long and contains 20 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
20671	0247.00	Channel type change.
20692	0248.00	LDA measures 20' high x 45' wide x 40' long and contains 25 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
22452	0266.00	LDA measures 5' high x 7' wide x 3' long and contains five pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
24301	0276.01	LDA measures 7' high x 13' wide x 15' long and contains five pieces of LWD. Water flows through the LDA and there are no visible gaps in it. Fish were observed above the LDA.
24301	0277.00	LDA measures 10' high x 20' wide x 5' long and contains six pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
27729	0303.00	LDA measures 15' high x 35' wide x 7' long and contains four pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
29836	0320.00	LDA measures 10' high x 20' wide x 30' long and contains nine pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
31215	0330.00	Left bank tributary enters with flow of approximately 0.1 cfs. The water temperature of the tributary was 58 degrees Fahrenheit. The water temperature of North Fork Elk River downstream of the tributary was 61 degrees Fahrenheit. The water temperature upstream was 62 degrees Fahrenheit. The slope of the tributary is approximately 0.5%. The tributary is accessible to fish, but no fish were observed.
32504	0340.00	LDA measures 10' high x 35' wide x 8' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand and gravel measuring 2' wide x 5' long x 1' deep. Fish were observed above the LDA.
5978	0373.00	Cables in middle of pool.
36081	0374.00	Tributary enters on the right bank with an estimated flow of 0.2 cfs. The channel goes dry 20' upstream from the mouth. The water temperature of the tributary was 62 degrees Fahrenheit. The water temperature of

North Fork Elk River

North Fork Elk River downstream and upstream of the tributary was 62 degrees Fahrenheit. The slope of the tributary is approximately 1.5%.

36206	0375.00	Road access by trail.
37547	0391.00	LDA measures 15' high x 35' wide x 58' long and contains 12 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sediment measuring 3' wide x 10' long x 1' deep. Fish were observed above the LDA.
38737	0400.00	Side channel.
38967	0400.01	LDA measures 15' high x 10' wide x 20' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
38999	0402.00	LDA measures 3' high x 10' wide x 10' long and contains seven pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
40070	0413.00	40' wide x 47' long x 80' high log stringer bridge crosses the channel.
40209	0415.00	Closed hydrology station.
43422	0449.00	Side channel.
44120	0455.00	LDA measures 10' high x 25' wide x 20' long and contains 10 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
45873	0475.00	LDA measures 20' high x 20' wide x 30' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
46603	0483.00	LDA measures 20' high x 25' wide x 10' long and contains five pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
47208	0488.00	LDA measures 20' high x 30' long and contains 10 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
47648	0492.00	Monitoring device observed. LDA measures 10' high x 25' wide x 20' long and contains nine pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand, gravel, and cobble measuring 20' wide x 10' long x 3' deep. Fish were observed above the LDA.

North Fork Elk River

47841	0495.00	LDA measures 5' high x 15' wide x 20' long and contains seven pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
48307	0500.00	Channel type change
48630	0503.00	Monitoring PCP pipe.
48687	0504.00	LDA measures 5' high x 15' wide x 10' long and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
49707	0511.00	LDA measures 15' high x 22' wide x 28' long and contains 14 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
51019	0527.00	LDA measures 30' high x 50' wide x 61' long and contains 11 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sediment measuring 10' wide x 20' long x 1' deep. Fish were observed above it.
51429	0531.00	LDA measures 11' high x 15' wide x 10' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand and gravel measuring 5' wide x 10' long x 2' deep. Fish were observed above the LDA.
53738	0549.00	South Branch North Fork Elk River enters on the left bank with an estimated flow of 0.1 cfs. The water temperature of the tributary was 58 degrees Fahrenheit. The water temperature of North Fork Elk River downstream and upstream of the tributary was 58 degrees Fahrenheit. The slope of the tributary is approximately 3.5%. The tributary is accessible to fish.
53905	0551.00	Channel type change.
54004	0552.00	Erosion site on right bank. LDA measures 5' high x 7' wide x 20' long and contains five pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand, gravel and small cobble measuring 3' wide x 4' long x 1' deep. Fish were observed above the LDA.
54984	0564.00	LDA measures 9' high x 25' wide x 15' long and contains nine pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand and gravel measuring 15' wide x 40' long x 3' deep. Fish were observed above it.

North Fork Elk River

55142	0567.00	LDA measures 11' high x 12' wide x 5' long and contains five pieces of LWD. Water flows through the LDA and there are no visible gaps in it. The LDA is retaining a volume of gravel and small cobble measuring 5' wide x 15' long x 3' deep. Fish were observed above the LDA. A second LDA measures 20' high x 40' wide x 10' long and contains 11 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of gravel and cobble measuring 5' wide x 15' long x 3' deep. Fish were observed above the LDA.
55208	0568.00	Road Access.
55326	0570.00	LDA measures 15' high x 25' wide x 5' long and contains six pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is storing a volume of sand, gravel, and small cobble measuring 10' wide x 20' long x 6' high. Fish were observed above the LDA.
55724	0574.00	YOY observed.
55799	0575.00	LDA measures 6' high x 13' wide x 3' high and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
55942	0576.00	LDA measures 15' high x 10' wide x 20' long and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.
56188	0580.00	Side channel.
56583	0584.00	North Branch North Fork Elk River enters on the right bank with an estimated flow of 0.2 cfs. The temperature of the tributary was 60 degrees Fahrenheit. The water temperature of North Fork Elk River downstream of the tributary was 58 degrees Fahrenheit. The water upstream of the tributary was 59 degrees Fahrenheit. The slope of the tributary is approximately 3.4%. The tributary is accessible to fish.
57184	0591.00	5' wide x 12' high x 40' long wooden footbridge crosses the channel.
57834	0600.00	LDA measures 15' high x 20' wide x 10' long and contains seven pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand, gravel and small cobble measuring 5' wide x 10' long x 3' deep. Fish were observed above the LDA.

North Fork Elk River

58179	0605.00	LDA measures 25' high x 20' wide x 10' long and contains 11 pieces LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
58485	0611.00	LDA measures 35' high x 40' wide x 20' long and contains 7 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above the LDA.
58726	0613.00	Landslide on left bank.
59279	0622.00	LDA measures 7' high x 15' wide x 3' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand and gravel measuring 2' wide x 5' long x 1' deep. Fish were observed above the LDA.
59758	0631.00	Side channel.
59855	0632.00	LDA measures 7' high x 20' wide x 5' long and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
60899	0646.00	6' high plunge.
60980	0648.00	LDA measures 35' high x 30' wide x 67' long and contains 26 pieces of LWD. Water does no flow through the LDA and there are visible gaps in it. The LDA is retaining a volume of sediment measuring 45' wide x 32' long x 30' deep. Fish were observed it.
61047	0649.00	1 + or bigger observed.
62269	0664.00	2' high plunge.
62302	0665.00	23' high plunge.
62470	0669.00	LDA measures 9' high x 78' wide x 47' long and contains 13 pieces of LWD. Water flows through the LDA and there are no visible gaps in it. The LA is retaining a volume of silt, sand, and gravel measuring 78' wide x 15' long x 5.5' deep. Fish were observed above the LDA.
62967	0679.00	Big resident observed.
63197	0685.00	LDA measures 15' high x 35' wide x 5' long and contains 12 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is not retaining sediment. Fish were observed above it.
63589	0697.00	9' high plunge over boulders.

North Fork Elk River

63686	0699.00	LDA measures 15' high x 30' wide x 15' long and contains 15 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of sand and gravel measuring 10' wide x 20' long x 5' deep. No fish were observed above the LDA.
64392	0716.00	2.5 high plunge over log.
64589	0722.00	Seep.
64915	0728.00	LDA measures 25' high x 15' wide x 30' long and contains 14 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of silt, sand, and gravel measuring 5' wide x 10' long x 5' deep. There is a 5.5' high plunge over the LDA.
65271	0733.00	Tributary enters on the right bank with an estimated flow of 0.5 cfs. The water temperature of the tributary was 52 degrees Fahrenheit. The water temperature of North Fork Elk River downstream and upstream of the tributary was 52 degrees Fahrenheit. The slope of the tributary is approximately 10%. The tributary is accessible to salmonids, but no fish were observed.
65822	0749.00	LDA measures 20' high x 30' wide x 40' long and contains 12 pieces of LWD. Water does not flow through the LDA and there are visible gaps in it. The LDA is retaining a volume of silt, sand, and gravel measuring 15' wide x 30' long x 5' deep.
66898	0771.00	LDA measures 15' high x 20' wide x 15' long and contains eight pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of gravel and small cobble measuring 1' wide x 2' long x 1' deep.
66918	0772.00	Tributary enters on the left bank with and estimated flow of 0.1 cfs. The water temperature of the tributary was 52 degrees Fahrenheit. The water temperature of North Fork Elk River downstream and upstream of the tributary was 52 degrees Fahrenheit. The slope of the tributary is approximately 2%. The tributary is accessible to salmonids, but no fish were observed.
67310	0780.00	LDA measures 10' high x 15' wide x 16' long and contains five pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of small cobble measuring 5' wide x 10' long x 1' deep.
67438	0783.00	8' high plunge over bedrock face.
67637	0786.00	LDA measures 30' high x 30' wide x 25' long and contains three pieces of LWD. Water does not flow through the LDA and there are visible

North Fork Elk River

		gaps in it. The LDA is retaining a volume of silt measuring 60' wide x 150' long x 6' deep.
68523	0802.00	LDA measures 30' high x 40' wide x 40' long and contains eight pieces of LWD. Water does not flow through the LDA and there are visible gaps in it. The LDA is retaining a volume of silt, sand and gravel measuring 15' wide x 100' long x 6' deep.
69690	0825.00	LDA measures 30' high x 20' wide x 40' long and contains eight pieces of LWD. Water does not flow through the LDA and there are no visible gaps in it. The LDA is retaining a volume of silt measuring 10' wide x 20' long x 3' deep.
70365	0833.00	Tributary enters on the left bank with an estimated flow of 0.1 cfs. The water temperature of the tributary was 49 degrees Fahrenheit. The water temperature of North Fork Elk River downstream and upstream of the tributary was 51 degrees Fahrenheit. The slope of the tributary was approximately 5%. The tributary is accessible to salmonids, but no fish were observed.
70835	0845.00	LDA measures 3' high x 28' wide x 10' long and contains six pieces of LWD. Water does not flow through the LDA and there are no visible gaps in it. The LDA is retaining a volume of gravel and small cobble measuring 10' wide x 15' long x 3' deep.
70848	0846.00	Valley splits into multiple channels.
71207	0849.02	Side channel.
71480	0860.02	Side channel.
71769	0869.00	LDA measures 3' high x 30' wide x 15' long and contain five pieces of LWD. Water flows through the LDA and there are no visible gaps in it. The LDA is retaining a volume of sand, gravel and small cobble measuring 5' wide x 15' long x 3' deep.
72771	0890.00	LDA.
73026	0897.00	Large metal wire in stream.
73298	0903.00	20' wide x 35' high x 10' long bridge crosses the channel. Hydraulic monitoring station.
74086	0919.00	Dry tributary.
74167	0920.00	4' high plunge over bedrock.

North Fork Elk River

74445	0922.00	LDA measures 15' high x 30' wide x 54' long and contains 13 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of gravel and large cobble measuring 10' wide 25' long x 3' deep.
74499	0923.00	LDA measures 10' high x 13' wide x 29' long and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of gravel and small cobble measuring 10' wide x 13' long x 3' deep.
74684	0926.00	LDA measures 13' high x 30' wide x 81' long and contains 22 pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of silt, sand, gravel and cobble measuring 10' wide x 15' long x 3' deep.
74808	0928.00	LDA measures 30' high x 15' wide x 23' long and contains three pieces of LWD. Water flows through the LDA and there are visible gaps in it. The LDA is retaining a volume of gravel and small cobble measuring 5' wide x 10' long x 3' deep.
74853	0930.00	30' wide x 6' long x 45' high metal bridge crosses the channel.
75063	0931.00	4' high plunge over bedrock.
75262	0936.00	Resident trout observed.
75325	0937.00	Slope is 14%.
75455	0939.00	End of survey.

REFERENCES

Flosi, G., Downie, S., Hopelain, J., Bird, M., Coey, R., and Collins, B. 1998. *California Salmonid Stream Habitat Restoration Manual*, 3rd edition. California Department of Fish and Game, Sacramento, California.

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.

North Fork Elk River

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]	