STREAM INVENTORY REPORT

North Branch North Fork Elk River

INTRODUCTION

A stream inventory was conducted from June 7 to August 8, 2005 on North Branch North Fork Elk River. The survey began at the confluence with North Fork Elk River and extended upstream two miles. Stream inventories and reports were also completed for two tributaries to North Branch North Fork Elk River: Doe Creek and Little North Fork Elk River.

The objective of the habitat inventory was to document the habitat available to anadromous salmonids in North Branch 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

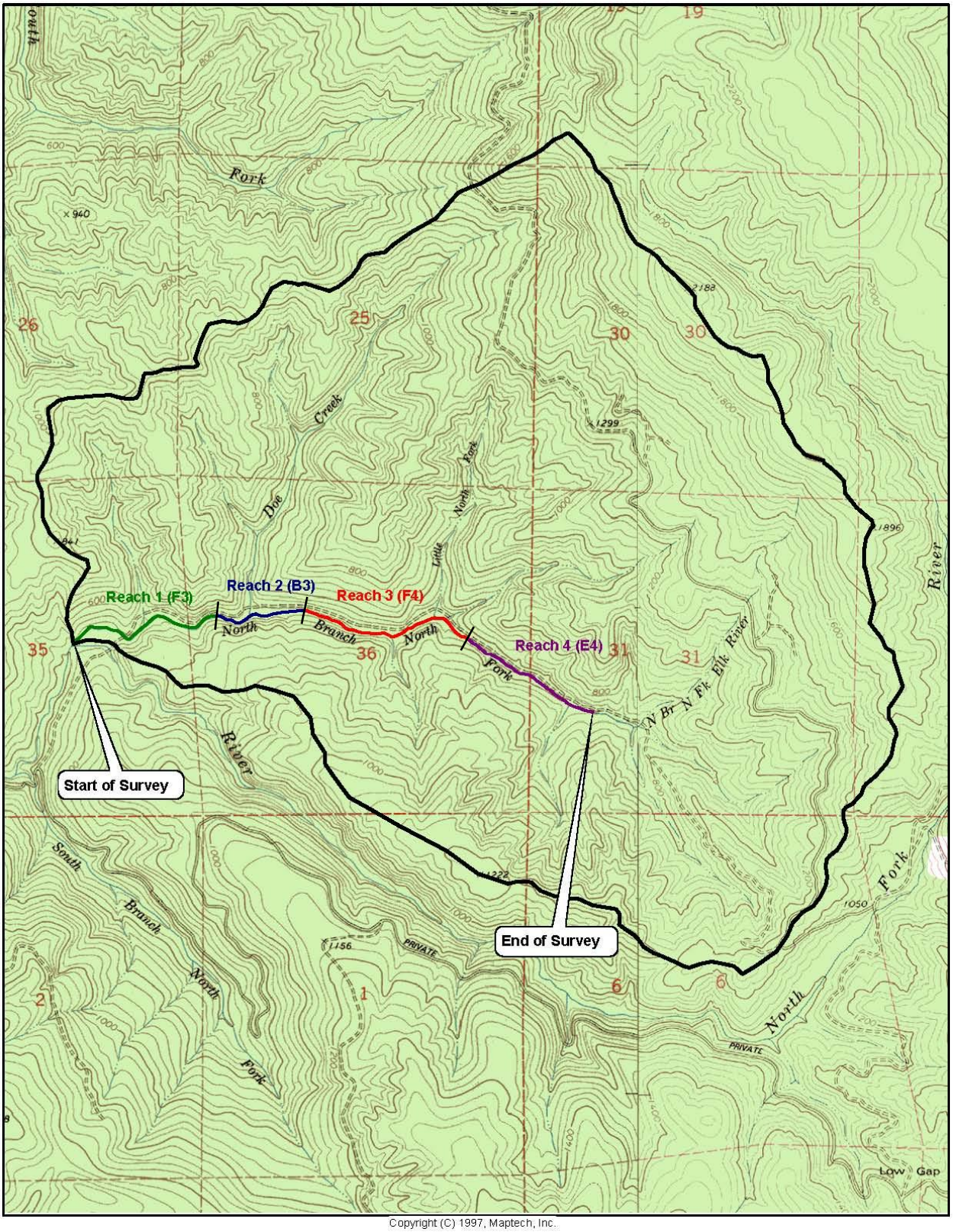
North Branch North Fork Elk River is a tributary to North Fork Elk River, a tributary to Elk River, a tributary to Humboldt Bay, which drains to the Pacific Ocean. It is located in Humboldt County, California (Map 1). North Branch North Fork Elk River's legal description at the confluence with North Fork Elk River is T04N R01E S35. Its location is 40.6875 degrees north latitude and 124.0289 degrees west longitude, LLID number 1240288406876. North Branch North Fork Elk River is a second order stream and has approximately 3.1 miles of blue line stream according to the USGS McWhinney Creek 7.5 minute quadrangle. North Branch North Fork Elk River drains a watershed of approximately 4.0 square miles. Elevations range from about 420 feet at the mouth of the creek to 2,000 feet in the headwater areas. Redwood forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via Highway 101 to Elk River Road Exit (Exit 702).

METHODS

The habitat inventory conducted in North Branch 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.

North Branch North Fork Elk River

Map 1



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 North Branch 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 Branch 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.

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

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 Branch 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

North Branch North Fork Elk River

- 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 June 7 to August 8, 2005 was conducted by C. Marston, A. Nelson, J. Freewoman, I. Mikus and S. McSmith (WSP). The total length of the stream surveyed was 10,450 feet with an additional 41 feet of side channel.

Stream flow was not measured on North Branch North Fork Elk River.

North Branch North Fork Elk River is an F3 channel type for 2,922 feet of the stream surveyed (Reach 1), a B3 channel type for 1,589 feet of the stream surveyed (Reach 2), an F4 channel type for 3,119 feet of the stream surveyed (Reach 3), and an E4 channel type for 2,820 feet of the stream surveyed (Reach 4). F3 channels are entrenched meandering riffle/pool channels on low gradients with high width/depth ratio; cobble channels. B3 channels are moderately entrenched, a moderate gradient, riffle dominated channels with infrequently spaced pools; very stable plan and profile; stable banks; cobble channels. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. E4 channels are low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition; very efficient and stable; high meander width ratio; gravel channel.

Water temperatures taken during the survey period ranged from 53 to 60 degrees Fahrenheit. Air temperatures ranged from 54 to 68 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 39% pool units, 31% riffle units, 29% flatwater units, and 1% unsurveyed units (Graph 1). Based on total length of Level II habitat types there were 36% pool units, 35% flatwater units, 25% riffle units, and 3% dry units (Graph 2).

Fourteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were 32% mid-channel pool units, 30% low gradient riffle units, and 22% run units (Graph 3). Based on percent total length, mid-channel pool units made up 28%, low gradient riffle units 24%, and run units 21%.

A total of 129 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 83%, and comprised 80% 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. Sixty four of the 128 pools measured, (50%) had a residual

depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 128 pool tail-outs measured, 33 had a value of 1 (26%); 48 had a value of 2 (38%); 40 had a value of 3 (31%); two had a value of 4 (2%); five had a value of 5 (4%); (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 9, flatwater habitat types had a mean shelter rating of 25, and pool habitats had a mean shelter rating of 76 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 103. Main channel pools had a mean shelter rating of 72. Backwater pools had a mean shelter rating of 10 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Large woody debris is the dominant cover type in North Branch North Fork Elk River. Graph 7 describes the pool cover in North Branch 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. Gravel was the dominant substrate observed in 62% of pool tail-outs. Small cobble was the dominant substrate observed in 30% of pool tail-outs.

The mean percent canopy density for the surveyed length of North Branch North Fork Elk River was 95%. The mean percentages of hardwood and coniferous trees were 42% and 56%, respectively. Five percent of the canopy was open. Graph 9 describes the mean percent canopy in North Branch North Fork Elk River.

For the stream reach surveyed, the mean percent right bank vegetated was 95%. The mean percent left bank vegetated was 93%. The dominant elements composing the structure of the stream banks consisted of 50% sand/silt/clay, 48% cobble/gravel, 1% bedrock and 1% boulders (Graph 10). Coniferous trees were the dominant vegetation type observed in 68% of the units surveyed. Additionally, 27% of the units surveyed had hardwood trees as the dominant vegetation type, and 4% had brush as the dominant vegetation (Graph 11).

DISCUSSION

North Branch North Fork Elk River is an F3 channel type for the first 2,950 feet of stream surveyed, a B3 channel type for the next 1,602 feet, an F4 channel type for 3,119 feet and an E4 channel for the remaining 2,820 feet. The suitability of F3 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders, single and opposing wing deflectors; fair for plunge weirs, boulder clusters, channel constrictors and log cover. The suitability of B3 channel types for fish habitat improvement structures is as follows: excellent for plunge weirs, boulder clusters and bank placed boulders, single and opposing wing-deflectors

and log cover. The suitability of F4 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; and poor for boulder clusters. The suitability of E4 channel types for fish habitat improvement structures is as follows: good for bank placed boulders; fair for opposing wing-deflectors; poor for plunge weirs, boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days June 7 to August 8, 2005 ranged from 53 to 60 degrees Fahrenheit. Air temperatures ranged from 54 to 68 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 35% of the total length of this survey, riffles 25%, and pools 36%. The pools are relatively deep, with 64 of the 128 (50%) 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.

Eighty-one of the 128 pool tail-outs measured had embeddedness ratings of 1 or 2. Forty-two of the pool tail-outs had embeddedness ratings of 3 or 4. Five 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 Branch North Fork Elk River should be mapped and rated according to their potential sediment yields, and control measures should be taken.

One-hundred-sixteen of the 125 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 76. The shelter rating in the flatwater habitats was 25. 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 Branch 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 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 95%. Reach 1 had a canopy density of 93%, Reach 2 had a canopy density of 95%, Reach 3 had a canopy density of 96% and Reach 4 had a canopy density of 93%. 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 95% and 93%, 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) North Branch 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 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) Increase woody cover in the pools and flatwater habitat units. Most of the existing cover in the pools is from large woody debris. Adding high quality complexity with woody cover in the pools 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	001	Start of survey at the confluence with North Fork Elk River. The channel type is an F3.
512	015	Log debris accumulation (LDA) measures 6' high x 30' wide x 30' long and is composed of 12 pieces of large wood. It is retaining a volume of sediment measuring 30' wide x 15' long x 3' high. Fish were observed above the LDA.
906	029	Log bridge spanning across channel measures 25' long x 50' wide x 8' high.
1,402	047	Right bank tributary.
1,633	052	LDA measures 20' high x 50' wide x 20' long and is composed of 24 pieces of large wood. It is not retaining sediment. Fish were observed above the LDA.
1,737	055	LDA measures 15' high x 50' wide x 50' long and is composed of 24 pieces of large wood. It is retaining a volume of sediment measuring 2' high. Fish were observed above the LDA.
1,760	056	Left bank erosion.

2,106	066	Access trail from the right bank.
2,136	067	LDA measures 10' high x 45' wide x 60' long and is composed of 20 pieces of large wood. It is retaining a volume of sediment measuring 5' high. The LDA is associated left and right bank erosion sites. Fish were observed above the LDA.
2,439	076	LDA measures 15' high x 40' wide x 20' long and is composed of 16 pieces of large wood. It is not retaining sediment. Fish were observed above the LDA.
2,598	078	Access to right bank trail.
2,922	088	Channel type changes from F3 to B3. Start Reach 2.
3,069	090	LDA measures 5' high x 25' wide x 15' long and is composed of 10 pieces of large wood. It is retaining a volume of sediment measuring 3’ high. Fish were observed above the LDA.
3,352	098	LDA measures 5' high x 15' wide x 10' long and is composed of eight pieces of large wood. It is retaining a volume of sediment measuring 2’ high. Fish were observed above the LDA.
3,543	103	Doe Creek enters from the right bank.
3,693	106	LDA measures 15' high x 27' wide x 60' long and is composed of 40 pieces of large wood. It is retaining a volume of sediment measuring 2’ high. Fish were observed above the tributary.
3,778	109	LDA measures 15' high x 35' wide x 23' long and is composed of 23 pieces of large wood. It is retaining a volume of sediment measuring 3’ high. Fish were observed above the LDA.
4,463	126	LDA measures 4' high x 20' wide x 15' long and is composed of 12 pieces of large wood. It is retaining a volume of sediment measuring 3’ high. Fish were observed above the LDA.
4,524	128	Channel type changes from B3 to F4. Start of Reach 3.
4,722	134	LDA measures 5' high x 30' wide x 10' long and is composed of four pieces of large wood. It is retaining a volume of sediment measuring 3’ high. Fish were observed above the LDA.
4,840	139	LDA measures 5' high x 25' wide x 15' long and is composed of six pieces of large wood. It is retaining a volume of sediment measuring 2’ high. Fish were observed above the LDA.

5,477	162	LDA measures 10' high x 20' wide x 50’ long and is composed of 12 pieces of large wood. It is retaining a volume of sediment measuring 2’ high. Fish were observed above the LDA.
5,999	180	Left bank erosion.
6,184	188	Left bank tributary accessible to fish for the first 50’.
7,643	241	Channel type changes from F4 to E4, start of reach 4.
8,343	266	LDA measures 8.5' high x 25' wide x 10' long and is composed of seven pieces of large wood. It is retaining a volume of sediment measuring 3’ high. Fish were observed above the LDA.
8,870	284	LDA measures 5.6' high x 17' wide x 4.5' long and is composed of six pieces of large wood. It is retaining sediment ranging from silt to small cobble and measuring 5’ high. No fish were observed above the LDA.
8,884	285	LDA with a 4’ plunge.
9,096	293	Right bank erosion site measures 20' high x 30' long.
9,368	301	Left bank erosion around large stump.
10,450	327	End of survey due to increasing stream gradient and no fish observed since the LDA at 8,870.

REFERENCES

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

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

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

LEVEL III and LEVEL IV HABITAT TYPES

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

Appendix A
Large Woody Debris (LWD) Riparian Inventory

North Branch North Fork Elk River
Humboldt County
August 2005

BACKGROUND

The importance of large woody debris (LWD) in the development of a stream's morphological and biological productivity has been well documented. It strongly influences stream habitat characteristics and biotic composition. Large woody debris is often the structural element associated with pool formation and is considered one of the major elements that create complex fish habitat vital for juvenile salmonid survival. Habitat complexity is particularly important for coho salmon and steelhead trout juveniles because these salmonids remain in the stream for at least one year before migrating to the ocean.

Large woody debris inventories describe the present relative abundance of LWD elements providing, or with the potential to provide, fish habitat within the stream channel. Large woody debris inventories also describe the relative abundance of "recruitable" LWD. Recruitable LWD is the large wood existing out of the stream channel that has a high potential of entering the stream channel in the future.

METHODS

Prior to conducting the LWD inventory, the stream was habitat typed employing the methods described by Flosi, et al (1998). The North Branch North Fork Elk River habitat typing survey delineated 4 stream reaches. The start and end points for the LWD inventory reaches correspond to stream reach start and end points of the habitat survey.

Large woody debris inventory methods, data recording forms, and database structure are described in Flosi, et al (1998). Large woody debris minimum size criteria was 12-inches in diameter and 6 feet in length. Root wads had the 12-inch minimum diameter criteria but had no minimum length requirement. Diameter and length categories consisted of the following:

Diameter Category	**Length Category**
1. 1-2 feet 2. 2-3 feet 3. 3-4 feet 4. Over 4 feet	1. 6-20 feet 2. Over 20 feet

North Branch North Fork Elk River

Condition or status categories included:

a) dead and down
b) dead and standing
c) perched for imminent delivery to the stream channel
d) live coniferous trees
e) live broadleaf trees (a.k.a. deciduous/hardwood)

The sampling strategy consisted of selecting a random starting point near the beginning of the LWD survey reach, and then systematically sampling 200 foot sections out of every 1,000 feet of stream length surveyed. The first 1,200 feet of the LWD survey reach was segmented into 200 foot sections and consecutively numbered 1 through 6. One of these six 200 foot sections was randomly selected as the beginning of the *first* sample section. After conducting the inventory survey in the initial 200 foot section, surveyors proceeded upstream 800 feet and surveyed the next 200 feet as the *second* sample section. The *third* sample section began 800 feet upstream of the end of the second sample section and the next 200 feet were surveyed, and so on. Systematic sampling continued upstream until the end of the LWD survey reach. This method produced a sampling level of approximately 20 percent. For channel type reaches that were less than 1000 feet, the entire reach was surveyed.

RESULTS

*Tables 1 and 2 are located at the end of this report.

				Number of pieces per 100 linear feet of stream within the bankfull channel					
North Branch North Fork Elk River	1	F3	2950	13	0		0.8	0	13.8
	2	B3	1602	9.5	0		0	0.5	10
	3	F4	3119	11.5	0		0	0	11.5
	4	E4	2820	3.3	0.2		0	0	3.5
				Number of pieces per 100 linear feet of stream out of channel on right and left banks and within the bankfull channel					
North Branch North Fork Elk River	1	F3	2950	15.2	0.2	0.5	14.5	0.5	30.9
	2	B3	1602	12	0	0	17.5	0.5	30
	3	F4	3119	11.8	0.2	0.2	13.8	1.2	27.2
	4	E4	2820	5	1.7	0.7	16	0	23.3
				Percentage of LWD pieces found out of channel on right and left banks					
North Branch North Fork Elk River	1	F3	2950	12.9	1.2	2.9	80.1	2.9	100
	2	B3	1602	12.5	0.0	0.0	87.5	0.0	100
	3	F4	3119	1.9	1.3	1.3	87.9	7.6	100
	4	E4	2820	8.6	7.6	3.5	80.8	0.0	100
				Percentage of LWD pieces found within the bankfull channel					
North Branch North Fork Elk River	1	F3	2950	94.2	0.0	0.0	5.8	0.0	100
	2	B3	1602	95.0	0.0	0.0	0.0	5.0	100
	3	F4	3119	100.0	0.0	0.0	0.0	0.0	100
	4	E4	2820	94.3	5.7	0.0	0.0	0.0	100
				Percentage of LWD pieces found out of channel on right and left banks and within the bankfull channel					
North Branch North Fork Elk River	1	F3	2950	49.2	0.6	1.6	46.9	1.6	100
	2	B3	1602	40.0	0.0	0.0	58.3	1.7	100
	3	F4	3119	43.4	0.7	0.7	50.7	4.4	100
	4	E4	2820	21.5	7.3	3.0	68.7	0.0	100

North Branch North Fork Elk River

The North Branch North Fork Elk River LWD inventory consisted of 4 inventory reaches. Reach 1, an F3 channel type extended upstream approximately 0 feet from the mouth. This reach contained 17.1 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 80.1% live coniferous, 12.9% dead and down, 2.9% live broadleaf, 2.9% perched and 1.2% dead and standing (Figure 1). Within the bankfull channel, Reach 1 contained 13.8 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 94.2% dead and down, 5.8% live coniferous, 0% live broadleaf, 0% dead and standing and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 30.9, of which 49.2% were dead and down, 46.9% were live coniferous, 1.6% live broadleaf, 1.6% perched and 0.6% dead and standing. Of the pieces in Reach 1, 57.8% were in LWD size category of 1-2 foot in diameter, 25.4% were in the 2-3 foot category, 14.1% were in the 3-4 foot category and, 2.7 % were in the >4 foot category (Figure 2).

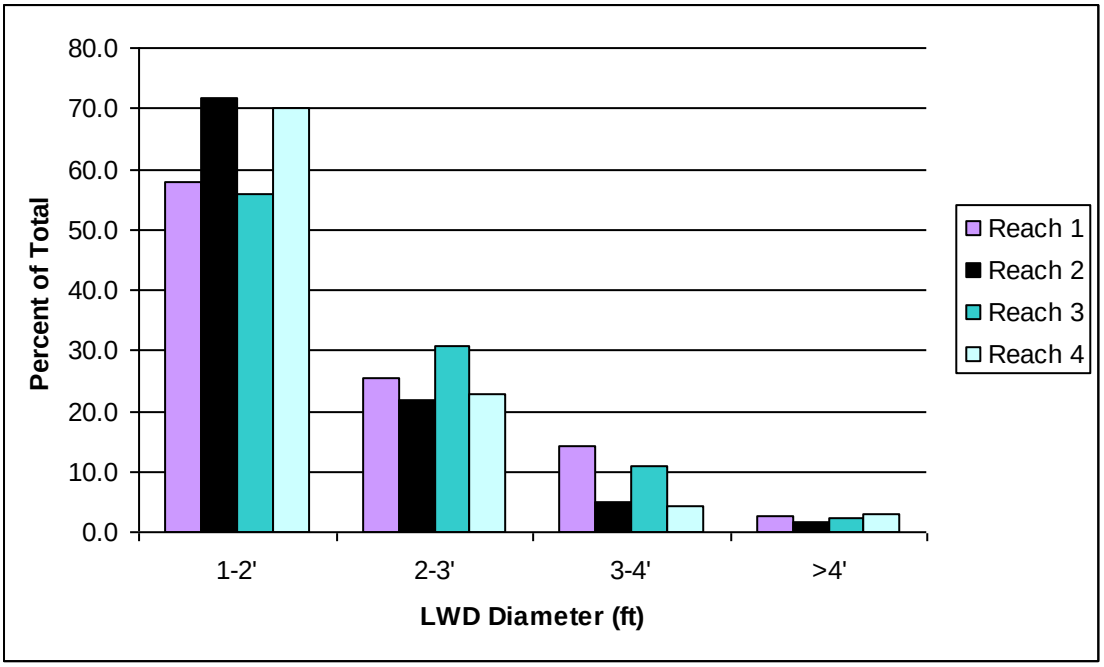
Reach 2, a B3 channel type extended upstream approximately 2950 feet from the mouth. This reach contained 20 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 87.5% live coniferous, 12.5% dead and down, 0% live broadleaf, 0% perched and 0% dead and standing (Figure 1). Within the bankfull channel, Reach 2 contained 10 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 95% dead and down, 5% live broadleaf, 0% live coniferous, 0% dead and standing and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 30, of which 58.3% were live coniferous, 40 % were dead and down, 1.7% live broadleaf, 0% perched and 0% dead and standing. Of the pieces in Reach 1, 71.7% were in LWD size category of 1-2 foot in diameter, 21.7% were in the 2-3 foot category, 5.0% were in the 3-4 foot category and, 1.7 % were in the >4 foot category (Figure 2).

Reach 3, an F4 channel type extended upstream approximately 4552 feet from the mouth. This reach contained 15.7 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 87.9% live coniferous, 1.9% dead and down, 7.6% live broadleaf, 1.3% perched and 1.3% dead and standing (Figure 1). Within the bankfull channel, Reach 3 contained 11.5 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 100% dead and down, 0% live coniferous, 0% live broadleaf, 0% dead and standing and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 27.2, of which 50.7% were live coniferous, 43.4% were dead and down, 4.4% live broadleaf, 0.7% perched and 0.7% dead and standing. Of the pieces in Reach 1, 55.8% were in LWD size category of 1-2 foot in diameter, 30.7% were in the 2-3 foot category, 11.0% were in the 3-4 foot category and, 2.5% were in the >4 foot category (Figure 2).

Reach 4, an E4 channel type extended upstream approximately 4721 feet from the mouth. This reach contained 19.8 pieces of LWD on both the right and the left banks per 100 linear feet of stream. In descending proportions, the condition of the pieces were 81.0% live coniferous, 12.9% dead and down, 2.9% live broadleaf, 2.9% perched and 1.2% dead and standing (Figure 1). Within the bankfull channel, Reach 1 contained 13.8 pieces of LWD per 100 linear feet of stream. The conditions of the pieces were 94.2% dead and down, 5.8% live coniferous, 0% live broadleaf, 0% dead and standing and 0% perched. The total number of pieces per 100 linear feet for both the banks and bankfull channel were 23.3, of which 21.5% were dead and down, 68.7%

were live coniferous, 0% live broadleaf, 0.3% perched and 7.3% dead and standing. Of the pieces in Reach 1, 70.0% were in LWD size category of 1-2 foot in diameter, 22.8% were in the 2-3 foot category, 4.3% were in the 3-4 foot category and, 2.9% were in the >4 foot category (Figure 2).

Figure 2: Percent of LWD according to diameter size class and stream reach



DISCUSSION

One goal of conducting LWD inventories is to provide data that, along with fish population and habitat type data, will enable resource managers to characterize the quality of available and potential fish habitat. Although, the relationship between the number, size, and type of LWD pieces per 100 feet, and quality of fish habitat has not been fully established, it is generally accepted that LWD in the stream channel plays a vital role in contributing to the quality of fish habitat. Large woody debris within the bank zone is the source for future instream LWD and addresses the issue of LWD recruitment to the stream channel. Information in this report will enable resource managers to identify areas lacking in LWD, subsequently leading to planning and prioritizing prescriptions for improvement. This information will also be useful in detecting changes in LWD relative abundance with relation to land use practices or riparian zone restoration projects.