STREAM INVENTORY REPORT

Soda Creek

INTRODUCTION

A stream inventory was conducted during the summer of 1999 on Soda Creek. The survey began at the confluence with Hayworth Creek and extended upstream 2,799 feet.

The Soda Creek inventory was conducted in two parts: habitat inventory and biological inventory. The objective of the habitat inventory was to document the habitat available to anadromous salmonids in Soda Creek. The objective of the biological inventory was to document the presence and distribution of juvenile salmonid species.

The objective of this report is to document the current habitat conditions and recommend options for the potential enhancement of habitat for coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Soda Creek is a tributary to Hayworth Creek, a tributary to the North Fork Noyo River, a tributary to the Noyo River located in Mendocino County, California (Map 1). Soda Creek's legal description at the confluence with Hayworth Creek is T19N R15W S25. Its location is 39°28′42″ north latitude and 123°28′57″ west longitude. Soda Creek is a first order stream and has approximately 0.9 miles of blue line stream according to the USGS Burbeck 7.5 minute quadrangle. Soda Creek drains a watershed of approximately 0.5 square miles. Elevations range from about 720 feet at the mouth of the creek to 1,760 feet in the headwater areas. Mixed conifer forest dominates the watershed. The watershed is entirely privately owned and is managed for timber production. Vehicle access exists via the road paralleling Hayworth Creek on Mendocino Redwood Company land. Soda Creek is approximately 2 miles northeast of Camp Four.

METHODS

The habitat inventory conducted in Soda Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi et al, 1998). The Watershed Stewards Project/AmeriCorps (WSP/AmeriCorps) Members that conducted the inventory were trained in standardized habitat inventory methods by the California Department of Fish and Game (DFG). This inventory was conducted by a two-person team.

SAMPLING STRATEGY

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach. All habitat units included in the survey are classified according to habitat type and their lengths are measured. All pool units are measured for maximum depth, depth of pool tail crest (measured in the thalweg), dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are measured for all the parameters and characteristics on the field form. Additionally, from the ten habitat units on each field form page, one is randomly selected for complete measurement.

HABITAT INVENTORY COMPONENTS

A standardized habitat inventory form has been developed for use in California stream surveys and can be found in the *California Salmonid Stream Habitat Restoration Manual*. This form was used in Soda Creek to record measurements and observations. There are nine components to the inventory form.

1. Flow:

Flow is measured in cubic feet per second (cfs) at the bottom of the stream survey reach using a Marsh-McBirney Model 2000 flow meter.

2. Channel Type:

Channel typing is conducted according to the classification system developed and revised by David Rosgen (1985 rev. 1994). This methodology is described in the *California Salmonid Stream Habitat Restoration Manual*. Channel typing is conducted simultaneously with habitat typing and follows a standard form to record measurements and observations. There are five measured parameters used to determine channel type: 1) water slope gradient, 2) entrenchment, 3) width/depth ratio, 4) substrate composition, and 5) sinuosity. Channel characteristics are measured using a clinometer, hand level, hip chain, tape measure, and stadia rod.

3. Temperatures:

Both water and air temperatures are measured and recorded at every tenth habitat unit. The time of the measurement is also recorded. Both temperatures are taken in degrees Fahrenheit at the middle of the habitat unit and within one foot of the water surface.

4. Habitat Type:

Habitat typing uses the 24 habitat classification types defined by McCain and others (1988). Habitat units are numbered sequentially and assigned a type identification number selected from a standard list of 24 habitat types. Dewatered units are labeled "dry". Soda 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. Habitat characteristics were measured using a clinometer, hip chain, and stadia rod. All measurements were in feet to the nearest tenth.

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 Soda Creek, embeddedness was ocularly estimated. The values were recorded using the following ranges: 0 - 25% (value 1), 26 - 50% (value 2), 51 - 75% (value 3) and 76 - 100% (value 4). Additionally, a value of 5 was assigned to tail-outs deemed unsuited for spawning due to inappropriate substrate particle size, a bedrock tail-out, or other considerations.

6. Shelter Rating:

Instream shelter is composed of those elements within a stream channel that provide salmonids protection from predation, reduce water velocities so fish can rest and conserve energy, and allow separation of territorial units to reduce density related competition. The shelter rating is calculated for each fully-described habitat unit by multiplying shelter value and percent cover. Using an overhead view, a quantitative estimate of the percentage of the habitat unit covered is made. All cover is then classified according to a list of nine cover types. In Soda Creek , a standard qualitative shelter value of 0 (none), 1 (low), 2 (medium), or 3 (high) was assigned according to the complexity of the cover. Thus, shelter ratings can range from 0-300 and are expressed as mean values by habitat types within a stream.

7. Substrate Composition:

Substrate composition ranges from silt/clay sized particles to boulders and bedrock elements. In all fully-described habitat units, dominant and sub-dominant substrate elements were ocularly estimated using a list of seven size classes and recorded as a one and two, respectively. In addition, the dominant substrate composing the pool tail-outs is recorded for each pool.

8. Canopy:

Stream canopy density was estimated using modified handheld spherical densiometers as described in the *California Salmonid Stream Habitat Restoration Manual*. Canopy density relates to the amount of stream shaded from the sun. In Soda Creek, an estimate of the percentage of the habitat unit covered by canopy was made from the center of approximately every third unit in addition to every fully-described unit, giving an approximate 30% sub-sample. In addition, the area of canopy was estimated ocularly into percentages of coniferous or deciduous trees.

9. Bank Composition and Vegetation:

Bank composition elements range from bedrock to bare soil. However, the stream banks are usually covered with grass, brush, or trees. These factors influence the ability of stream banks to withstand winter flows. In Soda 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.

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

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by Tim Curtis, Inland Fisheries Division, California Department of Fish and Game. This program processes and summarizes the data, and produces the following six tables:

- Riffle, flatwater, and pool habitat types
- Habitat types and measured parameters
- Pool types
- Maximum pool depths by habitat types
- Dominant substrates by habitat types
- Mean percent shelter by habitat types

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

- Riffle, flatwater, pool habitats by percent occurrence
- Riffle, flatwater, pool habitats by total length
- Total habitat types by percent occurrence
- Pool types by percent occurrence
- Total pools by maximum depths
- Embeddedness
- Pool cover by cover type
- Dominant substrate in low gradient riffles
- Mean percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

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HABITAT INVENTORY RESULTS

The habitat inventory of August 16, 1999, was conducted by Toni Beaumont and Christine Ramsey (WSP/AmeriCorps). The total length of the stream surveyed was 2,799 feet with an additional 125 feet of side channel.

Stream flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.085 cfs on August 23, 1999.

Soda Creek is an F4 channel type for the entire 2,799 feet of the stream surveyed. F4 channels are entrenched, meandering, riffle/pool channels with low gradients, high width/depth ratios, and gravel-dominant substrates.

Water temperatures taken during the survey ranged from 53 to 61 degrees Fahrenheit. Air temperatures ranged from 80 to 84 degrees Fahrenheit.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 14% riffle units, 34% flatwater units, and 45% pool units (Graph 1). Based on total length of Level II habitat types there were 15% riffle units, 50% flatwater units, and 17% pool units (Graph 2).

Six Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were mid-channel pools, 29%; runs, 22%; low gradient riffles, and plunge pools, each at 14% (Graph 3). Based on percent total length, runs made up 30%, step runs 20%, dry units 16%, and mid-channel pools made up 11%.

A total of 34 pools were identified (Table 3). Main channel pools were the most frequently encountered, at 65%, and comprised 61% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Eight of the 34 pools (24%) had depths between two and three feet (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the 34 pool tail-outs measured, fourteen had a value of 2 (41.2%), eleven had a value of 3 (32.4%), and nine had a value of 5 (26.4%) (Graph 6). On this scale, a value of 1 indicates the highest quality spawning substrate. The breakdown of dominant substrate composition for the nine pool tail-outs that had an embeddedness value of 5 was as follows: 11% silt/clay, 56% sand, and 33% gravel.

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 5, flatwater habitat types had a mean shelter rating of 12, and pool habitats had a mean shelter rating of 7 (Table 1). Of the pool types, the scour pools had the highest mean shelter rating at 10. Main channel pools had a mean shelter rating of 3 (Table 3).

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Table 5 summarizes mean percent cover by habitat type. Small woody debris is the dominant cover type in Soda Creek. Graph 7 describes the pool cover in Soda Creek. Boulders are the dominant pool cover type followed by small and large 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 76.5% of pool tail-outs while sand was the next most frequently observed substrate type, at 14.7%. The mean percent canopy density for the surveyed length of Soda Creek was 95%. The mean percentages of deciduous and coniferous trees were 41% and 59%, respectively. Graph 9 describes the mean percent canopy in Soda Creek.

For the stream reach surveyed, the mean percent right bank vegetated was 71%. The mean percent left bank vegetated was 76%. The dominant elements composing the structure of the stream banks consisted of 15.4% cobble/gravel and 84.6% sand/silt/clay (Graph 10). Coniferous trees were the dominant vegetation type observed in 73.1% of the units surveyed. Additionally, 30.8% of the units surveyed had deciduous trees as the dominant vegetation type, and 3.8% had brush as the dominant vegetation (Graph 11).

BIOLOGICAL INVENTORY RESULTS

Eight sites were electrofished for species composition and distribution in Soda Creek on September 1, 1999. The water temperature taken during the electrofishing period of 4:30 to 5:30 pm on September 1, 1999 was 55 degrees Fahrenheit. Air temperatures ranged from 63 to 65 degrees Fahrenheit. The sites were sampled by Michelle Gilroy (DFG), Ethan Jankowski (WSP/AmeriCorps), and Randy Turner (CCC).

The first site sampled included habitat unit 1, a run, located at the confluence with Hayworth Creek. The site yielded 2 sculpin and 1 young-of-the-year steelhead.

The second site included habitat unit 3, a plunge pool, located approximately 133 feet upstream of the creek mouth. The site yielded no fish.

The third site sampled included habitat unit 4, a mid-channel pool, located approximately 146 feet upstream of the creek mouth. The site yielded 1 one-plus age class steelhead, 2 sculpin, and 1 salamander.

The fourth site sampled included habitat unit 6, a low gradient riffle, located approximately 233 feet upstream of the creek mouth. The site yielded 1 young-of-the-year steelhead.

The fifth site sampled included habitat unit 7, a mid-channel pool, located approximately 244 feet upstream of the creek mouth. The site yielded 2 young-of-the-year steelhead .

The sixth site sampled included habitat unit 8, a step run, located approximately 262 feet upstream of the creek mouth. The site yielded no fish.

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The seventh site sampled included habitat unit 9, a mid-channel pool, located approximately 297 feet upstream of the creek mouth. The site yielded 1 one-plus age class steelhead.

The eighth site sampled included habitat unit 10, a low gradient riffle, located approximately 304 feet upstream of the creek mouth. The site yielded 2 young-of-the-year steelhead and 1 one-plus age class steelhead.

The following chart displays the information yielded from these sites:

Date	Site #	Approx. Dist. from mouth (ft.)	Hab. Unit #	Hab. Type	Reach #	Channel type	Steelhead		
							YOY	1+	2+
09/01/99	1	0	1	RUN	1	F4	1	0	0
09/01/99	2	133	3	PLP	1	F4	0	0	0
09/01/99	3	146	4	MCP	1	F4	0	1	0
09/01/99	4	233	6	LGR	1	F4	1	0	0
09/01/99	5	244	7	MCP	1	F4	2	0	0
09/01/99	6	262	8	SRN	1	F4	0	0	0
09/01/99	7	29	9	MCP	1	F4	0	1	0
09/01/99	8	304	10	LGR	1	F4	2	1	0

DISCUSSION

Soda Creek is an F4 channel type for the 2,799 feet of stream surveyed. The suitability of F4 channel types for fish habitat improvement structures is as follows: good for bank-placed boulders; fair for single and opposing wing-deflectors, channel constrictors, and log cover.

The water temperatures recorded on the survey day of August 16, 1999, ranged from 53 to 61 degrees Fahrenheit. This is a good water temperature range for salmonids. Air temperatures ranged from 80 to 84 degrees Fahrenheit. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 50% of the total length of this survey, riffles 15%, and pools 17%. Eight of the 34 (23.5%) pools had maximum depths between 2 and 3 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended.

Fourteen of the 34 pool tail-outs measured had an embeddedness rating of 2. Eleven of the pool tail-outs had an embeddedness rating of 3. Nine of the pool tail-outs had a rating of 5, which is

considered unsuitable for spawning. The nine pool tail-outs considered unsuitable for spawning had silt/clay, sand, or small gravel as the dominant substrate. 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 Soda Creek should be mapped and rated according to their potential sediment yields, and control measures should be taken.

Twenty-eight of the thirty-four 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 in the flatwater habitats was 12. The shelter rating for pools was 7. A pool shelter rating of approximately 100 is desirable. The small amount of cover that now exists is being provided primarily by small woody debris in the flatwater and riffle habitats. The primary cover in the pool habitats was boulders. Log and root wad cover structure 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%. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was 71.4% and 75.7%, respectively. In areas of stream bank erosion or where bank vegetation is not at acceptable levels, planting endemic species of coniferous and deciduous trees, in conjunction with bank stabilization, is recommended.

RECOMMENDATIONS

1) Soda 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 and the depth of the existing pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

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

5) 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):	Comments:
0'	Begin survey at confluence with Hayworth Creek. Channel type is an F4. Electrofishing site #1.
133'	Electrofishing site #2.
146'	Electrofishing site #3.
233'	Five foot diameter culvert leading to low water bridge. Culvert rust line is at 1.5 foot height. Electrofishing site #4.
244'	Electrofishing site #5.
262'	Electrofishing site #6.
297'	Electrofishing site #7.
304'	Electrofishing site #8.
377'	Log debris accumulation, 12' long x 10' wide x 4' high, accumulating gravel and fine sediment.
470'	Left bank failure, 10' wide x 11' high.
487'	Log debris accumulation, 10' long x 10' wide x 4' high, consisting of 15 pieces of large wood.
522'	Two and a half foot plunge.
582'	Five windthrown logs.
596'	Log debris accumulation, 15' long x 8' wide x 4' high, consisting of 10 pieces of large wood.
608'	Ten windthrown logs.
658'	Fifteen windthrown logs.

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683'	Log debris accumulation, 10' long x 10' wide x 5' high, consisting of ten pieces of large wood; 2.2 foot plunge.
706'	Log debris accumulation, 8' long x 12' wide x 3' high, retaining gravel and fine sediment.
797'	Six windthrown logs.
827'	Log debris accumulation, 15' long x 20' wide x 5' high, consisting of 15 pieces of large wood.
869'	Log debris accumulation, 25' long x 15' wide x 4' high, consisting of 10 pieces of large wood and retaining gravel and fine sediment.
895'	Log debris accumulation, 10' long x 15' wide x 4' high, consisting of 10 pieces of large wood.
1,079'	Log debris accumulation, 20' long x 12' wide x 4' high, consisting of 15 pieces of large wood; 3 foot plunge.
1,244'	Log debris accumulation, 40' long x 20' wide x 6' high, consisting of 20 pieces of large wood and retaining gravel and fine sediment. Possible road and log landing on left bank.
1,391'	Algae observed in channel.
1,551'	Right bank failure, 25' long x 10' high.
1,581'	Log debris accumulation, 10' long x 8' wide x 4' high. Right bank failure.
1,643'	Right bank failure, 10' long x 15' wide.
1,691'	Right bank failure, 10' long x 8' high. Log debris accumulation consisting of 5 pieces of large wood.
1,703'	Log debris accumulation, 12' long x 10' wide x 4' high, consisting of 10 pieces of large wood; unstable left bank.
1,760'	Log debris accumulation, 15' long x 15' wide x 6' high.
1,910'	Log debris accumulation spanning channel and consisting of 15 pieces of large wood.
1,955'	Right bank failure, 10' long x 5' high.

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2,164'	Log debris accumulation, 10' long x 15' wide x 4' high, retaining gravel and fine sediment.
2,221'	Log debris accumulation consisting of 10 pieces of large wood, not retaining sediment.
2,231'	Log debris accumulation spanning channel and consisting of 4 pieces of large wood.
2,346'	Log debris accumulation, 5' long x 10' wide x 5' high, retaining gravel and fine sediment.
2,362'	Log debris accumulation consisting of 2 pieces of large wood and retaining gravel and fine sediment.
2,799'	End of Survey due to dry channel. Log debris accumulation, 10' long x 15' wide x 5' high, consisting of 20 pieces of large wood and retaining gravel and sediment.

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.

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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]	

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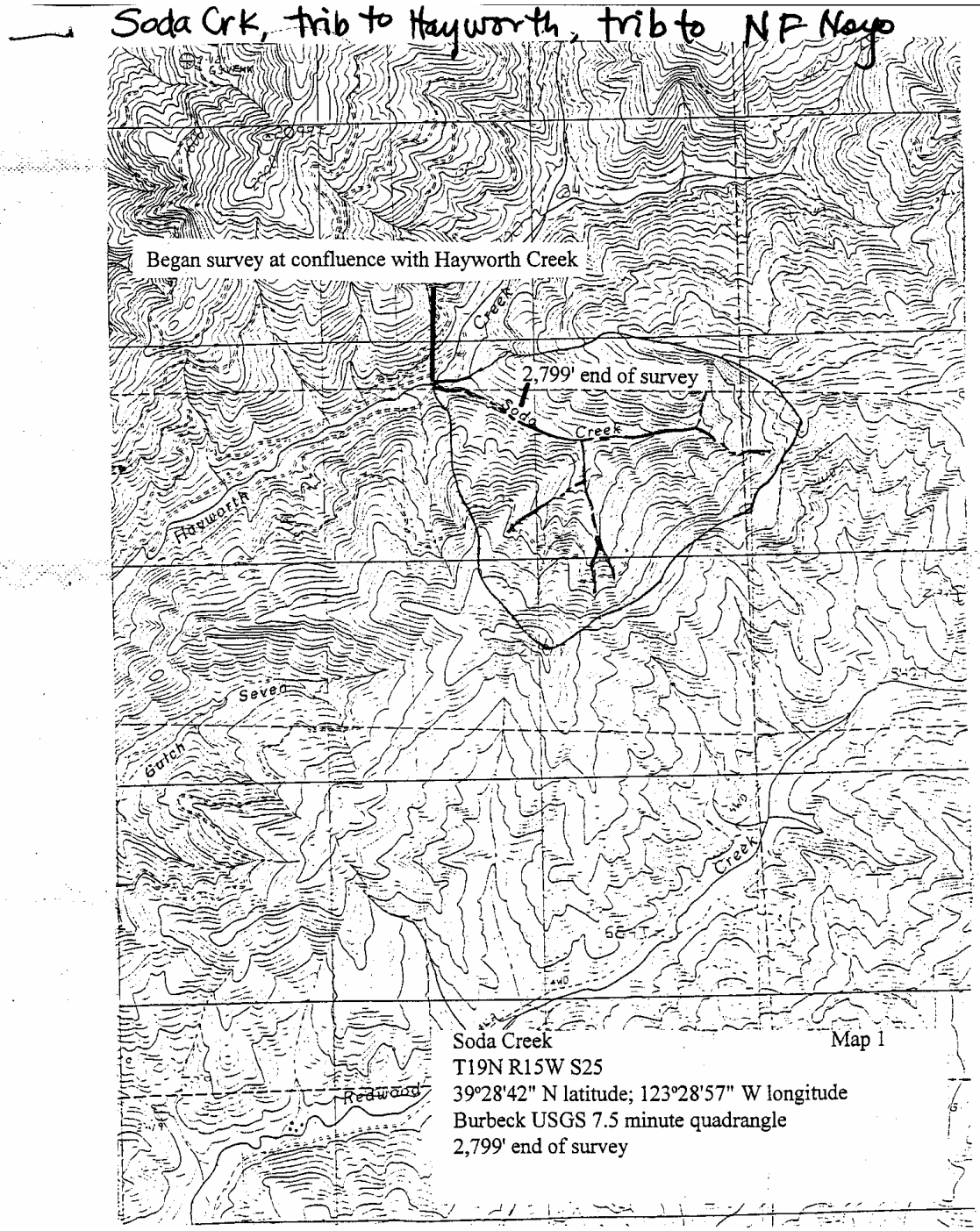
Soda Crk, trib to Hayworth, trib to NF Noyo
Began survey at confluence with Hayworth Creek
2,799' end of survey
Soda Creek
Hayworth
Creek
Seven
Gulch
Creek
Redwood
Soda Creek
T19N R15W S25
39°28'42" N latitude; 123°28'57" W longitude
Burbeck USGS 7.5 minute quadrangle
2,799' end of survey
Map 1