STREAM INVENTORY REPORT

Howe Creek, Main Stem Eel River

INTRODUCTION

A stream inventory was conducted during the summer of 1998 on Howe Creek . The 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 Howe 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 chinook salmon, coho salmon and steelhead trout. Recommendations for habitat improvement activities are based upon target habitat values suitable for salmonids in California's north coast streams.

WATERSHED OVERVIEW

Howe Creek is tributary to the mainstem Eel River, located in Humboldt County, California. Howe Creek 's legal description at the confluence with mainstem Eel River is T2N R1W S35. Its location is 40°30′50″ North latitude and 124°09′50″ West longitude. Howe Creek is a second order stream and has approximately 6.0 miles of blue line stream according to the USGS Fortuna and Taylor Peak 7.5 minute quadrangles. Howe Creek drains a watershed of approximately 10.2 square miles. Elevations range from about 100 feet at the mouth of the creek to 1900 feet in the headwater areas. Conifer forests and grasslands dominate the watershed. The watershed is primarily privately owned and is managed for timber production and rangeland. Vehicle access exists via Blue Slide Road which connects the towns of Rio Dell and Ferndale along the south side of the Eel River.

METHODS

The habitat inventory conducted in Howe Creek follows the methodology presented in the *California Salmonid Stream Habitat Restoration Manual* (Flosi, et. al., 1998). The AmeriCorps/Watershed Stewards Project (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

Howe Creek, 1998

The inventory uses a method that samples approximately 10% of the habitat units within the survey reach (Hopelain, 1994). 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, dominant substrate composing the pool tail crest, and embeddedness. Habitat unit types encountered for the first time are further 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 Howe 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 standard flow measuring equipment, if available. In some cases flows are estimated.

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.

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". Howe 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. Channel dimensions were measured using hip chains, range finders, tape measures, and stadia rods. All units were measured for mean length; additionally, the first occurrence of each unit type and a randomly selected 10% subset of all units were sampled for all features on the sampling form (Hopelain, 1995). Pool tail crest depth at each pool unit was measured in the thalweg. All measurements were in feet to the nearest tenth.

5. Embeddedness:

The depth of embeddedness of the cobbles in pool tail-out reaches is measured by the percent of the cobble that is surrounded or buried by fine sediment. In Howe 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, having 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 Howe 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 Howe 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 Howe 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 was estimated and recorded.

BIOLOGICAL INVENTORY

Biological sampling during stream inventory is used to determine fish species and their distribution in the stream. In Howe Creek fish presence was observed from the stream banks. These sampling techniques are discussed in the *California Salmonid Stream Habitat Restoration Manual*.

SUBSTRATE SAMPLING

Gravel sampling is conducted using a 9 inch diameter standard McNeil gravel sampler. Sample sites are identified numerically beginning at the most upstream site in the stream. Gravel samples are separated and measured to determine respective percent volume using five sieve sizes (25.4, 12.5, 4.7, 2.37, and 0.85 mm)(Valentine, 1995).

DATA ANALYSIS

Data from the habitat inventory form are entered into Habitat, a dBASE 4.2 data entry program developed by 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 Howe 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 the pool tail outs
- Percent canopy
- Bank composition by composition type
- Bank vegetation by vegetation type

HABITAT INVENTORY RESULTS

* ALL TABLES AND GRAPHS ARE LOCATED AT THE END OF THE REPORT *

The habitat inventory of August 13, 1998, was conducted by John Wooster and Carolyn Jezierski (AmeriCorps). The total length of the stream surveyed was 19,374 feet with an additional 22 feet of side channel.

Flow was measured at the bottom of the survey reach with a Marsh-McBirney Model 2000 flowmeter at 0.5 cfs on August 18, 1998.

Howe Creek is an F4 channel type for the first 16,357 feet of stream reach surveyed, and an A3 channel type for the remaining 3,943 feet. F4 channels are entrenched, meandering, riffle/pool channels on low gradients with high width/depth ratios and gravel-dominant substrates. A3 channels are steep, narrow, cascading step-pool streams with high energy/debris transport associated with deposional soils, and a predominantly cobble substrate.

Water temperatures taken during the survey period ranged from 58° to 67°F. Air temperatures ranged from 62° to 72°F.

Table 1 summarizes the Level II riffle, flatwater, and pool habitat types. Based on frequency of occurrence there were 46% riffle units, 36% flatwater units, and 17% pool units (Graph 1). Based on total length of Level II habitat types there were 66% riffle units, 28% flatwater units,

and 6% pool units (Graph 2).

Thirteen Level IV habitat types were identified (Table 2). The most frequent habitat types by percent occurrence were low gradient riffles, 46%; runs, 24%; and mid-channel pools, 13% (Graph 3). Based on percent total length, low gradient riffles made up 66%, runs made up 16%, and step runs 12%.

A total of forty five pools were identified (Table 3). Mid channel pools were most frequently encountered at 82% and comprised 84% of the total length of all pools (Graph 4).

Table 4 is a summary of maximum pool depths by pool habitat types. Pool quality for salmonids increases with depth. Eighteen of the forty five pools (53%) had a depth of two feet or greater (Graph 5).

The depth of cobble embeddedness was estimated at pool tail-outs. Of the one hundred pool tail-outs measured, none had a value of 1 (0%); twelve had a value of 2 (12%); seventy three had a value of 3 (73%);fifteen had a value of 4 (15%) and none had a value of 5 (0%) (Graph 6). On this scale, a value of 1 indicates the highest quality of spawning substrate and a value of 5 indicates the tail-out is not suitable for spawning.

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 10, flatwater habitat types had a mean shelter rating of 7, and pool habitats had a mean shelter rating of 12 (Table 1). Of the pool types, the backwater pools had the highest mean shelter rating at 23. Scour pools had a mean shelter rating of 16 (Table 3).

Table 5 summarizes mean percent cover by habitat type. Boulders are the dominant cover type in Howe Creek . Undercut banks and large woody debris are lacking in nearly all habitat types. Graph 7 describes the pool cover in Howe Creek .

Table 6 summarizes the dominant substrate by habitat type. Gravel was the dominant substrate observed in 152 of the 262 pool tail outs measured (58%). Small cobble was the next most frequently observed dominant substrate type and occurred in 28% of the pool tail outs (Graph 8).

The mean percent canopy density for the stream reach surveyed was 58%. The mean percentages of deciduous and coniferous trees were 80% and 20%, respectively. Graph 9 describes the canopy in Howe Creek .

For the stream reach surveyed, the mean percent right bank vegetated was 65.8%. The mean percent left bank vegetated was 68.7%. The dominant elements composing the structure of the stream banks consisted of 6.4% bedrock, 9.0% boulder, 78.2% cobble/gravel, and 6.4% sand/silt/clay (Graph 10). Deciduous trees were the dominant vegetation type observed in 74.33% of the units surveyed and 7.69% had coniferous trees as the dominant vegetation, including down trees, logs, and root wads (Graph 11).

Howe Creek, 1998

BIOLOGICAL INVENTORY RESULTS

Three sites were electrofished on September 15, 1998 in Howe Creek. The units were sampled by Ruth Goodfield (DFG) and Sandra Bartlett (CCC). All measurements are fork lengths unless noted otherwise.

The first site sampled was habitat unit 134, a mid-channel pool, approximately 12,569 feet from the mouth of the stream. The site had a surface area of 525 sq ft, and a volume of 1,418 cu ft. This unit yielded 62 steelhead, ranging from 58 to 174mm, and 58 Sacramento squawfish, ranging from 65 to 210mm.

The second site was located on the west fork of Howe Creek, approximately 200 ft from the confluence with mainstem Howe Creek. The unit sampled was a run, with a surface area of 422 sq ft, and a volume of 253 cu ft. The unit yielded 34 steelhead, ranging from 50 to 120mm.

The third electrofishing site was also located on the west fork of Howe Creek, approximately 870 ft from the confluence with mainstem Howe Creek. The habitat type sampled was a mid-channel pool with a surface area of 220 sq ft, and a volume of 198 cu ft. The unit yielded one steelhead/rainbow trout, which measured at 108mm.

GRAVEL SAMPLING RESULTS

No gravel samples were taken on Howe Creek .

DISCUSSION

Howe Creek is an F4 channel type for the first 16,357 feet of stream surveyed, and an A3 for the remaining 3,943 feet. The suitability of F4 channel types for fish habitat improvement structures is good for bank placed boulders, fair for plunge weirs; single and opposing wing-deflectors; channel constrictors; logs and poor for boulder clusters. The suitability of A3 channel types is good for bank-placed boulders; fair for plunge weirs and log cover; and poor for boulder clusters and single wing-deflectors.

The water temperatures recorded on the survey days August 13-18, 1998, ranged from 58 to 67 degrees Fahrenheit. Air temperatures ranged from 62 to 72 degrees Fahrenheit. This is a fair to good water temperature range for salmonids. However, 67 F, if sustained, is near the threshold stress level for salmonids. This does not seem to be the case here, and Howe Creek seems to have temperatures favorable to salmonids. To make any further conclusions, temperatures would need to be monitored throughout the warm summer months, and more extensive biological sampling would need to be conducted.

Flatwater habitat types comprised 36% of the total **length** of this survey, riffles 46%, and pools 17%. The pools are relatively deep, with 28 of the 45 (62.2%) pools having a maximum depth

greater than 2 feet. In general, pool enhancement projects are considered when primary pools comprise less than 40% of the length of total stream habitat. In first and second order streams, a primary pool is defined to have a maximum depth of at least two feet, occupy at least half the width of the low flow channel, and be as long as the low flow channel width. Installing structures that will increase or deepen pool habitat is recommended 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. The LDA's in the system are retaining needed gravel. Any necessary modifications to them should be done with the intent of metering the gravel out to downstream reaches that will trap the gravel for future spawning use. Therefore, gravel retention features may need to be developed prior to any LDA modification.

None of the one hundred pool tail-outs measured had an embeddedness rating of 1. Eighty eight of the pool tail-outs had embeddedness ratings of 3 or 4. None of the pool tail-outs had a rating of 5 or were considered unsuitable for spawning. Cobble embeddedness measured to be 25% or less, a rating of 1, is considered to indicate good quality spawning substrate for salmon and steelhead. In Howe Creek , sediment sources should be mapped and rated according to their potential sediment yields, and control measures should be taken.

The mean shelter rating for pools was low with a rating of 12. The shelter rating in the flatwater habitats was slightly lower at 7. A pool shelter rating of approximately 100 is desirable. The relatively small amount of cover that now exists is being provided primarily by boulders in all habitat types. Additionally, small woody debris contributes a small amount. Log and root wad cover structures in the pool and flatwater habitats are needed to improve 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.

Thirty nine of the forty five pool tail outs measured had gravel or small cobble as the dominant substrate. This is generally considered good for spawning salmonids.

The mean percent canopy density for the stream was 58%. This is a relatively low percentage of canopy. In general, revegetation projects are considered when canopy density is less than 80%.

The percentage of right and left bank covered with vegetation was moderate at 65.8% and 68.7%, 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) Howe Creek should be managed as an anadromous, natural production stream.

2) 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.

3) 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.

4) Where feasible, design and engineer pool enhancement structures to increase the number of pools. This must be done where the banks are stable or in conjunction with stream bank armor to prevent erosion.

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

6) 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.

7) Increase the canopy on Howe Creek by planting willow, alder, redwood, and Douglas fir along the stream where shade canopy is not at acceptable levels. The reaches above this survey section should be inventoried and treated as well, since the water flowing here is effected from upstream. In many cases, planting will need to be coordinated to follow bank stabilization or upslope erosion control projects.

8) There are a few log debris accumulations present on Howe Creek that are retaining large quantities of fine sediment. The modification of these debris accumulations is desirable in some locations, but must be done carefully, over time, to avoid excessive sediment loading in downstream reaches.

9) The survey reach is largely contained within a cattle ranch. It is noteworthy that the stream is largely undisturbed by livestock thanks to a functional fencing system that only allows stock access to Howe Creek in a few locations. These locations should be evaluated for possible habitat improvement projects.

COMMENTS AND LANDMARKS

The following landmarks and noteworthy sites were observed. All distances are approximate and taken from the beginning of the survey reach.

Howe Creek, 1998

0'	Begin survey at confluence with Eel River. Reach one is an F4 channel type for the first 16,357' of stream surveyed.
850'	A two foot artificial weir has been constructed out of large cobble. Several fish are using the pool ponded above the weir.
1077'	Blue Slide Road bridge spans Howe Creek
1389'	Upper end of the hydraulic influence of mainstem Eel River on stream channel.
3279'	Vehicle ford in stream; gabions protecting right bank (RB).
4681'	Vehicle ford in stream.
6433'	Vehicle bridge spans stream; bridge is 20 feet wide.
8481'	Atwell Creek enters from RB.
8834'	Cattle have accessed the stream in the reach from Atwell Creek to this point.
9903'	Left bank (LB) failure, approximately 50' long x 40' wide x 50' high.
11055'	Vehicle bridge spans stream; bridge is 15 feet wide.
11672'	Vehicle ford in stream.
12301'	RB failure; cables placed to collect woody debris. 200' LB “land flow” is contributing fines to the creek as well.
12569'	Vehicle bridge spans stream at end of County road. Location of electrofishing site #1.
12899'	RB failure (80'x 40'x 40').
12929'	Tributary enters from RB.
13126'	Vehicle ford in stream
13285'	Vehicle bridge spans stream.
14732'	Tributary enters from LB.
15675'	Juvenile salmonids observed.
16357'	Forks of Howe Creek; East Fork flow is .5 cfs, West Fork is .7 cfs. Survey continues up East Fork of Howe Creek. Channel type changes to an A3 for the

	remaining 3,943' of stream surveyed. Howe Creek is an A3 channel type for entire length.
18135'	Recent failure on RB (20' x 5 'x 15'), contributing sediment and fines.
18268'	RB landslide (70' x 15' x 30').
18375'	Gradient increases to over 8 percent.
18385'	LDA instream is possible barrier to fish passage.
19677'	Stream forks. Eastern Fork has only a trickle of flow over a bedrock sheet and boulder barrier. Survey continues up West Fork of East Fork Howe Creek.
19827'	Plunge 5' high cascades into pool.
20123'	Small fish observed, likely YOY salmonids.
20300'	Boulder cascade 90' high. Contains three 17' vertical falls. Barrier to fish passage at this time. End of survey.

REFERENCES

Flosi, G., S. Downie, J. Hopelain, M. Bird, R. Coey, and B. Collins, 1998. California salmonid stream habitat restoration manual, third edition. California Department of Fish and Game, Sacramento, California.

Hopelain, J. 1995. Sampling levels for fish habitat inventory, unpublished manuscript. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California.

Valentine, B. 1995. Stream substrate quality for salmonids: guidelines for sampling, processing, and analysis, unpublished manuscript. California Department of Forestry and Fire Protection, Santa Rosa, California.

LEVEL III and LEVEL IV HABITAT TYPE KEY

HABITAT TYPE	LETTER	NUMBER
RIFFLE		
Low Gradient Riffle	[LGR]	1.1
High Gradient Riffle	[HGR]	1.2
CASCADE		
Cascade	[CAS]	2.1
Bedrock Sheet	[BRS]	2.2
FLATWATER		
Pocket Water	[POW]	3.1
Glide	[GLD]	3.2
Run	[RUN]	3.3
Step Run	[SRN]	3.4
Edgewater	[EDW]	3.5
MAIN CHANNEL POOLS		
Trench Pool	[TRP]	4.1
Mid-Channel Pool	[MCP]	4.2
Channel Confluence Pool	[CCP]	4.3
Step Pool	[STP]	4.4
SCOUR POOLS		
Corner Pool	[CRP]	5.1
Lateral Scour Pool - Log Enhanced	[LSL]	5.2
Lateral Scour Pool - Root Wad Enhanced	[LSR]	5.3
Lateral Scour Pool - Bedrock Formed	[LSBk]	5.4
Lateral Scour Pool - Boulder Formed	[LSBo]	5.5
Plunge Pool	[PLP]	5.6
BACKWATER POOLS		
Secondary Channel Pool	[SCP]	6.1
Backwater Pool - Boulder Formed	[BPB]	6.2
Backwater Pool - Root Wad Formed	[BPR]	6.3
Backwater Pool - Log Formed	[BPL]	6.4
Dammed Pool	[DPL]	6.5