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AQUATIC CONSERVATION PLAN

Class I Aquatic Trend Monitoring

HRC HCP Section 6.3.5.3

2008 ANNUAL REPORT



Humboldt Redwood
COMPANY, LLC

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PROJECT TITLE:

HRC HCP Aquatic Conservation Plan, Class I Aquatic Trend Monitoring

ORGANIZATION IMPLEMENTING THE PROJECT:

HRC (Humboldt Redwood Company, LLC)
PO Box 712
125 Main St.
Scotia, CA 95565

EFFECTIVE DATE OF THE PLAN:

Plan in effect as of February 1999:

HRC HCP Class I Aquatic Trend Monitoring Program

Plan in effect as of October 15, 1999:

NCRWQCB Bear Creek Monitoring Plan
NCRWQCB North Fork Elk River Monitoring Plan

This document with attachments is the 2008 annual report for the HRC HCP Class I Aquatic Trend Monitoring Program as required by the HRC HCP. This document also serves as the 2008 annual report for both Bear Creek and North Fork Elk River Monitoring plans as required by the NCRWQCB.

“I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those directly responsible for gathering the information, the information submitted, is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.”

PRINCIPAL INVESTIGATOR

_____ Date _____

Kathleen Sullivan, Ph.D.



Humboldt Redwood
COMPANY, LLC

SECTION 1. PROGRAM OVERVIEW AND BACKGROUND

ABSTRACT AND SUMMARY

This document serves as the annual report for Aquatic Trend Monitoring of Class I Streams within Humboldt County, California where HRC (Humboldt Redwood Company, LLC) has ownership. This report is an annual requirement of the Aquatics Conservation Plan implemented under the HRC Habitat Conservation Plan (HCP). The goal of the Aquatics Conservation Plan is to maintain or achieve, over time, a properly functioning aquatic habitat condition. This condition, as defined by the National Oceanic & Atmospheric Administration Fisheries (NOAA Fisheries), is essential for the long-term survival of anadromous salmonids and is identified in a matrix (properly functioning conditions matrix) of habitat variables necessary to achieve this goal.

The foundation of the HRC HCP is based on gathering scientific information on watersheds such that a complete watershed analysis can be performed. Based on this information, adaptive management will be implemented in order to use the best land management practices for each individual watershed. Through this process, it is the intention of the Aquatic Conservation Plan portion of the HCP that watershed conditions will be minimally impacted by land use such that endangered fish species can recover with improvements in habitat conditions. The data collected by the aquatic trend monitoring program contributes this to cumulative effects analysis in watershed analysis and is used to assess stream conditions over the life of the Habitat Conservation Plan.

2008 served as the tenth year of aquatic trend monitoring data collection under the HRC HCP. Much work has been invested in advancing this program to a higher level of quality scientific data collection. This includes collaboration with state and federal agencies as well as private interest and consulting groups. Data collection and processing methods are being reviewed, refined and documented based on project goals as well as quality assurance goals.

DOCUMENT ORGANIZATION

This document is organized in four main sections.

- Section 1: Program Overview and Background, Design and Organization of Projects
- Section 2: Summary of Program Results
- Section 3: Data Summaries and Results
- Section 4: Quality Objectives and Criteria
- Section 5: Appendices



- Table Set 1, Tables 1-24; Data Summary Tables
- Figure Set 1, Figures 1-12; Sediment Parameters Plots
- Figure Set 2, Figures 13-16; Residual Pool Depth Plots
- Figure Set 3, Streambed Survey Plots

PROGRAM OBJECTIVES

The objective of the class I stream trend monitoring program is to develop the data necessary to assess long-term trends in physical and biological stream habitat conditions comparatively to the Aquatic APFC matrix target values. Monitoring is to be done at regular, well-spaced time intervals at stations distributed throughout the sub-watersheds. Trend monitoring can serve to indicate whether watersheds as a whole are on a long-term trajectory of recovery from both natural and management-related disturbances. HRC works under the approval and advice of HCP signatory agencies to review the monitoring program methods and station locations. Agencies review monitoring activities annually and/or following completed watershed analyses to confirm monitoring consistency and correctness. This review also addresses any concerns from public and local watershed specialists regarding monitoring efforts. HRC and the agencies work cooperatively to further develop details regarding monitoring objectives and hypotheses, sampling, and measurement methodologies, monitoring locations and distribution, frequency of sampling, and statistical analysis.

Annual Program Objectives are as follows:

- Complete all field data collections procedures in an efficient and timely manner, following all applicable Watershed Operating Protocols (WOP).
- Complete all QA/QA goals for each project within the monitoring program
- Complete reviews of operating protocols and further develop quality of data collection and processing where necessary
- Provide data summaries and analyses to HCP Signatory Agencies
- Provide progress report, comments and suggestions to the HCP Signatory Agencies regarding all aspects of the Class I Instream Trend Monitoring Program
- Actively participate with HCP Signatory Agencies and other involved parties regarding all aspects of the Class I Instream Trend Monitoring Program.
- Provide feedback to the HRC HCP Watershed Analysis Process



PROGRAM DESIGN

HRC's ownership includes over 217,000 acres of land, including over 208,000 of which are included in the HCP. HRC's ownership contains seven major drainages including Yager and Freshwater Creeks, and Bear, Elk, Eel, Van Duzen and Mattole Rivers. To facilitate the analysis of this extensive property, HRC divided its ownership into five watershed assessment areas or WAAs (Humboldt Bay, Yager, Van Duzen, Eel, and Bear-Mattole). These WAAs were delineated, in part; using the boundaries of the state of California's Planning Watersheds and includes non-HRC or "off-ownership" lands to ensure that all areas within the relevant planning watersheds were considered. A description of the location, physical characteristics, major watercourses and dominant vegetation within each WAA is given in the HRC HCP Aquatic Conservation Plan Class I Aquatic Trend Monitoring Quality Assurance Program Plan.

ATM sites are on various schedules for repeat measurement. See Table 1 for schedule.

PROJECT METHODS

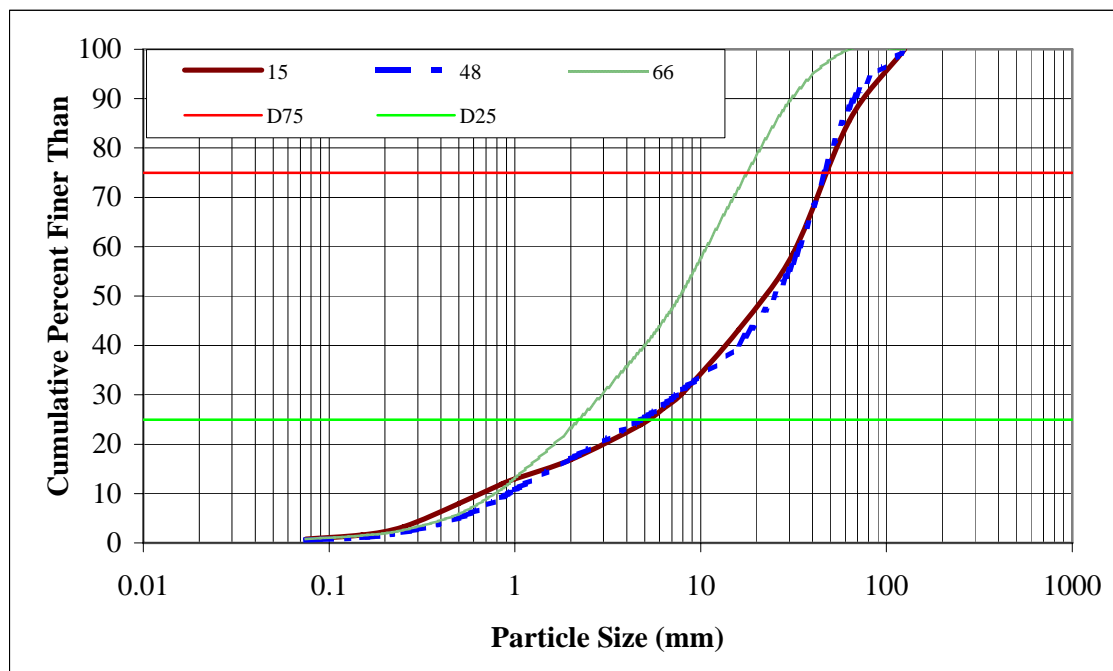
HRC's Class I Trend monitoring program currently utilizes four main variables (surface and sub-surface sediment sampling [pebble counts and bulk sediment], canopy cover, and pool attributes) to address APFC matrix targets at all monitoring stations (except temperature only stations). Three additional variables (water temperature, large woody debris, and streambed surveys) are collected at a subset of these sampling stations. Brief summaries of each of these variables are provided in the HRC HCP Aquatic Conservation Plan Class I Aquatic Trend Monitoring Quality Assurance Program Plan that contains a Watershed Operating Protocol for each parameter measured (with exception to those currently under development). Details are provided in the data discussion portion of the sampling parameters section on data calculation methods not described within the associated WOP. Methods are briefly described below.

- Pebble count measurements collected at riffles are used to address the APFC matrix target for D_{50} (diameter of the median [50th of 100] particle). These sediment measures can be tracked over time to determine whether bedload sediments in a watercourse are generally becoming coarser or finer, relative to both sediment loading rates and cumulative effects from management activities.
 - Using a transect method within bankfull boundaries, three riffles are surveyed within each monitoring reach with a 200 pebble count each, measuring the intermediate axis of each pebble. See *Watershed Operating Protocol 13, Surface and Sub-surface Sediment Sampling* for full protocol.
 - D_{50} values are calculated for each of three, 200-count surveys and averaged for the reach.



- Bulk sediment samples taken from pool to riffle breaks are used to assess the APFC matrix target for percent fines less than 0.85 mm and particles less than 6.35 mm. Bulk sediment samples are also used to assess the APFC Matrix targets of geomean diameter and Fredle Index values. In general, sediment sample findings are used as indicators of suitability for salmonid spawning and emergence survival success.
 - Three sediment samples are collected using a standard shovel at three pool to riffle breaks within the sampling reach. See *Watershed Operating Protocol 13, Surface and Sub-surface Sediment Sampling* for full protocol.
 - Samples are processed at the HRC Sediment Laboratory using a dry-sieving method and a series of sieves ranging from 125mm to 0.075mm. See *Watershed Operating Protocol 07, Bulk Sediment Laboratory Processing* for full protocol.
 - Laboratory sediment processing data is plotted on cumulative percent plots in order to determine the D50 values as well as calculate other matrix values. An example is included as follows:

Example of Bulk Sediment Cumulative Percent Weight Plot



Percent fines less than 0.85mm and percent particles less than 6.35mm were calculated based on the weight of sample in all sieves less than the target values of 0.85mm and 6.35mm divided by the



total weight of sample, not including any particles held in the largest (125mm) sieve (Valentine 1995).

Ninety-five percent confidence limits were calculated for all individual station values based on the three samples taken at each station for percent fines less than 0.85mm and percent particles less than 6.35mm. Ninety-five percent confidence limits were calculated using the equation:

$$95\% \text{ Confidence} = \text{average} \pm 1.96 \left(\frac{\text{StDev}}{\sqrt{n}} \right)$$

As an Example: Station 19 (Graham Gulch) the three sample percentages of fines less than 0.85mm are 11.93, 9.22, and 10.89 having an average of 10.68%.

$$95\% \text{ Confidence} = 10.68 \pm 1.96 \left(\frac{1.36}{\sqrt{3}} \right) = 10.68 \pm 1.54$$

Geometric Mean (Dg) was calculated following the APFC matrix reference (Valentine 1995) as:

$$Dg = d_1^{w1} * d_2^{w2} * d_3^{w3} * \dots * d_n^{wn}$$

Where d is the midpoint sieve diameter, w is the decimal fraction by volume retained by a given sieve, and n is the number of sieves used. Again, no particles held in the largest sieve (125mm) were included in the calculations. The geometric mean for Station 19, Sample 1 is as follows:

$$Dg = 94^{0.00} * 47.25^{0.146} * 23.75^{0.268} * 12^{0.155} * 7.15^{0.128} * \dots * 0.0375^{0.008} = 13.3$$

The Fredle Index was calculated based on APFC matrix references of Lotspeich and Everest (1981), Valentine (1995) and Shirazi and Seim (1981) in the following manner:

$$\text{Fredle Index} = \frac{Dg}{\sqrt{\frac{D75}{D25}}}$$

Where Dg is the geometric mean and D25 and D75 are the particle sizes at 25% and 75% cumulative weight respectively. Like other bulk sediment calculations, the particles held in the largest sieve (125mm) were not used in the calculation of this metric. This value is determined from a graph of particle size vs. percent cumulative weight. An example graph for Station 19 (Graham Gulch) is shown as figure 2.



The following calculation for Fredle Index uses Sample 1 (15.3 m) data, with $D_g = 13.3$, calculated above, $D_{25} = 4.0$ and $D_{75} = 40\text{mm}$ from the graph in Figure 1.

$$\text{Fredle Index} = \frac{13.3}{\sqrt{\frac{4.0}{40}}} = 4.21$$

- Canopy cover measurements (percent) are being used to document regrowth and/or stability of riparian areas, as well as to identify areas that may be subject to higher thermal loading (e.g., from sunlight). Canopy cover addresses the APFC matrix target for overstory tree canopy closure.
 - Canopy cover measurements are taken at 200 ft (61 m) intervals throughout the sampling reach using a concave densiometer. Measurements are taken along transects at midchannel, water's edge, bankfull, and riparian points. More midchannel measurements are taken if the bankfull width is greater than 25 ft (7.6 m). See *Watershed Operating Protocol 12, Stream and Riparian Canopy Cover Measurement* for full protocol.
 - For reporting purposes, data is presented only for the average of measurements taken within the riparian canopy. For the years prior to 2001, the average of measurements taken only at mid-channel points located 50, 100 and 150 feet upstream of the station start. Methods for the canopy survey were changed in 2001 to align with those recommended by the APFC matrix. In 2003 the protocol incorporated field assigned interference codes to exclude data that is directly influenced by road, bridge or other visual interference. The interference readings are not included in the station average.
- To address pool attributes, HRC conducts habitat typing on stream reaches to assess the abundance (i.e., the percentage of channel length composed of pools), size, and depth of pools at each sampling station. Habitat typing addresses matrix targets of pool-to-pool spacing based on bankfull widths, percent of surface area comprised of pool habitat, number of pools associated with large woody debris (LWD), and average residual pool depth.
 - Habitat typing measurements are done at each sampling station for a distance equal to approximately 20-30 times the average bankfull width. Habitat units are broken down to pool, riffle, or flatwater categories and not further. Basic physical measurements are taken and observations are made as to LWD influence and substrate type. See *Watershed Operating Protocol 14, Stream Habitat Typing* for full protocol.
 - Gradients were calculated using three different methods. Each was given an accuracy 'priority' and if data for the station was available it was used accordingly. The first method utilized longitudinal profile data, and is a basic trend line slope for the reach. In some cases, there were major morphological features that restricted this



use, for example on very low gradient reaches, due to sample point locations; the trend line slope was less than zero percent. Another example is when extremely deep pools exist within the reach, skewing the trend line in an unrepresentative manner. In those cases, sections of the reach were broken out and calculation of gradient was taken from the slope difference of the first pool tail out to the last pool tail out. At stations where streambed surveys were not conducted, gradient values were taken from the habitat typing methods, using a clinometer and stadia rod. This method accounts for the entire section of stream continuously. This was done by shooting a gradient shot and recording the distance, then 'leap-frogging' the next measurement such that all sections of stream were included in a gradient shot and distance measurement. The gradient was then calculated using a weighted average of the distance over which the gradient was measured.

- Multiple calculations are made from data to address APFC matrix targets. All calculations are standard summation calculation such as; residual pool depth is equal to the difference between maximum depth and pool tail crest depth.
- Measurements of water temperature over the warmest part of the year (June through September) are taken with continuous recording data logger devices (Hobos or Optic Stowaways). Temperature data are used to calculate the APFC matrix target for MWAT (Maximum Weekly Average Temperature).
 - Temperature data loggers are placed (within pvc cases) into the stream at a location that meets the requirements of having good thermal mixing, adequate cover, and the ability to maintain sufficient flow during the summer months. See *Watershed Operating Protocol 09, Stream Temperature Monitoring* for full protocol.
 - Maximum Weekly Average Temperature values were calculated based on APFC Matrix target references from US Fish and Wildlife and US EPA. MWAT calculations are further explained in *WOP-07 Stream Temperature Monitoring*.
- Streambed surveys (longitudinal and cross section profiles) are conducted to determine streambed elevation changes over time. This, in turn, is correlated to habitat type characteristics, as well as sediment and LWD loading within the stream channel. Streambed profiles address APFC criteria for channel conditions, specifically width to depth ratios and measures of streambed scour and fill (originally criteria set for scour chains).
 - A Topcon Total Survey Station was used in 2008 to collect streambed survey points. This was implemented in 2003 to increase accuracy and repeatability of streambed surveys. Permanent critical points were installed at each monitoring station as reference to the three-dimensional sampling grid encompassing the monitoring reach.
 - Data processing was streamlined to electronic data transferring and use of multiple validation, plotting, and processing programs.



METHOD CHANGES

In 2007, methods for LWD were revamped. The very intensive characterization of LWD at ATM stations was discontinued. Basic measurements of LWD were added to the habitat survey at ATM stations. A separate survey over extensive lengths of Class I streams of wood and pool counts (“LWD Lite”) to be repeated once every 5-10 years was initiated. Table 22 summarizes the LWD data collected in 2008. A WOP for the LWD Lite survey is in progress.

SECTION 2. SUMMARY OF PROGRAM RESULTS

FIELD DATA COLLECTION

Class I stream habitat monitoring at ATM stations is conducted every three years, except in the Elk River and Bear Creek watersheds, which are sampled each year. Criteria for more frequent sampling is based on the occurrence of a 10-year recurrence interval flood event recorded at either of USGS Eel River (Scotia) and Van Duzen (Bridgeville) gages or a 25-year recurrence interval precipitation event is recorded at either of the National Weather Service weather stations: Scotia or Eureka. In the year prior to 2008, neither of these occurred.

In 2008, Bulk Sediment, Pebble Count, Canopy Closure, and Habitat Typing and Streambed surveys were conducted at 20 stations within the WAA’s of Bear Creek and N. Fork Elk River as well as in the Lower Eel and Van Duzen WAAs. Stream temperature was taken at 61 stations across the property. Large Woody Debris surveys were conducted at the N. Fork Elk River, Van Duzen and Eel River WAAs. This complies with the agreed upon schedule for trend monitoring.

COMPLETED ACTIVITIES

- All fieldwork was completed within the scheduled time period. All data collection occurred before any major storm events.
- The following number of surveys were completed in the 2008 monitoring season:
 - 26 Bulk Sediment surveys
 - 26 Pebble Count surveys
 - 26 Canopy Closure surveys
 - 61 Stream Temperature meter deployment and retrievals
 - 26 Streambed surveys
 - 26 Habitat Typing surveys
 - 26 Large Woody Debris “Lite” surveys
- All samples and data were reviewed and accepted daily by a receiving agent.



FUTURE RECOMMENDATIONS

- No recommendations at this time

STATION SELECTION AND MAINTENANCE

Station Changes and/or Additions

Five stations were reinstated. See Table 2 for monitoring station changes.

Station Monumenting and Maintenance

All ATM survey stations are now permanently monumented.

LABORATORY ANALYSIS

The HRC laboratory has been processing bulk sediment samples since 2000. In 2002, the laboratory went through a complete review and upgrade. QA/QC procedures were developed for equipment maintenance and calibration as well as for sample processing. Operating procedures were fully implemented in 2003 following the 2002 change of the sediment processing protocol from wet sieving to dry sieving. The sediment laboratory fully functions independently and follows stringent guidelines, reducing any potential bias from laboratory technicians and/or knowledge of sample origin. The laboratory continues to process the bulk sediment with WOP-07.

COMPLETED ACTIVITIES

- All samples were accepted by a receiving agent daily and assigned laboratory numbers independent of any location identifiers.
- All QA/QC goals were completed, following criteria in WOP-07 Laboratory Analysis of Bulk Sediment Samples. Laboratory sample quality codes and criteria were used for accepting all samples into the lab.
- 87 bulk sediment samples were processed in 2008.
- 2 technicians were trained and passed proficiencies for the laboratory processing of bulk sediment using the dry sieving method.

FUTURE RECOMMENDATIONS

- No recommendations at this time.



DATABASE MANAGEMENT

Data is stored utilizing two main programs, Microsoft Access and Excel. Both store raw data as well as templates and queries for calculating and reporting data values.

COMPLETED ACTIVITIES .

- All data was completed, QAQC'd and entered into the permanent ACCESS data files.

FUTURE RECOMMENDATIONS

- No recommendations at this time.

PROGRAM QAQC ACTIVITIES

QAQC activities have been steadily implemented into the Aquatics Trend Monitoring Program since 2002. Many of these activities are described within each Watershed Operating Protocol.

COMPLETED ACTIVITIES

- Sites 15, 167, and 217 were resurveyed for sediment and habitat parameters as part of the QAQC program.

FUTURE RECOMMENDATIONS

- No recommendations at this time.

SPECIAL TRAINING REQUIREMENTS/CERTIFICATIONS

The Project Manager gave training to all field crewmembers, for all survey types.

INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

All instruments and equipment used for sampling were inspected and maintained daily. Any repairs and/or calibrations made on instruments were made either by the manufacturer or following manufacturer guidelines. Calibration of equipment was done on a regular schedule and upon any mishandling or questionable performance of the instrument. Calibration logs were kept of all calibration activity.



PROBLEMS ENCOUNTERED AND RESOLUTION

While reviewing Bear Creek Mapping data, errors in the data entry of some of the maps prior to 2007 were discovered. These errors occurred due to confusion regarding which side of the stream the measurements were being taken from, resulting in the data points being mapped on the opposite side of the stream. These maps will be assessed and new maps will be created if necessary.

SECTION 3. DATA SUMMARIES AND RESULTS

WATERSHED ASSESSMENT AREAS

Table 1 provides a listing of the monitoring stations organized by watershed assessment area (WAA) and arranged by upstream watershed acreage of each watershed unit. Table 2 provides a listing of discontinued and relocated stations. A summary of 2008 station monitoring activities by sampling parameter is presented in Table 3.

Humboldt Bay WAA

The Humboldt Bay WAA is 127, 682 acres in size, of which approximately 36, 800 acres are located on HRC's ownership. Elevations within this WAA range from sea level to 2, 800 feet. The Humboldt Bay WAA is dominated by two primary drainages, Freshwater Creek and Elk River, both which flow directly into Humboldt Bay. Currently there are nineteen permanent monitoring stations within this WAA.

FRESHWATER CREEK DRAINAGE

Freshwater Creek is the northern most drainage, currently within the monitoring program, located on HRC's ownership. Freshwater Creek was the first drainage of which to have the HRC HCP watershed analysis completed. There are nine monitoring stations in Freshwater Creek. . In 2008, seven stations within the watershed were surveyed for habitat, canopy and sediment parameters. LWD "Lite" and streambed surveys were conducted at seven stations and all of the stations were monitored for water temperature.

ELK RIVER DRAINAGE

Elk River is also located within the Humboldt Bay Watershed Assessment Area. It is comprised of two main forks, South and North Forks of Elk River. One small section of mainstem and very little of South Fork Elk River are located on HRC's ownership but most of North Fork Elk and its tributaries are located on the ownership. There are currently ten monitoring stations in the Elk River drainage. In 2008, all stations within the watershed were surveyed for habitat, canopy and sediment parameters. LWD "Lite" and streambed surveys were conducted in all stations and eight of the stations were monitored for water temperature. North Fork Elk River stations are surveyed



annually to meet NCRWQCB requirements, and are included in the Trend monitoring annual report.

Yager WAA

The Yager watershed assessment area is dominated by two primary drainages, Yager Creek and Lawrence Creek. Lawrence Creek drains into Yager Creek, which drains into the Van Duzen River. Although a part of the Van Duzen watershed, the Yager/Lawrence watershed was considered separately when developing the HRC HCP and watershed analysis plan due to considerable public and agency interest in this watershed. HRC's ownership encompasses approximately 40 percent of this WAA. Currently there are fifteen stations within the Yager WAA, seven within the Lawrence drainage and eight within the Yager Creek drainage. No habitat, canopy, streambed or sediment surveys were conducted in 2008. Water temperature was monitored at all of the stations.

Van Duzen WAA

The Van Duzen WAA is centrally located within HRC's ownership and includes the lower three miles of Yager Creek, and the Van Duzen river watershed, excluding the headwaters. Approximately 45 percent of this area is located within HRC ownership, which is mainly tributaries to the Van Duzen River from just above the confluence with Cumming's Creek to approximately 2.5 miles upstream of the confluence with Grizzly Creek. Currently there are four monitoring stations with the Van Duzen WAA. No habitat, canopy, streambed or sediment surveys were conducted in 2008. Water temperature was monitored at all of the stations.

Eel River WAA

The Eel River WAA includes much of the Eel River drainage but excludes the headwaters as well as the Van Duzen drainage. The Eel River is a first order stream, draining into the Pacific Ocean. The Eel River divides into the North, Middle, and South Forks. Most of HRC's ownership borders the mainstem of the Eel River with the area between Scotia, California and approximately six miles above the confluence with South Fork Eel River. Approximately 17 percent of the WAA is located within HRC ownership. The WAA also includes areas within Humboldt Redwoods State Park that, although historically monitored, are no longer included within the monitoring plan. There are currently twenty monitoring stations within the Eel River WAA, including the Bear Creek drainage that has annual monitoring requirements set forth by the NCRWQCB. In 2008, nine stations were surveyed for habitat, canopy and sediment parameters. LWD "Lite" and streambed surveys were conducted in nine stations and water temperature was monitored at seventeen stations.

Bear-Mattole WAA

The Bear-Mattole WAA includes the drainages of Bear River and Mattole River. The two drainages are adjacent to each other and located in the southern portion of the HRC ownership. Both drainages flow directly into the Pacific Ocean and approximately 21 percent of the watersheds, mainly the upper portions, are located within HRC ownership boundaries. Currently there are seven monitoring stations located within the Bear-Mattole WAA, three in the Mattole drainage and four in the Bear River



drainage. No habitat, canopy, sediment, streambed or LWD surveys were conducted in 2008. Stream temperature was monitored at all stations within the Bear-Mattole WAA.

SAMPLING PARAMETERS: 2008 DATA HIGHLIGHTS

Methods for highlighting changes were based on qualitative assessment with no specific quantitative criteria. Not all parameters were evaluated. Factors involved in the qualitative assessment included:

- If the 2008 values fell significantly outside the range observed in previous years. A change was considered significant if it was on the order of ½ or greater the previous value, with exception to canopy cover. Changes in canopy cover were considered significant if they were greater than 10 percent.
- Whether values met the APFC matrix target. The APFC matrix target values are included in the notes at the foot of the tables.
- Some less than significant changes are also included as highlights if deemed noteworthy.

Humboldt Bay WAA

- **Pebble Counts D50 (Table 4, Figure 1)**
 - In 2008, 0 of 17 sites met the APFC target values for particle size (D50).
 - Station 19 showed an increase in particle size (D50), however was still below APFC target values.
- **Bulk Sediment**
 - **Bulk Sediment <0.85mm (Table 5, Figure 5)**
 - Station 15- Percent fines less than 0.85mm significantly increased exceeding the APFC target.
 - Station 92 - Percent fines less than 0.85mm decreased.
 - Station 175 - Percent fines less than 0.85mm decreased, but still remained above the APFC target.
 - In 2008 13 of 17 sites met the APFC target values for percent fines less than 0.85mm.
 - **Bulk Sediment <6.35mm (Table 6, Figure 9)**
 - Station 92- Percent particles less than 6.35 mm decreased, meeting the APFC target.
 - Station 19- Percent particles less than 6.35mm decreased, meeting the APFC target.
 - Station 34 – Percent particles less than 6.35mm decreased, meeting the APFC target.



- Station 90 – Percent particles less than 6.35mm significantly decreased, meeting the APFC target.
- In 2008, 4 of 17 stations met the APFC target for percent particles less than 6.35mm.

- **Bulk Sediment Particle Size- Geometric Mean Diameter (Tables 7-12)**
 - Station 92 - Geometric mean diameter significantly increased, meeting the APFC target.
 - Station 202 – Geometric mean diameter decreased.
 - In 2008, 2 of 17 stations met the APFC target values for the geometric mean diameter.

- **Bulk Sediment Particle Size- Fredle Index (Tables 7-12)**
 - Station 92 – Fredle Index significantly increased, meeting the APFC target.
 - Station 202 – Fredle Index decreased.
 - In 2008, 2 of 17 stations met the APFC target values for the Fredle Index.

- **Riparian Canopy Closure (Table 14)**
 - Station 202 - Canopy closure significantly decreased, but still met the APFC target.
 - Station 214 – Canopy closure significantly increased, meeting the APFC target.
 - In 2008, 10 of the 17 stations met the APFC target values for canopy closure.

- **Pool Area (Tables 15-22)**
 - Station 34 - Pool area increased, meeting the APFC target.
 - Station 167 - Pool area decreased, falling below the APFC target.
 - In 2008, 16 of 17 met the APFC target values for pool area.

- **Pool to Pool Spacing (Tables 15-22)**
 - In 2008, 7 of the 17 stations met the APFC target values for pool to pool spacing.

- **Residual Pool Depth (Tables 15-22, Figure 13)**
 - Station 92 - Residual pool depth decreased falling below the APFC target.
 - Station 175 – Residual pool depth decreased falling below the APFC target.
 - In 2008, 4 of 17 stations met the APFC target values for residual pool depth.

- **Pools Associated with LWD (Tables 15-22)**
 - In 2008, 15 of 17 sites met the APFC target values for pools associated with LWD.



Eel River WAA

- **Pebble Counts D50 (Table 4, Figure 2)**
 - In 2008, 1 of 9 stations met the APFC target for particle size (D50).
 - Station 212 had a significant decrease in particle size, however only 1 year of prior data exists.

- **Bulk Sediment**
 - **Bulk Sediment <0.85mm (Table 5, Figure 6)**
 - In 2008 9 of 9 stations met the APFC target for percent fines less than 0.85mm.

 - **Bulk Sediment <6.35mm (Table 6, Figure 10)**
 - In 2008, 0 of 9 stations met the APFC target values for percent fines less than 6.85mm.

 - **Bulk Sediment Particle Size- Geometric Mean Diameter (Tables 8-12)**
 - Station 122- Geometric mean diameter decreased, falling below the APFC target.
 - In 2008, 0 of the 9 stations met the APFC target values for geometric mean diameter.

 - **Bulk Sediment Particle Size- Fredle Index (Tables 8-12)**
 - Station 122- Fredle Index decreased, falling below the APFC target.
 - In 2008, 0 of 9 stations met the APFC target values for the Fredle Index.

- **Riparian Canopy Closure (Table 14)**
 - Stations 107 and 203 - Canopy closure significantly increased.
 - Station 170 – Canopy closure significantly decreased.
 - In 2008, 3 of 9 stations met the APFC target values for canopy closure.

- **Pool Area (Tables 15-22)**
 - Station 122- Pool area significantly decreased, falling below the APFC target.
 - In 2008, 4 of 9 stations met the APFC target values for pool area.

- **Pool to Pool Spacing (Tables 15-22)**
 - Station 212- Pool to pool spacing significantly increased, exceeding the APFC target.
 - Stations 126 and 122 – Pool to pool spacing increased, exceeding the APFC target.
 - In 2008, 4 of 9 stations met the APFC target values for pool spacing.

- **Residual Pool Depth (Tables 15-22, Figure 14)**
 - In 2008, 2 of 9 stations met the APFC target values for residual pool depth.



- **Pools Associated with LWD (Tables 15-22)**
 - In 2008, 8 of 9 stations met the APFC target for pools associated with LWD.

WATER TEMPERATURE

Stream temperature data for all stations monitored are presented in Table 13 as maximum weekly average temperature (MWAT) values in degrees Celsius and the end date of the week of MWAT. Although only required at a subset of sampling stations, data loggers were placed at nearly all monitoring stations, based on location within the watershed and the attempt to collect data with adequate distribution throughout the watershed. In 2008, 41 of 58 temperature stations met the APFC matrix target MWAT value of 16.8 degrees Celsius. 10 of 58 stations had MWAT values between 16.86 and 19.3 degrees Celsius. The remaining 7 stations had MWAT values between 19.4 and 22.11 degrees Celsius. Eleven air temperature meters were placed in 2008. Air temperature MWAT values ranged from 15.27 degrees Celsius in Freshwater Creek Drainage to 21.89 degrees Celsius in the Mattole river drainage.

SECTION 4: QUALITY OBJECTIVES AND CRITERIA

Surveys are conducted according to the following Watershed Operating Protocols which have been submitted to the agencies previously. There were no changes to these protocols in 2008. The Large Woody Debris protocol is currently being rewritten to match the new scaled down assessment.

The quality objectives of data collection and analysis for this monitoring project are to provide data on an annual reporting basis to the NCRWQCB and to provide data summaries and comparison to APFC target values. Quality objectives are designed to ensure data collection and analysis in a manner that adequately meets the project objectives. Data quality is ensured by following methods described in the Watershed Operating Protocols (WOPs) and to ensure adequate personnel are assigned to complete sampling and troubleshooting as designed. Each WOP includes specific protocols for the methods along with sections on QA and QC to ensure data quality.

Measures of data quality, as applied to specific procedures, include: accuracy, precision, comparability, completeness, and representativeness. These measures are included in the WOPs, as appropriate to the methods. The following WOPs were used to implement this program and are included in the QA/QC Project Plan for the Class I Aquatic Trend Monitoring Program:

Watershed Operating Protocols

- WOP-07 Laboratory Analysis of Bulk Sediment Samples
- WOP-09 Stream Temperature Monitoring
- WOP-10 Surveying Methods



WOP-11 Stream and Riparian Canopy Cover Measurement
WOP-13 Surface and Sub-surface Sediment Sampling
WOP-14 Stream Habitat Typing Methods
WOP-15 Aquatic Trend Monitoring Site Selection, Monumenting, and Documentation
WOP-25 Streambed Surveying Methods
WOP-30 Large Woody Debris Survey Methods (to be completed.)

REFERENCES

Note: References specific to monitoring protocols and not directly referenced within this report are included with each WOP.

Bilby, R.E. and J.W. Ward. 1989. Changes in characteristics and function of woody debris with increasing size of streams in western Washington. *Transactions of the American Fisheries Society*. 118: 368-378.

Lotspeich, F. B. and F. H. Everest. 1981. A new method for reporting and interpreting textural composition of spawning gravel. U.S. Forest Service Research Note PNW-139.

Shirazi, M. A., W. K. Seim and D. H. Lewis. 1981. Characterization of spawning gravel and stream system evaluation. Pages 227-228 in *Proceedings from the conference on salmon spawning gravel: a renewable resource in the Pacific Northwest*. Washington State University, Washington Water Research Center Report 39, Pullman. Originally published as EPA Report EPA-800/3-79-109, October 1979.

The Pacific Lumber Company. 2001. *The Pacific Lumber Company 2002 Annual Report for the Habitat Conservation Plan Instream Monitoring Results, volume 2 supplemental*.

U.S. EPA. 2001. EPA Requirements for Quality Assurance Project Plans – EPA QA/R-5. EPA/240/B-01/003. Office of Environmental Information, Washington, D.C. March 2001.

Valentine, Bradley E. (1995). Stream substrate quality for salmonids: guidelines for sampling, processing and analysis. California Department of Forestry and Fire Protection, Coast Cascade Regional Office, Santa Rosa, CA 95401. Draft dated January 4, 1995.

SECTION 5. APPENDICES

- Table Set 1, Tables 1-24; Data Summary Tables
- Figure Set 1, figures 1-12; Sediment Parameters Plots



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- Figure Set 2, figures 13-16; Residual Pool Depth Plots
- Figure Set 3, Streambed Survey Plots

