Toward a Working TMDL: A Watershed Plan for The Van Duzen River Basin

Agreement # 06-149-551-0

Monitoring Plan

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Van Duzen Watershed Project

Project Director ______________________________ **Date** _____________________

Grant Manager ______________________________ **Date** _____________________

Introduction

In 1992, the EPA listed the "wild and scenic" Van Duzen River (VDR) as sediment-impaired under section 303(D) of the California Clean Water Act. Over the years the condition of local watersheds within the Van Duzen River have deteriorated. Potentially controllable sediment accounts for nearly 36% of the total sediment in the VDR (Pacific Watershed Associates 1999). Controllable sources of sedimentation included roads and skid trails (16%) and timber harvest (20%). Potentially controllable sediment sources in the Lower Basin totaled 2,505,500 cu yards per year. Today the mainstem of the VDR and its tributaries continue to qualify as sediment impaired, and most salmon stocks hover on the brink of extinction.

Long term effects of this sedimentation can be seen on a large scale in the extensive sand, silt, and gravel bars that typify the valley through which the river now flows, going both above and below ground. Not so easily seen is the silting and subsequent loss of Chinook and Coho salmon spawning grounds that has resulted in large-scale decimation of these populations. We propose to address the sediment problems in part, by recording characteristics that can be measured and quantified, such as turbidity and suspended sediment. We also propose to measure other physical data indicative of water quality including temperature, dissolved oxygen, pH, and stream habitat. Biological indicators will also be quantified including numbers and types of macro invertebrates.

Collaborating with local landowners, state agencies, and other members of the community, we have established at least 10 water quality monitoring sites on the mainstem and its tributaries, and propose to: 1) Engage in a monitoring strategy for turbidity and suspended sediment along the Van Duzen taking water samples at designated times as well as during storm events. 2) Collect and analyze macro invertebrates to determine the health of key areas along the main stem and tributaries. 3) Establish ties between residents and the project, to work closely with the California Department of Fish and Game recording annual salmon migration. 4) Bring together a team of scientists, community members, and state agencies to quantify water quality conditions and create a GIS database on the physical and biological conditions of the basin. 5) Target specific problem areas and define measurable parameters for sediment reduction. 6) Analyze water quality parameters including turbidity, suspended sediment, and temperature. 7) Share results with the community, Water Quality Control Board (WQCB), and other entities, to develop a local area plan for the recovery of the VDR Basin.

This Monitoring Plan describes volunteer monitoring activities conducted by The Van Duzen Watershed Project (VDWP) within the Lower Van Duzen River Basin. Through the work of volunteers, Friends of the Van Duzen River (FOVDR) has been monitoring streams of historic significance to salmon populations since 2001. As a result of funding through Proposition 40 and the Integrated Watershed Management Program (IWMP), the Van Duzen Watershed Project promotes continued monitoring of water quality by volunteers and cooperation between our research activities and state agencies. Monitoring efforts are intended to record water quality conditions, including sediment loading, sediment transport, and turbidity, and to develop an understanding of, and record the relationship between water quality and land use within the basin.

Although some data relating to water quality have been collected in past years, much remains to be accomplished. These types of data, along with other data gaps include:

a. Turbidity and suspended sediment studies are needed to note trends and problem areas.
b. Stream habitat typing on the main stem VDR and major tributaries need to be conducted in collaboration with the work of the CA Department of Fish and Game
c. Macro invertebrate analysis in the lower Van Duzen Basin are needed to determine
d. Update road data in the Lower Van Duzen Basin to allow accurate calculation of road densities, road stream crossings, and road conditions.

<u>Some of the Questions that arise include:</u>

a. How can volunteer monitoring programs be developed to best assess and quantify water quality conditions in the Lower VDR Basin?
b. How can habitat for native salmonid species best be assessed and quantified and the impact of upslope conditions on stream health best be understood?
b. How can the local community become involved in water quality monitoring activities, in order to increase awareness in the community regarding the conditions of local watersheds?
c. What steps are necessary to develop a watershed management plan for the Lower VDR Basin?

Objectives

a. Establish at least 10 key monitoring sites along the main stem of the VDR and the tributaries for the sampling of turbidity and suspended sediment.
b. Train members of the community in procedures and protocols for taking samples at specific designated times, as well as during storm events.
c. Sample and quantify physical data including turbidity, suspended sediment, temperature, flow rate, and stream habitat, as well as biological data including macro invertebrates.
a. Develop an ArcView GIS project documenting stream and upslope conditions.
d. Distribute information including maps through our web site (www.fovd.org), and newsletter (The Eel River Reporter), and thereby provide a platform for presentation and discussion.
e. Bring together staff, stakeholders, and members of the community to formulate and complete a Watershed Management Plan for the VDR Basin.

Geographical Setting

The Lower Van Duzen River Basin comprises the extent of the study area, and extends from the town of Bridgeville, CA upstream, to the point where the Van Duzen River merges with the Eel River near the town of Alton, CA, including the large Yager Creek drainage area. The Lower Basin is approximately 244 square miles in area (or 155,989.5 acres or 631.3 sq. kilometers). The headwaters of the Van Duzen River originate in Trinity County, but the entire lower basin is located in Humboldt County.

1. <u>Goals and Purpose of the Monitoring Program.</u>

- To collect baseline data on turbidity and suspended sediment in the VDR and important tributaries in order to contrast differences in watershed health among designated sub basins within the VDR Basin.

- To document seasonal and annual changes in water quality over time, and among planning watersheds.
- To provide a scientific basis for making recommendations regarding management of streams in the VDR Basin, and the development of a Watershed Management Plan.
- To encourage local community interest and involvement in their streams and watersheds.

2. Usefulness of the Monitoring Data.

Our data will be collected in agreement with accepted EPA and Water Quality standards, and our results will be deemed acceptable by state agencies and local scientists. As one of our goals is to help improve water quality for salmon and the local community, our results will have multiple applications. Some of the end users will include:

- Project analysts and staff
- State water quality analysts
- Fisheries biologists
- Schoolteachers
- Environmental organizations
- Parks and recreation staff
- State environmental agencies
- Resource conservation districts

3. How Data will be Used.

The monitoring project will provide data on turbidity, suspended sediment, and other physical, chemical, and biological components, as well as spatial data in GIS format and an ArcView project. Data will be analyzed and presented to the Water Quality Control Board (WQCB) in the form of quarterly reports, and as supplemental evidence for recommendations contained within the Watershed Management Plan that will culminate the completion of the project. Subsequent to the management plan, data will very likely be used in the decision-making process for implementation of recommendations provided in the management plan. Other potential uses of the data could include:

a) Physical Habitat Assessment:

- Establish a comparative ranking of relative watershed/stream health among the 8 sub basins and 10 monitoring sites within the lower VDR basin.

b) Physical (GIS) Watershed Survey

- Establish protocol for land use practices within the lower basin
- Provide an index for development and local zoning procedures

c) Biological Conditions

- Setting priorities for rehabilitation of salmon stocks, based on water quality standards and presence of adequate salmonid habitat

- Use of macro invertebrate data to assess relative stream health, and on a comparative basis among streams in the VDR basin.

d) Water Quality Assessment

- Set TMDL thresholds for turbidity and suspended sediment in the Lower Van Duzen River Basin
- Set statewide priorities for control of suspended sediment
- Rank streams for relative and absolute health based on critical physical & biochemical factors (e.g., temperature, dissolved oxygen, pH, etc.)
- Historic reference for future monitoring of the planning watersheds within the VDR Basin, and identification of water quality trends

4. Parameters and Conditions to be Monitored.

As the project focuses strongly on the survival of salmon populations, the major parameters of concern are those that tend to degrade stream habitat, including suspended sediment and turbidity, temperature, pH, and dissolved oxygen, and discharge. Secondarily, we are also concerned with the physical makeup of stream habitats (habitat types), physical recognition of sedimentation including bed load in stream cross-sections and degree of embeddedness, macro invertebrate populations as indicators of water quality, and other flora and fauna such as vegetation types, fish species, and reptiles, birds, and amphibians.

5. Data Quality.

Data quality objectives (DQOs) are "quantitative and qualitative statements of the overall level of uncertainty that a decision-maker is willing to accept in results or in decisions derived from environmental data (USEPA, 1996)." The overall level of uncertainty is based on estimates of measurement error, sampling error, and site variability. Data will feasibly be used to influence TMDL development, watershed management plan implementation, and watershed analyses by providing monitoring data that can be compared to action levels for turbidity and suspended sediment concentrations found in applicable regulations and guidelines.

The primary mechanism used to ensure data quality is strict adherence to accepted sample collection and analysis methods described in the Standard Operating Procedures (SOPs). Also incorporated into the monitoring plan are efforts to quantify the variability and reliability of the data collected, such as developing the relationship between turbidity sensor readings and volunteer grab samples.

Accuracy. For instruments, accuracy is specified by the manufacturer and assured by proper calibration and maintenance of the instruments. Laboratory instrument accuracy is evaluated using check weights, filter re-weighs, filter blanks and other standard QA methods.

Precision. Volunteer precision is estimated for stage, velocity, and grab sampling. Comparison of individual measurements of the same parameter is used to analyze the statistical precision of volunteer measurements. Precision of grab sample surveys is estimated by repeating the measurement and comparing results, and by using three replicates per individual sample taken.

Variability around the mean is interpreted to provide an index of precision, as well as accuracy of the sampling procedure. Laboratory precision is determined from analysis of repeated weighing of the balance check weight.

Completeness. Our completeness goal is to sample turbidity and suspended sediment concentration during all major storm events in designated streams. Volunteer absence, breakdown of equipment, frequency of major storms, variability in volunteer commitment, etc. may hamper completeness. Sampling methods of volunteers will be identical or as close to identical as can be attained, from one monitoring site to another. Frequency of sampling has been shown to be extremely variable and wide differences in the number of samples taken occur between different volunteers.

Representativeness. Sampling methods are designed to be as representative as possible and experiments are included to compare different methods of measuring the same parameter to quantify the representativeness of the sampling and analysis methods. When possible, the volunteer float velocity method for measuring stream flow will be compared with flow meter data, and at one site on the main stem Van Duzen River (Rainbow Bridge), will be compared to discharge data provided by the USGS gauging station.

Comparability. Ten monitoring sites will allow comparison between samplers and streams, in which degrees of variability around sample means will be quantified. Data will be used to compare sampler variability and also variability in results among and between streams of different morphology, geology, and volume. Sampling methods will be the same from site to site.

6. Methods to be Used.

a) Physical Samples.

Water is collected primarily via grab samples for turbidity and suspended sediment concentration (SSC) determination. Volunteers collect turbidity samples on a weekly basis on Sundays between 1000 to 1400 hours at each of 10 monitoring sites, and more frequently during storm events. Approximately 1,000 grab samples will be collected during the 2007 hydrologic year (HY), and as it appears to be a relatively dry year, at least 1,200 samples are anticipated for HY 2008. Due to the timing of funding availability in HY 2007, fewer grab samples were available for sediment analysis that anticipated, and will only reach approximately 40 to 60 samples that will be processed to determine the suspended sediment concentrations. During HY 2008, approximately 100 to 150 grab samples will be processed for suspended sediment concentration.

To supplement the grab sampling, a continuous sampling station is in operation at Cummings Creek to measure turbidity and suspended sediment variation with time. Data from continuous samples are compared with those from grab samplings collected at the same time to identify differences or biases between the two sampling methods. A continuous, turbidity-controlled sampling station (Lewis, 1996) has been installed at Cummings Creek. This station includes a continuous turbidity probe, stage recorder, and an ISCO automatic sampler capable of collecting 24 samples. Sample collection is controlled by the rate of change of turbidity and stage. At least one additional continuous suspended sediment monitoring station will be installed on the mainstem VDR at Rainbow Bridge adjacent the USGS gauging station.

Additional measurements required to evaluate the impacts of turbidity and SSC are also collected. These measurements include stream discharge or stage at sites where a rating curve has been or is being established. Either a direct (discharge) or indirect (stage) measurement must be recorded at the time water samples are collected. When possible, position on the storm hydrograph (rising, peak, or falling limb) is also noted. Suspended sediment samples will be transported to the Salmon Forever Sediment Lab in Sunny Brae within the required time period, for turbidity and SSC determination. The Quality Assurance protocol developed by Salmon Forever requires rapid processing of samples to prevent algae growth.

b) Physical-Biochemical Samples.

Data on discharge, temperature, dissolved oxygen, pH, and conductivity are collected throughout the year twice per month at seven monitoring sites considered most important based on stream size, perennial nature of the stream, catchment area, and ease of access. These parameters are sampled and measured on site, using appropriate meters and/or instruments that will be described in full in the QAPP standard operating procedures. Additional water samples will be taken at each monitoring site and transported to the laboratory at Humboldt State University, where they will be analyzed for turbidity and suspended sediment concentration.

c) Biological Samples.

Macro invertebrates will be sampled at the same sites where bi-monthly samples for physical-biochemical sampling occurs, which will provide a greater level of understanding regarding the impact of stream conditions on aquatic populations. Sampling will take place at least once during the Spring, Summer, and Fall seasons, for a total of 3 times per year per sampling site. Sampling for macro invertebrates on the main stem VDR will coincide with one of our community based field excursions during the Summer. Methods will involve using two established sampling protocols, including EPA's RAPD bioassessment of macro invertebrates, and CLBP (CDFG 1999), used by most state agencies and consultants to assess macro invertebrate communities.

7. Location of Monitoring Sites.

Monitoring sites were chosen based on a set of priorities. The first priority for choosing monitoring sites was that they would represent primary streams in a majority of the designated sub basins (in most cases, equivalent to standard Calwater Planning Watersheds) within the Lower VDR Basin. The second priority was accessibility to landowners with property adjacent representative streams. The VDR Basin is largely private property, with a large proportion representing the holdings of the Pacific Lumber Company. A site was considered prime where streams bordered or intersected the property of landowners who have expressed a willingness to participate in the watershed project. All landowners have provided written permission for project participants to have access to stream sites. The third priority was for sites that were deemed favorable when public access was available to representative streams. Although establishing sites on publicly accessible land allowed relatively easy access for monitoring, these types of sites also carry a greater risk of vandalism to monitoring facilities, such as staff plates and markers, and do not allow for the establishment of a continuous monitoring station. Employing these three priorities allowed for the designation of the 10 monitoring sites in the lower basin, with two sites on the main stem, and 8 others on important stream tributaries. All volunteers have been trained and extensively briefed on the importance of safety when taking water samples. Several of the volunteers are landowners who are able to sample very close to their residence.

Study design also addresses representativeness to the extent possible by site selection using a gradation of sub basin sizes and geology. Access to streams is sufficient to permit representative sampling of a substantial fraction of the litho-topo types. These streams, as well, represent a variety of sizes, morphology, and parent geology, while also representing a degree of similarity. For example, Cummings, Hely, and Grizzly Creeks are all roughly within the same size catchment area, and share similar forest types and geologic history. Wolverton Gulch is a small drainage area with quite different vegetation and geological formation. Yager Creek is vastly larger than any of the other sub basins, and has a unique geologic history. Based on size, Yager Creek approximates river status. The drainage area of Yager Creek is predominately coniferous forest and lies mostly within the holdings of the Pacific Lumber Company. Therefore, given the similarities, as well as the vast differences among the 9 sub basins, there is a complex relationship among the different streams that drain into the Lower VDR Basin, which will produce considerable variations and similarities in the results of the study. One of the monitoring sites (Rainbow Bridge) is located exactly at the site of the U.S. Geological Survey gauging station, which will serve as an asset in providing additional information on stream flow. All sites have been located using a GPS device, and these locations in Longitude/Latitude have been submitted to the Grant Manager. Monitoring sites will also be converted to a shapefile format and included in map rendition and in the ArcView project, relative to the outline of the entire project area.

8. <u>When Monitoring will Occur.</u>

Volunteers collect turbidity grab sample at each site during and after all storm events. Suspended sediment grab samples are collected less frequently than turbidity samples, and occur roughly once per week at random intervals based on volunteer discretion. The water quality analyst twice per month throughout the entire year collects data on discharge, temperature, dissolved oxygen, pH, and conductivity at seven sites. Macro invertebrates will be sampled at the same sites where bi-monthly samples for physical-biochemical sampling occurs. Sampling for macros will take place at least once during the Spring and Fall seasons, for a total of 2 times per year per sampling site.

9. <u>How Monitoring Data will be Managed and Presented.</u>

In agreement with USEPA Handbook standards, grab sample turbidity levels are transported to a laboratory setting and measured using a USEPA-approved Hach turbidimeter within 24-48 hours (usually less than 24 hours) after collection of the sample. Sample collection from the ISCO involves not only loading and unloading sample bottles but also downloading data from the on-site computer and occasionally calibration of the pressure transducer and temperature probe.

The Field Manager and Project Director conduct creek reconnaissance and select and document station locations. The Field Manager also provides field training, re-training and on call technical support; collects and checks completeness of field samples; and verifies the field data.

The Quality Assurance Manager conducts lab and field certification, documents lab and field volunteer proficiency through proficiency checklists and conducts periodic visits to observe lab and field technique. The QA Manager analyzes Quality Control checks (approximately 10% of data collected in the study), reviews all field and lab data for QAPP objectives and corrects any failures in the analytical system. The QA Manager also analyzes QC field and lab tests performed by the Field Manager and Lab Manager, respectively. Results of these analyses and corrective actions are reported to the Project Director.

The Lab Manager and Data Analyst proofread data entered into databases against the original data sheets, verify re-testing, clarify ambiguous issues, and review all field and lab data for QAPP objectives. The Lab Manager also assists the Data Analyst in presentations for data users and presentations for field operators.

The Data Analyst will statistically analyze the data and present the results to the WQCB in the form of reports and documents, and to the community in the form of presentations at annual and biannual meetings and workshops. Data will be analyzed based on sound statistical principles. Methods will apply to appropriate physical and biological sampling processes, with proper assumptions regarding these types of populations. Analyses will be subject to Technical Advisory Committee review and recommendations.

10. Assurance of Data Credibility.

The Project Director and Quality Assurance Manager review all field and laboratory data for QAPP objectives and reject or qualify data. The Project Director is responsible for report production and distribution, and will use the results of reports to implement any necessary changes to the study for subsequent sampling seasons.

The Lab Manager and Quality Assurance Manager supervise and train all volunteers processing lab samples, train lab technicians checks and copies field data. The Field Manager is responsible for lab and field equipment supplies and service, keeps all equipment calibration records, provides on call technical support and maintains field and lab QA proficiency checklists. The Field and Lab Managers share responsibility for maintenance, operation and documentation for the continuous, turbidity-controlled ISCO automatic sampling stations.

Quality Assessment and Control of Project deliverables will be described in a compendium of Quality Assurance principles and descriptions contained within the Quality Assurance Project Plan, including Standard Operating Procedures, to be submitted to the Water Quality Control Board by Day 90 of the project.