

Water Quality Monitoring Program

I. Project Need

In 1998 the U.S. Environmental Protection Agency (USEPA) designated the Upper Teton River (headwaters to Highway 33) and many of its tributaries as not meeting water quality standards due to excessive nutrients, temperature and sedimentation under section 303(d) of the Federal Clean Water Act. Designated tributaries include Badger Creek, Darby Creek, Fox Creek, Horseshoe Creek, Moody Creek, North Leigh Creek, Packsaddle Creek, South Leigh Creek and Spring Creek. Many of these creeks have experienced a history of livestock grazing resulting in bank de-stabilization and subsequent sedimentation. The Idaho Department of Environmental Quality (IDEQ) has submitted 2002 total Maximum Daily Load (TMDL) allocations for the Teton River and associated tributaries to the (USEPA) Region 10 for approval. A study conducted in 1999 by Idaho State University (ISU) (*Minshall, 2001, Origin and Fate of Water Quality Factors Affecting the Ecological Integrity of the Teton River*) showed elevated nitrate levels in the upper Teton River as affecting the ecological integrity of the Teton River. Furthermore, Friends of the Teton River conducted water quality monitoring during 2001 and 2002 revealing elevated nitrate and E.coli bacteria levels in the Teton River and several of its tributaries.

The monitoring sites located on the Teton River and its tributaries were selected with the assistance of Idaho Department of Environmental Quality, Teton Soil Conservation District, U.S. Forest Service, Idaho Fish and Game, and the Teton Regional Land Trust. The sites were chosen to best reflect what the general impacts are to the tributaries and the mainstem of the Teton River. Samples will be collected on a monthly schedule beginning in July 2003. Monthly monitoring will continue throughout the summer and into the early winter. When possible, monitoring may take place during the ascending and descending limbs of the runoff hydrograph to assess the impacts on water quality parameters. Some sites may be difficult to reach or completely frozen in the winter limiting winter sample collection. Monitoring sites are described in Table 1 and shown in Figure 1.

Warm Creek is located at the south end of Teton Valley. It originates in four major springs that emerge from the base of the Palisade Range. Land use just upstream from the monitoring site has recently changed from agricultural use to a golf course. Fox Creek originates in the Teton Mountains, WY and then flows into Idaho. It is diverted for irrigation purposes close to the USFS boundary and becomes an intermittent stream close to Highway 33. About two and a half miles above its confluence with the Teton River large springs add a significant amount of water into Fox Creek. Teton Creek is hydrologically similar to Fox Creek. Fox and Teton Creeks are currently the primary trout spawning streams. Fish Creek and Six Springs are both springs that emerge approximately two miles east of the Teton River and form creeks that historically supported cutthroat spawning. Woods Creek originates from springs just north and west of Driggs and receives treated effluent from the Victor/Driggs sewage ponds.

Table 1. Monitoring Sites, 303(d) Listings, and Pollutant Parameters for the Teton River Subbasin.

Monitoring Sites for the Upper Teton Basin		
MONITORING STATION NUMBERS	SUBWATERSHED NAME AND 303(d) LISTING STATUS	POLLUTANT PARAMETERS LISTED
1	Teton River (Headwaters) (303(d) listed)	Habitat Alteration
2	Teton River (South Bates) (303(d) listed)	Sediment Habitat Alteration
3	Teton River (Bates) (303(d) listed)	Sediment Habitat Alteration
4	Teton River (Highway 33) (303(d) listed)	Sediment Habitat Alteration
5	Warm Creek	
6	Fox Creek (303(d) listed)	Sediment Temperature
7	Fish Creek	
8	Six Springs	
9	Teton Creek	
10	Woods Creek	
11	Fox Creek above Wyoming Line	
12	Teton Creek above Wyoming Line	

II. Goals and Objectives

The goals of the water quality monitoring program are to develop a long-term water quality database for the upper Teton Watershed and identify sources and remediation strategies for water quality problems.

Objectives

1. This program will collect water quality data from 12 sites in the upper Teton Watershed 6 times a year in 2003 and 2004.
2. The program coordinator will disseminate water quality results at public meetings, in newsletters and on the FTR website.

III. Project Workplan

Schedule

Each of the 12 sites will be sampled once a month in 2003 starting in July 2003.

Each of the 12 sites will be sampled six times a year in 2004 in April, May, June, August, October and December.

Sampling Methods

The following sampling methods and protocol will be followed at each site:

WATER QUALITY

Kimberly Ball, FTR Field Technician, and Lyn Benjamin, FTR Program Coordinator, will collect samples for water quality analyses by grab sampling directly from the stream. The actual sampling sites will be located far enough upstream to avoid any backwater effects caused by other tributaries entering the stream. For narrow creeks four 1 liter grab samples will be collected from a well-mixed section, near mid-stream at approximately mid-depth. For larger creeks, multiple grab samples will be collected at equal intervals across the stream's cross section to provide a representative sample. For shallow water sites (1 foot deep or less) grab samples will be collected by hand using a clean one-liter container. At sites where the water depth is greater than one foot, a DH-81 integrated sampler will be used for water collection. Whichever method is used, individual samples will be collected at equal intervals across the entire width of the drain or creek. Each discrete sample will in-turn be composited as mentioned in the following paragraph. The actual location, number of grabs, and sample collection technique will be determined after observing the conditions at each sampling location.

Each grab sample will be composited into a 2.5-gallon polyethylene churn sample splitter. The resultant composite sample will then be thoroughly homogenized and poured off into properly prepared sample containers. For samples requiring filtration (ortho-phosphorous), a portion of the sample water will be transferred into the filtration unit and pressure filtered through a 0.45µm GN-6 Gelman Metrical Filter. The resultant filtrate will be transferred directly into a properly prepared sample bottle. The filtration unit will be thoroughly rinsed with deionized water and equipped with a new 0.45 µm filter at each sampling location. Water for nutrients, that require preservation, will be transferred into preserved (H₂SO₄ pH <2) 500 ml sample containers. The polyethylene churn splitter will be thoroughly rinsed with source water at each location prior to sample collection. Samples for bacteriological testing will be collected by hand from the midstream directly into sterile sampling containers, placed in a cooler of ice, and delivered to the laboratory the same day. Refer to Table 2 for a list of parameters, analytical methods, preservation, and holding times.

Table 2. FTR Sampling Water Quality Parameters.

Parameters	Sample Size	Preservation	Holding Time	Method
Non-Filterable Residue (TSS)	200 ml	Cool 4°C	7 Days	EPA 160.2
Volatile Residue (TVS)	200 ml	Cool 4°C	7 Days	EPA 160.4
Nitrogen-nitrate/nitrite	50 ml	Cool 4 °C H ₂ SO ₄ pH<2	28 Days	EPA 300
Ammonia	150 ml	Cool 4 °C H ₂ SO ₄ pH<2	28 Days	EPA 350.3
Total Phosphorus	100 ml	Cool 4 °C, H ₂ SO ₄ pH < 2	28 Days	EPA 365.4
<i>Ortho Phosphorus</i>	100 ml	Filtered, Cool 4°C	24 Hours	EPA 365.2
<i>E. Coli</i>	100 ml			

All sample containers will be equipped with sample labels that will be filled out using water proof markers with the following information: station location, sample identification, date of collection, and time of collection. All resultant samples will be placed within a cooler, on ice, to await shipment to the laboratory, Chain-of-Custody forms will accompany each sample shipment. Samples will be delivered to Intermountain Analytical Services-EnviroChem (IAS-EnviroChem) in Pocatello, Idaho. IAS-EnviroChem utilizes EPA approved and validated methods

FIELD MEASUREMENTS

At each location, field parameters for dissolved oxygen, specific conductance, pH, temperature, and turbidity will be measured. These measurements will be taken, when possible, from a well-mixed section, near mid-stream at approximately mid-depth. Calibration of all field equipment will be in accordance with the manufacture specifications. Refer to Table 3 for a listing of field measurements, equipment and calibration techniques. Photo points and GPS points will be taken at each monitoring site.

Table 3. FTR Sampling Field Measurements.

Parameters	Instrument	Calibration
Dissolved Oxygen	YSI Model 55	Ambient air calibration
Temperature	YSI Model 55	Centigrade thermometer
Turbidity		
Conductance	Orion Model 115	Conductance standards
pH	Orion Model 210A	Standard buffer (7,10) bracketing for linearity

All field measurements will be recorded in a logbook along with any pertinent observations about the site, including weather conditions, flow rates, personnel on site, or any problems observed that might affect the quality of data.

FLOW MEASUREMENTS

Flow measurements will be made with a Marsh McBirney Flow Mate Model 2000 flow meter. The six-tenth-depth method (0.6 of the total depth below water surface) will be used when the depth of water is less than or equal to three feet. For depths greater than three feet the two-point method (0.2 and 0.8 of the total depth below the water surface) will be employed. The discharge is computed by summation of the products of the partial areas (partial sections) of the flow cross-sections and the average velocities for each of those sections. This method will be used to calculate cubic feet per second at each of the monitoring sites.

DATA HANDLING

FTR staff will review all of the field data and analytical data generated from each sampling event. Each batch of data from a survey will be reviewed to insure that all necessary observations, measurements, and analytical results have been properly recorded. The analytical results will be reviewed for completeness and quality control results. Any suspected errors will be investigated and resolved if possible. The data will then be stored electronically. Kimberly Ball will integrate all data into a GIS database.

Quality Assurance and Quality Control (QA/QC)

IAS-EnviroChem utilizes EPA approved and validated methods. A method validation process including precision and accuracy performance evaluations and method detection limit studies are required of all of IAS-EnviroChem standard operating procedures. Method performance evaluations include quality control samples, analyzed with a batch to ensure sample data integrity. Internal laboratory spikes and duplicates are all part of

IAS-EnviroChem's quality assurance program. Laboratory QA/QC results generated from this project can be provided upon request.

QA/QC procedures from the field-sampling portion of this project will consist of duplicates (at 10% of the sample load) along with blank samples (one set per sampling event). The field blanks consist of laboratory grade deionized water, transported to the field, and poured off into prepared sample container. The dissolved phosphorous blank will be collected by filtering deionized water through the filtration unit and transferring the resultant filtrate into an appropriate sample container. The blank sample is used to determine the integrity of the field teams handling of samples, the condition of the sample containers supplied by the laboratory and the accuracy of the laboratory methods. Duplicates consist of two sets of sample containers filled with the same composite water from the same sampling site. All duplicate samples will be collected at the same location. The duplicates are used to determine both field and laboratory precision. The duplicate samples will not be identified as such and will enter the laboratories blindly for analyses. Both the duplicates and blank samples are stored and handled with the normal sample load for shipment to the laboratory.

At the end of each field season the means and standard deviations for the duplicates will be calculated and documented for each water quality parameter. Additionally, the relative percent precision (RPD) for each sample and duplicate will be calculated as a measure of precision. The calculation for RPD is as follows:

$$RPD = \frac{(C_1 - C_2) * 100\%}{(C_1 + C_2) / 2}$$

Where: RPD = Relative percent difference
C₁ = Larger of the two observed values
C₂ = Smaller of two observed values

Reporting, Education and Dissemination: November 2003-December 2004

Step 1: Reporting of Progress and Results

Program Coordinator, Lyn Benjamin, will submit annual reports (December 2003 and 2004) to the Environmental Protection Agency in accordance with 40 CFR 31.40(b). Reports will include the following information:

- 1) All water quality data collected and QA/QC results.
- 2) A discussion of possible unanticipated problems in completing work outlined in the work plan.
- 3) A set of suggestions for mediating problems encountered in number 2 of the reporting.

Step 2: Regional Meeting, November 2003 and 2004

Results from the water quality monitoring program will be presented by Lyn Benjamin and Kimberly Ball at the Annual State of the Watershed Conference convened by the Henry's Fork Watershed Council. All state, federal and local collaborators will be in attendance.

Step 3: Public Forum, December 2004

Friends of the Teton River will sponsor a public forum in Driggs to present results from this program.

Step 5: Publications

Friends of the Teton River will publish all results in its quarterly newsletter and annually in the Teton Valley news, Idaho Post Register and the Jackson Hole News.

Step 6: Web Site

All results and analysis will be posted regularly on the Friends of the Teton River website at www.tetonwater.org

Program Personnel

Program Coordinator

Lyn Benjamin, Executive Director of Friends of the Teton River, will oversee the project and assist with data collection. Lyn has a MS in Watershed Science and Hydrology from Utah State University, has conducted research on the Henrys Fork of the Snake with the Henrys Fork Foundation and as an independent consultant, and has run research projects for the U.S. Geological Survey and Bureau of Reclamation.

Field Technician

Kimberly Ball, FTR Research Associate, will collect all field data, perform analysis and assist with report writing and dissemination. Kimberly is currently completing an MS in Environmental Science at University of Idaho and has worked extensively with Idaho Department of Environmental Quality in the Big Lost River Watershed.

IV. Project Evaluation

The goals of this program are the development of a long-term water quality database for the upper Teton Watershed, and identification of sources and remediation strategies for water quality problems. We will know if we have been successful if we have sufficient high quality data to be able to identify trends in water quality and water movement. Finally we expect that this monitoring program will enable us to identify sources of water quality problems and to work with the Natural Resource Conservation Service, local landowners, and appropriate government entities to strategize ways to remediate the problem.

We will use scientific peer review panels from appropriate agencies and universities to validate the results and methodologies of the data collected (Sheryl Hill from DEQ, Dr. Rob Van Kirk from I.S.U. and Bill Schrader from Idaho Department of Fish and Game). We have conducted extensive literature reviews of pertinent scientific literature about water quality in surface water streams and will compare our results to this work. We will measure our success with regard to public education by the level of participation in Friends of the Teton River's public meetings (the kinds of questions that are asked, feedback that we solicit in our newsletters, and continued support of the organization through volunteer participation and donations). The value of the data will also be reflected in the degree to which it is used to make natural resource use decisions.