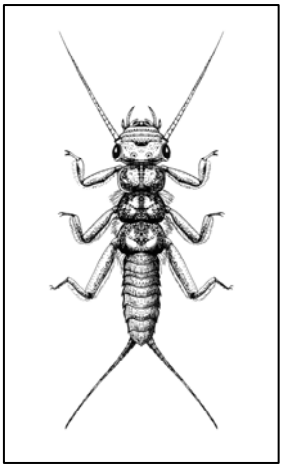
Upper Columbia Basin Network Integrated Water Quality Protocol Development Summary

(January 2009)



UCBN Protocol Development Summary

Protocol: Integrated Water Quality

Parks Where Protocol Will Be Implemented:
BIHO, CIRO, CRMO, JODA, NEPE, and WHMI

Justification/Issues being addressed:
Monitoring of NPS water resources has been identified as a core objective of the national I&M program, as well as by the UCBN. Several UCBN parks have identified water quality improvement-related land health goals for performance reporting purposes. All Network waters assessed by state DEQ agencies are on 303(d) lists for impairment of at least one parameter, and the riparian and wetland areas supported by Network waterbodies are foci for biological invasions and other management challenges. Several parks have begun concerted riparian and stream channel restoration projects.

Although the UCBN contains more than 34 rivers, streams, ponds, and reservoirs within park boundaries, water resources actually represent a very small percentage of total land cover, except in the case of LARO. Unlike many water resources in the National Park system, most UCBN parks and waterbodies are only small proportions of their watersheds. Consequently, water quality and aquatic resources are strongly affected by activities outside of the park boundaries, and NPS management authority and capability for water quality improvement in waterbodies that pass through the parks is minimal. However, aquatic environments are disproportionately important in terms of biodiversity, biological productivity, and many other ecosystem functions and values. The UCBN has prioritized three water quality vital signs, surface water dynamics, aquatic macroinvertebrates, and water chemistry, and is committed to implementing a modest integrated water quality monitoring program that address those vital signs.

Water quantity and flow regime have overriding influence on stream channel morphology and stream and riparian biota. The strong alteration of flow regimes by human activity in the UCBN has altered biotic communities and ecosystem processes. UCBN parks are small relative to their watershed areas and few contain established flow monitoring sites within their boundaries. Consequently, future revisions to the integrated water quality monitoring protocol will include the monitoring of stream flow and compilation of data available from stations within and outside of UCBN unit boundaries. Aquatic macroinvertebrates are good indicators of ecosystem condition because they occur in all waterbodies, integrate point, nonpoint, pulse, and press disturbances, are trophically diverse, and are less mobile than fishes. Macroinvertebrate communities are also affected both by conditions in local stream reaches and those within the watershed. The sampling of aquatic macroinvertebrates is relatively effective and efficient

compared to other biotic indicators (e.g., algae and fish), and hence, is relatively cost-effective. Water chemistry and temperature have strong effects on aquatic biota. Consequently, direct and indirect human alteration of stream water chemistry and temperature is associated with altered biotic communities and ecosystem processes. Because of the direct relationship between water chemistry and biota, water chemistry is typically a central component of any water quality monitoring program. More recently, monitoring of stream water temperatures has increased because of concerns over cold-water fish habitat (primarily salmonid fishes), the recognized influence of land- and water-use on stream thermal regime, and the need for baseline temperature information to monitor effects of climate change. For example, temperature was selected as one of two key parameters for monitoring in the John Day Basin by the NOAA research, monitoring, and effectiveness program and its partners.

The water monitoring protocol will be a single, integrated protocol because it will be modest in size and sampling locations and personnel will greatly overlap. Macroinvertebrates will be sampled directly from select UCBN waterbodies, and water chemistry will be monitored by sampling select waterbodies for a set of core water quality parameters using continuous water quality monitoring probes ("multiprobes"; temperature, pH, specific conductance, dissolved oxygen, and turbidity).

Specific Monitoring Questions and Objectives to be Addressed by the Protocol:
Monitoring questions addressed by this protocol include:

- Are the core water quality parameters of streams in the UCBN with established TMDLs selected for sampling improving over time?
- What is the status and long-term trend of core water quality parameters (temperature, pH, conductivity, dissolved oxygen, and turbidity) in UCBN streams selected for sampling?
- What is the status and long term trend in aquatic macroinvertebrate abundance and assemblage composition in selected UCBN streams?
- Do aquatic macroinvertebrate assemblages sampled within UCBN streams indicate polluted or otherwise impaired water quality?
- Do aquatic macroinvertebrate assemblages sampled within UCBN streams indicate "pristine" or "reference" conditions according to regional criteria established by EPA and the states of Idaho, Oregon, Montana, and Washington?

Monitoring objectives addressed by this protocol include:

- Determine status and long term trend in key water quality parameters for selected streams within UCBN park units. ***Justification:*** *Water quality has strong effects on aquatic biota, but both vary through time as a result of natural and human-induced causes. Understanding the patterns of variability among years is critical to detecting long-term trends.*

- Determine status and trend in aquatic macroinvertebrate abundance, assemblage composition, and functional feeding group composition in wadeable streams within the UCBN. ***Justification:*** *Aquatic macroinvertebrates are good indicators of ecosystem condition because they occur in all waterbodies, integrate point, nonpoint, pulse, and press disturbances, are trophically diverse, and are less mobile than fishes. Macroinvertebrate*

communities are also affected both by conditions in local stream reaches and those within the watershed.

Basic Approach:
The monitoring protocol will specify criteria for selecting suitable sites (i.e., maximum distance from UCBN park boundary, etc.). Data analysis, statistical testing, and data summarization and reporting protocols will be specified and SOPs will include examples. SOPs specifying statistical comparisons will include tests of long term changes in and status of macroinvertebrate assemblage structure.

Macroinvertebrate biomonitoring protocols are well developed and SOPs will be adapted from existing protocols developed by the EPA and the states of Idaho, Oregon and Washington, and other NPS monitoring Networks. Therefore, protocol development will not require field research and will primarily consist of writing protocols to meet NPS standards and to make existing national and regional protocols specific to UCBN parks. Site selection will be specified and will include protocols for selecting, permanently marking, photographing, and determining site coordinates using GPS. The type(s) of sampling device, size, and mesh size will be specified following consultation with local experts (EcoAnalysts, Moscow ID, Idaho DEQ, etc). Sample frequency and timing will be conducted using a rotating basin design, where one-third of UCBN wadeable streams are sampled each year, resulting in the sampling of each unit every 3 years. Protocols will specify the frequency and sampling within year, and samples will be taken during index periods suggested by Hayslip (2007) and Montana DEQ (2006); June through October. SOPs will also describe field sampling, sample preservation, processing, and archiving, field and laboratory data collection (including sample data sheets), data storage, sharing, and database management, and will include an SOP to ensure QA/QC. Following the first round of sampling, protocols for data summaries and statistical power analyses will be specified to determine the primary sources of variation in aquatic community structure and whether sampling levels are sufficient to meet monitoring goals. Additional SOPs will recommend potential sampling regime modifications, protocols for data analysis, including methods for testing for long-term trends, and suggested data summary and reporting formats.

Water chemistry and temperature data will be evaluated to determine the best sites for monitoring. The UCBN seeks to balance the need for a representative location within each stream, with factors such as: stream stages, channel morphology, water velocity, potential for debris damage, and logistics. The reasoning for specific site selection will be fully documented. Data analysis, statistical testing, and data summarization and reporting protocols will be specified and SOPs will include examples. SOPs specifying statistical comparisons will include tests of long term change in the magnitude and variability in parameters, and will emphasize reporting of trends in 303(d) listed streams.

The availability multiprobes for water quality monitoring will allow water quality data for a core set of parameter to be estimated at high resolution from selected UCBN waterbodies. The core parameters will be estimated every hour by the multiprobe. Probes will be deployed in each stream from May through the end of October to characterize daily, weekly, seasonal, and interannual patterns in mean parameter values and variability. SOPs will describe multiprobe transport, calibration, storage, maintenance, data retrieval, analysis, and archiving. Data analysis,

statistical testing, and data summarization and reporting protocols will be specified and SOPs will include examples.
SOPs outlining data screening and QA/QC protocols will be included, as well as procedures for revising monitoring protocols and documenting any changes.

NPS Project Leader:
Eric Starkey, 208-885-3010

Development Schedule, and Expected Interim Products:
A final monitoring protocol has been submitted to NPS Water Resource Division for review in January 2009.