Program for Monitoring Salmon Recovery in Index Watersheds: Water Quality and Quantity

Quality Assurance Program Plan

by
John Summers and Dave Serdar

September 2000

Washington State Department of Ecology
Environmental Assessment Program
Watershed Ecology Section

Water Body Numbers:
Manser Cr. - 1219187482652 (formerly WA-03-1020)
Big Beef Cr. - 1227820476521 (formerly WA-15-7000)
Bingham Cr. - 1234007471431 (formerly WA-22-4090)
Cedar Cr. - 1226174459365 (formerly WA-27-2045)

APPROVALS:

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Introduction

Wild salmon, steelhead, and trout[1] populations in Washington are being significantly depleted and many stocks are being pushed to extinction. Since the early 1800's human activities and actions have resulted in the depletion of many wild stocks. As of 1999, a total of 15 salmon species have been listed under the Endangered Species Act (ESA) as threatened or endangered. The listings cover 75% of the state and more are anticipated.

The need to reverse the declining trend in salmon stocks has been acknowledged by the Governor and recently culminated in *Extinction is Not an Option: A Statewide Strategy to Recover Salmon* released by the Joint Natural Resources Cabinet (JNRC) in September 1999 (JNRC, 1999). The Salmon Strategy addresses the four major factors affecting salmon - habitat, hatcheries, harvest, and hydropower - as well as science-based approaches to assess the effectiveness and validity of Strategy elements. One such approach is a statewide system of index watersheds to monitor long-term watershed responses to the Strategy. This document describes Ecology's plans for the initial implementation of the index watershed monitoring program.

Scope of Work

Efforts to recover salmon through habitat protection and restoration are predicated on the tenet that degradation of their physical habitat and the loss of cool, clean waters on which salmon rely are key elements in their decline. The index watershed monitoring program seeks to determine both the validity of these assumptions and to assess the Statewide Strategy's effectiveness in improving these components of the salmon recovery puzzle. This will be accomplished by monitoring stream temperature, water quality and quantity, benthic macroinvertebrate communities, and smolt production in five index watersheds. As conceived, the Index Monitoring program will be a decades-long coordinated effort between Washington State Departments of Ecology (Ecology) and Fish & Wildlife (WDFW).

Project Objectives

Objectives of the proposed study are to:

- Assess long-term trends in stream temperature, water quality, benthic macroinvertebrate assemblages, and flows in index watersheds.

- Provide data to calculate salmon recovery indices of water quality/quantity and biotic integrity.

- Determine if water quality/quantity and benthic macroinvertebrate variables correlate over time with smolt production in index watersheds.

[1]Hereafter salmon, steelhead, and trout are collectively referred to as salmon.

- Identify index watersheds needing improvements in water quality/quantity to meet the requirements of salmon throughout their freshwater life stages. This is a secondary objective since the initial monitoring effort is limited to a pilot scale (five watersheds). Identifying areas needing improvement will become a more prominent goal as the system of index watersheds expands over time.

Watersheds selected for index monitoring are: Big Beef Creek in the Hood Canal drainage, Bingham Creek in the Satsop/Chehalis basin, Manser Creek in the Skagit River basin, Cedar Creek in the Lewis/Lower Columbia basin, and one more to be determined in the Puget Sound Basin (Urban). Components of the initial monitoring effort are:

Water Quality Index (Ecology)
- Calculated from monthly sampling for conventional water quality variables and metals at one station per watershed.

Continuous Instream Temperature Monitoring (Ecology)
- Year-round stream temperature monitoring using *in-situ* temperature recorders at 3-4 stations per watershed.

Benthic Macroinvertebrate Index (Ecology)
- Based on yearly sampling of benthic macroinvertebrates at one station per watershed.

Continuous Instream Flow Monitoring (Ecology)
- Monitoring flows year-round at 1-2 stations per watershed.

Smolt Monitoring (WDFW)
- Estimation of watershed smolt production using traps at the watershed outlet and at tributary stations deemed necessary for accurate enumeration.

An interagency monitoring strategy work group originally considered habitat monitoring and landscape analysis to be important components of this index monitoring project. These were subsequently dropped due to resource limitations, and the project was pared down to the five monitoring tasks listed above. Ecology has the lead in the water quality/quantity, temperature, and macroinvertebrate monitoring tasks; WDFW has the lead for the smolt monitoring task. The project plan for smolt monitoring has been prepared separately by WDFW and is not discussed here.

Monitoring data will be reported to JNRC on a yearly basis as Salmon Strategy performance indicators. Models for these indicators are currently being developed by separate work groups. Conceptually, the water quality indicator will be a composite of variables scored relative to favorable/unfavorable conditions for salmon. Possible approaches to deriving water quantity scores include comparing index watershed flow data to critical high/low flows or by comparison to natural flow regimes. WDFW will develop the performance indicator for smolt production.

Project Organization and Responsibility

Schedule/Completion Dates for Year 1

Draft QAPP to Unit Manager	June 2000
Final QAPP complete	September 2000
Reconnaissance of watersheds for station selection	June-September 2000
Field Sampling	
Installation of continuous flow and temperature monitors	July-October 2000
Water quality monitoring	Monthly beginning October 2000
Benthic macroinvertebrate collection	Annual beginning August-October 2000
Environmental Information Management (EIM)	
Data entry	Ongoing
Annual Report	Annual

Project Roles/Contacts

- *John Summers, Ecology Project Lead*. (360) 407-7548. Responsible for preparation of Quality Assurance Project Plan (QAPP), sampling for water quality, macroinvertebrates, continuous temperature monitoring, and preparation of draft and final reports.

- *Dave Serdar, Ecology Project Manager*. (360) 407-6772. Responsible for oversight of project, analysis of project data, assistance with QAPP, and report preparation.

- *Dale Norton, Ecology Supervisor, Contaminant Studies Unit*. (360) 407-6765. Responsible for budget management.

- *Will Kendra, Ecology Supervisor, Watershed Ecology Section*. (360) 407-6698. Workgroup lead for salmon water quality indicators.

- *Brad Hopkins, Ecology Stream Hydrology Unit*. (360) 407-6686. Responsible for continuous flow monitoring sites including set-up, maintenance, data collection, and analysis.

- *Cliff Kirchmer, Ecology Quality Assurance Officer*. (360) 407-6455. Quality Assurance and technical support.

- *Stuart Magoon, Ecology Director, Manchester Environmental Laboratory (MEL)*. (360) 871-8801. Primary contact at MEL.

- *Greg Volkhardt, WDFW Freshwater Resources Division.* (360) 902-2779. Project lead for smolt monitoring.

- *David Seiler, WDFW Resource Assessment Division.* (360) 902-2784. Project Manager for smolt monitoring.

Data Quality Objectives

Data quality objectives are based on the stated objectives of the program. Objectives for precision, bias, representativeness, completeness, and comparability are described below. All aspects of the project plan, including sampling design, sampling methods, laboratory procedures, and quality control are formulated to meet these objectives.

Precision

Precision is the measure of scatter due to random error. Data for this project should be precise enough so that sampling and laboratory error will not mask environmental variability. Acceptable levels of precision are based on estimates of environmental variability, existing laboratory performance, and existing measures of sampling variability.

Precision requirements to detect trends in water quality variables have been described in the Quality Assurance Project Plan for Ecology's Freshwater Ambient Water Quality Monitoring Program (Ehinger, 1996). This plan includes a detailed power analysis of the data sets required to detect long-term trends in water quality variables across a range of mean concentrations. Maximum permissible error standard deviations can be adjusted based on the power $(1-\beta)$, confidence level (α), sample size (n), relative change in mean $(\Delta\mu)$, and minimal detectable trend relative to the standard deviation (δ). Appendix A, Table A-1, shows permissible error values for the following parameters: $\beta=0.1$ (power = 0.9), $\alpha=0.1$, $n=60$, $\Delta\mu=10\%$, and $\delta=1.3$. They will be adopted for the index monitoring program since objectives and data requirements are comparable with the Ambient Monitoring Program. Furthermore, Ehinger (1996) states that these values provide early trend detection capability in more pristine streams and rivers as well as sufficient detection capability in more impacted waters.

Short-term precision targets for water quality variables have also been established to determine the need for investigation of sampling and laboratory quality control. The coefficient of variation (CV) for replicate field measurements and sample results (with the exception of bacteria analysis) should not exceed 20% for results at or above the reporting limit. Since investigators have no control over environmental variability, measurement quality objectives (MQOs) for duplicate laboratory analyses will be set at a CV of 10%. For bacterial results, precision up to 50% CV is acceptable for replicate field samples and an MQO of 25% CV is acceptable for duplicate laboratory analyses. At levels close to the method detection limit, the CV may be greater than 50%, which is to

be expected and will be acceptable. Pooled results will also be evaluated, with the higher CV's of low values taken into account. Data variability will be taken into consideration in using the data for modeling and other analysis, and interpreting results. For benthic macroinvertebrates, Plotnikoff (1992) states that a CV ≤ 20% should be an objective when using the taxa richness metric derived from four replicate riffle samples.

Bias

Bias is a measure of deviation from the true value due to systematic errors. Bias is difficult to quantify because the true value of an environmental parameter is often unknown. Therefore, the goal will be to prevent biased data due either to sampling or laboratory practices. For laboratory-analyzed water quality samples, efforts will be made in all procedural steps to reduce contamination, a common source of bias in estimating concentrations of low-level analytes. Ehinger (1996) points out that non-parametric trend analysis is unaffected by a consistently biased data set. However, if bias is corrected at some mid-point in the project, then statistical analysis may be severely compromised. A possible way to avoid this problem for laboratory analyses is to correct any batch-specific bias as it occurs rather than allowing multiple batches to carry bias before attempting to correct the problem.

Representativeness

Sample data, including flow monitoring, should be representative of stream conditions during the period of sampling. The study will be designed in a manner to adequately reflect conditions in the stream or stream reach.

Completeness

The objective for completeness will be to obtain useable data from 100% of the samples targeted in the study design. Completeness is an especially important aspect of this project since long-term monitoring requires a substantial data set for accurate trend analyses.

Comparability

Comparability to data from other projects will be ensured by the use of standardized sampling and analytical methods.

Study Areas

The number of monitored watersheds was limited to five by budgetary constraints. Selection of watersheds was limited to a subset of basins where WDFW is currently monitoring smolt production and plans to continue. The selection process for each watershed was based on these elements:

1) WDFW commitment to long-term salmonid smolt monitoring.
2) Ecology Focus Watershed (Skagit, Dungeness, and Methow).
3) Predominant land uses in the drainage (urban, agriculture, forestry)
4) Geographical region
5) Locations suitable for sampling, installation of monitoring equipment, and accessibility throughout the course of a long-term study.
6) Availability of relatively homogeneous stream channels to characterize/describe watershed conditions.

An effort was made to select a set of watersheds which would include at least one of the Ecology Focus Watersheds as well as provide a mixture of land-use types. The initial set of watersheds was also selected to provide a range of geographical regions, although they were limited to western Washington. Additions to the set of index watersheds will likely include regions of eastern Washington. Reconnaissance of candidate watersheds also helped determine their suitability for monitoring based on logistical (sampling) considerations.

Based on these selection criteria, the five watersheds chosen for index monitoring are: Big Beef Creek in the Hood Canal drainage (rural residential/forestry), Bingham Creek in the Satsop/Chehalis Basin (forestry), Manser Creek in the Skagit River drainage (forestry/agriculture), Cedar Creek in the Lewis/Lower Columbia basin (forestry/agriculture/rural residential), and one more Puget Sound basin (urban) to be determined. The locations of these watersheds are shown in Figure 1.

Sampling Methods

Continuous instream temperature monitoring will begin in July 2000 and continue throughout the program. Beginning August 2000 instantaneous flow monitoring equipment will be installed and rating curves established. Annual benthic macroinvertebrate and monthly water quality sampling will begin September-October 2000. All sampling will continue for the duration of the project. WDFW monitors smolt migration up to nine months per year from January through September.
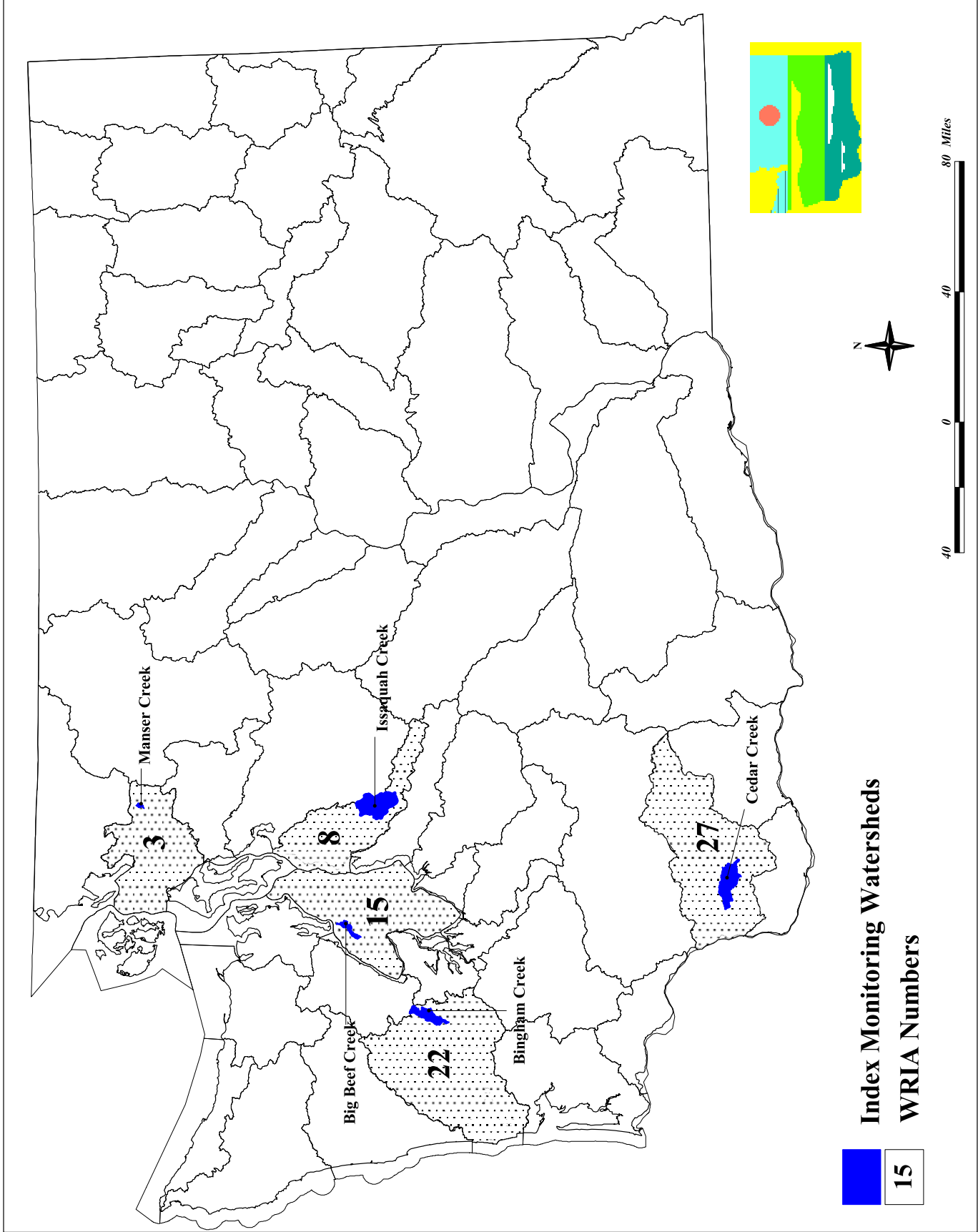
Manser Creek

Issaquah Creek

Big Beef Creek

Bingham Creek

Cedar Creek

3

8

15

22

27

N

40   0   40   80 *Miles*

Index Monitoring Watersheds

WRIA Numbers

15

Figure 1:   Location of Index Monitoring Watersheds

Water Quality

The Contaminant Studies Unit (CSU) of Ecology's Environmental Assessment Program will sample water quality parameters at one site in each watershed. Lab samples for dissolved oxygen, turbidity, total suspended solids, fecal coliform bacteria, ammonia-N, nitrate+nitrite-N, total nitrogen, total phosphorus, soluble reactive phosphorus (orthophosphate), hardness, dissolved metals (copper and zinc) and field measurements for pH, conductivity, and temperature will be taken monthly. During each sampling run every attempt will be made to collect samples at the same time of day at each station. Field measurements at all macroinvertebrate sampling stations will include temperature, dissolved oxygen (DO), conductivity, and pH.

Samples for laboratory analysis will be stored on ice immediately after collection and delivered to MEL within 24 hours. At sites where feasible, all samples will be taken as grab samples. Where bridge samples are taken, sampling procedures will follow the EAP Environmental Monitoring and Trends Section protocols (Ehinger, 1996). Dissolved metals sampling methods will follow the EPA Method 1669 (EPA, 1995; Kammin et al 1995).

Flow Monitoring

Instantaneous flow estimates will be measured by EAP's Stream Hydrology Unit (SHU) and the CSU. Gaging station installation, maintenance, data retrieval, estimation of discharge, and instantaneous flow measurements will follow the SHU protocols manual (Hopkins, 1999). One or two continuous flow gaging stations will be installed at selected representative sites within each watershed. Selected gaging stations will be near the macroinvertebrate sampling sites, easily accessible, and suitable for developing accurate rating curves. Staff gages will also be installed near the continuous flow gauging station. All stations will have data downloaded monthly throughout the monitoring period.

Temperature

Stream temperature monitoring will be conducted following the 1999 TFW Monitoring Program Manual: stream temperature survey methods and protocols (Schuett-Hames et al., 1999). Continuous instream temperature probes and data loggers (Onset StowAway Tidbit®) will be installed at each of the macroinvertebrate sampling sites and at two other sites within each watershed. Temperature monitors will be installed in areas which are representative of the surrounding environment and are shaded from direct sunlight. Tidbit® monitors are capable of recording a range of temperatures from -5°C to +37°C. Temperature will be monitored year-round.

Macroinvertebrates

Macroinvertebrate sampling will be used to evaluate the biological community using Ecology's Revised Benthic Macroinvertebrates Monitoring Protocols for Rivers and Streams (Plotnikoff, 2000). This method provides a sensitive measure of stream conditions, and can be used for a variety of objectives including effectiveness monitoring of restoration projects, biocriteria evaluations, and trend assessments. Each watershed will be sampled at one site once per year, during the low flow season (August through October). Collection of four composited riffle samples will be taken at each sampling site. All samples will be sent to a contract laboratory for analyses and evaluation of species composition and species richness. Each composited sample will be sub-sampled to attain a 500-organism sample size for taxonomic identification and enumeration of species. Each (major order of macroinvertebrate organism) will be identified to at least the genus level and to the species level if feasible. Biological metrics and indices will be calculated to characterize the invertebrate communities.

Limited habitat surveys and additional water quality sampling (pH, DO, temperature, and conductivity) will be done concurrently to help interpret results of macroinvertebrate sampling. Habitat survey elements will include stream reach profiles, canopy cover, and substrate composition using methods described in Ecology's Revised Benthic Macroinvertebrates Monitoring Protocols for Rivers and Streams (Plotnikoff, 2000).

Analytical Methods

Laboratory analyses, analytical methods, and the detection of precision limits for field measurements are listed in Tables 1, 2 and 3. Estimated laboratory cost is shown in Appendix B, Table B1. The laboratory's data quality objectives and quality control procedures are documented in the Manchester Environmental Laboratory's Lab Users Manual (MEL, 1994).

Table 1. Summary of laboratory methods and lower reporting limits.

Parameters	Methods[a]	Lower reporting limit
Fecal coliform	SM18 Membrane Filter 9222D	1 cfu/100 ml
Dissolved copper (low level)	EPA 200.8	0.03 µg/l
Dissolved zinc (low level)	EPA 200.8	0.4 µg/l
Turbidity	EPA 180.1	0.1 NTU
Total N	SM 4500 NO_3-F	10 µg/L
Ammonia-N	EPA 350.1	10 µg/L
Nitrite+nitrate-N	EPA 353.2	10 µg/L
Orthophosphate	EPA 365.1	10 µg/L
Total phosphorus	EPA 365.1	10 µg/L
Total suspended solids	EPA 160.2	1 mg/L

[a] Sources: EPA, 1993 and APHA, 1998 (SM)

Table 2. Container type, water volume required, method of preservation, and maximum recommended holding times for water samples.

Variable	Container Type	Sample Volume (ml)	Preservation	Holding Time
Turbidity	poly	500	cool to <4°C	48 hrs
Total suspended solids	poly	1000	cool to <4°C	7 days
Total phosphorus	poly	125	adjust pH<2 w/ H_2SO_4 and cool to <4°C	28 days
Orthophosphate	brown poly	125	filter in field and cool to <4°C	48 hrs
Nitrate+Nitrite-N	poly	125	adjust pH<2 w/ H_2SO_4 and cool to <4°C	28 days
Ammonia-N	poly	125	adjust pH<2 w/ H_2SO_4 and cool to 4°C	28 days
Total N	poly	125	adjust pH<2 w/ H_2SO_4 and cool to <4°C	28 days
Fecal coliform	Autoclaved glass/ploy	250	cool < 4°C	30 hrs
Copper	Teflon	1000	filter in field, adjust pH<2 w/ HNO_3 and cool to <4°C	6 months
Zinc	Teflon	1000	filter in field, adjust pH<2 w/ HNO_3 and cool to <4°C	6 months
Hardness	poly	125	adjust pH<2 w/ HNO_3 and cool to <4°C	6 months

Table 3. Summary of field measurements, methods, and accuracy.

Variable	Method	Accuracy
Velocity	Current meter	± 0.1 f/s
Specific Conductivity	Field meter	± 5%
pH	Field meter	± 0.2 standard units
Temperature	Red liquid thermometer	± 0.2ºC
Dissolved Oxygen	Winkler Modified Azide (EPA360.20 Field Meter)	± 0.1 mg/L ± 0.2 mg/L
Stage Height	Data logger and probe	± 0.03 feet
Continuous Temperature	Underwater data logger	± 0.2ºC @ 21ºC

Field sampling and measurement protocols will follow those listed in the Watershed Assessment Section protocols manual (Ecology, 1992). All meters will be pre- and post-calibrated in accordance with the manufacturers' instructions. Pre- and post-checks with standards will evaluate field measurement accuracy. Samples for laboratory analysis will be stored on ice and delivered to MEL within 24 hours of collection.

Quality Control Procedures

Field and laboratory sample variability are addressed by using a 10% duplication rate for water quality parameters. Field instrumentation will be calibrated and adjusted according to manufacturers' recommendations. pH and conductivity meters will be calibrated on the morning of each field event and tested with standards to assure they are within accuracy tolerances. Temperature recordings will occasionally be checked against liquid thermometer readings to assess their accuracy.

The accuracy of flow measurements will be assessed by occasionally measuring streamflows to determine their fit in the established rating curves. Response of pressure transducers to stage height are continually checked against staff gage readings and tape-down measurements from reference points.

Short-term environmental variability will be assessed by repetitive sampling (i.e. two samples from the same station collected 15-20 minutes apart) from each station at least once per year. Total error (sampling + laboratory) will be assessed by analyzing one field split sample per batch (sampling event). One laboratory duplicate per batch will also be analyzed to determine the contribution of laboratory error to total error. Bias of the laboratory samples will be assessed through analysis of check standards and matrix spikes at a frequency of at least one analysis per batch.

Data Reduction, Review, and Reporting

Standard laboratory procedures for analytical data reduction, review, and reporting will be followed (MEL, 1994). Microbiologists and chemists will immediately inform the project manager of any problems with sample shipment conditions, holding times, or analyses.

MEL will send an electronic copy of the data via Ecology's Environmental Information Management (EIM) system and a hard copy of the data to the project manager. Lab and field analytical data will be matched with sample times and locations. Field data will be screened for questionable values and problems and then entered into the EIM database.

Results from quality control samples (i.e., field duplicate samples and blanks) will be statistically analyzed after data from the first monitoring run have been reported, and then every other run afterwards. Numbers of duplicates, high or low range duplicate stratification, or other adjustments for sampling and laboratory analyses will be made as required.

All data collected during the project will be available in annual reports or upon request, after the data have been reviewed for quality assurance. Annual report and data summaries will be posted on Ecology's web site. Data reduction procedures will be explained in the text of annual reports.

All project data will be entered in Microsoft Access database and Ecology's EIM system. Statistical calculations will be made using SYSTAT software.

References

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MEL, 1994. Lab User's Manual, Fourth Edition. Washington State Department of Ecology, Environmental Assessment Program, Manchester, WA

Plotnikoff, R.W. 1992. Timber, Fish, and Wildlife Ecoregion Bioassessment Pilot Project. Washington Department of Natural Resources, Olympia, WA. TFW-WQ11-92-001.

Plotnikoff, R.W., 2000. (Draft). <u>Revised Benthic Macroinvertebrates Monitoring Protocols for Rivers   and Streams</u>. Washington Department of Ecology, Olympia, WA.

Schuett-Hames, D., A. E. Pleus, E. Rashin, and J. Matthews, 1999. <u>TFW Monitoring Program</u> <u>Method Manual for the Stream Temperature Survey.</u> Northwest Indian Fisheries Commission, Olympia, WA

Appendix A

Table A-1. Calculated maximum permissible error [$S_{error(mp)}$] values based on $\Delta\mu$=10% of μ (power=0.9, α=0.1, δ=1.3, and n=60).

Variable	$\Delta\mu$	μ	$S_{error(mp)}$
Temperature (°C)	1	N/A	0.32
Dissolved Oxygen (mg/L)	0.8 1.0 1.2	≤8 8-10 >10-12	0.26 0.32 0.38
pH (standard units)	0.5	N/A	0.16
Specific Conductivity (µmhos)	5 10 15 30	≤50 50-100 100-150 >150	1.6 3.2 4.8 9.6
Turbidity (ntu)	1 2 5 10	≤10 10-20 20-50 >50	0.3 0.6 1.6 3.2
Total Suspended Solids (mg/L)	1 2 5 10	≤10 10-20 20-50 >50	0.3 0.6 1.6 3.2
Total Phosphorus (µg/L)	5 10 20	≤50 50-100 >100	1.6 3.2 6.4
Soluble Reactive Phosphorus (µg/L)	5 10 20	≤50 50-100 >100	1.6 3.2 6.4
Nitrate+Nitrite-N (µg/L)	10 20 50 100	≤100 100-200 200-500 >500	3.2 6.4 16.0 32.0
Ammonia-N (µg/L)	5 10 20	≤50 50-100 >100	1.6 3.2 6.4
Total Nitrogen (µg/L)	10 20 50 100	≤100 100-200 200-500 >500	3.2 6.4 16.0 32.0
Fecal Coliform (cfu)	20*	100	6.4
Copper (µg/L)	1 2 5	≤10 10-20 20-50	0.3 0.6 1.6
Zinc (µg/L)	1 2 5	≤10 10-20 20-50	0.3 0.6 1.6
Hardness (mg/L)	5 10 20	≤50 50-100 >100	1.6 3.2 6.4

N/A=not applicable
* not based on a 10% increase in mean
Source: Ehinger, 1996

Appendix B

Table B-1. Estimated laboratory budget for water quality sampling, FY01 (July 01, 2000 through June 30, 2001).

Parameter	# of Samples (5 stations x 12 events)	Q A Analyses	Total # of Analyses	Cost per Analysis	Total Cost of Samples
Fecal Coliform	60	12	72	$20	$1440
Ammonia	60	12	72	$12	$864
Nitrate-Nitrite	60	12	72	$12	$864
Total Phosphorus	60	12	72	$12	$864
Orthophosphate	60	12	72	$12	$864
Total Persulfate Nitrogen	60	12	72	$16	$1152
Total Suspended Solids	60	12	72	$10	$720
Turbidity	60	12	72	$7	$504
Hardness	60	12	72	$12	$864
Zinc	60	24	84	$55	$4620
Copper	60	24	84	$55	$4620
Total lab expenditure FY01					**$17,376**

DEPARTMENT OF ECOLOGY

September 24, 2001

TO: Will Kendra, Watershed Ecology Section Manager - EAP

THROUGH: Dale Norton, Toxics Studies Unit Supervisor - EAP

FROM: John Summers, Nonpoint Studies Unit Staff - EAP

RE: **ADDENDUM TO MONITORING PLAN FOR SALMON
               RECOVERY IN INDEX WATERSHEDS: WATER QUALITY
               AND QUANTITY 2000 QAPP**

To more appropriately meet the program objectives, four changes to the program have
been instituted.

1. Project Organization
    John Summers is now project manager and responsible for project oversight,
    preparation of Quality Assurance Project Plan (QAPP), sampling for water quality,
    macroinvertebrates, continuous temperature monitoring, data analysis, web page
    coordination, and preparation of draft and final reports.

2. Study Areas
    Selecting a set of watersheds that included all of the selection criteria proved to be
    difficult due to various resource and logistical limitations that WDFW has on their
    smolt-monitoring program. After reviewing early smolt-monitoring results, the initial
    set of five watersheds had to be modified. Two watersheds, Mannser and Issaquah
    Creeks, were dropped and replaced with the Deschutes River in the South Puget
    Sound drainage (urban/rural residential, agriculture/forestry) and the Chiwawa River
    in the Wenatchee basin (rural/forestry). Attached is the revised figure1 map.

3. Flow Monitoring
    Access to real-time flow data is available on the web beginning winter 2001. Cedar
    Creek and Bingham Creek flow stations are to be upgraded to real-time using hard-
    wired phone lines. Chiwawa River station is to be upgraded via the GOES satellite
    system. Big Beef Creek and the Deschutes River will continue to be downloaded
    monthly and data posted on the web periodically at
    http://www.ecy.wa.gov/programs/eap/flow/salmon.html.

4. Metals Analysis
    Due to consistent lack of significant "hits" for Copper and Zinc, the metals sampling
    will be discontinued August 2001 in Bingham, Cedar, and Big Beef Creeks. This will
    complete one year of data collection in these watersheds. The Deschutes and
    Chiwawa Rivers will continue to be monitored quarterly (August 2001, November
    2001, February 2002, and May 2002). At that time, all metals monitoring will also be
    discontinued in these watersheds.

While these changes have caused a delay in the full implementation of the program, the
outcome of the changes will make it possible to improve the focus on long-term index
monitoring for salmon recovery.

JS:cn
Attachment

cc: Brad Hopkins, Stream Hydrology Unit Supervisor - EAP
       Cliff Kirchmer, Ecology QA Officer - EAP
       Stuart Magoon, Lab Director - EAP
       Greg Volkhardt, Fish Biologist – Washington Department of Fish and Wildlife