Application for a Permit for Scientific Purposes Under the Endangered Species Act of 1973 for Juvenile Salmonid Use of Habitat in the Sultan River

Prepared for:

National Marine Fisheries Service
Protected Resources Division
c/o Gary Rule
1201 NE Lloyd Blvd, Suite 1100
Portland, Oregon 97232-2737

Prepared by:

R2 Resource Consultants, Inc.
15250 NE 95th St.
Redmond, Washington 98052-2518

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A. TITLE

Application for Permit for Scientific Purposes under the Endangered Species Act of 1973.

Project Name
Juvenile fish abundance, life history and distribution in mainstem and off-channel habitats of the Sultan River, Washington.

B. SPECIES

Juvenile, threatened, Puget Sound ESU Chinook salmon (*Oncorhynchus tshawytscha*), and Puget Sound DPS steelhead trout (*Oncorhynchus mykiss*) if present in the study area, will be captured/handled during electrofishing surveys and may be harassed during snorkel surveys in the Sultan River watershed. Specifically, the Snohomish River summer and fall Chinook stocks may be impacted.

C. DATE OF APPLICATION

19 June 2008
Study continues through December 2009

D. APPLICANT IDENTITY

R2 Resource Consultants, Inc.
c/o Dudley W. Reiser
15250 NE 95th Street
Redmond, Washington 98052
phone (425) 556-1288
fax (425) 556-1290
Principal contact: dreiser@r2usa.com

E. INFORMATION ON PERSONNEL, COOPERATORS, AND SPONSORS

1. Identity of Principle Investigators and Field Supervisors

Principal Investigator / Field Supervisor: Dr. Dudley Reiser, R2 Resource Consultants, Inc. (see above address)
Field Supervisor: Mr. Eric Jeanes, R2 Resource Consultants, Inc. (see above address)
Field Supervisor: Ms. Catherine Morello, R2 Resource Consultants, Inc. (see above address)

2. Identity of Field Personnel

Mr. Mike Gagner, R2 Resource Consultants, Inc. (see above address)
Mr. Timothy Sullivan, R2 Resource Consultants, Inc. (see above address)
Mr. Curt Kraemer, Subcontractor to R2 Resource Consultants, Inc. (see above address)
Mr. Keith Binkley, Public Utility District No. 1 of Snohomish County (see address below)
See attached resumes (Appendix B)

3. Identity of Cooperator and Sponsor

Public Utilities District No. 1 of Snohomish County
c/o Mr. Keith Binkley
Senior Environmental Coordinator
1802 75th Street SW
Everett, Washington 98203
(425) 783-1769

4. Identity of Contractor.

R2 Resource Consultants, Inc. will perform all field activities associated with this project. R2's office is located at 15250 N.E. 95th Street, Redmond, Washington 98052.

5. Disposition of Specimens.

Any expired specimens (mortalities) will be recovered during sampling and preserved frozen to be turned over to the University of Washington Fish Collection in Seattle at the contact below.

Theodore W. Pietsch, Professor
Fish Collection: 206-543-3816
School of Aquatic and Fishery Sciences
University of Washington
Campus Box 355020
Seattle, Washington 98195-5020

6. Transport and Long-Term Holding of Listed Species.

No live specimens will be transported or held long-term as part of this study.

F. PROJECT DESCRIPTION, PURPOSE, AND SIGNIFICANCE

A full project study plan is attached to this application (Attachment B). This is a continuation of the study performed in 2007 and 2008.

1. Justification of the Objectives.

The objective of this study is to determine the relative abundance of juvenile salmonids in the Sultan River and identify the distribution of juvenile salmonids in relation to mainstem and off-channel habitat types. This permit application is in regard to the continuation of the 2008 study performed by R2 Resource Consultants, Inc. for Snohomish County PUD as part of their Henry M. Jackson Hydroelectric Project relicensing (FERC Project No. 2157) (Figure 1). Species present in the Sultan River include Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), pink (*O. gorbuscha*), and chum (*O. keta*) salmon; steelhead (*O. mykiss*), and coastal cutthroat trout (*O. clarki*). These species exhibit a wide variety of rearing strategies and behavioral tendencies in their adaptation to their local habitat. The City of Everett Diversion Dam (Washington), located at river mile 9.7 limits the migration of these species in the Sultan River (Figure 1). The presence and operation of the Jackson Hydroelectric Project (RM 16.5) interrupts the natural hydrology of the Sultan River and has potentially impacted fish habitat composition and use in the lower Sultan River. Water management strategies employed in the Sultan River basin may invoke different implications for each of these fish species, based upon their respective distribution and life history strategy. Overall, life history information specific to the Sultan River fish stocks is limited. In particular, the relative abundance of ocean-type (fish that emigrate during their first spring) and stream-type (fish that rear in the system for over a year) Chinook salmon juveniles in the Sultan River is unknown. The freshwater habitat requirements for stream-type Chinook are much more extensive than the requirements of ocean-type Chinook. The identification of areas and timing of utilization of salmonids in the Sultan River will allow for better water management strategies and effective habitat protection/restoration of these areas by Snohomish County PUD. Therefore it is necessary that the proposed sampling take place in areas of possible Chinook salmon habitat.

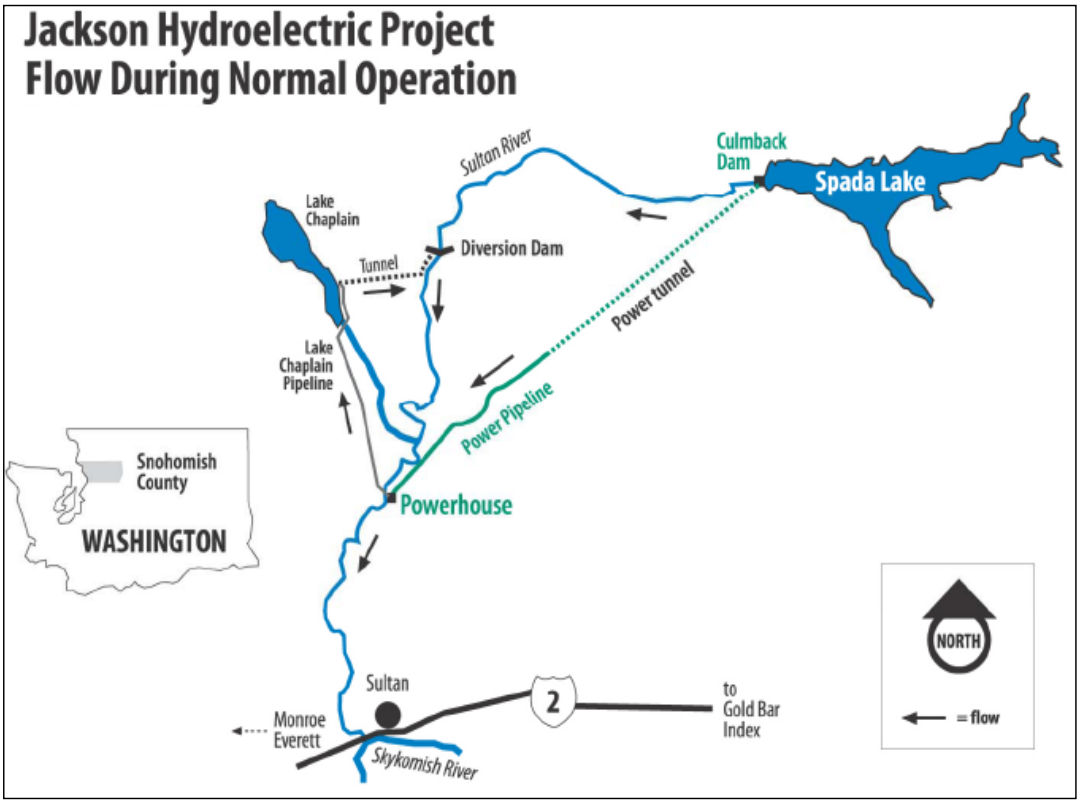

Figure 1. Map of the Jackson Hydroelectric Project in the Sultan River basin, Washington.

2. *Statement of Recommendation of Requirement of Federal Agency*

This study is 1 of 21 studies that have been specified and agreed to as part of the Federal Energy Regulatory Commission (FERC) Integrated Relicensing Process (ILP) associated with the Henry M. Jackson Hydroelectric Project (FERC Project No. 2157). The study will help Snohomish County PUD and the City of Everett (Co-Licensees) to determine the implications of various water management strategies of the Jackson Hydroelectric Project on the presence of fish species in the Sultan River, and will help identify appropriate protection, enhancement and mitigation measures for the new license period.

3. *Statement of Whether Proposed Project has Broader Significance than the Individual's Goals*

Results from this study will aid in the determination of the present range and timing of threatened Puget Sound Chinook and steelhead, as well as other salmonids, possibly including threatened native char, within the Sultan River system, and the greater Snohomish River basin.

Life history and habitat use data will provide important information to help sustain and recover Sultan River stocks as well as Puget Sound populations as a whole.

4. Description of Relationship or Similarities to Other Projects

As noted in (2), this study is 1 of 23 studies currently being initiated in the Sultan River basin by the Co-Licensees as part of the Jackson Hydroelectric Project relicensing effort. All of the studies proposed are being coordinated by the Snohomish County PUD. To our knowledge, this particular study is not duplicative of other studies or research being conducted in the Sultan River basin.

5. Justification for Using Listed Species, and Possible Alternates

The overall objective of the study is to evaluate seasonal usage and relative abundance of juvenile salmonids, including and in particular Chinook salmon, within the lower mainstem of the Sultan River and side channel habitats. As a result, there are no alternative species available for use.

Although alternative sampling methods such as exclusively performing snorkeling surveys, would eliminate the capture and handling of Chinook, physical conditions including water clarity, water depth and velocity, and complexity of instream and side-channel cover in the study reaches, especially during overwintering periods, would limit the overall effectiveness of snorkeling for detecting and enumerating juvenile fish. As a result, electrofishing is proposed as a secondary fish collection method that will be used to calibrate snorkel observations during spring and summer surveys within discrete areas of stream, and as the primary sampling method during the winter surveys of off-channel habitats.

G. PROJECT METHODOLOGY

1. Proposed Project Duration

This study began in the spring of 2007 and is anticipated to continue through December 2009. Snorkel surveys will be conducted in sets. Each set consists of once a week sampling for four weeks with sets being conducted quarterly (once each season). Snorkeling will occur during February, July, and November 2009. Electrofishing will be used to calibrate snorkel survey efforts, ideally taking place in February and again in November to minimize young of year Chinook capture, and maximize possible yearling Chinook capture.

2. *Procedures and Research Techniques Used During the Project*

a) Method(s) of capture and release.

Snorkeling and electrofishing will be utilized for the survey of juvenile salmonid populations. The spring and summer survey protocols generally follow that of Hankin and Reeves (1998) a common research method used with success in projects with similar goals and constraints. Mark-recapture and/or multi-pass electrofishing will provide an index of abundance of juvenile salmonids present in side-channel habitats during the overwintering period in conditions not allowing for direct visual observation. All captured fish will be anesthetized, measured, checked for hatchery marks and released. A SmithRoot, Inc. Model 15-C programmable wave output backpack electrofishing unit will be used to conduct electrofishing surveys in sites less then 0.9m (3 ft) maximum depth. A block net will be installed at both ends of the survey reaches. Electrofishing will begin at the lower site boundary and continue upstream to the upper block net. A team of three biologists will be performing the survey, with a trained individual operating the shocking unit, one person immediately removing stunned fish, and a third carrying a holding bucket of fresh water. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act (NMFS 2000) will be strictly adhered to during the field season.

Supplemental sampling may also be performed using Gee Type minnow traps (mesh 0.25 inch) baited with commercial salmon eggs or other bait products. Two strings of 5 traps connected at about 20-foot intervals to a weighted line will be deployed in shallow water near shoreline cover or large woody debris. If utilized, the minnow traps will be checked as frequently as needed to reduce predation, a minimum of twice daily, and the fish subsequently processed (identified and measured) and released. Length of trap deployment will be as short as possible, depending on catch success, but will generally not exceed three days.

All fish will be captured with a dip net and placed into a darkened recovery unit where they will be anesthetized with tricaine methanesulfonate (~60 mg/l), identified to species and measured to the nearest mm total length. Fish will then be allowed to fully recover in fresh water and will be released within the survey site they were captured in.

b) Sampling Schedule and Location

The study area consists of the lower mainstem Sultan River, WRIA 07.0881, from the Diversion Dam (RM 9.7) to the Skykomish River confluence (Figure 1). Select areas will be sampled within this reach. Snorkel surveys will be conducted in sets. Each set consists of

once a week sampling for four consecutive weeks with sets being conducted quarterly (once each season). This is similar to the snorkel survey study performed in 2007 and 2008.

c) Description of any tags, including the method, location and duration of tag attachment.

This study does not employ the use of attached external tags. However, fin clips may be used to identify salmonids re-captured during electrofishing surveys. A combination of pelvic, pectoral and/or caudal fin clips will be utilized. Only fish greater than 45 mm in length will be clipped. An effort will be made to keep the size of the clip as small and uninvasive as possible while remaining readily identifiable in subsequent captures.

d) Description of type and dosage of any drugs to be used, purpose of use, and method of application.

To reduce the effects of handling stress, all juvenile fish will be anesthetized with buffered tricaine methanesulfonate (about 60mg/l). Any adult fish captured will be immediately released unanaesthetized.

e) Temporary holding time prior to release of animal.

After processing, fish will be allowed to fully recover in fresh water as necessary and will be released within the survey site they were captured in.

f) Number and type of samples to be taken.

Fish will be identified to species, measured to the nearest mm total/fork length and assessed for hatchery marks. No tissue samples will be taken.

3. Possible Alternatives to Using the Proposed Methods

As discussed in Section F.5, there are no alternative methods available that will meet the stated objectives of the study. Careful consideration has been given to selecting a sampling approach to assess seasonal habitat use and relative abundance of juvenile salmonids in the lower Sultan River and off-channel habitats. The combination of snorkeling and electrofishing surveys was determined as the most appropriate methods for accomplishing this.

4. Potential for Injury or Mortality to the Animals Involved, Steps to Minimize Adverse Effects and to Ensure that Animals will be taken in a Humane Manner.

Potential for injury and mortality to fish is most likely to occur during electrofishing surveys, and subsequent processing of the captured fish. Electrofishing injuries to juvenile salmonids will be reduced by several methods. First, the guidelines for electrofishing published by the

NMFS (NMFS 2000) will be strictly adhered to during sampling. Furthermore, electrofishing current is supplied by using two hand-held wands as the anode and cathode, instead of the traditional format of a hand-held wand anode, and a "rat-tail" cathode (see Nielsen 1998). Juvenile fish captured using this technique are exposed to a brief electrical current before they are captured in the dip net. Only experienced individuals properly trained in the use of electrofishing equipment will perform the surveys. R2 personnel have several years of experience electrofishing for juvenile salmonids in local rivers, including several years of surveys in the middle Green River, with low injury/mortality rates (R2 Resource Consultants 2006). "Smooth" DC current at voltages of less than 400 has proven effective in local waters, and will be used in this study.

Stress, rather than shocking, has been correlated to the reduced survival of juvenile salmonids exposed to electrofishing (Nielsen 1998). Handling of the fish processed as part of this research will be minimized. If any fish appears distressed, it will not be processed (anesthetized and measured), but allowed to immediately recover in freshwater and released. Water temperatures will be monitored, and no electrofishing will take place in water over 18ºC.

During fall electrofishing surveys the area to be shocked will be visually inspected for adult Chinook or steelhead that may be present. Any area containing adult listed salmonids (Chinook or steelhead) will not be electrofished. In addition, areas containing salmonid redds will also be avoided during surveys.

Electrofishing activities in 2007 and 2008 have not resulted in any immediate injury or mortality of listed salmonid species. Overall, 24 juvenile Chinook have been captured in electrofishing and minnow trapping surveys performed in 2008. These fish were captured and released unharmed in January and February. No Chinook were captured during 2007 electrofishing work.

H. DESCRIPTION AND ESTIMATES OF TAKE

1. Description of the Recent Status and Trends of Each Species and/or Population to be Taken.

The Puget Sound ESU encompasses all Chinook populations from the Elwha River on the Olympic Peninsula to the Nooksack River in North Puget Sound and south to the Nisqually River. Overall, most Puget Sound Chinook populations are a fraction of their historic levels. However, specifically in the Sultan River, escapement estimates from 1978 to 2004 have

averaged 494 fish, ranging from 235 to 937, and increased contribution to the Snohomish basin escapement from 7 to 12 percent since 1986 (CH2M Hill 2005). Since 2001, the nearby Wallace River hatchery has phased out fall Chinook production, and now the relatively high returns of all native fall Chinook to the Sultan River in recent years is a positive trend.

The Puget Sound steelhead distinct population segment (DPS) was listed as threatened in 2007. The DPS includes all naturally spawned anadromous winter-run and summer-run *O. mykiss* (steelhead) populations, in streams in the river basins of the Strait of Juan de Fuca, Puget Sound, and Hood Canal, Washington including the Sultan River basin. From 1993 to 2005 escapement estimates of native steelhead in the Sultan River have averaged 259 fish (range of 66 to 574). Although in general the escapement record is short in the Sultan River it appears to closely track what is occurring in the Snohomish River system as a whole (CH2M 2005). Escapement goals in the Snohomish River have not been met since 1995, but recent data suggests that populations are starting to recover.

2. *Estimates of Potential Annual Mortalities by Take Category, Including Justifications*

Further information on potential mortality rates is available in section G.4 and is discussed below in section H.3.

3. *Derivation of Take Estimates*

Specific take estimation is provided in Table 1 at the end of this document in Attachment A. An estimated 150 naturally produced juvenile (age-0+ and age-1+) Chinook salmon and 150 juvenile hatchery Chinook (as identified by clipped adipose fin) salmon will be captured during electrofishing surveys. An estimated 500 naturally produced juvenile steelhead (or rainbow/cutthroat trout) will be captured during electrofishing surveys. All take approximations are educated estimates based on historical sampling of the project area by other researchers, and similar sampling performed by R2 Resource Consultants in 2007 and 2008 in the Sultan River as well as in other studies. An understanding of the number and habitat use of the Sultan River by juvenile salmonids is a key concept in our sampling plan, and is therefore difficult to exactly quantify until sampling begins. However, preliminary study results from electrofishing sampling performed in early 2008 in the Sultan River indicate a greater population of young of the year Chinook than earlier anticipated. In order to electrofish a representative reach of all areas snorkeled (9 sites) in each season (3 sets) an increased number of Chinook take has been requested for 2009, with no increase in estimated unintentional mortality. Electrofishing in early 2008 did not lead to any immediate injury or mortality to Chinook salmon, therefore a take estimate of 150 in 2009 rather than 75 Chinook

(2008) will allow for better coverage of the sampling areas with little to no anticipated increase in injury or mortality to juvenile Chinook. Overall, hatchery Chinook populations in Puget Sound are greater than naturally produced fish, and this is reflected in our take estimates (Brennan et al. 2004). In recent years, WDFW has released hatchery reared steelhead smolts at the mouth of the Sultan River, and at the powerhouse. Our survey activities will be coordinated around any hatchery releases in order to minimize large captures of hatchery steelhead juveniles. Unintentional mortality of not more than 3 naturally produced and 3 hatchery produced Chinook salmon is anticipated to occur. Unintentional mortality of not more than 5 naturally produced steelhead/rainbow trout is anticipated to occur. Strict adherence to electrofishing guidelines and the use of trained and experienced individuals further minimizes the possibility of a Chinook or steelhead mortality. No mortalities from snorkel observations or the deployment of minnow traps, a passive capture technique, is expected. No mortalities or immediate injuries from snorkel observations or minnow trapping were observed in 2007 and through May 2008. All mortalities will be unintentional. A maximum unintentional take (mortality) of less than 5% from electrofishing is a reasonable number based on our past experience sampling in similar conditions.

4. USFWS Listed Species

The remote possibility exists to capture Puget Sound and Coastal DPS Bull Trout during juvenile salmonid surveys that will be conducted in the Sultan River, Washington. However, no information has been found supporting a natal population of bull trout in the Sultan River (WDFW 1998; King County 2000; Snohomish County 2005; CH2M Hill 2005). Adult and sub-adult bull trout populations residing in the upper Skagit River generally move downstream during the late winter and early spring periods (January-April) before their entry into Puget Sound. These fish will select temporary refugia in downstream portions of tributary streams during their migration to saltwater, however this is generally less than one day in duration. Sub-adults will spend up to several months in the lower reaches of the Skagit River (North Fork and South Fork) before their entry to saltwater. Skykomish River bull trout follow similar patterns, whereby they reside in the lower Snohomish River for up to several months before their entrance to saltwater. The above life history patterns indicate that an encounter in the Sultan River would be unlikely. If a bull trout is encountered, it would be allowed to recover and immediately released without further handling. Only one native char was observed during sampling and snorkeling surveys in 2007 and through May 2008. One sub-adult native char was observed during snorkel surveys on 28 September 2007. It was observed in a deep water location whose habitat conditions were not suitable for backpack electrofishing.

I. TRANSPORTATION AND HOLDING

No live individuals will be transported from the capture site; all captured species will be released within 100 feet of their capture location. No individuals will be held for extended periods. All anesthetized individuals will be released after a recovery period in fresh water.

J. COOPERATIVE BREEDING PROGRAM

R2 Resource Consultants is willing to participate in a cooperative breeding program and to maintain or contribute data to a breeding program, if such action is requested. However, upon project completion, all data collected will be the property of Snohomish County PUD, Washington and will be released only at their discretion.

K. PREVIOUS OR CONCURRENT ACTIVITES INVOLVING LISTED SPECIES

1. Identification of Pervious Permits to Work with Federally-Listed Species.

Permit 1: U.S. Fish and Wildlife permit No. TE005113-6 covering bull trout (*Salvelinus confluentus*) under Section 10(a)(1)(A) of the Endangered Species Act. Effective date 10 April 2008, expiring 16 August 2010. This permit was issued for work on Boundary Reservoir, Ross Lake and tributaries, Baker River basin from the mouth to headwaters, Lake Shannon, Baker Lake and Middle Skagit River. Principle officer is Dr. Dudley Reiser. Other authorized individuals include Eric Jeanes, Catherine Morello, and Mike Gagner of R2 Resource Consultants.

Permit 2: NOAA permit No 1609 covering juvenile fish surveys in the mainstem and off-channel habitats of the Sultan River, Washington. Permit expires on 31 December 2008. Permit holder and principal investigator is Dudley Reiser, Field supervisors are Eric Jeanes and Catherine Morello of R2 Resource Consultants.

2. Mortality Events of Listed Species in the Last Five Years

Overall, over 200 native char have been tagged and released by R2 personnel under Permit 1 above. One of these fish was injured during hook and line surveys in the Baker River basin. The fish was released alive; it is not known whether the injury was fatal. No immediate mortalities have occurred during work under Permit #1 listed above. No immediate injuries or mortalities were observed to Chinook salmon with research conducted under Permit #2 listed above.

L. CERTIFICATION

"I hereby certify that the foregoing information is complete, true and correct to the best of my knowledge and belief. I understand this information is submitted for the purpose of obtaining a permit under the Endangered Species Act of 1973 (ESA) and regulations promulgated thereunder, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or to penalties under the ESA."

Signature

Date

Dr. Dudley Reiser
Senior Fisheries Biologist

REFERENCES

Brennan, J. S., K. F. Higgins, J. R. Cordell and V. A. Stamatiou. 2004. Juvenile salmon composition, timing distribution, and diet in marine nearshore waters of central Puget Sound in 2001-2002. King County, Dept. of Natural Resources and Parks, Seattle WA.

CH2M Hill. 2005. Project effects on anadromous bull trout and salmon in the Sultan River. Prepared for Public Utility District No. 1 of Snohomish County.

Hankin, D. G. and G. H. Reeves. 1988. Estimating total fish abundance and total habitat area in small streams based on visual estimation methods. Canadian Journal of Fisheries and Aquatic Sciences 45:834-844.

King County Dept. of Natural Resources. 2000. Literature review and recommended sampling protocol for bull trout in King County. Seattle, WA.

National Marine Fisheries Service (NMFS). 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act (ESA). Portland, Oregon.

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R2 Resource Consultants, Inc. 2006. Juvenile salmonid use of lateral habitat in middle Green River, Washington. Data Report. Prepared for the U.S. Army Corps of Engineers, Settle District, and City of Tacoma Public Utilities, Tacoma Water by R2 Resource Consultants, Inc.

Snohomish County Surface Water Management Division. 2005. Snohomish River Basin Salmon Conservation Plan.

Vincent, R. 1971. River electrofishing and fish population estimates. Progressive Fish-Culturist 33: 163-169

Washington Dept. of Fish and Wildlife and Western Washington Treaty Tribes. 1994. 1992 Washington State salmon and steelhead stock inventory.

Washington Dept. of Fish and Wildlife (WDFW). 1998. Washington State salmonid stock inventory, bull trout / Dolly Varden.

ATTACHMENT A

Table 1. Anticipated annual take of Puget Sound Chinook salmon and steelhead trout by R2 Resource Consultants, Inc. in the Sultan River, Washington for the 2009 field seasons.

ESU / Species	Life Stage	Origin	Take Activity	Number of Fish Requested	Requested Unintentional Mortality	Research Location	Research Period
PS Chinook Salmon	Juvenile	Natural	Capture, handle, mark, release	150	3	Sultan River	Electrofishing February 1-28 and November 1-30, 2009
PS Chinook Salmon	Juvenile	Hatchery, clipped adipose	Capture, handle, mark, release	150	3	Sultan River	Electrofishing February 1-28 and November 1-30, 2009
PS Steelhead	Juvenile	Natural	Capture, handle, release	500	5	Sultan River	Electrofishing February 1-28 and November 1-30, 2009

ATTACHMENT B

Study Plan for Juvenile Salmonid Use of Habitat in the Sultan River

Juvenile Fish Abundance, Life History and Distribution in Mainstem and Off-Channel Habitats of the Sultan River, Washington

Introduction

The Sultan River supports a wide array of fish species, each with a slightly different life history strategy. Populations of Chinook (*Oncorhynchus tshawytscha*), coho (*O. kisutch*), pink (*O. gorbuscha*), and chum (*O. keta*) salmon; steelhead (*O. mykiss*), and coastal cutthroat trout (*O. Clarki*) are present in the system in varying numbers. Bull trout (*Salvelinus confluentus*) are not believed to use the Sultan River for spawning, but are known to use the river as rearing and foraging habitat. The variety of rearing strategies and behavioral tendencies of juvenile salmonids referenced above play a significant role in their evolution as a species as well as their adaptation to local environments. The City of Everett Diversion Dam, located at river mile (RM 9.7) defines the migratory extent of these species within the Sultan River. The presence and operation of the Jackson Hydroelectric Project (RM 16.5) interrupted the natural hydrology of the Sultan River and has potentially changed the fish habitat composition and use in the lower Sultan River. Water management strategies employed in the Sultan River basin may invoke different implications for fish species, based upon their respective distribution and life history strategy. The objectives of this study are to: determine the relative abundance of juvenile salmonids in the Sultan River and identify the species distribution of juvenile salmonids in relation to mainstem and off-channel habitat types.

R2 team members have successfully completed similar studies of the impact of water control projects on juvenile fish for Puget Sound Energy on the White River and for the U.S. Army Corps of Engineers on the Green River. For these studies, R2 conducted day-and nighttime snorkel and electrofishing surveys to monitor the timing and utilization of mainstem and side channel habitat by anadromous salmonids. The White and Green river projects are just two examples of our teams experience in conducting fisheries studies; these and additional examples are described in Section 2, the 2-page resumes of each team member in Section 3, and project summaries in Section 6.

Key Personnel

R2 Resource Consultants has broad experience in the study and evaluation of fish populations, aquatic ecosystems, and riverine processes. Dr. Dudley Reiser is the Project Manager for the study. He will be assisted by Mr. Eric Jeanes the Project Leader who will directly oversee all project activities for the Juvenile Fish Abundance, Life History and Distribution Study. Eric Jeanes has over 15 years of experience conducting fisheries investigations in Pacific Northwest streams and rivers, and most recently was the study lead for projects on the Green and

Sammamish rivers studying the emergence, growth, movement, abundance, and species distribution of juvenile salmonids occupying riverine habitat. Catherine Morello and Mike Gagner will be responsible for field data collection, and supervision of field crew members. Both Ms. Morello and Mr. Gagner have directed field crews conducting day- and nighttime snorkel surveys and backpack and barge mounted electrofishing surveys of stream and rivers throughout western Washington. Curt Kraemer (subcontractor) will provide technical input concerning study timing and logistical issues as well as providing a back up for the field crew. Assisting with field studies will be Adam Weybright; a seasonal field technician will be hired as necessary.

Approach

R2 has carefully reviewed the study approach described in the RSP and has incorporated its major elements into the study proposal outlined below. Particular details of our study are presented in the following Methodology section.

Methodology

To quantify juvenile fish abundance, life history and distribution in the lower Sultan River (Diversion Dam to the Skykomish River confluence) R2 proposes to perform a series of snorkel surveys that will be calibrated using multiple-pass electrofishing. Two spring surveys will be performed, one in the spring of 2007 and one in 2008. One late-summer/early fall survey will be performed in 2007, and one additional survey during the winter of 2007, for a total of four snorkel events. Additional similar work may be required in 2009.

Permitting

Prior to field work, R2 will work with the Co-Licensees to apply for the proper scientific collection permits from the Washington Department of Fish and Wildlife, NOAA Fisheries/NMFS, and U.S. Fish and Wildlife Service (USFWS). The Federal permits are required by law due to the possible "take" of Chinook salmon and bull trout which are listed for protection under the Endangered Species Act (ESA). Although Puget Sound steelhead trout are not currently a federally protected species, the NMFS has recently requested that steelhead trout be include as part of permit applications. Given the review time involved in processing of ESA permits, it is unlikely that a permit can be obtained prior to the spring 2007 surveys. As a result, the spring 2007 surveys would be limited to snorkeling only.

Field Reconnaissance

Surveys to determine the number and distribution of habitat types in the Sultan River are not scheduled to occur until late summer or early fall of 2007 (SP 18 Riverine, Riparian, and

Wetland Habitat Assessment). It is assumed that the peak of Chinook fry emergence in the Sultan River occurs in late winter or early spring. The discrepancies in timing of these two events will require that a field reconnaissance survey be conducted prior to the first proposed juvenile fish sampling scheduled for spring of 2007. In coordination with a District representative, R2 biologists (D. Reiser, E. Jeanes) will conduct a site visit to the Sultan River Study Area to review access locations and river conditions, evaluate the use of field sampling techniques and equipment needs, and identify candidate habitat units/sites (including off-channel areas) to be sampled as part of the juvenile fish surveys. The selection of candidate sites will be based on physical data collected in 2003 and 2004 and local knowledge of habitat use by juvenile salmonids. Candidate sampling areas will include mainstem habitat units including riffles, runs, pool, and cascade units as defined in Pleus et al. (1999). Off-channel areas including backbar channels, alcoves, abandoned channels, and wallbased channels will also be noted during this survey for potential sampling during proposed late winter sampling.

Candidate sampling areas will be flagged in the field and mapped on aerial photographs. To the extent possible, GPS coordinates will be collected at the upstream and downstream most extent of each proposed sampling area. Map figures, annotated photographs, and a brief description (directions, habitat characteristics, estimated size, etc.) of each proposed sampling area will be produced following completion of the field reconnaissance.

For planning purposes, it is assumed that three habitat units of each type (riffle, run, pool) present within Reach 1a will be sampled and two habitat units of each type (riffle, run, pool, cascade) present within Reaches 1b and 2 will be sampled. Using these assumptions, a total of 25 individual habitat units will be surveyed during each of the spring and late summer/early fall surveys. Based on results of early habitat surveys (2003 and 2004) and the study methods described in RSP 5, this would appear to be an appropriate sampling rate to produce abundance and distribution estimates of requisite precision. Preliminary selection of the habitat units to be sampled will occur during the field reconnaissance survey described above.

Spring and Late Summer/Early Fall Surveys

R2 will perform two springtime snorkel surveys (one during the spring of 2007 [exact timing will be dependant on receipt of collection/recovery permits] and one in the spring of 2008) and one snorkel survey in late-summer/early fall of 2007. The purpose of these surveys is to identify relative abundances of subyearling and yearling salmonids and their distribution in the Sultan River. Early spring surveys will take place during the time estimated to have the highest number of fry present, for a maximum population estimate. The timing of these surveys is anticipated to be in late March or early April. Depending on the average daily water temperature at the time of

the spring surveys, there may be a need to conduct nighttime surveys to ensure the highest possible detection of juvenile fish. From our experience in completing juvenile salmonid fish studies on the Green River, there was a significant difference between daytime and nighttime juvenile fish counts when average water temperature dropped below 9ºC. Late summer surveys will take place when all subyearling Chinook should have outmigrated from the system, leaving only stream-type Chinook, coho, and steelhead trout that smolt the following spring.

Spring and summer surveys will generally follow the protocol outlined by Hankin and Reeves (1998) utilizing a two-person averaged independent count approach. If the wetted width of the sample unit is too great for one observer to cover the entire area, the protocol will be slightly modified, with each snorkeler covering half of the habitat area and the two counts will be summed rather than averaged. A third crew member will be on the bank recording data. Prior to conducting the snorkel survey, the length and width of the area to be sampled will be measure using a laser rangefinder and/or reel tape. The area sampled within any given habitat unit will vary depending on water velocity, depth, and safety concerns. The surveyors will work slowly in an upstream direction identifying and counting species and age class of fish observed. Only those fish observed within the boundary of the sample area delineated by the survey crew will be included in the count.

The Sultan River watershed is managed to protect the drinking water supply for the City of Everett and generally experiences very low levels of turbidity (PAD 2005). However, on occasion, the turbidity level has risen to a level that would make detection of juvenile fish during snorkel surveys difficult. Therefore, prior to conducting each snorkel survey a secchi disk reading will be used to determine the maximum distance of underwater visibility. Snorkel surveys will not be conducted if the secchi disk reading is less than two times the maximum depth of the area to be snorkeled.

It is assumed that electrofishing calibration will be performed on a subsample of the snorkel units within each of the three channel reaches. These surveys will be used to develop a “true” count of the fish on a per unit area basis which will then be used to estimate the total number of fish in each habitat type in each stream reach. A Smith-Root, Inc. Model 15-C programmable wave output backpack electrofishing unit, using “straight DC” current will be used to conduct multi-pass removal electrofishing surveys. Electrofishing surveys will adhere to guidelines developed for electrofishing waters containing salmonids listed under the ESA by the NMFS (2000). Due to the size and depth of the Sultan River below the City of Everett Diversion Dam, it is assumed that in all but the lowest flow conditions, blocking nets cannot be installed across the entire width of the river. Furthermore it is impractical to assume that backpack electrofishing

surveys can be conducted in high velocity areas with large, uneven bed elements. Knowing this, we have assumed that electrofishing calibration will sample only those areas within sampled habitat units that can be efficiently and safely surveyed using a backpack electrofisher.

To complete the electrofishing calibration survey, each sample site will be enclosed with a 5-mm-mesh blocking net placed around an area of the habitat unit that is practical and safe to sample. Blocking nets will be secured in position using steel fencepost and rocks to ensure population closure. The area defined by the blocking net will be measured using a laser rangefinder and/or reel tape. Electrofishing will begin at the downstream most point within the sample area and continue upstream to the edge of the blocking net which will constitute one pass. Electrofishing will continue in the block net area until sufficient numbers have been captured to generate a maximum-likelihood population estimate. All removal-depletion surveys will be completed using the same crew to ensure equal effort on each subsequent pass, despite declining fish numbers. Population estimates will be computed for all salmonids using the Zippin (1958) formula for three pass removals; 95 percent confidence intervals will be calculated using standard error estimates of Robson and Regier (1971). All efforts will be made to minimize injury and mortality to sampled fish. All captured fish will be released near their capture location.

Winter Survey

The survey of off-channel habitat will occur during the December 2007 to January 2008 timeframe and will focus on areas believed to provide overwintering habitat for juvenile salmonids. Off-channel habitat areas of the Sultan River downstream of the City of Everett Diversion Dam will be identified and mapped during completion of RSP 18: Riverine, Riparian, and Wetland Habitat Assessment. These areas would include those noted in the Field Reconnaissance survey and may include side channels, groundwater channels, floodplain ponds and riparian wetlands. R2 would propose to work closely with the field crew responsible for completing the riverine habitat surveys to ensure there is a clear definition of off-channel areas and that the location of these areas is mapped in such a way as to ensure relocation during winter surveys. For planning purposes it is assumed that at least five off-channel areas will be sampled during winter 2007/2008 survey.

Survey methods will be similar to those described for the spring and summer/fall sampling with the exception of multi-pass exclusion sampling. Other methods that may be used in place of multi-pass exclusion would include mark recapture and/or the use of baited minnow traps. These methods would not provide population estimates but would result in an index of abundance. Winter surveys will be weather dependant, with the primary goal to determine which types of

off-channel habitat are most heavily used by overwintering salmonids. R2 believes that backpack electrofishing, if stream conditions permit, (i.e., water clarity, depth and flow), would be the most cost effective survey method.

Analysis and Reporting

After the completion of the 2007 field work, a progress report will be prepared that presents the results of the spring and summer/fall 2007 surveys. R2 will also make all habitat and census data available to the District at this time. The final report will be prepared at the completion of all field activities in 2008. The report will be presented in two parts including a summary and analysis of data for the spring and summer/fall surveys and estimates of juvenile abundance during the winter surveys of selected off-channel habitats. The report will contain photographic, textual, and tabular summaries and analysis of the habitats surveyed. Details for 0+ and 1+ age Chinook and coho salmon and steelhead trout will include:

- Juvenile abundance estimates and density (fish/m^2) by habitat unit and type and by reach,
- Abundance estimates for the entire lower Sultan River (the entire survey area), and
- Confidence limits of abundance and density estimates.

Schedule

The schedule for the Juvenile Fish Abundance, Life History and Distribution study is presented in Table 1. A progress report will be provided after completion of 2007 field work. A final report will be completed by August 2008. The schedule of additional work to be completed in 2009 is still under discussion with the client.

Table 1. Juvenile Fish Abundance, Life History and Distribution Study Schedule

Activity	**2007**				**2008**				**2009**		
	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q	4 Q	1 Q	2 Q	3 Q
Initial field study coordination and preparation – permit application	----										
Reconnaissance survey	▲										
Snorkel abundance survey		▲	▲	▲		▲			**?**	**?**	**?**
Progress Report for 2007 work					---						
Data entry and analysis						----	----				
Final report completed							■				
Meeting/Discussion of results								●			

----- office activity ▲ field activity ● agency site visit/meeting ◘ interim report ■ final report

References

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National Marine Fisheries Service (NMFS). 2000. Guidelines for electrofishing waters containing salmonids listed under the Endangered Species Act (ESA). Portland, Oregon.

Pleus, A. E., D. Schuett-Hames and L. Bullchild. 1999. TFW Monitoring Program methods manual for the habitat unit survey. Prepared for the Washington State Dept. of Natural Resources under the Timber, Fish and Wildlife Agreement. TFW-AM9-99-003.

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Zippin, C. 1958. The removal method of population estimation. J. Wildl. Manag. 22: 82–90.

ATTACHMENT C

Staff Resumes

DUDLEY W. REISER, Ph.D. – PRESIDENT
Senior Fisheries Scientist

Dr. Reiser is a fisheries scientist with more than 30 years experience designing, implementing, and managing fisheries and aquatic ecology projects, and habitat and instream flow assessments. His particular areas of expertise include fish ecology (anadromous and resident species), habitat assessments and criteria development, endangered species evaluations, assessments of flow regulation on fish populations and habitats, fisheries habitat enhancement, fisheries engineering, instream flow studies, assessments of sedimentation impacts on aquatic ecosystems, and flushing flow studies (related to sediment deposition). He has been involved in technical studies related to numerous hydroelectric projects including most recently, Jackson Hydroelectric Project (Washington), Boundary Hydroelectric Project (Washington), Skagit Project (Washington), White River (Washington), Clackamas (Oregon), Deschutes (Oregon), Carmen-Smith (Oregon), Connell and Whitman (Alaska), Cooper Lake (Alaska), Upper American River (California), Big Creek (California), Tapoco (North Carolina), Natahala (North Carolina), and Missouri-Madison (Montana).

EDUCATION

Ph.D. (Forestry, Wildlife, and Range Sciences – major in fishery resources) University of Idaho, 1981
M.S. (Water Resources) University of Wyoming, 1976
B.A. (Zoology) Miami University, Ohio, 1972

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

American Fisheries Society (AFS), Certified Fisheries Scientist (No. 1447); re-certified 2002
Society of Environmental Toxicology and Chemistry
Certified USFWS IFIM Course - Computer Modeling (201), IFIM:IFG210, SNTEMP (310)
Member, Independent Science Panel (ISP) – Washington State – appointed by Governor Gary Locke to serve on Salmon Recovery Science Panel, Term: 1999-2003; reappointed through 2006.

EXPERIENCE

Instream Flow, Flushing Flow, Ramping Rate Determinations: Dr. Reiser is a recognized expert in the area of instream flow needs for aquatic ecosystems. Since his doctoral research that involved defining spawning and egg incubation flow needs of anadromous salmonids, he has conducted numerous studies and published many papers related to determining instream flow needs and assessing effects of flow regulation on aquatic biota. He has been involved in instream flow projects in Washington, Oregon, Alaska, California, Colorado, Idaho, Maine, Montana, New York, Vermont, and Wyoming, and has applied a variety of different instream flow methods including the USFWS IFIM/PHABSIM, Tennant (Montana) Method, Habitat Mapping, Wetted Perimeter (WP), Trout Cover Rating (TCR), R-2 Cross Method, and the New England Method. He recently served as lead fish biologist as a 3rd party contractor to FERC where he was responsible for impact analysis for the DEIS of Portland General Electric's operations of the Clackamas River Hydroelectric Project. The work included an evaluation of three instream flow methods including 1-d and 2-d PHABSIM and an expert habitat mapping method. Dr. Reiser also recently served as the Project Manager of a national technical support contract with the U.S. Forest Service where he participated in instream flow related studies associated with hydroelectric

relicensing involving a number of resource issues including fish flows, impacts of flow fluctuations, impacts of whitewater flows on aquatic biota, and sediment transport issues. Dr. Reiser served as the Project Manager for Pacific Gas and Electric in an assessment of potential ecological effects (fish, aquatic invertebrates, riparian) of whitewater release flows in the Pit River, California. He also recently served as Project Manager of a large-scale ramping rate study conducted on the Flathead River, Montana that included development of a flow attenuation model, a stranding study, and invertebrate recolonization.

Fish Population Assessments: Dr. Reiser has directed numerous studies focused on determining fish population abundance and dynamics in streams, rivers, and lakes. These studies have most recently included fish studies conducted for the City of Kent (urban streams), General Electric (Housatonic River, Massachusetts), Seattle Public Utilities (Lake Chester Morse and Cedar watershed), J.L. Storedahl Company (East Fork Lewis River and series of adjoining ponds), Bureau of Indian Affairs (upper Klamath Basin watershed and Klamath Lake), Ketchikan Public Utilities (Whitman and Connell lakes, and tributaries), and the U.S. Fish and Wildlife Service (Coeur d'Alene basin and St. Regis River). He has applied and is familiar with many sampling techniques including snorkeling, electrofishing, seining, trap/gill netting, pop-nets, cast nets, trammel nets, ichthyoplankton sampling, and others.

Endangered Species Issues: Direct experience working on endangered species issues related to resource developments. Dr. Reiser is currently leading a study on Lake Chester Morse focused on evaluating effects of lake level changes on bull trout redd inundation and egg survival to emergence. Recently, he was the technical lead for a study evaluating the thermal effects of the White River project operations on ESA listed Chinook salmon. Project Manager for Tri-County Urban Issues ESA response project focused on evaluating restoration options for listed Chinook salmon within urban watersheds. Project Manager of an HCP developed for a gravel mine near the East Fork Lewis River, Washington, and an HCP for the City of Kent related to water supply. Project Manager of a study evaluating the effects of lake elevation change of Upper Klamath Lake on endangered Shortnose and Lost River sucker habitat.

Habitat Assessments and Habitat Suitability Curve Development: Dr. Reiser has worked on habitat assessments and HSI curve development projects throughout the Pacific Northwest. Most recently he participated in a large scale habitat mapping study of the entire Willamette River basin for the Corps of Engineers. Developed habitat suitability curves for brown and brook trout, bull trout, Chinook salmon, pink salmon, chum salmon, and steelhead trout. Collaborated with USFS instream flow personnel in preparing an approach for developing regionalized HSI curves for use in hydroelectric relicensing projects, and then completed a technical comparison of regional HSI curves with empirical data sets.

Fish Passage: Recently designed and directed a fish barrier analysis study to assess potential flow-dependent barriers located in Ward Creek, below Connell Dam near Ketchikan, Alaska and published results in a peer-reviewed journal. Co-developer of a procedure for assessing fish passage problems at low head hydro projects. Assessed barrier potential of falls in two Idaho streams, and formulated plans for removal of an abandoned power dam in the East Fork Salmon River drainage in Idaho.

ERIC D. JEANES, M.S.
Fisheries Biologist

Mr. Jeanes is a fisheries biologist experienced in conducting fisheries investigations in riverine and lacustrine systems. He has experience in evaluating the effects of perturbations of stream habitat on fish populations in the Pacific Northwest. His expertise includes study design, data collection, data analysis, report writing, and presentation of results. Mr. Jeanes is experienced in the analysis and interpretation of population, habitat, and water quality data as it relates to both salmonid and non-salmonid fish populations.

EDUCATION

M.S. (Biology) Montana State University, 1997
B.S. (Fish and Wildlife) Montana State University, 1993

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

American Fisheries Society Member (1990-2006)

EXPERIENCE

Telemetry Studies: Mr. Jeanes has more than ten years of experience conducting telemetry studies throughout the Pacific Northwest. His experience has spanned the design, implementation, as well as the data analysis of both radio and ultrasonic telemetry techniques. He has used telemetry techniques to identify home range of endangered pallid sturgeon in Montana and South Dakota, spawning migrations of rainbow trout and arctic grayling in Montana, distribution and habitat use of Walleye in the mid-Missouri Reservoir Complex, Montana, juvenile Chinook, coho, and sockeye passage through hydroelectric facilities in Washington, cutthroat trout home range in the Coeur d'Alene River, Idaho, and native char distribution and habitat use in western Washington. Mr. Jeanes has surgically implanted over 50 combined acoustic radio transmitters (CART tags) in native char to identify life history patterns, seasonal migrations, and habitat use in the Upper Skagit River, Washington. Recently, he surgically implanted over 150 ultrasonic transmitters in native char to identify the habitat use, periodicity, and timing of entry of char to and from the northern Puget Sound and over 100 transmitters in juvenile steelhead smolts to estimate survival throughout the Green/Duwamish River into Puget Sound and Juan de Fuca Strait.

Endangered/Threatened/Sensitive Species Studies: Mr. Jeanes is currently the project manager for a multi-year study looking at the potential effects of seasonal drawdowns on an adfluvial population of bull trout in Ross Lake, Washington. The objective of the study is to use radio telemetry to identify life history parameters of bull trout residing in Ross Lake and relate them to reservoir management strategies employed by the City of Seattle. Mr. Jeanes is also using acoustic telemetry to determine the periodicity and habitat use of adult and sub-adult bull trout in Puget Sound nearshore habitats as well as estuarine habitats of the Snohomish, Skagit, and Stillaguamish rivers. Mr. Jeanes is also the project manager for a study that is attempting to define the periodicity of native char presence in the lower Chehalis River/Grays Harbor for the U.S. Army Corps of Engineers, Seattle District. Mr. Jeanes was task lead in bull trout studies and habitat characterizations within the Pend Oreille drainage related to the City of Seattle's Boundary Hydroelectric Project as well as for an instream flow study in the Lostine River, Oregon to identify flows needed to support resident bull trout and Chinook salmon. He devised and

supervised a study on the evaluation of Arctic grayling populations in Ennis Reservoir, Montana, as part of his graduate thesis. Led a radio telemetry effort to determine the population status and life history of fluvial, resident, and adfluvial cutthroat trout in the Coeur d'Alene River basin, Idaho, and assisted in radio telemetry studies designed to obtain home range and habitat utilization of the pallid sturgeon in the lower Missouri and Yellowstone rivers, Montana. Fisheries lead for a multi-year project that is examining the removal of a low head dam that negatively affected upstream migrations of salmon on Goldsborough Creek, Washington. The study is utilizing spawning and snorkel surveys to monitor pre- and post-removal distribution of chum and coho salmon throughout the basin. Currently the fisheries lead for an ongoing project that involves the downstream passage of juvenile salmon through the Electron Project for Puget Sound Energy.

Fish Population Assessments: Assisted in fisheries studies on three mid-Missouri impoundments to determine relative abundance, composition, and size class structure of resident and adfluvial salmonids and their interaction with non-native fish species. Currently studying the emergence, growth, movement, abundance, and species distribution of juvenile salmonids occupying the lateral habitat in the Green and Sammamish rivers, Washington, for the U.S. Army Corps of Engineers, Seattle District. Directed the evaluation of juvenile Arctic grayling population status in Ennis Reservoir, Montana, including an effort to provide for a reserve population of adult Arctic grayling. Grayling identified were used in recovery efforts of fluvial grayling in the Big Hole River, the last fluvial population of Arctic grayling remaining in the contiguous 48 states. Collected and analyzed IFIM and PHABSIM data identifying baseline flows to support anadromous and resident fish flow recommendations in Idaho.

Analysis of Water Supply Projects: Involved in the development of an aquatic habitat conservation plan for the City of Tacoma Water Department on the Green River, Washington. The plan for Howard Hanson Reservoir includes raising the pool to provide for 22,400 acre-feet of storage, of which 9,600 acre-feet will be used during periods of low flow. Recommended mitigation and restoration activities that are included in the development of a fish passage facility for salmon in the upper Green River watershed, outmigrant monitoring, reservoir refill rate analysis, use of artificial freshets to facilitate juvenile salmon migration to the Green/Duwamish River estuary, and monitoring and rehabilitation of lateral habitats used by juvenile salmon. Assisted in the aquatic resource sections of a SEPA documentation concerning a 56-cfs water right transfer from industrial to municipal use on the Snohomish River, Washington. Analyzed native char population data for the City of Seattle Water Department on Chester Morse Lake, the primary water supply for the City of Seattle. Chester Morse Lake is the site of two pumping plants that are used to meet water demands during periods of drought. Analysis included abundance and distribution, life history, and the spawning habitat used by unexploited populations of bull trout, rainbow trout, and pygmy whitefish. Participated in a limiting factor analysis of primary productivity in Hyalite Reservoir, the primary water source for the city of Bozeman, Montana. The study concentrated on the ammonium stimulation of dark carbon fixation as a measure of nitrogen deficiency in chlorophyte species.

Behavioral Investigations: Investigated the behavioral response to water current of an inlet spawning population of Arctic grayling from the Madison River, Montana. Evaluated the microhabitat use of the stream environment by age-0 Arctic grayling and timing of migration to Ennis Reservoir via the Madison River. Monitored the movements of walleye in Holter Reservoir, Montana; and the spawning migration of Arctic grayling in Ennis Reservoir, Montana, via radio and ultrasonic telemetry. Assisted in data collection efforts to evaluate potential effects of water fluctuations on reproductive success of shoreline spawning fishes in Hauser and Holter reservoirs.

CATHERINE M. MORELLO
Biologist

Ms. Morello is an aquatic biologist with more than 8 years experience directing and conducting biological sampling, habitat surveys, and other aquatic projects in freshwater and marine systems. In particular, she has specialized in monitoring aquatic habitat for salmonid presence and utilization. She is experienced in the taxonomic identification of marine, estuarine and freshwater fish, and invertebrates, and is proficient in underwater identification and enumeration of fish, particularly salmonids. Ms. Morello has completed several extensive literature searches and reviews, and has provided technical assistance in the development of habitat conservation plans, numerous baseline and project monitoring programs, and data management and analysis.

EDUCATION

B.S. (Marine Biology) Western Washington University, 1994

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

NAUI Openwater SCUBA Certification
Adult CPR and Standard First Aid

EXPERIENCE

Freshwater Biology: Ms. Morello has performed extensive fish population monitoring utilizing hook and line, snorkeling, backpack and boat electrofishing, and beach seining techniques. She is experienced in fish marking/tagging technology including the use of Passive Integrative Transponders (PIT), acoustic, radio, floy and elastomer tagging techniques. She has performed numerous snorkel surveys to identify and enumerate salmonid populations. Specifically, she has monitored juvenile salmonid use of engineered log jams in the Green River, off channel habitat in the East Fork Lewis River and tributaries to the Baker River system. She has performed detailed salmonid dissections in the field and laboratory for genetic and feeding habit assessment. Ms. Morello has identified salmonid spawning habitats and performed spawning surveys in numerous streams and river systems. In particular she has performed 6 years of spawning surveys on Goldsborough Creek, Washington in an effort to quantify salmon populations before and after the removal of an outdated dam. Ms. Morello assisted in field data collection and processing for computer mapping of several stream channels in order to assess instream flow needs. She has been responsible for inventory of large woody debris, spawning gravel, and areas containing juvenile salmonid rearing potential in many river systems. Ms. Morello has performed in depth assessment of salmonid production utilizing fyke netting and emergent trapping on a Cedar River side channel in Washington. In addition, Ms. Morello has experience assessing invertebrate populations in the Deschutes River, Oregon, Madison River, Montana, and many Puget Sound streams and rivers. She has performed detailed summarization of existing literature concerning lamprey and whitefish life history and passage research. She has also performed an extensive literature review concerning spring-fed stream systems in relation to fish production.

Telemetry: Ms. Morello is experienced in the maintenance and operation of radio and acoustic telemetry equipment. In particular, she has assisted with juvenile Chinook radio tracking studies in the forebay to a

hydroelectric facility on the Puyallup River, and with acoustic tagging of redband trout in the Klamath River basin, Oregon. Currently she is assisting with radio and acoustic tagging and tracking of over 200 native char, Chinook salmon, and cutthroat and rainbow trout in the greater Puget Sound basin. She is responsible for assisting with fish capture, surgical implantation of tags, and subsequent fixed and mobile tracking efforts and data management.

Marine and Estuarine Biology: Ms. Morello has monitored dredging activities onboard U.S. Army Corps of Engineers vessels as part of a study to determine effectiveness of bio-excluders on invertebrates, and the entrainment of fish by the dredge head. She was responsible for invertebrate and fish identification and enumeration. She has performed intensive beach seining to determine native char and salmonid utilization of the Chehalis and Duwamish river estuaries in Washington. She has participated in an acoustic and PIT tagging study to monitor the effects of high water temperature on the migration of Chinook salmon through the Lake Washington Ship Canal. Ms. Morello is experienced at determining age and life history of salmonids based on scale reading techniques.

Habitat Assessment: Ms. Morello has been involved in detailed qualitative and quantitative habitat surveys using a variety of assessment techniques, including surveying, habitat mapping, substrate, and invertebrate sampling. She has performed extensive inventories of stream channels, riparian vegetation, and aquatic habitat conditions for the U.S. Forest Service on a watershed-wide scale. Ms. Morello has conducted large-scale habitat mapping on 22 miles of the Cedar River, and over 18 miles of the Green River, Washington. She was responsible for obtaining and reviewing numerous habitat assessment protocols as part of the Tri-County urban issues salmon recovery effort in the Puget Sound region.

Endangered/Threatened/Sensitive Species Studies: Ms. Morello is currently studying the effects of reservoir drawdown on adfluvial population of native char in Ross Lake, Washington. She has assisted with radio telemetry studies of juvenile Chinook passage in a Puyallup River dam forebay and adult Chinook passage through the Lake Washington Ship Canal. She has extensive experience working with threatened native char populations in Puget Sound. Ms. Morello has also aided in the preparation and coordination of scientific collection permits for many projects.

Multi-Species Habitat Conservation Plan: Ms. Morello assisted in the preparation of aquatic sections, including extensive review of data on current salmon and trout populations, and their federal (Endangered Species Act) status. She has also assisted in the review of literature involving large woody debris (LWD) input and depletion, buffer zone widths for water quality protection (stream side shade, and sediment input), and stream temperature condition

Database Management and Analysis: Ms. Morello is responsible for updating and maintaining R2 Resource Consultant's in-house library, which consists of over 3,000 cataloged fisheries related documents. In addition, she has compiled a reference library of habitat suitability curve information for Northwest streams and rivers. She is familiar with the collection of habitat data for use with the USFS SMART database.

COMPUTER SKILLS

Experience includes Microsoft Word, Word Perfect, Excel, Lotus, Access, and ArcView.

MICHAEL R. GAGNER
Aquatic Scientist

Mike Gagner is an aquatic scientist with over 16 years of experience conducting baseline evaluation and monitoring of aquatic habitat, water quality, and riparian conditions for rivers and streams throughout the Pacific Northwest. He has managed and conducted several watershed and site-specific assessments of land use impacts and water control project on fish habitat, fish populations, and watershed processes in Washington State. Mr. Gagner recently conducted field surveys of stream channel morphology, riparian function, water quality, invertebrate community, fish habitat, and fish utilization in rivers and streams throughout the Mt. Baker-Snoqualmie National Forest. He is currently conducting an evaluation of instream flow needs for projects in eastern Washington and southern Oregon. As part of these projects, he has directed and participated in the collection of long-term monitoring data related to stream flow quantity, water quality, fish habitat use, and monitoring long-term changes in channel morphology. Mr. Gagner has experience with the use of several fisheries, riparian, and instream flow assessment methodologies including: Timber Fish and Wildlife fish habitat unit surveys, Hankin and Reeves fish habitat mapping, Instream Flow Incremental Methodology (IFIM), Physical Habitat Simulation Modeling (PHABSIM), Washington Department of Natural Resources watershed analysis, USFS Region 6 Level II Stream Survey Protocol, USFS Region 10 Watershed Sensitivity Analysis, and the USFS Federal Guide for Watershed Analysis.

EDUCATION

B.S. (Natural Science) Lewis Clark State College, 1989

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

Washington Department of Natural Resources, Certified Watershed Analyst (1992-1996)
- Fish Habitat, Stream Channel, Riparian, Hydrology, Water Quality, and Monitoring Assessment Modules

Certified USFWS Courses:
- Design and Negotiating Studies using IFIM
- Field Techniques for Stream Habitat Analysis
- Computer Modeling of Aquatic Habitat using PHABSIM

EXPERIENCE

Instream Flow/Hydroelectric: Directed and participated in numerous instream flow studies as part of watershed assessments, water rights adjudication, and hydroelectric licensing/relicensing activities throughout the Pacific Northwest and Alaska. Responsibility on these projects has included: project management, study design, sample site selection, agency consultation and coordination, development and selection of habitat suitability criteria, coordination of data collection, habitat mapping and assessment, data analysis, hydraulic and habitat modeling, report preparation, and client and stakeholder presentation. Mr. Gagner specializes in the design of field sampling methods on large rivers and in the placement of sampling sites to capture unique stream characteristics (i.e., critical fish passage sites, spawning areas, off-channel areas, complex island habitat). He has extensive formal training from the USGS (formally National Biological Survey) instream flow group in study design, sampling methods, and using habitat and hydraulic models to determine instream flow needs on a variety of water resource projects.

Habitat Investigation: Project manager for conducting stream inventory surveys within the Skykomish and White River drainage of western Washington using USFS level I and II Stream Survey Protocol. Stream inventories include identification of stream channel type, fish habitat classification, channel measurements, large woody debris counts, evaluation of stream crossings, measurement of stream discharge and channel gradient, characterization of riparian vegetation, pebble counts, and fish and amphibian surveys. Additional tasks included conducting nighttime snorkel surveys to determine the presence of bull trout, providing technical assistance to Forest Service crews conducting stream inventories and fish distribution surveys, and recommending sites for possible restoration or enhancement. Recently co-authored and presented a methodology that applies a phased approach for evaluating baseline habitat conditions and prioritizing recovery, restoration, and monitoring efforts within the urban and urbanizing areas of King, Snohomish, and Pierce Counties. Project responsibilities included collection, review and summary of scientific literature on recovery efforts in urban and urbanizing areas; assisting with development and testing of a phase approach for evaluation of baseline habitat conditions and prioritization of recovery efforts in freshwater streams; review of state, federal and local regulations, current practices, and enforcement; and identification and compilation of potential engineering solutions and habitat enhancement techniques used to improve, enhance, or support ecosystem functions at site-specific locations.

Watershed Analysis: Task leader for watershed assessment of riparian shade, large woody debris (LWD), water temperature, and fish distribution on private and public forest lands throughout the Pacific Northwest. Responsibilities included development of assessment methodologies, data collection and analysis, report preparation, and client and agency presentation. Analysis included review of aerial photographs to determine riparian vegetation composition, streamside shade, LWD recruitment potential, and stream channel confinement. Responsibilities include a review of data on current salmon and trout populations; evaluation of site-specific habitat conditions; assessment of road and harvest area impacts on streams, water quality, and fish; and development of evaluation criteria to assess current conditions and monitor long-term recovery.

Endangered/Threatened/Sensitive Species Studies: Task leader for watershed and fisheries assessment studies involving federally protected stocks of bull trout and Chinook salmon. Responsibilities included the development of sampling methodologies, securing sampling/recovery permits, data collection and analysis, report preparation, and client and agency presentation. Mr. Gagner performed habitat and distribution surveys for shortnose and Lost River sucker populations in southern Oregon and bull trout and Chinook salmon in Washington State. Analysis included determination of streamside shade and large woody debris recruitment levels, evaluation of water temperature data, fish habitat mapping and assessment, and determination of historic and present day distribution.

Fish Population Studies: Field and laboratory experience includes: fish collection surveys and population estimation studies using electrofishing, seining, otter trawling, trapping, snorkeling, and other techniques; studies of water quality, bioaccumulation in fish tissues, feeding habits, salmonid spawning gravels and production, fish habitat and carrying capacity biotelemetry, and Passive Integrated Transponder (PIT) tagging. Experience in using Delphi process to develop microhabitat preference curves for multiple salmonid species in Oregon and Washington. Conducted preliminary survey of anadromous fish passage barriers to evaluate potential hydropower development on select streams in Washington. Deployment and monitoring of irrigation diversion fish trap to determine water diversion impacts on fish populations.

TIMOTHY J. SULLIVAN
Fisheries Biologist

Mr Sullivan is a fisheries scientist with more than 10 years experience designing, and conducting fisheries and aquatic ecology projects, fish protection studies, and habitat and instream flow assessments. His particular areas of expertise include fish ecology (anadromous, diadromous, and resident species), laboratory and field evaluations of fish protection technologies, zone-of-passage suitability studies for diadromous species using CFD models, and fish telemetry and tracking studies using a variety of methods (PIT tags, radio-, passive acoustic, and three-dimensional acoustic telemetry).

EDUCATION

M.S. (Wildlife and Fisheries Conservation) University of Massachusetts, 2004
B.S. (Biology - Environmental Science Concentration) Colby College, 1997
Semester at SFS Center for Coastal Studies School for Field Studies (SFS), Bamfield, BC, 1996

PROFESSIONAL AFFILIATIONS AND CERTIFICATIONS

Member, American Fisheries Society (AFS; 1998 to present)
Member, AFS Bioengineering Section (2001 to present)

EXPERIENCE

Fisheries Biologist: Performed desktop, laboratory, and field studies to address fish passage and protection at hydroelectric projects and water intakes. Responsibilities as project manager for studies budgeted up to $500,000 included: preparing proposals; developing study plans and experimental designs; collaborating with engineers and CFD (computational fluid dynamics) modelers; training and directing technicians; coordinating subcontractors; obtaining requisite permits for field studies; collecting data with biotelemetry and other techniques (e.g., PIT-tags, underwater video, plankton nets, beach seines); performing statistical analyses; preparing reports for clients and publication; and verbally presenting results.

Specific project expertise:

- Laboratory and field evaluations of fish protection technologies (e.g., bar racks, barrier nets, traveling water screens, wedgewire screens, fine-mesh screens, behavioral barriers, downstream bypass systems) for numerous species throughout the U.S.
- CWA Section 316(b) alternative intake technology assessments (throughout the U.S.)
- Authoring fish passage and protection reference manuals for the Electric Power Research Institute (EPRI) based on literature reviews of available technologies
- Authoring NEPA documents (Aquatic Resources, Threatened & Endangered Species sections) for hydropower relicensing in Oregon and Idaho (Hells Canyon and Malad Hydroelectric Projects) under contract to the Federal Energy Regulatory Commission
- Zone-of-passage suitability studies for diadromous species using CFD models (Susquehanna River, Pennsylvania and Winnicut River, New Hampshire)
- Evaluating telemetry tagging effects on migratory behavior of silver-phase American eel

Graduate Research Assistant: For thesis research project, developed novel application of passive integrated transponders (PIT tags) to monitor detailed adult American shad movement within a fishway, test structural and operational fishway modifications, and describe passage behavior. Other techniques used include radio-, passive acoustic, and three-dimensional acoustic telemetry to track migrating Atlantic salmon smolts, silver-phase American eels, and adult American shad.

Thesis research and other responsibilities included:

- Directing technicians during field efforts
- Fabricating and installing telemetry and data logging equipment
- Collecting test fish and surgically implanting transponders
- Working with large relational databases, primarily MS Access
- Performing parametric and nonparametric statistical analyses
- Preparing annual reports and presenting results to agencies and professional groups

Environmental Specialist: Duties included leading field efforts, analyzing data, writing reports, and presenting results at public meetings, while working within *budget constraints.*

Project experience throughout the northeastern U.S.:

- In-stream flow incremental methodology (IFIM) studies using PHABSIM models
- CWA Section 316(a) thermal variance studies
- Evaluation of biotic integrity of fish communities using EPA's rapid bioassessment protocols
- Fish contaminant surveys at superfund sites
- Lake and watershed management diagnostic/feasibility studies
- Water quality monitoring
- Watershed nutrient-load modeling
- Benthic macroinvertebrate surveys

Biological Technician: Coordinated and executed the field component of a study that estimated the size of rainbow smelt spawning populations in coastal Massachusetts streams to assess the effects of a power plant cooling water intake.

Environmental Protection Resource Assistant (Fisheries): Assisted in the state's anadromous fish restoration program. Specific duties included: quantifying fishway passage; operating, maintaining, and constructing a variety of fishways; collecting Atlantic salmon broodstock; stocking Atlantic salmon fry; assessing growth and survival through electrofishing surveys; and conducting snorkel surveys to locate spawning adult Atlantic salmon.

Fisheries Biological Technician: Supported the USFWS Atlantic salmon restoration program. Specific duties included: surveying habitat using GPS; surveying redds by canoe; assessing juvenile stocks through electrofishing surveys; tending broodstock weirs; and assisting in hatchery operations.

Curt Kraemer, BS
Fish Biologist

Mr. Kraemer is a retired fish biologist with more than 30 years experience with the State of Washington's Department of Fish and Wildlife. That experience was in the North Puget Sound region and included fisheries management and stock assessment work with both salmonid and non salmonid species in riverine and lacustrine habitats from the alpine region of the Cascades to the marine waters of Puget Sound. Extensive experience at both the field biologist and supervisor level. Expertise includes all anadromous salmonids with particularly focus on steelhead, sea-run cutthroat, bull trout and Chinook salmon.

Extensive experience as team member in a number of resource initiatives. This includes both inter-agency and intra-agency efforts. That work included work with various tribal staff, other agencies and the public and ranged from management to conservation issues requiring the dovetailing a variety of disciplines; including biological, habitat, population modeling, fisheries plans, and interspecies behavior.

Education

B.S. (Fisheries Science) University of Washington, 1969

Experience

Endangered/Threatened/Sensitive species studies: Mr. Kraemer is recognized expert on Puget Sound bull trout and was a sitting member of the U.S. Fish and Wildlife's Recovery Unit Team (Rut) responsible for developing the draft recovery plan for listed Puget Sound bull trout. Conducted early life history studies (1980s) that lead to the foundation of the fisheries management strategy used through out the region that assures adequate stock recruitment. Established the spawning survey used to assess and track the status of spawning populations, Conducted several early tagging studies leading to insights in char behaviors and life histories.

Was a member of various technical teams that provided information for and aided in the development of basin Chinook recovery plans for the Snohomish, Stillaguamish, Skagit and Nooksack basins as well as the over riding planning effort of the Shared Strategy for Puget Sound Chinook. That work included stock status and monitoring, population and habitat modeling, and integration of the harvest, hatchery and habitat components of the recovery plans.

Fish population and fisheries assessments: Mr. Kraemer's experience in population assessment includes low land lake assessments for both warm water and salmonid species as well as stock assessments for anadromous and resident stream salmonids. Conducted and/or supervised the annual of escapement estimates for a variety of species including steelhead, bull trout, Chinook, coho, pink, chum and sockeye salmon for river basins throughout the Puget Sound region. Depending on the species and the basin those estimates may be based on total or index redd census (bull trout, steelhead, Chinook) to fish-day counts.

Mr. Kraemer evaluated a number of fisheries by conducting, directing and/or designing a variety of methods including creel surveys and censuses. Those fisheries evaluated included lowland lake and reservoir fisheries targeting both salmonids and warm water species as well as river fisheries targeting salmon and steelhead.

Ecosystem interactions: Mr. Kraemer's multiple species experience has put him a unique position regarding the interspecies interactions among themselves and with their habitats. He has been involved in various life history studies including bull trout, sea-run cutthroat, Chinook salmon, and summer and winter steelhead. Those studies included genetic and scale collections as well as tagging efforts. Those studies coupled with the recovery planning efforts, fisheries and hatchery management planning, population monitoring and status assessment provide for a well round foundation to understand the relationship individual populations/species have with their habitats and the other species with which they share that habitat.

Keith Michael Binkley
2320 California Street
Everett, WA 98206
425 783-1769

As a fisheries scientist for over 20 years, I have accumulated considerable experience developing, implementing, evaluating, and managing environmental studies associated with hydroelectric and other water resource projects. My professional experience includes project management; FERC licensing and compliance studies; environmental impact analysis for fish, wildlife, and water quality; instream flow data collection and analysis, and technical aquatic studies. I have extensive experience designing and performing large river and reservoir aquatic resource inventories, habitat and water quality investigations, and fish behavioral studies. My areas of expertise include the management of regulated rivers and characterization of aquatic environments degraded by heavy metals.

EDUCATION:

Master of Science Degree — 1996
Fish and Wildlife Management
Montana State University, Bozeman, Montana

Bachelor of Science Degree — 1982
Fisheries and Wildlife Science
North Carolina State University, Raleigh, North Carolina

CERTIFICATIONS/TRAINING:

Hazardous Waste Safety Training (40 HR)
NAUI Certified SCUBA Diver
Swift Water Rescue Technician
First Aid / CPR Training

EXPERIENCE:

Agency Consultation: Served as the City of Seattle's representative on the Snohomish Basin Salmonid Technical Recovery Committee during the preparation of the Initial Chinook Salmon Recovery Plan. Represented Seattle City Light and acted as sub-committee chairperson on the Transboundary Gas Group addressing dissolved gas issues in the Columbia Basin. Served as technical consultant and liaison between Joint Trustees (Coeur d'Alene Tribe, US Forest Service, and US Fish and Wildlife Service) in preparation of studies and litigative documents for Coeur d'Alene Basin Natural Resource Damage Assessment. Represented ARCO Corporation as technical representative in state and federal forums focused on characterizing aquatic resource, habitat, and water quality conditions within the Clark Fork Basin, Montana. Served as liaison during cooperative field investigations performed by ARCO and the Montana Department of Fish, Wildlife, and Parks. Represented Montana Power Company during consultation with state and federal agencies and in coordination of cooperative field studies during relicensing of the Madison/Missouri Hydroelectric Project. Served as agency representative for National Marine Fisheries Service in preparation of two Biological Opinions regarding the impact of mining upon endangered spring/summer Chinook salmon in the Salmon River Basin, Idaho.

EXPERIENCE (continued):

Population Biology: Directed and conducted comprehensive riverine and lacustrine population surveys throughout the western United States. Censused and monitored macro-invertebrate, crustacean, plankton, and larval and adult fish populations through seining, netting, trapping, electroshocking, and snorkeling methods. Compiled and analyzed data on species abundance, composition, size, sex, age, growth rates, health/condition, food habits, and disease. Studied and evaluated fish behavior and habitat selection related to unfavorable thermal conditions, altered flow regimes, interspecific competition (simulated carrying capacity) and intraspecific competition. Monitored salmonid and percid habitat utilization within river and reservoir systems through use of radio and ultrasonic telemetry. Determined salmonid reproductive success and production through redd trapping, out-migrant netting, and egg incubation studies.

Habitat Assessments: Directed and conducted instream flow (IFIM) studies in all sizes of streams and rivers in California, Idaho, Montana, Oregon, and Washington. Snorkeled and collected seasonal data on salmonid micro-habitat preference and habitat utilization to generate site specific habitat suitability curves. Conducted studies at several hydroelectric projects to determine downramping rates that were non-injurious to anadromous fish species. Performed detailed qualitative and quantitative assessments of substrate suitability within salmonid spawning areas including measurements of sediment chemistry, deposition, particle size analysis, suspended load and bedload. Familiar with a variety of habitat assessment techniques including EPA Rapid Bioassessment Protocol, U.S. Forest Service Hankin and Reeves Methodology, Trout Cover Rating (TCR), Habitat Quality Index (HQI), Habitat Suitability Index (HSI), and Stream Reach Inventory and Channel Stability Evaluations.

Water Quality Determinations: Performed detailed limnological investigations on several rivers and reservoirs throughout the Pacific Northwest. Collected surface and ground water samples for a variety of physical and chemical analyzes (including analysis of total dissolved gas and heavy metals). Proficient in the operation and maintenance of automatic temperature (Ryan, Omnidata, HOBO) and water quality (Hydrolab) monitoring devices. Conducted numerous evaluations of temperature, discharge, dissolved gas, and water chemistry patterns in surface waters.