Bonneville Power Administration
Fish and Wildlife Program FY99 Proposal Form

Section 1. General administrative information

Monitor fine sediment and overwinter sedimentation in John Day and Grande Ronde Rivers

Bonneville project number, if an ongoing project 9703400

Business name of agency, institution or organization requesting funding

Columbia River Inter-Tribal Fish Commission

Business acronym (if appropriate) CRITFC

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Subcontractors. List one subcontractor per row; to add more rows, press Alt-Insert from within this table

Organization	Mailing Address	City, ST Zip	Contact Name
Confederated Tribes of the Umatilla Indian Reservation, Dept. of Natural Resources	P.O. Box 638	Pendleton, OR 97801	Project Leader: Michael D. Purser Admin. Contact: Michelle Thompson

NPPC Program Measure Number(s) which this project addresses.
3.3D.1, 7.6C, 7.6C2, 7.6D

NMFS Biological Opinion Number(s) which this project addresses.

The NMFS ESA Section 7 - Consultation Biological Opinion for Wallowa-Whitman Timber Sales (NMFS, 1993) recommended monitoring of substrate conditions in salmon habitat and investigation of relationship between ambient substrate conditions and fines at depth. *The NMFS ESA Section 7 - Consultation Biological Opinion Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests* (NMFS, 1995) established a Riparian Management Objective (RMO) of <20% surface fines in spawning habitat in "high priority watersheds," such as the Upper Grande Ronde River. NMFS (1995) also called for monitoring baseline conditions, land management effects, and progress towards meeting objectives (p. 68). Measurement of important habitat components was cited as a key aspect of effectiveness monitoring (NMFS, p. 86, 1995). The project will address all of these recommendations by monitoring surface fines in spawning habitat in the Upper Grande Ronde River (UGRR).

Other planning document references.

Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon, The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes (CRITFC, 1995) sets a substrate standard of <20% surface fines in spawning habitat, recommends that surface fines be monitored in natal habitat, and that trend monitoring occur to document recovery (pp. 5B-10, 5B-38). The *Wallowa-Whitman National Forest Plan* (WWNF, 1990) sets a standard of <15% surface fine sediment (p. 4-44). *The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan* (Anderson et al., p. 17, 1992) cited investigation of the relationship of fine sediment in redds to ambient substrate conditions as a critical research need.

If the project type is “Watershed” (see Section 2), reference any demonstrable support from affected agencies, tribes, local watershed groups, and public and/or private landowners, and cite available documentation.

Monitoring of surface fine sediment condition and trend has been recommended by *The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan* Anderson et al (1992) and *Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon, The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes* (CRITFC, 1995). *The NMFS ESA Section 7 - Consultation Biological Opinion Land and Resource Management Plans for the: Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests* (NMFS, 1995) recommended monitoring salmon habitat to update baseline information and determine progress towards meeting objectives (including surface fine sediment); NMFS (1995) recommended periodic measurement of important habitat components as part of effectiveness monitoring. The investigation of the potential relationship of fine sediment in redds to ambient substrate conditions, such as surface fines, has been recommended to be undertaken in the Grande Ronde River by *The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan* (Anderson et al., p. 17, 1992) and *The NMFS ESA Section 7 - Consultation*

Biological Opinion for Wallowa-Whitman Timber Sales (NMFS, 1993). The Department of Natural Resources of the Confederated Tribes of the Umatilla Indian Reservation is a subcontractor on this project.

Subbasin.

Grande Ronde River, John Day River

Short description.

For 5 years, annually monitor surface fine sediment and overwinter sedimentation in cleaned gravels in spawning habitats in the Grande Ronde and North Fork John Day Rivers, analyze potential trends, investigate potential relationships in data, and relate to salmon survival.

Section 2. Key words

Mark	Programmatic Categories	Mark	Activities	Mark	Project Types
X	Anadromous fish		Construction	X	Watershed
	Resident fish		O & M		Biodiversity/genetics
	Wildlife		Production		Population dynamics
	Oceans/estuaries	*	Research	*	Ecosystems
	Climate	X	Monitoring/eval.		Flow/survival
	Other		Resource mgmt		Fish disease
			Planning/admin.		Supplementation
			Enforcement		Wildlife habitat en-
			Acquisitions		hancement/restoration

Other keywords.

Fine sediment, egg-to-fry survival, cumulative effects

Section 3. Relationships to other Bonneville projects

Project #	Project title/description	Nature of relationship
N/A	N/A	There are no other projects that depend on this project being funded. However, continuing monitoring under this project is critical for analyzing project results in previous years for temporal trends.

Section 4. Objectives, tasks and schedules

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Determine if substrate goals of CRITFC (1995) and NMFS (1995) are being met in monitored reaches.	a	Annually measure surface fine sediments in monitored reaches in John Day and Grande Ronde Rivers for five years.
2	Estimate if substrate goals of NPPC FW Program are met (<20% in salmon redds).	a	Prior to spawning, annually emplace containers of cleaned gravels in areas excavated to simulate redds and collect containers after incubation for particle size analysis to determine amount of overwinter sedimentation.
3	Estimate effects of fine sediment on salmon survival from egg-emergence	a	Analyze results of tasks in Objectives 1 and 2 using available methods relating fine sediment to salmon survival, e.g, Stowell et al., 1983; data of Scully and Petrosky (1991).
4	Investigate potential temporal trends in surface fine sediment and overwinter sedimentation	a	Statistical analysis of results of multi-year measurement of surface fine sediment and overwinter sedimentation.
5	Investigate potential relationship between surface fine sediment levels and overwinter sedimentation in cleaned gravels	a	Analyze results of Objectives 1, 2, and 4.
6	Determine if spawning habitats in different streams have different levels of surface fine sediment and different levels of overwinter sedimentation.	a	Analyze annual and multi-year results of tasks in Objectives 1 and 2 via regression analysis.
7	Report and disseminate findings.	a	Prepare and distribute annual and final reports, report results to StreamNet, present findings to watershed councils and fish and land management agencies, submit an article summarizing results to a peer-reviewed publication.

Objective schedules and costs

Objective #	Start Date mm/yyyy	End Date mm/yyyy	Cost %
1	Annually: 7/1999 7/2000 7/2001 7/2002	Annually: 10/1999 10/2000 10/2001 10/2002	13%
2	Annually: 7/1999 7/2000 7/2001 7/2002	Annually: 6/2000 6/2001 6/2002 6/2003	37%
3	Annually: 4/1999 4/2000 4/2001 4/2002 4/2003	Annually: 7/1999 7/2000 7/2001 7/2002 7/2003	8%
4	5/1999	7/2003	8%
5	Annually: 4/1999 4/2000 4/2001 4/2002 4/2003	Annually: 7/1999 7/2000 7/2001 7/2002 7/2003	13%
6	Annually: 4/1999 4/2000 4/2001 4/2002 4/2003	Annually: 7/1999 7/2000 7/2001 7/2002 7/2003	11%
7	Annually: 6/1999 6/2000 6/2001 6/2002 6/2003	Annually: 8/1999 8/2000 8/2001 8/2002 10/2003	10%

Schedule constraints.

High flows or late snowfall may cause seasonal delays in sample retrievals in some years.

Completion date.

Section 5. Budget

FY99 budget by line item

Item	Note	FY99
Personnel	Project leader for 1.6 mo. @ $4,121/mo.; Technician for 1.0 mo. @ $2,600/mo.	$9,194
Fringe benefits	31.5% of salaries	$2,896
Supplies, materials, non-expendable property	Film, field books	$74
Operations & maintenance	Postage, photocopying, film processing	$524
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	0	$0
PIT tags	# of tags: 0	$0
Travel	Vehicle rental, per diem, lodging, and fuel	$1,850
Indirect costs	37.9% of personnel, supplies, operations and maintenance, and travel	$5,482
Subcontracts	CTUIR DNR hydrologist	$10,046
Other		
TOTAL		$29,992

Outyear costs

Outyear costs	FY2000	FY01	FY02	FY03
Total budget	$31,500	$33,070	$34,720	$36,455
O&M as % of total	1.7%	1.7%	1.7%	1.7%

Section 6. Abstract

For five years, the proposed project will annually measure surface fine sediment and overwinter sedimentation of fine sediment in salmon spawning habitat during the incubation period in portions of the Grande Ronde and John Day Rivers in sites constructed to mimic salmon redds. Objectives are to: a) determine temporal trends in surface fine sediment and relation to substrate goals of CRITFC (1995) and NMFS (1995); b) determine magnitude and temporal trends over five years in overwinter sedimentation and relationship to NPPC (1994) substrate goals; c) estimate effect of overwinter sedimentation on salmon survival using existing information; d) investigate relationship between overwinter sedimentation and surface fine sediment and other environmental variables; e) investigate potential differences in trends in surface fines and overwinter sedimentation in different rivers and reaches. Prior to the onset of spawning, surface fine sediment will be measured by the grid method (Bauer and Burton, 1993); overwinter sedimentation will be measured by burying containers filled with cleaned

gravels at the depth of egg centrum in areas excavated to mimic salmon redds. After fry emergence, containers will be collected and samples analyzed for the magnitude of fine sediment.

Section 7. Project description

a. Technical and/or scientific background.

Previous assessments have consistently noted that fine sediment is a major problem for salmon in the Grande Ronde River (Anderson et al., 1992; Huntington, 1993; NMFS, 1993; Mobrand et al., 1995) and, to a lesser extent, in the John Day River (OWRD, 1986). High levels of fine sediment in substrate reduce salmon survival from egg-to-smolt by contributing to in-filling of pools, reducing survival-to-emergence from redds by entombing eggs and fry and/or reducing dissolved oxygen, reducing interstitial rearing space, and/or reducing the amount of food for juvenile salmonids (USFS, 1983; Alexander and Hansen, 1986; Everest et al., 1987; Chapman, 1988; Bjornn and Reiser, 1991; Scully and Petrosky, 1991; Lisle and Hilton, 1992). In the Grande Ronde River, reductions in sediment delivery and fine sediment levels have been repeatedly identified as a priority measure to improve habitat conditions and egg-to-smolt salmon survival (Anderson et al., 1992; NMFS, 1993; Huntington, 1993; Mobrand et al., 1995).

Our proposed project will monitor surface fine sediments and overwinter intrusion of fine sediments into cleaned gravels in spawning habitat to for five years to determine baseline conditions and trends and whether habitat objectives for substrate in salmon habitat are being met in monitored reaches. The NMFS Biological Opinion for the USFS Land and Resource Management Plans (NMFS, 1995) and the salmon recovery plan of Columbia River basin Treaty Tribes (CRITFC, 1995) both set goals for surface fine sediment in spawning habitat at <20%; the NPPC's 1994 Fish and Wildlife program set a goal of <20% fine sediments in salmon redds in measure 7.6D (NPPC, 1994). However, despite these goals for fine sediment and the documented sediment-related problems, baseline and trends in surface fine sediment are not being monitored in these rivers, to our knowledge. Our proposed project will monitor surface fine sediment levels and overwinter intrusion of fine sediment into cleaned gravels in spawning habitat.

It has been posited that high levels of fine sediment in ambient stream substrate may not reduce egg-to-fry survival in field conditions because salmon winnow fine sediment from the redd during the act of spawning (Everest et al. 1987; Chapman 1988). However, it has been documented in laboratory and field settings that sedimentation of fine sediment occurs in cleaned gravels during sediment transport and in salmonid redds subsequent to spawning (Meehan and Swanston, 1977; Beschta and Jackson, 1979; Chapman, 1988; Lisle, 1989; Grost et al., 1991). Our proposed project will attempt to cast light on sedimentation within redds during the incubation period by measuring overwinter intrusion of fine sediment into cleaned gravels in a field setting for five years.

Our proposed project will also investigate the potential relationship between surface fines sediment levels and overwinter intrusion rates. The amount and size

distribution of fine sediment at the surface of channel substrate can affect sediment transport during the incubation period (Carson and Griffiths, 1987; Wilcock and McArdell, 1997) and thereby affect sedimentation and resultant fine sediment concentration in redds (Lisle, 1989). Within a stream reach, the threshold of stream discharge needed to initiate sediment transport decreases with decreasing particle size at the substrate surface (Carson and Griffiths, 1987; Wilcock and McArdell, 1997). Fine sediment at the substrate surface can be transported at extremely low levels of stream discharge (Booth and Jackson, 1997). Typically, the expected frequency of flow exceedance increases with decreasing stream discharge (Leopold, 1992). Therefore, it is likely that streams with high levels of fine sediment at the substrate surface have a greater frequency and duration of sediment transport of fine sediment than streams with lower levels of surface fine sediment, assuming other factors remain equal (Leopold, 1992; Wilcock and McArdell, 1997). The infiltration of fine sediment into a relatively clean substrate in redds appears to be inexorable once transport of fine sediment begins (Chapman, 1988; Lisle, 1989). The amount of fine sediment deposited into cleaned gravels is mediated by a variety of factors, but it generally increases as the particle sizes in transport decrease, because smaller particles settle deeper within the substrate (Beschta and Jackson, 1979). Thus, it is likely that the amount of fine sediment at the surface of channel substrate may affect salmon survival by influencing the amount of fine sediment in salmon redds during the incubation period.

Despite the biological and management importance of the relationship among ambient substrate conditions, fine sediment levels in redds, and the survival of threatened salmon, to our knowledge there have been no investigations of these relationships in northeastern Oregon, USA and very few elsewhere. Reckendorf and Van Liew (1989) monitored fine sediment intrusion into artificial redds in the Tucannon River, Washington, but did not rigorously analyze the potential relationship between fine sediment intrusion into artificial redds and surface fine sediments. Reckendorf and Van Liew (1989) used the pebble count method (Wolman, 1954) to characterize the substrate surface and noted that the pebble count method to failed account for the particle sizes of fine sediment at the substrate surface that were found to intrude into the artificial redds. In contrast, the proposed project will measure surface fine sediments as Kondolf (1997) and Smith et al. (1997) have recommended for situations where surface fine sediment occupies a significant amount of the substrate and/or differential transport of sediment and fine sediment intrusion is of interest. Investigation into the potential relationship between surface fines and overwinter sedimentation may result in a more cost-effective monitoring tool than coring or other extractive, bulk substrate sampling methods.

b. Proposal objectives.

Obj 1.: For five years, annually measure surface fine levels in monitored reaches and determine if substrate goals of CRITFC (1995) and NMFS (1995) are being met in monitored reaches in John Day and Grande Ronde Rivers.

Obj. 2.: For five years, annually measure overwinter of sedimentation of fine sediment and estimate if substrate goals of NPPC FW Program (NPPC, 1994) are met (<20% in salmon redds).

Obj. 3.: Estimate effects of fine sediment on salmon survival from egg-emergence, using available data and methods.

Obj. 4.: Investigate potential temporal trends in surface fine sediment and overwinter sedimentation based on results of multi-year sampling and analysis.

Obj. 5.: Investigate potential relationship between surface fine sediment levels and overwinter sedimentation in cleaned gravels.

Obj. 6.: Determine if spawning habitats in different streams have different levels of surface fine sediment and different levels of overwinter sedimentation.

Obj. 7: Report results and disseminate to watershed councils and fish and land management entities.

Our proposed project will also test the following hypotheses: 1) The fine sediment substrate goals in recovery plans (NPPC, 1994; CRITFC, 1995) and biological opinions (NMFS, 1995) are being met; 2) the aggregate effectiveness of land management is adequate to meet fine sediment/substrate goals, prevent degradation of substrate conditions, and allow improvement in substrate conditions; 3) overwinter sedimentation in salmon redds is not occurring at magnitudes that reduce salmon survival; 4) overwinter sedimentation is not related to the level of surface fine sediment; 5) watersheds with differing magnitudes of land disturbance, such as logging and road construction, do not have significantly different levels of surface fine sediment nor significantly different levels of overwinter sedimentation in cleaned gravels in spawning habitat; 6) temporal trends in surface fine sediment levels and the magnitude of overwinter sedimentation are not significantly different in watersheds with differing levels of land disturbance. Additionally, the project will quantify the magnitude of overwinter sedimentation in cleaned gravels and use this data to estimate salmon survival from egg-to-emergence.

The proposed project directly addresses NPPC Fish and Wildlife Measures 7.6C, 7.6C.2, and 7.6D. The project addresses the NMFS Biological Opinions for the USFS Land and Resource Management Plans for the Boise, Challis, Nez Perce, Payette, Salmon, Sawtooth, Umatilla, and Wallowa-Whitman National Forests (NMFS, 1995). The project addresses the habitat protection and restoration goals and monitoring recommendations of *Wy-Kan-Ush-Mi Wa-Kish-Wit, Spirit of the Salmon, The Columbia River Anadromous Fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakama Tribes*.

The results will provide an updated assessment of the current condition of a key aspect of salmon habitat in the John Day and Grande Ronde rivers. The study should

supply information to: determine trends in fine sediment levels, indicate the need for additional watershed restoration, and estimate trends in salmon survival from egg-to-fry.

c. Rationale and significance to Regional Programs.

The NPPC's 1994 Fish and Wildlife program sets a goal of <20% fine sediments in salmon redds in measure 7.6D (NPPC, 1994). The proposed project will monitor overwinter intrusion in cleaned gravels in areas excavated to mimic salmon redds in order to estimate whether the NPPC's substrate goal is being met in monitored reaches of the North Fork John Day and the Grande Ronde Rivers. The project will also supply trend data on both overwinter sedimentation and surface fine sediment levels to determine in-channel progress towards meeting NPPC substrate objectives as recommended in NPPC Fish and Wildlife Program measure 7.6C2. Collection of trend data in key habitat variables such as substrate conditions have repeatedly been recommended in regional efforts to protect/restore salmon habitat (CRITFC, 1995; NMFS, 1995) and have been cited as lacking in the Grande Ronde (NMFS, 1993).

The project will provide an indication of habitat trend and status with respect to substrate, as recommended in NPPC Fish and Wildlife Program measure 3.3D1. The data will be supplied to StreamNet. The project will also provide updated data on conditions within stream reaches using peer-reviewed methods (Lisle and Eads, 1991; Bauer and Burton, 1993), as recommended in NPPC Fish and Wildlife measure 7.6C. The trend data should also provide an indication if watershed efforts have been adequate to lead to improved substrate conditions within monitored reaches, which should be useful to watershed councils, the Grande Ronde Model watershed, and entities interested in improving salmon habitat.

d. Project history

The previous project number was 5506000 (now 9703400). Due to administrative delays, project funding will begin on Jan. 1, 1998. The project is funded at $30,000 from Jan. 1, 1998 through Dec. 1998 with FY97 funds. Due to the administrative delays, to date, the funded project has not generated reports, technical papers, or major results. However, the results of previous unfunded efforts, similar to the proposed project, were presented at the Forest-Fish Conference: Land Management Affecting Aquatic Ecosystems, in Calgary, Alberta in May, 1996; a written report on these results is to be published in a peer-reviewed proceedings: Rhodes, J.J. and Purser, M.D., *in press*. Overwinter sedimentation of clean gravels in simulated redds in the upper Grande Ronde River and nearby streams in northeastern Oregon, USA: Implications for the survival of threatened spring chinook salmon, Proceedings of Forest-Fish Conference: Land Management Affecting Aquatic Ecosystems, Calgary, Alberta, Canada, May, 1996. Results in Rhodes and Purser (*in press*) include the following: 1) measurable overwinter sedimentation occurred in cleaned gravels in all reaches in all years monitored; 2) among stations and years, the magnitude of overwinter sedimentation was related to the

magnitude of % surface fines in a statistically significant manner; 3) reaches with the highest levels of surface fine sediment consistently had the highest levels of overwinter sedimentation; 4) inter-annual stream discharge was not related to overwinter sedimentation in a statistically significant fashion during the monitoring period; 5) ocular estimates of surface fines by trained observers had an absolute standard error of about 5% and no significant bias, when compared to the magnitude of surface fines measured via the methods of Bauer and Burton (1993); and, 6) surface fines and overwinter sedimentation were not related in a statistically significant fashion in individual reaches where surface fines and overwinter sedimentation were consistently high and showed no significant inter-annual variation during the monitoring period.

Adaptive management implications include the following. The proposed project will provide an updated assessment of substrate conditions and trends in salmon spawning habitat, and thus provide an indication whether watershed level restoration efforts have been adequate to allow improvement in key habitat conditions when combined with cumulative effects under a variable climatic and hydrologic regime and whether additional watershed/restoration efforts may be needed. The study will supply information to: determine whether substrate trends and conditions in monitored reaches meet the objectives of NPPC (1994), CRITFC (1995) and NMFS (1995).

e. Methods.

Obj 1., Task a: For five years, annually measure surface fine sediments in monitored reaches in John Day and Grande Ronde Rivers.

Obj. 2., Task a: Prior to onset of spawning, annually place containers of cleaned gravel at locations similar to salmon egg centrums, in areas excavated to mimic salmon redds in spawning habitat. Collect containers after emergence and measure overwinter sedimentation of fine sediments (% by volume with diam<6.4mm and <0.8 mm) via standard soil particle size methods.

Obj. 3., Task a: Estimate effects of fine sediment on salmon survival from egg-emergence by analyzing results of tasks in Objectives 1 and 2, using available methods relating fine sediment to salmon survival, e.g, Stowell et al., 1983; data of Scully and Petrosky (1991).

Obj. 4., Task a: Analyze results of multi-year sampling and analysis of surface fine sediment and overwinter sedimentation via regression analysis and analysis of variance to determine statistical significance of temporal trends in monitored reaches.

Obj. 5, Task a: Investigate potential relationship between surface fine sediment levels and overwinter sedimentation in cleaned gravels, using non-parametric analyses of variance.

Obj. 6, Task a: Determine if monitored spawning habitats in different streams have different levels of surface fine sediment and different levels of overwinter sedimentation, using non-parametric analyses of variance.

Obj. 7, Task a: Report and disseminate findings via annual and final reports, presentations to watershed councils and land and fish management entities, reporting of results to StreamNet, and submission of an article summarizing results to a peer-reviewed publication.

Study reaches will be established within spawning habitat in sections of the John Day and Grande Ronde rivers. These reaches will include sites within relatively unimpacted sections of the John Day River and heavily impacted sections of the Grand Ronde and John Day rivers.

For five years, surface fine sediment will be annually measured at the onset of the spawning period using the grid method (Bauer and Burton, 1993). Explicit measurements of the amount of surface fine sediment have been recommended by Kondolf (1997) and Smith et al. (1997) for situations where fine sediment covers a significant amount of the channel substrate and/or differential transport of particle sizes and intrusion of fine sediment is of interest. The pebble count method of Wolman (1954) does not adequately sample fine sediments (Wolman, 1954; Nelson et al., 1996) and is not well-suited to characterizing channel substrate when the particle size distribution is highly bimodal (Smith et al., 1997) or fine sediment covers a significant amount of the channel substrate (Kondolf, 1997).

Discharge in the study reaches during the monitoring period will be estimated from data from the gaging stations nearest the study reaches, using area/elevation methods (Dunne and Leopold, 1978). Stream width, stream gradient, and depth will be measured using standard methods (Dunne and Leopold, 1978).

To investigate the effects of fine sediment on redds during the incubation period, containers filled with cleaned gravels will be emplaced annually in artificially-constructed, mock salmon redds prior to the onset of the salmon incubation period. This method has been used successfully to monitor fine sediment accumulation in channel substrate in northern California (Lisle, 1989), and such data provide an indication of the ultimate sediment conditions in salmonid redds (Lisle and Eads, 1991). The mock salmon redds will be excavated in pool tail-outs within salmon spawning habitat, prior to the onset of salmon spawning. The excavation and container placement will occur prior to spawning to ensure that it does not affect salmon spawning or redds. Two containers of cleaned gravels will be placed within each constructed redd; at least five mock redds will be constructed within each transect. Transects will be established within study reaches in each river. The containers will be collected shortly after the end of the incubation period, in April. Collection will occur outside of the incubation period to ensure there are no effects on incubating eggs. Sediment accumulations and the particle size of accumulated sediment within the containers of cleaned gravels will be determined using standard particle size methods.

Salmon survival from egg-to-fry will be estimated from the fine sediment and overwinter sedimentation data via the methods of Stowell et al. (1983) and the data of Scully and Petrosky (1991).

The relationship between surface fine sediment and overwinter sedimentation will be analyzed via regression analysis. This potential relationship will be investigated for two reasons: 1) the data will be available without any additional collection effort; and 2) to investigate whether monitoring surface fines can be a useful surrogate for bulk monitoring of bed composition to estimate the effects of fine sediment on salmon survival. The latter consideration is key, because sampling of bed materials at depth is time-consuming (and, thus, expensive) while still introducing bias in some environments and failing to provide a representative characterization of substrate conditions (Platts et al., 1987; Lisle and Eads, 1991). For instance, in warm water (about 70^{o}F), more than 45 minutes may be required to obtain a single freeze core (R. Baker, USFWS, pers. comm., Sept. 8, 1997) and many cores are required to provide an indication of conditions within a reach (Lisle and Eads, 1991). In contrast, surface fines within a reach can be measured using the grid method in approximately 75 minutes using five randomly spaced measurement points across three transects within a reach. Visual estimation of surface fines can be done still more rapidly and with reasonable accuracy: preliminary data indicate that with trained observers, when compared to surface fines measured by the method of Bauer and Burton (1993), ocular estimates of surface fines (%) have an absolute standard error of about 5% and no significant bias (Rhodes and Purser, *in press*). Further, in order to estimate effects on redds during incubation via bulk sampling of substrate, repeated sampling and subsequent analysis is required (Lisle and Eads, 1991); even then, there is limited assurance that such "before" and "after" comparisons are valid given the destructive nature of sampling and questions regarding bias and accuracy (Lisle and Eads, 1991). Therefore, if there is a valid relationship between surface fines and intrusion levels in some streams, measuring surface fines, alone, may be adequate to assess relative trends in habitat condition and salmon survival at a fraction of the expense and effort related to repeated bulk substrate sampling.

The relationship between stream discharge and overwinter sedimentation will be analyzed by regression analysis, to assess whether potential sediment transport capacity appears to play affect the magnitude of overwinter sedimentation. However, preliminary data indicate that stream discharge explains little of the variability in the volume of overwinter sedimentation in cleaned gravels (Rhodes and Purser, *in press*).

Variability within and among sample sites will also be analyzed using standard statistical methods. Initial estimates of variability will be used to estimate the number of samples needed in future investigations to generate a given level of statistical significance at given probabilities of "type I and II" errors using standard statistical methods (Benjamin and Cornell, 1970). Trend analysis will be analyzed via standard regression methods.

While one of the goals of the project is to assess the cumulative effectiveness of land management in reducing fine sediment in salmon spawning habitat over time, the project is <u>not</u> aimed at attempting to identify which particular activities are effective or

ineffective. The proposal's goals are to test the hypothesis that salmon habitat and survival has improved and will continue to do so, consistent with the goals of recovery plans (CRITFC, 1995). Other objectives include determining if fine sediment goals of NPPC (1994), NMFS (1995), and CRITFC (1995) are being met; determining if additional restoration/protection measures are needed (e.g., if high levels of fine sediment are maintained or fine sediment levels are increasing), investigating the relationship betwixt surface fines and fine sediment intrusion, and estimation of egg-fry survival. As noted by Reid and Dunne (1997) full sediment budgets (including erosion, transport, sedimentation, periodic re-mobilization, and export) are not necessary to evaluate every land management issue. The simplest possible approach should be employed to answer a specific management question related to sediment and erosion (Reid and Dunne, 1997). The simplest possible approach to the meeting the proposal's objectives will be taken, e.g, overwinter sedimentation and surface fines will be measured annually in monitored reaches.

f. Facilities and equipment.

No major special equipment is needed. Vehicles will be rented. The CRITFC has suitable office space and personal computers that support a variety of widely used word-processing, spreadsheet, and statistical analysis applications adequate to store and analyze data and report findings.

g. References.

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Section 8. Relationships to other projects

The project will provide updated data on the trend and condition of fine sediments in monitored reaches in spawning habitats in the Grande Ronde and John Day River. This will provide an indication of whether habitat objectives are met and whether conditions are improving, which can be used to assess the aggregate effectiveness of past and on-going restoration efforts together with the cumulative effects of watershed conditions. This information can also be used to assess the need for additional sediment abatement actions. As such, the information should be useful to all land and fish management entities in the two watersheds, including the Grande Ronde Model Watershed Project (BPA Project #: 9402700 and 908300).

Section 9. Key personnel

Michael D. Purser, Consulting Hydrologist, Confederated Tribes of the Umatilla Indian Reservation (CTUIR), Project FTE: 0.11. Project Duties: Monitoring, data analysis, project oversight and coordination, report writing. Education: B.S. Natural Resource Planning and Interpretation (Humboldt State Univ., 1983); M.S. Forest Resources--Hydrology (Univ. of Wash., 1988). Certification status: None. Current Employer: CTUIR (7/97-present). Current Responsibilities: Facilitator/member of Umatilla River Total Maximum Daily Load (TMDL) Committee. Develop technical recommendations for CTUIR On-Reservation Range Management Plan, development of planning tools to identify CTUIR priorities for aquatic restoration projects, and revisions of CTUIR Land Development and Interim Water Codes. Recent Previous Employment: Forest

Hydrologist/Watershed Management Specialist, CTUIR (4/91-6/97); Research Technologist, Wash. State Univ. (10/87-4/91); Water Quality Consultant, Jefferson County Conservation District, (7/86-10/87) Expertise: Watershed hydrology, water quality, soils, sediment transport, monitoring of non-point source pollution, and geomorphology. Recent/relevant publications/job completions: 1) Co-author with eight others: 1992. The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan; 2) Purser, M.D. and Cundy, T.W., 1992. Changes in soil physical properties due to cable yarding and their hydrologic implications. Western J. Applied Forestry. 7: 36-39.; 3) Preparation and governmental coordination of the implementation of Nonpoint Source of Water Pollution Assessment and Management Program, Umatilla River Basin, under contract with USEPA; 4) Rhodes, J.J. and Purser, M.D., *in press*. Overwinter sedimentation of clean gravels in simulated redds in the upper Grande Ronde River and nearby streams in northeastern Oregon, USA: Implications for the survival of threatened spring chinook salmon, Proceedings of Forest-Fish Conference: Land Management Affecting Aquatic Ecosystems, Calgary, Alberta, Canada, May, 1996.

Jon Rhodes, Hydrologist, Columbia River Inter-Tribal Fish Commission (CRITFC), Project FTE: 0.13. Project Duties: Monitoring, data analysis, project oversight and coordination, report writing. Education: B.S. Hydrology and Water Resources (Univ. of Arizona, 1981); M.S. Hydrogeology (Univ. of Nev.-Reno, 1985); Ph.d. candidacy degree Forest Hydrology (Univ. of Wash., 1989). Certification status: None. Current Employer: CRITFC (4/89-present). Current Responsibilities: Analysis of direct and cumulative effects of land-use on salmon habitat, channel morphology, water quality, and watershed processes. Provide scientific input as a member of numerous policy and technical forums dealing with aquatic issues, including forest practices and water quality monitoring programs. Recent Previous Employment: Research Assistant, Univ. of Wash. (11/88-4/89, 8/84-6/87); Consulting Hydrologist, Tahoe Regional Planning Assoc. (5-10/88, 7-10/87); Hydrologic Tech., USGS (10/83-6/84). Expertise: General watershed hydrology, water quality, direct and cumulative effects of land-use on aquatic resources, monitoring non-point source pollution, water temperature alteration, sedimentation, analysis of water quality data. Recent/relevant publications/job completions: 1) Co-author with eight others: 1992. The Upper Grande Ronde River Anadromous Fish Habitat Protection, Restoration and Monitoring Plan; 2) A Coarse Screening Process for Evaluation of the Effects of Land Management Activities on Salmon Spawning and Rearing Habitat in ESA Consultations. CRITFC Tech. Rept. 94-4, Portland, Or.--developed under contract with NMFS; 3) 1995. A Comparison and Evaluation of Existing Land Management Plans Affect Spawning and Rearing Habitat of Snake River Basin Salmon Species Listed Under the Endangered Species Act, CRITFC, Portland, Or, unpub. (1995)--developed under contract with NMFS; 4) Espinosa, F.A., Rhodes, J.J., and McCullough, D. A. 1997. The failure of existing plans to protect salmon habitat on the Clearwater National Forest in Idaho. J. Env. Management **49**: 205-230; 5) Rhodes, J.J. and Purser, M.D., *in press*. Overwinter sedimentation of clean gravels in simulated redds in the upper Grande Ronde River and nearby streams in northeastern Oregon, USA: Implications for the survival of threatened spring chinook

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Section 10. Information/technology transfer

Study results will be reported in annual and final reports, submitted for publication in a peer-reviewed journal, presented to watershed councils and fish and land management entities, presented at symposia, and supplied to StreamNet.