Revised Master Plan for Yakima Subbasin Summer- and Fall-Run Chinook, Coho Salmon and Steelhead

VOLUME II

Appendices

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Submitted by

The Confederated Tribes and Bands of the Yakama Nation

Toppenish, Washington

Appendix A

Draft Hatchery and Genetic Management Plan: Coho Reintroduction Project

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Yakima Basin Coho Reintroduction Project
Species or Hatchery Stock:	Coho Salmon (*Oncorhynchus kisutch*)
Agency/Operator:	Yakama Nation (lead agency) in cooperation with WDFW and BPA as funding agency
Watershed and Region:	Yakima River Subbasin/Columbia Plateau Province
Date Submitted:	May 2010
Date Last Updated:	April 2004; updated July 2005, Nov 2007, Jan 2009; January 7, 2010; May 10, 2010

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program: Yakima Basin Coho Reintroduction Project

Brief History and Description: This project was initiated as part of the U.S. v Oregon Columbia River Fish Management Plan with a stated purpose of providing "for a directed tribal harvest within the Yakima River system". Through the mid-1980s and early 1990s approximately 700,000 coho were imported and released annually as pre-smolts in the Yakima River below the Wapato irrigation diversion dam. In 1996, the scope of the project was expanded under the Yakima-Klickitat Fisheries Project, "to determine the feasibility of re-establishing a naturally spawning population and a significant fall fishery for coho in the Yakima River Basin" (BPA 1996). The first phase of this effort (referred to as Phase I in this document) was aimed at moving release sites to locations above the confluence of the Yakima and Naches rivers and evaluating the extent and "feasibility" of naturally spawning coho in the Yakima Basin. This effort was considered successfully completed in 2003 and results were published in Bosch et al. (2007). The second phase of this effort is ongoing and is referred to as Phase II in this document. The goal of Phase II is to increase spawning in tributaries and to phase out imported releases of coho in the Yakima Basin replacing them with fish reared from locally collected brood stock. Phase II is expected to culminate in the development of a long-term Master Plan for Yakima Basin coho in 2011-2012. The Master Plan will discuss options, strategies, and recommendations for long-term production of coho in the Yakima Basin. It is expected that this HGMP will again be updated pursuant to submittal of the Master Plan for review through the Northwest Power and Conservation Council's (NPCC) 3-step review process.

1.2) Species and population (or stock) under propagation, and ESA status.

Coho Salmon (*Oncorhynchus kisutch*)
ESA Status: Not listed and not a candidate for listing

1.3) Responsible organization and individuals

Indicate lead contact and on-site operations staff lead.
Name (and title): Joe Blodgett, Fish Production Biologist and Facility Manager
Agency or Tribe: Yakama Nation
Address: P.O. Box 151, Toppenish, WA 98948
Telephone: (509) 865-5121, ext. 6706
Fax: 509-865-6293
Email: joewb@earthlink.net

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Co-Operators	Role
Bonneville Power Administration	Funding Entity- Administrator
U.S. Bureau of Reclamation	Owner of facility land; and minor funding entity for facility upgrades and public education
U.S. Fish and Wildlife Service	Mitchell Act Funds (Eagle Creek Fish Production / Acclimation of Out of Basin Production); Decision on Listed Species; Fish Pathology Monitoring & Analyses

National Marine Fisheries Service	Decision on Listed Species
Washington Department of Fish & Wildlife	Co-Manager
Northwest Power and Conservation Council (NPCC)	Makes Fish and Wildlife Program decisions under the Northwest Power Act.

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Funding sources: Bonneville Power Administration, Yakama Nation, U.S. Bureau of Reclamation (Funds for facility improvements, public education, in-kind land contribution), Mitchell Act, NOAA Fisheries.

Staffing and annual operational costs:
Prosser Hatchery
9 scientific technicians, 2 management biologists, total of 11 full time equivalent staff. Annual operating cost: $1,141,042. These data include staff and costs for both Yakama coho and fall Chinook programs.

1.5) Location(s) of hatchery and associated facilities.

Include name of stream, river kilometer location, basin name, and state. Also include watershed code (e.g. WRIA number), regional mark processing center code, or other sufficient information for GIS entry. See "Instruction E" for guidance in responding.

Note that in the past out-of-basin coho had been received from the Little White Salmon/Willard NFH Complex (LWS/Willard) but was discontinued due to funding cuts. Currently out-of-basin coho salmon come from Washougal State Hatchery and the Eagle Creek NFH. All broodstock collection and rearing activities at these facilities will not be described in this document. An HGMP for the Eagle Creek NFH coho salmon program which supplies coho salmon to this program has been submitted to NMFS for approval and is available at:
http://www.fws.gov/Pacific/fisheries/hatcheryreview/Reports/columbiagorge/EC--002COS_hgmp_5_04.pdf. The Eagle Creek NFH Coho program is currently covered under a Section 7 Biological Opinion date November 27, 2007 (http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Sec-7-USFWS-Columbia.cfm).
An HGMP for the Washougal State Hatchery coho salmon program is available at:
http://wdfw.wa.gov/hat/hgmp/

Broodstock source	Yakima River and out-of-basin sources (See note above).
Broodstock collection location (stream, RKm, subbasin)	Prosser Dam- Right Bank Fish Ladder, Yakima, RKm 75.4. Also at Roza on Upper Yakima and at Cowiche, and Wapatox Dams in the Lower Naches system.
Adult holding location (stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.1, Yakima Subbasin
Spawning location (stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.16Yakima Subbasin
Incubation location (facility name, stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.16, Yakima Subbasin
Rearing location (facility name, stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.1, Yakima Subbasin

WRIA code for Prosser Dam and Hatchery: 37

Acclimation Sites
Naches River (WRIA code 38):
Stiles Ponds (T14N, R18E, Sec 31, SW ¼; RM 9.0; WRIA code 38)
Lost Creek Ponds (T17N, R14E, Sec 35, NE ¼; RM 38.6; WRIA code 38)
Yakima River (WRIA code 39):
Holmes Property (RM 160; WRIA code 39)
Boone Pond (RM 180.5; WRIA code 39)
Hundley Pond (RM 191; WRIA code 39)
Brunson Pond (Wilson Creek RM 6.8; WRIA code 39)
Reecer Creek Acclimation Pond (Reecer Creek RM .5 WRIA code 39)
Courier Creek Acclimation Pond (Courier Creek RM 1.5 WRIA code 39)
Lake Cle Elum (from net pens above dam; WRIA code 39)
Mobile Acclimation:
Mobile acclimation unit rotating yearly between the following tributaries:
Toppenish Ck (WRIA code 37), Cowiche Ck (WRIA code 38), Ahtanum Ck (WRIA code 37), Rattlesnake Creek (WRIA 38)

1.6) Type of program.

Define as either: Integrated Recovery; Integrated Harvest; Isolated Recovery; or Isolated Harvest (see Attachment 1 - Definitions" section for guidance).

This is an integrated program to provide fish for harvest and recovery. Initially this was a *U.S. v Oregon* production (mitigation) program designed to provide upriver production for the Tribal fisheries. In 1996, the program was adopted into the Yakima-Klickitat Fisheries Project (YKFP) as an effort to test the feasibility of using supplementation to re-establish self-sustaining populations in the basin. Providing fish for harvest continues to be a goal of the program as well.

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPCC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6. Example: "The goal of this program is the restoration of spring chinook salmon in the White River using the indigenous stock".

Consistent with federal treaty obligations, existing laws and plans, the purposes of this program are to: mitigate for historical losses in tribal usual and accustomed fishing areas, provide fish for harvest, and contribute to regional conservation, recovery, research and education goals.

The Yakima Coho Reintroduction Program's short-term goal (Phases I and II) is to determine the feasibility of re-establishing a naturally spawning coho population and a significant fall fishery for coho within the Yakima River Basin, while keeping adverse ecological impacts within acceptable limits.

The long-term goal is to design and implement a hatchery production program based on outcomes from the short-term feasibility study. The YKFP Policy Group will determine the course of actions (i.e., supplementation of naturalized populations, harvest augmentation, alternative production program, etc.) to be pursued for the long-term program. This decision will be consistent with YKFP goals, the *U.S. vs. Oregon* decision and the Columbia River Fisheries Management Plan (CRFMP). The timeline for implementation of a long-term Yakima Basin coho production program is as follows:
2011 – Update and resubmittal of Yakima Basin coho Master Plan to NPCC for step review (with concurrent update of this HGMP)
2012-2013 – NPCC step review and approval of Master Plan
2013-2014 – construction of required coho facilities
2015 and beyond - implementation

1.8) Justification for the program.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population (integrated or isolated recovery programs), or how the program will be operated to provide fish for harvest while minimizing adverse effects on listed fish (integrated or isolated harvest programs).

- Wild stocks of coho salmon were once widely distributed within the Columbia River Basin, including the Yakima River. However, coho salmon were extirpated from the Yakima River in the early 1980s.
- As stated in Section II.F and III.A of the *U.S. v Oregon* 2008-2017 Management Agreement (2008): "The Parties recognize that the actions defined in this Agreement reflect the Parties' best efforts at reaching a negotiated agreement to protect, rebuild, and enhance upper Columbia River coho while providing harvests for both treaty Indian and non-treaty fisheries. … The Parties intend to use artificial production techniques where appropriate, among other strategies, to assist in rebuilding weak runs and mitigating for lost production. … The Parties hereby commit to a good faith effort to meet the juvenile release programs identified in Tables B1, B2, B3, B4 (A or B), B5, B6, and B7."
- This project meets the definition of "Restoration" from NPCC document 99-15: "Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored."
- To contribute to scientific knowledge regarding the effects of hatchery supplementation on natural salmon populations. For example, the Yakima and mid-Columbia coho restoration programs have documented evidence that any domestication effects from long-established hatchery stocks may be reversed after just a few generations of being re-established in native wild habitats (Murdoch et al. 2006; Bosch et al. 2007).

The program is included in the *United States versus Oregon* 2008-2017 Columbia River Fish

Management Plan and the recently signed Columbia River Accords between the Columbia River Tribes and the Bonneville Power Administration. The program is consistent with the Yakima Subbasin Salmon Recovery Plan (Freudenthal et al. 2005).

1.9) List of program "Performance Standards".

"Performance Standards" are designed to achieve the program goal/purpose, and are generally measurable, realistic, and time specific. The NPCC "Artificial Production Review" document attached with the instructions for completing the HGMP presents a list of draft "Performance Standards" as examples of standards that could be applied for a hatchery program. If an ESU-wide hatchery plan including your hatchery program is available, use the performance standard list already compiled.

> *Example: " (1) Conserve the genetic and life history diversity of Upper Columbia River spring chinook populations through a 12 year duration captive broodstock program; (2) Augment, restore and create viable naturally spawning populations using supplementation and reintroduction strategies; (3) Provide fish to satisfy legally mandated harvest in a manner which minimizes the risk of adverse effects to listed wild populations; (4)....".*

See Section 3.4 and Section 6 of the master plan (Hubble et al. 2004). The master plan's objectives correspond to Performance Standards, and its strategies correspond to Performance Indicators (see 1.10 of this HGMP).
Objective 1. Attempt to establish naturally producing coho populations in the upper and lower Yakima River and tributaries, and in the Naches River and tributaries.
Objective 2. Continue to investigate the coho life history in the Yakima basin.
Objective 3. Assess ecological interactions.
Objective 4. Develop and test use of additional culturing, acclimation and monitoring sites.
Objective 5. Determine long-term facility needs.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

The NPCC "Artificial Production Review" document referenced above presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program. If an ESU-wide hatchery plan is available, use the performance indicator list already compiled. Essential 'Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates, and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest *objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.*

1.10.1) "Performance Indicators" addressing benefits.

(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Performance Indicators Addressing Benefits		
Indicator	Performance Standard	Indicator is Monitored
Total number of fish harvested in tribal fisheries targeting this program.	Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in *U.S. v. Oregon* management agreements	*U.S. v OR* TAC and YN monitoring
Number of fish released by program, returning, or caught, as applicable to given mitigation requirements.	Program contributes to mitigation requirements.	*U.S. v OR* TAC and YN monitoring
Annual number of fish produced by this program caught in all fisheries, including estimates of fish released and associated incidental mortalities, by fishery.	Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	*U.S. v OR* TAC and YN monitoring documents total harvest of coho in fisheries; proportion Yakima would need to be derived from available information such as release numbers, dam counts, etc.
Annual escapements of natural populations that are affected by fisheries targeting program fish.		YN conducts annual redd counts of naturally spawning coho in the Yakima Basin. In addition, since all hatchery-released coho are marked (see 7.3), enumeration of hatchery and natural coho migrating upstream at Prosser Dam is accomplished through video monitoring at the left and center ladders plus sampling of approximately 40% of the return passing upstream by way of the Prosser right bank denil trap and sampling facility.
Annual number of spawners on spawning grounds, by age.	Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	YN estimates Yakima River run size from Prosser dam count, harvest, and redd count data. Age composition can be estimated from Prosser Denil passage and Prosser hatchery broodstock scale sampling.
Annual number of redds in selected natural production index areas.		YN conducts annual redd counts of naturally spawning coho in the Yakima Basin

1.10.2) "Performance Indicators" addressing risks.

(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Performance Indicators Addressing Risks		
Indicator	Performance Standard	Indicator is Monitored
Marking rate by mark type for each release group.	Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Yes, marking rates for each mark group are documented. See 7.3 and response to "Annual escapements of natural populations…" above.
Temporal distribution of broodstock collection, and of naturally produced population at point of collection.	Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Yes, see response to "Annual escapements of natural populations…" above.
Age composition of broodstock collected, and of naturally produced population at point of collection.		Scale samples are taken from all brood collected for age composition.

Number of spawners of natural origin removed for broodstock.	Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Proportion of Hatchery- and natural-origin fish used for brood is documented via mark sampling at brood collection and spawn time.
Number and origin of spawners migrating to natural spawning areas.		Number and origin of natural spawners is documented. See response to "Annual escapements of natural populations…" above.
Number of eggs or juveniles placed in natural rearing areas.		Juveniles are released from acclimation sites in natural juvenile rearing areas. These numbers are documented annually.
Life history characteristics	Life history characteristics of the natural population do not change as a result of this artificial production program.	The following characteristics are monitored on an annual basis: Juvenile migration timing (at Chandler), juvenile size at outmigration (Chandler and hatchery release sampling operations), adult return timing (at Prosser), adult return age and sex composition and size at return (Prosser Denil and brood sampling), Spawn timing and distribution (comprehensive spawner surveys), fecundity and egg size (hatchery spawn sampling)
Carrying capacity criteria for basin-wide and local habitat, including method of calculation.	Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, and migration corridor.	Yakima Basin carrying capacity determined using EDT and AHA model analysis.
Annual release numbers from all programs in basin and subbasin, including size and life-stage at release, and length of acclimation, by program.		YN documents these data.
Location of releases and natural rearing areas.		YN documents these data.
Timing of hatchery releases, compared to natural populations.		Timing of hatchery releases is known. Timing of wild/natural migration determined from Chandler juvenile trap monitoring.
Genetic profiles of naturally produced adults, as developed at program's outset (e.g. through DNA or allozyme procedures) and compared to genetic profiles developed each generation.	Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	This is not presently a program priority. However, DNA samples could be taken from fish at the Prosser Denil and during spawning if sufficient funding were made available.
Total number of natural spawners reaching the collection facility.	Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.	Hatchery and natural origin returns are known (see above).
Total number of spawners estimated to pass the collection facility to spawning areas, compared to minimum effective population size (when established) required for those natural populations.		Total number of natural spawners is known (see above); minimum effective population size could be determined using EDT and AHA model analysis.
Timing of collection compared to overall run timing.		See above.
The ratio of observed and/or estimated total numbers of artificially produced fish on natural spawning grounds, to total number of naturally produced fish, for each significant spawning area.	Artificially produced origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.	Hatchery and natural origin returns are known (see above).
Observed and estimated total numbers of naturally produced and artificially produced adults passing a counting station close to natural spawning areas.		Hatchery and natural origin returns are known (see above).
Location of juvenile releases.	Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Fish are released from acclimation sites currently located at Boone and Holmes properties in Upper Yakima, and at Stiles and Lost Creek sites in Naches.
Length of acclimation period.		Fish are reared to and released as yearlings
Release type, whether forced, volitional, or direct stream release.		Volitional release.
Level of smoltification at release, compared to a regional smoltification index (when developed). Release type, whether forced, volitional, or direct stream release.	Juveniles are released at fully smolted stage.	Volitional release as smolt yearlings.

Number of adults available for broodstock (moving geometric mean, based on number of ages at return for this species).	The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Prosser dam counts should provide an index with which to make this determination.
Scientifically based experimental design, with measurable objectives and hypotheses.	The artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.	Yes. A Master Plan exists. Phase I results have been published (Bosch et al. 2007). See also http://www.efw.bpa.gov/searchpublications/ YKFP M&E annual report for latest year's results.
Monitoring and evaluation framework including detailed time line.	The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objective and evaluate beneficial and adverse effects on natural populations.	See above
Annual and final reports.		See http://www.efw.bpa.gov/searchpublications/ YKFP M&E annual report for latest year's results.
Annual reports indicating level of compliance with applicable standards and criteria.	Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and MDFWP.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results
Discharge water quality compared to applicable water quality standards and guidelines, such as those described or required by NPDES, IHOT, PNFHPC, and Co-Managers of Washington Fish Health Policy tribal water quality plans, including those relating to temperature, nutrient loading, chemicals, etc.	Effluent from artificial production facility will not detrimentally affect natural populations.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results
Water withdrawals compared to applicable passage criteria.	Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results for all performance indicators for this standard.
Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria	Water intake meets criteria.	Water intake structures inspected to ensure criteria met.
Number of adult fish aggregating and/or spawning immediately below water intake point.		Will be monitored at Prosser Hatchery and at the acclimation sites. Fish may be used as backup broodstock or for adult planting in tributaries.
Number of adult fish passing water intake point.		
Proportion of diversion of total stream flow between intake and outfall.		
Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence.	Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	USFWS fish health professionals sample and certify all releases.
Number and location(s) of carcasses or other products distributed for nutrient enrichment.	Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results for all performance indicators for this standard.
Statement of compliance with applicable regulations and guidelines.		
Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.	Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.	Derived from spawner survey (temporal and spatial) and Prosser Dam counts (temporal).
Mortality rates in trap.	Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	Mortality rates are documented.

Prespawning mortality rates of trapped fish in hatchery or after release.		Mortality rates are documented.
Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present.	Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	These data are available for analysis (see above).
Total cost of program operation.	Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	See 1.4 above.
Sum of ex-vessel value of commercial catch adjusted appropriately, appropriate monetary value of recreational effort, and other fishery related financial benefits.		This calculation will be difficult to do accurately since these fish are harvested in marine fisheries from Alaska possibly as far south as Northern California and inland to Prosser Dam and as expressed above, the proportion of Yakima fish in the total coho harvest in these fisheries can only be roughly estimated.
Total cost of program operation.	Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	See 1.4 above.
Average total cost of activities with similar objectives.		
Number of adult fish available for tribal ceremonial use.	Non-monetary societal benefits for which the program is designed are achieved.	YN documents this use.
Recreational fishery angler days, length of seasons, and number of licenses purchased.		See relevant U.S. v OR TAC and WDFW documentation.

1.11) Expected size of program.

In responding to the two elements below, take into account the potential for increased fish production that may result from increased fish survival rates affected by improvements in hatchery rearing methods, or in the productivity of fish habitat.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

In-basin broodstock collection varies depending on run size. Up to 960 local brood fish may be collected at Prosser (either hatchery swim-in trap or right bank denil ladder at Prosser Dam), Roza, and/or Cowiche Dams in the Yakima Basin. If fewer fish are available in-basin they may be augmented with coho from lower Columbia River hatcheries. See also Appendix A of Yakima Coho Master Plan (Hubble et al. 2004).

The long-term goal of the in-basin brood stock program is to use 100% natural-origin brood stock (pNOB). This will occur when sufficient numbers of natural-origin fish are returning from local brood releases. In 2004 the pNOB approached 70% (Table 1.11.1.1), but in most years releases from in-basin brood production remained too low to achieve sufficient adult returns with which to establish a local-origin brood stock. Therefore, the YN maintains an interim policy of allowing use of hatchery-origin fish returning to the vicinity of Prosser Dam for the local brood program. As returns of local-origin fish increase, more of these fish will spawn naturally, eventually resulting in sufficient returns of natural-origin fish to the Yakima Basin to meet the 100% pNOB goal.

Table 1.11.1.1. Percentage of local hatchery- and natural-origin and out-of-basin

hatchery-origin fish used in the Yakima Basin local brood stock coho program, 2000-2008.

Year	Yakima Basin Hatchery-Origin	Yakima Basin Natural-Origin	Out-of-Basin Hatchery-Origin
2000	0.58	6.93	92.49
2001	12.58	4.06	83.36
2002	13.24	38.21	48.55
2003	20.68	49.26	30.06
2004	1.29	69.56	29.15
2005	2.74	4.13	93.13
2006	9.72	5.21	85.07
2007	13.52	12.14	74.34
2008	25.21	2.63	72.16

The project presently has no established criteria for managing for specific proportion of natural influence (PNI) or proportion of hatchery-origin spawners (PHOS). These criteria may be established as data and results from short-term efforts are further evaluated pursuant to development of the long-term Master Plan.

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling/Parr	Parr releases will be conducted in: North Fork Little Naches, Little Naches River, Pile Up Creek, Quartz Creek, Blow Out Creek, Little Rattlesnake Creek, Nile Creek, Cowiche Creek, Ahtanum Creek, Toppenish Creek, Reecer Creek, Wilson Creek, Big Creek, and the Crystal Spring area of the Upper Yakima River.	3,000 per stream (to be subtracted from program total of 1 million juveniles – smolts and parr - released per year)

Life Stage	Release Location	Annual Release Level
Yearling	Naches River: Stiles Ponds (T14N, R18E, Sec 31, SW ¼; RM 9.0) Lost Creek Ponds (T17N, R14E, Sec 35, NE ¼; RM 38.6) Yakima River: Holmes Property (RM 160) Boone Pond (RM 180.5) Hundley Pond (RM 191) Brunson Pond (Wilson Creek RM 6.8) Reecer Creek Pond (Reecer Creek RM .5) Courier Creek Pond (Courier Creek RM 1.5) Lake Cle Elum (from net pens above dam) Mobile Acclimation: Mobile acclimation unit rotating yearly between the following tributaries: Toppenish Ck, Cowiche Ck, Ahtanum Ck, Rattlesnake Ck	~500,000 from local brood stock – (total 1 million juveniles – smolts and parr, local and out-of-basin stock - released per year)
Yearling	Naches River: Stiles Ponds (T14N, R18E, Sec 31, SW ¼; RM 9.0) Lost Creek Ponds (T17N, R14E, Sec 35, NE ¼; RM 38.6) Yakima River: Holmes Property (RM 160) Boone Pond (RM 180.5) Hundley Pond (RM 191) Brunson Pond (Wilson Creek RM 6.8) Lake Cle Elum (from net pens above dam) Mobile Acclimation: Mobile acclimation unit rotating yearly between the following tributaries: Toppenish Ck, Cowiche Ck, Ahtanum Ck, Rattlesnake Ck.	Up to 700,000 from out-of-basin hatchery stock (total 1 million juveniles – smolts and parr, local and out-of-basin stock - released per year)

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas) data available for the most recent twelve years (roughly three fish generations), or for the number of years of available and dependable information. Indicate program goals for these parameters.

The adult return data provided in the following table and graph also serve as approximate escapement data.

Table 1.12.1. Preliminary estimates of smolt-to-adult survival (SAR) indices for adult returns from hatchery- and natural-origin coho for the Yakima reintroduction program, juvenile

migration years 2000-2007. Data source: B. Bosch, YN.

Juvenile Migration Year	Hatchery-origin Chandler Smolts[a]	Hatchery-origin Prosser Adults[b]	Hatchery-origin SAR Index	Natural-origin Chandler Smolts[a]	Natural-origin Prosser Adults[b]	Natural-origin SAR Index
2000	165,056	3,819	2.31%	37,359	2,985	7.99%
2001	442,249	211	0.05%	40,605	332	0.82%
2002	30,006	768	2.56%	19,859	1,767	8.90%
2003	13,854	552	3.98%	9,092	1,935	21.28%
2004	164,135	2,443	1.49%	18,787	511	2.72%
2005	214,694	2,976	1.39%	31,631	1,584	5.01%
2006	41,260	2,123	5.15%	8,298	1,205	14.52%
2007	88,575	3,252	3.67%	8,665	698	8.06%

[a] Yakama Nation estimates of coho smolt passage at Chandler (for details see Neeley 2000).
[b] Yakama Nation estimates of age-2 and age-3 coho returns to Prosser Dam for this juvenile migration cohort.

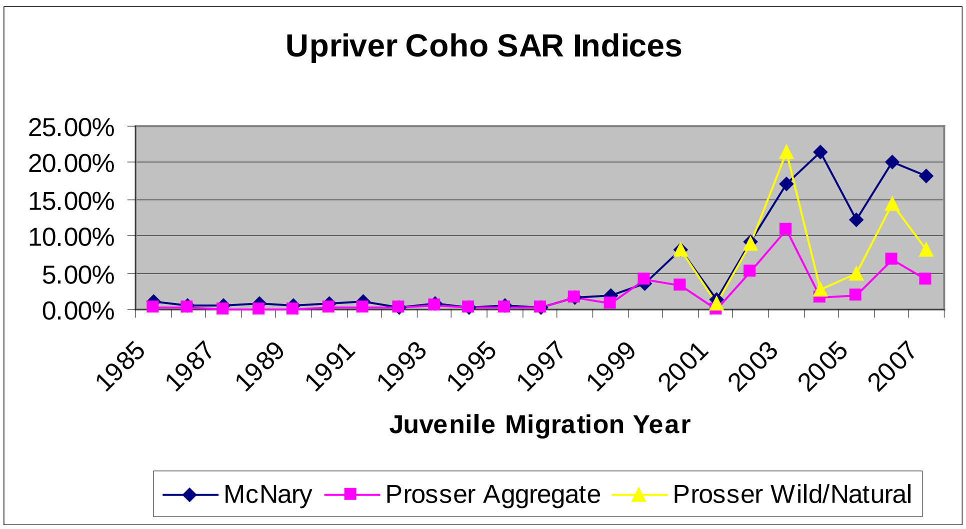


Figure 1.12.1. Aggregate smolt-to-adult survival (SAR) indices at Chandler/Prosser and McNary Dams for mid- and upper-Columbia (Yakima, Snake, and Upper Columbia) coho reintroduction programs, juvenile migration years 1985 to 2007 and Yakima natural-origin SAR indices for juvenile migration years 2000 to 2007. Data source: B. Bosch, YN.

1.13) Date program started (years in operation), or is expected to start.

Out-of-basin stocks have been outplanted into the Yakima Subbasin since 1981. Locally collected coho were first spawned and reared at the Prosser Hatchery in 1997.

1.14) Expected duration of program.

Phase I of the feasibility study was completed in 2003. Phase II is in progress with public and environmental review of a preliminary Master Plan (Hubble et al. 2004) conducted from 2004 to

2007 and implementation of this phase scheduled for completion in 2011. At that time the co-managers will develop and submit a long-term Master Plan to NPCC step-review. The Master Plan will recommend how the program should proceed.

1.15) Watersheds targeted by program.

Include WRIA or similar stream identification number for desired watershed of return.

Yakima River Subbasin/Columbia Plateau Province. Yakima Basin, including the Naches subbasin, middle and upper Yakima subbasins, and tributaries. See 1.5 for WRIA codes.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

A variety of planning and evaluation processes have led the program to this point. Alternatives to the YKFP program were evaluated in the Yakima Fisheries Project EIS (BPA 1996). The program continues to be adjusted, based on the principles of adaptive management adopted by the YKFP. Those changes were described in sections 2 & 3 of Hubble et al. (2004). In addition, Section 6 (various subsections) of Hubble et al. (2004) identified alternatives to the current proposed program that were considered. Also from 2003 HGMP provincial meetings:

1.16.1 Brief Overview of key issues
The primary goal for this program is the reintroduction of coho into historical habitats in the upper Yakima and Naches River Basins. Hatchery reared pre-smolts are trucked to sites near natural coho habitat where they are acclimated and released. The strategy to meet this goal is to develop a locally adapted stock from adults returning to Prosser, Roza, and/or Cowiche dams resulting from releases of a Lower Columbia hatchery donor population.

Key issues preventing the achievement of this goal are:

1. The present main station for local brood capture, holding, spawning, and rearing is Prosser Dam and Prosser Hatchery. Unfortunately, this facility has poor water quality and water temperatures typical of this lower portion of the Yakima River. This can sometimes reduce our success in producing adequate numbers of locally adapted smolts for release. In addition, Prosser Dam may be too low in the Basin to collect fish that are adapted to migrate to the upper portions of the basin where they are targeted to spawn and rear naturally. Development of new spawning and rearing facilities are needed in the upper Yakima and Naches Basins.
2. Cowiche Dam on the Naches River is insufficiently developed as a brood capture facility.
3. Some irrigators may not be supportive as they do not want fish (coho or steelhead) above their diversion dams.
4. The complexity and length of time required to conduct monitoring and evaluation on coho interactions with other salmonid species.

1.16.2 Potential alternatives to the current program

1. Do not attempt reintroduction.
2. Plant fry.
3. Increase the numbers of released smolts.
4. Collect local brood in-basin but spawn and rear these fish out-of-basin. Bring the smolts back

for acclimation and release from upriver sites.

1.16.3 Potential reforms and investments
1. Collect local brood at Roza and Cowiche, upgrading the Cowiche collection facility as necessary.
2. Build a full facility and smaller satellite facilities in the upper Yakima Basin as necessary.

It is anticipated that these alternatives and others that may arise will be further explored and evaluated through the NPCC Master Planning 3-step review process.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

This document is intended to be consistent with NOAA (2008) which states (RPA 39):

> The FCRPS Action Agencies will continue funding hatcheries in accordance with existing programs… Consultation under the ESA on the operation of hatchery programs funded by the FCRPS Action Agencies [will] include[e] the submittal of updated and complete HGMPs. Updated and complete HGMPs are to be submitted to NOAA Fisheries and ESA consultation should be initiated by … July 2009 for hatchery programs in the Middle Columbia … ESA consultations should be completed by January 2010 for hatchery programs in the Middle Columbia …

Project sponsors are also aware of direction in NOAA (2009) calling “for consultations on hatchery programs within the MCR Steelhead DPS to be completed by January 2010”. Project sponsors remind NOAA of its statement in this document that “mitigation obligations will not be diminished under this process”. The Yakama Nation considers this project essential to meeting federal commitments to honor the Treaty of 1855, and to “protect, rebuild, and enhance” anadromous salmon populations throughout tribal usual and accustomed fishing areas as described in the 2008-2017 *United States v Oregon* Management Agreement and in the Columbia River Fish Accords. As such, any changes to program parameters described herein which would diminish the number of adult salmon returning to tribal usual and accustomed fishing areas that result from this HGMP development and consultation process will not be implemented unless and until they are considered and approved in appropriate policy fora.

The program has the following permits or authorizations: A biological assessment was submitted to NMFS in 1999 that addressed the effects of the program on steelhead. A biological opinion has never been completed. YKFP projects have been operating under a "Section 7(d) Letter" dated 4/6/01 from Robert Beraud to Rob Jones which states that BPA is proceeding with the program under the 7(d) provision of the ESA regulations with the understanding that NMFS has no concern that YKFP activities would be in violation of ESA. An electronic copy of the letter is not available but could be mailed via U.S. mail if desired. The Yakama Nation also prepared a previous version of this HGMP and submitted it to NMFS in 2005. BPA also holds Section 10 permit 1426 for steelhead adult collection, radio-tagging, and release at Roza Dam (expires 12/31/2007) as part of the overall Yakima Fisheries Project (but not specific to the coho program). In addition, the BPA environmental coordinator for the YKFP has prepared NEPA documents which cover all the environmental aspects of the project. Copies of this documentation are available from Patricia R. Smith, BPA, 503-230-7349 (prsmith@bpa.gov).

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid population(s) affected by the program.</u>

Include information describing: adult age class structure, sex ratio, size range, migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

- Identify the NMFS ESA-listed population(s) that will be <u>directly</u> affected by the program. *(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).*

None

- Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.

(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

Populations of wild steelhead Oncorhynchus mykiss in the Columbia River Basin have declined dramatically from historical levels (Nehlsen et al. 1991; NRC 1996; Williams et al. 1999). Average abundance of wild steelhead in the Yakima River Subbasin over the last two decades is only 2% of pre-1890 abundance levels reported by Howell et al. (1985). Causes of these declines include a host of environmental and human-induced factors (NRC 1996; Williams et al. 1999). In 1997 steelhead in the upper Columbia River were listed as endangered under the Endangered Species Act (ESA) and those in the Snake River were listed as threatened (62 FR 43937-43954). Stocks originating in mid-Columbia Basin tributaries (including the Yakima River) were listed as threatened in 1999 (64 FR 14517-14528). No hatchery fish have been released in the Yakima Subbasin since 1993. Regional plans recognize the need to protect and enhance weak upriver steelhead populations and their habitat while maintaining the genetic integrity of those stocks (NPPC 1994).

Steelhead in the Yakima Basin are divided into four populations: the Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River populations. The NOAA Interior Columbia Technical Recovery Team (ICTRT) identifies the Satus Creek population as steelhead that spawn in the Satus Creek drainage on the Yakama Indian Reservation, the mainstem Yakima River below Satus Creek, and tributaries to the lower mainstem. For management purposes, local planners have subdivided the Satus population into the Satus block, which spawns in the Satus Creek drainage, and a mainstem block, whose current and historic status is uncertain. The Toppenish population consists of steelhead that spawn in Toppenish Creek, its tributaries and the short stretch of the mainstem between Toppenish and Satus creeks, and is entirely on the Yakama Reservation. The Naches population includes steelhead spawning in the Naches River and its tributaries (including the Tieton, Little Naches, American, and Bumping rivers and Cowiche, Rattlesnake and Nile creeks), the mainstem Yakima from the Naches confluence to the Toppenish Creek confluence and the tributaries to that reach of the Yakima, including Ahtanum Creek. The Upper Yakima population consists of all steelhead that spawn in the Yakima River and its tributaries upstream of the Naches confluence. Together these four populations make up the Yakima MPG.

Risks for Yakima Basin coho restoration feasibility study objectives and strategies are discussed in Section 6 of the Coho Master Plan. Risks of the coho program generally fall into three categories:

- Physical effects on environmental resources caused by facility development
- Effects on target fish (coho) and non-target taxa (NTT) caused by monitoring and broodstock collection activities (e.g., trapping, marking, handling, etc.)
- Interaction risks to non-target fish from the presence of reintroduced coho.

As documented in Hubble et al. 2004, all the risk levels are relatively low and do not warrant additional monitoring beyond what is currently proposed.

2.2.2) <u>Status of NMFS ESA-listed salmonid population(s) affected by the program.</u>

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1").*

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. *(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).*

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Adult and juvenile passage estimates for Yakima Basin projects are available at www.ykfp.org and Columbia River DART. Estimated counts of juvenile steelhead migrating past Prosser for recent years are:

Table 2.2.1. Prosser Dam Steelhead Juvenile (Downstream) Migration Estimates

Juv. Migr. Year	Wild	Hatch.	Total	%Wild
1988	42,522	14,636	57,158	74.4%
1989	22,345	5,056	27,401	81.5%
1990	21,805	6,499	28,304	77.0%
1991	21,309	612	21,921	97.2%
1992	33,096	549	33,645	98.4%
1993	17,165	3,109	20,274	84.7%
1994	17,977	602	18,579	96.8%
1995	17,765	16	17,781	99.9%
1996	43,366	14	43,380	100.0%
1997	44,631	0	44,631	100.0%
1998	85,360	0	85,360	100.0%
1999	38,266	0	38,266	100.0%
2000	42,696	0	42,696	100.0%
2001	28,428	0	28,428	100.0%
2002	38,560	0	38,560	100.0%
2003	29,641	0	29,641	100.0%
2004	32,428	0	32,428	100.0%
2005	46,741	0	46,741	100.0%
2006	18,838	0	18,838	100.0%
2007	31,898	0	31,898	100.0%
2008	26,327	0	26,327	100.0%
2009	28,754	0	28,754	100.0%
Average:	33,389	1,413	34,591	95.9%

Data source: YN databases (YakRSthdDB.xls)

Table 2.2.2. Yakima Basin Adult Steelhead Escapement and Spawning Summary						
Run Year	Prosser Dam Count	Redd Counts by Survey Stream				Roza Dam Count
		Satus	Toppenish	Ahtanum	Naches	
1987-88	2,840	445				
1988-89	1,162	404	45			
1989-90	814	289	26			
1990-91	834	125				
1991-92	2,263					116
1992-93*	1,184	73				15
1993-94	554	114				28
1994-95**	925	85				23
1995-96	505	148				92
1996-97*	1,106	76	5			22
1997-98*	1,113	190	13			51
1998-99	1,070	130	78			14
1999-00	1,611	169	185	11		14
2000-01	3,089	102	355	8		140
2001-02**	4,525	240	111	13		238
2002-03	2,235	172	354	8		134
2003-04	2,755	93	56	12	94	213
2004-05	3,451	108	99	16	140	227
2005-06**	2,005	60	20	1	19	117
2006-07	1,537	87	42**	4**	44	61
2007-08	3,310	110	68*	8*	11**	169
2008-09	3,450	119	79	3	29**	230

Blank = no data available

* Partial survey.

**Survey affected by access problems, high flows, or poor redd visibility

Hatchery releases were discontinued in the early 1990s. Recent 9-year average (since 1998-99 run year) escapement over Prosser Dam has been >98% wild; since 1983-84 the annual steelhead escapement has averaged about 92% wild. Data source: YN databases (YakRSthdDB.xls, SthdReddSummary.doc).

Available data indicates smolt-to-adult survival for naturally produced smolts in the Yakima Basin ranged from approximately 0.35% to 4.21% for calendar years 1985 through 2002 (C. Frederiksen, Yakama Nation Fisheries, personal communication).

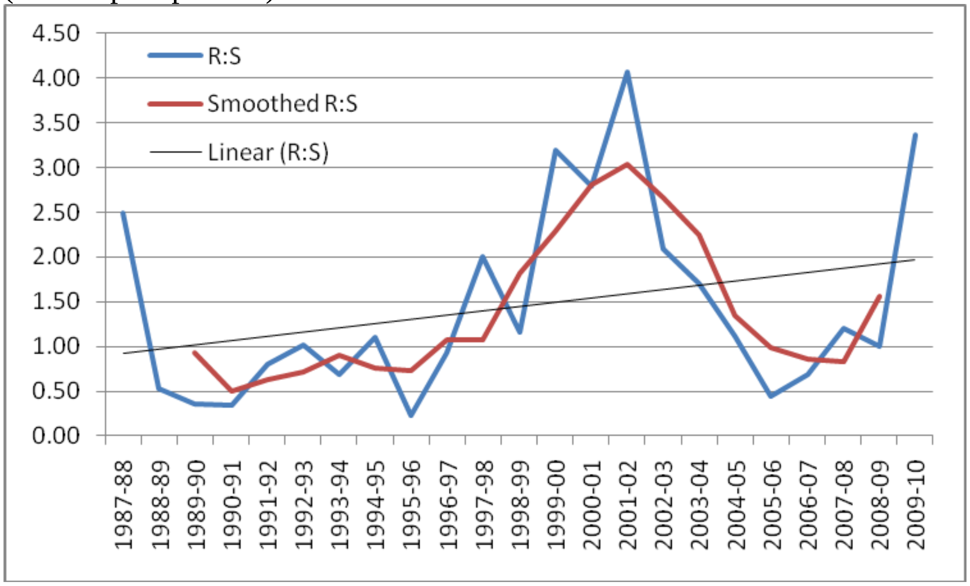
Table 2.2.3. Age-4 aggregate adult-to-adult productivity (returns per spawner) estimates for Yakima Basin Steelhead.

Run Year	Prosser Adult Count	Prosser Aggregate Age-4 Returns per Spawner	Smoothed Average Age-4 R:S
1983-84	1,140		
1984-85	2,194		
1985-86	2,235		
1986-87	2,465		
1987-88	2,840	2.49	
1988-89	1,162	0.53	
1989-90	814	0.36	0.93
1990-91	834	0.34	0.51
1991-92	2,263	0.80	0.63
1992-93	1,184	1.02	0.71
1993-94	554	0.68	0.90
1994-95	925	1.11	0.76
1995-96	505	0.22	0.74
1996-97	1,106	0.93	1.07
1997-98	1,113	2.01	1.08
1998-99	1,070	1.16	1.82
1999-00	1,611	3.19	2.29
2000-01	3,089	2.79	2.80
2001-02	4,525	4.07	3.03
2002-03	2,235	2.09	2.66
2003-04	2,755	1.71	2.25
2004-05	3,451	1.12	1.34
2005-06	2,005	0.44	0.99
2006-07	1,537	0.69	0.86
2007-08	3,310	1.20	0.83
2008-09	3,469	1.01	1.56
2009-10	6,743[1]	3.36	
Mean	2,108	1.44	1.39
Geometric Mean	1,740	1.10	1.20

[1] through May 6, 2010.

Data source: YN databases (YakRSthdDB.xls).

Figure 2.2.1. Graph of age-4 aggregate and smoothed average adult-to-adult productivity (returns per spawner) estimates for Yakima Basin Steelhead.



The data in Table 2.2.3 and Figure 2.2.1 are admittedly gross representations of adult-to-adult productivity. However, the geometric means for these metrics over a 26-year data set are greater than one and show an increasing trend. This indicates with high likelihood that combined artificial production and habitat restoration activities in the Yakima Basin are having a neutral or net positive impact on listed steelhead in the Basin.

Please see Yakima Basin steelhead HGMP (submitted to NOAA fisheries in 2005; available from YN) and Yakima Basin steelhead recovery plan for further information.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take</u> *(see "Attachment 1" for definition of "take")***.**

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

(*e.g. "Broodstock collection directed at sockeye salmon has a "high" potential to take listed spring chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation*").

Yakima Basin Coho: Hatchery activities assessed include broodstock collection and transfer to and release from acclimation sites. Parr releases will be conducted in: North Fork Little Naches, Little Naches River, Pile Up Creek, Quartz Creek, Blow Out Creek, Little Rattlesnake Creek, Nile Creek, Cowiche Creek, Ahtanum Creek, Toppenish Creek, Reecer Creek, Wilson Creek, Big Creek, and the Crystal Spring area of the Upper Yakima River. Adults will be transferred and out planted into Ahtanum Creek, Toppenish Creek, Wilson Creek, Pile Up Creek, Cowiche Creek, Nile Creek, and Quartz Creek. M&E activities include: spawner surveys, PIT and radio tagging, juvenile and adult trapping and sampling operations, boat and backpack electroshocking, snorkeling, etc. See also Section 3.5 below.

ESU/Population	Mid-Columbia ESU, Yakima wild/natural steelhead
Activity	Prosser adult trap monitoring and broodstock collection operation Adult Broodstock capture at Roza, Wapatox and Cowiche Dams.
Location of hatchery activity	Prosser Adult Facility (right bank denil ladder and trap), Yakima River, 75.6 RKm
Dates of activity	Approximately Sept. 1 – November 30 annually
Hatchery Program Operator	Joe Blodgett, YN

Although not specifically enumerated, risks for Yakima Basin coho restoration feasibility study objectives and strategies are fully discussed in Section 6 of the Coho Master Plan.

- **Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish**.

Juvenile passage estimates at Prosser and adult counts of steelhead at Prosser and Roza Dam were given above in 2.2.2.

See also take table at end of this HGMP. Annual adult and juvenile passage estimates for Yakima Basin projects are also available at http://www.ykfp.org.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*
See Take Table at end of document.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.
(*e.g. "The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected inseason to exceed the 1988-99 maximum observed level of 100 fish."*)

We do not anticipate exceeding take levels specified in this HGMP. At Prosser Dam, steelhead can use three ladders and only the right bank Denil ladder contains an adult sampling facility. Historically, only 10-20% of the annual steelhead run passes upstream at Prosser via the Denil ladder and monitoring facility and the adult monitoring facility only operates during the fall (first 40-60% of the adult steelhead migration).

Contingency plans for YKFP projects are addressed by the YKFP Policy Group on a timely basis using adaptive management. For example, in the drought emergency of 2003, the Policy Group determined that coho survival could likely be improved with an earlier release and fish were volitionally released in April instead of May.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPCC *Annual Production Review* Report and Recommendations - NPCC document 99-15). Explain any proposed deviations from the plan or policies. *(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").*

A Yakima Subbasin salmon recovery plan is presently being developed in cooperation with the Yakima Subbasin Fish and Wildlife Recovery Board. A draft document is available for public review at http://www.ybfwrb.org/Draft%20plan/RecPlanFinal.pdf. Yakima Basin coho production activities will be consistent with this recovery plan and the Middle Columbia River DPS recovery plan. The program is included in the *United States versus Oregon* 2008-2017 Columbia River Fish Management Plan and the recently signed Columbia River Accords between the Columbia River Tribes and the Bonneville Power Administration. The project is implementing HSRG recommendations to move to local brood stock and phase out (or segregate) out-of-basin releases.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

Document Title	Type
Treaty of 1855. Asserted the right of the Yakama Nation to "take fish at all usual and accustomed fishing areas". Federal courts have held that this right means more than the right of Indians to hang a net in an empty river (*Washington v Washington State Commercial Passenger Fishing Vessel Association, 1979*).	Federal Treaty
United States versus Oregon. 2008-2017 United States v. Oregon Management Agreement, May 2008. Section II.K of the original Columbia River Fish Management Plan described provisions for moving coho production to upriver areas. See also 1.8 above.	Federal Court Order
US v Washington	Federal Court Order
Northwest Power and Conservation Council (NPCC), Fish and Wildlife Program.	Northwest Power Act

BPA. 1996. Yakima Fisheries Project. Final Environmental Impact Statement. Bonneville Power Administration. Washington Department of Fish and Wildlife. Yakama Indian Nation. January, 1996. DOE/EIS-0169. DOE/BP-2784. Portland, OR.	NEPA document
Mitchell Act annual Congressional Appropriations language. The primary purpose of the Mitchell Act is to mitigate for fishery losses due to hydroelectric development in the Columbia River Basin. Congress has recognized that it is appropriate to mitigate these losses in upriver areas where the losses occurred.	Mitchell Act
WY-KAN-USH-MI WA-KISH-WIT	Columbia River Anadromous Fish Restoration Plan of the Columbia River Tribes
Yakama Nation and US Bureau Reclamation Prosser Hatchery Agreement	MOU
Yakama Nation and US Fish & Wildlife Service Fish Health Agreement	MOU
2008 Columbia Basin Fish Accords Memorandum of Agreement between the Three Treaty Tribes and FCRPS Action Agencies	MOA

Since the 1990s, various entities in the Pacific Northwest have renewed the region's focus on reintroduction of coho to the mid-Columbia.

The four Columbia River Treaty Tribes (Nez Perce, Umatilla, Warm Springs, and Yakama) identified coho reintroduction in the mid-Columbia as a priority in the Wy-Kan-Ush-Mi-Wa-Kish-Wit document, commonly referred to as the Tribal Restoration Plan (TRP) (CRITFC 1995). It is a comprehensive plan put forward by the Tribes to restore the Columbia River fisheries. This project is an essential component of implementing that long-term vision in the mid-Columbia region.

In 1996, the Northwest Power and Conservation Council (NPCC) recommended the tribal mid-Columbia reintroduction project for funding by BPA, which has responsibilities under the Northwest Electric Power Planning and Conservation Act of 1980 to protect, mitigate, and enhance fish and wildlife that have been affected by the construction and operation of the Federal Columbia River Power System. It was identified as one of fifteen high-priority projects for the Columbia River basin, and was incorporated into the NPCC's Fish and Wildlife Program (program measures 7.1H, 7.4A, 7.4F, and 7.4O). The project will be subject to a Step-Two Review by the Council once the feasibility phase is completed and the time is ripe to consider full implementation of the long-term vision.

The release of coho from lower Columbia hatcheries into mid-Columbia tributaries is also recognized in the Columbia River Fish Management Plan, a court-mandated plan under the jurisdiction of *U.S. v. Oregon*, involving Federal, state and tribal fish managers in the Columbia basin (CRITFC 1988, 2008). The CRFMP and associated management agreements call for a release of approximately 700,000 to 1.0 million coho annually in the Yakima Basin. These agreements are recognized and incorporated into the Columbia River Fish Accords.

The draft Yakima Coho, Project Status Review (YKFP 2001) prepared by the YKFP, Monitoring Implementation Planning Team (MIPT) provided direction for objectives and strategies for short-term feasibility efforts.

The U.S. District Court ruled on March 22, 1974 that the Yakama Nation and Washington Department of Fish and Wildlife co-manage fish resources in Washington State. This decision is commonly referred to as the Boldt Decision.

A Memorandum of Understanding, dated 12/27/93, stipulates that the Wenatchee National Forest (WNF) and the YN will cooperatively manage fish resources on the Wenatchee National Forest.

The YN has a Memorandum of Understanding with the BOR, which stipulates responsibilities between the two parties pertaining to the Prosser Hatchery facility.

The YN has a subcontract with the USFWS to monitor fish health at the main hatchery facility and satellite acclimation facilities.

Mitchell Act funds are used for in-basin acclimation of out-of-basin fish transported to the Yakima Basin.

3.3) Relationship to harvest objectives.

Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

3.3.1) Describe fisheries benefiting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish.

Stated harvest objectives for this project are general in nature. BPA (1996) stated the goal for the preferred alternative was to "determine the feasibility of re-establishing a naturally spawning population and a significant fall fishery for coho in the Yakima River Basin". Hubble et al. (2004) stated the following objective: "Expand harvest opportunities for treaty Indian and sport fisheries inside and outside of the Yakima River Basin while meeting objectives for genetics, experimentation, natural production and ecological interactions."

Present efforts are focused on improving survival and establishing a locally adapted broodstock. These objectives are considered highest priority and achieving these goals (especially improving survival) will obviously facilitate achievement of harvest objectives. The project has temporarily moved away from using the adipose-fin-clip to mass mark releases in an effort to improve survival because this mark is used in highly successful mark-selective fisheries in Buoy 10 and the lower Columbia River. Instead, coded or blank wire tags are used to identify hatchery-origin fish in adult return sampling and brood stock collection efforts (see 7.3). Unfortunately, this makes it difficult to determine mortality rates in fisheries because adipose-present fish are not sampled for wire tags. We presently assume that Yakima Basin coho are harvested at the same rate as other unmarked coho in fisheries. Marking regimes will be re-evaluated and specific numerical objectives for harvest may be established pursuant to development of the long-term

Master Plan.

The Yakama Nation has set an in-basin coho subsistence fishery since the mid-1990's, however, in-basin harvest has been virtually zero. This is largely due to the commercial Zone 6 fishery, which overlaps in time to a large extent with the Yakima fishery season.

In 1998 WDFW instituted an in-basin sport harvest in the Yakima basin and in recent years there has been substantial effort and catch in this fishery near the Yakima River mouth. There is an unofficial harvest maximum of 10% of the adult escapement to the river mouth. The two agencies cooperate in setting the geographic boundaries and fishing season. The WDFW is also providing bio-sample data from fish caught in the fishery to the YKFP monitoring and evaluation program.

See also section 4.1.1 of Hubble et al. (2004) for more details of past coho harvest.

3.4) Relationship to habitat protection and recovery strategies.

Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPCC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions.

Major inhibiting factors to coho production are:

1) Sublethal to lethal water temperatures typically by June below Prosser Dam (RM 47).

2) Low flow conditions (especially in poor water years) between Prosser Dam and the Chandler power plant outfall.

3) Predation by birds (especially in poor water years), and both native and exotic piscivorous fish (especially smallmouth bass).

4) Loss of structurally complex rearing habitat.

5) Excessive sediments from irrigation drains (though this is being slowly addressed in recent years) in major spawning areas.

6) Smolt mortality associated with predation in the vicinity of bypass outfalls at Wapato, Sunnyside and Prosser Dams, and a number of smaller Yakima Basin dams (e.g., Marion Drain re-use diversion, Columbia and Richland Ditches at Horn Rapids Dam).

7) Adult mortality associated with mainstem Columbia dams.

8) Smolt mortalities associated with traversing mainstem Columbia dams and impoundments.

These limiting factors in the Yakima Subbasin and strategies to address them are well described in the Yakima Subbasin Plan (YSFWPB 2004) and Freudenthal et al. (2005). In addition, YKFP habitat actions to date have resulted in: the protection of almost 1,000 acres of prime floodplain habitat, reconnection and screening of over 15 miles of tributary habitat, substantial water savings through irrigation improvements, and restoration of over 80 acres of floodplain and side channels. Additional habitat improvements implemented by other entities, including the Conservation Districts, counties and private interests are also continuing in the basin.

To review the Yakima Subbasin Plan or for additional information, please refer to the Northwest Power and Conservation Council's website at:
http://www.nwcouncil.org/fw/subbasinplanning/yakima/plan/
or visit the Yakima Basin Fish and Wildlife Recovery Board's web site at:
http://www.ybfwrb.org/

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]
Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

The following ESA-listed species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.
- Steelhead
- Chum
- Sockeye
- Coho
- Chinook
- Bull Trout

Describe salmonid and non-salmonid fishes or other species that could:

(1) negatively impact program

Pikeminnows, smallmouth bass, and avian predation have a large but un-quantified impact on coho hatchery smolts. Mergansers have been identified as a problem at certain acclimation sites. Gulls, especially during low flow periods are a known predator at the fish bypass outfall sites (i.e. Chandler) for all salmonid smolts. These impacts by both piscivorous fishes and birds are being investigated through two YKFP funded predation studies- one directed toward fish and the other towards birds.

(2) be negatively impacted by program

No significant impacts to other salmonid species have been demonstrated. A two-year coho smolt predation study was initiated in 1998 to investigate the potential predation of hatchery coho smolts on newly emergent spring chinook fry in the upper Yakima (Dunnigan 1999).

Impacts of these hatchery coho smolt releases were concluded as having no significant impact on the wild spring chinook population. To date there has been very little information on interaction between coho and steelhead. We are continuing to investigate possible interactions on a limited scale. There has been extensive research since 1999 on interactions between Spring Chinook Salmon and RBT/Steelhead in the Teanaway River. In general, this work has found that ecological impacts to valued non-target taxa were within containment objectives or impacts that were outside of containment objectives were not caused by spring Chinook supplementation activities. The most recent results from these studies were documented in:

> Pearsons, T. N. and G. M. Temple. 2007. Impacts of Early Stages of Salmon Supplementation and Reintroduction Programs on Three Trout Species. North American Journal of Fisheries Management 27:1-20.

(3) positively impact program

There is presently no directed effort to study this issue. However, it is expected that other aspects of the YKFP are likely to positively impact this project.

(4) be positively impacted by program

Though not rigorously investigated, the addition of carcasses to tributaries and side channels, especially in the upriver reaches, is a benefit for nutrient enrichment to the stream itself, as well as, to terrestrial animals, which feed on the carcasses.

See also Section 6 of Hubble et al. (2004), Sampson et al. (2009), the Mid-Columbia Coho Restoration Master Plan (Yakama Nation 2005), and ykfp.org for additional data and links to current results from species interactions studies.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria.

Prosser Hatchery operates under NPDES permit WAG135017.

Prosser Hatchery has the ability to use 30 cfs Yakima River water, and has three wells that contribute 3200 gallons per minute. The river water supply is used from March through July for juvenile fish rearing and September through January for adult broodstock. The surface water is gravity flow from Chandler Canal behind the fish screens. One well is used from September through April to incubate eggs. The well is capable of pumping 800 gallons per minute. The other two wells are used all year to rear juvenile salmon and adult steelhead kelts. Each well is able to pump 1,200 gallons per minute. The well water is constant 57 degrees, and the surface water temperature changes with the seasons. The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) guidelines.

The Yakima River (Chandler Canal) and two wells supply the water needed to operate the Prosser Hatchery. Lost Creek, Holmes, and Boone ponds are all side channels with a natural river water source. The influent water at these ponds is not screened, but the effluent is to keep smolts in the pond for specified acclimation periods. Stiles pond is fed through a screened natural river water source. Hundley and Brunson ponds are off-channel ponds which are only connected during periods of high water, so additional small-scale infrastructure is planned for these sites. Mobile acclimation sites will utilize screened gravity-fed local water sources.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.
(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

The production from this facility falls below the minimum production requirement for an NPDES permit, but the facility operates in compliance with state or federal regulations for discharge. Chandler Canal is screened to prevent juvenile salmonids from entering the canal and the hatchery intake. See also 4.1.

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

Prosser Hatchery is presently the primary facility for coho restoration activities. It is expected that new or additional facilities for coho will be proposed as part of the long-term Master Plan that will be developed in 2011-2012. In addition, use and proposed expansion of the Prosser Hatchery for on-going fall and summer run Chinook will be further described in that Master Plan which is expected to be completed in 2010.

5.1) Broodstock collection facilities (or methods).

Since 1997, some local broodstock have been collected at the Prosser Dam right bank adult denil ladder and trap. These fish are supplemented with the progeny of fish collected at other facilities (see HGMPs for Eagle Creek NFH and Washougal State Fish Hatchery and section 1.5 of this document).

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)

1	Vinyl line Raceway	22000	150	50	4	1100

Coho broodstock currently are collected at the Prosser Dam steep-pass ladder and trucked ½ mile to the holding ponds at Prosser Hatchery. In addition to collecting broodstock at Prosser, the future program proposes also to collect broodstock at existing facilities at Roza Dam on the upper Yakima and at Cowiche or Wapatox dams on the Naches River. The potential for incidental interaction with adult steelhead during coho broodstock collection at Roza, Cowiche and/or Wapatox is minimal. Typically, passage at Roza Dam, Cowiche and/or Wapatox is at or fewer than 5 steelhead (each dam) during the month of December when coho broodstock collection would occur. Coho brood stock collection would typically end in mid-December. See also Master Plan, Section 6.1, Strategy 1d.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Adult Transfer Tanker Truck	700	Y	N	5	Light dose MS	
Juvenile Transfer Tanker Truck	2500	Y	N	150		

Adults are captured at the steep pass denil ladder at Prosser Dam and trucked ½ mile to Prosser Hatchery. Transportation meets IHOT guidelines.

5.3) Broodstock holding and spawning facilities.

Spawning for this program takes place at the Prosser Hatchery where adults are held in large holding ponds (150 ft by 50 ft) and treated with formalin and checked weekly for ripeness. The holding ponds meet IHOT adult holding guidelines for adult holding, density, water quality, alarm systems and predator control measures to provide the necessary security for the broodstock. Fish are spawned in the spawning shed. The unfertilized gametes are taken to the incubation room where eggs are fertilized.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Vinyl line Raceway	22000	150	50	4	1100

5.4) Incubation facilities.

Prosser Hatchery has four deep troughs used for initial incubation (to eyed-stage) and 15 (16 trays/stack) vertical stacks (Heath trays) used for final incubation to hatch-out.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Deep Trough with perforated plates (10 cells per trough)- Prosser Hatchery	5	10	12	100,000 per cell	nya
Vertical Stack (16 trays/stack)- Prosser Hatchery	15 stacks	8	nya		5000

5.5) Rearing facilities.

Fry are ponded at 1,100 fpp from the vertical stacks into the three upper, outside raceways. When the parr reach 500 fpp they are transferred to the four lower, outside raceways.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maximum Density Index
16	Stainless Wall with Vinyl Line Raceways- Prosser Hatchery	3375	75	15	3	750		0.75
6	Raceways- Flow Through (Per Acclimation Site)[a] - Yakima Basin	5400	100	12	4.5	650	0.11	0.66

[a] Derived from Upper Yakima Spring Chinook Cle Elum Hatchery Procedures Manual, Working Draft, March 1998.

5.6) Acclimation/release facilities.

Coho acclimation sites on the upper Yakima have included the Easton D.O.T. Ponds, Holmes Pond, Hundley Ponds, Brunson Pond, Wilson Creek, and Boone Pond. There are two sites on the Naches- Lost Creek Ponds and Stiles Ponds.

Since 2003 releases from all sites have been volitional beginning the first week of April (unless drought conditions occur). Fish are delivered to their respective acclimation sites the last week of February or the first week of March. Since 2003 the main 4 acclimation sites have been Stiles, Lost Creek, Holmes, and Boone ponds.

The numbers of coho acclimated in each pond varies depending on the number of fish available each year. Generally, no more than 250,000 coho are acclimated in a pond. With the addition of Hundley and Brunson Ponds the numbers of coho acclimated will decrease in each pond, however we will keep conducting our experimental in basin vs. out of basin releases. There are approximately 24,000 PIT tagged coho for all release groups (8 mark groups). The coho are brought into the acclimation sites at 17-22 fish/lb.

See also Appendix Table 1 of this document for additional information.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

Water temperatures during the summer months at the Prosser hatchery are a problem and can lead to early smolting and disease problems. In 2011, when feasibility studies conclude, we intend to update the 2004 Master Plan to include new, permanent production facilities which are more appropriately sited and submit to NPCC step-review.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.

(e.g. "The hatchery will be staffed full-time, and equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure.").

The facility is sited so as to minimize the risk of catastrophic fish loss from flooding, but experienced flooding in 1996 with no fish loss because fish were released into the river early. At Prosser Hatchery, staff members are on-site 24/7 during critical phases of the program, and the facility is enclosed in chain linked fence, and periodic patrols of law enforcement (local and tribal) maintain a security envelope of facility.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

Yakima Broodstock Source:

Coho were extirpated from the Yakima Basin. We are developing a local brood source from adult coho returning to Prosser Dam. In recent years, progeny of local broodstock have ranged from about 10-30% of total releases. Of local broodstock, the proportion that were natural-origin fish collected at the Prosser denil ladder ranged from 25-75%. See 1.11.1 and Bosch et al (2007) for additional information on development of this local broodstock. We are optimistic that over the long-term this restoration effort will observe positive trends in coho survival and natural production in the Yakima Basin as this localized broodstock develops and as habitat conditions in the basin improve.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

Broodstock Source	Origin	Year(s) Used	
		Begin	End
Cascade Hatchery Early Run Coho (ODFW)	H	U	2004
Washougal Fish Hatchery (WDFW) Late run	H	2004	U
Eagle Creek National Fish Hatchery (USFWS)	H	2004	U
Little White Salmon/Willard NFH Complex (USFWS)	H	1983	2004
Yakima River	H and N	1997	U

The Yakama Nation (YN) has released between 85,000 and 1.4 million coho smolts in the Yakima Basin annually since 1985. All of these releases derive from a variety of stocks in the lower Columbia River Basin and most are believed to be of early-run origin reared in hatcheries near to or below Bonneville Dam (234 km/146 miles upstream from the Columbia River mouth). The history of lower Columbia River hatchery coho salmon was well described by Johnson et al. (1991). Given this history, the hatchery coho we are using in this Yakima Basin restoration effort have likely been in culture anywhere from 30 to over 100 years (10 to more than 30 generations), and are expected to successfully migrate and spawn in the Yakima River where they are released, which is between 500 and 650 km further than returning to their natal hatcheries.

In 1997 the Yakima program began collecting naturalized spawners at Prosser Dam. The project has relied less on the lower river stock (Washougal and Eagle Creek) as the Yakima basin adult returns increased. The long-term goal is to meet all smolt production goals using in-basin (Yakima NORs) broodstock (see 1.11.1). Eventually broodstock collection will occur at Cowiche (or Wapatox) and Roza dams as the numbers of natural spawners increase into these two subbasins.

6.2.2) Annual size.

Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their population status relative to critical and viable thresholds.

The program objective is to produce a self-sustaining natural population greater than 1,000 fish per generation. We intend to meet this objective by gradually increasing the use of local, natural-origin broodstock (eventually hoping to achieve 100% for all production and releases in the Yakima Basin) in this program. Passage of returning natural-origin coho at Prosser Dam was estimated at 1,500 fish or greater in 5 of the 9 return years from 2001-2009. Since, on average, about 40% of the coho migrate upstream via the right bank denil ladder at Prosser, a substantial number of local, natural-origin fish are available annually for collection as broodstock.

Broodstock is randomly collected from adults returning to Prosser Dam/Chandler Canal area, and these fish are derivatives of introduced stocks from outside of the subbasin and adults from the localized broodstock. The in-basin broodstock are collected at Prosser Dam (RM 47), at the right ladder. Broodstock collection occurs between mid-September through mid-November, and fish are collected in proportion to the population run time past Prosser Dam. Based on the pre-season run forecast and the number of experimental and broodstock fish required, the total number of fish to be collected is proportioned in weekly increments throughout the run. This results in a pre-season, weekly collection target number (low in the tails of the run, and higher in the peak). At the beginning of a new week the steep-pass ladder is operated, and all fish are taken (no selection) until the week's target collection number is met.

In the past it was assumed that more than 10% of the broodstock were from naturally produced fish; this was due to the inability to discriminate between hatchery and naturally produced fish since fish have not been 100% marked. In recent years all hatchery production has been externally marked (see 7.3).

6.2.3) Past and proposed level of natural fish in broodstock.

If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the broodstock annually.

Since 2000, the proportion of natural-origin coho used for the local broodstock program ranged from 3-70% (see Table 1.11.1.1). The project is using a stepped approach to increase returns from the local broodstock program (see 1.11.1). See also Section 1.12 and Appendix A of Yakima Coho Master Plan.

6.2.4) Genetic or ecological differences.

Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

Broodstock is derived from adults returning to the Yakima River. Generally these are naturally produced fish of hatchery ancestry. The primary reason for choosing Lower River brood stock to begin with is that it is the closest stock available geographically and it is the only early stock in the Columbia River basin. There are no differences between the hatchery and natural populations because the natural population was extirpated and the current hatchery populations are being used to develop the natural stock.

6.2.5) Reasons for choosing.

Describe any special traits or characteristics for which broodstock was selected.

The native stock has been extirpated, however the broodstock chosen is likely to adapt to the system based on life history and evolutionary history.

The question of reverse domestication is being investigated as part of the genetics monitoring and evaluation program. Part of the hatchery treatments is to investigate differences in survival between in-basin and out-of-basin stocks. Preliminary results were published in Bosch et al (2007). Preliminary indices of smolt-to-adult survival for natural-origin coho were 3.5 to 17.0 times survival indices of hatchery-origin coho. The number of coho returning to historical native spawning habitats in upriver areas generally increased. Spawning surveys demonstrated the existence of robust and sustainable spawning aggregates in various locations in the basin. Hatchery releases from local brood source parents had significantly higher smolt-to-smolt survival than releases from out-of-basin hatchery broodstock, but some of these observed differences in survival could have been due in part to differences in smolt size. We concluded that hatchery-origin coho, with a legacy of as many as 10 to 30 generations of hatchery-influence, demonstrated their ability to reestablish a naturalized population after as few as 3 to 5 generations of outplanting in the wild.

Survival differences between the various stocks used for brood are evaluated annually and published in project annual reports, most recently in Sampson et al. (2009). The selected broodstocks are meeting the management objectives set forth in this phase of the program.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.

(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous chinook salmon population for use as broodstock in the supplementation program.*").

Risks for Yakima Basin coho restoration feasibility study objectives and strategies are discussed in Section 6 of the Coho Master Plan. Risks of the coho program generally fall into three categories:

- Physical effects on environmental resources caused by facility development
- Effects on target fish (coho) and non-target taxa (NTT) caused by monitoring and broodstock collection activities (e.g., trapping, marking, handling, etc.)
- Interaction risks to non-target fish from the presence of reintroduced coho.

As documented in Hubble et al. 2004, all the risk levels are relatively low and do not warrant additional monitoring beyond what is currently proposed. See also section 6 of Yakima Coho Master Plan.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Generally, adults for the local-origin broodstock are collected for brood stock from the Prosser right bank denil ladder. See table 7.4.2.1 of this HGMP. In the future, brood stock may be collected at Roza Dam on the Upper Yakima (trap operations there in the fall of 2009 encountered nearly 1,000 returning adult coho). Brood collection at Cowiche or Wapatox Dams on the Naches River is also a possibility in the future; however, upgrades to existing facilities may be required to make this truly feasible. Thus, brood collection in the Naches system will be considered further in development of the long-term Master Plan.

7.2) Collection or sampling design.

Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired broodstock source.

Broodstock for program is randomly collected at Prosser Dam facility over the adult run entry pattern. Broodstock collection occurs between mid-September through mid-November, and fish are collected in proportion to the population run time past Prosser Dam. Based on the pre-season run forecast and the number of experimental and broodstock fish required, the total number of fish to be collected is proportioned in weekly increments throughout the run. This results in a pre-season, weekly collection target number (low in the tails of the run, and higher in the peak). At the beginning of a new week the steep-pass ladder is operated, and all fish are taken (no selection) until the week's target collection number is met.

See also Appendix A in Yakima Coho Master Plan.

7.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

Marking techniques are used to distinguish among hatchery population segments. One hundred percent (100%) of the hatchery fish released are marked so that they can be distinguished from the natural population. Natural-origin fish comprise approximately 30-50% of the broodstock for this program annually.

Beginning with the 2001 adult return (2000 smolt release) 100% of all hatchery-origin coho were adipose fin-clipped and coded-wire-tagged in the snout. This marking scheme occurred through the 2004 smolt release. For 2005-2009 smolt releases, all coho smolts, both of in-basin (local) and out-of-basin brood hatchery-origin were adipose fin-clipped. Beginning with smolt release year 2010, all in basin brood coho will receive blank wire tags and all out of basin coho smolts will be adipose clipped.

Since smolt release year 2001, PIT tags have been used to evaluate survival differences between in basin and out of basin brood coho. Generally, up to 24,000 PIT tags (12,000 per release group) have been used to evaluate smolt survival from Yakima River acclimation sites. PIT tags are also used to evaluate survival of summer parr releases as all releases are PIT-tagged.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The broodstock goal is 960 local origin adults to meet the 1 million production goal (500,000 smolts and 500,000 parr). See Appendix A of Yakima Coho Master Plan.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Collection of local origin broodstock from the Prosser right bank denil ladder from 1997 to present were:

Table 7.4.2.1. Prosser Denil Broodstock Collection

Brood	Adults			Jacks		
Year	Total	Hat.	Nat.	Total	Hat.	Nat.
1997		32				
1998		48				
1999	282	282		4		
2000	448			21	2	19
2001	586	445	141	12	8	4
2002	87	25	62	47	13	34
2003	467	139	328	20	5	15
2004	265	7	258	5	0	5
2005	157	66	91	11	1	10
2006	401	263	138	3	0	3
2007	274	3	271	1	0	1
2008	415	380	107	23	13	10

Data source: B. Bosch/T. Newsome. YN Fisheries. YakRCoho.xls

On average, local brood collection resulted in production of up to 300,000 local brood origin smolts for release annually. Up to 700,000 pre-smolts were imported from out-of-basin (lower Columbia River hatcheries) and released from acclimation sites to meet program goals. Brood stock varies from year to year depending on the run size. The increase in Hatchery Origin Broodstock noted above, is the direct result of the difficultly in capturing enough Natural Origin Brood to fulfill program goals. The Prosser Steep Pass Denil attracts on average 40% of the coho run depending on the water year and ladder conditions. In the future to meet broodstock goals, broodstock will be collected at Roza Dam in the upper Yakima River and at Cowiche or Wapatox Dams in the lower Naches River.

Table 7.4.2.2. Denil passage and Proportion Hatchery/ Wild Escapement

Return Year	Denil Passage	Hatchery Percentage	Wild Percentage
2001	42.5%	71.6%	28.4%
2002	41.8%	31.3%	68.7%
2003	43.8%	30.4%	69.6%
2004	47.7%	23.5%	76.5%
2005	35.2%	78%	22%
2006	33.9%	59.3%	40.7%
2007	37.6%	59.5%	40.5%

2008	33%	73.8%	26.2%

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
Describe procedures for remaining within programmed broodstock collection or allowable upstream hatchery fish escapement levels, including culling.

Because fish are collected from sites adjacent or near Prosser Hatchery according to a pre-defined collection schedule, no fish have been collected in surplus of broodstock needs at the Prosser Hatchery. The program only imports as many pre-smolts from lower Basin facilities as necessary to supply annual program release goals.

7.6) Fish transportation and holding methods.
Describe procedures for the transportation (if necessary) and holding of fish, especially if captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Adult Transfer Tanker Truck	700	Y	N	5	Light dose MS	nya
Juvenile Transfer Tanker Truck	2500	Y	N	150	NONE	nya

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1	Vinyl line Raceway	22000	150	50	4	1100

Adults are captured at steep pass at Prosser Dam and trucked ½ mile to Prosser Hatchery and held in large holding ponds. They are treated with formalin and checked weekly for ripeness. Broodstock are collected and held in a manner that results in less than 10% prespawning mortality. IHOT guidelines for transport are followed for this program.

7.7) Describe fish health maintenance and sanitation procedures applied.

Integrated Hatchery Operations Team (IHOT 1995), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed for broodstock fish health inspection, transfer of eggs or adults and broodstock holding and disposal of carcasses. Fish transfers into the subbasin are inspected and accompanied by notifications as described in these guidelines.

7.8) Disposition of carcasses.
Include information for spawned and unspawned carcasses, sale or other disposal methods, and use for stream reseeding.

Carcasses are distributed within the subbasin to provide ecological benefits in late winter (January and February) either by foot or boat. Using guidelines developed by USFWS fish health specialists, the fish carcasses are prepared by gutting them and removing the heads, then bagging and cooking the fish at over 100 degrees Fahrenheit for a minimum of 4 hours. The fish are then frozen for at least 2 weeks. Each bag usually has up to four coho (4-6 pounds each) or two fall Chinook (10 pounds each).

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.
(e.g. "The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

Coho broodstock collection activities at Prosser Dam (right bank denil ladder and sampling facility) occur during the early portion of steelhead passage at Prosser Dam. It should be noted that the Prosser denil sampling facility is operated in the fall for multiple purposes, two of which are to enumerate and sample returning coho and to collect broodstock for the locally-adapted coho program. Steelhead sampling at the denil during the fall could, and probably would, occur regardless of coho sampling activities at the denil. Steelhead encounter rates at the denil during fall season sampling activities for recent years are given in table 7.9.1.

Table 7.9.1. Yakima River Prosser Dam right bank denil ladder/trap sample rate for steelhead, 2000-2009.

	Hatchery			Wild			Total		
Year	TotCount	Denil	Denil%	TotCount	Denil	Denil%	TotCount	Denil	Denil%
2000	57	5	8.8%	3,032	82	2.7%	3,089	87	2.8%
2001	34	5	14.7%	4,491	472	10.5%	4,525	477	10.5%
2002	45	7	15.6%	2,190	175	8.0%	2,235	182	8.1%
2003	16	7	43.8%	2,739	575	21.0%	2,755	582	21.1%
2004	74	6	8.1%	3,377	987	29.2%	3,451	993	28.8%
2005	10	2	20.0%	1,995	359	18.0%	2,005	361	18.0%
2006	14	4	28.6%	1,523	196	12.9%	1,537	200	13.0%
2007	285	3	1.1%	3,025	274	9.1%	3,310	277	8.4%
2008	25	1	4.0%	3,425	244	7.1%	3,450	245	7.1%
2009[1]	95	8	8.4%	4,359	619	14.2%	4,454	627	14.1%

[1] "TotCount" fields are preliminary; data through late December, 2009. For all other years these data represent Steelhead return years, e.g., July 1 through June 30.

All steelhead were released to the river unharmed following sampling. In these recent years of brood collection activities only one steelhead mortality is known to have occurred (fish jumped out of trapping/holding area and was found dead).

The primary objective of the coho program is the restoration/recovery of a natural spawning population using hatchery and hatchery/natural derivatives. The program recognizes the Proportion Natural Influence (PNI) concept as recommended by the HSRG and is working to increase both the proportion of natural-origin fish in the local broodstock composition (PNoB) and on the spawning grounds (see 1.11.1).

See also Bosch et al 2007 and section 6 of the Yakima Coho Master Plan.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

Broodstock are selected to represent the full spectrum of the run.

At Prosser Hatchery spawning occurs on a weekly basis utilizing whatever females and males are ripe for that particular week. Males and females available on a given day are mated randomly.

Eggs are fertilized with more than one male whenever possible, however, to the extent possible, males are only used once (one-to-one spawning). Jacks are incorporated into the mating scheme.

8.2) Males.

Specify expected use of backup males, precocious males (jacks), and repeat spawners.

Eggs are fertilized with more than one male whenever possible, however, to the extent possible, males are only used once (one-to-one spawning). Jacks are incorporated into the mating scheme. Precocious males (jacks) are used as a set percentage or in proportion to their contribution to the adult run. Back-up males are also used in the spawning protocol if necessary. Beginning in 2009, back-up males will be live-spawned and milt used to fertilize all out-of-basin (Eagle Creek) females. This strategy will increase the proportion of local brood stock parentage in the overall population over time.

8.3) Fertilization.

Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

Eggs from one female are placed into an individual bucket, and fertilized with a single male. After approximately one minute, the gametes from the buckets containing eggs of three females are combined to allow some pooling to occur prior to water hardening.

IHOT, PNFHPC, tribal, and federal guidelines are followed for culture practices for this program. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

8.4) Cryopreserved gametes.

If used, describe number of donors, year of collection, number of times donors were used *in the past, and expected and observed viability.*

Cryopreserved gametes are not used.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

(*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program".*).

The program is attempting to increase diversity by incorporating as many natural-origin fish into the local broodstock program as possible. See also above sections.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Provide data for the most recent twelve years (1988-99), or for years dependable data are available.

At Prosser Hatchery, the egg take has ranged from 50K to 350K since broodstock collection was initiated in 1997. The egg take goal is 1M parr/smolts. The rearing protocol allows for an egg-to-smolt survival rate of 65%. The Prosser Hatchery has warmer water than is preferable for coho spawning. This has created elevated mortality rates for all spawning and rearing life stages. In an attempt to increase survival, we now use a chiller to cool water to the adult holding pond. This has decreased the water temperature by about 10 degrees F. Egg-to-smolt survival remains highly variable and is generally lower than observed for most Columbia Basin coho facilities. As stated in 5.7 above, an updated facility will be included in the program's long-term Master Plan expected to be submitted to the NPCC for step-review after 2011.

9.1.2) Cause for, and disposition of surplus egg takes.

Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent exceeding of programmed levels.

No culling of eggs or juveniles has occurred for this program except for dead and diseased eggs.

9.1.3) Loading densities applied during incubation.

Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

Vertical Stack incubators are used at Prosser with a loading density of approximately 5,000 eggs per tray (Heath). Individual families are not maintained within spawning groups and are mixed randomly at ponding. Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations were followed for water quality, flows, temperature, substrate and incubator capacities.

9.1.4) Incubation conditions.
Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria (influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.

Incubation water is an on-site shallow well source that is probably recharged from sources similar to the Chandler Canal/Yakima surface water. Integrated Hatchery Operations Team (IHOT) species-specific incubation recommendations are followed for water quality, flows, temperature, substrate and incubator capacities. Eggs are incubated under conditions that result in equal survival of all segments of the population to ponding. Families within spawning groups are mixed randomly at ponding so that unintentional rearing differences affect families equally. Fish are monitored regularly for temperature units.

In 2000 we had soft shell in the coho eggs. No formal fish health screenings occur during incubation. However, adult broodstock are screened for routine bacteria and viruses at the time of spawning by USFWS.

9.1.5) Ponding.
Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

Fry are moved from vertical trays to outside ponds at nearly 100% button up. This occurs at approximately 1,400 TUs. Fry are approximately 35mm in fork length at ponding. Any remaining fry are ponded the end of March.

9.1.6) Fish health maintenance and monitoring.
Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

Disinfection procedures are implemented during incubation to prevent pathogen transmission between stocks of fish on site. Following eye-up stage, eggs are inventoried, and dead or undeveloped eggs removed and disposed of as described in the disease control guidelines. Dead or culled eggs are discarded in a manner that prevents transmission to receiving watershed.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.
(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.")*

See above responses.

9.2) **Rearing:**

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

See 9.1.1 above.

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

The juvenile rearing density and loading guidelines used at the facility are based on: standardized agency guidelines and staff experience (e.g. trial and error). IHOT standards are followed for: water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading and density. The goal is 0.50 lb fish per cubic foot of rearing space.

9.2.3) Fish rearing conditions
(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

Settleable solids, unused feed and feces are removed periodically to ensure proper cleanliness of rearing containers. IHOT standards are followed for: water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading and density. The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines and staff experience (e.g. trial and error). Rearing containers are cleaned daily. Rearing containers are treated according to the Agency Disinfection and Sanitation Guidelines. The goal is 0.50 lb fish per cubic foot of rearing space.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

The following data were compiled using an average for the most recent 3 years. Fish per pound (fpp) was actually measured, with lengths estimated using Piper et al. (1982).

Rearing Period	Length (mm)	Weight (fpp)
February	33.9	1200
March	41	662
April	51	257
May	66.2	165
June	76	104
July	88	66
August	102.5	43
September	111.7	33
October	120	27

November	126.6	23
December	132.6	20
January	134.7	19
February	137.4	18
March	142.5	16
April	149.5	14

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.

See 9.2.4.

The correct amount and type of food is provided to achieve the desired growth rate and condition factors for the species and life stages being reared. Moore Clark dry pellets appropriate to size of fish being fed is used. Fish are fed according to body size, water temperature, and desired release size (ranging from 1½-5% of body weight).

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

See 9.2.5.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification to or within the watershed. The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines and staff experience (e.g. trial and error). Juveniles are screened monthly for routine bacteria, viruses and parasites by USFWS. The goal is 0.50 lb fish per cubic foot of rearing space.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is determined by volitional release.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size such that smoltification occurs within nearly the entire population, which will reduce retention in the streams after release. Rearing on parent river water or acclimation for several weeks to parent river water is done to ensure homing to the stream reaches geographically adjacent to the acclimation sites. Fish are volitionally released in March or April depending on annual flow conditions. Releases are volitional from all four sites.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation. (*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size.")*

See above responses.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program. *Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.*

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				
Fingerling	42,000		Last week of July	Yakima and Naches Watersheds, See Appendix A
Yearling	700,000-1,000,000	17-22/lb	Volitional Early April	Yakima and Naches Watersheds, See Appendix A

See also Section 1.11.2.

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: *(include name and watershed code (e.g. WRIA) number)*
Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

See Section 1.11.2. Coho acclimation sites are located at: Boone Pond (Rkm 290.5) and L.D. Holmes' property (Rkm 257.5) on the Upper Yakima River. In the Naches Basin, acclimation sites are located at Lost Creek Pond (Rkm 62.8) and Stiles Pond (Rkm 14.5). The new proposed acclimation sites are Hundley Pond (Rkm 307.3) and Brunson Pond (Wilson Creek Rkm 10.9). Parr release locations are provided in Appendix Table 1 of this document.

10.3) Actual numbers and sizes of fish released by age class through the program.
*For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in **Attachment 2**. Cite the data source for this information.*

Table 10.3.1. Yakima Basin Coho Release Numbers and Stock, release years 1999-2008. Prior to 1999, all releases were from Little White Salmon stock. See Section 9.2.4 for average size of fish at release.

Year	Subbasin	Total Numbers Released	Site	Stock	Date of Release[a]	Pit Tagged Number Released
1999	Upper Yakima	210,000	Cle Elum	Cascade	Early	799
				Yakima	Early	1158
				Cascade	Late	809
				Yakima	Late	1181
		226,000	Jack Creek	Cascade	Early	1245
				Yakima	Early	1243
				Cascade	Late	1246
				Yakima	Late	1229
	Naches	1,020,000	Lost Creek	Cascade	Early	1160
				Yakima	Early	1047
				Cascade	Late	1220
				Yakima	Late	1144
		237,000	Stiles	Cascade	Early	1274
				Yakima	Early	1244
				Cascade	Late	1248
				Yakima	Late	1240
2000	Upper Yakima	125,591	Cle Elum	Willard	Early	2487
		125,545		Willard	Late	2462
		125,501	Easton	Willard	Early	2476
		125,518		Willard	Late	2476
	Naches	125,567	Lost Creek	Willard	Early	2489
		125,539		Willard	Late	2488
		125,532	Stiles	Willard	Early	2488
		125,601		Willard	Late	2493
2001	Upper Yakima	96,373	Cle Elum	Willard	Early	**1219**
		36,131		Yakima	Early	**1207**
		85,122		Willard	Late	1197
		36,183		Yakima	Late	1240
		86,980	Easton	Willard	Early	**1234**
		34,042		Yakima	Early	**1249**
		87,721		Willard	Late	1234
		36,320		Yakima	Late	1247

Year	Subbasin	Total Numbers Released	Site	Stock	Date of Release[a]	Pit Tagged Number Released
	Naches	86,421	Lost Creek	Willard	Early	**1245**
		35,428		Yakima	Early	**1250**
		85,122		Willard	Late	1240
		31,213		Yakima	Late	1251
		86,680	Stiles	Willard	Early	**1237**
		9,953		Yakima	Early	**1249**
		87,217		Willard	Late	1236
		7,364		Yakima	Late	1249
2002	Upper Yakima	62,530	Easton	Willard	Early	1248
		62,525		Willard	Late	2497
	Naches	62,604	Lost Creek	Willard	Early	1249
		30,494		Yakima	Early	1192
		62,542		Willard	Late	1247
		30,133		Yakima	Late	1250
		62536	Stiles	Willard	Early	1249
		34,992		Yakima	Early	1250
		62,562		Willard	Late	1251
		34,041		Yakima	Late	1250
2003	Upper Yakima	310,726	Holms,Easton	Willard	Volitional	4960
				Yakima	Volitional	3355
	Naches	166,803	Lost Creek	Willard	Volitional	2497
		17,824		Yakima	Volitional	3333
		166,547	Stiles	Willard	Volitional	2501
		6,356		Yakima	Volitional	3332
2004	Upper Yakima	264000	Holmes	Willard	Volitional	2500
		14000	Boone	Yakima	Volitional	
		125000		Cascade	Volitional	2500
	Naches	14000	Lost Creek	Yakima	Volitional	2500
		125000		Cascade	Volitional	
		268000	Stiles	Willard	Volitional	2500
2005	Upper Yakima	261,207	Holmes	Eagle Creek	Volitional	2500
		52000	Boone	Yakima	Volitional	2500
	Naches	52000	Lost Creek	Yakima	Volitional	2500
		239,494	Stiles	Eagle Creek	Volitional	2500
2006	Upper Yakima	18750	Holmes	Yakima	Volitional	2500
		40000		Washougal	Volitional	
		97487		Eagle Creek	Volitional	2500
		18750	Boone	Yakima	Volitional	2500
		50000		Washougal	Volitional	

Year	Subbasin	Total Numbers Released	Site	Stock	Date of Release[a]	Pit Tagged Number Released
		97430		Eagle Creek	Volitional	2500
	Naches	18750	Lost Creek	Yakima	Volitional	2500
		50000		Washougal	Volitional	
		97482		Eagle Creek	Volitional	2500
		18750	Stiles	Yakima	Volitional	2500
		50000		Washougal	Volitional	
		97473		Eagle Creek	Volitional	2500
2007	Upper Yakima	30382	Holmes	Yakima	Volitional	2500
		57381		Washougal/EC	Volitional	
		150000		Eagle Creek	Volitional	2500
			Boone	Yakima	Volitional	2500
		50117		Washougal/EC	Volitional	
				Eagle Creek	Volitional	2500
	Naches		Lost Creek	Yakima	Volitional	2500
		101016		Washougal/EC	Volitional	
		150000		Eagle Creek	Volitional	2500
		9199	Stiles	Yakima	Volitional	2500
		51300		Washougal/EC	Volitional	
		150000		Eagle Creek	Volitional	2500
	Prosser	80000	Prosser	Washougal/EC	Volitional	1000
		40,000	Prosser	Eagle Creek	Volitional	
2008	Upper Yakima	77793	Holmes	Yakima	Volitional	2500
				Washougal/EC	Volitional	
		150000		Eagle Creek	Volitional	2500
			Boone	Yakima	Volitional	
		39726		Washougal/EC	Volitional	
				Eagle Creek	Volitional	2500
	Naches	81674	Lost Creek	Yakima	Volitional	2500
				Washougal/EC	Volitional	
		100000		Eagle Creek	Volitional	2500
		85079	Stiles	Yakima	Volitional	2500
				Washougal/EC	Volitional	
		100000		Eagle Creek	Volitional	2500
	Easton	100000	Easton	Eagle Creek	Volitional	2500
		89328	Easton	Washougal	Volitional	
	Prosser		Prosser	Washougal/EC	Volitional	
		41,000	Prosser	Eagle Creek	Volitional	1250

[a] Early releases occurred on or about May 6-17. Late releases occurred on or about May 25-31. Volitional releases began in early April.

10.4) Actual dates of release and description of release protocols.

Provide the recent five year release date ranges by life stage produced (mo/day/yr). Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size such that smoltification occurs within nearly the entire population, which will reduce retention in the streams after release. Rearing on parent river water or acclimation for several weeks to parent river water is done to ensure homing to the stream reaches geographically adjacent to the acclimation sites. See above for release dates. Since 2003, fish have generally been released volitionally beginning in March or April depending on annual flow conditions. Releases are volitional from all four sites. Fish are volitionally released over a two week period and forced out of the rearing units at the end of the two week period, during the latter part of the natural outmigration window. The program specifies release times and sizes for fish (See 9.2.9).

10.5) Fish transportation procedures, if applicable.

Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Adult Transfer Tanker Truck	700	Y	N	5	Light dose MS	nya
Juvenile Transfer Tanker Truck	2500	Y	N	150	nya	nya

Above information applies to Prosser Hatchery

Summer parr are transported in pickup trucks using 500 gallon aerated tanks. Smolts (from both out-of-basin and in-basin programs) are transported using large trucks supporting 2500 gallon tanks.

10.6) Acclimation procedures (*methods applied and length of time***).**

Pre-smolts are acclimated approximately six or nine weeks depending on flow conditions and snow pack. Remote pit tag detectors are checked daily. Typical fish culture activities include net pond maintenance, pond cleaning (if applicable), mortality assessments, and growth and fish health measurements.

Approximately 17,000 summer coho parr will be raised at the LaSalle High School grounds and scatter-planted in Ahtanum Creek (below the forks) as part of a cooperative project with the school. Up to 45,000 coho will be released as parr in late July from 2007-2011 to assess overwinter survival in the selected 14 tributaries and two lakes (see Overwinter Survival Studies in Section 1.5 of Appendix). Because parr are expected to rear for up to an additional year in freshwater after planting, they should be well acclimated to local waters prior to their smolt outmigration.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Marking techniques are used to distinguish among hatchery population segments. One hundred percent (100%) of the hatchery fish released are marked so that they can be distinguished from the natural population.

Beginning with the 2001 adult return (2000 smolt release) 100% of all hatchery-origin coho were adipose fin-clipped and coded-wire-tagged in the snout. This marking scheme occurred through the 2004 smolt release. For 2005-2009 smolt releases, all coho smolts, both of in-basin (local) and out-of-basin brood hatchery-origin were adipose fin-clipped. Beginning with smolt release year 2010, all in basin brood coho will receive blank wire tags and all out of basin coho smolts will be adipose clipped.

Since smolt release year 2001, PIT tags have been used to evaluate survival differences between in basin and out of basin brood coho. Generally, up to 24,000 PIT tags (12,000 per release group) have been used to evaluate smolt survival from Yakima River acclimation sites. PIT tags are also used to evaluate survival of summer parr releases with up to 3,000 PIT tags per release group.

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

No surpluses have occurred in the program; all fish reared and acclimated to smolt phase are released.

10.9) Fish health certification procedures applied pre-release.

All fish are examined for the presence of “reportable pathogens” as defined in the PNFHPC disease control guidelines, within 3 weeks prior to release by USFWS pathologist under contract. Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guidelines.

10.10) Emergency release procedures in response to flooding or water system failure.

Pull screens and boards, and allow fish to exit the facility volitionally into Yakima and/or Naches Rivers.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.

(*e.g. “All yearling coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May”).*

See above responses.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Plans and methods are generally set forth in the Yakima/Klickitat Fisheries Project relative to collecting data that is responsive to monitoring and evaluating program performance standards/indicators.

Specific program performance objectives as stated in the Planning Status Report (PSR) for the YKFP.
-Estimate annual life stage survival rates

- Egg-to-smolt: derived from adult counts, known fecundity rate and estimated smolt count past CJMF.

- Smolt-to-smolt (natural and hatchery): derived from PIT data analysis at CJMF and the lower Columbia mainstem dams.

- Smolt-to-adult (natural and hatchery): derived from, 1) PIT tag data and 2) estimated smolt divided into the Prosser adult counts.

-Temporal and spatial spawning distribution: Radio telemetry study and selected foot surveys.

-Hatchery Experimental Design (location, release time, and stock): PIT tag and CWT data analysis from the various treatment groups.

-Smolt Production: Monitored annually at CJMF.

-Adult Returns: Monitored annually at Prosser and Roza dams. May be monitored in the future at Cowiche and/or Wapatox Dams in the Naches system pending infrastructure upgrades; this issue will be addressed in the long-term Master Plan.

-Genetic monitoring of reverse domestication: Develop and implement a genetics monitoring plan.

-Predation on other species (NTTOC): Monitored through the YKFP indirect and direct predation studies.

-Other potential ecological interactions: Monitored through snorkel surveys in the upper Yakima and Naches rivers.

See also Hubble et al. (2004) and Bosch et al. (2007).

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

BPA Fish & Wildlife Program funding available for Yakima Fisheries Project M&E activities (Project #199506325).

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

Risks for Yakima Basin coho restoration feasibility study objectives and strategies are discussed in Section 6 of the Coho Master Plan. Risks of the coho program generally fall into three categories:

- Physical effects on environmental resources caused by facility development
- Effects on target fish (coho) and non-target taxa (NTT) caused by monitoring and broodstock collection activities (e.g., trapping, marking, handling, etc.)
- Interaction risks to non-target fish from the presence of reintroduced coho.

As documented in Hubble et al. 2004, all the risk levels are relatively low and do not warrant additional monitoring beyond what is currently proposed.

See also section 6 of Hubble et al. 2004.

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

The ultimate goal of the Yakima coho reintroduction project is to determine whether adaptation and recolonization success is feasible and to reestablish sustainable populations in the wild. The program has been separated into two phases. To date, we have concluded that it is feasible to use out of basin founding stocks and create a naturalized population (Bosch et al. 2007). We are presently working to re-establish coho into tributaries and to determine which tributaries give the coho recovery its best chance at success. This project integrates other federal and state agencies as well as local property owners, irrigators and conservation districts.

We are continuing work to determine the optimal locations, life stage, release timing, and brood source that will maximize opportunities to achieve the long-term objective. We also continue to monitor trends in returning adults (e.g., abundance of natural- and hatchery-origin returns, spawning distribution, return timing, age and size at return, etc.) to evaluate progress towards achieving objectives.

The overall focus is on evaluating the survival parameters of the hatchery releases. The project has investigated survival differences between the Naches and upper Yakima subbasins, date of smolt release (early vs late) and stock effect (in basin vs out-of-basin). We are presently evaluating the survival of adult and parr outplants in tributaries. For most recent results see Sampson et al. (2009). There are other YKFP projects that indirectly provide information to address reintroduction feasibility questions (i.e. predation studies, EDT modeling).

The following summarizes findings from our research to date:

Historical returns of coho salmon to the Yakima River Basin were estimated to range from 45,000 to 100,000 fish annually but declined to zero by the 1980s after decades of overexploitation of fishery, water, and habitat resources. In 1996 the Yakama Nation and cooperators initiated a project to determine the feasibility of reestablishing a naturally spawning coho population in the Yakima River. The Yakima coho project explored whether successful recolonization was feasible when multi-generational, hatchery-reared coho were reintroduced to native habitats. After 10-20 years of outplanting, we compared data for adult returns of known natural- and hatchery-origin coho. We found that natural-origin coho returned at a significantly larger size than hatchery-origin coho. Mean egg mass and mean egg size of natural-origin females were greater than those of hatchery-origin females, though the differences were statistically significant for only one of three sample years. Natural-origin adults returned (2 to 9 days) and spawned (5 days) later than their hatchery-origin counterparts. Preliminary indices of smolt-to-adult survival for natural-origin coho were 3.5 to 17.0 times survival indices of hatchery-origin coho. The number of coho returning to historical native spawning habitats in upriver areas generally increased. Spawning surveys demonstrated the existence of robust and sustainable spawning aggregates in various locations in the basin. Hatchery releases from local brood source parents had significantly higher smolt-to-smolt survival than releases from out-of-basin hatchery broodstock, but some of these observed differences in survival could have been due in part to differences in smolt size. We conclude that hatchery-origin coho, with a legacy of as many as 10 to 30 generations of hatchery-influence, demonstrated their ability to reestablish a naturalized population after as few as 3 to 5 generations of outplanting in the wild.

For additional detail and results see:
Dunnigan, J.L., Feasibility and Risks of Coho Reintroduction in Mid-Columbia, Monitoring and Evaluation 1999 Annual Report, Prepared for U.S. Dept. of Energy, Bonneville Power Administration, Division of Fish and Wildlife, Project #9604000, Portland, OR.

Dunnigan, J.L., Yakima coho monitoring and evaluation, Project Annual Report 1999, Bonneville Power Administration, Portland, OR.

Dunnigan, J. L., W. J. Bosch, and J. D. Hubble. 2002. Preliminary results of an effort to re-introduce coho salmon in the Yakima River, Washington. In "Hatchery Reform: the Science and the Practice", Proceedings of the International Congress on the Biology of Fish, July, 2002, Don MacKinlay, editor, 555 West Hastings St., Vancouver BC V6B 5G3 Canada.

Bosch, W. J., T. H. Newsome, J. L. Dunnigan, J. D. Hubble, D. Neeley, D. T. Lind, D. E. Fast, L. L. Lamebull, and J. W. Blodgett. 2007. Evaluating the Feasibility of Reestablishing a Coho Salmon Population in the Yakima River, Washington. North American Journal of Fisheries Management 27:198-214.

For additional information on objectives, strategies, and methods see:
Yakima Coho Master Plan, Hubble et al. (2004).

12.2) Cooperating and funding agencies.

The YN and WDFW conduct studies associated with the coho program. Fish for this program are generally reared, transferred (if out-of-basin brood), marked and acclimated using Mitchell Act funds. Bonneville Power Administration is the funding agency for monitoring and evaluation (Project 199506325).

12.3) Principle investigator or project supervisor and staff.

Joe Blodgett, YN Hatchery Manager (for Yakima and Marion Drain),
Dr. David Fast, YKFP Research Manager,
Bill Bosch, YKFP Data Manager, and
Todd Newsome, YN Fisheries Biologist, principle M&E investigator.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Same as section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

A large portion of the M&E relies upon analysis of marks (PIT and CWT) to answer key feasibility questions. Monitoring for PIT tags is done at CJMF and at the lower Columbia River projects. Marks are also recovered in the broodstock collection, spawner surveys and the fisheries. Fish are enumerated as smolts at the CJMF and as adults at Prosser, Cowiche (partial video depending on conditions) and Roza dams using video. Adults used in the telemetry study are drugged for insertion of the tag and bio-sampling. All parr releases are 100% PIT tagged. See also 7.3.

12.6) Dates or time period in which research activity occurs.

Smolt releases are made in the spring (May) and tagging activities associated with these releases occurs in the preceding fall or winter. Predation studies occur in the spring during the outmigration period. Residualism surveys occur in the summer period. The radio-telemetry study occurs in the fall with tagging at Prosser, and continues into early winter with the tracking phase. PIT-tagged parr will be detected at downstream sites when they outmigrate as smolts. Spawning ground surveys occur annually from October through December.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

See section 9 of this HGMP.

12.8) Expected type and effects of take and potential for injury or mortality.

Coho are not being killed for research purposes, however, in 1998 and 1999 hatchery fish were collected for the direct predation study in the upper Yakima River. Steelhead adults intercepted at Prosser steep-pass ladder for the coho adult radio-telemetry study are passed directly back to the river (water-to-water transfer; See Section 7.9 for additional information). Electrofishing will be limited. Electrofishing is planned for certain tributaries that are part of interactions studies between coho and RBT's however, snorkeling and seining will be the main monitoring techniques. Nearly all tributaries have Rainbow Trout/Steelhead in them, however, we have not documented any mortality on previous activities, i.e., electro fishing, seining, in tributaries and maintsem streams. We do not expect any mortality. See take table (Table 1) and the Appendix at end of this document for additional information.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Mid-Columbia ESU (Yakima Basin) Steelhead

ESU / Population	Mid-Columbia ESU, Yakima Basin wild/natural steelhead
Activity	Summary for all Yakima Basin coho-related program activities (listed separately in section 2.2.3
Location of hatchery activity	Various
Dates of activity	Year round
Hatchery Program Operator	Joe Blodgett/YN, Bill Fiander/YN, Todd Newsome/YN

Potential for / estimates of injury or mortality, and methods to reduce either is minimal for both coho and other salmonids. No problems have been experienced to date with any field activities. See Section 2 of this HGMP and take table at end of this document.

12.10) Alternative methods to achieve project objectives.

None. This is the approved level of M&E agreed upon by the TWG to address all issues associated with coho reintroduction in the Yakima Basin. Alternative methods were explored during the extensive planning and public comment period and none were identified. See also Section 1.16 of this HGMP.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Potential take is minimal for both coho and other salmonids. No problems have been experienced to date with any field activities. Some of the proposed tributary work is designed to look into the interactions between coho and rainbow trout and effects of coho on rainbow trout (Tanuem Creek and Nile Creek). The results of this work will guide the future work in tributaries. Any take related to this work is included in the take Table 1.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.

(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

See other sections of this HGMP and section 6 of the Yakima Coho Master Plan.

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

Please contact YN or visit ykfp.org "Technical Reports and Publications" for copies of additional documents or citations.

Bosch, W. J., T. H. Newsome, J. L. Dunnigan, J. D. Hubble, D. Neeley, D. T. Lind, D. E. Fast, L. L. Lamebull, and J. W. Blodgett. 2007. Evaluating the Feasibility of Reestablishing a Coho Salmon Population in the Yakima River, Washington. North American Journal of

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by______________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity.

Listed species affected: ___Steelhead/RBT____________ ESU/Population:___Mid-Columbia Steelhead________ Activity:__R, M & E_________				
Location of hatchery activity:___ Yakima Basin _____ Dates of activity:__Year-round________ Hatchery program operator:___YN____________				
	Annual Take of Listed Fish By Life Stage (***Number of Fish***)			
Type of Take	Egg/Fry	Juvenile-parr	Adult	Carcass
Observe or harass a) (snorkeling activities, spawning surveys?)		<500	<500 Resident Adults	
Collect for transport b)				
Capture, handle, and release c) (electrofishing/seining, broodstock collection at Prosser and Roza Dams)			See Yakima fall Chinook HGMP	

Listed species affected: ___Steelhead/RBT____________ ESU/Population:___Mid-Columbia Steelhead________ Activity:__R, M & E_________				
Location of hatchery activity:___ Yakima Basin _____ Dates of activity:__Year-round________ Hatchery program operator:___YN____________				
Capture, handle, tag/mark/tissue sample, and release **Electrofishing Tributaries** • **Reecer Creek** • **Wilson Creek** • **Taneum Creek** • **Rattlesnake Creek** • **Big Creek** • **Nile Creek** • **Cowiche Creek** • **Toppenish Creek** **Toppenish Creek** **Snorkeling Tributaries** • **Taneum Creek (120 females and 160 males)** • **Reecer Creek** • **Big Creek** • **Wilson Creek** **- Naches and Little Naches River tributaries** • **Pile Up Creek** • **Quartz Creek** • **Rattlesnake Creek** • **North Fork Little Naches (2009-2011)** • **Nile Creek** • **Cowiche Creek** **- Mid Yakima River tributaries** • **Ahtanum Creek** • **Toppenish Creek** **Redd Capping** **Taneum Creek** **Spawning Surveys** **All Tributaries listed above** **Coho Acclimation Ponds**		< 500 Juvenile RBT per Tributary,Except Tanuem Creek < 1000 RBT No Effect No Effect No Effect	<500 Resident RBT adults per Tributary Spawning Surveys < 500 Resident Adults per Tributary No Effect	

Listed species affected: ___Steelhead/RBT____________ ESU/Population:___Mid-Columbia Steelhead________ Activity:__R, M & E_________				
Location of hatchery activity:___ Yakima Basin _____ Dates of activity:__Year-round________ Hatchery program operator:___YN____________				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g) (electrofishing/seining)		No more than 5 per tributary		
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as “fishery enhancement”.

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as “supplementation”.
Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural origin recruit (NOR) - See *natural fish* .

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see “Population”).

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.

(generally from Washington Department of Fish and Wildlife, November, 1999).

	SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Fingerling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fed Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 800	0.6 to <23
X	Sockeye Fall Releases	<150	>2.9
X	Sockeye Fry	> 800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fed Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fingerling	>20 to 150	3 to <23
X	Steelhead Fry	>150	<3
X	Cutthroat Trout Yearling	<=20	>=23
X	Cutthroat Trout Fingerling	>20 to 150	3 to <23
X	Cutthroat Trout Fry	>150	<3
X	Trout Legals	<=10	>=45
X	Trout Fry	>10	<45

1/ Coho yearlings defined as meeting size criteria <u>and</u> 1 year old at release, <u>and</u> released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria <u>and</u> 1 year old.

Appendix A. **Yakima Coho Program Description**

1.1. Background

Historical returns of coho salmon to the Yakima River Basin were estimated to range from 45,000 to 100,000 fish annually, but declined to zero by the 1980s after decades of overexploitation of fishery, water, and habitat resources. In 1996, the YN and cooperators initiated a project to determine the feasibility of reestablishing a naturally-spawning coho population. This project contains two steps, each with two phases:

Step 1: Feasibility Studies
- Phase I - Feasibility studies (covered in previous Section 7 Consultation).
- Phase IB - Study quality of habitat for juvenile survival and adult spawning (this Section 7 Consultation).

Step 2: Final Development, and Submittal of the Yakima Coho Master Plan (scheduled for 2010 and beyond)
- Phase I - Implement Master Plan, construct facilities (later Section 7 Consultation)
- Phase IB - Full scale program implementation and adaptive management (later Section 7 Consultation).

Step 1, Phase I of the project explored whether successful adaptation and recolonization were feasible when multi-generational, hatchery-reared coho were reintroduced to native habitats (documented in Dunnigan et. al. 1999, 2002 and Bosch et. al. 2007).

After 10-20 years of outplanting, known natural- and hatchery-origin returns were compared for four years. Natural-origin coho returned significantly larger than hatchery-origin coho. Mean egg mass and mean egg size of natural-origin females were greater than those of hatchery-origin females, though the differences were statistically significant for only one of three sample years. Natural-origin adults returned (2 to 9 days) and spawned (5 days) later than their hatchery-origin counterparts.

Indices of smolt-to-adult survival for natural-origin coho were 3.5 to 16.9 times survival indices of hatchery-origin coho and 0.5 to 6.9 times survival indices of wild/natural spring Chinook. Smolt-to-adult survival indices between coho and spring Chinook were compared, since both are stream-type (yearling migrant) salmon. For seven juvenile migration years from 1997-2003, mean smolt-to-adult survival for returns from all hatchery-influenced coho production was 3.7 percent, or approximately 76 percent of the estimated mean survival for wild/natural spring Chinook (4.9 percent) over the same period. Releases from local brood source parents had significantly higher smolt-to-smolt survival than releases from out-of-basin brood source parents. Hatchery-origin coho, with a legacy of as many as 10 to 30 generations of hatchery-influence, showed evidence of local adaptation and increasing fitness after as few as 3 to 5 generations of outplanting in the wild.

Step 1, Phase IB of the project is the subject of this Section 7 Consultation. This phase will continue to develop an in-basin broodstock and includes reintroducing juveniles and adults into select tributaries to monitor and assess current rearing and spawning conditions. Phase IB also includes monitoring and assessing the feasibility of small scale mobile acclimation units that seed individual tributaries with coho, creating self-sustaining populations.

Step 2, Phase I of the project is to develop and implement a Master Plan, and begin construction of proposed facilities. Facilities may include two small-scale hatcheries, one in the Naches Basin and one in the Upper Yakima River. These hatcheries would provide an in-basin broodstock source for ongoing out plants, mobile acclimation, and mainstem acclimation. These activities would be the subject of a later Section 7 Consultation, since implementation would not begin prior to 2010.

Step 2, Phase IB of the project is to provide ongoing adaptive management and full-scale implementation of the coho program. These activities would also be the subject of a later Section 7 Consultation.

1.2. Project Description

The coho project is part of the YKFP and has been ongoing since 1997. The overall feasibility of full coho reestablishment in the Yakima Basin is still being researched. Step 1, Phase I, has been completed and is currently awaiting publication. The conclusion of Phase I found that reintroduction of an extinct salmonid species using a non-native stock is feasible. The feasibility results indicated that natural origin coho can be produced from F1 generation hatchery returns. In addition, natural origin recruits survive at a higher smolt-to-adult rate than F1 hatchery smolts. Radio tracking and redd surveys have identified three major areas of mainstem spawning. Over 90 percent of the coho redds are in the mainstem Naches and Yakima rivers, which leaves possible reintroduction efforts in these areas exposed to potentially adverse environmental conditions. However, with the conclusion of Phase I, questions remain. If a fully reestablished, self-sustaining, resilient coho population is to exist, tributaries in the Yakima Basin must be in included in the reintroduction. Therefore, the YN proposes expanding research into 14 identified tributaries and two reservoirs in Step 1, Phase IB. The focus will primarily be on researching and assessing the quality of tributary habitat for juvenile survival and adult spawning. Additionally, small-scale mobile acclimation is being proposed as a new way to help reintroduce coho into the tributaries. Tributaries were chosen using three criteria: 1) relatively healthy watershed, 2) functional stream system, and 3) presumed and known historic use by coho. Appendix B shows these streams.

Genetics

Currently, the genetics of the Yakima coho are mixed from various sources. The original Yakima coho has been extinct since 1985. All genetics that are currently residing in the Yakima coho now are a mixture of lower Columbia River coho populations. The current out-of-basin sources being used are Washougal River and Eagle Creek coho stocks. Both have proven to be excellent fish. Other than length of adult migration, no specific change in the genetic make-up has occurred or is expected.

1.3. Propagation Activities

Broodstock Collection

Broodstock collection for the continuing coho reintroduction feasibility project is currently occuring at Prosser Dam at the existing Denil ladder structure on the right bank and at the Prosser Hatchery swim-in trap. Development of localized broodstock is crucial in the future success of coho reintroduction. In the future, coho broodstock will be taken from Roza Dam for the upper Yakima group and Cowiche Dam for the Naches group. Prosser Dam and Roza Dam have existing infrastructure to capture broodstock. At Roza Dam, the existing ladder and trap will be used, which traps 100 percent of the fish that ascend the fish ladder. Cowiche Dam collection will be accomplished with a trap fabricated for the YN. Coho collected at these locations will have traveled approximately 100 miles farther than adults being collected at the Prosser Dam.

Up to approximately 960 adult coho will be collected throughout the run from the first week of September through the first week of December. All non-target fish intercepted during broodstock collection at Cowiche and Roza dams will be immediately passed back to the river to minimize stress and potential mortality. During the broodstock collection operation, any fish detected with a PIT tag (inserted as juveniles) will be radio tagged, released and tracked to determine their spawning locations and timing (see monitoring section below).

The Bureau of Reclamation is planning to retrofit Wapatox Dam with an adult trap in the near future. When that is completed, broodstock will be collected there instead of at Cowiche Dam.

Adult Releases/Out Planting

Adults will be racked into Tanuem Creek for up to two weeks. Up to 150 female and 150 male adult coho will be placed in three different 200 meter (218 yard) sections of Tanuem Creek. These three sections have been sampled by WDFW for approximately 12 years, so they represent an excellent baseline. This will allow research to be done on spawning conditions, impacts to native fish, and overall spawning success.

The racks will be constructed of heavy metal tubing and will be bolted to one another (see Appendix B for a photo). The spaces in the racks will be wide enough to allow juvenile fish to pass, but will prevent adults from moving through them. The racks will be in the creek no longer than necessary (generally up to two weeks). Fisheries technicians, (both state and tribal) will check each site daily to process carcasses and check for debris. Bull trout have not been documented in Taneum Creek, so it is unlikely that bull trout would be caught against the racks. However, as a precaution to protect any unknown bull trout populations and other fish species, and to prevent channel erosion, the racks would be removed during any flood events.

Up to 20 pairs of adults will be outplanted in other select tributaries including Cowiche Creek, Pile Up Creek, Ahtanum Creek, Nile Creek, Wilson Creek, Reecer Creek, Quartz Creek, and Toppenish Creek. Additionally, North Fork Little Naches River will be included for outplanting in 2009-2011. Wooden framed or PVC racks, each approximately 5 feet high and 5 feet wide with 3-inch hardware cloth screens attached, will be placed in each creek. The frames will be attached to one another and left in place for only 24 hours before being removed. This will keep adults from running downstream immediately after release. In addition, technicians will be on site to keep the screens free of debris. It is unlikely that bull trout would get caught in the screens, because the racks will be in the creeks for less than 24 hours and the racks will be removed if the water rises. The coho outplanting areas will be located in fairly secluded areas where there is moderate to good habitat and good road access. To ensure the coho will spawn soon after outplanting, they will be held at the Prosser facility until they begin to ripen, and then transported to the selected tributary. A Hydraulic Project Approval (HPA) will be obtained from WDFW habitat biologists for installing adult racks in the streams.

1.4. Juvenile Releases

Continuing Hatchery Releases

Since 1999, up to 1,000,000 coho smolts have been released into the upper Yakima and Naches rivers. The total number of smolts ranges from 650,000 to 1,000,000 each year depending on brood success. During 2006-2010, the Yakima River coho program will release up to 1,000,000 smolts annually in the Yakima Subbasin. Of these fish, up to 500,000 will be produced from broodstock collected from returning adults. The remaining 500,000 will be smolts from lower Columbia River hatcheries, Eagle Creek National Fish Hatchery and Washougal Fish Hatchery.

Smolts will be acclimated and released from two locations in the Naches subbasin, three locations in the upper Yakima Basin, and from La Salle High School on Ahtanum Creek. Releases in the Naches Subbasin will continue to occur at the existing Lost Creek Pond and Stiles Pond acclimation sites. In the Yakima Basin, acclimation facilities include the existing Holmes Pond, Boone Pond, and Easton Ponds, and two new sites, Brunson Pond and Hundley Pond.

All acclimation sites are existing off-channel ponds. Boone Pond is fed by ground water, Stiles Pond is fed through a WDFW fish screen, Holmes Pond is also fed by ground water, and only becomes a fish bypass system when the Cascade Canal is flowing, at which time the coho are allowed to leave the pond. Lost Creek is the only pond with a direct water source from the creek. The water is piped approximately 150 yards underground from Lost Creek and sent through the two Lost Creek ponds, and then back to Lost Creek. Fish are held in these sites from late February to early April. None of the above acclimation sites or proposed sites dewater any part of the associated stream or river. Approximately 17,000 summer coho parr will be raised at the LaSalle High School grounds and scatter-planted in Ahtanum Creek (below the forks) as part of a cooperative project with the school. All coho smolts will be volitionally released from each location on the first Monday of April (up to 1,000,000 season total). Up to 45,000 of the total 1,000,000 coho will be released as parr in late July each of the next 4 years to assess overwinter survival in the selected 14 tributaries and two lakes (see Overwinter Survival Studies below).

Stream Seeding

The YN proposes to test mobile acclimation units for 3 years on Toppenish Creek, Ahtanum Creek, Rattlesnake Creek and Cowiche Creek. The units are portable aluminum raceways that are 20 feet long, 4 feet wide and 4 feet tall, and will have gravity fed or pumped water into and out of the tanks. In addition, a small emergency generator will be connected to a float that will activate an aerator. The mobile acclimation units will be placed near the streams in areas that have existing disturbance (such as spur roads), and plumbed into the creek. The two proposed units will hold up to 10,000 coho smolts for up to 4 weeks. A small portion of smolts will be PIT tagged to evaluate smolt-to-smolt survival and smolt-to-adult survival. Once the smolts are released, the units will be removed until the following season. The stream seeding may reduce flows to a small portion of each creek; however, this activity would take place during the winter and spring when stream flows are relatively high and would not cause dewatering of any stream reaches.

1.5. Monitoring and Evaluation Activities

Juvenile Collection at Roza Dam

The juvenile fish trap at Roza Dam will be operated all winter and into the spring. This trap will assess coho parr and smolt out migration. Operation of the trap is intended to collect juvenile wild and hatchery coho smolts. Once collected, the coho will be PIT tagged and released directly back into the river. These activities are designed to determine the overall survival of hatchery fish as compared to wild fish and those migrating hatchery fish as compared to those fish migrating later.

Juvenile Collection at Chandler Canal

Juvenile collection at Chandler Canal will be similar to that described in the spring Chinook section.

Other Juvenile Collection Facilities

Ahtanum Creek

This existing trap is operated under the Yakima Reservation Watersheds Project, and has been in operation for 7 years. The trap is run from early December through May. The trap is visited once or twice daily depending on stream flows.

Toppenish Creek

This existing rotary trap has been in full operation for approximately 7 years. Its purpose is to monitor and assess summer steelhead production from Toppenish Creek and its tributaries. The trap is operated from early November through May. The trap is visited once or twice daily depending on flows.

Naches River

A new box trap in the Wapatox Diversion will be operated from April through May. This location will be used because of problems with the Selah Naches Diversion location. A 3 by 3-foot box trap will be operated four days a week from April 1 until May 31. Fisheries technicians will check the trap up to twice daily, depending on the fish capture numbers. The trap will be operated to collect baseline data on migrating salmonid smolts.

Spawning Surveys

Coho spawning surveys are conducted annually on the Ahtanum, Cowiche, Wide Hollow and Satus creeks. They are also conducted in the mainstem Naches River from Cowiche Dam to the confluence with the Yakima and in the

Yakima River between Selah and Union Gap. Spawning ground surveys will be expanded among the proposed tributaries and reservoirs. Surveys will also be expanded to include other suitable tributaries if found. The creek surveys will continue to be conducted on foot, while the mainstem surveys are by raft and power boat. As more coho return to the basin, the index reaches for surveys will be expanded. Data including length, sex and scales for age analysis, are collected from spawned-out carcasses.

Visual surveys will also be conducted in the upper Yakima and Naches subbasins near the acclimation sites described above from mid-September through Late November. Surveys will consist of either walking stream margins or floating stream reaches to count and record the spatial distribution of coho redds in these areas.

Migration timing, habitat utilization and spawning distribution will continue to be monitored for up to 200 adult coho radio-tagged at Prosser Dam from 2006 through 2010 by using a combination of fixed and mobile radio telemetry gear located throughout the Yakima Basin from mid-September through November. Weekly jet boat and automobile surveys will be conducted, in addition to fixed monitoring sites which may include Sunnyside, Roza, Cowiche, and Wapatox dams.

Snorkel Surveys

Snorkeling spot checks will be conducted near acclimation release sites and throughout both entire river systems from spring through fall. These checks will determine whether coho have residualized, and if so, to what extent. The presence of coho will allow fisheries managers to find and collect naturally-rearing coho to PIT tag.

Redd Capping

Redd caps are large nets that are buried around a select redd. The net funnels newly-emergent fry into a small holding vessel were they can be enumerated and released. The nets are inverted and the edges are buried 6 inches down and up to 3 feet from the redd. The net is then allowed to fall over the redd and tail out below it. This is the location of the capture vessel. Redd caps will not impact other species of fish. Selected redds will be capped in tributaries that are fairly stable with good flow. It is possible that redd capping may be done on all 14 tributaries. However, it is impossible to know before the adult coho are racked into the spawning areas, whether the cap is feasible in the tributary. Redd caps will be checked daily and used to assess percent survival of dug redds in tributaries.

Over-winter Survival Studies

Up to 3,000 PIT-tagged summer parr will be released into 14 select tributaries in early August. The parr will range from 75-90 mm (2.95-3.5 inches) to closely resemble the size of naturally-rearing coho. The coho survival for each tributary will be monitored using the PIT tag detectors on the mainstem Yakima River and Columbia River dams. Late summer snorkeling and shocking will also occur to look for presence and absence of these coho.

In addition, summer parr will be released into the Upper Cle Elum River.. The spillway on Lake Cle Elum has been retrofitted to surface spill water through two PIT tag detectors. Bumping Lake has no such detectors; however, engineering plans are currently being drawn for downstream juvenile monitoring sites using PIT tag detectors on mainstem dams in the Yakima and Columbia rivers. Because once the fish are released there will be no way to tell if the fish remain in the tributaries over winter or move into the mainstem systems, replication will be planned for 4 years. Over the span of 4 migration years, different environmental changes will occur and juvenile coho survival in the tributaries should reflect the changes.

Lake Cle Elum coho activities will be done in conjunction with the Bureau of Reclamation and their feasibility studies of providing upstream and downstream passage at the two projects.

Non-Target Taxa of Concern

Interaction evaluations will be conducted on Taneum Creek, Quartz Creek, and Nile Creek. Baseline studies identifying weight/length relationships in rainbow/steelhead trout and sculpin have been conducted on these tributaries. Adult coho will be racked into these monitoring areas to assess changes in resident fish populations.

Evaluations will be conducted in the summer by electrofishing and snorkeling monitoring reaches.

Adult outplanting in Taneum Creek will be performed annually during the spawning season. This work is intended to determine if 1) coho adults will successfully spawn in Taneum Creek and will produce desirable numbers of juvenile parr, and 2) an increase in natural production of coho will negatively affect existing non-target taxa (NTT; e.g., rainbow trout, cutthroat trout), 3) the total combined biomass of juvenile salmonids increases (target + NTT). We will evaluate the net ecological benefit or cost by evaluating the potential benefits of carcass nutrient enhancement and the potential costs of interspecific competition among juveniles. NTT monitoring will utilize the BACIP study design to evaluate changes in the status of the NTT. Adult coho will be racked into three index sites on Taneum Creek for up to two weeks. Up to 150 female and 150 male adult coho will be divided evenly among each of three, 400 meter long (437 yard) sections of the creek (treatment sites). Half of the index site length (200 m) in these three sections have been sampled annually by WDFW for approximately 17 years, so they represent an excellent baseline for the BACIP test. The other 200 m in the 400 m long sections provide additional area to capture and PIT tag NTT for evaluating potential changes in the growth rate of individually tagged NTT. Two or three additional 400 meter long sites in Swauk Creek that will not have coho introduced will serve as control sites and 5 additional 200 m long in-stream control sites will be sampled in Taneum Creek. Sampling treatment and control sites before vs. after coho planting provides a powerful statistical design for evaluating impacts to NTT abundance, mean size, and instantaneous growth. Even with this rigorous sampling design, preliminary power analysis suggests it may take 10 or more years of sustained stocking/or significant natural production to detect changes in the abundance or size structure of NTT in index sites if a treatment effect exists.

Treatment and control sites in Taneum and Swauk creeks will be sampled three times annually by WDFW. The first sampling will occur in the spring (probably March depending on water conditions), using a backpack electrofisher, to collect and PIT tag NTT in 200 m of the 400 m index sites. Then in July and August, index sites will be electrofished following mark-recapture protocols to obtain population abundance estimates of NTT and coho for the BACIP test. A final electrofishing sample will be performed in the fall (October) to recapture PIT tagged NTT and to obtain estimates of summer growth rates of tagged NTT in both treatment and control areas. All electrofishing will be performed following the NMFS electrofishing guidelines.

Carcass Distribution

Approximately 400-500 adult coho and fall Chinook broodstock fish carcasses will be distributed in tributaries where coho are known to overwinter. In addition, carcasses will be put into side channels and beaver ponds of the Upper Yakima River, Naches River and Little Naches River. Carcasses will be put out in late winter (January and February) and distributed either by foot or boat. The fish carcasses will be prepared by gutting them and removing the heads, then bagging and cooking the fish at over 100 degrees Fahrenheit for a minimum of 4 hours. The fish will then be frozen for at least 2 weeks. Each bag will usually have up to four coho (4-6 pounds each) or two fall Chinook (10 pounds each).

Appendix Table 1. Existing and Proposed Coho Reintroduction Feasibility Program (new Phase 1B proposed activities highlighted in bold type)

Activity	Location, Numbers, Timing
Hatchery rearing and broodstock development	- Prosser Hatchery: Up to 500,000 smolts reared - Lower Columbia River hatcheries: between 500,000 – 1 million fry/smolts reared Total production not to exceed 1 million fish for release

Acclimated volitional smolt releases from mainstem sites (smolt-smolt survival studies)	900,000 annually, spring volitional release • 450,000 Upper Yakima River (Easton (RM 201), Boone (RM 180) , Holmes (RM 160), **Brunson (Wilson Creek RM 6.8)**, **Hundley (RM 191) , Reecer Creek RM .5 (2009), and Courier Creek RM 1.5 (2009)** acclimation ponds) 1,250 of these fish acclimated over winter and released from Easton Lake in the Keechelus Easton Reach • 450,000 Naches River (Stiles RM 9) and Lost Creek (RM 39) acclimation ponds)
Acclimated volitional smolt releases from new tributary sites (smolt-smolt survival studies)	**Annually 5-10,000 smolts released in spring from a mobile acclimation unit rotating yearly between the following tributaries:** • **Toppenish Creek** • **Cowiche Creek** • **Ahtanum Creek** • **Rattlesnake Creek**
Cle Elum Dam passage study smolt releases	10-12,000 smolts released from net pens to study downstream passage at dam
Parr releases – scatter plant (over-winter survival studies)	**3,000 each site, up to 42,000 total annually, in July[1]** **- Upper Yakima River tributaries** • **Crystal Springs/Easton-Keechelus Reach** • **Big Creek** • **Upper Cle Elum River (above Cle Elum Lake)** • **Reecer Creek** • **Wilson Creek** **- Naches River tributaries** • **North Fork Little Naches** • **Little Naches River** • **Quartz Creek (Little Naches River tributary)** • **Upper Bumping River (above Bumping Lake)** • **Nile Creek** • **Little Rattlesnake Creek** • **Cowiche Creek** **- Mid Yakima River tributaries** • **Ahtanum Creek** • **Toppenish Creek** **In addition, 17,000 parr released in Ahtanum Creek from the LaSalle High School rearing project.**
Adult releases (egg-fry survival and F2 surrogate studies)	**Up to 20 pairs each site (except Taneum Creek), in fall** **- Upper Yakima tributaries** • **Taneum Creek (120 females and 160 males)** • **Reecer Creek** • **Wilson Creek** • **North Fork Little Naches (2009-2011)** **- Naches and Little Naches River tributaries** • **Pile Up Creek** • **Quartz Creek** • **Nile Creek** • **Cowiche Creek** **- Mid Yakima River tributaries** • **Ahtanum Creek** • **Toppenish Creek**

Broodstock **and adult collection**	Prosser, Roza, and Cowiche dams. Wapatox Dam may be substituted for Cowiche Dam in the future. Collect no more than 50% natural origin, or 75% hatchery origin returns for broodstock. Up to 500 fish collected for broodstock **and 560 for adult outplanting**. Oct. 1–Dec. 30.
Radio-telemetry	Tag up to 100 adults, release from lower river sites (Mabton, RM 56 and Granger, RM 84) and track from jet boats, planes, and autos and at fixed dam sites (Prosser, Cowiche, Roza, and Wapatox) Mid-Sept. through Nov.
Redd Capping	**Adult release sites as proposed. Temperature monitors will be placed near redd. Each tributary will be evaluated for redd capping. Spring freshets may determine which tributaries can be capped.**
Spawning surveys (foot/boat)	September 15-November 30 - Mainstem Yakima (Keechelus Dam to Granger) - Mainstem Naches (Little Naches to confluence) - Ahtanum, Cowiche, Wide Hollow, and Satus creeks **- Other tributaries where coho are being released as needed**
Juvenile collection/rotary trapping	- Roza Dam juvenile trap: Up to 3,000 Yakima River naturally produced winter migrants will be PIT tagged (Nov.-Mar.) - Chandler Juvenile Monitoring Facility: Count, measure, PIT tag up to 3,000 coho (Nov. 15–July 15) - Ahtanum Creek rotary trap (RM 2.8) Nov. 1–June 30 - Toppenish Cr. rotary trap (RM 26.5) Nov. 1–June 30 - Naches R. (Wapatox Diversion (RM 18.4)) box trap, April 1 through May 31
Snorkeling – coho distribution, habitat use	Preferred habitat (side channel areas and mainstem pools) in the following streams: - Upper Yakima: systematic sampling (10%) of preferred habitat from Easton to Ellensburg - Naches mainstem: systematic sampling (10%) of preferred habitat from Little Naches R. to confluence **- Release tributaries (Taneum, Ahtanum, Toppenish, Pileup, Nile) - systematic sampling of preferred habitat. Specific reach generally will coincide with release reaches.** Summer, 3 days for each major subbasin, 1-2 days each for tributaries
Juvenile electro-fishing surveys (boat)	Yakima mainstem: systematic sampling of preferred habitat, 10 half-mile reaches between Roza Dam (RM 128) and Granger (RM 83). One in summer, one in fall/winter
Juvenile electro-fishing surveys (backpack)	<u>Distribution surveys (presence/absence)</u> Backwater channel areas in the following rivers: - Upper Yakima mainstem (Easton Dam to Wilson Cr.) - Naches mainstem: confluence to the Little Naches R. - Little Naches R.: confluence to North Fork and lower half mile of tributaries (based on presence of redds) - **Tributaries near adult and parr release areas** Nov.-Feb., 5-10 days/month, not every area annually <u>Non-Target Taxa of Concern surveys</u> - Upper Yakima: Taneum Cr. (treatment), Swauk Cr. (control) - Naches: Nile Cr. (treatment), Quartz Cr. (control)
1. All parr releases would be PIT tagged. If numbers prove too small for reliable estimates of survival, releases would be increased, probably to no larger than 5,000 per group.	

Appendix B

Draft Hatchery and Genetic Management Plan: Yakima River Summer/Fall Chinook Production Program

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Yakima River Summer and Fall Run Chinook Production Program
Species or Hatchery Stock:	Fall Chinook (*Oncorhynchus tschawytcha*)
Agency/Operator:	Yakama Nation
Watershed and Region:	Yakima River Subbasin/Columbia Plateau Province
Date Submitted:	May 2010
Date Last Updated:	August 26, 2004; Updated July 2005, Sept. 2007, March 2009, January 29, 2010

SECTION 1.   GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.

Yakima River summer and fall run Chinook Production Program (includes Prosser and Marion Drain hatchery production and feasibility program to re-establish summer run Chinook).

Brief Overview: The Yakima Subbasin Summer and Fall Run Chinook Master Plan (Master Plan) proposes to transition the existing hatchery program. When upgrades to the Prosser Hatchery are completed pursuant to the Master Plan, fall Chinook transfers from Little White Salmon would be replaced with an adult brood collection program at Priest Rapids Dam (preferred alternative) or an egg transfer from Priest Rapids Hatchery (PRH). The Prosser Hatchery would be expanded as necessary to accommodate the program, including changes necessary for fish health and disease considerations. Fish would be released from acclimation site(s) in the lower Yakima River below Horn Rapids Dam. In addition, an integrated program using local fall Chinook brood stock to augment harvest and natural spawning escapement would continue to be developed. This program will use local brood stock collected at or near Prosser Dam and will mark releases so that natural-origin returns can be distinguished. These fish would be released from Prosser Hatchery or acclimation sites upstream in the lower Naches or middle Yakima Rivers. New hatchery releases targeted at re-establishing the summer run component would be implemented. Summer Chinook collected from Wells Hatchery or Wells Dam will be used initially to re-establish a summer run until adult returns are sufficient to meet the targeted summer run release objective with an integrated local brood source program. The existing fall Chinook program at Marion Drain would be replaced with the summer run rearing program. Marion Drain fall Chinook would be treated as part of the aggregate Yakima fall run Chinook population (see Section 6.2). The combined annual release goal for the fall-run and summer-run portion of the program would be approximately 2.0 to 2.7 million Chinook (generally consistent with the existing program – see Table 1.11.2.2).

These fish would be released from acclimation sites in the Yakima River as follows:

- ~1.7 million PRH fall run Chinook from acclimation site(s) below Horn Rapids Dam. These will continue to be LWS NFH fish released from Prosser Hatchery until the Master Plan is submitted, approved, and implemented.

- ~0.1-0.5 million Prosser Hatchery fall run Chinook (local brood program) from Prosser Hatchery or acclimation sites in the lower Naches and middle Yakima Rivers. This portion of the program is already occurring and will be ongoing.

- ~0.2-0.5 million summer run Chinook (initially from Wells Hatchery or Wells Dam brood source) from acclimation sites in the lower Naches and middle Yakima Rivers. This portion of the program is already occurring and will be ongoing. Transition to local brood is expected to occur slowly over the next 20-30 years as adult returns to the Yakima increase.

These program modifications are consistent with HSRG recommendations and are expected to contribute to enhancement of VSP parameters for naturally spawning fall Chinook and reduce ecological risks to native species relative to the existing program.

1.2) Species and population (or stock) under propagation, and ESA status.

State common and scientific names.

Fall Chinook (*Oncorhynchus tschawytcha*)
ESA Status: Not listed and not a candidate for listing. NOAA Fisheries grouped summer and fall run Chinook together as part of the Upper Columbia River Summer-/Fall-run Chinook ESU when it made a “not warranted for listing” determination for this ESU in 1998. Yakima River summer/fall Chinook are part of this ESU. The term “fall Chinook” in this document applies to the aggregate summer- and fall-run components.

1.3) Responsible organization and individuals

Indicate lead contact and on-site operations staff lead.
Name (and title): Joe Blodgett, Fish Production Biologist and Facility Manager
Agency or Tribe: Yakama Nation
Address: P. O. Box 151, Toppenish, WA 98948
Telephone: (509) 865-5121, Ext. 6706
Fax: (509) 865- 6293
Email: joewb@earthlink.net

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Co-operators	Role
Yakama Nation	Lead entity; manages and operates Prosser Hatchery complex
U.S. Bureau of Reclamation	Owner of facility land; and minor funding entity for facility upgrades and public education
U.S. Fish and Wildlife Service	Little White Salmon/Willard NFH Complex and Fish Pathology Monitoring and Analyses
Grant County Public Utility District	Priest Rapids Hatchery funding entity
National Marine Fisheries Service	Funding Entity/Administration via Mitchell Act Funds
Washington Department of Fish & Wildlife	Co-Manager; Operator of Priest Rapids and Wells Hatcheries
Bonneville Power Administration	Funding Entity- Administrator
U.S. Army Corps of Engineers	Funding Entity- Administrator via John Day mitigation
Northwest Power and Conservation Council (NPCC)	Makes Fish and Wildlife Program decisions under the Northwest Power Act
Yakima Basin Fish and Wildlife Recovery Board	Lead entity on development of mid-Columbia Salmon and Steelhead Recovery Plan

1.4) Funding source, staffing level, and annual hatchery program operational costs.

The program includes 9 scientific technicians and 2 management biologists for Marion Drain and Prosser Hatcheries or 11 full-time equivalent staff with an annual operating cost of approximately $1.1 million (2002 dollars). This operational information includes Prosser and Marion Drain production of summer and fall-run Chinook as well as coho.

The URB fall Chinook production program in the Yakima Basin is funded through John Day mitigation, the Mitchell Act, and the Bonneville Power Administration. John Day mitigation funds are used to culture the LWS fish up to being transferred to the Yakima Basin. Mitchell Act funds are used for final rearing and acclimation at the Prosser Hatchery. Bonneville Power Administration funds are used to culture the in-basin Yakima and Marion Drain production and for monitoring and evaluation.

1.5) Location(s) of hatchery and associated facilities.

Include name of stream, river kilometer location, basin name, and state. Also include watershed code (e.g. WRIA number), regional mark processing center code, or other sufficient information for GIS entry. See "Instruction E" for guidance in responding.

As described in 1.1 under "Brief Overview", the Yakama Nation Prosser and Marion Drain hatcheries are the main facilities for the program described in this HGMP. Although Little White Salmon NFH (USFWS) and Priest Rapids and Wells Hatcheries (WDFW) provide current or future fish for this program, activities at these out-of-basin facilities will not be described in this document.

An HGMP for the LWS NFH fall Chinook salmon program which supplies fall Chinook salmon to this program is available at the follow website: http://www.fws.gov/pacific/Fisheries/Hatcheryreview/Reports/columbiagorge/LW--006LWURBHGMPMay04.doc. The LWS NFH URB fall Chinook program is currently covered under a Section 7 Biological Opinion dated November 27, 2007 (http://www.nwr.noaa.gov/Salmon-Harvest-Hatcheries/Hatcheries/Sec-7-USFWS-Columbia.cfm). The LWS NFH URB fall Chinook program is being updated to reflect changes due to reprogramming at the Spring Creek NFH.

The HGMP for Priest Rapids fall Chinook (which may supply fish to this program in the future) can be found at:
http://wdfw.wa.gov/hat/hgmp/pdf/snake_river/ucol_priest_rapids_fck.pdf

The HGMP for Wells Hatchery Summer Chinook can be found at:
http://wdfw.wa.gov/hat/hgmp/pdf/snake_river/wells_sck.pdf

Broodstock source	Yakima River
Broodstock collection location (stream, RKm, subbasin)	Chandler Canal (Water diversion system upstream of and off right bank at Prosser Dam) and Prosser Dam- Right Bank Fish Ladder, RKm 75.1, Yakima Subbasin; and Marion Drain fishwheel, ~RKm 132.9, Yakima Subbasin.
Adult holding location (stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.1, Yakima Subbasin; and Marion Drain Hatchery, ~RKm 132.9, Yakima Subbasin.
Spawning location (stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.16Yakima Subbasin; and Marion Drain, ~RKm 132.9, Yakima Subbasin.
Incubation location (facility name, stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.16, Yakima Subbasin; and Marion Drain, ~RKm 132.9, Yakima Subbasin.
Rearing location (facility name, stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam , RKm 75.1, Yakima Subbasin; and Marion Drain, ~RKm 132.9, Yakima Subbasin.

The WRIA code for Prosser Dam and Hatchery, Chandler canal, and Marion Drain facility is 37.

1.6) Type of program.

Define as either: Integrated Recovery; Integrated Harvest; Isolated Recovery; or Isolated Harvest (see Attachment 1 - Definitions" section for guidance).

The long-term intent of the program as described here and in the Master Plan is a combination of integrated harvest and integrated recovery using locally adapted brood sources.

Background: The Yakima fall Chinook program originated strictly as a mitigation program to mitigate for activities within the Columbia River Basin that have decreased salmonid populations. Upriver production was designed to mitigate for the loss of Tribal harvest opportunity as a result of reduced natural fall Chinook runs above Bonneville Dam. Since 1997, after being adopted into the YKFP, the program has evolved into a supplementation program, while still having mitigation responsibilities under *United States versus Oregon* and the Columbia River Fish Management Plan.

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPPC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6. Example: "The goal of this program is the restoration of spring Chinook salmon in the White River using the indigenous stock".

The purposes of this hatchery program are: to provide harvest, to maintain viable salmon population parameters for Yakima River fall Chinook, to contribute to regional research and education, and as mitigation for hydro system impacts. Specific goals are:

Conservation: 1) increase population viability (abundance, productivity, diversity and spatial distribution; McElhany et al. 2000; see also NRC 1996) by enhancing local adaptation of fall Chinook released in the subbasin, by re-establishing a summer run component, and by working with other parties to implement habitat restoration strategies, and 2) ensure that population size remains large enough to allow the population to maintain itself (Sections 6.1.1 and 6.1.3 of Master Plan)

Harvest: 1) meet or exceed Treaty harvest obligations consistently and on a long-term sustainable basis, 2) maintain or increase recreational fisheries on a long-term sustainable basis (Section 6.1.3 of Master Plan)

Habitat: continue work to address limiting factors as identified in the Yakima Subbasin Plan and Yakima Steelhead Recovery Plan (Section 6.1.5 of Master Plan)

1.8) Justification for the program.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population (integrated or isolated recovery programs), or how the program will be operated to provide fish for harvest while minimizing adverse effects on listed fish (integrated or isolated harvest programs).

The hatchery strategy calls for transitioning the existing hatchery program. Fall Chinook from Little White Salmon would be replaced with fish from Priest Rapids Dam (or Hatchery) and these fish would be released from new acclimation sites below Horn Rapids Dam. Given the geographical and genetic proximity of Priest Rapids fish to the lower Yakima River, these releases could continue indefinitely to meet mitigation and harvest goals with little impact to conservation objectives. Improved survival from a lower basin release of these fish combined with increased production from habitat restoration and a more fully developed local brood source should work synergistically to further conservation and harvest objectives. The integrated program using local fall Chinook brood stock to augment harvest and natural spawning escapement in the middle reaches of the Basin would continue to be developed and new hatchery releases targeted at re-establishing the summer run component would be implemented. The integrated program will use local brood stock collected at or near Prosser Dam and will mark all releases so that natural-origin returns can be distinguished. Summer Chinook collected from Wells Hatchery or Wells Dam will be used initially to re-establish a summer run until adult returns are sufficient to meet the targeted summer run release objective with an integrated local brood source program. The combination of these strategies as well as habitat protection and enhancement strategies identified in the Yakima Subbasin and Recovery Plans should work to improve VSP parameters for summer and fall run Chinook in the Yakima and Columbia Basins.

Impacts to listed steelhead in the Yakima Basin are discussed in other sections of this HGMP.

Background: The *United States versus Oregon* Columbia River Fish Management Plan (1988) stated a short-term production goal for the Yakima Basin as a release of 1.7 million Upriver Bright Stock fall Chinook from the Little White Salmon Hatchery. The long-term production goal for the Yakima Basin was stated as the construction of a Yakima Hatchery with capacity for production of 3.0 million Upriver Bright fall Chinook. The CRFMP also supported the establishment of a new program where the production of 200,000 fall Chinook was to be converted to summer Chinook and identified the construction of a Yakima hatchery for regional [summer Chinook] supplementation as a long-term goal. This program is part of mitigation for the lost natural production of tens of thousands of adult spawners due to flooding of mainstem habitat from construction of John Day Dam. The proposed program is consistent with the 2008-2017 *U.S. v Oregon* Management Agreement (Tables B.2 and B.5), the Columbia River Fish Accords, and other mitigation obligations and agreements (e.g., John Day mitigation).

1.9) List of program "Performance Standards".

"Performance Standards" are designed to achieve the program goal/purpose, and are generally measurable, realistic, and time specific. The NPPC "Artificial Production Review" document attached with the instructions for completing the HGMP presents a list of draft "Performance Standards" as examples of standards that could be applied for a hatchery program. If an ESU-wide hatchery plan including your hatchery program is available, use the performance standard list already compiled.

Example: "(1) Conserve the genetic and life history diversity of Upper Columbia River spring Chinook populations through a 12 year duration captive broodstock program; (2) Augment, restore and create viable naturally spawning populations using supplementation and reintroduction strategies; (3) Provide fish to satisfy legally mandated harvest in a manner which minimizes the risk of adverse effects to listed wild populations; (4)....".

In general the YKFP monitors production programs in terms of performance relative to:
1) Increasing natural production.
2) Increasing harvest opportunity.
3) Limiting genetic impacts to target and nontarget populations.
4) Limiting ecological impacts to nontarget populations.

Monitoring and Evaluation for this particular program will fall into the following five general categories: Hatchery, Harvest, Escapement (Abundance and Spatial Distribution), Productivity, and Predation. Chapter 7 of the Master Plan (included in Section 11 here) details objectives and strategies for each of these five categories. Diversity will be monitored through genetic and biological sampling of returning fish recaptured at adult traps and those fish used for brood stock. Ecological Interactions monitoring is part of the umbrella YKFP M&E project, BPA project id 199506325.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

The NPPC "Artificial Production Review" document referenced above presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program. If an ESU-wide hatchery plan is available, use the performance indicator list already compiled. Essential 'Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates, and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.

1.10.1) "Performance Indicators" addressing benefits.

(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Performance Indicators Addressing Benefits

Indicator	Performance Standard	Indicator is Monitored
Total number of fish harvested in tribal fisheries targeting this program.	Program contributes to fulfilling tribal trust responsibility mandates and treaty rights, as described in *U.S. v. Oregon* management agreements	*U.S. v OR* TAC and YN monitoring
Number of fish released by program, returning, or caught, as applicable to given mitigation requirements.	Program contributes to mitigation requirements.	*U.S. v OR* TAC and YN monitoring
Annual number of fish produced by this program caught in all fisheries, including estimates of fish released and associated incidental mortalities, by fishery.	Fish produced for harvest are produced and released in a manner enabling effective harvest, as described in all applicable fisheries management plans, while avoiding overharvest of non-target species.	*U.S. v OR* TAC and YN monitoring documents total harvest of URBs in fisheries; proportion Yakima would need to be derived from available information such as release numbers, dam counts, etc.
Annual escapements of natural populations that are affected by fisheries targeting program fish.		YN and WDFW conduct annual redd counts of naturally spawning fall Chinook in the Yakima Basin
Annual number of spawners on spawning grounds, by age.	Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	YN and WDFW estimate Yakima River run size from Prosser dam count, harvest, and redd count data. Age composition can be estimated from Prosser Denil passage and Prosser hatchery broodstock scale sampling.
Annual number of redds in selected natural production index areas.		YN and WDFW conduct annual redd counts of naturally spawning fall Chinook in the Yakima Basin

1.10.2) "Performance Indicators" addressing risks.

(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Performance Indicators Addressing Risks

Indicator	Performance Standard	Indicator is Monitored
Marking rate by mark type for each release group.	Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Yes, marking rates for each release group will be documented. For M&E purposes, we intend to mark 100% of all hatchery-origin releases. However, due to the large number of releases, associated marking costs, and tribal policies relative to mass marking and selective fisheries, it may be necessary to modify M&E measures to monitor performance based on less than 100% marking. Marking rates will be sufficient to determine relative survival differences between different release groups.
Temporal distribution of broodstock collection, and of naturally produced population at point of collection.	Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Broodstock will be taken representatively from throughout the run (e.g., Denil at Prosser Dam, fishwheel in Marion Drain, and possibly other methods such as seining).
Age composition of broodstock collected, and of naturally produced population at point of collection.		Scale samples will be taken from all brood collected for age composition.
Number of spawners of natural origin removed for broodstock.	Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Mark rates and sampling protocols will be designed so that the proportion of Hatchery- and natural-origin fish used for brood and escaping to the spawning grounds will be known and for calculating Proportion Natural Influence (PNI).
Number and origin of spawners migrating to natural spawning areas.		(see above).
Number of eggs or juveniles placed in natural rearing areas.		Juvenile fish will be released from acclimation sites in the upper (summer run) and lower (fall run) Yakima Basin. Annual seine surveys will be conducted in natural juvenile rearing areas.

Life history characteristics	Life history characteristics of the natural population do not change as a result of this artificial production program.	At least the following characteristics will be monitored on an annual basis: Juvenile migration timing (at Chandler), juvenile size at outmigration (Chandler sampling, hatchery release and seining operations), adult return timing (at Prosser), adult return age and sex composition and size at return (Prosser Denil and brood sampling), Spawn timing and distribution (comprehensive spawner surveys), fecundity and egg size (hatchery spawn sampling)
Carrying capacity criteria for basin-wide and local habitat, including method of calculation.	Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and nearshore rearing.	Yakima Basin carrying capacity will be monitored using life-cycle and habitat production modeling analyses. Models will be frequently updated to include the most recent production and habitat parameters.
Annual release numbers from all programs in basin and subbasin, including size and life-stage at release, and length of acclimation, by program.		YN documents these data.
Location of releases and natural rearing areas.		YN documents these data.
Timing of hatchery releases, compared to natural populations.		Timing of hatchery releases is known. Timing of wild/natural migrations determined from Chandler juvenile trap monitoring.
Genetic profiles of naturally produced adults, as developed at program's outset (e.g. through DNA or allozyme procedures) and compared to genetic profiles developed each generation.	Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	This is not presently a program priority. However, DNA samples could be taken from fish at the Prosser Denil and during spawning if sufficient funding were made available.
Total number of natural spawners reaching the collection facility.	Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.	Mark rates and sampling protocols will be designed so that the proportion of Hatchery- and natural-origin fish used for brood and escaping to the spawning grounds will be known and for calculating Proportion Natural Influence (PNI).
Total number of spawners estimated to pass the collection facility to spawning areas, compared to minimum effective population size (when established) required for those natural populations.		Total number of natural spawners is estimated (see above); minimum effective population size could be estimated using available data.
Timing of collection compared to overall run timing.		Prosser Dam counts and Prosser Denil sampling and collection data should be sufficient.
The ratio of observed and/or estimated total numbers of artificially produced fish on natural spawning grounds, to total number of naturally produced fish, for each significant spawning area.	Artificially produced origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.	Mark rates and sampling protocols will be designed so that the proportion of Hatchery- and natural-origin fish used for brood and escaping to the spawning grounds will be known and for calculating Proportion Natural Influence (PNI).
Observed and estimated total numbers of naturally produced and artificially produced adults passing a counting station close to natural spawning areas.		(see above).
Location of juvenile releases.	Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Juvenile fish will be released from acclimation sites in the upper (summer run) and lower (fall run) Yakima Basin. Annual seine surveys will be conducted in natural juvenile rearing areas.
Length of acclimation period.		Fish will be acclimated for a period of 6 weeks to 12 weeks depending on annual water conditions.
Release type, whether forced, volitional, or direct stream release.		Volitional release.
Level of smoltification at release, compared to a regional smoltification index (when developed). Release type, whether forced, volitional, or direct stream release.	Juveniles are released at fully smolted stage.	Volitional release as pre-smolt subyearlings or yearling smolts.
Number of adults available for broodstock (moving geometric mean, based on number of ages at return for this species).	The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Prosser dam counts and denil sampling should provide an index with which to make this determination.

Scientifically based experimental design, with measurable objectives and hypotheses.	The artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.	The fall Chinook program is currently evaluating the effects of conventional versus accelerated rearing on smolt-to-smolt and smolt-to-adult survival. See http://www.efw.bpa.gov/searchpublications/ YKFP M&E annual report for latest year's results.
Monitoring and evaluation framework including detailed time line.	The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objective and evaluate beneficial and adverse effects on natural populations.	Monitoring and evaluation framework is being developed as part of the Master Plan for this species.
Annual and final reports.		See http://www.efw.bpa.gov/searchpublications/ YKFP M&E annual report for latest year's results.
Annual reports indicating level of compliance with applicable standards and criteria.	Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT (1995), Pacific Northwest Fish Health Protection Committee (PNFHPC), the Co-Managers of Washington Fish Health Policy, National Investigational New Animal Drug (INAD) Office, and Montana Dept. of Fish Wildlife, and Parks (MDFWP).	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results
Discharge water quality compared to applicable water quality standards and guidelines, such as those described or required by NPDES, IHOT, PNFHPC, and Co-Managers of Washington Fish Health Policy tribal water quality plans, including those relating to temperature, nutrient loading, chemicals, etc.	Effluent from artificial production facility will not detrimentally affect natural populations.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results
Water withdrawals compared to applicable passage criteria.	Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results for all performance indicators for this standard.
Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria		
Number of adult fish aggregating and/or spawning immediately below water intake point.		Hatchery personnel will monitor.
Number of adult fish passing water intake point.		
Proportion of diversion of total stream flow between intake and outfall.		
Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence.	Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	USFWS fish health professionals sample and certify all releases.
Number and location(s) of carcasses or other products distributed for nutrient enrichment.	Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results for all performance indicators for this standard.
Statement of compliance with applicable regulations and guidelines.		
Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.	Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.	Derived from spawner survey (temporal and spatial) and Prosser Dam counts (temporal).
Mortality rates in trap.	Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	Mortality rates are documented.

Prespawning mortality rates of trapped fish in hatchery or after release.		Mortality rates are documented.
Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present.	Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	These data are available for analysis (see above).
Total cost of program operation.	Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	See 1.4 above.
Sum of ex-vessel value of commercial catch adjusted appropriately, appropriate monetary value of recreational effort, and other fishery related financial benefits.		This calculation will be difficult to do accurately since these fish are harvested in marine fisheries from Alaska possibly as far south as Northern California and inland to Prosser Dam and as expressed above, the proportion of Yakima fish in the total URB harvest in these fisheries can only be roughly estimated.
Total cost of program operation.	Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	See 1.4 above.
Average total cost of activities with similar objectives.		
Number of adult fish available for tribal ceremonial use.	Non-monetary societal benefits for which the program is designed are achieved.	YN documents this use.
Recreational fishery angler days, length of seasons, and number of licenses purchased.		See relevant U.S. v OR TAC and WDFW documentation.

See also Sections 1.7-1.9 above.

1.11) Expected size of program.

In responding to the two elements below, take into account the potential for increased fish production that may result from increased fish survival rates effected by improvements in hatchery rearing methods, or in the productivity of fish habitat.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The program goal is to maintain an annual release of 2.0 to 2.7 million fall Chinook consisting of:

- Up to 1.7 million Priest Rapids stock (presently LWS NFH) fall run Chinook. Brood stock (~800-1000 fish) collected at Priest Rapids Dam or Hatchery (presently LWS NFH).
- ~0.1 to 0.5 million local (Prosser Hatchery) fall run Chinook. The brood stock would be collected from several locations: a) the Prosser Dam right bank denil ladder and fish trapping facility; b) from fish stranded in the Chandler canal during maintenance operations in October; c) from a denil ladder at the Prosser Hatchery outlet stream; d) potential retrofits at existing irrigation diversion dams; and e) potential seining or trapping operations at other locations in the lower Yakima River. It is anticipated that up to 600 adults would be collected annually for this program. Broodstock would be collected throughout the entire adult migration period to increase the diversity of life histories being reared at the hatchery. On average, about 400 fall Chinook passed upstream via the Denil ladder from 2000-2008 (Table 6.5.1.1 in Master Plan). Chandler canal collections ranged from about 50-500 and averaged about 100 fall Chinook since 1997 (YN, unpublished data). The denil ladder at the Prosser Hatchery has not yet been

operated to capture fall Chinook, but biologists estimate another 100-200 fish could be captured there. Since fall Chinook collected at these three locations may consist largely of hatchery-origin returns, other collection options will be developed to increase the number of natural-origin fish used for brood stock.

- ~0.2 to 0.5 million summer run Chinook (100-250 adults, initially from Wells Hatchery or Wells Dam brood source).
- The existing fall Chinook program at Marion Drain would be replaced with the summer run rearing program. Marion Drain fall Chinook would be treated as part of the aggregate Yakima fall run Chinook population (see Section 6.2).

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		
Unfed Fry		
Fry		
Fingerling	Acclimation sites in the upper (summer run) and lower (fall run)Yakima Basin	~ 2.0-2.7 million (part of the summer run release might be a yearling program)
Yearling	Prosser Hatchery	~ 30,000 to 300,000 (for research and survival evaluation)

The *U.S. vs OR* production goal is an out-of-basin release of 1.7 million [Little White Salmon] fall Chinook. The program expects to maintain an annual release of approximately 2.0 to 2.7 million fall Chinook. Table 1.11.2.1 summarizes historic releases of hatchery fall Chinook smolts made in the Yakima between 1983 and 1996. Table 1.11.2.2 reflects the current status of the fall Chinook program with respect to release numbers and release location.

Table 1.11.2.1. Summary statistics, LWS hatchery fall Chinook smolt releases in the Yakima Subbasin, 1983 - 1996.

	Hatchery Plants Above Prosser		Hatchery Plants Below Prosser				
Year	No.	% Clipped	No.	% Clipped	Hat. Smolt Survival To Prosser, Pen Reared Fish Only (%)	Hat. Smolt Survival To Prosser, Direct Releases Only (%)	Catch Rate In Oceanic And Columbia River Fisheries (% Of No. Tagged Fish Released)
1983	0	N. A.	323,796	0	N. A.	N. A.	NO DATA
1984	105,097 (Sunnyside Dam)	100 (98.8% tagged)	479,556 (84.6% Horn, 15.4% Prosser)	21.5 (all Horn; 99,522 tagged)	N. A.	27.1	.09%
1985	100,655 (Sunnyside Dam)	100 (100% tagged)	1,763,500 (52.4% Horn, 47.6% Prosser)	6.1 (all Prosser, all tagged)	N. A.	15.7	PROSS = .09% SUNNY = 0.0%

1986	97,460 (Sunnyside Dam)	100 (96.1% tagged)	1,547,700 (53.2% Horn, 46.8% Prosser)	6.5 (all Prosser, all tagged)	N. A.	32.2	PROSS = .03% SUNNY = 0.0%
1987	196,980 (Sunnyside Dam)	100 (100% tagged)	872,609 (all Prosser)	22.6 (all Prosser, all tagged)	N. A.	44.4	PROSS = .15% SUNNY = .09%
1988	444,795 (55.3% Wapato net pens, 44.7% Sunnyside Dam)	100 (100% tagged)	1,375,888 (all Prosser)	14.5 (all Prosser, 95.6% tagged)	22.6	6.7	PENS = .001% PROSS = .005% SUNNY = 0.0%
1989	540,198 (63% Wapato net pens, 37% Sunnyside Dam)	90.6 (85% Wapato fish clipped and tagged; 100% Sunnyside fish clipped and tagged)	1,430,316 (24% Horn, 76% Prosser)	14.0 (18.4% Prosser fish clipped and tagged; 0% Horn fish clipped and tagged)	18.5	8.7	PENS = .001% SUNNY & WAPATO = .0005%
1990	679,714 (70.6% Wapato net pens, 29.4% Sunnyside Dam)	45.6 (39.9% Sunnyside fish clipped and tagged; 50% Wapato fish clipped, 48% Wapato fish clipped and tagged)	880,344 (all Prosser)	9.2 (9.2% Prosser fish clipped and tagged)	38.0	33.9	PENS = .05% PROSS & SUNNY = .05%
1991	478,916 (Wapato net pens); 1,152,829 (Roza WW #3)	100% Wapato fish clipped and tagged; all of the Roza WW#3 fish were ventral clipped, but none were tagged.	0	N/A	35.0	31.4	PENS = .04%
1992	0	N/A	0	N/A	N/A	N/A	No Data
1993	165,428 Frontage Rd.	98.5% tagged, 100% clipped	582,731 Prosser ?	98.5% tagged, 100% clipped	N/A	5.5	.005%
1994	0	N/A	1,703,892 Prosser Hatch.	11.6%	N/A	N/A	.001%
1995	0	N/A	1,694,188 Prosser Hatch.	11.7%	N/A	N/A	NO DATA
1996	0	N/A	1,885,504 Prosser Hatch.	10.6%	N/A	N/A	NO DATA

Table 1.11.2.2. Yakima Fall Chinook Release Summary, 1997-2008.

Release Yr.	LWS NFH[1]	Prosser[2]	Marion[2]	Edler[2]	Stiles[2]	TOTAL
1997	1,694,861					1,694,861
1998	1,695,399					1,695,399
1999	1,690,000	192,000				1,882,000
2000	1,695,037	306,000	16,000			2,017,037
2001	1,699,136	427,753	12,000			2,138,889
2002	1,704,348	286,158	4,000			1,994,506
2003	1,771,129	365,409	18,000			2,154,538
2004	1,748,200	561,385	52,223			2,361,808
2005	1,700,000	466,000	41,000	75,000	38,890	2,320,890
2006	1,683,664	130,002	2,000		118,835	1,934,501
2007	1,200,000	550,000	20,000		95,000	1,865,000

2008	800,000	8,336	12,000	55,000	55,000	930,336

[1] Transfers from Little White Salmon NFH released as subyearlings from Prosser Hatchery.
[2] Progeny of local brood stock released as subyearlings from Prosser Hatchery and upriver acclimation sites.

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.

Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas) data available for the most recent twelve years (roughly three fish generations), or for the number of years of available and dependable information. Indicate program goals for these parameters.

Table 1.12.1. Yakima River Basin Fall Chinook Data, 1983 - 2008.

	Hatchery Releases by Brood Source		Natural Smolt	Wild and Hatchery Returns to Prosser			Redd Counts[3]	
Year	LWS[1]	Yakima[2]	Counts	Adults	Jacks	Total	Yakima	Marion Drain
1983	323,796		22,403	264	116	380	50	101
1984	584,663		9,078	694	637	1,331	118	81
1985	1,863,155		285,191	181	92	273	45	77
1986	1,645,160		19,811	497	238	735	134	117
1987	1,022,236		157,581	472	64	536	14	75
1988	1,819,671		75,508	190	34	224	400	12
1989	2,310,636		47,631	670	0	670	149	114
1990	1,560,058		291,092	1,504	0	1,504		
1991	1,632,233		87,252	865	106	971	29	42
1992	130,630		287,727	1,500	112	1,612		39
1993	750,000		181,317	1,056	9	1,065	74	34
1994	1,695,392		246,029	1,357	163	1,520		29
1995	1,694,188		32,354	1,179	143	1,322		34
1996	1,685,278		6,292	1,166	226	1,392		26
1997	1,694,861		35,494	1,031	89	1,120		16
1998	1,695,399		486,573	1,064	84	1,148		22
1999	1,690,000	192,000	45,702	1,876	20	1,896		24
2000	1,695,037	322,000	198,002	1,371	922	2,293		
2001	1,699,136	439,753	1,677,537	3,651	660	4,311		34
2002	1,704,348	290,158	95,424	6,146	95	6,241	590	56
2003	1,771,129	383,409	113,577	4,796	79	4,875	1,273	86
2004	1,748,200	613,608	217,832	2,862	85	2,947	889	100
2005	1,700,000	620,890	182,278	1,920	22	1,942	350	56
2006	1,683,664	250,837	43,716	1,499	29	1,528	357	60
2007	1,200,000	665,000	28,989	892	240	1,132	321	67
2008	800,000	130,336	88,905	2,739	124	2,863	201	46
Avg:	1,453,803	390,799	190,896	1,594	169	1,763	312	58

[1] Little White Salmon National Fish Hatchery.
[2] Includes Marion Drain.
[3] Blanks indicate no data were available.

Table 1.12.2. Average combined hatchery- and natural-origin smolt counts at Prosser for fish returning at age-3, -4, and -5, combined adult returns to Prosser Dam of all age classes, and estimated Prosser smolt-to-adult return indices for Yakima River fall Chinook for adult return years 1988-2008.

Adult Return Year	Prosser Average Smolts[1]	Prosser Total Adults	Prosser Smolt-to-Adult Return Index (SAR)
1988	1,029,429	224	0.02%
1989	1,469,019	670	0.05%
1990	1,664,378	1,504	0.09%
1991	1,579,989	971	0.06%
1992	1,811,088	1,612	0.09%
1993	2,034,865	1,065	0.05%
1994	1,976,301	1,520	0.08%
1995	1,329,664	1,322	0.10%
1996	1,023,053	1,392	0.14%
1997	1,097,032	1,120	0.10%
1998	1,533,093	1,148	0.07%
1999	1,786,511	1,896	0.11%
2000	1,716,156	2,293	0.13%
2001	1,867,966	4,311	0.23%
2002	1,946,676	6,241	0.32%
2003	2,108,238	4,875	0.23%
2004	2,653,056	2,947	0.11%
2005	2,707,132	1,942	0.07%
2006	2,724,824	1,528	0.06%
2007	2,312,562	1,132	0.05%
2008	2,450,308	2,863	0.12%
Average	1,848,635	2,027	0.11%

[1] Average combined hatchery- and natural-origin smolt counts for the years which would comprise the age-3, -4, and -5 adult return components for each adult return year. For example, the "Prosser Average Smolts" for adult return year 1988 is the average of hatchery- and natural-origin Prosser smolt estimates for juvenile migration years 1983-1985.

Table 1.12.3. Release-to-adult survival rates of summer and fall Chinook salmon reared as sub-yearlings and yearlings at selected hatcheries in the Mid-Columbia Region. Survival rates are expressed as un-weighted means of variable-sized release groups. Data from Priest Rapids Fall Chinook HGMP, August 26, 2005.

Hatchery	Age at Release	Release Years	Release-to-adult survival rate (%)
Priest Rapids	sub-yearling	1976-1989	0.835
Priest Rapids	sub-yearling	1990-1996	0.370
Rocky Reach	yearling	1984-1989	1.366
Wells	sub-yearling	1976-1989	0.098
Wells	yearling	1976-1989	0.410

Estimates of total fall Chinook escaping fisheries and spawning naturally in the Yakima River have ranged from about 1,350 to 11,300 fish from 1998 to 2007.

Table 1.12.4. Estimated fall Chinook return, escapement, and harvest in the Yakima River, 1998-2008. Data from WDFW and YN databases, 6 March 2009.

			Escapement						
	Total Return		Above Prosser		Below Prosser		WA Recreational Harvest		
Year	Adult	Jack	Adult	Jack	Adult	Jack	Adult	Jack	Rate
1998	1,743	106	1,064	84	645	22	34	0	1.8%
1999	4,056	43	1,876	20	2,046	23	134	0	3.3%
2000	4,557	1,138	1,371	922	2,931	194	255	22	4.9%
2001	5,886	869	3,651	660	1,293	151	942	58	14.8%
2002	13,369	211	6,146	95	4,923	116	2,300	0	16.9%
2003	10,092	193	4,796	79	3,874	73	1,422	41	14.2%
2004	5,825	271	2,862	85	2,231	140	732	46	12.8%
2005	3,121	45	1,920	22	491	7	710	16	22.9%
2006	2,299	67	1,499	29	363	10	437	28	19.7%
2007	1,318	461	892	240	194	26	232	195	24.0%
2008			2,739	124			502	64	

Because of the quantity and relatively higher quality of fall Chinook available to tribal fishers in Zone 6 Columbia River fisheries, Yakima River tribal harvest is typically at or near zero even though regulations allowing fall season fisheries in the Yakima River are propagated annually by the Yakama Nation.

1.13) Date program started (years in operation), or is expected to start.

The Yakima Upriver Bright Program began in 1983. In early years the program consisted of direct stream and/or acclimated releases transferred from out-of-basin facilities. The first year of operation for the Prosser hatchery was 1994. The first year of operation for the Marion Drain hatchery was 1997. The first year that Wells hatchery summer run eggs were transferred to Prosser Hatchery was 2008.

1.14) Expected duration of program.

This is an ongoing supplementation program designed to augment both natural production and tribal and sport harvest. The program is expected to end when goals can be met by other means not requiring artificial production.

1.15) Watersheds targeted by program.

Include WRIA or similar stream identification number for desired watershed of return.

Yakima River Subbasin/Columbia Plateau Province, generally WRIAs 37 and 38.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

The YN considered four other alternatives for managing Yakima River summer/fall Chinook.

1) Maintain existing program. The existing program does not meet current conservation goals identified for the Subbasin. The USFWS hatchery review group and the HSRG have recommended transitioning the Yakima program from LWS NFH stock to Priest Rapids stock.

2) Transition to a segregated program for non-local fall Chinook with releases below Prosser and an integrated hatchery program using locally collected broodstock with releases at or above Prosser. This alternative was rejected due primarily to the difficulty maintaining a segregated program without adequate trapping facilities in the lower Yakima River; disease considerations were also a factor. Using green or eyed-eggs instead of pre-smolts or isolating adults eliminates disease concerns with Priest Rapids stock fish. Thus, portions of this alternative were incorporated into the preferred alternative.

3) Eliminate hatchery production. This alternative was considered not viable because it is inconsistent with harvest objectives and existing *U.S. v Oregon* management agreements, principles and case law (see sections 1.8 and 3.2 of Master Plan).

4) Restore the natural fall Chinook spawning habitat eliminated by the construction of The Dalles and John Day dams. This alternative was not considered practical for a number of reasons. First, the direct costs associated with the removal of the dams would be very great, possibly in the billions of dollars. In addition to the direct expenses involved in dam removal, secondary expenses would accrue from providing an alternative to lost electrical generation and shipping as well as the cost of habitat mitigation required during and after dam removal. Dam removal would also require broad political support. Though the benefits to fish could be very large, the alternative was rejected on economic grounds.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

This document is intended to be consistent with NOAA (2008) which states (RPA 39):

> The FCRPS Action Agencies will continue funding hatcheries in accordance with existing programs… Consultation under the ESA on the operation of hatchery programs funded by the FCRPS Action Agencies including the submittal of updated and complete HGMPs. Updated and complete HGMPs are to be

> submitted to NOAA Fisheries and ESA consultation should be initiated by … July 2009 for hatchery programs in the Middle Columbia … ESA consultations should be completed by January 2010 for hatchery programs in the Middle Columbia …

Project sponsors are also aware of direction in NOAA (2009a) calling "for consultations on hatchery programs within the MCR Steelhead DPS to be completed by January 2010". Project sponsors remind NOAA of its statement in this document that "mitigation obligations will not be diminished under this process". The Yakama Nation considers this project essential to meeting federal commitments to honor the Treaty of 1855, and to "protect, rebuild, and enhance" anadromous salmon populations throughout tribal usual and accustomed fishing areas as described in the 2008-2017 *United States v Oregon* Management Agreement and in the Columbia River Fish Accords. As such, any changes to program parameters described herein which would diminish the number of adult salmon returning to tribal usual and accustomed fishing areas that result from this HGMP development and consultation process will not be implemented unless and until they are considered and approved in appropriate policy fora.

The program has the following permits or authorizations: YKFP projects have been operating under a "BPA Letter" dated 4/6/01 from Robert Beraud to Rob Jones which states that NMFS has no concern that YKFP activities would violate 7d rules. An electronic copy of the letter is not available but could be mailed via U.S. mail if desired. In addition, the BPA environmental coordinator for the YKFP has prepared NEPA documents which cover all the environmental aspects of the project, including ESA coverages. At least the following related documents are on file with BPA (Obtain copies from Patricia R. Smith prsmith@bpa.gov, or Rachel Rounds rarounds@bpa.gov, BPA, 800-282-3713):

- Bonneville Power Administration, Yakama Indian Nation, Washington Department of Fish and Wildlife (BPA, YIN, WDFW). 1999a. Biological Assessment on Bull Trout for the Yakima/Klickitat Fisheries Project 1999-2004. March 1999.
- BPA, YIN, WDFW. 1999b. Biological Assessment on Mid-Columbia River Steelhead for the Yakima/Klickitat Fisheries Project 1999-2004. April 1999.
- National Marine Fisheries Service. 1999. Biological Opinion on Artificial Propagation in the Columbia River Basin. National Marine Fisheries Service, Northwest Region, Portland, OR.
- United States Department of Energy, Bonneville Power Administration (USDOE/BPA). 1996. Yakima Fisheries Project Final Environmental Impact Statement. DOE/EIS-0169. Portland, OR.
- USDOE/BPA. 1999. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-01. Portland, OR
- USDOE/BPA. 1999. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-02. Portland, OR
- USDOE/BPA. 2000. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-03. Portland, OR
- USDOE/BPA. 2000. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-04. Portland, OR
- USDOE/BPA. 2002. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-

SA-05. Portland, OR
- USDOE/BPA. 2003. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-06. Portland, OR
- USDOE/BPA. 2003. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-07. Portland, OR
- USDOE/BPA 2004. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-08. Portland, OR
- USDOE/BPA 2005. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-09. Portland, OR
- USDOE/BPA 2005. Supplement Analysis for Yakima Fisheries Project, DOE/EIS-0169-SA-10. Portland, OR

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) <u>Description of NMFS ESA-listed salmonid population(s) affected by the program.</u>

Include information describing: adult age class structure, sex ratio, size range, migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

- Identify the NMFS ESA-listed population(s) that will be <u>directly</u> affected by the program. *(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).*

None.

- Identify the NMFS ESA-listed population(s) that may be <u>incidentally</u> affected by the program.
(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

Populations of wild steelhead *Oncorhynchus mykiss* in the Columbia River Basin have declined dramatically from historical levels (Nehlsen et al. 1991; NRC 1996; Williams et al. 1999). Average abundance of wild steelhead in the Yakima River Subbasin over the last two decades is only 2% of pre-1890 abundance levels reported by Howell et al. (1985). Causes of these declines include a host of environmental and human-induced factors (NRC 1996; Williams et al. 1999). In 1997 steelhead in the upper Columbia River were listed as endangered under the Endangered Species Act (ESA) and those in the Snake River were listed as threatened (62 FR 43937-43954). Stocks originating in mid-Columbia Basin tributaries (including the Yakima River) were listed as threatened in 1999 (64 FR 14517-14528). No hatchery fish have been released in the Yakima Subbasin since 1993. Regional plans recognize the need to protect and enhance weak upriver steelhead populations and their habitat while maintaining the genetic integrity of those stocks (NPPC 1994).

Steelhead in the Yakima Basin are divided into four populations: the Satus Creek, Toppenish Creek, Naches River, and Upper Yakima River populations. The NOAA Interior Columbia Technical Recovery Team (ICTRT) identifies the Satus Creek population as steelhead that spawn in the Satus Creek drainage on the Yakama Indian Reservation, the mainstem Yakima River below Satus Creek, and tributaries to the lower mainstem. For management purposes, local planners have subdivided the Satus population into the Satus block, which spawns in the Satus Creek drainage, and a mainstem block, whose current and historic status is uncertain. The Toppenish population consists of steelhead that spawn in Toppenish Creek, its tributaries and the short stretch of the mainstem between Toppenish and Satus creeks, and is entirely on the Yakama Reservation. The Naches population includes steelhead spawning in the Naches River and its tributaries (including the Tieton, Little Naches, American, and Bumping rivers and Cowiche, Rattlesnake and Nile creeks), the mainstem Yakima from the Naches confluence to the Toppenish Creek confluence and the tributaries to that reach of the Yakima, including Ahtanum Creek. The Upper Yakima population consists of all steelhead that spawn in the Yakima River and its tributaries upstream of the Naches confluence. Together these four populations make up the Yakima MPG (see YBFWRB 2009 and Small et al. 2006).

Risks for the Yakima Basin fall Chinook program generally fall into three categories:

- Physical effects on environmental resources caused by facility development
- Effects on target fish (fall Chinook) and non-target taxa (NTT) caused by monitoring and broodstock collection activities (e.g., trapping, marking, handling, etc.)
- Interaction risks to non-target fish from the presence of released fall Chinook.

2.2.2) <u>Status of NMFS ESA-listed salmonid population(s) affected by the program.</u>

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1").*

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. *(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).*

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Adult and juvenile passage estimates for Yakima Basin projects are available at www.ykfp.org and Columbia River DART. Estimated counts of juvenile steelhead migrating past Prosser for recent years are:

Table 2.2.1. Prosser Dam Steelhead Juvenile (Downstream) Migration Estimates

Juv. Migr. Year	Wild	Hatch.	Total	%Wild
1988	42,522	14,636	57,158	74.4%
1989	22,345	5,056	27,401	81.5%
1990	21,805	6,499	28,304	77.0%
1991	21,309	612	21,921	97.2%
1992	33,096	549	33,645	98.4%
1993	17,165	3,109	20,274	84.7%
1994	17,977	602	18,579	96.8%
1995	17,765	16	17,781	99.9%
1996	43,366	14	43,380	100.0%
1997	44,631	0	44,631	100.0%
1998	85,360	0	85,360	100.0%
1999	38,266	0	38,266	100.0%
2000	42,696	0	42,696	100.0%
2001	28,428	0	28,428	100.0%
2002	38,560	0	38,560	100.0%
2003	29,641	0	29,641	100.0%
2004	32,428	0	32,428	100.0%
2005	46,741	0	46,741	100.0%
2006	18,838	0	18,838	100.0%
2007	31,898	0	31,898	100.0%
2008	26,327	0	26,327	100.0%
2009	28,754	0	28,754	100.0%
Average:	33,389	1,413	34,591	95.9%

Data source: YN databases (YakRSthdDB.xls)

Table 2.2.2. Yakima Basin Adult Steelhead Escapement and Spawning Summary						
Run Year	Prosser Dam Count	Redd Counts by Survey Stream				Roza Dam Count
		Satus	Toppenish	Ahtanum	Naches	
1987-88	2,840	445				
1988-89	1,162	404	45			
1989-90	814	289	26			
1990-91	834	125				
1991-92	2,263					116
1992-93*	1,184	73				15
1993-94	554	114				28
1994-95**	925	85				23
1995-96	505	148				92
1996-97*	1,106	76	5			22
1997-98*	1,113	190	13			51
1998-99	1,070	130	78			14
1999-00	1,611	169	185	11		14
2000-01	3,089	102	355	8		140
2001-02**	4,525	240	111	13		238
2002-03	2,235	172	354	8		134
2003-04	2,755	93	56	12	94	213
2004-05	3,451	108	99	16	140	227
2005-06**	2,005	60	20	1	19	117
2006-07	1,537	87	42**	4**	44	61
2007-08	3,310	110	68*	8*	11**	169
2008-09	3,450	119	79	3	29**	230

Blank = no data available
* Partial survey.
**Survey affected by access problems, high flows, or poor redd visibility

Hatchery releases were discontinued in the early 1990s. Recent 9-year average (since 1998-99 run year) escapement over Prosser Dam has been >98% wild; since 1983-84 the annual steelhead escapement has averaged about 92% wild. Data source: YN databases (YakRSthdDB.xls, SthdReddSummary.doc).

Available data indicates smolt-to-adult survival for naturally produced smolts in the Yakima Basin ranged from approximately 0.35% to 4.21% for calendar years 1985 through 2002 (C. Frederiksen, Yakama Nation Fisheries, personal communication).

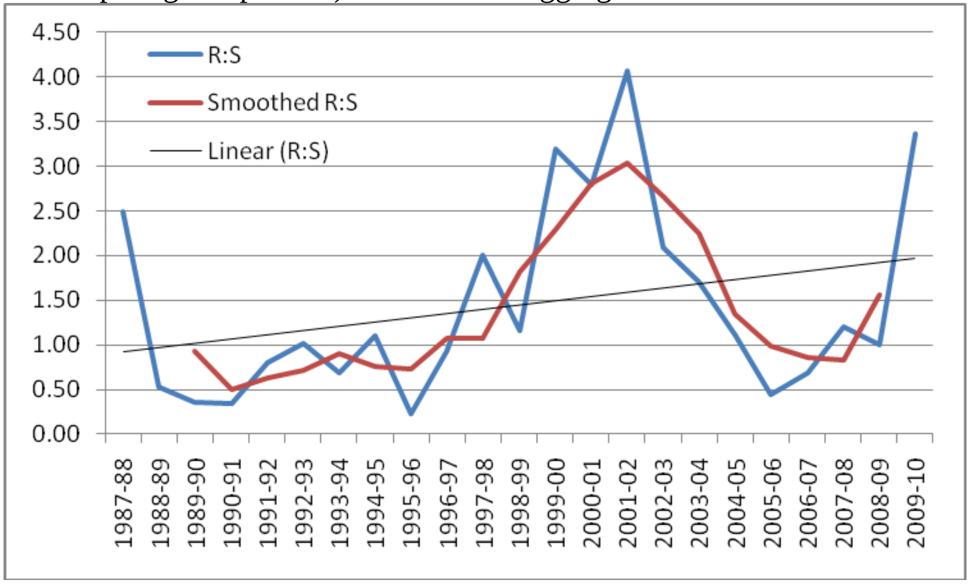
Table 2.2.3. Adult-to-adult productivity (age-4 returns per age-4 spawner) estimates for aggregate Yakima Basin Steelhead.

Run Year	Prosser Adult Count	Prosser Aggregate Age-4 Returns per Spawner	Smoothed Average Age-4 R:S
1983-84	1,140		
1984-85	2,194		
1985-86	2,235		
1986-87	2,465		
1987-88	2,840	2.49	
1988-89	1,162	0.53	
1989-90	814	0.36	0.93
1990-91	834	0.34	0.51
1991-92	2,263	0.80	0.63
1992-93	1,184	1.02	0.71
1993-94	554	0.68	0.90
1994-95	925	1.11	0.76
1995-96	505	0.22	0.74
1996-97	1,106	0.93	1.07
1997-98	1,113	2.01	1.08
1998-99	1,070	1.16	1.82
1999-00	1,611	3.19	2.29
2000-01	3,089	2.79	2.80
2001-02	4,525	4.07	3.03
2002-03	2,235	2.09	2.66
2003-04	2,755	1.71	2.25
2004-05	3,451	1.12	1.34
2005-06	2,005	0.44	0.99
2006-07	1,537	0.69	0.86
2007-08	3,310	1.20	0.83
2008-09	3,469	1.01	1.56
2009-10	6,743[1]	3.36	
Mean	2,108	1.44	1.39
Geometric Mean	1,740	1.10	1.20

[1] through May 6, 2010.

Data source: YN databases (YakRSthdDB.xls).

Figure 2.2.1. Graph of point and smoothed average adult-to-adult productivity (age-4 returns per age-4 spawner) estimates for aggregate Yakima Basin Steelhead.



The data in Table 2.2.3 and Figure 2.2.1 are admittedly gross representations of adult-to-adult productivity. However, the geometric means for these metrics over a 26-year data set are greater than one and show an increasing trend. This indicates with high likelihood that combined artificial production and habitat restoration activities in the Yakima Basin are having a neutral or net positive impact on listed steelhead in the Basin.

Please see Yakima Basin steelhead HGMP (submitted to NOAA fisheries in 2005; available from YN) and Yakima Basin steelhead recovery plan for further information.

2.2.3) <u>Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take</u> *(see "Attachment 1" for definition of "take")*.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.

(*e.g. "Broodstock collection directed at sockeye salmon has a "high" potential to take listed spring Chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation*").

Yakima Basin fall Chinook: Hatchery activities assessed include broodstock collection and transfer to and release from acclimation sites. M&E activities include: spawner surveys, PIT and radio tagging, juvenile and adult trapping and sampling operations, electroshocking, etc. See also Section 3.5 below.

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

Juvenile passage estimates at Prosser and adult counts of steelhead at Prosser and Roza Dam were given above in 2.2.2.

See also take table at end of this HGMP. Annual adult and juvenile passage estimates for Yakima Basin projects are also available at http://www.ykfp.org.

Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

See Take Table at end of document.

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.
(*e.g. "The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected inseason to exceed the 1988-99 maximum observed level of 100 fish."*)

We do not anticipate exceeding take levels specified in this HGMP. At Prosser Dam, steelhead can use three ladders and only the right bank Denil ladder contains an adult sampling facility. Historically, only 10-20% of the annual steelhead run passes upstream at Prosser via the Denil ladder during adult monitoring facility operations in the fall (first 40-60% of the adult steelhead migration). Contingency plans for YKFP projects are addressed by the YKFP Policy Group on a timely basis using adaptive management.

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.
(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").

A Yakima Basin salmon recovery plan is presently being developed as part of the Subbasin Planning Process. A draft document is available for public review at http://www.ybfwrb.org/Draft%20plan/RecPlanFinal.pdf. The proposed project is cognizant of and consistent with a number of other recent and on-going planning and recovery efforts in the area including the: Yakima/Klickitat Fisheries Project (see Sampson et al. 2009), Yakima Subbasin Plan (YSFWPB 2004), Yakima Subbasin Salmon and Steelhead Recovery Plans (YBFWRB 2009), Mid-Columbia Sub-Domain ESA Steelhead Recovery Plan (NOAA 2009b), Hatchery Scientific Review Group reform recommendations (HSRG 2005 and 2009), Yakama Nation Riparian / Wetlands Restoration, Yakama Reservation Watersheds Project, and Yakima Basin Side Channels Project. Increasing the viability of fall and summer run Chinook populations within the Yakima Subbasin can be supported from multiple standpoints.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

Document Title	Type
Treaty of 1855. Asserted the right of the Yakama Nation to "take fish at all usual and accustomed fishing areas". Federal courts have held that this right means more than the right of Indians to hang a net in an empty river (*Washington v Washington State Commercial Passenger Fishing Vessel Association, 1979*).	Federal Treaty
United States versus Oregon Columbia River Fish Management Plan and 2008-2017 Management Agreement. Appendix B of the CRFMP describes provisions for moving fall Chinook production to upriver areas. See 1.8 above.	Federal Court Order
US v Washington	Federal Court Order
Northwest Power and Conservation Council (NPCC), Fish and Wildlife Program.	Northwest Power Act
Mitchell Act annual Congressional Appropriations language. The primary purpose of the Mitchell Act is to mitigate for fishery losses due to hydroelectric development in the Columbia River Basin. Congress has recognized that it is appropriate to mitigate these losses in upriver areas where the losses occurred.	Mitchell Act
WY-KAN-USH-MI WA-KISH-WIT	Columbia River Anadromous Fish Restoration Plan of the Columbia River Tribes
Yakama Nation and US Bureau Reclamation Prosser Hatchery Agreement	MOU
Yakama Nation and US Fish & Wildlife Service Fish Health Agreement	MOU
Yakama Nation and Grant County PUD	MOU
Yakama Nation and Wasco County PUD	MOU
2008 Columbia Basin Fish Accords Memorandum of Agreement between the Three Treaty Tribes and FCRPS Action Agencies	MOA

3.3) Relationship to harvest objectives.

Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish.

See Section 1.7 for overall program objectives.

Table 3.3.1.1. Estimated fall Chinook return, escapement, and harvest in the Yakima River, 1998-2008. Data from WDFW and YN databases, 6 March 2009.

			Escapement						
	Total Return		Above Prosser		Below Prosser		WA Recreational Harvest		
Year	Adult	Jack	Adult	Jack	Adult	Jack	Adult	Jack	Rate
1998	1,743	106	1,064	84	645	22	34	0	1.8%
1999	4,056	43	1,876	20	2,046	23	134	0	3.3%
2000	4,557	1,138	1,371	922	2,931	194	255	22	4.9%
2001	5,886	869	3,651	660	1,293	151	942	58	14.8%
2002	13,369	211	6,146	95	4,923	116	2,300	0	16.9%
2003	10,092	193	4,796	79	3,874	73	1,422	41	14.2%
2004	5,825	271	2,862	85	2,231	140	732	46	12.8%
2005	3,121	45	1,920	22	491	7	710	16	22.9%
2006	2,299	67	1,499	29	363	10	437	28	19.7%
2007	1,318	461	892	240	194	26	232	195	24.0%
2008			2,739	124			502	64	

Note: Because of the quantity and relatively higher quality of fall Chinook available to tribal fishers in Zone 6 Columbia River fisheries, Yakima River tribal harvest is typically at or near zero.

However, fall Chinook are also harvested in marine fisheries from Alaska south into Oregon and northern California, and in Columbia River fisheries from the mouth to the Hanford Reach. Out-of-basin harvest rates have not been estimated specifically for Yakima hatchery fish, but the total ocean and freshwater adult equivalent harvest rates for Upriver Bright fall Chinook for return years 1989-1996 ranged from 33% to 73%. It is assumed that Yakima River fall Chinook are harvested at the same rate in these fisheries as other upriver bright fall Chinook.

3.4) Relationship to habitat protection and recovery strategies.

Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPPC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions.

YN, state, federal, local (irrigation districts) entities are working together to improve habitat and water resources in the Yakima Subbasin, by overcoming major inhibiting factors to the recovery of fall Chinook populations.

Major inhibiting factors to fall Chinook production are:

1) Sublethal to lethal water temperatures typically by June below Prosser Dam (RM 47).

2) Low flow conditions (especially in poor water years) between Prosser Dam and the Chandler power plant outfall.

3) Predation by birds (especially in poor water years), and both native and exotic piscivorous fish (especially smallmouth bass).

4) Loss of structurally complex rearing habitat.

5) Excessive sediments from irrigation drains (though this is being slowly addressed in recent years) in major spawning areas.

6) Smolt mortality associated with predation in the vicinity of bypass outfalls at Wapato, Sunnyside and Prosser Dams, and a number of smaller Yakima Basin dams (e.g., Marion Drain re-use diversion, Columbia and Richland Ditches at Horn Rapids Dam).

7) Adult mortality associated with mainstem Columbia dams.

8) Smolt mortalities associated with traversing mainstem Columbia dams and impoundments.

In recent years the DOE and the Roza-Sunnyside irrigation districts have made a concerted effort to reduce the amount of TDS through project return drains or pipes. Most notably is Granger Drain, where turbidity levels have dropped from around 400 NTU's to 25-30 in 2000. This effort is being applied elsewhere in the basin to improve drain water quality.

The BOR is currently exploring the feasibility of eliminating the Chandler Canal irrigation withdrawal at Prosser Dam with a "pump exchange" using Columbia River water to improve instream flows in this reach.

The YN and WDFW through the YKFP are investigating the impact of smallmouth bass, pikeminnow, and bird predation on salmonid smolts in the Yakima Basin.

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]

Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program; and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

The following species co-occur to a significant degree with the program fish in either freshwater or early marine life stages.

- Steelhead
- Chum
- Sockeye
- Coho
- Chinook
- Bull Trout

(1) negatively impact program

Smallmouth bass and gulls concentrating at the fish bypass outfalls and dams appear to be the two predators having the most impact on fall Chinook parr and smolts.

(2) be negatively impacted by program

At this time no negative impact by the hatchery fall Chinook program has been identified.

(3) positively impact program

Results from the YKFP indirect predation study have shown that fall Chinook smolt survival is positively correlated to both the total smolt (all salmonids) and total hatchery smolt (all salmonids) density at Prosser.

(4) be positively impacted by program

No benefits to other salmonid species have been identified. Generally, fall Chinook smolts outmigrate after the peak outmigrations of spring Chinook, coho and steelhead.

This stock of fall Chinook appears to be well suited for this river and is probably providing food for scavenging wildlife and raptors, as well as providing nutrient enhancement that could increase the productivity of the watershed.

To view recent reports on the YKFP's ecological interactions studies, see ykfp.org / technical reports and publications and Sampson et al. (2009).

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria.

Prosser Hatchery has the ability to use 30 cfs Yakima River water (with the exception of mid-

November through December when canal maintenance is performed and canal flow can get as low as 1-2 cfs), and has three wells that contribute 3200 gallons per minute. The river water supply is used from March through July for juvenile fish rearing and September through January for adult broodstock. The surface water is gravity flow from Chandler Canal behind the fish screens. One well is used from September through April to incubate eggs. The well is capable of pumping 800 gallons per minute. The other two wells are used all year to rear juvenile salmon and adult steelhead kelts. Each well is able to pump 1,200 gallons per minute. The well water is constant 57 degrees (Fahrenheit), and the surface water temperature changes with the seasons.

Marion Drain has the ability to pump approximately 800 gallons per minute surface water directly from Marion Drain and has two wells for egg incubation and fry rearing. One well pumps 80 gallons per minute and another 300 gallons per minute. The surface water is used all year for fall Chinook and some trout/sturgeon rearing. The two wells are used from September through March for egg incubation and fry rearing. The well water is 58 degrees (Fahrenheit) and the surface water changes with seasons.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

The facility operates in compliance with state or federal regulations for discharge. Discharge is covered under existing Bureau of Reclamation permits because the intake for the surface water is behind the USBOR fish screens in Chandler canal which is also in compliance with all guidelines for juvenile fish. The wells are 160 feet deep so no screening is necessary.

Marion Drain: The surface water pump station is fitted with meshed screen adequate to keep all sizes of fish from the pumps.

All production facilities operated by the Yakama Nation conform to NOAA screening guidelines as necessary. However, the YN is aware of several BOR facilities in the Yakima Basin that are likely not in compliance with these same guidelines. The Yakama Nation expects NOAA to hold all action agencies to the same standards with respect to ESA reporting and compliance.

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) Broodstock collection facilities (or methods).

The Prosser Hatchery consists of the following: Office, workshop, spawning shed, three adult/juvenile ponds, an incubation room, thirteen raceways (start tanks), 16 raceways, four circular tanks, adult collection raceways, chiller, two backup electrical generators, and a freezer.

Yakima local broodstock are collected from the wild/natural and hatchery-origin return either at the Prosser right bank steep-pass denil ladder or by seine net from the Chandler canal or other locations (see section 7.2 for additional information).

Marion Drain - A fish-wheel is operated in Marion Drain to collect fall Chinook broodstock. Broodstock are trucked 8 miles to the Marion Drain hatchery raceway(s). The Marion Drain hatchery is separate and unique from the Prosser Hatchery. All fish collected in Marion Drain are spawned at, and their progeny reared and released from the Marion Drain facility. Evaluation of the status of the Marion Drain fish is ongoing (see section 6.2); brood collection operations in Marion Drain may not be necessary in the future.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

Prosser and Marion Drain: Adult fish are transported in either a 400 gallon tank placed on the back of a pick up truck, or a three compartment 1500 gallon tank on a flatbed. Both are designed to safely haul fish equipped with oxygen and aeration system.

5.3) Broodstock holding and spawning facilities.

Spawning for this program takes place at the Prosser Hatchery, Rkm 75.6. Integrated Hatchery Operations Team (IHOT) adult holding guidelines are followed for adult holding, density, water quality, alarm systems and predator control measures to provide the necessary security for the broodstock.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1 (Prosser fall)	Vinyl line Raceway	22000	150	50	4	1100
1 (Marion Dr fall)	Stainless raceway	375	25	5	3	65

5.4) Incubation facilities.

Incubator Type	Units (number)	Flow (gpm)	Volume (cu.ft.)	Loading-Eyeing (eggs/unit)	Loading-Hatching (eggs/unit)
Deep Trough with perforated plates (10 cells per trough)- Prosser Hatchery	5	5	nya	60000 per cell	nya
Vertical Stack (24 trays/stack)- Prosser Hatchery	23 stacks	5	nya	nya	5000
Vertical Stack – Marion Drain	6 half-stacks 2 deep troughs	5			

Prosser Hatchery has four deep troughs used for initial incubation (to eyed-stage) and 23 (24 trays/stack) vertical stacks (Heath trays) used for final incubation to hatch-out.
Marion Drain Hatchery has two deep troughs used for initial incubation (to eyed-stage) and 1 (8 trays/stack) vertical stack (Heath trays) used for final incubation to hatch-out.

5.5) Rearing facilities.

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Flow (gpm)	Maximum Flow Index	Maximum Density Index
16 (Prosser)	Stainless Wall with Vinyl Line Raceways	3375	75	15	3	750	nya	0.75
4 (Marion Drain)	Stainless steel	375	25	5	3	65		0.75

Prosser Hatchery – Fry are ponded at 1,100 fpp from the vertical stacks into the three upper, outside raceways. When the parr reach 500 fpp they are transferred to the four lower, outside raceways.
Marion Drain Hatchery - The buttoned-up fry are transferred into a single raceway (5 ft by 25 ft) where they remain through acclimation and release.

5.6) Acclimation/release facilities.

Most fish are released on-station from the facilities described above in 5.5.
Prosser Hatchery - When the parr reach 150 fpp they are transferred to the larger, portable raceways where they will be released. Parr will be released directly into the river on-site at ~65 fpp.
Marion Drain Hatchery - See Rearing Section above. Smolts are released directly into the drain at (approximately RM 14) at ~65 fpp.

The Yakama Nation intends to use the following additional acclimation sites:

"Billy's Pond". This site is located near the city of Yakima, Washington and may ultimately be used to acclimate up to 200,000 smolts. The pond is not a natural pond; it was most likely a gravel pit created during construction of Interstate 82. It is located near River Mile 113 on the mainstem Yakima River, on the outskirts of the town of Union Gap next to a sewage treatment plant. Fish would be transferred from Prosser Hatchery into this pond in mid-March and a proportion would be PIT-tagged for experimental purposes. They would then be released volitionally to the river between mid-April and mid-May to migrate to the ocean. An aluminum screen is placed across the outlet to keep fish in the pond until the time for their release. Yakama Nation personnel feed and check on the fish daily. The pond is accessed by vehicle over an existing unimproved road through the Wastewater Treatment Plant. The YN received a "no effect determination" from BPA in March, 2007 for activities at this acclimation site relative to anticipated impacts to listed species and critical habitat.

Stiles Ponds. Stiles ponds are located at approximately RM 3.7 on the Naches River, which is located at RM 116.3 on the Yakima River. These ponds are entirely screened off from the

Naches River as part of the Chapman Nelson irrigation canal system. Approximately 200,000 mainstem in-basin stock fall Chinook would be acclimated at Stiles pond from February – April. Volitional release would begin in early April. To determine survival rate, approximately 2,500 within the group would be PIT-tagged and monitored for survival to Bonneville Dam.

Edler Pond. Edler Pond #3 is located in Union Gap, Washington. Edler Pond #3 is an old highway development gravel pit resulting in a pond at least 500 feet across and 15 feet deep, fluctuating with the Yakima River. Approximately 200,000 mainstem in-basin fall Chinook broodstock would be acclimated beginning in mid-March with two volitional release periods of mid-April and mid-May (75,000 to 100,000 fish in each release group).

BPA supplemental analysis DOE/EIS-0169-SA-10 determined that "the potential impacts from the addition of Stiles and Edler Ponds are not substantially different from those discussed in the Yakima Fisheries Project EIS (DOE/EIS-0169), ROD, Supplement Analyses (SA-01 through SA-09), and related biological assessments and biological opinions. No additional impacts would occur in connection with these activities. There are no new circumstances or information relevant to environmental concerns and bearing on the proposed actions or their impacts. Therefore, a supplement to the YFP EIS is not needed and no further NEPA documentation is required."

The Yakama Nation proposes to acclimate 10,000 of the Yakima Fisheries Project fall Chinook smolts (early and late) at two new locations, Elks Pond and Skov Pond, near the city of Yakima, Washington. Ultimately up to 250,000 fall Chinook smolts may be acclimated at each site.

Elks Pond is located at River Mile 117 on the mainstem Yakima River, one mile from the confluence with the Naches River. Elks Pond empties into a creek which enters the Yakima River under the North 1st Street Bridge in Selah. A screen or net will be placed near the top of the creek to prevent smolts from entering the Yakima River prematurely. Skov Pond is located at River Mile 122.5 (opposite of Wenas Creek) on the mainstem Yakima River. It is connected to the Yakima River by a six inch PVC underground pipe. Smolts in Skov Pond would be kept in a net pen. At the time of release a connection will be made from the existing PVC to the net pen to release the smolts to the river. The fall Chinook smolts are part of the Yakima/Klickitat Fisheries Project -Yakima Fall Chinook Supplementation Program. The smolts would be PIT-tagged for experimental purposes. The fish would be released into the ponds in mid-March. They would then be released volitionally into the Yakima River between mid-April and mid-May to migrate to the ocean. No modifications are needed to the ponds. Yakama Nation personnel would feed and check on the fish daily. Both ponds are accessible by vehicle.

The Yakama Nation is also investigating potential acclimation sites in the lower Yakima River (either ponds below Horn Rapids Dam or mobile units placed near Horn Rapids Dam). Additional information will be provided as it becomes available.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

No major mortality events have occurred to date for fall Chinook reared at YN Facilities. Refer to the out-of-basin facility HGMP links provided in section 1.5 for mortality information related to these facilities.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.
(e.g. "The hatchery will be staffed full-time, and equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure.").

Prosser Hatchery: Staff members are on-site 24/7 during critical phases of the program, and the facility is enclosed in chain linked fence, and periodic patrols of law enforcement (local and tribal) maintain a security envelope of facility. The hatchery is also equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure. The Hatchery also has 3 backup power generators (2 at Prosser, 1 at Marion Drain) in case of power failure.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.
List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

The brood sources chosen for the program described in this HGMP represent natural populations native or adapted to the watersheds in which hatchery fish will be released.

Until 1997 Little White Salmon National Fish Hatchery was the sole broodstock source used in the Yakima Basin through the release of 1.7 million smolts. The original source of the LWS stock was upriver bright (URB) fall Chinook trapped at the Bonneville State Fish Hatchery. The current source is from adult URB fall Chinook returning to the Little White Salmon River. The original stock used in the Priest Rapids spawning channel and at Priest Rapids Hatchery (considered a future brood source for this program) came from late-run Chinook trapped at Priest Rapids Dam. Beginning in 1997 to present Yakima (including Marion Drain) basin spawners were incorporated into the overall broodstock collection for the Prosser and Marion Drain facilities.

With respect to summer run Chinook, Wenatchee fish were originally considered the 'best fit' due to the watershed's proximity to the Yakima Basin. However, risks associated with pathogen introduction to the Yakima Basin, which is relatively clean compared to other basins, were considered much higher for Wenatchee fish relative to Okanogan fish. This is a legitimate concern given the diversity of anadromous species and their respective populations existing in the Yakima Basin. Additionally, the Wenatchee stock is not as suited to the Yakima Basin when comparing habitat conditions and water temperatures. The Okanogan stock is clearly better suited due to the similarities in temperatures endured during adult migration, especially in lower portions of the river near its confluence with the Columbia. In theory, these fish have adapted to somewhat inhospitable conditions and have maintained an exceptional productivity given all the factors working against them. Temperature and flow conditions in the lower Yakima River are likely one of several factors contributing to the extirpation of summer run populations in the 1970s. For these reasons, the YN proposes to use summer run Chinook from Wells Hatchery or natural origin adults from the Okanogan or from Wells dam for its efforts to reestablish a summer run component in the Yakima Basin. Since the initial operation of the spawning channel in 1967, broodstock collected for Wells Hatchery has come from fish diverted out of fish ladders while passing Wells Dam or from volunteers that enter the trap at the upper end of the hatchery discharge.

For additional information on the history of out-of-basin brood sources proposed for this program, please refer to the HGMP links cited in section 1.5.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

Based on an electrophoretic analysis of allozyme samples collected from spawning fish in Marion Drain and the mainstem near Benton City in 1989 and 1990, Busack et al (1991) concluded that there were two genetically distinct stocks in the basin: the Marion Drain 'stock' and the 'mainstem stock'. Subsequent analyses of allozymes from fish collected in the mainstem above Prosser Dam were indistinguishable from the Benton City samples. Therefore, all mainstem spawners appeared to belong to the same genetic group, which was indistinguishable from Hanford reach URB's. The Marion Drain 'stock', which genetically resembled Snake River fall Chinook and Deschutes River (OR) fall Chinook more than Hanford Reach URB's, appeared to occur only in Marion Drain.

Some phenotypic differences between Marion Drain and mainstem Yakima fall Chinook have also been observed. The Marion Drain spawner population appears to have an unusually high jack component. The mean fish per redd ratio (for 2 years of data) was 9.3. The exact fish per redd ratio for the 'mainstem stock' is unknown, but is thought to be in the normal 2.5 fish per redd range. Marion Drain fry emerge beginning in early February due to the warmer groundwater influence, compared with mid-April for the Yakima stock. As a result, Marion Drain juveniles are thought to initiate smolt outmigration past the Chandler Juvenile Monitoring Facility earlier than mainstem Yakima smolts.

There is some anecdotal evidence that the generally constant flows in Marion Drain may attract fall Chinook into the drain, especially in years when mainstem flows in the Yakima River are particularly low, which could provide some insight as to the unique traits observed for Marion Drain fish. However, as noted earlier, the YN program has released from 400,000 to >2.0 million fall Chinook URB smolts throughout the lower half of the Yakima mainstem since 1983.

These and other 'mainstem stock' fall Chinook have likely spawned to some extent in Marion Drain over the years and it is also probable that some 'Marion Drain' fall Chinook have spawned in the mainstem. Therefore, the probability of potentially substantial annual gene flow between these two 'populations' has always been reasonably high. Recent genetic samples (WDFW, 2005, unpublished data) were unable to find the genetic distinction observed in 1991. The WDFW and YN will continue to collect and evaluate samples through 2010 to determine if any differentiation still exists.

However, even if differences exist, there is only very limited empirical research to suggest that maintaining several small isolated populations with periodic mixing is more effective at reducing losses of genetic diversity and fitness than maintaining a single large population (NRC 1996; Fraser 2008; see also Narum et al. 2008). Considering habitat capacity within Marion Drain, the population dynamics of Yakima Basin fall Chinook, and other characteristics, the Marion Drain subgroup is probably not an "independent population" (McElhany et al 2000), but rather part of a "stock complex" as defined by WDFW (1998). Given these considerations, as well as logistical and economic factors, it is reasonable to manage Marion Drain fish as part of the larger Yakima River summer and fall run Chinook population.

See also 6.1.

6.2.2) Annual size.
Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their population status relative to critical and viable thresholds.

The program goal is to maintain an annual release of 2.0 to 2.7 million fall Chinook consisting of:

- Up to 1.7 million Priest Rapids stock (presently LWS NFH) fall run Chinook. Brood stock (~800-1000 fish) collected at Priest Rapids Dam or Hatchery (presently LWS NFH).
- ~0.1 to 0.5 million local fall run Chinook. The brood stock would be collected from several locations: a) the Prosser Dam right bank denil ladder and fish trapping facility; b) from fish stranded in the Chandler canal during maintenance operations in October; c) from a denil ladder at the Prosser Hatchery outlet stream; d) potential retrofits at existing irrigation diversion dams; and e) potential seining or trapping operations at other locations in the lower Yakima River. It is anticipated that up to 600 adults would be collected annually for this program. Broodstock would be collected throughout the entire adult migration period to increase the diversity of life histories being reared at the hatchery. On average, about 400 fall Chinook passed upstream via the Denil ladder from 2000-2008 (Table 6.5.1.1 in Master Plan). Chandler canal collections ranged from about 50-500 and averaged about 100 fall Chinook since 1997 (YN, unpublished data). The denil ladder at the Prosser Hatchery has not yet been operated to capture fall Chinook, but biologists estimate another 100-200 fish could be captured there. Since fall Chinook collected at these three locations may consist largely of hatchery-origin returns, other collection options will be developed to increase the number of natural-origin fish used for

brood stock.

- ~0.2 to 0.5 million summer run Chinook (100-250 adults, initially from Wells Hatchery or Wells Dam brood source).
- The existing fall Chinook program at Marion Drain would be replaced with the summer run rearing program. Marion Drain fall Chinook would be treated as part of the aggregate Yakima fall run Chinook population (see Section 6.2).

6.2.3) Past and proposed level of natural fish in broodstock.
If using an existing hatchery stock, include specific information on how many natural fish were incorporated into the broodstock annually.

Because of the low levels of marking of hatchery-origin fish in the past, the proportion of natural-origin fish in the local broodstock program (since 1997) is unknown. Pending funding to implement marking strategies, in the future, we propose to work towards a point where the local (integrated) broodstock program would consist of a much greater proportion (at least 50%, and if possible, 100%) natural origin fish. See also Sections 6.2.2, 1.11.1 and 1.12.

6.2.4) Genetic or ecological differences.
Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

Little White Salmon hatchery fall Chinook were chosen to start this program because they were an URB fall Chinook stock. The Yakima stock is similarly an URB stock. Priest Rapids, an URB stock, though geographically close to the Yakima Basin, were not available as they were dedicated to another mitigation program; however, these fish are now being reconsidered based on recommendations by the USFWS and regional hatchery review groups. Bonneville (Oregon) was the only other source of URB fall Chinook, but ruled out because of concerns with disease transfer issues across state lines.

There are no known differences between LWS and Yakima stocks. Given the release history of LWS fish into the basin dating back to 1983, one would expect similar genotypic and phenotypic traits between these two stocks. Priest Rapids stock fall Chinook (collected at the Dam or the Hatchery) are likely even more similar to Yakima fall chinook given their proximity. In addition, these populations are all part of the same URB population as defined by NOAA fisheries. See also 6.1 and 6.2.1 above.

6.2.5) Reasons for choosing.
Describe any special traits or characteristics for which broodstock was selected.

See 6.1, 6.2.1, and 6.2.4.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.
(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous Chinook salmon population for use as broodstock in the supplementation*

program.”).

See above responses in this section and also section 7.2 below.

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adults.

7.2) Collection or sampling design.

Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired broodstock source.

The program goal is to maintain an annual release of 2.0 to 2.7 million fall Chinook consisting of:

- Up to 1.7 million Priest Rapids stock (presently LWS NFH) fall run Chinook. Brood stock (~800-1000 fish) collected at Priest Rapids Dam or Hatchery (presently LWS NFH).
- ~0.1 to 0.5 million local fall run Chinook. The brood stock would be collected from several locations: a) the Prosser Dam right bank denil ladder and fish trapping facility; b) from fish stranded in the Chandler canal during maintenance operations in October; c) from a denil ladder at the Prosser Hatchery outlet stream; d) potential retrofits at existing irrigation diversion dams; and e) potential seining or trapping operations at other locations in the lower Yakima River. It is anticipated that up to 600 adults would be collected annually for this program. Broodstock would be collected throughout the entire adult migration period to increase the diversity of life histories being reared at the hatchery. On average, about 400 fall Chinook passed upstream via the Denil ladder from 2000-2008 (Table 6.5.1.1 in Master Plan). Chandler canal collections ranged from about 50-500 and averaged about 100 fall Chinook since 1997 (YN, unpublished data). The denil ladder at the Prosser Hatchery has not yet been operated to capture fall Chinook, but biologists estimate another 100-200 fish could be captured there. Since fall Chinook collected at these three locations may consist largely of hatchery-origin returns, other collection options will be developed to increase the number of natural-origin fish used for brood stock.
- ~0.2 to 0.5 million summer run Chinook (100-250 adults, initially from Wells Hatchery or Wells Dam brood source).
- The existing fall Chinook program at Marion Drain would be replaced with the summer run rearing program. Marion Drain fall Chinook would be treated as part of the aggregate Yakima fall run Chinook population (see Section 6.2).

Broodstock is collected from adults returning to Prosser Dam/Chandler Canal area, and these fish are derivatives of local, Yakima River fall Chinook and returns from imported URB stocks released in the subbasin. From 1997 through 2007, broodstock were nearly exclusively collected from Chandler Canal in November using beach seines. This interim collection site/method has been used because the canal has been routinely dewatered in the late fall to remove salmon and steelhead entrained into the canal and because relatively few fall Chinook were thought to use the right bank denil ladder at Prosser Dam. Before 1997 fish seined from Chandler canal were released back into the river. When the canal is used for broodstock collection, fish are randomly captured in that no purposeful selection criteria are used. However, females that are ripe (dripping eggs) are taken, knowing that if released into the river their chances of spawning success are minimal. After being seined, fish are placed into individual PVC tubes, carried up the bank, and placed into the hatchery truck. The fish are then transported (less than ¼-mile) and released into the adult holding pond. Any steelhead captured (very few if any steelhead are typically entrained into the canal) are handled the same as fall Chinook and released back into the river at the Prosser boat ramp located in the forebay approximately ½-mile upstream of the dam.

Beginning in 2008, the project proposes to use the Prosser steep-pass ladder for broodstock collection. The Prosser denil trap is operated continuously from September through early December. The trap is checked at least every 2 hours during operation. Passage of fall Chinook through the denil ladder ranged from 125 to 960 fish (7-23% of total Prosser passage) from 2001-2008 (Table 6.5.1.1 of Master Plan). Observed sex ratios (based on physical observation of secondary sexual characteristics of fish passing the denil) for this same period were: 45.5% female, 46.3% adult male, 8.2% jack. Since availability of fall Chinook at the denil may not meet the program goal for local broodstock in some years, the project may also use seining or trapping methods (in the Chandler Canal, Sulfur Drain, and other locations) to collect additional broodstock.

Some broodstock have been collected using a fish wheel located in Marion Drain at RM 6.2. The fish wheel has been operated and manned 24 hours a day. Fish were transported from the fish wheel using individual PVC tubes and placed in the waiting hatchery truck. Fish were transported about 8 miles to the hatchery, where they are released into the holding raceway. All fish collected were taken for broodstock. Collections were generally fewer than about 25 fish per year. No known selection biases were associated with the fish wheel. No steelhead were collected in the fish wheel since the beginning of its operation in 1999. The Marion Drain broodstock collection program is expected to be discontinued in the near future.

7.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

The Yakima integrated program broodstock collection will be based on examination of adipose, CWT, VIE and possibly other marks to distinguish fish of hatchery- and natural-origin and for experimental and non-experimental reasons. Presently these fish are not identified as to origin due to the fact that so few fish are marked.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

The program goal is to maintain an annual release of 2.0 to 2.7 million fall Chinook consisting of:

- Up to 1.7 million Priest Rapids stock (presently LWS NFH) fall run Chinook. Brood stock (~800-1000 fish) collected at Priest Rapids Dam or Hatchery (presently LWS NFH).
- ~0.1 to 0.5 million local fall run Chinook. The brood stock would be collected from several locations: a) the Prosser Dam right bank denil ladder and fish trapping facility; b) from fish stranded in the Chandler canal during maintenance operations in October; c) from a denil ladder at the Prosser Hatchery outlet stream; d) potential retrofits at existing irrigation diversion dams; and e) potential seining or trapping operations at other locations in the lower Yakima River. It is anticipated that up to 600 adults would be collected annually for this program. Broodstock would be collected throughout the entire adult migration period to increase the diversity of life histories being reared at the hatchery. On average, about 400 fall Chinook passed upstream via the Denil ladder from 2000-2008 (Table 6.5.1.1 in Master Plan). Chandler canal collections ranged from about 50-500 and averaged about 100 fall Chinook since 1997 (YN, unpublished data). The denil ladder at the Prosser Hatchery has not yet been operated to capture fall Chinook, but biologists estimate another 100-200 fish could be captured there. Since fall Chinook collected at these three locations may consist largely of hatchery-origin returns, other collection options will be developed to increase the number of natural-origin fish used for brood stock.
- ~0.2 to 0.5 million summer run Chinook (100-250 adults, initially from Wells Hatchery or Wells Dam brood source).
- The existing fall Chinook program at Marion Drain would be replaced with the summer run rearing program. Marion Drain fall Chinook would be treated as part of the aggregate Yakima fall run Chinook population (see Section 6.2).

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

Table 7.4.2.1. Actual numbers of fall Chinook spawned at Prosser and Marion Drain facilities, 1998-2006.

Year	Prosser Hatchery[a]		Marion Drain	
	Females	Males[b]	Females	Males[b]
1998	45	60	2	6
1999	70	95	7	25
2000	93	107	3	9
2001	42	53	4	7
2002	133	117	8	15
2003	186	161	2	6
2004	34	37	9	21

Year	Prosser Hatchery[a]		Marion Drain	
	Females	Males[b]	Females	Males[b]
2005	91	101	12	5
2006	42	50	7	15

[a] Ripe fish from Chandler canal rescue; others were released generally around Granger or above.
[b] Including jacks.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.

Describe procedures for remaining within programmed broodstock collection or allowable upstream hatchery fish escapement levels, including culling.

Because most fish have been collected from Chandler canal during annual "rescue" operations, fish determined to be surplus to spawning needs are trucked upstream several miles and released directly back to the Yakima River. In the future, procedures will be developed to minimize the chances of collecting surplus and any surplus will either be released to the river to spawn naturally or distributed to tribal members for ceremonial and subsistence use.

7.6) Fish transportation and holding methods.

Describe procedures for the transportation (if necessary) and holding of fish, especially if captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics.

Broodstock are held for spawning in holding ponds or raceways until ready for spawning. Fish are checked weekly for ripeness and spawned. A formalin drip is applied weekly into the holding ponds to treat for fungus on the gills and any open wounds.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Adult Transfer Tanker Truck-Prosser Hatchery	700	Y	N	5	Light dose MS	nya

Ponds (number)	Pond Type	Volume (cu.ft)	Length (ft.)	Width (ft.)	Depth (ft.)	Available Flow (gpm)
1 (Prosser)	Vinyl line Raceway	4500	75	15	4	1100
1 (Marion Dr)	Stainless Raceway	375	25	5	3	65

7.7) Describe fish health maintenance and sanitation procedures applied.

Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed for broodstock fish health inspection, transfer of eggs or adults and broodstock holding and disposal of carcasses. Fish transfers into the subbasin are inspected and accompanied by notifications as described in these guidelines. USFWS fish health specialists are present annually for spawning and sample every fish for presence of known salmon viruses and pathogens. USFWS sampling to date indicates that the Yakima Basin remains among the most pathogen-free systems in the Columbia Basin.

7.8) Disposition of carcasses.

Include information for spawned and unspawned carcasses, sale or other disposal methods, and use for stream reseeding.

Following USFWS protocol, hatchery carcasses are eviscerated, heads are removed, and heated at 100^{o} F for 3 hours, then frozen. This process effectively kills any viruses or pathogens potentially hosted by these fish. Carcasses are distributed by staff (generally in December) within the subbasin to provide ecological benefits. Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed for broodstock fish health inspection, transfer of eggs or adults and broodstock holding and disposal of carcasses.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.

(e.g. "The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

Integrated Hatchery Operations Team (IHOT), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed for broodstock fish health inspection, transfer of eggs or adults and broodstock holding and disposal of carcasses.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

Prosser Hatchery: Ripe fish on a weekly basis are randomly spawned using three males and females at a time. No directed selection of which males are spawned with females or visa versa.

Marion Drain: Fish are spawned randomly on a 1 female to 1 male basis as fish are trapped and become ripe.

8.2) Males.

Specify expected use of backup males, precocious males (jacks), and repeat spawners.

At both Prosser and Marion Drain, precocious males are used as they occur naturally during collection and are dipped from adult holding ponds at spawn time. The number of precocials used represents 0-2% of male spawners annually. At Prosser and Marion Drain Hatcheries, backup males are used approximately 30 seconds after the primary male's milt is infused into the egg bucket.

Prosser Hatchery: Jacks will be collected in the proportions in which they occur during denil and seining operations and incorporated into the mating scheme in a random fashion.
Marion Drain: Jacks are randomly incorporated into collection and mating as they occur in relation to female collection and spawning protocol.

8.3) Fertilization.

Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

At Prosser Hatchery, the eggs from 1 female are pooled in a bucket and fertilized with milt from 1 male with a backup male's milt added approximately 30 seconds later. Since fewer fish are available at Marion Drain, 2 males selected at random are spawned per female. IHOT and PNFHPC tribal guidelines are followed for culture practices for this program. Disinfection procedures that prevent pathogen transmission between stocks of fish are implemented during spawning.

8.4) Cryopreserved gametes.

If used, describe number of donors, year of collection, number of times donors were used in the past, and expected and observed viability.

Cryopreserved gametes are not used.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

(*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program"*.).

Males and females available on a given day are mated randomly. Back-up males are used in the spawning protocol. Precocious males are used as they occur. See also above comments in section 8.

SECTION 9. INCUBATION AND REARING

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Provide data for the most recent twelve years (1988-99), or for years dependable data *are available.*

Prosser Hatchery Component: The egg-take for local origin brood has ranged from 190,000 to 670,000 since broodstock collection was initiated in 1997. To date, we have experienced a 92% survival rate from egg-to-subyearling-smolt at both Prosser and Marion Drain hatcheries:
a) Collection to spawning: 99%.
b) Green eggs to eyed eggs: 95%.
c) Eyed eggs to release: 90%.

Mean fecundity ranges from 4,000 to 5,000 eggs/female for the Prosser and Marion Drain hatcheries.

9.1.2) Cause for, and disposition of surplus egg takes.
Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent exceeding of programmed levels.

Prosser Hatchery: Surplus adults are released to the river, so no surplus egg production has occurred. No culling of juveniles occurs.
Marion Drain: Collection is minimal, so no surplus has occurred.

9.1.3) Loading densities applied during incubation.
Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

Prosser Hatchery: Egg size is approximately 0.23 grams per egg, flows are about 4-9 gallons per minute per incubation stack (23 incubation trays) with about 5,000 eggs per incubation tray. Data are the same for the Marion Drain facility.

9.1.4) Incubation conditions.
Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria (influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.

At Prosser Hatchery, well water (about 52-54^{o} F) is used for incubation. Fish are reared to a target of 1,600 total temperature units prior to ponding. Dissolved oxygen is measured weekly and typically ranges from 8-12 ppm. Monitoring of temperature and dissolved oxygen levels is done manually on a daily basis. The facility has had no problems with silt. For Marion Drain, all information is the same.

9.1.5) Ponding.
Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

For both Marion Drain and Prosser facilities: Fry are ponded at nearly 100% button up. This occurs at approximately 1,600 TUs. The approximate fork length is 37mm at ponding. Ponding takes places around mid-January.

9.1.6) Fish health maintenance and monitoring.
Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

See 7.7. For both facilities, heath trays are monitored and culled for dead or diseased eggs twice (at eye-up and at emergence). Culled fish are thrown in a dumpster.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.
(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation.")*

See previous comments in this section.

9.2) Rearing:
9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

See 9.1.1.

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

The rearing density criteria for both facilities are less than 0.50 lb fish per cubic foot of rearing space.

9.2.3) Fish rearing conditions
(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

For both facilities: Fish are reared on well water (about 57^{o} F) for about the first 4 weeks (until fish are about 500/lb). Then fish are transferred to river water. Intake screens are cleaned daily and mortalities are also picked daily. Rearing containers are cleaned weekly. Rearing ponds are monitored manually on a daily basis for temperature and dissolved oxygen levels.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Rearing Period	Length (mm)	Weight (fpp)
December	37	1100
January	41	800

February	55	330
March	75	130
April	80	107
May	90	75

Above information applies to fish reared at Prosser Hatchery. Weight is recorded regularly in terms of fpp throughout the rearing period. Length information is derived using Piper et al. (1982). Marion Drain fish are slightly larger by month due to slightly warmer water at that facility.

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.

Both facilities use BioOregon dry pellets appropriate to size of fish being fed. Fry are fed at 5% of their body weight, and fingerlings and presmolts 2-5%. Food conversion rates range from 1.0-1.3. Additional growth rate and energy reserve information is collected by the USFWS through their routine fish health checks.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

Both facilities use BioOregon dry pellets appropriate to size of fish being fed. Fry are fed at 5% of their body weight, and fingerlings and presmolts 2-5%. Feeding rates range from 8 times daily (fry) to twice daily as fish near smoltification. Food conversion rates range from 1.0-1.3. Additional growth rate and energy reserve information is collected by the USFWS through their routine fish health checks.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

IHOT fish health guidelines are followed to prevent transmission between lots of fish on site or transmission or amplification to or within the watershed. The juvenile rearing density and loading guidelines used at the facility are based on standardized agency guidelines and staff experience (e.g. trial and error). Vaccines are not used in this program. Juveniles are screened monthly for routine bacteria, viruses and parasites by USFWS according to USFWS procedures and guidelines in 713 FW, and IHOT.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

The migratory state of the release population is determined by volitional release and/or the best judgment of experienced aquaculture staff.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size such that smoltification occurs within nearly the entire population, which will reduce retention in the streams after release. Rearing on parent river water or acclimation for several weeks to parent river water is done to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations.

At Prosser Hatchery local broodstock fish are released in mid-April (non-volitional, direct releases from the hatchery), and out-of-basin fish are released volitionally beginning at the end of May. For out-of-basin fish, all remaining fish are forced out at the end of June. The one exception to these release dates occurs if extremely poor smolt survival conditions (i.e., high water temperatures and predation) are expected or are occurring.

The Marion Drain smolts are released at the end of March directly from the hatchery.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation. (*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size.")*

IHOT standards are followed for: water quality, alarm systems, predator control measures to provide the necessary security for the cultured stock, loading and density. The facility is continuously staffed to assure the security of fish stocks on-site. Fish are released at sizes similar to natural fish of the same life stage and species. Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guidelines. Fish are released in the same subbasin as the final rearing facility. See also preceding responses to section 9 questions.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.
Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs				
Unfed Fry				
Fry				

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Fingerling	~ 2.0 to 2.7 million (some summer run fish may be released as yearling)	~50 to 75	April-June	See 5.6 and 10.2
Yearling	~ 30,000 (for research and survival evaluation)			

See 7.4.1.

10.2) Specific location(s) of proposed release(s).

Stream, river, or watercourse: *(include name and watershed code (e.g. WRIA number)*
Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

Fish are released in the same subbasin as the final rearing facility.

Fish have been released directly from the Prosser Hatchery located at RM 46.8 into the Yakima mainstem. In the future, some of these fish may be released from selected acclimation sites in the Yakima subbasin above and below Prosser Dam (see Section 5.6).

Fish are also released directly from the Marion Drain Hatchery into the drain located at approximately RM 8.

Prosser Hatchery is located on the left bank of the Yakima River at RM 46.8 (latitude 46" 12' 51.36" N, longitude 119" 45' 42.53" W). Marion Drain Hatchery is located on the left bank of Marion Drain at RM 14.1 (latitude 46" 20' 17.60" N, longitude 120" 28' 45.38" W).

See also section 1.

10.3) Actual numbers and sizes of fish released by age class through the program.

For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in ***Attachment 2****. Cite the data source for this information.*

See 1.11.2. Fish generally released as subyearlings at 50-65 fish per pound. In years when colder water conditions prevail into late spring, fish have been as small as 90 fish per pound.

10.4) Actual dates of release and description of release protocols.

Provide the recent five year release date ranges by life stage produced (mo/day/yr). Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

Rearing and release strategies are designed to limit the amount of ecological interactions occurring between hatchery and naturally produced fish. Fish are reared to sufficient size such that smoltification occurs within nearly the entire population, which will reduce retention in the streams after release. Rearing on parent river water or acclimation for several weeks to parent river water is done to ensure strong homing to the hatchery, thus reducing the stray rate to natural populations.

At Prosser Hatchery local broodstock fish are released in mid-April (non-volitional, direct releases from the hatchery), and out-of-basin fish are released volitionally beginning at the end of May. For out-of-basin fish, all remaining fish are forced out at the end of June. The one exception to these release dates occurs if extremely poor smolt survival conditions (i.e., high water temperatures and predation) are expected or are occurring.

The Marion Drain smolts are released at the end of March directly from the hatchery.

10.5) Fish transportation procedures, if applicable.

Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Adult Transfer Tanker Truck-Prosser Hatchery	700	Y	N	5	Light dose MS	nya

10.6) Acclimation procedures (*methods applied and length of time*).

Local river water is used at both facilities (Prosser and Marion Drain) for at least the final two months of rearing. Fish are generally forced out of rearing ponds in mid-April with out-of-basin fish releases in mid-May (see 10.4).

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

Draft marking strategies (Table 10.7.1) are presently under development and review as part of the Master Plan. Marking rates for each release group will be documented. For M&E purposes, the goal is to mark 100% of all hatchery-origin releases. However, due to the large number of releases, associated marking costs, and tribal policies relative to mass marking and selective fisheries, it may be necessary to modify M&E measures to monitor performance based on less than 100% marking. Marking rates will be sufficient to determine relative survival differences between different release groups.

Table 10.7.1: DRAFT Hatchery release numbers, number marked, and mark type by species and hatchery component DRAFT – subject to change as noted above.

Species	# Released	# Marked	Tag or Mark[1]

Summer Run Chinook (upper Columbia stock)	200,000-500,000	200,000-500,000	100% CWT
Fall Chinook (Priest Rapids stock)	~1.7 million	~1.7 million	100% AD clip + 250K CWT
Fall Chinook (Yakima stock)	100,000-500,000	100,000-500,000	100% either PIT tagged or AD clip + some portion CWT

[1] subject to change as noted above.

The Yakima integrated program broodstock collection will be based on examination of adipose, CWT, VIE and possibly other marks to distinguish fish of hatchery- and natural-origin and for experimental and non-experimental reasons. Presently these fish are not identified as to origin due to the fact that so few fish are marked. There is a chance that some Marion Drain origin fish could have been incorporated into the Yakima local broodstock, however, the level of incorporation of these fish is thought to be very low.

The Yakima broodstock collection is based on adipose and ventral fin clips used to externally mark the fish for experimental and non-experimental reasons. To date, adults taken from Chandler Canal have predominately been clipped indicating their identity to the Yakima Hatchery. A small portion of the broodstock are adipose present fish, but this does not necessarily mean the fish is natural-origin, since hatchery-origin fish are not presently 100% marked. Presently these fish are not identified as to origin based on scale analysis. There is a chance that a Marion Drain origin fish could be one of these adipose present broodstock, however, the probability is thought to be very low. Most of the adipose present fish are likely to be Yakima hatchery fish originally released from the Prosser Hatchery.

To evaluate the Prosser Hatchery (out-of-basin origin) accelerated and non-accelerated smolt release groups, ten to twenty thousand PIT tags have been used for each group. PIT tags have also been used to evaluate survival of in-basin versus out-of-basin production. Approximately 10% of out-of-basin releases have been adipose-clipped and coded-wire-tagged. Beginning in 2008, all in-basin production at Prosser Hatchery was 100% marked (either PIT-tagged or adipose clipped). Summer run chinook will be differentially marked with coded-wire tags only (no other fish should be coded wire tagged with an adipose fin present).

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

See 7.5 and 9.1.2.

10.9) Fish health certification procedures applied pre-release.

All fish are examined by USFWS personnel for the presence of "reportable pathogens" as defined in the PNFHPC disease control guidelines, within 3 weeks prior to release. Fish transfers into the subbasin are inspected and accompanied by notifications as described in IHOT and PNFHPC guidelines.

10.10) Emergency release procedures in response to flooding or water system failure.

Pull screens and boards, and allow fish to exit the facility volitionally.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.
(*e.g. "All yearling coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural Chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May").*

Fish are released at sizes similar to natural fish of the same life stage and species. Fish are released at a time and size specified in an established juvenile production goal. Fish are released within the historic range for that stock. See also preceding responses to Section 10 questions.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

Response to Section 11.1.1 is extracted directly from Chapter 7 of the Master Plan (YN 2010 under development; current as of 29Jan2010) and includes the numbering scheme used in the Master Plan.

The proposed monitoring and evaluation program deals only with the hatchery and harvest components of the Master Plan. Habitat actions are not included because these measures are addressed in the Yakima Subbasin and Recovery planning documents developed by the Yakima Basin Fish and Wildlife Recovery Board, YN, WDFW, and the federal agencies. This will assure that the program proposed for the Yakima River habitat strategy is consistent with M&E protocols being used throughout the Columbia River Basin.

Summer and fall run Chinook M&E activities will be coordinated through the Yakima YKFP M&E "umbrella" project (BPA project id 199506325) and will leverage existing activities to the maximum extent practical to accomplish objectives stated here. The results of M&E activities under the Master Plan will be presented in PISCES status reports and annual reports. Fall Chinook study findings will also be reviewed annually at both internal and external intra-agency meetings (e.g., Yakima Subbasin Science and Management Conference). Study results and workshop materials will be stored on the web at www.ykfp.org. Data may also be presented in peer-reviewed scientific publications.

YKFP's M&E data collection and reporting protocols will be consistent with the Columbia River Basin regional strategies including Inter-tribal data management initiatives, HSRG, regional framework and PNAMP.

7.1 Hatchery Monitoring and Evaluation

Objective 7.1.1. Operate adult trap(s) at the Prosser Denil ladder and ____________ to collect brood stock and to sample returning fish for stock composition. Hold and spawn fish maintaining established fish health standards.

Approach: YN biologists and technical staff will operate adult fish traps at the Prosser Denil ladder and other locations for endemic broodstock development. YN staff have been operating the Prosser denil facility for years to sample returning fish in the fall and to collect coho brood stock. Factors such as weir/trap impedance/avoidance, run timing, spawn timing, population demographics, phenotypic and genetic characteristics, and return rates are part of the necessary evaluation that should be conducted to facilitate future development of this program. Evaluation staff is responsible for daily record keeping of all species captured, passed, or hauled for broodstock, along with any biological samples collected. These adult traps are also used for estimating adult returns (see 7.3).

Task 7.1.1.1. Operate adult trap(s) and collect and transport broodstock for the Prosser hatchery complex summer/fall run Chinook program.

Task 7.1.1.2. Hold broodstock and document mortalities during holding.

Task 7.1.1.3. Compile all data from trapping and spawning, and calculate return rates for program evaluation.

Task 7.1.1.4. Utilize USFWS fish health professionals during spawning to collect and analyze appropriate fish health samples. Cull fish as necessary per established USFWS and YKFP fish health protocols.

Objective 7.1.2. Determine the origin and stock of summer and fall run Chinook salmon used as broodstock. Monitor and evaluate changes in the phenotypic and genotypic characteristics of summer and fall run chinook used at Prosser Hatchery complex.

Approach: YN uses an assortment of endemic and non-endemic stocks of summer and fall run chinook for production at Prosser Hatchery complex. Summer run fish will start out as imports from Wells Hatchery and/or Columbia River dams (e.g., Priest Rapids or Wells Dams). An endemic stock will be developed over time using returns from these releases. Fall run fish will be comprised of non-endemic Priest Rapids hatchery stock (Little White Salmon Hatchery stock was used through 2010) and endemic stock (both natural and hatchery-origin). YN, WDFW co-managers and NMFS desire to maintain the integrity of the salmon stocks for use in the program and to minimize the potential negative effects of hatchery operations on ESA listed populations. In addition, the project has goals of protecting the health of natural populations while using these stocks for harvest mitigation production.

Broodstock Management

To monitor the phenotypic and genotypic integrity of populations cultured for the program, YN staff strives to collect and mate adults for broodstock to monitor stock demographics (e.g. run/spawn timing, age structure, sex ratios and size of fish) for gametes retained for production. Ideally this would be accomplished by selecting broodstock from throughout the run/spawning season.

YN will use CWTs, fin clips, scale readings, or DNA sampling to identify and remove stray hatchery fish from broodstock. We will estimate the numbers of untagged stray fish associated with decoded CWTs to derive the stray component of fish that were processed.

Since all endemic stock fish are from unmarked/untagged natural origin fish, any external or internal marks that identify them as hatchery origin fish can quickly be identified and enable them to be removed from the broodstock.

Task 7.1.2.1. Collect scale samples on all untagged fish processed at Prosser Hatchery complex. Scales from each fish will be used to document age-structure and to assist in differentiation of hatchery and naturally produced fish.

Task 7.1.2.2. Examine all Chinook for marks and tags, and determine sex. Recover and decode all tags.

Task 7.1.2.3. Calculate the rate at which natural origin Chinook are included in broodstock.

Task 7.1.2.4. Estimate the rate at which unmarked/untagged hatchery strays were included in broodstock (goal = not exceed 5% of the broodstock).

Task 7.1.2.5. Estimate stock composition (summer, fall, in-basin or out-of-basin brood, etc.) of fish retained for broodstock.

Task 7.1.2.6. Examine Chinook for marks, wire (CWT), sex, and collect scales to determine age composition after spawning.

Task 7.1.2.7. Collect length and weight samples from hatchery and natural origin spawned female Chinook. Estimate fecundity for each and create relationships with body size information to track for long-term changes.

Task 7.1.2.8. Determine length frequency ranges for jack fall Chinook based on CWTs.

Task 7.1.2.9. Enumerate jacks retained in broodstock each week to assist with reporting and to assure jacks are incorporated in broodstock within the spawning protocol guideline.

Task 7.1.2.10. Document brood year specific phenotypic characteristics for chinook stocks used at Prosser Hatchery complex (endemic, conventional production/supplementation), and compare and report changes that have occurred over time. Methods will be similar to those described in Knudsen et al 2006 and Knudsen et al 2008.

Objective 7.1.3. Monitor and evaluate the survival of hatchery summer and fall run Chinook salmon produced and reared at Prosser Hatchery complex.

Approach: YN staff will collect data on growth and survival of summer and fall run Chinook produced and reared at the Prosser Hatchery complex by life stage, from egg to release as pre-smolts.

Task 7.1.3.1. Using gravimetric methods, estimate the number of eggs spawned.

Task 7.1.3.2. Enumerate live eggs at “shock” time using an egg counter.

Task 7.1.3.3. Document fry mortalities during incubation.

Task 7.1.3.4. Estimate the number of fish ponded as the live egg count less documented fry mortalities.

Task 7.1.3.5. Document mortalities during rearing by pond and month.

Task 7.1.3.6. Document size of fish (length and weight) using sub-sample by rearing pond and month.

Task 7.1.3.7. Document feed type and food conversion (weight gained divided by pounds of food fed) by rearing pond and month.

Task 7.1.3.8. Estimate the number of fish released as the number of fish marked (see 7.1.4) less documented mortalities from ponding to release.

Objective 7.1.4. Comply with HSRG guidelines and program goals for natural stock restoration and local, natural-origin brood stock development.

Approach: Establish and maintain program marking protocols that allow returning fish to be distinguished by origin and stock. Marking strategies (Table 7.1) are still under development and review. Marking rates for each release group will be documented. For M&E purposes, the goal is to mark 100% of all hatchery-origin releases. However, due to the large number of releases, associated marking costs, and tribal policies relative to mass marking and selective fisheries, it may be necessary to modify M&E measures to monitor performance based on less than 100% marking. Marking rates will be sufficient to determine relative survival differences between different release groups.

Table 7.2: DRAFT Hatchery release numbers, number marked, and mark type by species and hatchery component DRAFT – subject to change as noted above.

Species	# Released	# Marked	Tag or Mark[1]
Summer Run Chinook (upper Columbia stock)	200,000-500,000	200,000-500,000	100% CWT
Fall Chinook (Priest Rapids stock)	~1.7 million	~1.7 million	100% AD clip + 250K CWT
Fall Chinook (Yakima stock)	100,000-500,000	100,000-500,000	100% either PIT tagged or AD clip + some portion CWT

[1] subject to change as noted above.

Task 7.1.4.1. Mark hatchery-origin summer and fall run Chinook salmon produced at Prosser Hatchery complex as documented in Table 7.1.

Task 7.1.4.2. Estimate the total number of fish on hand at marking.

Task 7.1.4.3. Observe marks on returning fish and use these data to manage proportion of natural fish in brood stock (PNoB – Objective 7.1.2) and proportion of hatchery fish on the spawning grounds (PHoS – Objective 7.3.1) per guidelines established by the YKFP Policy Group (as recommended by the fall Chinook MIPT and STAC).

Objective 7.1.5. Monitor and evaluate the quality and release of hatchery summer and fall run Chinook salmon produced at Prosser Hatchery complex.

Approach: Evaluation staff will analyze marking data and releases of juvenile salmon to determine survival rates between life stages and examine potential variables that may influence observed survivals. To document the percent precocious male fish in all of our release groups, visual sampling of summer and fall run Chinook salmon juveniles will occur. To document PIT tag loss that occurs between tagging and release of Chinook, we will install a PIT tag arrays in the outlet channels at all release sites.

Task 7.1.5.1. Evaluate mark quality and tag retention before release.

Task 7.1.5.2. Evaluate fish health of a sub-sample of fish at release. Document and report release size and general condition of juvenile salmonids prior to release.

Task 7.1.5.3. Summarize hatchery records for each brood year to document and report green egg-to-fry, fry-to-smolt, and green egg-to-smolt survival rates for each species, and for each release strategy where appropriate (e.g. - yearling/subyearling Chinook releases).

Task 7.1.5.4. Recommend changes in rearing, marking, and/or tagging based on above monitoring to hatchery and YKFP management to maximize production.

Task 7.1.5.5. Install and maintain PIT tag antenna array in the outlets of _____________.

Task 7.1.5.6. Document the number of PIT tagged fish in the release and calculate the number of PIT tags shed between tagging and release.

Task 7.1.5.7. Document the number of CWT tagged fish in the release and calculate the number of CWT tags shed between tagging and release.

Task 7.1.5.8. Report tagged release data to regional PTAGIS and RMIS data bases.

Objective 7.1.6: Evaluate summer and fall run Chinook release strategies, release sites, and smolt out-migration timing and survival from Prosser Hatchery complex releases to downstream detection sites.

Approach: Acclimation facilities are located throughout the Yakima River basin to promote homing of summer and fall run Chinook to their historical spawning grounds. Out-migration timing can be derived from PIT tag detections at smolt monitoring facilities in the Columbia basin. Our primary evaluations will be performed on sub-yearling and yearling fish released from Prosser hatchery complex facilities. PIT tags will be used to document arrival, duration, and travel times between dams. These data along with size at release data, projected flow data, and projected spill data will be used to determine the optimal release date. Marks/tags applied for the yearling program are used for adult return calculations and for spawning procedures. Calculated SARs for the releases will be used to compare and contrast performance, and will be the primary metric for determining relative success of subyearling and yearling releases. Marking strategies were given above under objective 7.1.4, Table 7-1.

Task 7.1.6.1. Maintain services of a qualified biometrician with experience in estimating smolt-to-smolt and smolt-to-adult survival rates for Yakima Basin fish.

Task 7.1.6.2. PIT tag 27,000 yearlings from the onstation release, and 3,500 subyearlings each from ___________________________________.

Task 7.1.6.3. Document migration timing and survival for yearling and subyearling summer and fall run Chinook using PIT tag detections at Columbia River dams.

Task 7.1.6.4. Document survival (SAR) differences between yearling and subyearling summer and fall run Chinook released from Prosser hatchery complex.

Task 7.1.6.5. Document survival (SAR) based on PIT tag detections and SARs derived from CWTs to determine if post-release CWT loss is occurring and to what extent.

Objective 7.1.7. Assist in the planning, spawning, record keeping, and summarizing data for spawned summer and fall run Chinook salmon at Prosser Hatchery Complex.

Approach: YN biologists annually assist in the spawning operations of summer and fall run Chinook salmon at Prosser Hatchery complex. The role of the evaluation staff has been and will be to collect the biological data (date of spawning, sex, length, scales, marks/tags, extraction of CWTs, DNA and scale sampling, fecundity estimation, etc.) from all fish retained/spawned for broodstock from each of the species. This collaborative role will be critical for optimizing production strategies. In addition, evaluation staff will work closely with the hatchery staff to provide weekly /monthly /yearly summaries of the data for hatchery reports and ESA compliance.

Task 7.1.7.1. Develop or update spawning protocols as needed for review and approval by YKFP MIPT and Fish Management staffs prior to the onset of spawning for all species.

Task 7.1.7.2. Assist in the spawning of summer and fall run Chinook salmon at Prosser Hatchery complex.

Task 7.1.7.3. Collect biological data from all (or representative sample) spawned fish (sex, length, scales, DNA, marks/tags, CWT extraction and verification, fecundity estimation)

Task 7.1.7.4. Where applicable, assist or provide hatchery staff with the necessary data summaries for completion of hatchery records from spawning activities.

7.2 Harvest Monitoring and Evaluation

Harvest monitoring of Yakima River-origin salmonids will be performed by WDFW and The Yakama Nation. The WDFW is responsible for monitoring non-tribal sport and commercial fisheries in the Columbia River, Yakima River, and ocean. The fisheries monitoring methodologies used by WDFW and other state and federal agencies are outside the scope of this document.

The Tribal harvest monitoring program is designed to achieve project goals through:

- sampling subsistence fisheries below Bonneville Dam and at Cascade Locks, The Dalles Dam, John Day Dam, and McNary Dam on the mainstem Columbia River

- sampling all Tribal fisheries in the Yakima River

Objective 7.2.1. Monitor Tribal Subsistence Fisheries in the Columbia River

Approach: YN biologists and technicians annually monitor tribal ceremonial and subsistence fisheries in the Columbia River from the newly established tribal fishing area below Bonneville Dam upstream to McNary Dam. Fishing areas are observed to record total effort in a monitored time frame, with a subsample of effort monitored for observed catch. Biologists expand recorded data for each fishing area and time frame to estimate total catch.

Task 7.2.1.1. Monitor Tribal fisheries below Bonneville Dam and at Cascade Locks, The Dalles, John Day, and McNary dams daily whenever fisheries are conducted.

Task 7.2.1.2. Each fishing day will be divided into three 8-hour periods. A different observer will be used to monitor each 8-hour period.

Task 7.2.1.3. Every 2 hours, the observer will record the number of active gear, the number of fish captured per gear type, and the length of the observation period.

Task 7.2.1.4. Catch estimates will be calculated by expanding the counts for both time and gear.

Task 7.2.1.5. Caught fish will be randomly sub-sampled for marks. Fish species and (if possible) sex will be identified for each fish and each fish will be examined for marks. Length measurements will be taken for each fish caught. Scale samples will be collected on each fish for aging. DNA samples will also be collected on a sub-sample of fish if required as part of genetic studies being undertaken by YN or other research groups.

Task 7.2.1.6. Recovered CWTs will be sent to WDFW for processing. WDFW will report tag recoveries and information to the appropriate regional databases.

Task 7.2.1.7. YN will be responsible for reporting PIT-tag recoveries to PITAGIS (the PIT-Tag Information System) and other regional databases.

Task 7.2.1.8. YN reports estimated harvest in these fisheries through the U.S. v Oregon Technical Advisory Committee (TAC). Annual harvest in these fisheries are maintained as part of the TAC record.

Task 7.2.1.9. YN biologists will analyze available data and estimate the number of Yakima summer and fall run Chinook by origin caught in these fisheries.

Objective 7.2.2. Monitor Fisheries in the Yakima River Basin

Approach: The majority of Tribal fishing activities in the Yakima River occur below the four irrigation diversion dams on the mainstem: Horn Rapids, Prosser, Sunnyside, and Wapato/Parker. This fishery will be monitored in a manner similar to that described in Objective 7.2.1. Non-tribal recreational fisheries also occur in the Yakima and are monitored by WDFW using standard creel methods.

Task 7.2.2.1. YN staff will monitor tribal subsistence fisheries in the Yakima Baisn using methods described in Objective 7.2.1.

Task 7.2.2.2. YN staff will conduct interviews with Tribal fishers. Their catch may be subsampled as described in Objective 7.2.1 above.

Task 7.2.2.3. WDFW will monitor recreational fisheries in the lower Yakima River using standard creel methods.

Objective 7.2.3. Estimate harvest of Yakima Basin summer and fall run Chinook in Marine Fisheries.

Approach: The Regional Mark Information System (RMIS) will be queried regularly for any CWT recoveries of Prosser hatchery complex releases in ocean or Columbia River mainstem fisheries. The results of these queries will be analyzed to estimate the number of fish harvested in marine and lower Columbia River non-tribal fisheries.

Task 7.2.3.1. YN staff will maintain a database of CWT codes released in Prosser hatchery complex summer and fall run Chinook program.

Task 7.2.3.2. YN staff will run annual queries of the regional RMIS database, searching for recoveries of Prosser hatchery complex CWT codes.

Task 7.2.3.3. YN staff will estimate harvest of Prosser hatchery complex summer and fall run Chinook in marine and lower Columbia river fisheries and report these estimates in annual reports.

7.3 Escapement Monitoring and Evaluation

Objective 7.3.1. Estimate escapement of summer and fall run Chinook to the mouth of the Yakima River by stock and origin.

Approach: YN staff utilize video cameras at all ladders at Prosser Dam and maintain a database of counts of fish by date, ladder, and species. In addition, YN biologists and technical staff will operate adult fish traps at the Prosser Denil ladder and other locations for endemic broodstock development and biological sampling. YN staff have been operating the Prosser denil facility for years to sample returning fish in the fall and to collect coho brood stock. Adult trap data and Prosser PIT and CWT detection data will also be used for estimating adult return composition (stock and origin).

Task 7.3.1.1. Enumerate returning fish using video counting equipment, databases, and present methods.

Task 7.3.1.2. Operate Prosser denil (and other) trapping operations and conduct fish sampling per established protocols.

Task 7.3.1.3. Evaluate trapping operation and tag detection databases to estimate composition of returning fish by stock and origin.

Task 7.3.1.4. Evaluate harvest estimates for lower Yakima Basin fisheries and spawning survey data for areas below Prosser dam to estimate escapement below Prosser Dam.

Task 7.3.1.5. Summarize and report above data.

Objective 7.3.2: Estimate adult returns, collect life history characteristics, and document distribution of adults to spawning areas.

Approach: Measuring adult returns to the point of release and to other intermediate areas is necessary to determine program success. YN monitors the returns of salmon and summer steelhead throughout the Yakima Basin via video counts and adult trap operations at Prosser and Roza Dams, spawning ground surveys, and harvest monitoring. Trapped and/or spawned broodstock fish and carcasses provide data concerning origin, stray rates, sex ratios, and composition of each year's run. Spawning surveys provide numbers of redds, spawn timing, and distribution of fish in each of the surveyed reaches and tributaries. These are primary actions to track program performance and progress toward meeting goals.

Task 7.3.2.1. Conduct spawning ground surveys to count redds, determine distribution of spawners, and sample carcasses (sex, length, scales for age composition, and tissue for genetic typing) to document life history characteristics of summer and fall run Chinook in the Yakima Basin.

Task 7.3.2.2. Process scales and CWTs for age composition.

Task 7.3.2.3. Estimate stray rates from the PTAGIS and RMIS regional databases.

7.4 Productivity Monitoring and Evaluation

Objective 7.4.1. Estimate juvenile smolt production of summer and fall run Chinook by stock and origin.

Approach: YN staff will maintain and operate the Chandler juvenile monitoring facility. A number of summer and fall run juvenile migrants will be diverted and sub-sampled at this facility annually. Staff will maintain a database containing length, weight, marks, DNA, etc. information collected from these samples. These and available PIT data will be analyzed to estimate smolt outmigration past Prosser Dam and smolt-to-adult productivity (return) rates.

Task 7.4.1.1. Operate Chandler juvenile monitoring facility and collect phenotypic and genotypic data from a subsample of migrating juveniles.

Task 7.4.1.2. Maintain a database of these sample data.

Task 7.4.1.3. Use PIT or acoustic tags and technologies to evaluate flow and entrainment relationships to estimate annual smolt outmigration at Prosser by stock and origin.

Task 7.4.1.4. Evaluate available PIT data to estimate smolt-to-smolt and smolt-to-adult survival indices (see objective 7.1.6).

Objective 7.4.2. Estimate adult-to-adult productivity of summer and fall run Chinook in the Yakima Basin.

Approach: YN staff will compile and maintain annual run reconstruction tables using the data collected from the objectives and tasks described above. Available age-at-return data will be used to develop brood/cohort return tables and adult return per spawner productivity.

Task 7.4.2.1. Compile available escapement, harvest, and age-at-return data. Update and maintain these data annually in appropriate databases and spreadsheets.

Task 7.4.2.2. Report these data in annual reports and other appropriate technical fora.

7.5 Predation Monitoring and Evaluation

Objective 7.5.1. Estimate juvenile smolt mortalities of summer and fall run Chinook and identify mortality "hot spots" in the Yakima system during outmigration. Utilize collected data to develop and make recommendations to policy makers that will improve juvenile survival through the Yakima system migration corridor.

Approach: YN staff will continue avian and northern pikeminnow predation studies conducted under the YKFP M&E umbrella project, 199506325.

Task 7.5.1.1. Monitor, evaluate, and index the impact of avian predation on annual salmon and steelhead smolt production in the Yakima Subbasin. The index consists of two main components: 1) an index of bird abundance along sample reaches of the Yakima River and 2) an index of consumption along both sample reaches and at key dam and bypass locations (called hotspots).

Task 7.5.1.2. Examine roosting and nesting sites for the presence of salmon PIT tags. Link tag detections to sources of release and correlate with river flows. Analyze and utilize these data to recommend changes in present water and irrigation facility management practices to policy makers that will improve juvenile survival through the Yakima River system migration corridor.

Task 7.5.1.3. Monitor, evaluate, and index impact of piscivorous fish on annual smolt production of Yakima Subbasin salmon and steelhead.

Task 7.5.1.4. Develop methods (e.g., bounty fisheries) to remove some salmonid predators from the Yakima system.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

BPA Fish & Wildlife Program (Project # 199506325) and 2008 Fish Accords funding available for Yakima Fisheries Project M&E activities.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.
(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring Chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

See Section 6. Assessment of ecological effects of fall Chinook production activities are addressed in "umbrella" M&E activities for the Yakima Basin (Project 199506325).

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

Research will focus on determining changes in viable population parameters, e.g., abundance, productivity, spatial distribution, and diversity. This will be done by monitoring performance indicators as described in 1.10 and 11.1.1 (Chapter 7 of the Master Plan). Life history research is being conducted on the natural population in the Yakima mainstem and Marion Drain. The focus is on describing their growth rate, relative spatial distribution. A rotary trap is operated in Marion Drain to learn the juvenile outmigration timing, duration spent in the drain, growth rates, and survival to CJMF.

Supporting research from YKFP predation studies are providing information on the impacts of predation upon the natural and hatchery fall Chinook smolts (see ykfp.org technical reports and publications and Sampson et al. 2009).

12.2) Cooperating and funding agencies.

Yakama Nation (Co-Manager)

Washington Department of Fish & Wildlife (Co-Manager; Priest Rapids and Wells Hatchery production)

Bonneville Power Administration (Funding entity for YKFP Project)

U.S. Fish & Wildlife Service (Little White Salmon NFH production and tagging)

12.3) Principle investigator or project supervisor and staff.

Dr. David Fast (YKFP Research Manager, Yakama Nation Fisheries)
Melinda Davis (biologist, Yakama Nation Fisheries)
Joe Blodgett (Prosser Hatchery complex manager, Yakama Nation Fisheries)

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

See Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

The hatchery accelerated and non-accelerated treatment study being conducted at Prosser requires that a portion of these fish be PIT tagged, as well as, CWT tagged to evaluate differences in smolt-to-smolt and smolt-to-adult survivals. The PIT tagging is conducted at the Prosser hatchery, and the CWT tagging at LWS NFH prior to being transported to the Prosser Hatchery. See 10.7 and 11.1.1 for proposed future marking and M&E activities.

Beach seines are used to sample naturally produced fall Chinook for the life history study. Fish are anesthetized using MS-222, measured and weighted, and released on site after recovery.

12.6) Dates or time period in which research activity occurs.

Research activities for all field activities begin in February and end in late November after the fall Chinook smolt and adult migrations are over.

The marking activities associated with the hatchery fish are completed the fall prior to release.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

Egg transfers from PRH will be conducted by YN staff using standard YN/PRH protocols. As stated previously, both Yakima and Marion Drain broodstock are transported from their respective collection site to their respective hatchery holding ponding using the Yakama Nation hatchery truck. The transportation duration for Prosser is a few minutes, and Marion Drain about 15 minutes.

12.8) Expected type and effects of take and potential for injury or mortality.

YKFP projects have been operating under a "BPA Letter" dated 4/6/01 from Robert Beraud to Rob Jones which states that NMFS has no concern that YKFP activities would violate 7d rules. An electronic copy of the letter is not available but could be mailed via U.S. mail if desired. In addition, the BPA environmental coordinator for the YKFP has prepared NEPA documents which cover all the environmental aspects of the project, including ESA coverages. Copies of this documentation are available from Patricia R. Smith, BPA, 800-282-3713 (prsmith@bpa.gov). See also Section 2.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

See 12.8 and Section 2.

12.10) Alternative methods to achieve project objectives.

Alternatives for the fall Chinook programs described in this HGMP were discussed in section 1.16.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

See 12.8, Section 2, and take table at the end of this document.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

See previous sections in this HGMP.

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by______________________________ Date:_____________

Table 1. Estimated annual take of *O. Mykiss* for all activities associated with the Yakima Basin summer and fall Chinook program, including research, monitoring and evaluation conducted under BPA project id 199506325.

Activity Description	Amount of Annual Take	Life Stage of Take	Type of Take (a-h)	Associated Permit or HGMP
Broodstock Collection (Prosser Dam Denil operation)	<1500 <5	Adult	d g	The main purpose of this activity is fall Chinook and **coho** brood collection and data sampling.
Spawning Ground Surveys	0	-	-	-
Juvenile sampling activities (shocking, seining, Screw trapping,etc.)	<25	Juvenile/smolt	d	

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. An entry for a fish to be taken should be in the take category that describes the greatest impact.
2. Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).
3. If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as “fishery enhancement”.

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as “supplementation”.
Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural origin recruit (NOR) - See *natural fish* .

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see “Population”).

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.

(generally from Washington Department of Fish and Wildlife, November, 1999).

		SIZE CRITERIA	
	SPECIES/AGE CLASS	Number of fish/pound	Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Fingerling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fed Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 800	0.6 to <23
X	Sockeye Fall Releases	<150	>2.9
X	Sockeye Fry	> 800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fed Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fingerling	>20 to 150	3 to <23
X	Steelhead Fry	>150	<3
X	Cutthroat Trout Yearling	<=20	>=23
X	Cutthroat Trout Fingerling	>20 to 150	3 to <23
X	Cutthroat Trout Fry	>150	<3
X	Trout Legals	<=10	>=45
X	Trout Fry	>10	<45

1/ Coho yearlings defined as meeting size criteria and 1 year old at release, and released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria and 1 year old.

Appendix C

Draft Hatchery and Genetic Management Plan: Yakima River Steelhead Kelt Reconditioning Program

HATCHERY AND GENETIC MANAGEMENT PLAN (HGMP)

Hatchery Program:	Yakima Basin Steelhead Reconditioning Project
Species or Hatchery Stock:	Steelhead (*Oncorhynchus mykiss*)
Agency/Operator:	Yakama Nation In cooperation with CRITFC And BPA as funding agency
Watershed and Region:	Yakima River Subbasin/Columbia Plateau Province
Date Submitted:	August 27, 2004; Updated July 6, 2005
Date Last Updated:	January 4, 2008

SECTION 1. GENERAL PROGRAM DESCRIPTION

1.1) Name of hatchery or program.
Yakima Basin Steelhead Reconditioning Project

1.2) Species and population (or stock) under propagation, and ESA status.
State common and scientific names.

Steelhead (*Oncorhynchus mykiss*)
ESA Status: Threatened (part of Mid-Columbia ESU listed as threatened - Final Rule 3/25/99: 64 FR 14517-14528, reconfirmed as DPS 1/5/2006: 71 FR 834-862)

1.3) Responsible organization and individuals
Indicate lead contact and on-site operations staff lead.

Name (and title): Joe Blodgett, Fish Production Biologist and Facility Manager
Agency or Tribe: Yakama Nation
Address: P. O. Box 151, Toppenish, WA 98948
Telephone: 509-865-5121, ext. 6706
Fax: 509-865-6293
Email: joewb@earthlink.net

Name (and title): Dr. David Fast,
Research Manager, Yakima-Klickitat Fisheries Project
Agency or Tribe: Yakama Nation
Address: 771 Pence Road, Yakima, WA 98908
Telephone: 509-945-1206
Fax: 509-966-4972
Email: fast@yakama.com

Name (and title): Douglas R. Hatch, Research Biologist
Agency or Tribe: Columbia River Inter-Tribal Fish Commission
Address: 729 N.E. Oregon St., Suite 200, Portland, OR 97232
Telephone: 503-238-0667
Fax: 503-235-4228
Email: hatd@critfc.org

Other agencies, Tribes, co-operators, or organizations involved, including contractors, and extent of involvement in the program:

Co-operators	Role
Bonneville Power Administration	Funding Entity- Administrator
U.S. Bureau of Reclamation	Owner of facility land; and minor funding entity for facility upgrades and public education
National Marine Fisheries Service	Decision on Listed Species; radio telemetry support
Washington Department of Fish & Wildlife	Co-Manager
Northwest Power Planning Council	Makes Fish and Wildlife Program decisions under the Northwest Power Act.

University of Idaho	Radio Telemetry support

1.4) Funding source, staffing level, and annual hatchery program operational costs.

Funding sources: Bonneville Power Administration, Yakama Nation, and U.S. Bureau of Reclamation (Funds for facility improvements, public education, in-kind land contribution).

Staffing and annual operational costs:
Prosser Hatchery
9 scientific technicians, 2 management biologists, total of 11 full time equivalent staff. Annual operating cost (dollars): $1,141,042. These data include staff and costs for both Yakama coho and fall Chinook programs.

1.5) Location(s) of hatchery and associated facilities.

Include name of stream, river kilometer location, basin name, and state. Also include watershed code (e.g. WRIA number), regional mark processing center code, or other sufficient information for GIS entry. See "Instruction E" for guidance in responding.

Broodstock source	Program reconditions and releases Yakima Basin kelt steelhead. No spawning or rearing occurs under this program.
Kelt collection location (stream, RKm, subbasin)	Chandler Juvenile Monitoring Facility (CJMF), Yakima, RKm 75.4
Adult holding location (stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam, RKm 75.1, Yakima Subbasin
Reconditioning location (stream, RKm, subbasin)	Prosser Hatchery (Off river of the Yakima River ~0.75 miles downstream of Prosser Dam, RKm 75.1, Yakima Subbasin
Incubation location (facility name, stream, RKm, subbasin)	Not applicable
Rearing location (facility name, stream, RKm, subbasin)	Not applicable

WRIA code for Prosser Dam and Hatchery: 37

1.6) Type of program.

Define as either: Integrated Recovery; Integrated Harvest; Isolated Recovery; or Isolated Harvest (see Attachment 1 - Definitions" section for guidance).

Integrated Recovery.

1.7) Purpose (Goal) of program.

Define as either: Augmentation, Mitigation, Restoration, Preservation/Conservation, or Research (for Columbia Basin programs, use NPPC document 99-15 for guidance in providing these definitions of "Purpose"). Provide a one sentence statement of the goal of the program, consistent with the term selected and the response to Section 1.6. Example: "The goal of this program is the restoration of spring chinook salmon in the White River using the indigenous stock".

The purpose of this program is to test the feasibility of kelt reconditioning as a method to enhance the survival and repeat spawning of steelhead and as mitigation for hydro and habitat impacts.

1.8) Justification for the program.

Indicate how the hatchery program will enhance or benefit the survival of the listed natural population (integrated or isolated recovery programs), or how the program will be operated to provide fish for harvest while minimizing adverse effects on listed fish (integrated or isolated harvest programs).

- Yakima Basin steelhead are part of the mid-Columbia ESU listed as ESA-threatened in 1999, reconfirmed as DPS 1/5/2006: 71 FR 834-862.
- The parties to the *United States versus Oregon* Columbia River Fish Management Plan agreed to approve and implement supplementation recommendations and to evaluate the effectiveness of outplanting of steelhead.
- This project meets the definition of "Restoration" from NPPC document 99-15: "Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored."

The program attempts to increase the abundance and diversity of steelhead in the Yakima Basin by increasing the number of iteroparous (repeat spawning) steelhead on the spawning grounds.

1.9) List of program "Performance Standards".

"Performance Standards" are designed to achieve the program goal/purpose, and are generally measurable, realistic, and time specific. The NPPC "Artificial Production Review" document attached with the instructions for completing the HGMP presents a list of draft "Performance Standards" as examples of standards that could be applied for a hatchery program. If an ESU-wide hatchery plan including your hatchery program is available, use the performance standard list already compiled.

> *Example: " (1) Conserve the genetic and life history diversity of Upper Columbia River spring chinook populations through a 12 year duration captive broodstock program; (2) Augment, restore and create viable naturally spawning populations using supplementation and reintroduction strategies; (3) Provide fish to satisfy legally mandated harvest in a manner which minimizes the risk of adverse effects to listed wild populations; (4)....".*

In order to evaluate the feasibility of kelt reconditioning as a potential recovery and restoration strategy for wild steelhead in the Columbia River basin, this project was designed to address the following research objectives:

Objective 1: Implement and evaluate short-term kelt reconditioning, transportation and release downstream from Bonneville Dam.

Objective 2: Continue to refine and improve efficiency and success of long-term steelhead reconditioning at the Prosser Hatchery.

Objective 3: Assess homing fidelity of steelhead kelts following their release from the reconditioning program.

Key questions relating to objectives 1-3:

1. What feed types result in growth and re-maturation of gonads when rearing kelt steelhead in a captive environment?
2. Do captive kelts grow and survive?
3. Is abundance of potential repeat spawners better enhanced by a short- or long-term reconditioning program?
4. Do reconditioned kelts migrate to the spawning grounds?

Objective 4: Evaluate the reproductive success of reconditioned kelt steelhead.

1.10) List of program "Performance Indicators", designated by "benefits" and "risks."

"Performance Indicators" determine the degree that program standards have been achieved, and indicate the specific parameters to be monitored and evaluated. Adequate monitoring and evaluation must exist to detect and evaluate the success of the hatchery program and any risks to or impairment of recovery of affected, listed fish populations.

The NPPC "Artificial Production Review" document referenced above presents a list of draft "Performance Indicators" that, when linked with the appropriate performance standard, stand as examples of indicators that could be applied for the hatchery program. If an ESU-wide hatchery plan is available, use the performance indicator list already compiled. Essential 'Performance Indicators" that should be included are monitoring and evaluation of overall fishery contribution and survival rates, stray rates, and divergence of hatchery fish morphological and behavioral characteristics from natural populations.

The list of "Performance Indicators" should be separated into two categories: "benefits" that the hatchery program will provide to the listed species, or in meeting harvest objectives while protecting listed species; and "risks" to listed fish that may be posed by the hatchery program, including indicators that respond to uncertainties regarding program effects associated with a lack of data.

1.10.1) "Performance Indicators" addressing benefits.

(e.g. "*Evaluate smolt-to-adult return rates for program fish to harvest, hatchery broodstock, and natural spawning.*").

Indicator	Performance Standard	Indicator is Monitored
Annual escapements of natural populations that are affected by fisheries targeting program fish.		YN, WDFW, and USFS conduct annual redd counts of naturally spawning steelhead in the Yakima Basin
Annual number of spawners on spawning grounds, by age.	Artificial propagation program contributes to an increasing number of spawners returning to natural spawning areas.	YN estimates Yakima River run size from Prosser dam count, harvest, and redd count data. Age composition can be estimated from Prosser Denil passage and Prosser/Roza steelhead and kelt sampling.
Annual number of redds in selected natural production index areas.		YN, WDFW, and USFS conduct annual redd counts of naturally spawning fall chinook in the Yakima Basin

1.10.2) "Performance Indicators" addressing risks.

(*e.g. "Evaluate predation effects on listed fish resulting from hatchery fish releases."*).

Indicator	Performance Standard	Indicator is Monitored
Marking rate by mark type for each release group.	Release groups are sufficiently marked in a manner consistent with information needs and protocols to enable determination of impacts to natural- and hatchery-origin fish in fisheries.	Yes, all released kelts are PIT-Tagged and some are radio tagged.
Temporal distribution of broodstock collection, and of naturally produced population at point of collection.	Fish collected for broodstock are taken throughout the return or spawning period in proportions approximating the timing and age distribution of the population from which broodstock is taken.	Yes, kelts are collected from throughout the duration of their return migration from the subset of kelts which migrate downstream and are diverted into the Chandler Canal and juvenile fish monitoring facility.
Age composition of broodstock collected, and of naturally produced population at point of collection.		Scale samples are taken (if not reabsorbed) from collected kelts; in addition, PIT-tagging of juvenile steelhead in Yakima Basin has occurred since the 2002 outmigration. These combined with Roza-tagged steelhead can also be used for age composition.
Number of spawners of natural origin removed for broodstock.	Broodstock collection does not significantly reduce potential juvenile production in natural rearing areas.	Not applicable.
Number and origin of spawners migrating to natural spawning areas.		The contribution of reconditioned kelts to the (fresh) natural spawning return is known and computed on an annual basis.
Number of eggs or juveniles placed in natural rearing areas.		Not applicable.
Life history characteristics	Life history characteristics of the natural population do not change as a result of this artificial production program.	The following characteristics are monitored on an annual basis: Juvenile migration timing (at Chandler), juvenile size at outmigration (tributary screw trapping and Chandler juvenile monitoring operations), adult return timing (at Prosser), adult return age and sex composition and size at return (Prosser Denil and kelt sampling), Spawn timing and distribution (comprehensive spawner surveys), fecundity and egg size (beginning to build a database from fish used in reproductive success studies)
Carrying capacity criteria for basin-wide and local habitat, including method of calculation.	Annual release numbers do not exceed estimated basin-wide and local habitat capacity, including spawning, freshwater rearing, migration corridor, and estuarine and nearshore rearing.	Yakima Basin carrying capacity determined using EDT model analysis.
Annual release numbers from all programs in basin and subbasin, including size and life-stage at release, and length of acclimation, by program.		The number of short- and long-term kelts released annually is documented as well as location of release.
Location of releases and natural rearing areas.		Short-term Kelts are trucked from Prosser Hatchery and released in the vicinity of the Hamilton Island Boat Ramp below Bonneville Dam. Long-term kelts are released in the vicinity of Mabton upstream of Prosser Dam; some are also released in the vicinity of Wallula Gap near McNary Dam to assess homing fidelity.
Timing of hatchery releases, compared to natural populations.		Short-term reconditioned kelts are released below Bonneville Dam in the spring and return on their own schedule. The majority have returned after spending 3-5 months in the estuary/ocean, but a few have returned immediately after release and a few have returned 1+ years after release. To date none have returned after more than 2 years. Long-term kelts are released in late November or early December to coincide with returning 'fresh' steelhead.

Genetic profiles of naturally produced adults, as developed at program's outset (e.g. through DNA or allozyme procedures) and compared to genetic profiles developed each generation.	Patterns of genetic variation within and among natural populations do not change significantly as a result of artificial production.	DNA samples are taken from a subset of kelts that are reconditioned. DNA samples are also being taken from a subset of fish passing upstream at Roza Dam.
Total number of natural spawners reaching the collection facility.	Collection of broodstock does not adversely impact the genetic diversity of the naturally spawning population.	Hatchery, natural, and reconditioned origin returns are known (see above).
Total number of spawners estimated to pass the collection facility to spawning areas, compared to minimum effective population size (when established) required for those natural populations.		Total number of natural spawners is known (see above); minimum effective population size could be determined using EDT model analysis.
Timing of collection compared to overall run timing.		See above.
The ratio of observed and/or estimated total numbers of artificially produced fish on natural spawning grounds, to total number of naturally produced fish, for each significant spawning area.	Artificially produced origin adults in natural production areas do not exceed appropriate proportion of the total natural spawning population.	Hatchery, natural, and reconditioned origin returns are known (see above).
Observed and estimated total numbers of naturally produced and artificially produced adults passing a counting station close to natural spawning areas.		Hatchery, natural, and reconditioned origin returns are known (see above).
Location of juvenile releases.	Juveniles are released on-station, or after sufficient acclimation to maximize homing ability to intended return locations.	Not applicable.
Length of acclimation period.		Not applicable.
Release type, whether forced, volitional, or direct stream release.		Fish are released directly into the Columbia or Yakima Rivers after reconditioning, but the location and timing of their return and spawning are volitional (see above).
Level of smoltification at release, compared to a regional smoltification index (when developed). Release type, whether forced, volitional, or direct stream release.	Juveniles are released at fully smolted stage.	Not applicable.
Number of adults available for broodstock (moving geometric mean, based on number of ages at return for this species).	The number of adults returning to the hatchery that exceeds broodstock needs is declining.	Prosser dam and Chandler kelt counts should provide an index with which to make this determination.
Scientifically based experimental design, with measurable objectives and hypotheses.	The artificial production program uses standard scientific procedures to evaluate various aspects of artificial propagation.	See http://www.efw.bpa.gov/searchpublications/ for annual report detailing latest year's results.
Monitoring and evaluation framework including detailed time line.	The artificial propagation program is monitored and evaluated on an appropriate schedule and scale to address progress toward achieving the experimental objective and evaluate beneficial and adverse effects on natural populations.	Monitoring and evaluation framework is being developed as part of the Master Plan for this species.
Annual and final reports.		See http://www.efw.bpa.gov/searchpublications/ for annual report detailing latest year's results.
Annual reports indicating level of compliance with applicable standards and criteria.	Artificial production facilities are operated in compliance with all applicable fish health guidelines and facility operation standards and protocols such as those described by IHOT, PNFHPC, the Co-Managers of Washington Fish Health Policy, INAD, and MDFWP.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results
Discharge water quality compared to applicable water quality standards and guidelines, such as those described or required by NPDES, IHOT, PNFHPC, and Co-Managers of Washington Fish Health Policy tribal water quality plans, including those relating to temperature, nutrient loading, chemicals, etc.	Effluent from artificial production facility will not detrimentally affect natural populations.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results

Water withdrawals compared to applicable passage criteria.	Water withdrawals and instream water diversion structures for artificial production facility operation will not prevent access to natural spawning areas, affect spawning behavior of natural populations, or impact juvenile rearing environment.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results for all performance indicators for this standard.
Water withdrawals compared to NMFS, USFWS, and WDFW juvenile screening criteria		
Number of adult fish aggregating and/or spawning immediately below water intake point.		
Number of adult fish passing water intake point.		
Proportion of diversion of total stream flow between intake and outfall.		
Certification of juvenile fish health immediately prior to release, including pathogens present and their virulence.	Releases do not introduce pathogens not already existing in the local populations, and do not significantly increase the levels of existing pathogens.	USFWS fish health professionals sample and certify all releases.
Number and location(s) of carcasses or other products distributed for nutrient enrichment.	Any distribution of carcasses or other products for nutrient enhancement is accomplished in compliance with appropriate disease control regulations and guidelines, including state, tribal, and federal carcass distribution guidelines.	See http://www.efw.bpa.gov/searchpublications/ Lower Yakima O&M annual report for latest year's results for all performance indicators for this standard.
Statement of compliance with applicable regulations and guidelines.		
Spatial and temporal spawning distribution of natural population above and below weir/trap, currently and compared to historic distribution.	Adult broodstock collection operation does not significantly alter spatial and temporal distribution of any naturally produced population.	Derived from spawner survey and radio telemetry work (temporal and spatial), and Prosser Dam counts (temporal).
Mortality rates in trap.	Weir/trap operations do not result in significant stress, injury, or mortality in natural populations.	Mortality rates are documented.
Prespawning mortality rates of trapped fish in hatchery or after release.		Mortality rates are documented.
Size at, and time of, release of juvenile fish, compared to size and timing of natural fish present.	Predation by artificially produced fish on naturally produced fish does not significantly reduce numbers of natural fish.	Not applicable.
Total cost of program operation.	Cost of program operation does not exceed the net economic value of fisheries in dollars per fish for all fisheries targeting this population.	See 1.4 above.
Sum of ex-vessel value of commercial catch adjusted appropriately, appropriate monetary value of recreational effort, and other fishery related financial benefits.		This calculation will be difficult to do accurately since these fish are impacted in marine fisheries from Alaska possibly as far south as Northern California and inland to Prosser Dam and as expressed above, the proportion of Yakima fish in the total wild/natural steelhead harvest in these fisheries can only be roughly estimated.
Total cost of program operation.	Juvenile production costs are comparable to or less than other regional programs designed for similar objectives.	See 1.4 above.
Average total cost of activities with similar objectives.		
Number of adult fish available for tribal ceremonial use.	Non-monetary societal benefits for which the program is designed are achieved.	YN documents this use.
Recreational fishery angler days, length of seasons, and number of licenses purchased.		See relevant *U.S. v OR* TAC and WDFW documentation.

1.11) Expected size of program.

In responding to the two elements below, take into account the potential for increased fish production that may result from increased fish survival rates affected by improvements in hatchery rearing methods, or in the productivity of fish habitat.

1.11.1) Proposed annual broodstock collection level (maximum number of adult fish).

The program collects kelt steelhead that naturally migrate downstream after spawning and are entrained into the Chandler irrigation diversion canal at Prosser Dam. The fish are then diverted into the Chandler Juvenile Monitoring Facility (CJMF) staffed by Yakama Nation fisheries technicians and biologists. Between 2001 and 2007, the annual handle of kelt steelhead at the CJMF ranged from 520 to 1,157 and averaged 803 over the seven years that this program has operated to date. All handled fish are biologically sampled by staff at the CJMF. Steelhead which are in very poor condition or are considered "green" pre-spawned steelhead upon examination by staff are released immediately back to the river near the Prosser hatchery. A random sample of the remaining kelts (generally every fifth fish) are biologically sampled, tagged with a Passive Integrated Transponder (PIT) tag, and placed immediately back into the river near the Prosser Hatchery (Yakima direct release group) as a control group to measure "baseline" return rates for iteroparous steelhead. After sampling, the remaining fish are placed into either: a) a "no term" program where fish are PIT tagged and hauled within 1-3 days to a release site below Bonneville Dam, b) a "short term" program where fish are PIT tagged and hauled within 4-10 weeks to a release site below Bonneville Dam, or c) a "long term" program where fish are retained in one of four circular rearing tanks at the Prosser Hatchery, held and fed for up to six months, then released to the Yakima River in the vicinity of Prosser Hatchery in late October to early November coincident with the peak of the "fresh" upstream migration of steelhead returning from the ocean to spawn. Annual release ranges, averages, and years of release for the four release groups were:
Yakima direct: from 52 to 67 (average of 57) kelts from 2005-2007
"No Term": from 38 to 96 (average of 62) kelts from 2004-2007
"Short Term": from 38 to 332 (average of 142) kelts from 2002-2007
"Long Term": from 85 to 301 (average of 176) kelts from 2001-2007

1.11.2) Proposed annual fish release levels (maximum number) by life stage and location. (*Use standardized life stage definitions by species presented in* Attachment 2).

Life Stage	Release Location	Annual Release Level
Eyed Eggs		Not applicable – see 1.11.1
Unfed Fry		Not applicable – see 1.11.1
Fry		Not applicable – see 1.11.1
Fingerling		Not applicable – see 1.11.1
Yearling		Not applicable – see 1.11.1

1.12) Current program performance, including estimated smolt-to-adult survival rates, adult production levels, and escapement levels. Indicate the source of these data.
Provide estimated smolt-to-adult survival rate, total adult production number, and escapement number (to the hatchery and natural areas) data available for the most recent twelve years (roughly three fish generations), or for the number of years of available and dependable information. Indicate program goals for these parameters.

The following is the abstract of a manuscript titled, "Reconditioning Kelt Steelhead: A Novel Management Strategy for Populations in Low Abundance", which summarized results from the first five years of this program and was submitted to *Fish Management and Ecology* for peer review in late September of 2007.

> We reconditioned steelhead kelts in short- and long-term programs in a five-year study. Short-term reconditioned kelts were fed for approximately 3-11 weeks, transported around Columbia River hydroelectric facilities and released, with natural rearing and gonad rematuration occurring in the ocean. In long-term reconditioning, kelts were reared for 6-10 months then released locally. Survival to release for short-term reconditioning ranged from 69-93% and averaged 79%. Post-release survival and return of short-term kelts ranged from 1-9% with returning "ocean-reared" kelts showing an average weight gain of 46%. Survival to release for long-term reconditioning ranged from 19-62% and averaged 36% with captive-reared kelts showing an average weight gain of 38%. Short- and long-term reconditioned steelhead kelts represented 2-11% of the annual spawning escapement from 2001 to 2005 compared to a repeat spawning rate of 1.6% from the literature. Radio telemetry results demonstrated success in locating spawning grounds and constructing redds.

A study to investigate the relative reproductive success of artificially reconditioned kelt steelhead is being implemented.

1.13) Date program started (years in operation), or is expected to start.

To address recovery, the YKFP in cooperation with the University of Idaho and the Columbia River Inter-Tribal Fish Commission began capturing wild emigrating steelhead kelts from the Yakima River in 1999 to test reconditioning and the effects of several diet formulations on its success at Prosser Hatchery (Rkm 76) on the Yakima River.

The first two years of the program were primarily aimed at assessing feasibility and determining feed-types and methods that would successfully encourage kelts to begin actively feeding. The long-term reconditioning program began in earnest in 2001. Short-term reconditioning began in 2002.

1.14) Expected duration of program.

Undetermined.

1.15) Watersheds targeted by program.
Include WRIA or similar stream identification number for desired watershed of return.

Yakima River Subbasin/Columbia Plateau Province. Yakima Basin (WRIA code 37 and 39), including the Naches subbasin (WRIA code 38), middle and upper Yakima subbasins, and tributaries.

1.16) Indicate alternative actions considered for attaining program goals, and reasons why those actions are not being proposed.

From 2003 HGMP provincial meetings:

Yakima Steelhead Kelt Reconditioning

1.16.1 Brief Overview of key issues
The primary goal for this program is to test the hypothesis that increasing the natural expression of historical repeat spawning rates using fish culturing means is a viable technique to assist the recovery of depressed steelhead populations. Reconditioning is the process of culturing post-spawned fish (kelts) in a captive environment until they are able to reinitiate feeding, growth, and again develop mature gonads. Key issues are:
1. Developing commercial food products that stimulate the initiation of feeding in wild adult steelhead.

1.16.2 Potential alternatives to the current program
1. Do not attempt kelt reconditioning
2. Collect kelts and transport them by truck or barge to lower Columbia for release to avoid mortality associated with passage at Hydro dams.
3. Keep kelts until mature, spawn, and rear/release resulting smolts.
4. [added by Bill Bosch, YN, 08/27/04]. Develop full-scale steelhead hatchery program for the Yakima Basin.

1.16.3 Potential reforms and investments
1. Develop Kelt reconditioning sites in upper watershed for identified stocks in each subbasin of Yakima.

Because of their diverse life history (steelhead can migrate to sea after one to three years in freshwater) and since steelhead in the Yakima Subbasin are apparently uniquely adapted to one of several specific tributaries or reaches, it is difficult to design a steelhead supplementation program for the Yakima Subbasin using traditional fish culture practices. For these reasons, the YKFP has not incorporated steelhead into its supplementation activities. However, it is anticipated that the habitat actions undertaken pursuant to the YKFP are likely to benefit steelhead populations as well. In lieu of a “traditional” supplementation program, the Yakama Nation, in cooperation with the Columbia River Inter-Tribal Fish Commission, is exploring the potential to increase the rate of repeat spawning in Yakima Subbasin steelhead populations via the steelhead kelt reconditioning program. The M&E results of this program over the next several years should lead to recommendations on future methods, plans, and strategies for facilitating recovery of steelhead in the Yakima Basin and hopefully, in other parts of the Columbia Basin as well.

SECTION 2. PROGRAM EFFECTS ON NMFS ESA-LISTED SALMONID POPULATIONS. (USFWS ESA-Listed Salmonid Species and Non-Salmonid Species are addressed in Addendum A)

2.1) List all ESA permits or authorizations in hand for the hatchery program.

The program has all applicable permits and/or authorizations.

See appendices:
Appendix A. 2004 Biological Assessment.
Appendix B. 2005 Permit Application
Appendix C. Coverage for Roza adult trapping operations.
Appendix D. Adult and Juvenile Take Tables for Mid-Columbia Steelhead Kelt Reconditioning Projects.
Appendix E. NOAA 2006 Determination Letter.

Contacts: Doug Hatch, CRITFC, 503-238-0667; Mark Johnston or Todd Newsome at 509-865-5121.

2.2) Provide descriptions, status, and projected take actions and levels for NMFS ESA-listed natural populations in the target area.

2.2.1) Description of NMFS ESA-listed salmonid population(s) affected by the program.

Include information describing: adult age class structure, sex ratio, size range, migrational timing, spawning range, and spawn timing; and juvenile life history strategy, including smolt emigration timing. Emphasize spatial and temporal distribution relative to hatchery fish release locations and weir sites

- Identify the NMFS ESA-listed population(s) that will be directly affected by the program. *(Includes listed fish used in supplementation programs or other programs that involve integration of a listed natural population. Identify the natural population targeted for integration).*

Yakima River summer steelhead were listed as threatened in 1999 as part of the mid-Columbia Distinct Population Segment (DPS). These fish spawn in tributaries of the Yakima Basin including: Satus, Toppenish, and Ahtanum Creeks, and the Naches and Upper Yakima River systems, and there is some evidence of genetic uniqueness among these subpopulations (Small et al. 2006). The Interior Columbia Technical Recovery Team designated four populations within the Yakima River major population group: Satus, Toppenish, Naches River, and Yakima River upper mainstem (ICTRT 2003 and 2005).

- Identify the NMFS ESA-listed population(s) that may be incidentally affected by the program.
(Includes ESA-listed fish in target hatchery fish release, adult return, and broodstock collection areas).

2.2.2) Status of NMFS ESA-listed salmonid population(s) affected by the program.

- Describe the status of the listed natural population(s) relative to "critical" and "viable" population thresholds (*see definitions in "Attachment 1").*

- Provide the most recent 12 year (e.g. 1988-present) progeny-to-parent ratios, survival data by life-stage, or other measures of productivity for the listed population. Indicate the source of these data.

- Provide the most recent 12 year (e.g. 1988-1999) annual spawning abundance estimates, or any other abundance information. Indicate the source of these data. *(Include estimates of juvenile habitat seeding relative to capacity or natural fish densities, if available).*

- Provide the most recent 12 year (e.g. 1988-1999) estimates of annual proportions of direct hatchery-origin and listed natural-origin fish on natural spawning grounds, if known.

Yakima Basin Steelhead Escapement and Spawning Summary

Run Year	Prosser Dam Count	Redd Counts by Survey Stream				Roza Dam Count
		Satus	Toppenish	Ahtanum	Naches	
1987-88	2,840	445				
1988-89	1,162	404	45			
1989-90	814	289	26			
1990-91	834	125				
1991-92	2,263					116
1992-93*	1,184	73				15
1993-94	554	114				28
1994-95**	925	85				23
1995-96	505	148				92
1996-97*	1,106	76	5			22
1997-98*	1,113	190	13			51
1998-99	1,070	130	78			14
1999-00	1,611	169	185	11		14
2000-01	3,089	102	355	8		140
2001-02**	4,525	240	111	13		238
2002-03	2,235	172	354	8		134
2003-04	2,755	93	56	12	94	213
2004-05	3,451	108	99	16	140	227
2005-06**	2,005	60	20	1	19	117
2006-07	1,537	87	42**	4**	44	58

Blank = no data available
* Partial survey.
**Survey affected by access problems, high flows, or poor redd visibility

Hatchery releases were discontinued in the early 1990s. Recent 9-year average (since 1998-99 run year) escapement over Prosser Dam has been >98% wild; since 1983-84 the annual steelhead escapement has averaged about 92% wild. Data source: YN databases (YakRSthdDB.xls, SthdReddSummary.doc).

Please see the Yakima Basin salmon recovery plan for further information. The recovery plan describes a process to remove or minimize the threats to the long-term survival of steelhead, and bull trout and reverse their decline in the Yakima subbasin. Actions proposed should also benefit other sensitive or at-risk species. Current and historical conditions of each population were described, and limiting factors that led to the decline of each population or local population in the Yakima subbasin were identified. Appropriate actions were then selected based on limiting factors analysis and analysis of metrics within preliminary guidelines for determining population viability (abundance, productivity, spatial structure, and diversity). Recovery actions were coordinated with local stakeholders and jurisdictions that determined the feasibility of the recommended actions. In addition to actions to address habitat limiting factors, the salmon recovery plan also includes discussion of steelhead kelt reconditioning and other potential production actions.

2.2.3) Describe hatchery activities, including associated monitoring and evaluation and research programs, that may lead to the take of NMFS listed fish in the target area, and provide estimated annual levels of take *(see "Attachment 1" for definition of "take")***.**

The program has all applicable permits and/or authorizations.

Please refer to the following appendices for information requested in this section:
Appendix A. 2004 Biological Assessment.
Appendix B. 2005 Permit Application
Appendix C. Coverage for Roza adult trapping operations.
Appendix D. Adult and Juvenile Take Tables for Mid-Columbia Steelhead Kelt Reconditioning Projects.
Appendix E. NOAA 2006 Determination Letter.

Contacts: Doug Hatch, CRITFC, 503-238-0667; Mark Johnston or Todd Newsome at 509-865-5121.

- Describe hatchery activities that may lead to the take of listed salmonid populations in the target area, including how, where, and when the takes may occur, the risk potential for their occurrence, and the likely effects of the take.
(*e.g. "Broodstock collection directed at sockeye salmon has a "high" potential to take listed spring chinook salmon, through migrational delay, capture, handling, and upstream release, during trap operation at Tumwater Falls Dam between July 1 and October 15. Trapping and handling devices and methods may lead to injury to listed fish through descaling, delayed migration and spawning, or delayed mortality as a result of injury or increased susceptibility to predation*").

- Provide information regarding past takes associated with the hatchery program, (if known) including numbers taken, and observed injury or mortality levels for listed fish.

- **Provide projected annual take levels for listed fish by life stage (juvenile and adult) quantified (to the extent feasible) by the type of take resulting from the hatchery program (e.g. capture, handling, tagging, injury, or lethal take).**
*Complete the appended "take table" (**Table 1**) for this purpose. Provide a range of potential take numbers to account for alternate or "worst case" scenarios.*

- Indicate contingency plans for addressing situations where take levels within a given year have exceeded, or are projected to exceed, take levels described in this plan for the program.
(*e.g. "The number of days that steelhead are trapped at Priest Rapids Dam will be reduced if the total mortality of handled fish is projected inseason to exceed the 1988-99 maximum observed level of 100 fish."*)

SECTION 3. RELATIONSHIP OF PROGRAM TO OTHER MANAGEMENT OBJECTIVES

3.1) Describe alignment of the hatchery program with any ESU-wide hatchery plan (e.g. *Hood Canal Summer Chum Conservation Initiative*) or other regionally accepted policies (e.g. the NPPC *Annual Production Review* Report and Recommendations - NPPC document 99-15). Explain any proposed deviations from the plan or policies.
(e.g. "The hatchery program will be operated consistent with the ESU-wide plan, with the exception of age class at release. Fish will be released as yearlings rather than as sub-yearlings as specified in the ESU-wide plan, to maximize smolt-to-adult survival rates given extremely low run sizes the past four years.").

A Yakima Subbasin salmon recovery plan is presently being developed in cooperation with the Yakima Subbasin Fish and Wildlife Recovery Board. A draft document is available for public review at http://www.ybfwrb.org/Draft%20plan/RecPlanFinal.pdf. Yakima Basin steelhead kelt reconditioning activities will be consistent with this recovery plan. Yakima kelt reconditioning activities are also an integral part of production actions being developed in negotiations to update the *U.S. v Oregon* Columbia River Fish Management Plan and reasonable and prudent alternative actions being developed in the Biological Opinion Remand process.

3.2) List all existing cooperative agreements, memoranda of understanding, memoranda of agreement, or other management plans or court orders under which program operates. *Indicate whether this HGMP is consistent with these plans and commitments, and explain any discrepancies.*

Document Title	Type
Treaty of 1855. Asserted the right of the Yakama Nation to "take fish at all usual and accustomed fishing areas". Federal courts have held that this right means more than the right of Indians to hang a net in an empty river (*Washington v Washington State Commercial Passenger Fishing Vessel Association, 1979*).	Supreme law of the land
United States versus Oregon Columbia River Fish Management Plan.	Federal Court Order
US v Washington	Federal Court Order

Northwest Power and Conservation Council (NPCC), Fish and Wildlife Program.	Northwest Power Act
WY-KAN-USH-MI WA-KISH-WIT	Columbia River Anadromous Fish Restoration Plan of the Columbia River Tribes
Yakama Nation and US Bureau Reclamation Prosser Hatchery Agreement	MOU
Yakama Nation and US Fish & Wildlife Service Fish Health Agreement	MOU

The four Columbia River Treaty Tribes (Nez Perce, Umatilla, Warm Springs, and Yakama) identified steelhead restoration and enhancement throughout the Columbia Basin as a priority in *Wy-Kan-Ush-Mi-Wa-Kish-Wit*, commonly referred to as the Tribal Restoration Plan (TRP) (CRITFC 1995, 2000). It is a comprehensive plan put forward by the Tribes to restore the Columbia River fisheries.

In 1996, the Northwest Power Planning Council (NPPC) recommended the tribal mid-Columbia reintroduction project for funding by BPA, which has responsibilities under the Northwest Electric Power Planning and Conservation Act of 1980 to protect, mitigate, and enhance fish and wildlife that have been affected by the construction and operation of the Federal Columbia River Power System.

Steelhead enhancement programs are also recognized in the Columbia River Fish Management Plan, a court-mandated plan under the jurisdiction of *U.S. v. Oregon*, involving Federal, state and tribal fish managers in the Columbia basin (CRITFC 1988). The U.S. District Court ruled on March 22, 1974 that the Yakama Nation and Washington Department of Fish and Wildlife co-manage fish resources in Washington State. This decision is commonly referred to as the Boldt Decision.

The YN has a Memorandum of Understanding with the BOR, which stipulates responsibilities between the two parties pertaining to the Prosser Hatchery facility.

The YN has a subcontract with the USFWS to monitor fish health at the main hatchery facility and satellite acclimation facilities.

3.3) Relationship to harvest objectives.

Explain whether artificial production and harvest management have been integrated to provide as many benefits and as few biological risks as possible to the listed species. Reference any harvest plan that describes measures applied to integrate the program with harvest management.

3.3.1) Describe fisheries benefitting from the program, and indicate harvest levels and rates for program-origin fish for the last twelve years (1988-99), if available.

Also provide estimated future harvest rates on fish propagated by the program, and on listed fish that may be taken while harvesting program fish.

There are no specific harvest objectives for this project.

3.4) Relationship to habitat protection and recovery strategies.

Describe the major factors affecting natural production (if known). Describe any habitat protection efforts, and expected natural production benefits over the short- and long-term. For Columbia Basin programs, use NPPC document 99-15, section II.C. as guidance in indicating program linkage with assumptions regarding habitat conditions.

Limiting factors in the Yakima Subbasin and strategies to address them are well described in the Yakima Subbasin Plan (YSFWPB 2004). The following text is a summary of Yakima Basin limiting factors for aquatic habitats excerpted directly from the Subbasin Summary.

> The loss of floodplain habitat, especially side channels and springs adjacent to the mainstem Naches and Yakima rivers, were identified as a significant limiting factor for the productivity of aquatic habitat in the subbasin. Actions to reverse this habitat loss are to relocate infrastructure (where possible) to allow natural processes to operate and reconnection of side channels by removal of obstructions. Artificial channels should be constructed where current conditions allow.
>
> Riparian zone (the area adjacent to the river which is influenced by the river itself) problems include lack of shade and large woody debris (LWD), bank instability, and the inability of black cottonwood to reproduce under existing flow regimes. The Subbasin Plan calls for restoration of riparian zones and reduction of chronic bed instability through revegetation, introduction of LWD, protection of riparian areas by purchase or easement, improved riparian area management, and restoration of natural flow regime.
>
> Channel confinement by levees, bridges and roads leads to altered floodplain functions and habitat loss. Multi-jurisdictional floodplain restoration and flood hazard reduction projects are necessary to reconnect floodplain side channels and to restore "unmanaged" or natural floodplain habitats.
>
> The presence of reservoirs in the system has reduced peak flows and may have either increased or decreased energy available for sediment transport. The effect the natural glacial lakes had on flow and other attributes such as temperature is not well understood, and therefore we do not have accurate guides to pre-1850s conditions. Characterizations of the pre-1850s flow regimes are important for evaluation of how system function has changed, and how those changes have affected fish and wildlife populations. An objective is to find or create a new model to simulate the physical, chemical, thermal effects of lakes in the pre-1850s environment so that we can better understand the difference between current conditions and conditions that existed before the lakes were dammed.
>
> Altered flows of water, sediment and water temperature changes (mostly summer increases) severely reduce the quantity and quality of aquatic habitats. The Plan contains objectives to replicate basin wide temperature variability by returning the timing and quantity of river flow to a more natural state. This restoration of a normative flow regime can be accomplished by the purchase, transfer, or lease of water rights; changes in flow management, conservation; and increased natural and artificial storage.

There is a high predation risk for juvenile salmonids in the Subbasin. To reduce the effect of elevated predation it is recommended to increase the number of spawning fish in the Yakima Subbasin, reduce populations of smallmouth bass in the lower Yakima River, improve cover and off channel habitats, and implement further control on predator populations in mainstem reservoirs.

Passage barriers and unscreened diversions and pumps have significant negative effects on salmon productivity. Related objectives of the plan are to improve passage and design of irrigation diversions to allow fish and sediment to pass through diversion points. The strategies recommended are to reduce or eliminate operational spill to tributaries during migration periods, increase irrigation efficiency, relocate or consolidate existing structures, replace or rebuild existing diversion dams, move or consolidate diversions, and provide pump screens to landowners.

Kachess, Kecheelus, Cle Elum and Bumping Dams block passage for sockeye and bull trout and Tieton Dam blocks passage for bull trout. A high priority objective is to restore passage to at least one dam by 2007, possibly through various fish passage options such as ladders, trap and haul, and modification of outlets for downstream passage.

Steelhead populations have been reduced from pre-1850s abundance levels because of habitat loss and alteration and changes in the biotic community. These factors have reduced habitat suitability, which in turn has reduced productivity, abundance, and spatial distribution of the species. To increase the abundance, productivity, and genetic diversity (and therefore stability), of the species it is recommended to increase distribution of healthy steelhead populations in areas that are currently suitable but inaccessible, such as Cowiche Creek and possibly Taneum Creek, and improve habitat in those areas currently accessible but of low quality. Steelhead population should be monitored for abundance, distribution, and genetic diversity.

Steelhead abundance and productivity have also been reduced due to a severe reduction in repeat spawning. To increase the number of repeat spawning steelhead in Yakima Subbasin, collect spawned out steelhead kelts and 1) recondition these kelts for release in the subbasin for natural spawning, and/or 2) transport kelts below the Columbia River dams to increase repeat spawning.

At least three specific (NPCC/BPA-sponsored) projects are ongoing in the Yakima Basin which are aimed at addressing limiting factors in the Basin (with some sub-components of these projects aimed specifically at enhancing steelhead habitats in the Basin):
199603501 – Yakama Reservation Watersheds Project
199705100 – Yakima Basin Side Channels
199206200 – Yakama Nation – Riparian/Wetlands Restoration

3.5) Ecological interactions. [Please review Addendum A before completing this section. If it is necessary to complete Addendum A, then limit this section to NMFS jurisdictional species. Otherwise complete this section as is.]
Describe salmonid and non-salmonid fishes or other species that could (1) negatively impact program; (2) be negatively impacted by program; (3) positively impact program;

and (4) be positively impacted by program. Give most attention to interactions between listed and "candidate" salmonids and program fish.

No negative ecological interactions are anticipated as a result of this project. Ecological interactions will be assessed indirectly via other work being conducted pursuant to YKFP activities in the Yakima Basin.

SECTION 4. WATER SOURCE

4.1) Provide a quantitative and narrative description of the water source (spring, well, surface), water quality profile, and natural limitations to production attributable to the water source.

For integrated programs, identify any differences between hatchery water and source, and "natal" water used by the naturally spawning population. Also, describe any methods applied in the hatchery that affect water temperature regimes or quality. Include information on water withdrawal permits, National Pollutant Discharge Elimination System (NPDES) permits, and compliance with NMFS screening criteria.

Prosser Hatchery operates under NPDES permit WAG135017.

Prosser Hatchery has the ability to use 30 cfs Yakima River water, and has three wells that contribute 3200 gallons per minute. The river water supply is used from March through July for juvenile fish rearing and September through January for adult broodstock. The surface water is gravity flow from Chandler Canal behind the fish screens. One well is used from September through April to incubate eggs. The well is capable of pumping 800 gallons per minute. The other two wells are used all year to rear juvenile salmon and adult steelhead kelts. Each well is able to pump 1,200 gallons per minute. The well water is constant 57 degrees F, and the surface water temperature changes with the seasons. The water used meets or exceeds the recommended Integrated Hatchery Operations Team (IHOT) guidelines.

4.2) Indicate risk aversion measures that will be applied to minimize the likelihood for the take of listed natural fish as a result of hatchery water withdrawal, screening, or effluent discharge.

(e.g. "Hatchery intake screens conform with NMFS screening guidelines to minimize the risk of entrainment of juvenile listed fish.").

The production from this facility falls below the minimum production requirement for an NPDES permit, but the facility operates in compliance with state or federal regulations for discharge. Chandler Canal is screened to prevent juvenile salmonids from entering the canal and the hatchery intake. See also 4.1.

SECTION 5. FACILITIES

Provide descriptions of the hatchery facilities that are to be included in this plan (see "Guidelines for Providing Responses" Item E), including dimensions of trapping, holding incubation, and rearing facilities. Indicate the fish life stage held or reared in each. Also describe any instance where operation of the hatchery facilities, or new construction, results in destruction or adverse modification of critical habitat designated for listed salmonid species.

5.1) **Broodstock collection facilities (or methods)**.

Kelt reconditioning research is conducted at the Prosser Fish Hatchery in Prosser, Washington. Prosser Hatchery is located on the Yakima River at river kilometer, (rkm) 75.6, downstream from Prosser Dam, and adjacent to the Chandler Juvenile Monitoring Facility (CJMF). The Yakima River is approximately 344 km in length and enters the Columbia River at rkm 539. Summer steelhead populations primarily spawn upstream from Prosser Dam in Satus Creek, Toppenish Creek, Naches River, and other tributaries of the Yakima River (TRP 1995). The Yakama Nation (YN) operates Prosser Hatchery, with a primary function of rearing, acclimation, and release of fall chinook salmon *O. tshawytscha*. The facility is also used for coho salmon *O. kisutch* rearing prior to acclimation and release in the upper Yakima River Basin.

After spawning naturally in tributaries of the Yakima River, a proportion of the steelhead kelts that encounter the Prosser Dam facility during emigration are diverted into an irrigation channel that directly connects to the Chandler Juvenile Monitoring Facility. The CJMF diverts migratory fishes away from the irrigation canal to reduce mortality associated with agriculture. Once diverted into the CJMF, emigrating kelts can be manually collected from a fish separation device (a device which allows smaller juvenile salmonids to “fall through” for processing in the juvenile facility while larger fish can be dipnetted off the separator for processing or release back to the river). Yakama Nation (YN) staff monitor the Chandler bypass separator 24 hours a day from mid-March mid-July annually. All adult steelhead arriving at the CJMF separator, regardless of maturation status (kelt or pre-spawn), are dipnetted off the separator and placed into a water-lubricated PVC pipe slide that was directly connected to a temporary holding tank 20’ (l) x 6’ (w) x 4’(h) containing oxygenated well water (57F or 13.8C).

Out-migrating steelhead kelt specimens are transferred with a dipnet from the temporary holding tank to a nearby 190-L sampling tank containing fresh river water, and anesthetized in a buffered solution of tricaine methanesulfonate (MS-222) at 60 ppm.

All specimens visually determined to be prespawn individuals are immediately returned to the Yakima River. Following kelt identification, we collect data on weight (collected in pounds but converted to kg for reporting purposes), condition (good- lack of any wounds or descaling, fair- lack of any major wounds and/or descaling, poor- major wounds and/or descaling), coloration (bright, medium, dark), and presence or absence of physical anomalies (e.g., head burn, eye damage). Steelhead kelts in poor condition and dark in color are released back in the river, all others are retained for reconditioning. Passive Integrated Transponder (PIT) tags (if not already present) are then implanted in the fish’s abdominal cavity for individual fish identification during reconditioning.

Upon admission of kelts to the reconditioning program at Prosser Hatchery, all kelts are retained in one of four 20’(diameter) x 4’(h) circular tanks. Individual tank carrying capacity was set at a maximum of 200 fish based on the aquaculture experience of YN hatchery staff, and the project goal of maximizing kelt survival in captivity. Formalin was administered five times weekly at 1:6,000 for 1 hour in all reconditioning tanks to prevent fungal outbreaks.

5.2) Fish transportation equipment (description of pen, tank truck, or container used).

See 5.1 Once kelts are reconditioned, fish are transported in either a 400 gallon tank placed on the back of a pick up truck, or a three compartment 1500 gallon tank on a flatbed for transportation to release site(s): either below Bonneville Dam, Wallula Gap, or Mabton. Both trucks are designed to safely haul fish equipped with oxygen and aeration system.

5.3) Broodstock holding and spawning facilities.

See 5.1.

5.4) Incubation facilities.

Not applicable.

5.5) Rearing facilities.

See 5.1.

5.6) Acclimation/release facilities.

See 1.11.1 and 5.1.

5.7) Describe operational difficulties or disasters that led to significant fish mortality.

Given the low natural iteroparity rates observed in the literature, natural mortality rates for steelhead kelts are assumed to be very high. Mortalities of kelts held for reconditioning are generally assumed to be related to the natural condition of these post-spawned steelhead.

5.8) Indicate available back-up systems, and risk aversion measures that will be applied, that minimize the likelihood for the take of listed natural fish that may result from equipment failure, water loss, flooding, disease transmission, or other events that could lead to injury or mortality.
(e.g. "The hatchery will be staffed full-time, and equipped with a low-water alarm system to help prevent catastrophic fish loss resulting from water system failure.").

The facility is sited so as to minimize the risk of catastrophic fish loss from flooding. At Prosser Hatchery, staff members are on-site 24/7 during critical phases of the program, and the facility is enclosed in chain linked fence, and periodic patrols of law enforcement (local and tribal) maintain a security envelope of facility.

SECTION 6. BROODSTOCK ORIGIN AND IDENTITY

Describe the origin and identity of broodstock used in the program, its ESA-listing status, annual collection goals, and relationship to wild fish of the same species/population.

6.1) Source.

List all historical sources of broodstock for the program. Be specific (e.g., natural spawners from Bear Creek, fish returning to the Loon Creek Hatchery trap, etc.).

Steelhead kelts are collected at Prosser Dam and therefore may be one of several populations residing in the Yakima Basin (e.g., Satus, Toppenish, Ahtanum, upper Yakima, Naches, etc.). Releasing reconditioned kelts in the vicinity of Prosser in late October to early December allows the fish to decide for themselves where in the Basin they will migrate to. See also 1.11.1 and 5.1.

6.2) Supporting information.

6.2.1) History.

Provide a brief narrative history of the broodstock sources. For listed natural populations, specify its status relative to critical and viable population thresholds (use section 2.2.2 if appropriate). For existing hatchery stocks, include information on how and when they were founded, sources of broodstock since founding, and any purposeful or inadvertent selection applied that changed characteristics of the founding broodstock.

Steelhead are no longer stocked in the Yakima subbasin, but over the years steelhead from several sources were introduced, most notably the Skamania stock, which originated from the Washougal River. The co-managers agreed in the mid-1980s that a new approach was needed for Yakima steelhead enhancement, and entered into an agreement to produce fish from wild Yakima broodstock. In 1985 the YN and WDFW started a hatchery production program with wild Yakima stocks. Broodstock were trapped by YN at Prosser Dam and transported to the WDFW Yakima hatchery for spawning, egg incubation and rearing. Final rearing was at the Nelson Springs raceway by volunteers from the Yakima Chapter, Northwest Steelhead and Salmon Council of Trout Unlimited. The co-mangers agreed that wild broodstock collection should discontinue after 1989 because of a low smolt-to-adult survival rate, and because there was no way to differentiate steelhead populations at Prosser Dam. From 1990 through 1992 a small number of adult Yakima subbasin steelhead were trapped and their progeny reared by Yakima-Klickitat Fisheries Project (YKFP) researchers to evaluate species interactions in the upper Yakima River. Hatchery-produced steelhead smolts were last released in the Yakima subbasin in 1993. Since the last of these fish likely returned by 1998, any steelhead returning to the Yakima Basin with fin clips since that time are designated “hatchery” and are most probably out-of-basin strays. There have been no hatchery bull trout programs in the Yakima subbasin.

6.2.2) Annual size.

Provide estimates of the proportion of the natural population that will be collected for broodstock. Specify number of each sex, or total number and sex ratio, if known. For broodstocks originating from natural populations, explain how their use will affect their population status relative to critical and viable thresholds.

See 2.2.2 for annual steelhead returns (upstream migration) to the Yakima Basin. See 1.11.1 for annual kelt (downstream migration) collections at Chandler.

6.2.3) Past and proposed level of natural fish in broodstock.

If using an existing hatchery stock, include specific information on how many natural fish *were incorporated into the broodstock annually.*

All fish used in this program are wild/natural fish.

6.2.4) Genetic or ecological differences.
Describe any known genotypic, phenotypic, or behavioral differences between current or proposed hatchery stocks and natural stocks in the target area.

Yakima River summer steelhead spawn in tributaries of the Yakima Basin including: Satus, Toppenish, and Ahtanum Creeks, and the Naches and Upper Yakima River systems, and there is some evidence of genetic uniqueness among these subpopulations (Small et al. 2006). The Interior Columbia Technical Recovery Team designated four populations within the Yakima River major population group: Satus, Toppenish, Naches River, and Yakima River upper mainstem (ICTRT 2003 and 2005).

6.2.5) Reasons for choosing.
Describe any special traits or characteristics for which broodstock was selected.

See 6.1 and other earlier responses.

6.3) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish that may occur as a result of broodstock selection practices.
(e.g. "*The risk of among population genetic diversity loss will be reduced by selecting the indigenous chinook salmon population for use as broodstock in the supplementation program.*").

See earlier responses and Kelt Reconditioning: A Research Project to Enhance Iteroparity in Columbia Basin Steelhead (*Oncorhynchus mykiss*), BPA Project Annual reports, DOE #00004185[-1 through -4], available on BPA website at http://www.bpa.gov/efw/pub/searchpublication.aspx

SECTION 7. BROODSTOCK COLLECTION

7.1) Life-history stage to be collected (adults, eggs, or juveniles).

Adult (post-spawned) steelhead kelts.

7.2) Collection or sampling design.
Include information on the location, time, and method of capture (e.g. weir trap, beach seine, etc.) Describe capture efficiency and measures to reduce sources of bias that could lead to a non-representative sample of the desired broodstock source.

See 1.11.1 and 5.1.

7.3) Identity.

Describe method for identifying (a) target population if more than one population may be present; and (b) hatchery origin fish from naturally spawned fish.

Steelhead kelts are collected at Prosser Dam and therefore may be one of several populations residing in the Yakima Basin (e.g., Satus, Toppenish, Ahtanum, upper Yakima, Naches, etc.). Releasing reconditioned kelts in the vicinity of Prosser in late October to early December allows the fish to decide for themselves where in the Basin they will migrate to. See also 1.11.1 and 5.1.

7.4) Proposed number to be collected:

7.4.1) Program goal (assuming 1:1 sex ratio for adults):

There is no program goal in terms of the number of kelts to be collected for this program. Rather, kelts which are entrained into the Chandler irrigation diversion canal on their downstream migration are considered "volunteers" to the program and handled as described in 1.11.1.

7.4.2) Broodstock collection levels for the last twelve years (e.g. 1988-99), or for most recent years available:

See 1.11.1.

7.5) Disposition of hatchery-origin fish collected in surplus of broodstock needs.
Describe procedures for remaining within programmed broodstock collection or allowable upstream hatchery fish escapement levels, including culling.

Not applicable. As described earlier (6.2.1), very few marked (hatchery) fish return to the Yakima Basin any more, and those that do are assumed to be strays from out-of-basin that escape to the natural spawning grounds.

7.6) Fish transportation and holding methods.
Describe procedures for the transportation (if necessary) and holding of fish, especially if captured unripe or as juveniles. Include length of time in transit and care before and during transit and holding, including application of anesthetics, salves, and antibiotics.

See 5.1.

7.7) Describe fish health maintenance and sanitation procedures applied.

Integrated Hatchery Operations Team (IHOT 1995), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed at the Prosser Hatchery for all hatchery activities. The Yakama Nation maintains subcontracts with the U.S. Fish and Wildlife Service for fish health screening and consultation.

7.8) Disposition of carcasses.

Include information for spawned and unspawned carcasses, sale or other disposal methods, and use for stream reseeding.

In the past kelt mortalities were bio-sampled (sex, length, weight, etc.), PIT tags were removed, and carcasses were placed in the river each day. Beginning in 2005, kelt mortalities are being stored in the freezer to take bio samples later. The PIT tags will be removed and the carcasses will be heated to remove any chance of virus and they will be distributed in the tributaries. All surviving kelts (including immatures) are released at the end of each year's long-term reconditioning program.

7.9) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the broodstock collection program.
(e.g. "The risk of fish disease amplification will be minimized by following Co-manager Fish Health Policy sanitation and fish health maintenance and monitoring guidelines").

See earlier responses.

SECTION 8. MATING

Describe fish mating procedures that will be used, including those applied to meet performance indicators identified previously.

8.1) Selection method.

Specify how spawners are chosen (e.g. randomly over whole run, randomly from ripe fish on a certain day, selectively chosen, or prioritized based on hatchery or natural origin).

See 1.11.1. Steelhead kelts reconditioned in this program are taken from the entire downstream kelt migration population. Kelts are randomly entered into the various reconditioning treatments. Kelts released below Bonneville Dam in the "no term" and "short term" programs re-enter the wild/natural population and surviving and returning fish from these programs obviously choose their own spawning mates, timing and location. Kelts from the "long term" program are released in the vicinity of Prosser Dam in late October to early December coincident with the peak of upstream migrating "fresh" fish returning from the ocean. Thus, these fish are also allowed to choose their own spawning mates, timing and location.

8.2) Males.

Specify expected use of backup males, precocious males (jacks), and repeat spawners.

Not applicable.

8.3) Fertilization.

Describe spawning protocols applied, including the fertilization scheme used (such as equal sex ratios and 1:1 individual matings; equal sex ratios and pooled gametes; or factorial matings). Explain any fish health and sanitation procedures used for disease prevention.

Not applicable.

8.4) Cryopreserved gametes.

If used, describe number of donors, year of collection, number of times donors were used in the past, and expected and observed viability.

In 2005, the milt from one "fresh" male destined for the Satus Creek drainage was cryo-preserved and stored at the University of Idaho. The milt from this male was tested and had 83% observed viability (compared to 90% expected). However, the female that was used in the same Gamete and Progeny study perished and Gamete and Progeny analysis was terminated due to concerns of mining the wild population from Satus Creek by both CRITFC and YN staff. The possibility of utilizing cryo-preservation in 2008-09 using wild kelts or first time spawning males was reestablished in planning meetings late in 2007 to assist in evaluation of the viability of female kelt gametes.

8.5) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic or ecological effects to listed natural fish resulting from the mating scheme.

(*e.g. "A factorial mating scheme will be applied to reduce the risk of loss of within population genetic diversity for the small chum salmon population that is the subject of this supplementation program".*).

See 8.1.

SECTION 9. INCUBATION AND REARING -

Specify any management *goals* (e.g. "egg to smolt survival") that the hatchery is currently operating under for the hatchery stock in the appropriate sections below. Provide data on the success of meeting the desired hatchery goals.

9.1) Incubation:

9.1.1) Number of eggs taken and survival rates to eye-up and/or ponding.

Provide data for the most recent twelve years (1988-99), or for years dependable data are available.

Not applicable.

9.1.2) Cause for, and disposition of surplus egg takes.

Describe circumstances where extra eggs may be taken (e.g. as a safeguard against potential incubation losses), and the disposition of surplus fish safely carried through to the eyed eggs or fry stage to prevent exceeding of programmed levels.

Not applicable.

9.1.3) Loading densities applied during incubation.

Provide egg size data, standard incubator flows, standard loading per Heath tray (or other incubation density parameters).

Upon admission of kelts to the reconditioning program at Prosser Hatchery, all kelts were retained in one of four 20'(diameter) x 4'(h) circular tanks. Individual tank carrying capacity was set at a maximum of 200 fish based on the aquaculture experience of YN hatchery staff, and the project goal of maximizing kelt survival in captivity. Formalin was administered five times weekly at 1:6,000 for 1 hour in all reconditioning tanks to prevent fungal outbreaks.

9.1.4) Incubation conditions.
Describe monitoring methods, temperature regimes, minimum dissolved oxygen criteria (influent/effluent), and silt management procedures (if applicable), and any other parameters monitored.

Not applicable.

9.1.5) Ponding.
Describe degree of button up, cumulative temperature units, and mean length and weight (and distribution around the mean) at ponding. State dates of ponding, and whether swim up and ponding are volitional or forced.

Not applicable.

9.1.6) Fish health maintenance and monitoring.
Describe fungus control methods, disease monitoring and treatment procedures, incidence of yolk-sac malformation, and egg mortality removal methods.

Integrated Hatchery Operations Team (IHOT 1995), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed at the Prosser Hatchery for all hatchery activities. The Yakama Nation maintains subcontracts with the U.S. Fish and Wildlife Service for fish health screening and consultation.

9.1.7) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish during incubation.
(*e.g. "Eggs will be incubated using well water only to minimize the risk of catastrophic loss due to siltation."*)

Not applicable.

9.2) Rearing:

9.2.1) Provide survival rate data (*average program performance*) by hatchery life stage (fry to fingerling; fingerling to smolt) for the most recent twelve years (1988-99), or for years dependable data are available.

Survival to release for short-term reconditioning ranged from 69-93% and averaged 79%. Post-release survival and return of short-term kelts ranged from 1-9% with returning "ocean-reared" kelts showing an average weight gain of 46%. Survival to release for long-term reconditioning ranged from 19-62% and averaged 36% with captive-reared kelts showing an average weight gain of 38%.

9.2.2) Density and loading criteria (goals and actual levels).
Include density targets (lbs fish/gpm, lbs fish/ft3 rearing volume, etc).

See Section 1.11.1, 5.1, and 9.1.3.

9.2.3) Fish rearing conditions
(Describe monitoring methods, temperature regimes, minimum dissolved oxygen, carbon dioxide, total gas pressure criteria (influent/effluent if available), and standard pond management procedures applied to rear fish).

See Section 1.11.1, 5.1, and 9.1.3.

9.2.4) Indicate biweekly or monthly fish growth information (*average program performance*), including length, weight, and condition factor data collected during rearing, if available.

Based on visual observations, the overwhelming majority of kelts captured were female (93.5%). The majority of kelts collected for reconditioning during 2001-2005 were considered in good (43.0%) or fair (56.5%) overall condition. Approximately 51% of kelts classified in good and 40% of kelts in fair condition at collection survived to release. Fewer than 7 kelts per year classified in poor condition at collection were even retained, none of which survived to release. Similarly, the majority of kelts collected for reconditioning during 2001-2005 were considered bright (33.5%) or intermediate (62.6%) in color. Approximately 50% of kelts classified as bright and 42% of kelts intermediate in color at collection survived to release. Almost 140 fish (3.9%) were classified as dark in color at collection, of which 56 (41%) survived to release.

Short-term kelts were held for an average of 44 days before being trucked below Bonneville Dam for release, while long-term kelts were reconditioned for an average of 227 days prior to release. The average weight of surviving kelts captured and held for short-term reconditioning was 2.0 kg. The average weight at release of short-term reconditioned kelts was 1.9 kg representing a mean weight loss during short-term reconditioning of 5.9%. The average weight of surviving kelts captured and held for long-term reconditioning was 2.0 kg. The average weight at release of long-term reconditioned kelts was 2.7 kg representing a mean weight gain during long-term reconditioning of 37.7%. The vast majority (70-90%) of short-term program fish experienced a zero to 20% weight loss, while a substantial proportion (> 45%) of long-term program fish experienced a weight gain of 30% or more during the reconditioning process (Table 3).

Table 9.2.4.1. Holding time and weight change statistics for surviving short- and long-term kelts reconditioned at Prosser hatchery, 2001-2005.

	Days Held	Capture Weight	Release Weight	Percent Weight Change
Short-Term (n = 667)				
Mean	43.5	2.00	1.87	-5.9%

Minimum	21.0	0.90	0.90	-46.8%
Maximum	78.0	4.19	4.12	120.9%
Median	41.0	1.85	1.73	-6.4%
Long-Term (n = 883)				
Mean	227.3	1.97	2.65	37.7%
Minimum	162.0	0.58	0.77	-47.6%
Maximum	294.0	4.48	7.70	210.9%
Median	230.0	1.80	2.48	31.6%

Table 9.2.4.2. Percent of fish by weight change distribution category (percentage change from capture weight to release weight) for surviving short- and long-term kelts reconditioned at Prosser hatchery, 2001-2005.

Percent	Short-Term Releases				Long-Term Releases				
Wt. Chg.	2002	2003	2004	2005	2001	2002	2003	2004	2005
<= -20%	4.0	3.2	0.0	21.8	2.1	7.1	4.0	3.7	4.9
>-20% to 0	72.0	93.5	81.8	69.0	2.1	27.9	12.4	13.8	14.6
>0 to 30%	21.9	2.7	15.2	9.2	11.6	18.6	35.2	38.1	28.0
>30 to 70%	1.5	0.5	3.0	0.0	31.6	28.6	31.5	30.6	29.3
>70 to 100%	0.3	0.0	0.0	0.0	27.4	12.9	10.7	10.1	18.3
>100%	0.3	0.0	0.0	0.0	25.3	5.0	6.0	3.7	4.9

9.2.5) Indicate monthly fish growth rate and energy reserve data (*average program performance*), if available.

Contrast fall and spring growth rates for yearling smolt programs. If available, indicate hepatosomatic index (liver weight/body weight) and body moisture content as an estimate of body fat concentration data collected during rearing.

See 9.2.4.

9.2.6) Indicate food type used, daily application schedule, feeding rate range (e.g. % B.W./day and lbs/gpm inflow), and estimates of total food conversion efficiency during rearing (*average program performance*).

The use of krill as a starter diet was associated with higher overall survival rates while the use of maintenance feed pellets appeared to increase rates of maturation. Kelts that received krill as a starter diet had an average survival rate of 45% compared to only 21% survival for kelts not exposed to krill (Table 9.2.6.1). In the tank that received a diet of just krill, only 25% of surviving fish were classified as mature compared to an average of almost 60% for the three tanks receiving a maintenance diet of pellets. Mean percentage weight gains were highest for fish in tanks which received both a starter diet of krill and a maintenance diet of pellets, while fish which received only krill had the smallest mean weight gain. We used these results to establish a feeding regime for subsequent years. Short-term reconditioned kelts were fed a diet of krill for the duration (3-11 weeks) of their captivity. Long-term reconditioned fish were fed a combination of frozen krill for the first 2.5 months and unaltered Moore-Clarke pellets thereafter.

Table 9.2.6.1. Survival, maturity, and weight (kg) statistics for four experimental feed groups of

steelhead kelts captured and reconditioned at the Prosser Hatchery, March 12 – November 15, 2001.

Feed Description	Tank	Collection N	Survival N	Wt. at Collection Mean	Wt. at Collection Std Dev	Reconditioned Wt. Mean	Reconditioned Wt. Std Dev	Survival Percent	Maturity Percent
Early[a] krill + pellets	C1	130	58	1.99	0.49	3.15	0.99	44.6%	63.8%
Specialized[b] pellets	C2	132	28	1.87	0.51	2.45	0.78	21.2%	67.9%
Late[c] krill + pellets	C3	105	55	1.93	0.65	3.23	1.25	52.4%	47.3%
Krill only	C4	102	40	2.01	0.69	2.30	0.89	39.2%	25.0%

[a] Fish were collected from 12 March to 20 April, 2001.
[b] Fish received only variations of a Moore-Clark Trout Brood Diet, a Moore-Clark Pedigree Salmon Brood Diet, and a wet fish/krill slurry modified from a North Attleboro National Fish Hatchery (NFH) diet all fed in pellet form. The Moore-Clark Trout Brood Diet was modified so that the pellets would float and pellets were top-coated with a krill/squid mixture.
[c] Fish were collected from 23 April to 5 June, 2001.

9.2.7) Fish health monitoring, disease treatment, and sanitation procedures.

Integrated Hatchery Operations Team (IHOT 1995), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed at the Prosser Hatchery for all hatchery activities. The Yakama Nation maintains subcontracts with the U.S. Fish and Wildlife Service for fish health screening and consultation.

9.2.8) Smolt development indices (e.g. gill ATPase activity), if applicable.

Not applicable.

9.2.9) Indicate the use of "natural" rearing methods as applied in the program.

See 1.11.1, 5.1, and 8.1.

9.2.10) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish under propagation.

(*e.g. "Fish will be reared to sub-yearling smolt size to mimic the natural fish emigration strategy and to minimize the risk of domestication effects that may be imparted through rearing to yearling size."*)

See 8.1.

SECTION 10. RELEASE

Describe fish release levels, and release practices applied through the hatchery program.
Specify any management goals (e.g. number, size or age at release, population uniformity, residualization controls) that the hatchery is operating under for the hatchery stock in the appropriate sections below.

10.1) Proposed fish release levels. *(Use standardized life stage definitions by species presented in **Attachment 2**. "Location" is watershed planted (e.g. "Elwha River").)*

Age Class	Maximum Number	Size (fpp)	Release Date	Location

Age Class	Maximum Number	Size (fpp)	Release Date	Location
Eggs	Not applicable – see 1.11.1			
Unfed Fry	Not applicable – see 1.11.1			
Fry	Not applicable – see 1.11.1			
Fingerling	Not applicable – see 1.11.1			
Yearling	Not applicable – see 1.11.1			

10.2) Specific location(s) of proposed release(s).
Stream, river, or watercourse: *(include name and watershed code (e.g. WRIA) number)*
Release point: (*river kilometer location, or latitude/longitude*)
Major watershed: (e.g. "Skagit River")
Basin or Region: *(e.g. "Puget Sound")*

All no-term and short-term reconditioned kelts were transported and released at the Hamilton Island Boat Ramp, below Bonneville Dam (approximate Columbia River Rkm 234) on the lower Columbia River. All long-term reconditioned kelts were transported and released at the Mabton Boat Ramp (Yakima Rkm 96.3) on the Yakima River (WRIA 37).

10.3) Actual numbers and sizes of fish released by age class through the program.
For existing programs, provide fish release number and size data for the past three fish generations, or approximately the past 12 years, if available. Use standardized life stage definitions by species presented in ***Attachment 2****. Cite the data source for this information.*

See 1.11.1 and 5.1.

10.4) Actual dates of release and description of release protocols.
Provide the recent five year release date ranges by life stage produced (mo/day/yr). Also indicate the rationale for choosing release dates, how fish are released (volitionally, forced, volitionally then forced) and any culling procedures applied for non-migrants.

Fish are trucked to the release locations described in 10.2 and released directly to the river. Release dates for the various treatments were as follows:

	2001	2002	2003	2004	2005	2006	2007
Yakima Direct					12Apr – 5May	29Mar – May	12Apr – 1May
No Term				3May	22Apr, 13May	21Apr, 12May	20Apr, 25May
Short Term		20May	4Jun	3May, 11May	13May, 30Jun	12May, 23Jun	25May

Long Term	15Nov	10Dec	8Dec	30Nov	12Dec	17Oct	11Oct

We are evaluating whether nutrition factors could lead to reduced egg development or whether missed environmental cues may lead to hardened or reabsorbed eggs in long-term reconditioned female kelts. A critical period for initiation of maturation in Pacific salmonids is the autumn one year prior to maturation, but the period may extend into late winter and early spring (Flagg and Nash 1999). As the threshold of growth or body fat levels for initiating and maintaining sexual maturation are not yet known, Flagg and Nash (1999) recommended an artificial culture strategy that mimics the patterns of growth and body fat levels of wild fish and suggested feeding high-protein, low-fat diets and reducing the feeding ration over the winter period. Since initiation of maturation in long-term reconditioned kelts may begin in the late summer or early fall, beginning in 2006 we stopped feeding and released long-term reconditioned kelts to the wild 1-2 months earlier than in prior years. This could lead to a more natural repeat spawning cycle with greater potential reproductive success for these fish. See also 1.11.1 and 5.1.

10.5) Fish transportation procedures, if applicable.

Describe fish transportation procedures for off-station release. Include length of time in transit, fish loading densities, and temperature control and oxygenation methods.

The Prosser Hatchery has two transportation trucks which are used to transport reconditioned kelts to release locations described in 10.2.

Equipment Type	Capacity (gallons)	Supplemental Oxygen (y/n)	Temperature Control (y/n)	Normal Transit Time (minutes)	Chemical(s) Used	Dosage (ppm)
Adult Transfer Tanker Truck	700	Y	N	5	Light dose MS	nya
Juvenile Transfer Tanker Truck	2500	Y	N	150	nya	nya

10.6) Acclimation procedures (*methods applied and length of time*).

Not applicable.

10.7) Marks applied, and proportions of the total hatchery population marked, to identify hatchery adults.

If not already present, passive integrated transponder (PIT) tags were implanted in the fish's pelvic girdle (Prentice et al. 1990) upon initial collection and sampling for individual fish identification during reconditioning and post-release tracking.

Radio telemetry was used to determine if reconditioned kelts released in the Yakima River would migrate to spawning areas and construct redds. Prior to release, a subsample of fish from the long-term reconditioning program (ranged from 12-62 fish annually over the 5-year study; 16-56% of fish released) were instrumented with Lotek radio tags (MBFT series, Lotek Engineering Inc., Newmarket, Ontario, Canada). Each tag had unique bandwidth pulses that provided individual identification codes. The tags were programmed to last for at least 155 days;

however, some tags were used and may have had a lesser life. Radio tags were implanted using the gastric insertion technique (Adams et al.1998). Radio-tagged fish were released at the Mabton boat launch (Rkm 93) upstream from Prosser Hatchery. Fish were tracked using fixed and mobile tracking receivers (Lotek Inc.). Fixed receiver sites were located at Prosser Dam (Rkm 76), Slagg Ranch (Rkm 106), Sunnyside Dam (Rkm 167), Roza Dam (Rkm 206), Naches River (Cowiche Dam, Naches Rkm 6), Toppenish Creek (Rkm 71), and Simcoe Creek (Rkm 13). Mobile tracking was done by road and by raft and allowed for actual pinpoint locations and visual observations of steelhead kelt redd construction and spawning. Aerial flights were also conducted in all basins and proved to be essential in locating fish not detected by other methods. See Hatch et al. 2002, 2003, 2004a, and 2004b and Branstetter et al. 2006a and 2006b for details and results from these studies.

In addition, a total of 284 no-term release kelts and short-term reconditioned kelts received hydro-acoustic tags to assess return survival, travel time, and migratory behavior below Bonneville Dam from 2004 through 2007 (see Hatch et al. 2004b and Branstetter et al. 2006a and 2006b).

10.8) Disposition plans for fish identified at the time of release as surplus to programmed or approved levels.

In the past kelt mortalities were bio-sampled (sex, length, weight, etc.), PIT tags were removed, and carcasses were placed in the river each day. Since 2005, kelt mortalities have been stored in the freezer with biological samples taken later. The PIT tags were removed and the carcasses were heated to remove any chance of virus and they were distributed in the tributaries. All surviving kelts (including immatures) are released at the end of each year's long-term reconditioning program (see 1.11.1 and 5.1).

10.9) Fish health certification procedures applied pre-release.

Integrated Hatchery Operations Team (IHOT 1995), Pacific Northwest Fish Health Protection committee (PNFHPC), state or tribal guidelines are followed at the Prosser Hatchery for all hatchery activities. The Yakama Nation maintains subcontracts with the U.S. Fish and Wildlife Service for fish health screening and consultation.

10.10) Emergency release procedures in response to flooding or water system failure.

Fish would be dipnetted from the circular rearing tanks, placed in tanks, and transported by truck or "4-wheeler" tractors to the Yakima River in the vicinity of the hatchery and released directly to the river.

10.11) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from fish releases.
(*e.g. "All yearling coho salmon will be released in early June in the lower mainstem of the Green River to minimize the likelihood for interaction, and adverse ecological effects, to listed natural chinook salmon juveniles, which rear in up-river areas and migrate seaward as sub-yearling smolts predominately in May").*

See earlier responses.

SECTION 11. MONITORING AND EVALUATION OF PERFORMANCE INDICATORS

This section describes how "Performance Indicators" listed in Section 1.10 will be monitored. Results of "Performance Indicator" monitoring will be evaluated annually and used to adaptively manage the hatchery program, as needed, to meet "Performance Standards".

11.1) Monitoring and evaluation of "Performance Indicators" presented in Section 1.10.

11.1.1) Describe plans and methods proposed to collect data necessary to respond to each "Performance Indicator" identified for the program.

To date, monitoring and evaluation has consisted of measuring growth and survival parameters as well as tracking released fish using PIT and radio tags as described in earlier sections of this HGMP. Monitoring and evaluation methods and results to date are more fully described in Bosch et al. (2007 submitted) and in BPA Project Annual reports, DOE #00004185[-1 through -4], available on the BPA website at http://www.bpa.gov/efw/pub/searchpublication.aspx.

11.1.2) Indicate whether funding, staffing, and other support logistics are available or committed to allow implementation of the monitoring and evaluation program.

BPA Fish & Wildlife Program funding is committed for this Project and its associated M&E activities through at least fiscal year 2009.

11.2) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse genetic and ecological effects to listed fish resulting from monitoring and evaluation activities.

(*e.g. "The Wenatchee River smolt trap will be continuously monitored, and checked every eight hours, to minimize the duration of holding and risk of harm to listed spring chinook and steelhead that may be incidentally captured during the sockeye smolt emigration period.)"*

Please refer to the following appendices for information requested in this section:

Appendix A. 2004 Biological Assessment.
Appendix B. 2005 Permit Application
Appendix C. Coverage for Roza adult trapping operations.
Appendix D. Adult and Juvenile Take Tables for Mid-Columbia Steelhead Kelt Reconditioning Projects.
Appendix E. NOAA 2006 Determination Letter.

Contacts: Doug Hatch, CRITFC, 503-238-0667; Mark Johnston or Todd Newsome at 509-865-5121.

SECTION 12. RESEARCH

Provide the following information for any research programs conducted in ***direct association with the hatchery program described in this HGMP. Provide sufficient detail to allow for the independent assessment of the effects of the research program on listed fish****. If applicable, correlate with research indicated as needed in any ESU hatchery plan approved by the co-managers and NMFS. Attach a copy of any formal research proposal addressing activities covered in this section. Include estimated take levels for the research program with take levels provided for the associated hatchery program in* ***Table 1****.*

12.1) Objective or purpose.

Indicate why the research is needed, its benefit or effect on listed natural fish populations, and broad significance of the proposed project.

Populations of wild steelhead *Oncorhynchus mykiss* in the Columbia River Basin have declined dramatically from historical levels (Nehlsen et al. 1991; NRC 1996; Williams et al. 1999) and are now listed under the Endangered Species Act. Average abundance of wild steelhead (summer run; there are no winter run steelhead) in the Yakima River Subbasin over the last two decades is only 2% of pre-1890 abundance levels (Howell et al. 1985). Causes of these declines include a host of environmental and human-induced factors (NRC 1996; Williams et al. 1999). Some measures to restore habitats in the Yakima Subbasin have been identified and are being implemented (YSFWPB 2004). Because habitat restoration is inherently long-term in nature, efforts to sustain or increase abundance in the near-term are also being pursued. However, the substantial biological and genetic diversity inherent in Columbia Basin steelhead (Busby et al. 1996; NOAA 2003) make it difficult to design a cost-effective enhancement program using traditional fish culture practices that preserves this rich diversity.

Columbia River steelhead are iteroparous (able to spawn multiple times). Hockersmith et al. (1995) documented average incidence of natural iteroparity of about 1.6% for Yakima River steelhead from 1989-1993. However, major dams affect their survival as post-spawned steelhead (kelts) attempt to migrate downstream for a return trip to the ocean (Wertheimer and Evans 2005). Therefore, a novel approach to effectively increase abundance and productivity of steelhead populations is to capitalize on their inherent iteroparity by artificially reconditioning kelts. Reconditioning is the practice of capturing, holding, and feeding post-spawned salmon or steelhead in an artificial rearing environment for the purpose of regeneration of gonads for repeat spawning. This concept has been applied to Atlantic salmon *Salmo salar* populations in the U.S. and Canada over the last three decades by maintaining fish in freshwater (Hill 1978; Johnston et al. 1987) and seawater (Ducharme 1972; Gray et al. 1987; Pepper and Parsons 1987). Reconditioning of Atlantic salmon has also been attempted in Europe (Dumas et al. 1991) where natural rates of iteroparity are also low (1%). Artificial reconditioning of sea-run brown trout *Salmo trutta L.* has also been undertaken with some success (Poole et al. 1994; Poole et al. 2002). We could only find one published study of artificially reconditioning steelhead (Wingfield 1976).

The Yakama Nation, in cooperation with the Columbia River Inter-Tribal Fish Commission, is managing a reconditioning project aimed at increasing the survival and potential repeat spawning rates of Yakima River steelhead kelts. The questions we addressed in the initial phase of this project, conducted from 2001 through 2005, were:

1. What feed types result in growth and re-maturation of gonads when rearing kelt steelhead in a captive environment?
2. Do captive kelts grow and survive?
3. Is abundance of potential repeat spawners better enhanced by a short- or long-term reconditioning program?
4. Do reconditioned kelts migrate to the spawning grounds?

To address these questions, wild steelhead kelts from the Yakima River were captured during their emigration past Prosser Dam and through the Chandler irrigation canal (see 1.11.1). These kelts were held in circular tanks at Prosser Hatchery. The short-term program was conducted from 2002 to 2005 while the long-term program was from 2001 to 2005. Short-term program fish were held and fed for three to eleven weeks, then trucked around mainstem irrigation and hydroelectric facilities and released below Bonneville Dam to continue the reconditioning process on their own. Long-term program kelts were reconditioned for about 6-10 months at the Prosser Hatchery, and released at Mabton in late November or early December concurrent with the return of the natural spawning run. This allowed reconditioned kelts to naturally select their spawning location, timing, and mates. The key question of course, is whether reconditioned kelt steelhead were able to successfully spawn and reproduce once they were released to the natural environment. We are addressing this uncertainty more rigorously with additional ongoing research.

12.2) Cooperating and funding agencies.

The YN and CRITFC conduct studies associated with the steelhead reconditioning program. Bonneville Power Administration is the funding agency. See also 1.3.

12.3) Principle investigator or project supervisor and staff.

Joe Blodgett, YN Prosser Complex Hatchery Manager,
Dr. David Fast, YKFP Research Manager,
Douglas R. Hatch, CRITFC research biologist,
Ryan Branstetter, CRITFC research biologist,
Bill Bosch, YKFP Data Manager, and
Todd Newsome, YN Fisheries Biologist.

12.4) Status of stock, particularly the group affected by project, if different than the stock(s) described in Section 2.

Same as described in Section 2.

12.5) Techniques: include capture methods, drugs, samples collected, tags applied.

See earlier responses.

12.6) Dates or time period in which research activity occurs.

Collection of kelts occurs from March through June or early July. Short-term release is in May. Long-term release has occurred from mid-October to early December. Monitoring of returns occurs year-round.

12.7) Care and maintenance of live fish or eggs, holding duration, transport methods.

See section 9 of this HGMP.

12.8) Expected type and effects of take and potential for injury or mortality.

Please refer to the following appendices for information requested in this section:
- Appendix A. 2004 Biological Assessment.
- Appendix B. 2005 Permit Application
- Appendix C. Coverage for Roza adult trapping operations.
- Appendix D. Adult and Juvenile Take Tables for Mid-Columbia Steelhead Kelt Reconditioning Projects.
- Appendix E. NOAA 2006 Determination Letter.

Contacts: Doug Hatch, CRITFC, 503-238-0667; Mark Johnston or Todd Newsome at 509-865-5121.

12.9) Level of take of listed fish: number or range of fish handled, injured, or killed by sex, age, or size, if not already indicated in Section 2 and the attached "take table" (Table 1).

Please refer to the following appendices for information requested in this section:
- Appendix A. 2004 Biological Assessment.
- Appendix B. 2005 Permit Application
- Appendix C. Coverage for Roza adult trapping operations.
- Appendix D. Adult and Juvenile Take Tables for Mid-Columbia Steelhead Kelt Reconditioning Projects.
- Appendix E. NOAA 2006 Determination Letter.

Contacts: Doug Hatch, CRITFC, 503-238-0667; Mark Johnston or Todd Newsome at 509-865-5121.

12.10) Alternative methods to achieve project objectives.

See Section 1.16 of this HGMP.

12.11) List species similar or related to the threatened species; provide number and causes of mortality related to this research project.

Please refer to the following appendices for information requested in this section:
- Appendix A. 2004 Biological Assessment.
- Appendix B. 2005 Permit Application

Appendix C. Coverage for Roza adult trapping operations.
Appendix D. Adult and Juvenile Take Tables for Mid-Columbia Steelhead Kelt Reconditioning Projects.
Appendix E. NOAA 2006 Determination Letter.

Contacts: Doug Hatch, CRITFC, 503-238-0667; Mark Johnston or Todd Newsome at 509-865-5121.

12.12) Indicate risk aversion measures that will be applied to minimize the likelihood for adverse ecological effects, injury, or mortality to listed fish as a result of the proposed research activities.
(*e.g. "Listed coastal cutthroat trout sampled for the predation study will be collected in compliance with NMFS Electrofishing Guidelines to minimize the risk of injury or immediate mortality.").*

See earlier responses in this HGMP.

SECTION 13. ATTACHMENTS AND CITATIONS

Include all references cited in the HGMP. In particular, indicate hatchery databases used to provide data for each section. Include electronic links to the hatchery databases used (if feasible), or to the staff person responsible for maintaining the hatchery database referenced (indicate email address). Attach or cite (where commonly available) relevant reports that describe the hatchery operation and impacts on the listed species or its critical habitat. Include any EISs, EAs, Biological Assessments, benefit/risk assessments, or other analysis or plans that provide pertinent background information to facilitate evaluation of the HGMP.

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SECTION 14. CERTIFICATION LANGUAGE AND SIGNATURE OF RESPONSIBLE PARTY

"I hereby certify that the information provided is complete, true and correct to the best of my knowledge and belief. I understand that the information provided in this HGMP is submitted for the purpose of receiving limits from take prohibitions specified under the Endangered Species Act of 1973 (16 U.S.C.1531-1543) and regulations promulgated thereafter for the proposed hatchery program, and that any false statement may subject me to the criminal penalties of 18 U.S.C. 1001, or penalties provided under the Endangered Species Act of 1973."

Name, Title, and Signature of Applicant:

Certified by_____________________________ Date:_____________

Table 1. Estimated listed salmonid take levels of by hatchery activity. See Tables in Appendices C and D.

Listed species affected: _________________________ ESU/Population:________________________________ Activity:____________________				
Location of hatchery activity:_____________________ Dates of activity:____________________ Hatchery program operator:_________________				
Type of Take	**Annual Take of Listed Fish By Life Stage (*Number of Fish*)**			
	Egg/Fry	Juvenile/Smolt	Adult	Carcass
Observe or harass a)				
Collect for transport b)				
Capture, handle, and release c)				
Capture, handle, tag/mark/tissue sample, and release d)				
Removal (e.g. broodstock) e)				
Intentional lethal take f)				
Unintentional lethal take g)				
Other Take (specify) h)				

a. Contact with listed fish through stream surveys, carcass and mark recovery projects, or migrational delay at weirs.
b. Take associated with weir or trapping operations where listed fish are captured and transported for release.
c. Take associated with weir or trapping operations where listed fish are captured, handled and released upstream or downstream.
d. Take occurring due to tagging and/or bio-sampling of fish collected through trapping operations prior to upstream or downstream release, or through carcass recovery programs.
e. Listed fish removed from the wild and collected for use as broodstock.
f. Intentional mortality of listed fish, usually as a result of spawning as broodstock.
g. Unintentional mortality of listed fish, including loss of fish during transport or holding prior to spawning or prior to release into the wild, or, for integrated programs, mortalities during incubation and rearing.
h. Other takes not identified above as a category.

Instructions:

1. *An entry for a fish to be taken should be in the take category that describes the greatest impact.*
2. *Each take to be entered in the table should be in one take category only (there should not be more than one entry for the same sampling event).*
3. *If an individual fish is to be taken more than once on separate occasions, each take must be entered in the take table.*

Attachment 1. Definition of terms referenced in the HGMP template.

Augmentation - The use of artificial production to increase harvestable numbers of fish in areas where the natural freshwater production capacity is limited, but the capacity of other salmonid habitat areas will support increased production. Also referred to as “fishery enhancement”.

Critical population threshold - An abundance level for an independent Pacific salmonid population below which: depensatory processes are likely to reduce it below replacement; short-term effects of inbreeding depression or loss of rare alleles cannot be avoided; and productivity variation due to demographic stochasticity becomes a substantial source of risk.

Direct take - The intentional take of a listed species. Direct takes may be authorized under the ESA for the purpose of propagation to enhance the species or research.

Evolutionarily Significant Unit (ESU) - NMFS definition of a distinct population segment (the smallest biological unit that will be considered to be a species under the Endangered Species Act). A population will be/is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species.

Harvest project - Projects designed for the production of fish that are primarily intended to be caught in fisheries.

Hatchery fish - A fish that has spent some part of its life-cycle in an artificial environment and whose parents were spawned in an artificial environment.

Hatchery population - A population that depends on spawning, incubation, hatching or rearing in a hatchery or other artificial propagation facility.

Hazard - Hazards are undesirable events that a hatchery program is attempting to avoid.

Incidental take - The unintentional take of a listed species as a result of the conduct of an otherwise lawful activity.

Integrated harvest program - Project in which artificially propagated fish produced primarily for harvest are intended to spawn in the wild and are fully reproductively integrated with a particular natural population.

Integrated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), and fish produced are intended to spawn in the wild or be genetically integrated with the targeted natural population(s). Sometimes referred to as “supplementation”.
Isolated harvest program - Project in which artificially propagated fish produced primarily for harvest are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Isolated recovery program - An artificial propagation project primarily designed to aid in the recovery, conservation or reintroduction of particular natural population(s), but the fish produced are not intended to spawn in the wild or be genetically integrated with any specific natural population.

Mitigation - The use of artificial propagation to produce fish to replace or compensate for loss of fish or fish production capacity resulting from the permanent blockage or alteration of habitat by human activities.

Natural fish - A fish that has spent essentially all of its life-cycle in the wild and whose parents spawned in the wild. Synonymous with *natural origin recruit (NOR).*

Natural origin recruit (NOR) - See *natural fish* .

Natural population - A population that is sustained by natural spawning and rearing in the natural habitat.

Population - A group of historically interbreeding salmonids of the same species of hatchery, natural, or unknown parentage that have developed a unique gene pool, that breed in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, can be separated from another population by genotypic or demographic characteristics. This term is synonymous with stock.

Preservation (Conservation) - The use of artificial propagation to conserve genetic resources of a fish population at extremely low population abundance, and potential for extinction, using methods such as captive propagation and cryopreservation.

Research - The study of critical uncertainties regarding the application and effectiveness of artificial propagation for augmentation, mitigation, conservation, and restoration purposes, and identification of how to effectively use artificial propagation to address those purposes.

Restoration - The use of artificial propagation to hasten rebuilding or reintroduction of a fish population to harvestable levels in areas where there is low, or no natural production, but potential for increase or reintroduction exists because sufficient habitat for sustainable natural production exists or is being restored.

Stock - (see “Population”).

Take - To harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.

Viable population threshold - An abundance level above which an independent Pacific salmonid population has a negligible risk of extinction due to threats from demographic variation (random or directional), local environmental variation, and genetic diversity changes (random or directional) over a 100-year time frame.

Attachment 2. Age class designations by fish size and species for salmonids released from hatchery facilities.

(generally from Washington Department of Fish and Wildlife, November, 1999).

	SPECIES/AGE CLASS	SIZE CRITERIA Number of fish/pound	Grams/fish
X	Chinook Yearling	<=20	>=23
X	Chinook (Zero) Fingerling	>20 to 150	3 to <23
X	Chinook Fry	>150 to 900	0.5 to <3
X	Chinook Unfed Fry	>900	<0.5
X	Coho Yearling 1/	<20	>=23
X	Coho Fingerling	>20 to 200	2.3 to <23
X	Coho Fry	>200 to 900	0.5 to <2.3
X	Coho Unfed Fry	>900	<0.5
X	Chum Fed Fry	<=1000	>=0.45
X	Chum Unfed Fry	>1000	<0.45
X	Sockeye Yearling 2/	<=20	>=23
X	Sockeye Fingerling	>20 to 800	0.6 to <23
X	Sockeye Fall Releases	<150	>2.9
X	Sockeye Fry	> 800 to 1500	0.3 to <0.6
X	Sockeye Unfed Fry	>1500	<0.3
X	Pink Fed Fry	<=1000	>=0.45
X	Pink Unfed Fry	>1000	<0.45
X	Steelhead Smolt	<=10	>=45
X	Steelhead Yearling	<=20	>=23
X	Steelhead Fingerling	>20 to 150	3 to <23
X	Steelhead Fry	>150	<3
X	Cutthroat Trout Yearling	<=20	>=23
X	Cutthroat Trout Fingerling	>20 to 150	3 to <23
X	Cutthroat Trout Fry	>150	<3
X	Trout Legals	<=10	>=45
X	Trout Fry	>10	<45

1/ Coho yearlings defined as meeting size criteria <u>and</u> 1 year old at release, <u>and</u> released prior to June 1st.
2/ Sockeye yearlings defined as meeting size criteria <u>and</u> 1 year old.

Appendix A. 2004 Biological Assessment.

Biological Assessment of Incidental Impacts on Salmon Species Listed Under the Endangered Species Act in the Proposed Research Project: Kelt Reconditioning: A Research Project to Enhance Iteroparity in Columbia Basin Steelhead *(Oncorhynchus mykiss)*

2004- Dec. 31st, 2006

Prepared by the
Columbia River Inter-Tribal Fish Commission

July 14, 2004

Table of Contents

Introduction

Biological Assessment of Incidental Impacts on Salmon Species Listed Under the Endangered Species Act in the Proposed Research Project:

This biological assessment has been prepared by staff of the Columbia River Inter-Tribal Fish Commission by and through the Bureau of Indian Affairs (BIA) as trustee for the Commission's member tribes for the purpose of initiating a consultation process for proposed research on steelhead in the mid-Columbia and upper Columbia that may affect species listed for protection under the Endangered Species Act (ESA). This biological assessment describes new proposed research activities. The project will be under the direction of researchers from the Columbia River Inter-Tribal Fish Commission's Fishery Science department, in cooperation with staff from the Yakama Nation, Confederated Tribes of the Warm Springs Reservation, and the Confederated Tribes of the Colville Indian Reservation.

The described research in this biological assessment will occur between May 15, 2004, and December 31, 2005, and includes:

- Evaluating effects of directly transporting steelhead kelts around the hydro system on enhancement of iteroparity.
- Evaluating effects of long-term kelt reconditioning and subsequent release for natural spawning on enhancement of iteroparity.
- Evaluating effects of long-term kelt reconditioning and captive spawning on: a) gamete and progeny viability; and b) enhancement of iteroparity.
- Examining reproductive success in hatchery-origin, natural-origin, and reconditioned kelt steelhead in several streams

RPA Number	Description
NMFS RPA 107	Assess survival of adult salmonids migrating upstream, and factors contributing to unaccountable losses.
NMFS RPA 118	Assess and enumerate indirect prespawning mortality of upstream-migrating fish. Enhance efforts to enumerate unaccountable losses in mainstem reservoirs.
NMFS RPA 184	Develop an hatchery research, monitoring, and evaluation program to determine whether hatchery reforms reduce the risk of extinction for salmonids
RA 994	Assess adult salmon passage success in the lower Columbia and Snake rivers, evaluate specific flow and spill conditions, and evaluate measures to improve adult anadromous passage.
RM&E Topics:	General migration corridor; NMFS RPAs and RAs: 85,87,190, 193
	Adult homing/straying: Outmigration of steelhead kelts;

	NMFS RPAs and RAs: 37,109,199,1224,2000
Corps Action 109	The Corps shall initiate an adult steelhead downstream migrant (kelt) assessment program to determine the magnitude of passage, the contribution to population diversity and growth, and potential actions to provide safe passage (Draft Mainstem/Systemwide Artificial Production Program Summary, pg 24).

This biological assessment provides a description and evaluation of the effects of the proposed research project on the following listed "species" as so designated by NOAA Fisheries or the U.S. Fish and Wildlife Service for protection under the ESA: Upper Columbia river steelhead ESU, Middle Columbia River steelhead ESU, and Columbia River Bull Trout ESU.

Description of Fish Stocks

<u>Steelhead</u> **(***Oncorynchus mykiss***)**
Historically, summer steelhead differed in their time of entry into the Columbia River and were defined accordingly as groups A and B in the CRFMP and in the Status Review of West Coast Steelhead. These designations are based on the observation of a bimodal migration of adult steelhead at Bonneville Dam and differences in age (1-versus 2-ocean) and adult size observed among Snake River steelhead (Busby et al 1996). Typically, adult A-run steelhead enter fresh water from June to August; as defined, the A-run passes Bonneville Dam before 25 August (CBFWA 1990). Group A steelhead originate in production areas throughout the Columbia River Basin, whereas Group B steelhead are believed to originate only in portions of the Clearwater and Salmon River drainages in Idaho (TAC 1997). Upper Columbia River steelhead are designated as Group A

<u>Bull Trout</u> **(***Salvelinus confluentus***)**
Historically bull trout were found throughout the Columbia River Basin. At present, bull trout are found primarily in upper tributary streams and in lake and reservoir systems; they have been eliminated or have been greatly reduced in the mainstems of large rivers. Upper Columbia River bull trout can be migratory or resident (Rieman and McIntyre 1993). Resident bull trout complete their entire life cycle in or near their natal tributary. Migratory bull trout spawn in tributary streams where juvenile fish rear one to four years before migrating to either a lake (adfluvial form) or a river (fluvial form).

Descriptions of ESA Listed Populations

Since 1991, the NOAA Fisheries has identified several populations of Columbia River Basin salmon and steelhead as ESUs that require protection under the ESA. The populations potentially affected by the proposed research project are shown below as described by the NOAA Fisheries and their current listing status (NMFS 1999), currently under review. Any changes in the status of these listings or ESU boundary changes will be addressed in the consultation process. These ESU populations are only those that are potentially present in the proposed research areas from March 2003, to December 31, 2005. The U.S. Fish and Wildlife Service (USFWS) have listed the bull trout populations as threatened since 1998. Since bull trout are widely distributed and have varying life histories and therefore different threats, the USFWS identified 22 recovery units within the Columbia River Distinct Population Segment, each with its own recovery strategy (USFWS 2002). Unless otherwise noted, the listed component only includes wild/naturally-spawning populations.

1. Upper Columbia River steelhead, endangered, August 18, 1997. This inland steelhead ESU occupies the Columbia River Basin upstream from the Yakima River, Washington, to the United States/Canada Border (Busby et al. 1996). (USFWS 2002)

2. Columbia River bull trout, threatened, June 10, 1998. (USFWS 2002). The particular unit that could be effected by our research would be the Unit 6 Deschutes River Population. (USFWS 2002)

3. Mid-Columbia River steelhead, threatened, March 25, 1999. The Mid-Columbia River Unit encompasses the geographic area from Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington. (USFWS 2002)

Project Description

Background

Populations of wild steelhead *(O. mykiss)* have declined dramatically from historical levels in the Columbia and Snake rivers (Nehlsen et al. 1991; NRC 1996; *US v. Oregon* 1997; ISRP 1999). Steelhead in the upper Columbia River have been listed as an endangered species under the Endangered Species Act (ESA) since 1997[1]. Those in the Snake River have been listed as threatened, also since 1997[1], and those in the mid-Columbia were listed as threatened in 1999[2]. Causes of the declines are numerous and well known (TRP 1995; NPPC 1986; NRC 1996; ISRP 1999), and regional plans recognize the need to protect and enhance weak upriver steelhead populations while maintaining the genetic integrity of those stocks (NPPC 1995).

Enhancing the species' natural iteroparity (i.e. its ability to spawn more than once in its life) may strengthen wild steelhead populations. Fish that have spawned in one or more previous years contribute substantially to some wild steelhead populations (e.g. as high as 79% for 1994-96 in the Utkholok River of Kamchatka; MSU undated; M. Powell UI and R. Williams, ISRP pers. comm.). However, the contribution from iteroparous steelhead in Columbia River populations is much lower. For example, recent estimates of repeat spawners in the Kalama River (tributary of the unimpounded lower Columbia River) have exceeded 17% (NMFS 1996), which is the highest published iteroparity rate we found from the Columbia River Basin. Farther upstream, 4.6% of the summer run in the Hood River (above only one mainstem dam) are repeat spawners (J. Newton, ODFW, pers. comm.). Similarly, summer steelhead in the South Fork Walla Walla River have 2%-9% rates of repeat spawning (J. Germond, ODFW, pers. comm.), whereas repeat

[1] Final Rule 8/18/97: 62 FR 43937-43954.
[2] Final Rule 3/25/99: 64 FR 14517-14528.

spawners compose only 1.6% of the Yakima River wild run (from data in Hockersmith et al. 1995) and 1.5% of the Columbia River run upstream from Priest Rapids Dam (L. Brown, WDFW, unpubl. data). In the Snake River subbasin, at least 2% of wild steelhead returning to Idaho's Clearwater River were repeat spawners when there were only two downstream dams (Lewiston Dam and Bonneville Dam; Whitt 1954). In recent years, we know of a few confirmed repeat spawners that were observed in the juvenile bypass system at Little Goose Dam in 2000 and 2001(Evans and Beaty 2001) as well as a small number that returned to the Lower Granite Dam in 2002 (Hatch et al. 2002), and we suspect that < 1% of wild Snake River steelhead survive to spawn more than once. Under present conditions, very few (< 5% overall) summer steelhead in the Columbia River – especially in the upper basin – appear capable of exhibiting iteroparity in the impounded, post-development Columbia Basin.

Iteroparity rates for *0. mykiss* were estimated to be as high as 79% for 1994-96 in the Utkholok River of Kamchatka (MSU undated; M. Powell UI and R. Williams, ISRP pers. comm.) Reported iteroparity rates for Columbia basin steelhead (*O. mykiss*) were considerably lower, due largely to high mortality of downstream migrating kelts at hydropower dams (Evans and Beaty 2001; Hatch et al. 2002; Hatch et al.b In-Review), and to inherent differences in iteroparity rate based on geography (e.g. latitudinal effect, inland distance effect; Withler 1966; Bell 1980; Fleming 1998). Chilcote (In review) reported iteroparity rates ranging from 3 to 21% for 12 different steelhead populations in Oregon. Outmigrating steelhead averaged 58% of the upstream run in the Clackamas River from 1956 to 1964 (Gunsolus and Eicher 1970). Recent estimates of repeat spawners in the Kalama River (tributary of the unimpounded lower Columbia River) have exceeded 17% (NMFS 1996), which is the highest published iteroparity rate we found from the Columbia River Basin. Farther upstream, 4.6% of the summer run in the Hood River (above only one mainstem dam) are repeat spawners (J. Newton, ODFW, pers. comm.). Iteroparity for Klickitat River steelhead was reported at 3.3% from 1979 to 1981 (Howell et al. 1985). Summer steelhead in the South Fork Walla Walla River exhibited estimated 2% to 9% iteroparity rates (J. Gourmand, ODFW, pers. comm.), whereas repeat spawners composed only 1.6% of the Yakima River wild run (from data in Hockersmith et al. 1995) and 1.5% of the Columbia River run upstream from Priest Rapids Dam (L. Brown, WDFW, unpubl. data).

Before repeat spawners can contribute to population growth and diversity, they must first successfully outmigrate to the ocean following spawning. The term "kelt" has been used to describe this unique post-spawned life history phase within salmonids. In 1999 and 2000 ultrasound and visual methods were developed – with funding from the U.S. Army Corp of Engineers – to accurately distinguish kelts from pre-spawners (mature steelhead). The ultrasound technique provided a highly accurate and non-invasive way to enumerate the abundance of kelts in the Snake and Columbia rivers basins (Evans and Beaty 2000). Using this technique, kelts were enumerated at Little Goose bypass (1999 and 2000), Lower Granite bypass (2000 and 2001), and at McNary and John Day bypass facilities (2001). In 2002, CRITFC compared visual identification and the ultrasound identification technique (Hatch et al. In Review). Identification crews, with proper identification training, were able to accurately identify steelhead kelts. Data revealed that approximately 2,780 wild kelts, equivalent to *ca.* 23% of the 1999 wild run above Lower Granite Dam, passed through the juvenile collections systems at Lower Granite and Little Goose dams in the spring of 2000 (Evans and Beaty 2001). In 2001, an estimated 4,695 wild kelts, equivalent to *ca*. 21% of the 2000 wild run, passed through Lower Granite bypass facility alone (Evans 2002). During the spring of 2002 the number of wild kelts was approximately 3,348, equivalent to ca. 7% of the 2001 wild run (Hatch et al., In Review). The majority of kelts were considered to be in good physical condition (> 70%) and the kelt run was predominately female (> 80%). A trend toward higher post-spawn female survival, relative to males, is consistent with data from other iteroparous populations (Withler 1966, Leider et al. 1986, Jonsson et al. 1991, Fleming 1998, and Niemela et al. 2000).

Despite the thousands of kelts that arrived at Lower Granite Dam in 2002, as in 2001, very few successfully navigated the Columbia Basin hydrosystem. Radio telemetry indicated that only 17.6% (37/210) and 13.3% (8/210) of tagged kelts released from Lower Granite Dam tailrace reached the Ice Harbor Dam tailrace and Bonneville Dam tailrace, respectively. In addition to kelt mortality associated with dam passage, depleted energy stores and physical deterioration likely constituted important mortality, compounded by fasting for many months during migration and spawning (Love 1970). However, based on the above suite of empirical iteroparity estimates, steelhead kelts in impounded areas of the Columbia basin should have significantly greater likelihood of exhibiting iteroparity if they are reconditioned in captivity, relative to their current inability to exhibit iteroparity in the impounded, post-development Columbia Basin.

Kelt reconditioning promotes re-initiation of feeding, thereby enabling them to survive and rebuild energy reserves required for proper gondal development and iteroparous spawning. Kelt reconditioning techniques were initially developed for Atlantic salmon *Salmo salar* and sea-trout *S. trutta.* A review of these studies and those applicable to steelhead kelts are summarized in Evans et al. 2001. This project identifies and systematically tests several kelt reconditioning approaches.

- 2000

In the spring of 2000, the YN collected 512 wild kelts (38% of the subbasin's run that year) at the Chandler Juvenile Migrant Fish Facility (CJMFF) for reconditioning at Prosser Hatchery. The kelts – arriving in surprisingly high numbers even before this project's contract was in place – had to be initially held at undesirably high densities in temporary tanks, where they were fed using the slurry method of the previous year. During mid-June, when the four 20' diameter circular tanks were received and installed, the 354 surviving kelts were treated for parasites and transferred to the new tanks. A high proportion of the transferred fish was emaciated, clearly starving. The feeding methods had not been working satisfactorily under the exceptionally stressful conditions in the temporary tanks. During July, the YN started to feed freeze-dried krill, which elicited a strong feeding response from kelts that were already eating pelleted diet and a weaker – but still positive – response from emaciated, previously non-feeding fish. One-fourth of the kelts were lost when inflow to one of the tanks was interrupted overnight in late July, and attrition due to starvation continued in the remaining three tanks. In mid-December, when the 90 survivors (18% of those collected) were examined and released, ultrasound revealed that 51 (57%) were rematuring. Hence, first year re-spawner rate (reconditioned plus rematuring in the next year) was only 10% (51/512).

- 2001

In the spring of 2001, the YN collected 551 wild kelts ca. 18.7% of the 2000 wild run from the (CJMFF) for reconditioning at the Prosser hatchery. Steelhead kelts held for reconditioning were held in the four 20' diameter circular tanks. Captured steelhead kelts were released on two dates

November 15, 2001 and January 18, 2002 (kelts held longer to assure rematuration). Different diet formulations were fed to reconditioned kelts to ascertain an optimum reconditioning diet. The diet formulation that showed the most promise at reinitiating a feeding response was krill followed by a maintenance diet of Moore-Clark pellets. Under this diet formulation kelts also showed some weight gain with 95%(91of 95 measured) showing a weight increase. A total of 108 kelts survived the reconditioning experiment to release while an estimated number of kelts 96% showed some sign of rematuration.

- 2002

During 2002, the YN CJMFF crew collected a total of 899 wild kelts ca. 19.8% of the 2001 wild run for reconditioning. Steelhead kelts continued to be held in the four 20’ diameter circular tanks. The experiment was separated into a short-term (1 and 2 month reconditioning) and long-term (6-7 months) feeding experiment with 3 different feeding combinations. Another dimension of the experiment was trucking short-term releases below Bonneville dam for release. Survival rates in all groups increased this year, with especially high survival rates being found in the short-term reconditioning groups. Long-term experiments had overall lower survival rates when compared to short-term reconditioned fish, although they had a significantly higher rematuration rate (when compared to short-term 0% rematuration vs. long-term at about 30-75%). Long-term reconditioned fish also tended to increase in weight during reconditioning, while short-term reconditioned fish lost a small amount of weight. So far, a total of 28 out of 331 Passive Integrated Transponder (PIT) tagged fish have returned to the Yakima River basin to respawn.

- 2003

In 2003, ongoing BPA funded projects that were being reviewed in the Systemwide Provincial Review Process were required to maintain work scopes from the previous year. Therefore, we repeated the experiments from 2002. We collected 811 kelt steelhead at CJMFF and retained 677 for reconditioning. The short-term reconditioning group had 97% survival to release and the current survival (as of 9/30/03) for fish in the long-term reconditioning group is approximately 73%.

Project Goals for 2004-2006

1. Develop, test, and evaluate methods and protocols for successful reconditioning of kelt steelhead.
2. Work in close cooperation with fishery managers to formulate and test critical questions about the technical and management feasibility of kelt reconditioning.
3. Apply reconditioning methods and protocols to appropriate fishery management programs within five years, when warranted by the results of reconditioning and benefit/risk analysis.
4. Directly examine reproductive success in hatchery-origin, natural-origin, and reconditioned kelt steelhead in several streams

5. Replicate and evaluate kelt reconditioning procedures and protocols at a variety of locations.

6. Track migration behavior of reconditioned steelhead kelts through the Columbia River Basin to estuaries and possibly continental shelf.

Rationale

The primary purpose of this assessment is to estimate the incidental take of ESA listed fish by ESU as a result of the proposed research at the Yakima River, Shitike Creek, Omak Creek, and Satus Creek. Available data on run size, run timing, age composition, hatchery production, and ecology of stocks were used to evaluate potential effects.

Direct Release

In an effort to determine the impact that reconditioning has on steelhead kelts, up to 200 Yakima River outmigrating kelts will be captured at the CJMFF and directly be released in a one time release below Bonneville Dam. These fish will receive no treatment except for the placement of PIT-tags in all individuals and surgical implantation of 30 radio tags and 30 acoustic tags into 60 individuals, once we receive an adequate amount of fish to compare against reconditioned fish, they will then be transported to the Hamilton boat ramp below Bonneville Dam.

Capture and Placement of Virgin Spawners

In Shitike and Omak Creek we will attempt to capture around 200 virgin spawners using a weir at each stream system to obtain genetic samples from each fish captured so that we can assign parentage to offspring. Fish captured in Shitike and Omak Creeks will be released to continue their migration to spawning grounds upstream. At Satus Creek we will obtain at most 80 (minimum 40) virgin spawners headed upstream and obtain genetic samples from them before they are transported to either 2 of the 4 streams (North and South Fork Logy, Section Corner, and/or Yatamai Creeks will be decided by end of 2004) that have suitable steelhead spawning gravels. The 4 creeks are geographically isolated by large waterfalls and will be racked to keep adult steelhead in the streams until they spawn. We will capture our released fish when they become outmigrating kelts using a V-weir. These outmigrating kelts will then be held for long-term reconditioning (6-8 months) and subsequently be reintroduced to the system the following year. These streams provide a good opportunity for us to establish parentage rates in a field laboratory setting.

Long-term Reconditioning

We made substantial progress in 2001 and 2002 regarding long-term kelt reconditioning, achieving a current long-term survival rate of 73% in 2003. However, the applicability of long-term reconditioning must be evaluated at different locations (i.e., with different source populations) in order to adequately assess long-term reconditioning's ability to augment iteroparity rates. Long-term reconditioning will be performed using fish from 4 sites: Omak Creek, Yakima River, Satus Creek, and Shitike Creek.

Gamete and Progeny Viability

Approximately 20 first-time spawners and 20 steelhead kelts from the long-term reconditioning experiment at the CJMFF will be retained to ascertain gamete and progeny viability. These fish will be air spawned, their gametes will then be refrigerated and sent to the University of Idaho where they will be fertilized and evaluated. Some of the fertilized eggs will be raised to adulthood to evaluate the gamete viability of the progeny.

Short-term reconditioning

Successful expression of iteroparity in steelhead may not simply be limited by post-spawning downstream passage through the mainstem corridor but also by starvation. Thus, short-term conditioning may augment iteroparity rates by initiating the feeding process and allowing kelts to naturally undergo gonadal recrudescence in the estuary and marine environments. Short-term reconditioning is defined as the period of time needed (6 to 8 weeks) for kelts to initiate post-spawning feeding, followed by the transportation of kelts around mainstem hydroelectric facilities for release and natural rearing and rematuration in the Pacific Ocean. Short-term reconditioning will be performed at the CJMFF on the Yakima River.

Juvenile *Oncorhynchus mykiss* Collection

There is no method to avoid sampling ESA-listed fish in a screw-trap or V-weir. The rotary screw trap or V-weir will be deployed at Omak Creek, Shitike Creek, and/or 2 of the 4 streams in the Satus watershed. We will take precautions to minimize the effect of sampling all fish including frequent monitoring, safe handling procedures, and expedient measurement. No take of ESA listed fish is expected.

Collection of Adult Rainbow Trout (*O. mykiss*)

It is possible that resident rainbow trout may be mating with returning steelhead and must be identified so that assigning parentage will be successful. There is no method to avoid sampling ESA-listed fish in a screw-trap or V-weir. The rotary screw trap or V-weir will be deployed at Omak Creek, Shitike Creek, and/or 2 of the 4 streams in the Satus watershed. Adult rainbow trout will have a genetic sample taken (caudle fin punch) that will be analyzed to isolate genetic contributors to juvenile stocks. We will take precautions to minimize the effect of sampling all fish including frequent monitoring, safe handling procedures, and expedient measurement. No take of ESA listed fish is expected.

PIT tag

All adult Steelhead kelts will receive Passive Integrated Transponder (PIT) tags inserted into the body cavity via syringe. No take of ESA listed fish is expected.

Acoustic Telemetry

A portion of the adult steelhead kelts at the Yakima River (~60 individuals), will have long-life (>300 day) acoustic transmitters surgically implanted into the body cavity below the pectoral fin for long-term tracking. No take of ESA listed fish is expected.

Radio Telemetry

A portion of adult steelhead kelts at Shitike Creek (~40 individuals), Yakima River (~100 individuals) will have long-life (>50 day) radio transmitters surgically implanted into the body cavity below the pectoral fin for long-term tracking or use of the gastric insertion technique for short-term tracking. No take of ESA listed fish is expected.

Floy-Tagging

Adult steelhead kelts at Shitike Creek will have floy-tags attached at the base of the dorsal fin to aid in identification of experimental fish. No take of ESA listed fish is expected.

Genetic Sampling

Adult Steelhead kelts at Shitike Creek, Satus Creek and Omak Creek, will have a fin clip taken for genetic analysis. No take of ESA listed fish is expected.

Truck Transport

Given the high mortality rates of emigrating kelts observed via radio telemetry in the Snake River (Evans et al. 2001; Evans 2002; Hatch et al, in review), iteroparity may simply be augmented by transporting kelts around the hydro system, thereby increasing the number of kelts that successfully have access to the marine environment. The purpose for this objective is to evaluate the lowest cost alternative aimed at increasing steelhead iteroparity. The objective will be conducted at the CJMFF at Prosser, WA.

Project Methodology

This project focuses on research to determine the best methodology for reconditioning steelhead kelts. The start date for this project is March 2004. This project is expected to last until 2006.

Steelhead Kelt Collection

Some of the steelhead kelts will be captured at V-weir sites (Shitike Creek, Omak Creek, and Satus Creek) that will direct fish to a capture box that will hold them until they can be dip netted into a holding tank then transported via truck to a reconditioning facility. Once at the reconditioning facility kelts will be placed in 20’ circular tanks that use well water and/or river water and given a diet of krill and Moore-Clark pellets for 4-5 months. The rest of the steelhead kelts will need to be captured at the Yakima River at the Chandler juvenile evaluation facility at the juvenile bypass and dip netted off of the separator and held in 4’x 6’ tank until they can be transported to 20’ circular tanks that use well water and/or river water and given a diet of krill and Moore-Clark pellets for reconditioning for 4-5 months and 6-8 weeks.

Steelhead Kelt Reconditioning

All steelhead kelts captured at all sites (Shitike Creek, Omak Creek, Satus Creek, and the Yakima River) will be retained in a 20’(l) x 20’(w) x 4’(h) circular tank. Individual tank carrying capacity was set at a maximum of 200 fish based on the aquaculture experience of YN hatchery staff, and the project goal of maximizing steelhead kelt survival in captivity. Formalin will be administered five times weekly at 1:6,000 for 1 hour in all reconditioning tanks to prevent fungal outbreaks. Due to the successful use in treating *Salmonicola* during the kelt reconditioning experiments in 2000 (Evans and Beaty 2000), Ivermectin™ will again be diluted with saline (1:30) and injected into the posterior end of the fish’s esophagus using a small (1cc) plastic syringe. Water used for the tanks will either be ground well, river, or both depending on the site and will be of good quality for the health of the fish. Kelts will be given a diet of krill and Moore-Clark pellets to elicit a feeding response from steelhead kelts. Short-term reconditioned fish will be held for a total of 6-8 weeks then trucked below Bonneville for release. A portion of the Yakima River short-term reconditioned fish (~60) along with the direct transport and release group (~60) will be either radio-tagged or acoustically tagged using surgical implantation into the body cavity just below the pectoral fin, so that we may ascertain outward migration behavior from below Bonneville Dam to the estuaries and continental shelf. Long-term reconditioned fish will be held for a total of 4-7 months and then released in-river to spawn. Approximately 40 Yakima River individuals from the long-term reconditioning experiment will receive radio-tags using the gastric insertion technique to monitor return spawning rates and the location of spawning grounds.

Gamete and Progeny Viability

Fish that are kept for gamete and progeny viability will be air spawned with gametes going to the University of Idaho where they will be evaluated using a number of different tests (i.e. keel counts, eye counts) to compare virgin spawners versus reconditioned fish. Some of the fertilized eggs will be raised to adulthood to evaluate the gamete viability of the progeny to determine if there are any deleterious effects on offspring from the reconditioning process.

Juvenile *O. mykiss* Collection

Downstream migrating juvenile steelhead will be trapped at a 5-foot diameter rotary-screw trap located on Omak Creek and Shitike Creek, and a V-weir on 2 of the 4 following creeks (North Fork Logy, South Fork Logy, Section Corner, and Yatamai Creeks). Collected data will be used to measure success of the parents' reproductive success. Data will also be collected on the physical characteristics of the sample sites (i.e., discharge).

When river conditions are conducive to trap operation, the migrant trap will be operated in a manner that will insure collection of a representative sample of juvenile steelhead. Operation will be noncontiguous and will span the entire outmigration period that is generally recognized as occurring from March through late August in the streams of interest.

Collection of Adult Rainbow Trout (*O. mykiss*)

Resident adult rainbow trout (*O. mykiss*) will be captured using a V-weir on Omak Creek, Shitike Creek, and on 2 of the 4 following creeks (North Fork Logy, South Fork Logy, Section Corner, and Yatamai Creeks). Genetic samples will be taken from resident adults to aid in assigning parentage. Data will also be collected on the physical characteristics of the sample sites (i.e., discharge).

Genetic sampling

Tissue samples of Adult steelhead, juvenile steelhead, and rainbow trout will consist of a non-lethal fin clips and scale samples to estimate age. Each sample will be measured and labeled accordingly.

PIT-tagging

Target species will be PIT tagged in accordance with protocols established by the Columbia Basin Fish and Wildlife Authority PIT Tag Steering Committee (CBFWA PTSC 1999). Data on tag release, tag detection, stream temperature, and fish length will be recorded. Target species will be examined for marks, clips, injuries, and descaling, as well as scanned for previous PIT tags prior to PIT tag injections. Hand-held PIT tag injectors will be disinfected between fish to reduce the possibility of transfer of diseases (CBFWA PTSC 1999).

Floy Tagging
Colored and uniquely numbered tags will be inserted using a floy tag piercing gun held at a 45 degree angle, just below the dorsal fin.

Acoustic Tagging
Some short-term reconditioned (~30) and direct transport/release (~30) fish will receive acoustic tags (~12 grams) that will be surgically implanted into the body cavity just below the pectoral fin (FAO Fish Telemetry Web site).

Radio Tagging
An additional (~30) short-term reconditioned and (~30) direct transport/release fish that received acoustic tags will also receive radio tags (~3 grams) that will be surgically implanted into the body cavity below the pectoral fin (FAO Fish Telemetry Web site). Long-term reconditioned fish will receive radio tags (~4 grams) using the gastric insertion technique (FAO Fish Telemetry Web site).

Assessment of Potential Impacts to Listed Fish

The primary purpose of this assessment is to estimate the incidental take of ESA listed fish by ESU as a result of the proposed research at Shitike Creek, Omak Creek, Satus Creek and the Yakima River. Available data on run size, run-timing, age composition, hatchery production, and ecology of steelhead were used to evaluate potential affects to ESA-listed species.

Steelhead Kelt Collection
Adult steelhead sampling will be strictly limited to the capture of adult steelhead kelts at the Chandler juvenile evaluation facility located on the Yakima River and the Satus Creek dam. At Shitike Creek there is the possibility of capturing Bull Trout at the weir site. It is anticipated that work will begin in 2005. It is expected that there will be no to little effect on ESA-listed Bull Trout. Sites will be continuously monitored to ensure that fish are appropriately sorted and either kept for reconditioning or released back to the river to continue migration.

Steelhead Kelt Reconditioning
Steelhead kept for reconditioning will then be expedited to the reconditioning site where they will be processed and then reconditioned. It is expected that there may be some mortalities associated with handling stress after processing for reconditioning. It should be noted though that the survival rate for reconditioned steelhead held in captivity ~70%, is still much higher than would be found in the altered hydrosystem ~1%. (Hatch et al. In Review; Wertheimer et al. 2002)

Juvenile *O. mykiss* Collection
There is no method to avoid sampling ESA-listed fish in a rotary-screw trap. The rotary screw trap will be deployed on the Shitike Creek, Omak Creek, and Satus Creek but some bull trout

may be trapped incidentally at Shitike Creek. The rotary-screw trap will be used for a short period of time to avoid sampling large numbers of ESA-listed stocks. We will take precautions to minimize the effect of sampling all fish including frequent monitoring, safe handling procedures, and expedient measurement.

Fluvial bull trout from the Columbia River use Shitike Creek primarily as a migration corridor although some adults hold in the larger pools to feed. Bull trout spawning and rearing typically occurs near headwaters; there is no known spawning near the mouth of Omak Creek. The resident form is typically found in portions above passage barriers and therefore should not be affected by the proposed research. Some sub-adults may be trapped incidentally as well as some bull trout fry later in the season.

Collection of Adult Rainbow Trout (*O. mykiss)*

Adult rainbow trout (*O. mykiss*) will be collected using a rotary screw trap in Shitike and Omak Creek and a V-weir in either 2 of 4 listed creeks in the Satus Creek drainage (North Fork Logy, South Fork Logy, Section Corner, and Yatamai Creeks) for capture of resident *O. mykiss* for parentage assignment. After capture fish will be anesthetized and have a non-lethal fin clip taken for genetic analysis. No effect on ESA-listed stocks is expected.

Genetic Sampling

Adult steelhead kelts, juvenile steelhead and adult rainbow trout will be sampled. We expect no effect on ESA-listed stocks.

PIT Tagging

Only adult steelhead kelts will be PIT-tagged so no effect is expected on ESA-listed adult steelhead kelts from PIT tagging.

Floy Tagging

Only adult steelhead kelts from Shitike Creek will be Floy tagged. We expect no effect on ESA-listed adult steelhead kelt stocks.

Acoustic-Tagging

A portion of adult steelhead kelts in the short-term reconditioning and direct transport/release experiments from the Yakima River will receive acoustic tags. We expect none to little effect on ESA-listed stocks.

Radio-tagging

A portion of adult steelhead kelts from the Yakima River and Shitike Creek are expected to be radio-tagged. We expect none to little effect on ESA-listed stocks.

Description and Estimates of Harrasment/Take

Based upon the methodology described above and the anticipated low level of 'take' (capture, handling and/or tagging) of ESA-listed species identified below through this research project, we have determined that this project may incidentally effect, but will not jeopardize ESA-listed species.

List of Each Species and/or Population and/or ESU to be harassed/taken

<u>Harassment</u>

Steelhead Kelt Collection
Steelhead Captured for reconditioning, data collected:

Endangered, adult UCR steelhead- 250
Threatened, naturally produced adult Unit 6 bull trout- 55
Threatened, naturally produced adult MCR steelhead- 1,600

Steelhead Kelt Reconditioning
Kept in captivity, only handled before release for data recording and with some individuals receiving radio tag placement then trucked to release sites:

Endangered, adult UCR steelhead- 200
Threatened, naturally produced adult MCR steelhead- 1,280

Juvenile steelhead collection
Captured, anesthetized, handled (genetic samples taken), allowed to recover from the anesthetic, and released:

Endangered, juvenile UCR steelhead- 1,700
Threatened, naturally produced juvenile Unit 6 bull trout- 55
Threatened, naturally produced juvenile MCR steelhead- 1,876

Collection of adult rainbow trout (O. mykiss)
Captured, anesthetized, handled (genetic samples taken), allowed to recover from the anesthetic, and released:

Threatened, naturally produced juvenile Unit 6 bull trout that may be harassed- 55

<u>Indirect Mortalities</u>

Steelhead Kelt Collection
Captured for reconditioning, data collected:

Endangered, adult UCR steelhead- 10
Threatened, naturally produced adult Unit 6 bull trout- 1
Threatened, naturally produced adult MCR steelhead- 64

Steelhead Kelt Reconditioning
Kept in captivity, only handled before release for data recording and with some individuals receiving radio tag placement then trucked to release sites:

Endangered, naturally reared adult UCR steelhead- 80
Threatened, naturally produced adult MCR steelhead- 440

Juvenile steelhead collection
Captured, anesthetized, handled (genetic samples taken), allowed to recover from the anesthetic, and released:

Endangered, juvenile UCR steelhead- 17
Threatened, naturally produced juvenile Unit 6 bull trout- 1
Threatened, naturally produced juvenile MCR steelhead- 18

Collection of Adult Rainbow Trout (O. mykiss)
Captured, anesthetized, handled (genetic samples taken), allowed to recover from the anesthetic, and released:

Threatened, naturally produced juvenile Unit 6 bull trout that may suffer mortality- 1

Calculation of potential harassment/take of ESA-listed species

<u>Calculation of potential steelhead harassment/take</u>

Adult Steelhead Kelt Collection

- Upper Columbia River Adult Steelhead Harassment/Take Estimates

    We are interested in reconditioning ~200 steelhead kelts at Omak Creek. With the Yakama reconditioning effort we typically kept 80% of what was handled and released ~20%(Hatch et al. a. in review).

    200 intended for reconditioning / .8 percent kept for reconditioning = 250 total harassment

    For the incidental mortality we used Yakama reconditioning as an estimate for the amount of handling mortalities associated with adult steelhead kelt capture. Handling mortalities at the CJMFF averaged ~4% (Hatch et al. a. in review).

    250 total fish handled * .04= 10 potential mortalities

- Middle Columbia River Adult Steelhead Harassment/Take Estimates

We are interested in reconditioning ~200 steelhead kelts at Shitike Creek, and min (40)/max (80) virgin spawners from Satus Creek. We are also interested in reconditioning ~ 800 adult steelhead kelts at the facility at the CJMFF. With the Yakama reconditioning effort we typically kept 80% of what was handled and released ~20% (Hatch et al. a. in review).

CJMFF on Yakima River @ Prosser, WA

800 intended for reconditioning and 200 for direct release/ .8 percentage kept for reconditioning = 1,250 total harassment

Shitike Creek steelhead kelts + Satus Creek virgin spawners

(200 intended for reconditioning / .8 percentage kept for reconditioning) + (80 intended for transport/ .8 total kept for transport) + (maximum of 80 steelhead kelts recaptured for reconditioning) = 250 + 100 = 350 total harassment

Total MCR adult steelhead kelt harassment = 1,600

For the incidental mortality we used the Yakama reconditioning effort as an estimate for the amount of handling mortalities associated with adult steelhead kelt capture. Handling mortalities at the CJMFF averaged ~4% (Hatch et al. a. in review).

CJMFF on Yakima River @ Prosser, WA

1,250 total fish handled * .04= 50 potential mortalities

Shitike Creek and Satus Creek

(250 fish handled * .04) + (100 fish handled * .04) = 10 + 4 = 14 potential mortalities.

Adult Steelhead Kelt Reconditioning

- Upper Columbia River Adult Steelhead

Harassment rates are based on the number of steelhead that may be potentially harassed during their movement from the reconditioning tank for sampling to the truck for release. We intend to recondition up to 200 fish at Omak Creek, which results in the possible harassment of up to 200 adult steelhead kelts.
Potential take is based off of last year's mortality rates from the Yakama Nation's previous reconditioning efforts, which was ~ 40% for the low in long-term reconditioning (Hatch et al. a. in review).

200 potential reconditioned fish * .4 mortality = 80 potential mortalities

- Middle Columbia River Adult Steelhead

  Harassment rates are based on the number of steelhead that may be potentially harassed during their movement from the reconditioning tank for sampling to the truck for release. We intend to recondition up to 800 fish and 200 for direct transport/release at the Yakima River at the CJMFF, which results in the possible harassment of up to 1000 adult steelhead kelts. We also plan on reconditioning around 200 steelhead kelts at Shitike Creek and the 80 fish that will be released into the two of the four sites at the CJMFF. All together, this could result in the possible harassment of up to 1, 280 adult steelhead kelts in these locations combined.

  Potential take is based off of last year's mortality rates from the Yakama Nation's previous reconditioning efforts, which was ~ 40% for the low in long-term reconditioning (Hatch et al a. in review). Potential take for the direct release/transport is assumed to be ~4% based off of our handling take at the CJMFF (Hatch et al. a. in review).

  1000 potential long-term reconditioned fish * .4 assumed mortality rate = 400 potential mortalities

  200 potential direct transport/release *.04 assumed mortality rate = 8 potential mortalities

  80 potential capture/transport/long-term recondition/release * .4 assumed mortality rate = 32 potential mortalities

*Juvenile Steelhead (**O. mykiss**) collection*

- Upper Columbia River Juvenile Steelhead

  Harassment rates are based on the number of juvenile *O. mykiss* that may be captured by a rotary screw trap or V-weir, handled to obtain genetic data, and then released to resume migration. We based captures on yearly smolt release data at Omak Creek (WDFW 2003) then averaged the data (smolt release, ~17,000). Based on the average, we assume a 10% capture rate with a 1% mortality rate.

- Middle Columbia River Juvenile Steelhead.

  Harassment rates are based on the number of juvenile steelhead that may be captured by a rotary screw trap, handled to obtain genetic data, and then released to resume migration. The number of steelhead estimated captured by the rotary screw trap was based off of previous years capture data at Shitike Creek with a screw trap (Warm Springs Tribal Fisheries Program, personal communication). We then averaged the yearly screw trap capture data and then assumed that we would capture at nearly the same rate (1,644 juveniles). Based on the average capture rate, we assume a 1% mortality rate.

  1,644 potentially captured juvenile steelhead smolts *.01 assumed mortality rate = 16 potential mortalities

  In the 2 of the 4 following listed creeks in the Satus Creek drainage (North Fork Logy, South Fork Logy, Section Corner, and Yatamai Creeks) will have virgin spawners placed and then racked off to prevent them from descending the waterfalls. This area is geographically isolated from resident rainbow trout populations. We will then capture juvenile steelhead smolts to obtain parentage data. Based on Yuen and Sharma's smolt per spawner estimates (~ 58 smolts/spawner) and at least 40 spawners, there could possibly be 2,320 outmigrating smolts (Yuen and Sharma, 2004). We should be able to capture at least 10 % of the outmigrating smolt population, which gives us 232 smolts captured. We will assume a 1% mortality rate, which results in 2 possible mortalities.

<u>Calculation of potential Unit 6 bull trout harassment/take</u>

Little is known about the biology and abundance of the Columbia River fluvial bull trout population (USFWS 2002). The Warm Springs Fisheries Program monitors smolt production with a rotary screw trap in Shitike Creek from early spring through early fall.

Adult Steelhead Kelt Collection

Based on yearly data (Warm Springs Tribal Fisheries Program, personal communication) of adult fluvial bull trout weir trapping at Shitike Creek in 2001-2002 and then averaged, we estimate that we may potentially harass 55 bull trout during our trapping of adult steelhead kelts. Based on a 1% mortality rate we estimate that we may potentially take a single adult fluvial bull trout.

Juvenile Steelhead Collection

We estimated that we may capture 55 juvenile and sub-adult fluvial bull trout based on an average of rotary screw trap data in Shitike Creek (Warm Springs Tribal Fisheries Program, personal communication). We estimate based on a 1% mortality rate that we may have a single mortality during our trapping operation.

Collection of Resident Adult Rainbow Trout (O. mykiss)

Based on yearly data (Warm Springs Tribal Fisheries Program, personal communication) of adult fluvial bull trout weir trapping at Shitike Creek in 2001-2002 and then averaged, we estimate that we may potentially harass 55 bull trout during our trapping of adult rainbow trout. We will be using either a V-weir or rotary screw trap to capture adult rainbow trout (*O. mykiss*). We estimate based on a 1% mortality rate that we may have a single mortality during our trapping operation.

Assessment of Potential Impacts to Critical Habitat for Listed Fish

No potential impacts to critical habitat for ESA-listed steelhead and bull trout are expected from either adult steelhead capture, juvenile steelhead capture, or resident capture. Both in-stream structures, the rotary-screw trap used to sample juvenile steelhead and the weirs for adult capture are temporary structures that will not alter or otherwise affect critical habitat for listed species. Both of these structures will be located low on the Omak and Shitike Creek system below primary spawning and rearing habitat for ESA-listed species. Location of the North and South Fork Logy, Section Corner, and/or Yatamai Creek structures are located above any critical habitat to any listed species.

Conclusion

Steelhead Reconditioning has proven to be successful in the Yakima River Basin with survival rates >70%. The next step in our research is to see how successful a region wide attempt to improve listed steelhead stocks, as well as improve a life history strategy. The data provided from this proposed study would answer questions about the viability of this project on a region wide scale. The seven components of this study: long-term reconditioning, juvenile steelhead collection, electro fishing, PIT-tagging, radio telemetry, floy-tagging, and genetic sampling will provide valuable information to separately evaluate the productivity of reconditioned steelhead over a regional scale.

Since methods are limited to monitor and/or sample adult or juvenile salmonids without intercepting non-target species, this project should have little effect on ESA-listed species present in Shitike Creek, Omak Creek, Satus Creek (including it's 4 tributaries), and the Yakima River. Overlap in run-timing of juvenile emigration of steelhead and bull trout creates the potential for some incidental capture of these ESA-listed species, yet this capture represents a very low percentage of the total run (less than 1%). Based upon the project design and methodology described above, our assessment is that the proposed project, Steelhead Kelt Reconditioning, may effect but will not adversely impact ESA-listed Upper Columbia River steelhead, Columbia River bull trout stocks, Middle Columbia River steelhead.

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Appendix B. 2005 Permit Application

A. **Title:** Application for Permit for Scientific Purposes and to Enhance the Propagation or Survival of Listed Species under the Endangered Species Act of 1973.

B. **Species:** Upper Columbia River steelhead
Mid-Columbia River steelhead

C. **Date of Permit Application**: January 18, 2005

D. Applicant Identity:

1. Robert C. Lothrop, Manager, PDLSD;

2. By and through the Bureau of Indian Affairs;

3. c/o CRITFC, 729 NE Oregon Street, Suite 200, Portland, Oregon 97232; and

4. (503)238-0667; fax (503)235-4228 email lotr@critfc.org.

5. Doug Hatch, Fisheries Scientist, CRITFC, 729 NE Oregon Street, Suite 200, Portland, Oregon 97232; (503)238-0667; fax (503)235-4228, email: hatd@critfc.org.

E. **Information on Personnel, Cooperators, and Sponsors.**

1. **Douglas Hatch is the Principle Investigator** of the study. Mr. Hatch received a Masters of Science Degree in Fisheries Resources from the University of Idaho in 1991 and a Bachelor of Science Degree in Fisheries Resources from the University of Idaho in 1986. He has been employed as a Fisheries Scientist at CRITFC since 1990. Mr. Hatch has been the Project Manager on the BPA Kelt Steelhead Reconditioning Project (2000-017) and the Kelt Enumeration Study at Lower Granite Dam (COE funded) since 2001. During the fourteen years that Mr. Hatch has been with CRITFC he has led projects on developing escapement estimation techniques where he gained an extensive knowledge of weir construction, placement, and utilization. He also has managed all aspects of numerous contracts (with BPA 92-055; 2000-017; 2001-049), and subcontracts (with all CRITFC member tribes) including budgeting, contracting, and procurement. **Dr. David E. Fast** received a Ph.D. from the University of Washington in 1987. Dr. Fast is the Research Managers for Fisheries Resource Management Program, Yakama Nation. Dr. Fast is responsible for the design, development, and implementation of a major supplementation and research facility to test the concept of using artificial production to rebuild natural spawning populations of spring chinook salmon in the Yakima Basin (BPA Project 199506325). He also has developed research programs to reintroduce extirpated

coho salmon populations and to recondition ESA listed steelhead kelts for multiple spawning. Other responsibilities include writing detailed project plans, develop short- and long-term project goals and objectives, and supervise professional and technical staff.

2. Ryan Branstetter, Fisheries Biologist, CRITFC; Chris Brun, Fisheries Biologist, Bob Spatholts, Fisheries Biologist, Devin Best, Fisheries Biologist, CTWSRO; Chris Fisher, Fisheries Biologist, Jerry Marco, Fisheries Biologist, CCT; Joe Boldgett, Fisheries Biologist, YN.

3. Funding Source: Bonneville Power Administration, Division of Environment, Fish and Wildlife.

4. The proposed activities will be coordinated with and among the Warm Springs tribe, Yakama Nation, and Colville Confederated Tribes by the CRITFC, using the genetics lab at the University of Idaho. Permit conditions will be a made a part of any subcontract issued to carry out activities of this project.

5. Provide a description of the arrangements for the disposition of any tissue samples, dead specimens, or other remains, either in a museum or other institution, for the continued benefit to science. Include the list of researchers, laboratories, museums, and/or institutional collections that would receive these tissue samples or specimens. Please include name, address, contact, and phone number for each. **Shawn Narum will be the lead Geneticist** on the project. Shawn Narum received a Masters of Science Degree from the University of San Diego in 2000 and a Bachelor of Science Degree in Fishery Biology from Colorado State University in 1996. Mr. Narum has been employed by CRITFC (stationed at the Collaborative Center for Applied Fish Science Laboratory in Hagerman, ID) as Fisheries Scientist / Conservation Geneticist since 2002. Prior to coming to CRITFC, Mr. Narum was a Senior Research Associate for Chugai Biopharmeceuticals in San Diego and a Contract Geneticist for the National Marine Fisheries Service Southwest Fisheries Science Center. Mr. Narum is the lead Geneticist on several steelhead and chinook salmon projects using microsatellite DNA analyses to examine stock composition, relatedness, and defining conservation units. **Dr. Madison Powell** received his Ph.D. in the Systematics & Evolutionary Biology program at Texas Tech University in 1995 and is currently an Assistant Professor in the Department of Fish and Wildlife Resources and Department of Animal and Veterinary Sciences at the University of Idaho. Dr Powell is also the director of the Center for Salmonid & Freshwater Species at Risk at the University of Idaho. He supervises UofI molecular genetic laboratories at the Aquaculture Research Institute in Moscow, ID and at the Hagerman Fish Culture Experiment Station in Hagerman, Idaho. The laboratories' primary goals are to provide timely genetic information to applied conservation genetic questions, and provide genetic advice and consultation to state, federal, and tribal agencies regarding endangered fishes and fisheries management. Dr. Powell is currently the Principal investigator of several genetic projects examining reproductive success of hatchery and wild fish using

microsatellite DNA analyses including (sockeye BPA project, Chinook captive broodstock project). Dr. Powell will assist in the development of the research study design, supervise genetic lab work, analyze data and report results.

6. See Sections G & I for description of holding tanks and transport, respectively.

F. **Project Description, Purpose, and Significance:** Please describe the purpose of your study or project. If available, please attach a copy of the formal project proposal or contract, including the contract number, to your application. You may reference the appropriate section of the proposal/contract in response to a particular question.

1. Project justification and objective(s): The primary purpose of this assessment is to estimate the incidental take of ESA listed fish by ESU as a result of the proposed research at the Yakima River, Shitike Creek, Omak Creek, and Satus Creek. Available data on run size, run timing, age composition, hatchery production, and ecology of stocks were used to evaluate potential effects. Kelt reconditioning promotes re-initiation of feeding, thereby enabling them to survive and rebuild energy reserves required for proper gondal development and iteroparous spawning. Kelt reconditioning techniques were initially developed for Atlantic salmon *Salmo salar* and sea-trout *S. trutta.* A review of these studies and those applicable to steelhead kelts are summarized in Evans et al. 2001. This project identifies and systematically tests several kelt reconditioning approaches. Enhancing the species' natural iteroparity (i.e. its ability to spawn more than once in its life) may strengthen wild steelhead populations. Fish that have spawned in one or more previous years contribute substantially to some wild steelhead populations (e.g. as high as 79% for 1994-96 in the Utkholok River of Kamchatka; MSU undated; M. Powell UI and R. Williams, ISRP pers. comm.). However, the contribution from iteroparous steelhead in Columbia River populations is much lower. For example, recent estimates of repeat spawners in the Kalama River (tributary of the unimpounded lower Columbia River) have exceeded 17% (NMFS 1996), which is the highest published iteroparity rate we found from the Columbia River Basin. Farther upstream, 4.6% of the summer run in the Hood River (above only one mainstem dam) are repeat spawners (J. Newton, ODFW, pers. comm.). Similarly, summer steelhead in the South Fork Walla Walla River have 2%-9% rates of repeat spawning (J. Germond, ODFW, pers. comm.), whereas repeat spawners compose only 1.6% of the Yakima River wild run (from data in Hockersmith et al. 1995) and 1.5% of the Columbia River run upstream from Priest Rapids Dam (L. Brown, WDFW, unpubl. data). In the Snake River subbasin, at least 2% of wild steelhead returning to Idaho's Clearwater River were repeat spawners when there were only two downstream dams (Lewiston Dam and Bonneville Dam; Whitt 1954). In recent years, we know of a few confirmed repeat spawners that were observed in the juvenile bypass system at Little Goose Dam in 2000 and 2001(Evans and Beaty 2001) as well as a small number that returned to the Lower Granite Dam in 2002 (Hatch et al. 2002), and we suspect that < 1% of wild Snake River steelhead survive to spawn more than once. Under present conditions, very few (< 5% overall) summer steelhead in the Columbia River – especially in the upper basin – appear

capable of exhibiting iteroparity in the impounded, post-development Columbia Basin.

2. This proposed work responds directly to several reasonable and prudent alternatives identified in NOAA's biological opinion on the Federal Columbia River Power System, as listed in the box below:

RPA Number	Description
NMFS RPA 107	Assess survival of adult salmonids migrating upstream, and factors contributing to unaccountable losses.
NMFS RPA 118	Assess and enumerate indirect prespawning mortality of upstream-migrating fish. Enhance efforts to enumerate unaccountable losses in mainstem reservoirs.
NMFS RPA 184	Develop an hatchery research, monitoring, and evaluation program to determine whether hatchery reforms reduce the risk of extinction for salmonids
RA 994	Assess adult salmon passage success in the lower Columbia and Snake rivers, evaluate specific flow and spill conditions, and evaluate measures to improve adult anadromous passage.
RM&E Topics:	General migration corridor; NMFS RPAs and RAs: 85,87,190, 193
	Adult homing/straying: Outmigration of steelhead kelts; NMFS RPAs and RAs: 37,109,199,1224,2000
Corps Action 109	The Corps shall initiate an adult steelhead downstream migrant (kelt) assessment program to determine the magnitude of passage, the contribution to population diversity and growth, and potential actions to provide safe passage (Draft Mainstem/Systemwide Artificial Production Program Summary, pg 24).

3. Broader Significance: Steelhead kelts in impounded areas of the Columbia basin should have significantly greater likelihood of exhibiting iteroparity if they are reconditioned in captivity, relative to their current inability to exhibit iteroparity in the impounded, post-development Columbia Basin. Kelt reconditioning promotes re-initiation of feeding, thereby enabling them to survive and rebuild energy reserves required for proper gondal development and iteroparous spawning.

4. This project links with the Collaborative Center for Applied Fish Science (Project 2001-046-00).

5. Despite the thousands of kelts that arrived at Lower Granite Dam in 2002, as in 2001, very few successfully navigated the Columbia Basin hydrosystem. Radio telemetry indicated that only 17.6% (37/210) and 13.3% (8/210) of tagged kelts released from Lower Granite Dam tailrace reached the Ice Harbor Dam tailrace and Bonneville Dam tailrace, respectively. In addition to kelt mortality associated with dam passage, depleted energy stores and physical deterioration likely constituted important mortality, compounded by fasting for many months during migration and spawning (Love 1970). Without this project and associated efforts, return steelhead spawners will continue to be underrepresented in the Columbia River system.

G. **Project Methodology:** Please provide a detailed description of the project, or program, in which the listed species is to be used, including:

1. The described research in this biological assessment will occur between May 15, 2004, and December 31, 2005

2. A discussion of the procedures and techniques which will be used during the project. The discussion should include, at a minimum:

a. Yakima River: Up to 200 Yakima River outmigrating kelts will be captured at the CJMFF and directly be released in a one time release below Bonneville Dam. Shitike Creek: We will attempt to capture around 200 virgin spawners using a weir. Omak Creek: We will attempt to capture around 200 virgin spawners using a weir. Satus Creek: We will obtain at most 80 (minimum 40) virgin spawners headed upstream and obtain genetic samples from them before they are transported to either 2 of the 4 streams (North and South Fork Logy, Section Corner, and/or Yatamai Creeks will be decided by end of 2004) that have suitable steelhead spawning gravels. The 4 creeks are geographically isolated by large waterfalls and will be racked to keep adult steelhead in the streams until they spawn. We will capture our released fish when they become outmigrating kelts using a V-weir.

b. All adult Steelhead kelts will receive Passive Integrated Transponder (PIT) tags inserted into the body cavity via syringe. No take of ESA listed fish is expected. A portion of the Yakima River short-term reconditioned fish (~60) along with the direct transport and release group (~60) will be either radio-tagged or will have long-life (>300 day) acoustic transmitters surgically implanted into the body cavity below the pectoral fin for long-term tracking of outward migration behavior from below Bonneville Dam to the estuaries and continental shelf. Approximately 40 Yakima River individuals from the long-term reconditioning experiment will receive radio-tags using the gastric insertion technique to monitor return spawning rates and the location of spawning grounds.

A portion of adult steelhead kelts at Shitike Creek (~40 individuals), Yakima River (~100 individuals) will have long-life (>50 day) radio transmitters surgically implanted into the body cavity below the pectoral fin for long-term tracking or use of the gastric insertion technique for short-term tracking.

Adult steelhead kelts at Shitike Creek will have floy-tags attached at the base of the dorsal fin to aid in identification of experimental fish. No take of ESA listed fish is expected.

c. Formalin will be administered five times weekly at 1:6,000 for 1 hour in all reconditioning tanks to prevent fungal outbreaks.

d. We made substantial progress in 2001 and 2002 regarding long-term kelt reconditioning, achieving a current long-term survival rate of 73% in 2003. However, the applicability of long-term reconditioning must be evaluated at different locations (i.e., with different source populations) in order to adequately assess long-term reconditioning's ability to augment iteroparity rates. Long-term reconditioning will be performed using fish from 4 sites: Omak Creek, Yakima River, Satus Creek, and Shitike Creek. Some of the steelhead kelts will be captured at V-weir sites (Shitike Creek, Omak Creek, and Satus Creek) that will direct fish to a capture box that will hold them until they can be dip netted into a holding tank then transported via truck to a reconditioning facility. Once at the reconditioning facility kelts will be placed in 20' circular tanks that use well water and/or river water and given a diet of krill and Moore-Clark pellets for 4-5 months. The rest of the steelhead kelts will need to be captured at the Yakima River at the Chandler juvenile evaluation facility at the juvenile bypass and dip netted off of the separator and held in 4'x 6' tank until they can be transported to 20' circular tanks that use well water and/or river water and given a diet of krill and Moore-Clark pellets for reconditioning for 4-5 months and 6-8 weeks.

All steelhead kelts captured at all sites (Shitike Creek, Omak Creek, Satus Creek, and the Yakima River) will be retained in a 20'(l) x 20'(w) x 4'(h) circular tank. Individual tank carrying capacity was set at a maximum of 200 fish based on the aquaculture experience of YN hatchery staff, and the project goal of maximizing steelhead kelt survival in captivity. Formalin will be administered five times weekly at 1:6,000 for 1 hour in all reconditioning tanks to prevent fungal outbreaks. Due to the successful use in treating *Salmonicola* during the kelt reconditioning experiments in 2000 (Evans and Beaty 2000), Ivermectin™ will again be diluted with saline (1:30) and injected into the posterior end of the fish's esophagus using a small (1cc) plastic syringe. Water used for the tanks will either be ground well, river, or both depending on the site and will be of good quality for the health of the fish.

Kelts will be given a diet of krill and Moore-Clark pellets to elicit a feeding response from steelhead kelts. Short-term reconditioned fish will be held for a total of 6-8 weeks then trucked below Bonneville for release. Long-term reconditioned fish will be held for a total of 4-7 months and then released in-river to spawn.

Approximately 40 Yakima River individuals from the long-term reconditioning experiment will receive radio-tags using the gastric insertion technique to monitor return spawning rates and the location of spawning grounds. Once we receive an adequate amount of fish to compare against reconditioned fish, they will then be transported to the Hamilton boat ramp below Bonneville Dam.

Fish captured in Shitike and Omak Creeks will be released to continue their migration to spawning grounds upstream.

At Satus Creek we will obtain at most 80 (minimum 40) virgin spawners headed upstream and obtain genetic samples from them before they are transported to either 2 of the 4 streams (North and South Fork Logy, Section Corner, and/or Yatamai Creeks will be decided by end of 2004) that have suitable steelhead spawning gravels. The 4 creeks are geographically isolated by large waterfalls and will be racked to keep adult steelhead in the streams until they spawn. We will capture our released fish when they become outmigrating kelts using a V-weir. These outmigrating kelts will then be held for long-term reconditioning (6-8 months) and subsequently be reintroduced to the system the following year. These streams provide a good opportunity for us to establish parentage rates in a field laboratory setting.

Successful expression of iteroparity in steelhead may not simply be limited by post-spawning downstream passage through the mainstem corridor but also by starvation. Thus, short-term conditioning may augment iteroparity rates by initiating the feeding process and allowing kelts to naturally undergo gonadal recrudescence in the estuary and marine environments. Short-term reconditioning is defined as the period of time needed (6 to 8 weeks) for kelts to initiate post-spawning feeding, followed by the transportation of kelts around mainstem hydroelectric facilities for release and natural rearing and rematuration in the Pacific Ocean. Short-term reconditioning will be performed at the CJMFF on the Yakima River

Truck Transport: Given the high mortality rates of emigrating kelts observed via radio telemetry in the Snake River (Evans et al. 2001; Evans 2002; Hatch et al, in review), iteroparity may simply be augmented by transporting kelts around the hydro system, thereby increasing the number of kelts that successfully have access to the marine environment. The purpose for this objective is to evaluate the lowest cost alternative aimed at increasing steelhead iteroparity. The objective will be conducted at the CJMFF at Prosser, WA.

e. Approximately 20 first-time spawners and 20 steelhead kelts from the long-term reconditioning experiment at the CJMFF will be retained to ascertain gamete and progeny viability. These fish will be air spawned, their gametes will then be refrigerated and sent to the University of Idaho where they will be fertilized and evaluated. Some of the fertilized eggs will be raised to adulthood to evaluate the gamete viability of the progeny.

Adult Steelhead kelts at Shitike Creek, Satus Creek and Omak Creek, will have a fin clip taken for genetic analysis. No take of ESA listed fish is expected

3. <u>Steelhead kelt collection</u> While there are mortalities associated with the take of adult steelhead/kelts, these potential mortalities must be viewed in the context of the higher natural mortality that would occur for these fish without intervention.

<u>Juvenile *Oncorhynchus mykiss* Collection</u> There is no method to avoid sampling ESA-listed fish in a screw-trap or V-weir. The rotary screw trap or V-weir will be deployed at Omak Creek, Shitike Creek, and/or 2 of the 4 streams in the Satus watershed. We will take precautions to minimize the effect of sampling

all fish including frequent monitoring, safe handling procedures, and expedient measurement. No take of ESA listed fish is expected.

Collection of Adult Rainbow Trout (*O. mykiss*) It is possible that resident rainbow trout may be mating with returning steelhead and must be identified so that assigning parentage will be successful. There is no method to avoid sampling ESA-listed fish in a screw-trap or V-weir. The rotary screw trap or V-weir will be deployed at Omak Creek, Shitike Creek, and/or 2 of the 4 streams in the Satus watershed. Adult rainbow trout will have a genetic sample taken (caudle fin punch) that will be analyzed to isolate genetic contributors to juvenile stocks. We will take precautions to minimize the effect of sampling all fish including frequent monitoring, safe handling procedures, and expedient measurement. No take of ESA listed fish is expected.

H. Description and Estimates of Take:

The description of the listed species to be taken during the proposed activities should include the following:

1. Upper Columbia River steelhead, endangered, August 18, 1997. This inland steelhead ESU occupies the Columbia River Basin upstream from the Yakima River, Washington, to the United States/Canada Border (Busby et al. 1996). (USFWS 2002)

   Mid-Columbia River steelhead, threatened, March 25, 1999. The Mid-Columbia River Unit encompasses the geographic area from Wind River, Washington, and the Hood River, Oregon (exclusive), upstream to, and including, the Yakima River, Washington. (USFWS 2002)

2. Sampling will occur throughout the run of steelhead returning to the Omak and Satus Creeks, Yakima River and Shitike Creek sampling sites.

3. Since 1991, the NOAA Fisheries has identified several populations of Columbia River Basin salmon and steelhead as ESUs that require protection under the ESA. The populations potentially affected by the proposed research project are shown below as described by the NOAA Fisheries and their current listing status (NMFS 1999), currently under review. Any changes in the status of these listings or ESU boundary changes will be addressed in the consultation process. These ESU populations are only those that are potentially present in the proposed research areas from March 2003, to December 31, 2005. The U.S. Fish and Wildlife Service (USFWS) have listed the bull trout populations as threatened since 1998. Since bull trout are widely distributed and have varying life histories and therefore different threats, the USFWS identified 22 recovery units within the Columbia River Distinct Population Segment, each with its own recovery strategy (USFWS 2002).

   Historically, summer steelhead differed in their time of entry into the Columbia River and were defined accordingly as groups A and B in the CRFMP and in the Status Review of West Coast Steelhead. These designations are based on the observation of a bimodal migration of adult steelhead at Bonneville Dam and differences in age (1-versus 2-ocean) and adult size observed among Snake River steelhead (Busby et al 1996). Typically, adult A-run steelhead enter fresh water from June to August; as defined, the A-run passes Bonneville Dam before 25 August (CBFWA 1990). Group A steelhead originate in production areas throughout the Columbia River Basin, whereas Group B steelhead are believed to originate only in portions of the Clearwater and Salmon River drainages in Idaho (TAC 1997). Upper Columbia River steelhead are designated as Group A

4. A description of estimated take per annual period for activities at each discrete location:

Adult Steelhead Kelt Collection and Reconditioning

Upper Columbia River Adult Steelhead Harassment/Take Estimates

Capture

We are interested in reconditioning approximately 200 steelhead kelts at Omak Creek. With the Yakama reconditioning effort we typically kept 80% of what was handled and released about 20% (Hatch et al. a. in review). With 200 intended for reconditioning and with 80 percent captured kept for reconditioning, there will be 250 total harassed in capture. In order to determine incidental mortality for this phase, we used Yakama reconditioning as an estimate for the amount of handling mortalities associated with adult steelhead kelt capture. Handling mortalities at the CJMFF averaged about 4% (Hatch et al. a. in review). With a total of 250 fish handled and assuming a 4% mortality rate, we could have 10 potential mortalities for this phase.

Reconditioning

Harassment rates are based on the number of steelhead that may be potentially harassed during their movement from the reconditioning tank for sampling to the truck for release. We intend to recondition up to 200 fish at Omak Creek, which results in the possible harassment of up to 200 adult steelhead kelts. Potential take is based off of last year's mortality rates from the Yakama Nation's previous reconditioning efforts, which was ~ 40% for the low in long-term reconditioning (Hatch et al. a. in review). With 200 potential reconditioned fish at a 40% mortality rate, there is the potential for 80 mortalities.

***Totals*: 250 adults captured, handled, and released (in 2 different stages), with a total potential mortality of 90 adults.**

Middle Columbia River Adult Steelhead Harassment/Take Estimates

Capture

We are interested in reconditioning approximately 200 steelhead kelts at Shitike Creek, and min (40)/max (80) virgin spawners from Satus Creek. We are also interested in reconditioning approximately 800 adult steelhead kelts at the facility at the CJMFF. With the Yakama reconditioning effort we typically kept 80% of what was handled and released about 20% (Hatch et al. a. in review). For the CJMFF on Yakima River @ Prosser, WA, with 800 intended for reconditioning and 200 for direct release and 80 percent kept for reconditioning, there will be a total of 1,250 captured and handled initially, with 1000 kept for two different releases.

For Shitike Creek steelhead kelts and Satus Creek virgin spawners, we calculate:

(200 intended for reconditioning / 80 percent kept for reconditioning) + (80 intended for transport/ 80 percent total kept for transport) + (maximum of 80 steelhead kelts recaptured for reconditioning) = 250 + 100 = 350 total harassment

That means that the total MCR adult steelhead kelt captured and handled will be 1,600; with a total of 1,200 held for reconditioning and 80 for transport to release sites.

For the incidental mortality associated with the initial capture and handling, we used the Yakama reconditioning effort as an estimate for the amount of handling mortalities associated with adult steelhead kelt capture. Handling mortalities at the CJMFF averaged ~4% (Hatch et al. a. in review).

CJMFF on Yakima River @ Prosser, WA

1,250 total fish handled * .04= 50 potential mortalities

Shitike Creek and Satus Creek

(250 fish handled * .04) + (100 fish handled * .04) = 10 + 4 = 14 potential mortalities.

So, in the initial capture an handling phase, we estimate up to 64 mortalities.

Reconditioning

Since we intend to recondition up to 800 fish and 200 for direct transport/release at the Yakima River at the CJMFF, we will have a total of up to 1000 adult steelhead kelts in holding tanks for reconditioning. We also plan on reconditioning around 200 steelhead kelts at Shitike Creek and the 80 fish that will be released into the two of the four sites at the CJMFF. All together, this could result in up to 1, 280 adult steelhead kelts in these locations combined.

Potential take is based off of last year's mortality rates from the Yakama Nation's previous reconditioning efforts, which was about 40% for the low in long-term reconditioning (Hatch et al a. in review). Potential take for the direct release/transport is assumed to be about 4% based off of our handling take at the CJMFF (Hatch et al. a. in review). With 1000 potential long-term reconditioned fish at an assumed 40% mortality rate, there could be 400 potential mortalities. In the next group, with up to 200 potential kelts for direct transport/release at an assumed 4% mortality rate, there could be 8 potential mortalities. Finally, for the transport group of 80 potential capture/transport/long-term recondition/release at an assumed 40% mortality rate, there could be 32 potential mortalities.

Totals: 1600 adult steelhead/kelts captured and handled, of which 1,200 will be held for reconditioning, resulting in a total potential mortality of 504 adults (64 in initial phase and 440 potentially lost during reconditioning).

*Juvenile Steelhead (**O. mykiss)** collection*

Upper Columbia River Juvenile Steelhead

Harassment rates are based on the number of juvenile *O. mykiss* that may be captured by a rotary screw trap or V-weir, handled to obtain genetic data, and then released to resume migration. We based captures on yearly smolt release data at Omak Creek (WDFW 2003) then averaged the data (smolt release, ~17,000). Based on the average, we assume a 10% capture rate with a 1% mortality rate.

We will capture and handle 1,700 juveniles and may encounter a total of 17 mortalities.

Middle Columbia River Juvenile Steelhead

Harassment rates are based on the number of juvenile steelhead that may be captured by a rotary screw trap, handled to obtain genetic data, and then released to resume migration. The number of steelhead estimated captured by the rotary screw trap was based off of previous years capture data at Shitike Creek with a screw trap (Warm Springs Tribal Fisheries Program, personal communication). We then averaged the yearly screw trap capture data and then assumed that we would capture at nearly the same rate (1,644 juveniles). Based on the average capture rate, we assume a 1% mortality rate.

1,644 potentially captured juvenile steelhead smolts at an assumed 1% mortality rate could result in 16 potential mortalities

In the 2 of the 4 following listed creeks in the Satus Creek drainage (North Fork Logy, South Fork Logy, Section Corner, and Yatamai Creeks) will have virgin spawners placed and then racked off to prevent them from descending the waterfalls. This area is geographically isolated from resident rainbow trout populations. We will then capture juvenile steelhead smolts to obtain parentage data. Based on Yuen and Sharma's smolt per spawner estimates (~ 58 smolts/spawner) and at least 40 spawners, there could possibly be 2,320 outmigrating smolts (Yuen and Sharma, 2004).

We should be able to capture at least 10 % of the outmigrating smolt population, which gives us 232 smolts captured. We will assume a 1% mortality rate, which results in 3 possible mortalities.

I. **Transportation and Holding**

1. **Transportation of a Listed Species:** Provide a description of how any live individuals taken from the capture site or other facility (including rescue and relocation activities) will be transported including:

   a. All steelhead kelts captured at weir sites (Omak, Shitike, and Satus Creeks) will be truck transported from capture area to reconditioning site by respective Tribal Fish and Wildlife Program staff. At the end of reconditioning all surviving reconditioned kelts will be truck transported from reconditioning sites to release sites by respective Tribal Fish and Wildlife Program staff. Number of transported steelhead kelts will correspond with the number of kelts captured at weir sites (Please see Upper and Middle Columba River Adult Steelhead Harassment/Take Estimates, Capture Sections for details on the amount of steelhead kelts that we anticipate transporting to reconditioning facilities from capture sites) and subsequent release of all reconditioned kelts (Please see Upper and Middle Columba River Adult Steelhead Harassment/Take Estimates, Reconditioning Sections for details on the amount of steelhead kelts that we anticipate transporting to release sites from reconditioning tanks).

b. Length of time in transit for the transfer of the individual(s) from the capture site to the holding facility or to the target location. Steelhead kelts will not exceed 8 hours in transit from capture location to reconditioning facilities.

c. Length of time in transit for any planned future move/transfer of the individual(s). Steelhead kelts will not exceed 8 hours in transit from reconditioning facilities to release site.

d. The qualifications of the common carrier or agent used for transportation of the individual(s). All drivers have prior fish hauling experience and a Commercial Driver's License.

e. A description of the pen, tank, container, cage, cradle, or other devices used, both to hold the individual(s) at the capture site and during transportation. Steelhead kelts will immediately dipnetted from picket weir or removed from a weir trap box and then immediately hand carried to 1500-gallon tank truck via fish bag.

Special care before, during and after transportation (e.g., use of oxygen, temperature control, anesthetics, antibiotics, etc.) Maximum water temperature will not exceed 63^0 F by using cool circulating river water, a chiller, or ice (non-chlorinated). Oxygenation of water will be maintained at saturation. Fish will receive a .25ml injection of oxytetracycline to boost immune system response.

2. **Holding of a Listed Species:** Describe the plan for care and maintenance of any live individuals, including a complete description of the facilities where any such individuals will be maintained including:

Long-term reconditioning will be performed using fish from 4 sites: Omak Creek, Yakima River, Satus Creek, and Shitike Creek. Some of the steelhead kelts will be captured at V-weir sites (Shitike Creek, Omak Creek, and Satus Creek) that will direct fish to a capture box that will hold them until they can be dip netted into a holding tank then transported via truck to a reconditioning facility. Once at the reconditioning facility kelts will be placed in either a 20’ or 15’ circular tank that use well water and/or river water and given a diet of krill and Moore-Clark pellets for 4-5 months. The rest of the steelhead kelts will need to be captured at the Yakima River at the Chandler juvenile evaluation facility at the juvenile bypass and dip netted off of the separator and held in 4’x 6’ tank until they can be transported to 20’ circular tanks that use well water and/or river water and given a diet of krill and Moore-Clark pellets for reconditioning for 4-5 months and 6-8 weeks.

All steelhead kelts captured at all sites (Shitike Creek, Omak Creek, Satus Creek, and the Yakima River) will be retained in a 20’(l) x 20’(w) x 4’(h) circular tank. Individual tank carrying capacity was set at a maximum of 200 fish based on the aquaculture experience of YN hatchery staff, and the project goal of maximizing steelhead kelt survival in captivity. Formalin will be administered five times weekly at 1:6,000 for 1 hour in all reconditioning tanks to prevent fungal outbreaks. Due to the successful use in treating *Salmonicola* during the kelt reconditioning experiments in 2000 (Evans and Beaty 2000), Ivermectin™ will again be diluted with saline (1:30) and injected into the posterior end of the fish’s esophagus using a small (1cc) plastic syringe. Water used for the tanks will either be ground well, river, or both depending on the site and will be of good quality for the health of the fish.

Kelts will be given a diet of krill and Moore-Clark pellets to elicit a feeding response from steelhead kelts. Short-term reconditioned fish will be held for a total of 6-8 weeks then trucked below Bonneville for release. Long-term reconditioned fish will be held for a total of 4-7 months and then released in-river to spawn.

3. **Emergency contingencies**: Identify emergency contingencies- e.g., backup life support systems, alarm systems, redundant water and oxygen supply, release or destroy decision chains, etc. All reconditioning facilities will be continuously monitored by human and remote electronic systems that will alert audibly the presence of life support failure. All tanks are outfitted with back up generators, pumps, and oxygen. The Hatchery Manager will make the decision in consultation with CRITFC to make any release or destroy decisions.

J. **Cooperative Breeding Program:** You must include a statement of willingness to participate in a cooperative breeding program and to maintain or contribute data to a breeding program, if such action is requested.

K. **Previous or Concurrent Activities Involving Listed Species**:

1. Permit holder for #TE001598-2, issued by USFWS for Bull Trout; Section 10 Permits #825 and #1134 issued by NOAA Fisheries for salmon research; Section Permit #1149 issued b NOAA Fisheries for salmon enhancement activities.

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."

____

Robert C. Lothrop, Manager, PDLSD, by and through the BIA Date

Appendix C. Coverage for Roza adult trapping operations.

Annual Report for ESA Section 10 Scientific Research Permit - Provide separate tables for each study.

Part I:

ESU/Species	Life Stage	Take Activity	# of Fish Authorized for Take	Actual Number of Listed Fish Taken	Authorized Unintentional Mortality	Actual Number of Unintentional Mortality	Research Location	Research Period
Mid Columbia steelhead	Adult	Capture, radio tag, DNA sample, release	120	117	0	0	Yakima river Washington	November - April

The above table mirrors the Take Table for the Permit Application except for three columns: 1) # of Fish Authorized for Take, 2) Actual Number of Listed Fish Taken and 3) Actual Number of Unintentional Mortality. This table serves to contrast the number of fish authorized for take to the actual number of fish taken.

<u>Instructions</u>:
Life Stage: choose between juvenile (combine fry, fingerlings, smolts), adult, or post-spawned adults.

Take Activity: Indicate the type of activity: "observe/harass," "capture, handle release," "capture, tag [or mark], release," "intentional mortality." "Intentional mortality" (equivalent to direct mortality or sacrifice) is a type of take activity and must be accounted for on a separate line (see above).

# of Fish Authorized for Take: Indicate the number of fish authorized for take in the permit.

Actual Number of Listed Fish Taken: Indicate the actual number of fish taken during the activities relevant to the annual report.

Authorized Unintentional Mortality: Indicate the number of fish authorized for unintentional mortality in the permit.

Actual Number of Unintentional Mortality: Indicate the actual number of fish unintentionally killed.

Research Period: Indicate the months during which the Type of Take Activity took place.

Part II: Briefly Provide the Following Information

M. A. Measures taken to minimize effects to listed fish

Work-up protocol consisted of fish volitionally leaving the holding tank into anesthetic tank with 40ppm stock solution. After the fish were anesthetized biological data was obtained, fork length, pohp length, weight, sex and scales. DNA fin clip and then a radio tag was inserted gastro intestinally. The fish was then placed into fresh water and allowed to recover for up to 6 hours before they were released back to the river.

B. Effectiveness of these measures

All of the fish fully recovered and swam out of the facility on their own.

N. The condition of listed fish taken and used for the research

The fish appeared to be in excellent condition.

O. General extent of research activities on fish

As stated above collected bio-data to create a data base profile and radio tracked to determine critical habitat for the adult steelhead.

P. How listed fish were injured or killed and how were they disposed of

N/A

Q. Did the research activities have any unforseen effects

none

R. How were all take estimates derived

120 fish were chosen to get a good representation of the adult population above roza dam. And also the logistics of being able to track and monitor fish on a daily basis

S. What steps have been taken to coordinate the research with other researchers

This was a co-operative effort between Yakima nation and the bureau of reclamation to radio tag and track adult steelhead in the upper Yakima river watershed to determine holding and spawning areas. DNA samples were also taken as part of WDF&W genetic profiling for the Yakima river and the YKFP project.

T. Were any problems encountered during the activities

No

U. Briefly summarize any preliminary findings

We found that 50% of the fish tagged spawned in the mainstem Yakima river and the other 50% used tributaries in the upper Yakima watershed. We also determined that a large portion of the run were females and that they actually spawned with resident rainbows.

Appendix D. Adult and Juvenile Take Tables for Mid-Columbia Steelhead Kelt Reconditioning Projects.

Number of individuals	Species and/or Population and/or ESU	Life Stage	Sex	Origin	Take Activity Category (a)	Location	Date(s)	Details
250	Upper Columbia River Steelhead	Adult, Kelt	N/A	N/A	Capture, anesthetize, measure, weigh, release	Omak Cr, WA	March-June	Capture and release 40 PIT-tagged and reconditioned 200 Capture and release mortality 10 Reconditioning mortality 80
1,250	Middle Columbia River Steelhead	Adult, Kelt	N/A	wild	Capture, anesthetize, measure, weigh, release	Prosser, WA	March-June	Capture and release 200 Direct Transport and Release 200 PIT-tagged and reconditioned 800 Capture and release mortality 50 PIT-tagged Direct Transport and Release mortality 8 Reconditioning mortality 400

Number of individuals	Species and/or Population and/or ESU	Life Stage	Sex	Origin	Take Activity Category (a)	Location	Date(s)	Details
100	Middle Columbia River Steelhead	Adult First Time Spawners	N/A	wild	Capture, anesthetize, measure, weigh, tag, release	Satus Cr, WA	December-June	Capture and release 16 PIT-tagged and reconditioned 80 Capture and release mortality 4 Reconditioning mortality 32
250	Middle Columbia River Steelhead	Adult, Kelt	N/A	wild	Capture, anesthetize, measure, weigh, tag, release	Shitike Cr, OR	March-June	Capture and release 40 PIT-tagged and reconditioned 200 Capture and release mortality 10 Reconditioning mortality 80

Number of individuals	Species and/or Population and/or ESU	Life Stage	Sex	Origin	Take Activity Category (a)	Location	Date(s)	Details
1,700	Upper Columbia River Steelhead	Juvenile	N/A	N/A	Capture, anesthetize, genetic sample, release	Omak Cr, WA	March-June	Capture and release mortality 17
232	Middle Columbia River Steelhead	Juvenile	N/A	wild	Capture, anesthetize, measure, weigh, tag, release	Satus Cr, WA	December-June	Capture and release mortality 3
1,680	Middle Columbia River Steelhead	Juvenile	N/A	wild	Capture, anesthetize, measure, weigh, tag, release	Shitike Cr, OR	March-June	Capture and release mortality 16

Appendix E. NOAA 2006 Determination Letter.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
PORTLAND OFFICE
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232-1274

F/NWR5

March 1, 2006

Robert C. Lothrop, Manager
Columbia River Inter-Tribal Fish Commission
729 NE Oregon Street, Suite 200
Portland, OR 97232

RE: Determination of Take for Research Purposes (01-06 CRITFC)

Dear Mr. Lothrop:

This letter is to inform you that the National Marine Fisheries Service (NMFS) Hydropower Division's Federal Columbia River Power System (FCRPS) Branch has determined that the take associated with the ongoing study, "Proposal to Evaluate Reproductive Success of Natural Origin, Hatchery Origin, and Kelt Steelhead in the Columbia River Basin" is permitted in 2006 under the incidental take statement in the 2004 FCRPS Biological Opinion. The take is permitted under the terms, conditions, and requirements set forth below. This study received a determination in 2005 and this determination updates the take allowance for 2006. If the study continues beyond this year, the determination must be updated annually.

The study being considered in this determination would occur at several ongoing sites, including Prosser Hatchery, Shitike Creek, Omak Creek, Ahtanum Creek, Satus Creek, and Section Corner Creek. At each location, kelts will be captured and reconditioned for outmigration.

The study implements research described in the 2004 FCRPS Biological Opinion, Appendix G-14, Section 4.18, "Return Rates of Reconditioned Kelts Encountered in the System." The 2004 FCRPS Biological Opinion anticipated that this type of near term research would be implemented through the regional processes. The study is being funded by the Bonneville Power Administration's (BPA) Fish and Wildlife Program. The Northwest Power and Conservation Council recommended, and BPA has agreed, to fund the project in 2006.

Terms, Conditions, and Requirements

General Provisions

- Endangered Species Act (ESA)-listed fish must be handled with extreme care and kept in water to the maximum extent possible during sampling and processing. Adequate circulation and replenishment of water in holding units is required. When using gear that captures a mix of species, ESA-listed fish must be processed first to minimize the duration of handling stress. ESA-listed fish must be transferred using a sanctuary net (which holds water during transfer) whenever necessary to prevent the added stress of being out of water. Should the FCRPS Branch determine that a researcher's procedure is no longer acceptable; the researcher must immediately cease such activity until the FCRPS Branch determines an acceptable substitute procedure.

- Each ESA-listed fish handled out of water must be anesthetized to prevent injury or mortality. Anesthetized fish must be allowed to recover (e.g., in a recovery tank) before being released. Fish that are simply counted must remain in water, but do not have to be anesthetized.

- To minimize the lateral transfer of pathogens, a sterilized needle must be used for each individual injection when PIT-tagging ESA-listed fish. Sterilization techniques are required for all procedures.

- Whenever possible, unintentional or indirect mortalities of ESA-listed fish that occur during scientific research and monitoring activities shall be used in place of intentional lethal take, if applicable.

- Each researcher must ensure that the ESA-listed species are taken only by the means, in the areas, and for the purposes set forth in the research proposal, as limited by the terms and conditions.

- Each researcher, in effecting the take authorized by this determination, is considered to have accepted the terms and conditions of this determination and the incidental take statement of the 2004 FCRPS Biological Opinion, and must be prepared to comply with the provisions of these two documents, and the applicable NMFS' regulations and the ESA.

- Each researcher is responsible for the actions of any individual operating under the authority of the researcher's designated take authorization within the incidental take statement of the 2004 FCRPS Biological Opinion and this determination.

- Each researcher, staff member, or designated agent acting on the researcher's behalf must possess a copy of the incidental take statement in the 2004 FCRPS Biological Opinion and this determination when conducting the activities for which a take of ESA-listed species or other exception to ESA prohibitions is authorized herein.

- Researchers may not transfer or assign a take authorization included within this determination to any other person(s), as person is defined in Section 3(12) of the ESA. The take authorization ceases to be in force or effective if transferred or assigned to any other person without prior authorization from the FCRPS Branch.

- Each researcher must obtain any other Federal, State, and local permits or authorizations necessary to conduct the activities provided for in this incidental take statement.

- Each researcher must coordinate with other applicable co-managers and researchers to ensure that no unnecessary duplication or adverse cumulative effects occur as a result of the researcher's activities.

- Each researcher must allow any FCRPS Branch employee(s), or any other person(s) designated by the FCRPS Branch, to accompany field personnel during the activities provided for within the proposed research. Each researcher must allow such person(s) to inspect the researcher's records and facilities if such records and facilities pertain to ESA-listed species covered by this determination, the incidental take statement, or NMFS' responsibilities under the ESA.

- Under the terms of NMFS' regulations, a violation of any of the terms and conditions of the incidental take statement of the 2004 FCRPS Biological Opinion, which is also covered in this determination, will subject the offending researcher and/or any individual who is operating under the authority of the incidental take statement in the 2004 FCRPS Biological Opinion and this determination, to penalties as provided for in the ESA.

- Each researcher is responsible for biological samples collected from ESA-listed species as long as they are useful for research purposes. The terms and conditions concerning any samples collected remain in effect as long as the researcher maintains authority over and responsibility for the material taken. A researcher may not transfer biological samples to anyone not listed in the research proposal without obtaining prior written approval from the FCRPS Branch. Any such transfer will be subject to such conditions as the FCRPS Branch deems appropriate.

- The FCRPS Branch may amend a take authorization identified in this determination or adjust specific take levels after reasonable notice to the applicable researcher.

- The FCRPS Branch may revoke a take authorization identified in the incidental take statement of the 2004 FCRPS Biological Opinion and this determination if the activities it provides for are not carried out, if the activities are not carried out in accordance with the conditions of this determination and the incidental take statement in the 2004 FCRPS Biological Opinion and the purposes and requirements of the ESA, or if the FCRPS Branch otherwise determines that the continuation of activities would operate to the disadvantage of ESA-listed species.

Study Specific Methodology

- Up to 200 Yakima River outmigrating kelts are permitted to be captured at the Chandler Juvenile Monitoring Facility (CJMF) and directly released in a one-time release below Bonneville Dam. At Shitike Creek, up to 200 virgin spawners will be permitted to be captured using a weir. At Omak Creek, 200 virgin spawners will be permitted to be captured using a weir. At Ahtanum Creek, 200 virgin spawners will be permitted to be captured using a weir. At Satus Creek, up to 20 virgin spawners will be permitted to be captured before they are transported to Section Corner Creek. This location has suitable steelhead spawning gravels. Section Corner Creek is geographically isolated by a waterfall and will be racked to keep adult steelhead in the streams until they spawn. Fish will be captured using a V-weir when they become outmigrating kelts.

- All adult steelhead kelts will receive PIT tags that will be inserted into the body cavity via syringe. A portion of the Yakima River short-term reconditioned fish (~60), along with the direct transport and release group (~60), will be either radio tagged or will have long-life (>300 day) acoustic transmitters surgically implanted into the body cavity below the pectoral fin for long-term tracking of outward migration behavior from below Bonneville Dam to the estuaries and continental shelf. Approximately 40 Yakima River individuals from the long-term reconditioning experiment will receive radio-tags using the gastric insertion technique to monitor return spawning rates and the location of spawning grounds.

- A portion of adult steelhead kelts at Shitike Creek (~40 individuals) and Yakima River (~100 individuals) will have long-life (>50 day) radio transmitters surgically implanted into the body cavity below the pectoral fin for long-term tracking or use of the gastric insertion technique for short-term tracking.

- Long-term reconditioning will be performed using fish from 5 sites. Some of the steelhead kelts will be captured at V-weir sites (Shitike Creek, Ahtanum Creek, Omak Creek, and Satus Creek) that will direct fish to a capture box that will hold them until they can be dipnetted into a holding tank and then transported via truck to a reconditioning facility. Once at the reconditioning facility, kelts will be placed in 20-ft circular tanks that use well water and/or river water and given a diet of krill and Moore-Clark pellets for 4-5 months. The rest of the steelhead kelts will need to be captured at the Yakima River at the CJMF at the juvenile bypass and dipnetted off of the separator and held in a 4 ft x 6 ft tank until they can be transported to 20-ft circular tanks that use well water and/or river water and given a diet of krill and Moore-Clark pellets for reconditioning for 4-5 months.

- All steelhead kelts captured at all sites will be retained in a 20 ft long x 20 ft wide x 4 ft high circular tank. Individual tank carrying capacity will be set at a maximum of 200 fish based on the aquaculture experience of Yakama Nation hatchery staff and the study goal of maximizing steelhead kelt survival in captivity. Formalin will be administered 5 times weekly at 1:6,000 for 1 hour in all reconditioning tanks to prevent fungal outbreaks. Due to the successful use in treating *Salmonicola* during the kelt reconditioning experiments in 2000, Ivermectin™ will again be diluted with saline (1:30) and injected into the posterior end of the fish's esophagus using a small (1cc) plastic syringe. Water used for the tanks will either be ground well, river, or both, depending on the site, and will be of good quality for the health of the fish.

- Kelts will be given a diet of krill and Moore-Clark pellets to elicit a feeding response from steelhead kelts. Short-term reconditioned fish will be held for a total of 6-8 weeks and then trucked below Bonneville for release. Long-term reconditioned fish will be held for a total of 4-7 months and then released in-river to spawn.

- Fish captured in Shitike, Ahtanum, and Omak Creeks will be released to continue their migration to spawning grounds upstream.

- At most, 20 virgin spawners headed upstream at Satus Creek will be obtained for genetic samples before they are transported to Section Corner Creek, which has suitable steelhead spawning gravels. Section Corner Creek is geographically isolated by a waterfall and will be racked to keep adult steelhead in the streams until they spawn. Released fish will be captured when they become outmigrating kelts using a V-weir. These outmigrating kelts then will be held for long-term reconditioning (6-8 months) and subsequently will be reintroduced to the system the following year.

- Successful expression of iteroparity in steelhead may not simply be limited by post-spawning downstream passage through the mainstem corridor but also by starvation. Thus, short-term conditioning may augment iteroparity rates by initiating the feeding process and allowing kelts to naturally undergo gonadal recrudescence in the estuary and marine environments. Short-term reconditioning is defined as the period of time needed (6-8 weeks) for kelts to initiate post-spawning feeding, followed by the transportation of kelts around mainstem hydroelectric facilities for release and natural rearing and rematuration in the Pacific Ocean. Short-term reconditioning will be performed at the CJMF on the Yakima River.

- No more than 30 first-time spawners will be collected at Dworshak Hatchery and retained to ascertain gamete and progeny viability. These fish will be air spawned and then their gametes will be refrigerated and sent to the University of Idaho, where they will be fertilized and evaluated. Some of the fertilized eggs will be raised to adulthood to evaluate the gamete viability of the progeny. The adults then will be held and reconditioned for a second spawning at either the Nez Perce Tribal Hatchery Complex or the Aquaculture Research Institute at the University of Idaho.

- All adult steelhead kelts at Shitike Creek, Satus Creek, Ahtanum Creek, and Omak Creek will be fin clipped for genetic analysis.

- The rotary screw trap or V-weir will be deployed at Omak Creek, Shitike Creek, Ahtanum Creek, and Section Corner Creek. Precautions will be taken to minimize the effect of sampling all fish, including frequent monitoring, safe handling procedures, and expedient measurement. Adult rainbow trout will have a genetic sample taken (caudle fin punch) that will be analyzed to isolate genetic contributors to juvenile stocks.

- Sampling will occur throughout the run of steelhead returning to the Omak Creek, Ahtanum Creek, Satus Creek, and Shitike Creek sampling sites.

- All reconditioning facilities will be continuously monitored by human and remote electronic systems that will alert audibly the presence of life support failure. All tanks are outfitted with back up generators, pumps, and oxygen. The Hatchery Manager will make the decision in consultation with CRITFC to make any release or destroy decisions.

Transportation

- CJMF may transport kelts around the hydro system, thereby potentially increasing the number of kelts that successfully have access to the marine environment, as part of an evaluation of increasing steelhead iteroparity.

- All steelhead kelts captured at weir sites (Omak, Shitike, Ahtanum, and Satus Creeks) will be truck transported from the capture area to reconditioning site by respective Tribal Fish and Wildlife Program staff. At the end of reconditioning, all surviving reconditioned kelts will be truck transported from reconditioning sites to release sites by respective Tribal Fish and Wildlife Program staff

- The length of time in transit for the transfer of the individual(s) from the capture site to the holding facility, or to the target location for kelts, will not exceed 8 hours in transit from capture location to reconditioning facilities.

- The length of time in transit for steelhead kelts will not exceed 8 hours in transit from reconditioning facilities to release site.

- Necessary qualifications of the common carrier or agent used for transportation of the fish shall include a requirement that all drivers have prior fish hauling experience and a Commercial Driver's License.

- There will be a description of the pen, tank, container, cage, cradle, or other devices used both to hold the individual at the capture site and during transportation. Steelhead kelts will be immediately dipnetted from picket weir or removed from a weir trap box and then immediately hand carried to a 1500-gallon tank truck via a fish bag.

- Special care will be taken before, during, and after transportation (e.g., use of oxygen, temperature control, anesthetics, antibiotics, etc.). Maximum water temperature will not exceed 63 F by using cool circulating river water, a chiller, or ice (non-chlorinated). Oxygenation of water will be maintained at saturation. Fish will receive a .25ml injection of oxytetracycline to boost immune system response.

- In 2006, for this study the total amount of fish (listed and unlisted) allowed to be captured, handled, tagged, and released is limited to the following numbers and other conditions as indicated below:

Number of Individuals	Species and/or Population and/or ESU	Life Stage	Sex	Origin	Take Activity Category	Location	Date(s)	Allowable Take
250	Upper Columbia River Steelhead	Adult, Kelt	N/A	Listed/wild	Capture, anesthetize, measure, weigh, release	Omak Cr, WA	March-June	Capture and release 40 PIT-tagged and reconditioned 200. Capture and release mortality up to 10. Reconditioning mortality up to 80.
250	Middle Columbia River Steelhead	Adult, Kelt	N/A	Listed/wild	Capture, anesthetize, measure, weigh, release	Ahtanum Cr, WA	March-June	Capture and release 40 PIT-tagged and reconditioned 200. Capture and release mortality up to 10. Reconditioning mortality up to 80.
1,250	Middle Columbia River Steelhead	Adult, Kelt	N/A	Listed/wild	Capture, anesthetize, measure, weigh, release	Prosser, WA	March-June	Capture and release 200. Direct Transport and Release 200. PIT-tagged and reconditioned 800. Capture and release mortality up to 50. PIT-tagged Direct Transport and Release mortality up to 8. Reconditioning mortality up to 400.
20	Middle Columbia River Steelhead	Adult	N/A	Listed/wild	Capture, anesthetize, measure, weigh, tag, release, recondition	Satus Cr, WA	February-June	Capture , PIT-tag and release 20. Recapture and recondition the same 20 individuals. Capture and release mortality up to 4. Reconditioning mortality up to 20.
250	Middle Columbia River Steelhead	Adult, Kelt	N/A	Listed/wild	Capture, anesthetize, measure, weigh, tag, release	Shitike Cr, OR	March-June	Capture and release 40 PIT-tagged and reconditioned 200. Capture and release mortality up to 10. Reconditioning mortality up to 80.
1,700	Upper Columbia River Steelhead	Juvenile	N/A	Listed/wild	Capture, anesthetize, measure, genetic sample, release	Omak Cr, WA	March-June	Capture and release mortality up to 17.
1,700	Middle Columbia River Steelhead	Juvenile	N/A	Listed/wild	Capture, anesthetize, measure, genetic sample, release	Ahtanum Cr, WA	March-June	Capture and release mortality up to 17.
696	Middle Columbia River Steelhead	Juvenile	N/A	Listed/wild	Capture, anesthetize, measure, weigh, tag, release	Section Corner Cr, WA	February-June	Capture and release mortality up to 6.
1,680	Middle Columbia River Steelhead	Juvenile	N/A	Listed/wild	Capture, anesthetize, measure, weigh, tag, release	Shitike Cr, OR	March-June	Capture and release mortality up to 16.

Annual Report

Annual reports are due to the FCRPS Branch by January 31 of each year. The report must include the following:

- A detailed description of scientific research and monitoring activities, including the total number of fish taken at each location, an estimate of the number of ESA-listed fish taken at each location, the manner of take, and the dates and locations of the take.
- Measures taken to minimize disturbances to ESA-listed fish and the effectiveness of these measures, the condition of ESA-listed fish taken and used for research and monitoring, a description of the effects of research and monitoring activities on the subject species, the disposition of ESA-listed fish in the event of mortality, and a brief narrative of the circumstances surrounding fish injuries or mortalities to ESA-listed fish.
- Any problems that may arise during research and monitoring activities, and a statement as to whether the activities had any unforeseen effects.
- Descriptions of how all take estimates were derived.
- Any preliminary analyses of the data.
- Steps that have been and will be taken to coordinate research and monitoring activities with those of other researchers.

Operational Reporting and Notification Requirements

- Researchers must provide plans for future undefined projects and changes in sampling locations or research and monitoring protocols, and obtain the FCRPS Branch's approval before implementation.
- Each researcher must alert the FCRPS Branch whenever the authorized level of take is exceeded, or if circumstances indicate that such an event is imminent. Notification should be made as soon as possible, but no later than 2 days after the authorized level of take is exceeded. The researcher must then submit a detailed written report to the FCRPS Branch. Pending a review of the circumstances, the FCRPS Branch may suspend the research and monitoring activities or implement reasonable measures and/or alternatives to allow research and monitoring activities to continue.
- Each researcher must alert the FCRPS Branch when a take of any ESA-listed species not included in the research proposal is killed, injured, or collected during the course of research and monitoring activities. Notification should be made as soon as possible, but no later than 2 days after the unauthorized take. The researcher must then submit a detailed written report to the FCRPS Branch. Pending a review of the circumstances, the

FCRPS Branch may suspend research and monitoring activities or implement reasonable measures and/or alternatives to allow research and monitoring activities to continue.

Determinations by the NMFS FCRPS Branch for this research during the 2006 fish passage season and beyond will be made on an annual basis. The annual determination will depend upon information submitted in the research study's annual report, other new information, the annual anticipated status of fisheries stocks, and any subsequent review through regional review processes.

Please notify Blaine Bellerud (503-231-2238) as soon as possible of any deviation from the terms and conditions in this determination. Please provide the FCRPS Branch's research reporting coordinator, Eric Ostrovsky (503-736-4741, eric.ostrovsky@noaa.gov) with the annual report for this research study.

Sincerely,

James D. Ruff

James D. Ruff, Chief
Federal Columbia River Power System Branch

cc: Nancy H. Weintraub, BPA

Appendix D

Bioprogramming Reports and Hatchery Operations Schedule Technical Memo: Coho, Summer and Fall Chinook and Steelhead Kelt

DJWA
D.J. Warren & Associates, Inc.

P.O. Box 1511
3015 Southwood Drive
Philomath, OR 97370
(541) 929-4639
djwassociates.com

To: Bill Fiander, Yakama Nation

From: Mark Reiser, Dan Warren

Date: June 10, 2019

Subject: Biocriteria for Prosser Hatchery Fall Chinook and Coho Production Programs and Steelhead Kelt Reconditioning Program

1.0 INTRODUCTION

The Yakama Nation (YN), through the Yakima Klickitat Fisheries Program (YKFP), has retained DJ Warren and Associates to provide an updated Step 1 Master Plan for artificial production of Upriver Bright (URB) Fall Chinook, Summer Chinook, and Coho programs, primarily at its existing Prosser Hatchery. Improvements to the existing YKFP Steelhead Kelt reconditioning program at Prosser Hatchery are also included in the master plan update. The purpose of this memorandum is to document the bio-programming assumptions and criteria used to determine water supply flows and rearing volumes for each stage of fish development. This information is then used to develop conceptual facility design drawings and related cost estimates for capital improvements.

The production goals for the facilities are detailed in the Step 1 Master Plan currently being prepared by YN. The following fish production programs are addressed in this programming memo:

Prosser Hatchery Production Programs

- 210,000 URB Fall Chinook Yearlings, Segregated Program
- 1,700,000 URB Fall Chinook Sub-Yearlings, Segregated Program
- 1,000,000 Summer Chinook; Sub-Yearlings, Integrated Program – Transition Phase
- 500,000 Fall Chinook Sub-Yearlings, Integrated Program
- 500,000 Coho Yearlings, Segregated Program

In addition to these programs, two other related current programs are proposed to be supported under the updated Step 1 Master Plan:

- Steelhead Kelt Reconditioning 1,500 Adults at Prosser

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- Coho, 700,000 yearlings at MRS facility released in Upper Yakima and Naches sub basins. (Hatchery is under construction 2018-2019).
- 1,000,000 Summer Chinook; Sub-Yearlings, Integrated Program – Long Term Phase

The 1,000, 000 fish Summer Chinook sub-yearling production program would be implemented in a two-phase approach. The first phase, a transition phase would be supported at the existing Prosser Hatchery for adult holding, incubation and early rearing. Upon reaching a size of 250 fish per pound at Prosser, half of the fish would be marked and moved to two remote temporary acclimation/release sites for rearing to a release size of 90 to 100 fpp. Thus, 500,000 subyearlings would be acclimated at Prosser and 500,000 acclimated at remote temporary facilites (250,000 on the Naches River and 250,000 at an upgraded facility at Roza Dam on the Yakima River).

The second "long term" phase would move the adult holding, incubation, and early rearing functions for the 1,000,000 Summer Chinook sub-yearlings to a new hatchery on the upper Yakima River to improve imprinting for encouraging adult returns to spawning areas higher in the watershed. Upon reaching a size of 250 fish per pound at the new hatchery, the fish would be transferred to expanded temporary acclimation facilities for 500,000 fish each on the Naches and upper Yakima Rivers.

Biological programming tables have been developed for each program to establish water supply budgets by month, and to determine space requirements for incubation and juvenile rearing improvements. For the yearling program, overlapping infrastructure needs to support two brood years of fish on station at once have been considered.

A major difference from the original Step 1 Master Plan submitted in 2012 is that YKFP has changed fish rearing units from rectangular raceways with single pass water supplies to dual drain circular tanks with 75% partial recirculating aquaculture systems (PRAS). This change reduces water supply requirements and will allow the facility to largely eliminate the use of surface water in favor of a higher quality groundwater supply.

2.0 FISH DEVELOPMENT CYCLE

Table 2-1 illustrates the timing of the adult holding, incubation, and rearing cycles for each fish production program.

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Table 2-1 Fish Development Cycles

Program	Adult Holding	Incubation	Early Rearing	Final Rearing or Acclimation
210,000 URB Chinook Yearlings	Late Sept – Nov	Oct – Early Jan	Jan – March	April – March
1.7M URB Chinook Sub-Yearlings	Sept – Mid-Nov	Oct – Early Jan	Jan – May	-
1,000,000 Summer Chinook Sub-Yearlings	July-Sept	Sept-Early Jan	Jan-Feb	March-April
500,000 Fall Chinook Sub-Yearlings	Sept-Nov	Oct – Early Jan	Jan - March	-
500,000 Coho Yearlings	Mid-Oct – Nov	Oct – Feb	Feb – April	April – March
Steelhead Kelts	Year-Round	-	-	-
Remote Coho Sub-Yearlings	Mid-Oct – Nov	Oct – Early Jan	Jan – April	-
Remote Coho Yearlings	Mid-Oct – Nov	Oct – Early Jan	Jan – April	April - March

3.0 BIOLOGICAL VARIABLES

The primary biological variables used in the preparation of the preliminary operations schedule include water temperature, species specific condition factor, and density and flow indices. The basis of the variable values used in the development of the operations schedules are explained below.

3.1 Water Temperature

Water temperature is a primary determining factor in the development and growth rate of fish. A combination of groundwater and river water will be used at each facility. In general, pathogen free groundwater will be used for all programs. The groundwater temperatures are 55 to 57 degrees F at the existing Prosser Hatchery. This is significantly warmer than the natural river water would be

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during the winter incubation period. Therefore, mechanical chilling of the process water is used during the incubation stage to slow the rate of fish development to more closely mimic natural cycles. An existing 100-ton chiller is presently used at Prosser to chill incubation water supply and adult holding and should be adequate to support he upgraded facility. A 50-ton chiller with energy recovery is planned for adult holding and incubation at the proposed new upper Yakima River Summer Chinook Hatchery. Chiller size will be verified during future design phases depending on availability and temperature of groundwater at the selected site.

3.2 Fish Weight and Length

Target fish release sizes for each program are shown in Table 3-1.

Table 3-1 Target Fish Release Sizes

Program	Weight (grams)	Length (inches)
210,000 URB Fall Chinook Yearlings	30	6.04
1.7M URB Fall Chinook Sub-Yearlings	6	3.5
1,000,000 Summer Chinook Sub-Yearlings	5	3.35
500,000 Fall Chinook Sub-Yearlings	6	3.5
Remote Coho Yearlings	28.3	5.6
Remote Coho Sub-Yearlings	5.7	3.45

Fish weights are taken from historical YKFP fish culture records for the existing Fall Chinook and Coho programs at Prosser. Fish lengths used for calculating density indices are taken from standardized tables developed by Piper (1982).

3.4 Fish Density

The YKFP fish culture staff have experimented with various fish densities at both the Prosser and Marion Drain hatcheries for many years. For raceway rearing, they have found that maintaining a density index of less than 0.2 pounds of fish per cubic foot per inch of fish length (lb/cf/in) provides optimal fish health and production, using a combination of river water and groundwater. The 75% PRAS systems incorporate oxygenation supplementation to deal with the oxygen demand spikes

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that occur during and after feeding. Therefore, YKFP is comfortable with density indices in the 0.20 to 0.34 lb/cf/in. range for yearlings and sub-yearlings respectively. Tables 3-2, through 3-6 show a summary of the bioprogramming calculations for Prosser Fall Chinook, Coho, Summer Chinook, Kelt Reconditioning and Adult Holding programs respectively.

3.5 Water Supply Flow

The proposed dual drain circular tanks to be used for all fish rearing on the proposed programs will utilize groundwater for early rearing and grow-out to provide improved flow mixing and oxygen availability to the fish. Surface water will be used for acclimation of fish prior to release. Flow index (FI) has historically been used to determine water supply flow requirements. It is a function of pounds of fish (weight), divided by water flow times fish length in inches. Flow index is an indication of how much oxygen is available for fish metabolism and is adjusted based on the elevation of the project site and water temperature, both of which affect the amount of oxygen in the water supply at saturation. Due to the gas stripping and oxygen supplementation treatment provided by the PRAS systems, flow index is not used. Instead, it is assumed that the PRAS systems will provide maintain water supply at full dissolved oxygen saturation at the rearing tanks. The determining factor for water supply to the rearing tanks then becomes dependent on providing adequate water turnover to maintain self-cleaning tank hydraulics and uniform flow distribution. Turnover rates in the 45 to 200 minute range have been used successfully (Timmons and Ebeling 2013). The more conservative 45 minute turnover is used for the rearing tank recirculation and make-up water flow rates on this project. Make-up water flows are 25% of the total recirculation flow for each tank. Tables 3-7 through 3-12 shows water supply flow demands by month for each program along with an overall summary.

3.6 Partial Recirculating Aquaculture Systems (PRAS) Criteria

The proposed fish rearing will utilize large dual drain circular tanks with water reuse technology to reduce overall groundwater demand. There is evidence that the faster rotational currents in the circular tanks produce stronger swimming juvenile fish that out-migrate faster and with higher survival rates (vs. fish reared in linear raceways), in studies conducted at Eastbank Hatchery in 2008 (C. Good, B. Vinci 2009). The Prosser and Upper Yakima hatcheries are programmed to Eastbank criteria, with 45 minute tank turnover, 25% make-up water flow rates, particle filtration, CO_2 stripping and automated oxygen supplementation to maintain water quality. The Kelt Reconditioning program at Prosser would also utilize PRAS technology.

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The acclimation sites for the Summer Chinook program on the Naches and upper Yakima Rivers would also utilize dual drain circular tanks, however, the primary water source would be single pass surface water pumped from river intakes.

4.0 BROODSTOCK AND EGG TAKE

In order achieve the production goals for each program, historical survival data from YKFP has been used to calculate the number of adult fish and eggs required for each program. The projected survival rates from egg take to release for each species are:

- 73.5% for Coho
- 85% for imported Fall and Summer Chinook
- 90% for local Fall and Summer Chinook

Therefore, broodstock and egg take goals are:

Coho:	600 adults, 682,668 eggs
URB Chinook:	1,200 adults, 2,280,000 eggs
Integrated Fall Chinook:	310 adults, 589,000 eggs
Summer Chinook:	620 adults, 1,178,000 eggs

The adult holding ponds are sized in accordance with WDFW criteria, with regard for these survival rates. Adults are held at 5 cubic feet per fish 2 gpm of supply flow per fish in rectangular holding ponds. Steelhead kelts in circular tanks on oxygenated/conditioned water will be held at 3 cubic feet per fish and 1.5 gpm of supply flow per fish.

4.1 INCUBATION

YN proposes to use FRP deep troughs for bulk incubation of local fish stocks. Introduced fish stocks will utilize iso-bucket incubation racks until eye up. Both types of programs will then transition to Marisource tray incubators in double stack (16 trays per stack) configuration. The design flow rate is

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6 gpm of groundwater per double stack. The incubation effluent from introduced (out of basin) stocks will be disinfected prior to discharge.

4.2 EARLY REARING AND FINAL REARING

Swim-up fry will be directly transferred from trays into final rearing units. Spare ponds and round tanks are provided to allow space for marking fish when they reach the appropriate size and to provide operational flexibility.

4.3 ACCLIMATION AND RELEASE

The proposed Fall Chinook and Coho programs would acclimate fish on site with surface water at Prosser Hatchery prior to release. For the transition phase of the Summer Chinook Program, half of the 1,000,000 sub-yearling fish reared at Prosser would be released directly from Prosser with the other half transported to portable acclimation sites on the Naches and upper Yakima Rivers (250,000 to each location). For the long term phase of the Summer Chinook program, 500,000 fish would be acclimated at each facility on the Naches and upper Yakima Rivers.

Attachment

- Excel File containing Bioprograms (Tables 3-2 through 3-6) Hatchery flows (Tables 3-7 through 3-12)

Table 3-2. Prosser Fall Chinook Bioprogram Information - 2.41 M Total																	
Species/Location	**Number Fish**	**Fish Size Out (fpp)**	**Fish Size Out (L inches)**	**Fish Size Out (g/fish)**	**End Biomass (lbs)**	**Density lb/cf**	**Rearing Unit Size dia x water depth**	**Tank Vol. (cu ft)**	**Tank Vol. Req (cu ft)**	**# Tanks Req**	**Rounded # Tanks Req**	**Tank Turnover (min)**	**Total Recirc Flow per Tank (gpm)**	**Make Up Flow per Tank(gpm) at 75% PRAS**	**GW Req (gpm) at 75% Reuse**	**#Fish/Tank**	**Density Index (lb./L x cf)**
Fall Chinook Yearlings - Segregated	210,000	15	6.04	30.00	13,877	1.25	30x6	3,800	11,101	2.92	3	45.0	630	158	473	70,000	0.20
Fall Chinook Subyearlings - Integrated	500,000	75	3.50	6.00	6,608	1	30x6	3,800	6,608	1.7	2	45.0	630	158	315	250,000	0.25
Fall Chinook Subyearlings - Segregated	1,700,000	75	3.50	6.00	22,467	1.2	30x6	3,800	18,722	4.9	5	45.0	630	158	788	340,000	0.34
											10	**total**			1,575		

Table 3-3. Prosser Coho Bioprogram Information - 500,000 Total																	
Species/Location	**Number Fish**	**Fish Size Out (fpp)**	**Fish Size Out (L inches)**	**Fish Size Out (g/fish)**	**End Biomass (lbs)**	**Density lb/cf**	**Rearing Unit Size dia x water depth**	**Tank Volume (cu ft)**	**Tank Space Req (cu ft)**	**# Tanks Req**	**Rounded # Tanks Req**	**Tank Turnover (min)**	**Total Recirc Flow per Tank (gpm)**	**Make Up Flow Req (gpm) at 75% PRAS**	**GW Req (gpm) at 75% Reuse**	**#Fish/Tank**	**Density Index (lb./L x cf)**
Coho Yearlings	500,000	16	5.60	28.30	31,167	1.5	30 x 6	3,800	20,778	5.5	6	45.0	630	158	945	83,333	0.24

Table 3-4. Summer Chinook Bioprogram Information - 1,000,000 Sub-Yearlings																	
Species/Location	**Number Fish**	**Fish Size Out (fpp)**	**Fish Size Out (L inches)**	**Fish Size Out (g/fish)**	**End Biomass (lbs)**	**Density lb/cf**	**Rearing Unit Size dia x water depth**	**Tank Volume (cu ft)**	**Tank Space Req (cu ft)**	**# Tanks Req**	**Rounded # Tanks Req**	**Tank Turnover (min)**	**Total Flow per Tank (gpm)**	**Make Up Flow Req (gpm) at 75% PRAS**	**GW Req (gpm) at 75% Reuse**	**#Fish/Tank**	**Density Index (lb./L x cf)**
Transition Phase																	
Subyearling Early Rearing at Prosser	1,000,000	250	2.40	1.80	3,965	1.1	30 x 6	3,800	3,604	0.95	1.0	45.0	630	158	158	1,000,000	0.43
Subyearling Final Rearing at Prosser	500,000	90	3.35	5.00	5,507	1.1	30 x 6	3,800	5,006	1.3	2.0	45.0	630	158	315	250,000	0.22
Subyearling Naches Acclimation	250,000	90	3.35	5.00	2,753	1.1	20 x 4.5	1,256	2,503	2.0	2.0	45.0	208		-	125,000	0.33
Subyearling Roza Acclimation	250,000	90	3.35	5.00	2,753	1.1	20 x 4.5	1,256	2,503	2.0	2.0	45.0	208		-	125,000	0.33
Long Term Phase																	
Early Rearing at Upstream Hatchery	1,000,000	250	2.40	1.80	3,965	1	20 x 4.5	1,256	3,965	3.16	4.0	45.0	208	52	208	250,000	0.33
Subyearling Naches Acclimation	500,000	90	3.35	5.00	5,507	1.1	20 x 4.5	1,256	5,006	4.0	4.0	45.0	208		-	125,000	0.33
Subyearling Upper Yakima Acclimation	500,000	90	3.35	5.00	5,507	1.1	20 x 4.5	1,256	5,006	4.0	4.0	45.0	208		-	125,000	0.33

Table 3-5 Prosser Kelt Reconditioning

Species/Location	Number of Fish	Load Rate (cf/fish)	Req'd Water Volume (cf)	Rearing Unit Size dia x water depth	Tank Volume (cu ft)	# Tanks Req	Rounded # Tanks Req	Supply Flow per Fish (gpm)	Total Recirc Flow (gpm)	25% Make Up Water Flow at 75% Recirc (gpm)	GW Make-up Flow (cfs)	#Fish/Tank	Tank Turnover (min)
Steelhead Kelts / Long Term Holding	1500	3	4500	20 x 4.5	1,256	3.6	4	1.5	2250	563	1.25	375	17
Steelhead Kelts / Quarantine	100	3	900	10 x 4	315	3.0	3	1.5	150	38	0.08	33	47

Table 3-6 Peak Broodstock Holding by Month at Prosser

Program	Total Brood Req'd	July	August	September	October	November	December	January
Estimated Water Temperature - Degrees F			**55**	**55**	**55**	**51**	**38**	
Holding Volume per Fish - cf			**5**	**5**	**5**	**5**	**5**	**5**
Flow Per Fish - gpm			**2**	**2**	**2**	**2**	**2**	**2**
URB Segregated Program Adults	1200			400	600	800		
Fall Chinook - Integrated Adults	310			100	150	200		
Summer Chinook - Transition Phase Adults	620		300	500				
Coho - Lower River Segregated Adults	600				250	350		
Total Adults per Month			300	1000	1000	1350	0	0
Total Holding Volume Req'd (cf)			1500	5000	5000	6750	0	0
Total Flow Req'd (gpm)			600	2000	2000	2700	0	0

Table 3-7. Prosser Hatchery Chinook Grow-out Building Groundwater Supply Flow and Tank Requirements												
Flows Per Month (gpm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall Chinook Yearlings 210,000 -Zeros	158	158	158	473	473	473	473	473	473	473	473	473
# of 30-Foot Tanks	1	1	1	3	3	3	3	3	3	3	3	3
Fall Chinook Yearlings 210,000 - One+	473	473	473									
# of 30-Foot Tanks	3	3	3									
Fall Chinook Subs - 500,000	315	315	315									
# of 30-Foot Tanks	2	2	2									
Fall Chinook Subs - 1,700,000	473	473	473	788	788							
# of 30-Foot Tanks	3	3	3	5	5							
Summer Chinook Subs - 1,000,000 to 250 fpp	158	158										
# of 30 ft Tanks	2	2										
Summer Chinook Subs - 500,000 to 90 fpp			315	315								
# of 30 ft Tanks			2	2								
Total Flow (gpm)	1,575	1,575	1,733	1,575	1,260	473	473	473	473	473	473	473
No. of Tanks Loaded	11	11	11	10	8	3	3	3	3	3	3	3
Spare Tanks Available	1	1	1	2	4	9	9	9	9	9	9	9

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Table 3-8. Prosser Hatchery Coho Building Groundwater Supply Flow and Tank Requirements												
Flows Per Month (gpm)/	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
# of 30-Foot Tanks												
Coho Yearlings - 500,000 Zero's		315	315	315	945	945	945	945	945	945	945	945
# of 30-Foot Tanks		2	2	2	6	6	6	6	6	6	6	6
Coho Yearlings - 500,000 One+	945	945	945									
# of 30-Foot Tanks	6	6	6									
Total Flow (gpm)	945	1,260	1,260	315	945	945	945	945	945	945	945	945
No. of Tanks Loaded	6	8	8	2	6	6	6	6	6	6	6	6
Spare Tanks Available	2	-	-	6	2	2	2	2	2	2	2	2

Table 3-9. Prosser Hatchery Other Groundwater Flow and Tank Requirements												
Flows Per Month (gpm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Fall Chinook Incubation - URB Program (30 stacks)	180									180	180	180
Fall Chinook Incubation - Integrated Program (8 stacks)	48									48	48	48
Summer Chinook Incubation - Transition Phase(16 Stacks)	96									96	96	96
Coho Incubation (12 Stacks)	72	72								72	72	72
Kelts	601	601	601	601	601	601	601	601	601	601	601	601
# of 20-Foot Tanks	4	4	4	4	4	4	4	4	4	4	4	4
Adult Holding (50% SW in Sept-Oct)							0	600	1000	1000	1350	0
Totals	997	673	601	601	601	601	601	1201	1601	1997	2347	997

Table 3-10. Prosser Hatchery Groundwater Flow Summary By Month												
Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Flows Per Month (gpm)	3,517	3,508	3,594	2,491	2,806	2,019	2,019	2,619	3,019	3,415	3,765	2,415
Flows Per Month (cfs)	7.8	7.8	8.0	5.5	6.2	4.5	4.5	5.8	6.7	7.6	8.4	5.4

Table 3-11. Remote Acclimation Summer Chinook Flow and Tank Requirements - Transition Phase												
Flows Per Month (gpm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Summer Chinook Acclimation Upper Yakima Site			417	417								
# of 20-Foot Tanks			2	2								
Early Summer/Fall Acclimation at Naches Site			417	417								
# of 20-Foot Tanks			2	2								

Table 3-12. Summer Chinook Flow and Tank Requirements - Long Term Phase												
Flows Per Month (gpm)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Summer Chinook Adult Flow - Upper Yakima Hatchery								600	1000			
Summer Chinook Adult Vol. (cf) - Upper Yakima Hatchery								1500	2500			
Summer Chinook Incubation - Upper Yakima Hatchery	96								96	96	96	96
Summer Chinook Early Rearing - Upper Yakima Hatchery	208	208										
# of 20-Foot Tanks	4	4										
Summer Chinook Acclimation Upper Yakima Site			833	833								
# of 20-Foot Tanks			4	4								
Summer Chinook Acclimation at Naches Site			833	833								
# of 20-Foot Tanks			4	4								

Appendix E

Water Supply Reports

DRAFT TECHNICAL MEMORANDUM NO 1.0

MCMILLEN, LLC

To:	Bill Fiander Yakama Nation Fisheries - YKFP	Project:	Salmon Artificial Production Facility
From:	Mark Reiser	Cc:	File
Date:	December 5, 2011	Contract No:	
Subject:	Prosser Hatchery – Alternative River Water Supply		

1.0 INTRODUCTION

As part of a comprehensive master plan effort for the modernization of Prosser Hatchery, the Yakama Nation (YN), has identified the need for an alternative river water supply for fish rearing at the hatchery. The hatchery presently uses up to 30 cubic feet per second (cfs) of river water, via a screened diversion from Chandler Canal. The canal is operated and maintained by the United States Bureau of Reclamation (USBR) primarily for irrigation purposes. In early November each year, at the end of the irrigation season, the USBR dewaters the canal for maintenance which interrupts the flow of river water to the hatchery. The USBR has requested that YN explore an alternative, back-up water supply that will allow them more flexibility for scheduling prolonged canal maintenance activities that could last four to six weeks or more.

The initial scope of work contemplated obtaining a gravity flow water supply from a new screened intake to be located above Prosser Dam. The construction cost and complexity of obtaining USBR approval for this option resulted in the development of additional alternatives as described in Section 4.0 below.

2.0 EXISTING CONDITIONS

Prosser Hatchery is located on a 14 acre parcel, owned by USBR, on the left bank of the Yakima River, at River Mile 47.6, approximately 4,000 feet downstream of Prosser Dam. The hatchery is operated by YN under agreement with USBR. The hatchery supports several fish culture programs, including fall Chinook, coho, steelhead kelt re-conditioning, and lamprey research. A juvenile fish monitoring facility, used for gathering data on downstream migrating fish, is also located at the hatchery site. Figure 2.1 provides an aerial image of the existing site conditions.

The present river water supply intake is located on the juvenile fish bypass, immediately downstream of the USBR Chandler Canal fish screens. A 30-inch intake pipe delivers river water from the canal to the hatchery site, where it is routed through or around a small silt settling pond. The river water is then distributed to various points of use throughout the hatchery site.

The river water supply system is primarily used by the hatchery November through May each year. June through October the river water temperatures are too high for most fish culture uses.

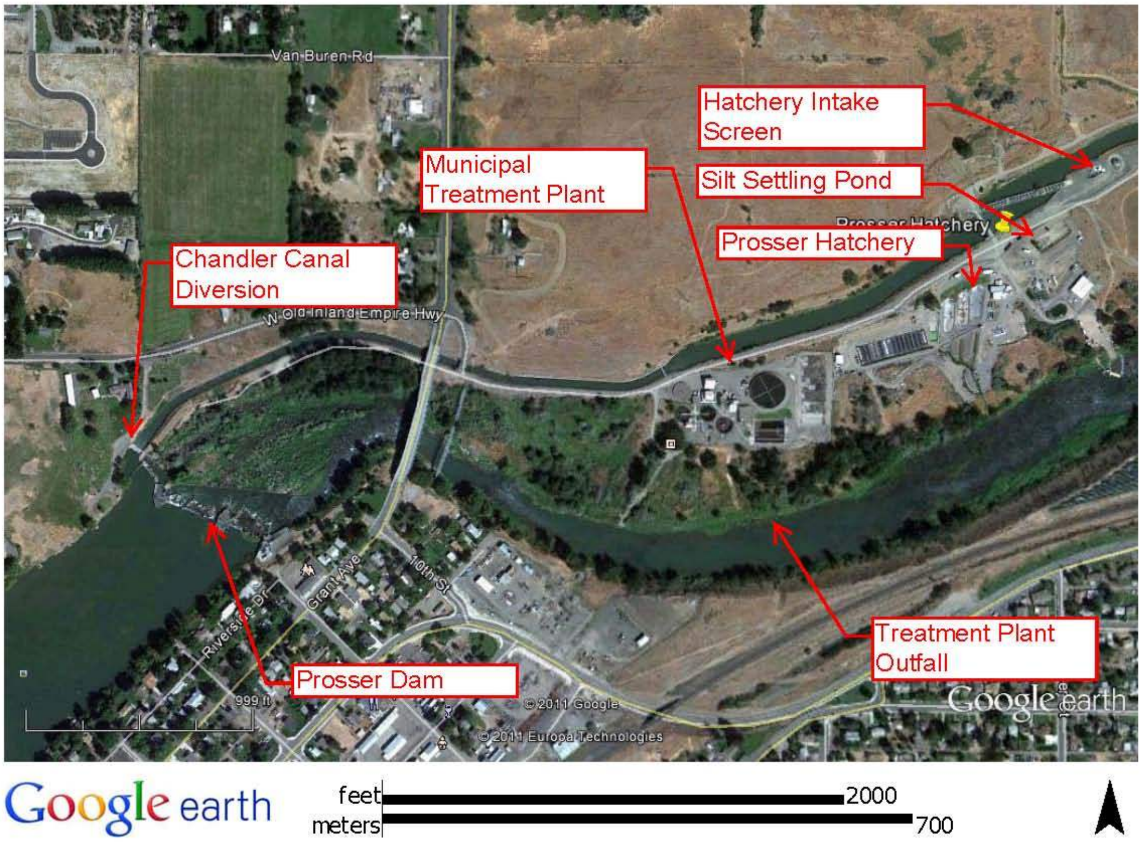

Figure 2.1 – Prosser Hatchery Vicinity, Existing Conditions

3.0 DESIGN CRITERIA

The alternative river water supply will need to function reliably for at least a four to six week period, each year, from early November through mid December. Biocriteria developed for the modernized hatchery indicates that approximately 14 cfs of river water is needed for fish rearing at the hatchery during this time period. A portion of this demand, up to 8 cfs will be met from the hatchery groundwater supply, however, the groundwater is too warm for optimal fish rearing. The YN has identified a design flow rate target of 7 cfs for the alternative river water supply system. The alternative supply will connect to the existing hatchery piping upstream of the silt settling pond in order to allow for some sediment removal prior to use.

Water quality, water rights, reliability, and costs (both capital and operations/maintenance) are the primary criteria to be used in comparing alternatives. Intake screening for all options is based on using a self cleaning wedge-wire cone screen designed to comply with NOAA criteria for anadromous salmonid passage facilities.

The gravity flow piping alternative will require relatively low flow velocities of 4 feet per second in order to preserve driving head by minimizing friction losses in the pipeline. For the pumped flow options, flow velocities of 6 to 7 feet per second will be used in order to minimize pipe sizes.

4.0 ALTERNATIVES

Three alternative diversion points have been developed to provide the hatchery with the 7 cfs of river water flow from an alternative source. These include:

- Option 1: A gravity flow supply via a new screened intake in the pool above Prosser Dam
- Option 2: A pumped supply via a new screened intake upstream of the City of Prosser sewage treatment plant outfall
- Option 3: A pumped supply via new screened intake upstream of the hatchery outfall, and downstream of the City of Prosser sewage treatment plant outfall.

Each of these alternatives is discussed in greater detail in the following sections.

3.1 Option 1 – Gravity Flow Supply from Prosser Dam Intake

The intake location and pipeline routing for this option were surveyed in June of 2011 as part of an as-built mapping contract for Prosser Hatchery (See Appendix A). Design drawings of the dam and canal head works were obtained from USBR as well.

The intake screens are proposed to be placed in the forebay of the Chandler Canal head works, in a location where the water right would be covered under the existing rights for the Chandler Canal diversion. Installing an intake at this location would require an 18-inch supply pipe penetrating either the Dam, or a short section of wall at the right end of the canal headworks structure, below the normal dam pool water elevation. Figure 3.1 and 3.2 show photos of the existing Dam and canal head works looking upstream and downstream respectively.

The pipeline would then be routed on pipe supports along the left bank of the Yakima River for 350 feet, trenched under a service road, and then supported above grade for another 250 feet before entering into a trenched alignment. The 18-inch pipeline would then remain in a buried trench for 3,800 feet, following the existing gravel access road from the Dam to the hatchery site, terminating at the silt settling pond flow control structure.

In order to provide an adequate slope to the pipeline, the trench depths would exceed 10 feet in some areas. There are basalt rock formations in evidence along the pipeline route. It is anticipated that a significant amount of rock excavation would be required to complete the pipeline portion of the project. A conceptual design for this alternative was developed to provide a basis for construction costs and feasibility analysis (See Appendix B).

Figure 3.1, Prosser Dam at Chandler Canal Head Works Looking Upstream

Figure 3.2, Prosser Dam at Chandler Canal Head Works Looking Downstream

Two other alternative pipe alignments were considered for this option. One alternative would have routed the pipeline inside the canal, with an exposed pipe, supported by metal supports. This route was discarded since the pipe line would interfere with canal hydraulics and USBR maintenance activities. It would also require two penetrations of the canal, one of them through the 3-inch thick concrete canal liner. The other route considered was to avoid the deep trenching and rock excavation by keeping the pipeline exposed, supported on concrete and/or metal bracing, on the river side of the access road. This route was discarded due to the irregular side slopes, floodway obstruction issues, and the required disturbance of a heavily vegetated riparian zone.

Option 1 offers the reliability and low operating costs of a gravity flow system. Water rights are already in place, and there are no anticipated problems with water quality issues at this location. USBR representatives have expressed some concerns with the lengthy review and approval process that would be required in order to penetrate the Dam.. The other major concern with this option is the cost of 18-inch pipe required (over 4,400 lineal feet), and the amount of rock excavation that would be required for the pipe trench.

Figure 2.2 illustrates the intake screen, pump stations, pipeline routes, and the termination point

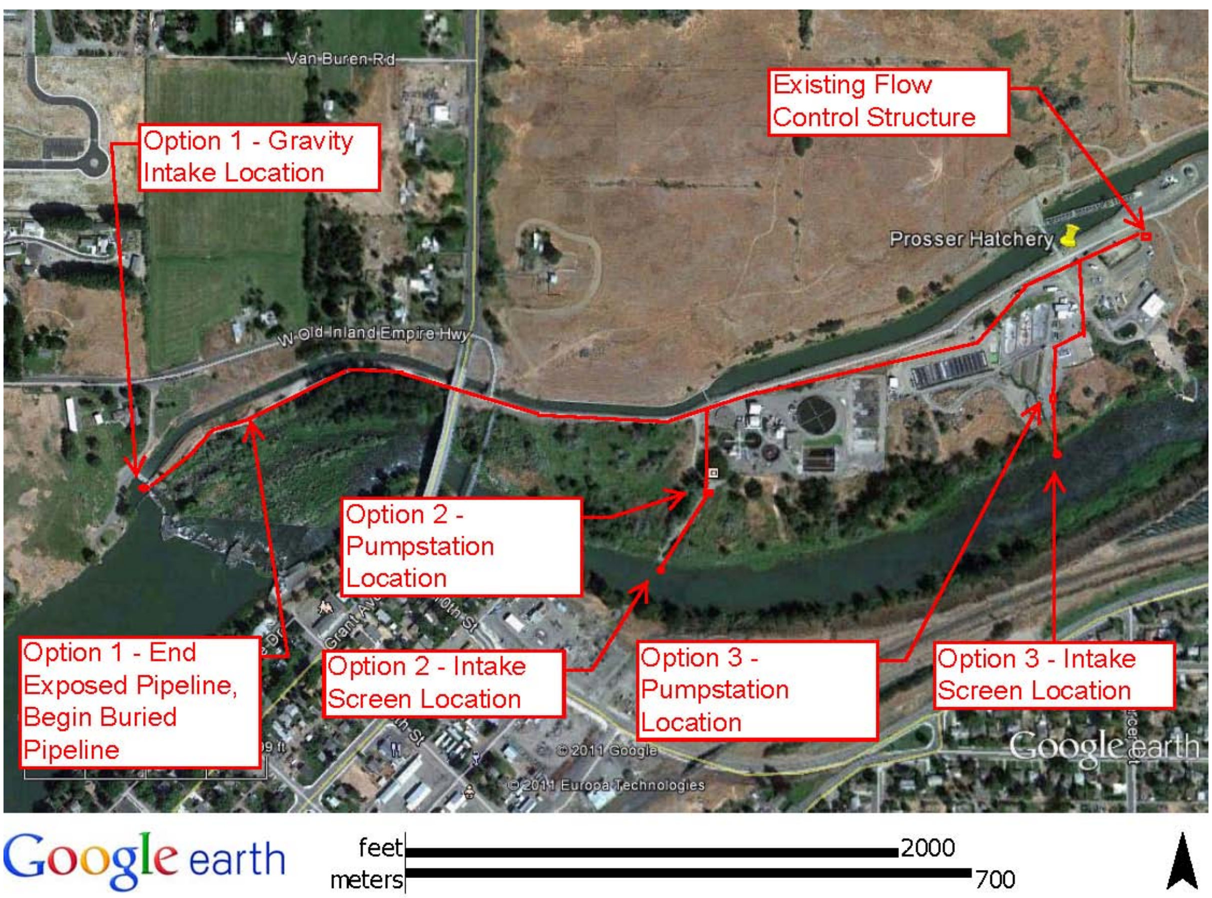

Figure 3.3, Proposed Facility Locations and Pipeline Routes

location for all three options.

3.2 Option 2 – Pumped Supply from Upstream of City Sewer Outfall

Under this option, the intake screens would be located on the stream bottom, in a deeper slow moving section of the Yakima River, at the upstream edge of the City of Prosser sewage treatment plant frontage. The City has indicated that they normally produce a high quality effluent and that upsets do occur, especially related to the grape processing that occurs around the time of the canal maintenance period.

The screen location would be located approximately 600 feet upstream of the treatment plant outfall. An 18-inch gravity flow pipeline would be trenched from the screen assembly across the river bottom, to a pump station wet well located 300 feet away on the left river bank, above the floodway elevation. The 7 cfs pump station would consist of two 60 hp submersible pumps, with lead/lag controls, check valves and isolation valves for flow control. A buried 16-inch force main, 2,200 feet in length, would convey the river water supply from the pump station to the silt settling pond flow control structure.

Since the pipeline is pressurized, the burial depth of the force main will be minimized in order to reduce trenching and rock excavation costs. This option was added to the study after the survey work was completed. Therefore the river intake, pump station and 700 feet of pipeline route between the river and Grande Road have not been surveyed yet. This portion of the project is located on City of Prosser property. YN would need to obtain land use easements and/or agreements from the City. There do not appear to be any constructability problems with this alternative, aside from coordinating pipeline routing to avoid conflicts with City sewer and water pipelines entering the treatment plant. Minimal disturbance of the riparian area is required.

Option 2 provides a pumped water supply option, with two primary advantages over Option 3. Foremost, the intake is located upstream of the City treatment plant outfall and will not be exposed to the river water quality variations that may be produced by the treated sewage outfall. This intake location is also in deeper water than what is available under Option 3 which reduces the chances of submergence problems during low water conditions. The site is accessible via an existing gravel road on City property. This option would require a new non-consumptive water right, and there is approximately 1800 feet between the intake screen and the outfall where the diverted flow would return to the river. The amount of piping required is roughly half of the length required under Option 1.

3.3 Option 3 - Pumped Supply from Upstream of Hatchery Outfall

For this option, the intake screens would be located on the stream bottom, in a shallow protected area, immediately upstream of the existing hatchery outfall channel. An 18-inch gravity flow pipeline would be trenched from the screen assembly across the river bottom and hatchery outfall channel, to a pump station wet well located 200 feet away on the hatchery site, above the floodway elevation. Identical to Option 2, the 7 cfs pump station would consist of two 60 hp submersible pumps, with lead/lag controls, check valves and isolation valves for flow control. A buried 16-inch force main, 950 feet in length, would convey the river water supply from the pump station to the silt settling pond flow control structure.

Option 3 is included as a least cost option. The intake location is 800 feet downstream of the City treatment plant outfall, and there may be some river water quality variations at the intake due to potential treatment plant upsets. The proposed screen location is protected from the main flow, but is in a shallow reach, with water depths of only 2 feet during low flow conditions. This increases the chance of submergence and flow availability problems at the screen. The primary advantages of this option are the shorter runs of piping, a less rigorous approval/land use process since the facilities are located within the existing hatchery site, and more immediate access for maintenance and operations.

Figure 3.4, Option 3 - Proposed Intake Screen Location at Low Water, Sept. 2011

This option would require a new non-consumptive water right. There is less than 50 feet between the intake screen and the outfall where the diverted flow would return to the river. There is adequate flow velocity in the river to prevent any recycling of hatchery effluent. The primary advantage of this option is cost - the amount of piping required is less than half of the length required under Option 2, and less than one quarter of the pipe length required under Option 1. The other two options will require more coordination effort in order to obtain USBR concurrence on the dam modifications in Option 1 and the City of Prosser land use agreements under Option 2.

4.0 COSTS

This section provides a conceptual level construction cost and a 20-year life cycle cost comparison of the three options described above. Our cost estimates are based on the conceptual layouts shown in Figure 3.3 above. To accommodate the level of uncertainty associated with the conceptual level of completion, a 10 to 20% percent contingency is applied to each construction cost area. Such a contingency is largely dependent on the number of uncertainties associated with the project and amount of investigation work completed. Estimated construction costs represent a maximum range and it is likely cost reductions would be indentified in future planning stages through analysis of alternatives and elimination of many uncertainties.

The life cycle cost analysis takes into consideration the total cost to construct, maintain, and operated the facility over a 20-year period, including the replacement cost of mechanical and electrical equipment. The formulas used to calculate these costs include fixed annual interest rates (cost of money), capital cost escalation, and inflation rates. Since these rates will vary significantly from year to year, they are useful primarily for comparison purposes rather than as actual cost projections. The power costs used for the operations cost comparison are based on published Benton County PUD rates for demand and metered usage charges, for a 30-day pumping period.

Table 4-1. Cost Comparisons

Description	Option 1	Option 2	Option 3
Construction Cost	1,475,000	1,071,000	754,000
20-Year O and M Cost	39,000	248,000	185,000
Replacement Cost	50,000	273,000	199,000
20-year Life Cycle Cost	1,564,000	1,592,000	1,138,000

The cost comparison table shows that Options 1 and 2 have similar life cycle costs, with Option 1 having higher initial construction costs, and Option 2 having the higher operations and maintenance costs. Option 3 has significantly lower costs due to the shorter pipe runs and the ability to connect to the central hatchery back-up power supply. With a life cycle cost of $1.14M, Option 3 is approximately $430,000 less costly over the 20-year service period than Option 1, the second most economical option.

5.0 SUMMARY

An evaluation of the selected alternatives was completed considering a range of criteria including construction issues, impact to the environment, operation impacts, and cost. Table 5-1 presents a summary evaluation matrix. The evaluation matrix is followed by a more detailed discussion of the three options under consideration. Review an input from YN is needed prior to reaching a final decision on a preferred alternative.

Table 5-1. Alternative Evaluation Matrix

Criteria	Evaluation		
	Option 1	Option 2	Option 3
Potential Expansion Space	Unlimited	Limited	4 AC Limit –may be negotiable
Access	Fair	Fair	Fair
Riparian Area	Some Impact	Some Impact	Some Impact
Water Quality	Good	Good	Some Risk
Wildlife	Limited Impact	Limited Impact	Limited Impact
Existing Water Rights	Yes	No	No
Operational Effort	Lowest	Highest	Higher
Design Complexity	Average	Higher	Higher
Proven Technology	Yes	Yes	Yes
Schedule	Slowest	Slower	Faster
Land Negotiations and/or Approvals	Complex – More Costly	Complex- More Costly	Simple – Less Costly
Capital Cost	Highest	Lower	Lowest
O&M Cost	Lowest	Highest	Higher
Life Cycle Cost	Higher	Highest	Lowest
Replacement	Lowest	Highest	Higher

5.1 Alternatives Discussion

A brief summary of each alternative evaluation is presented in the following paragraphs. Each of the sites is feasible and appears to be suitable for constructing the proposed improvements.

Option 1 -The gravity flow supply provided under Option 1 is highly desirable in terms of reliability and operating cost. The intake screen would be located in a more serviceable location compared to the other two options. The ability to make use of the existing USBR water right for the Chandler Canal diversion is also a significant advantage. Mixed opinions have been received from USBR on the feasibility of this option with regard to obtaining permission to penetrate the Dam. A lengthy design review and approval process is anticipated if Option 1 is pursued. Option 1 also has the highest level of cost uncertainty due to the deep trenching and unknown amount of rock excavation that would required for the pipeline construction. The cost estimate above includes a $100,000 allowance for rock excavation which may or may not be adequate.

Option 2 – This pumped supply option was developed in response to concerns from the City of Prosser that seasonal variations in their sewage treatment plant effluent could result in water quality issues for the intake at the location identified under Option 3. This option has a similar life cycle cost to Option 1 due to the short, 30 day pumping duration that was used for the comparison. A longer pumping duration would further increase the life cycle cost difference between these options. The intake screen location for this option has greater water depth than Option 3 which will result in more reliable operations during low flow periods. Since the screens will mainly function after the irrigation diversions are shut off, river flows will typically be above normal low flow stages when the screens are in use. The relatively long distance between the withdrawal and the discharge points may be an issue for the non-consumptive water right.

This option was added late in the process, survey and detailed investigations will be required for this site. The City of Prosser has indicated that they would probably cooperate with the improvements at this site, but no detailed discussions have been held with them.

Option 3 – This is the lowest cost option in terms of construction and life cycle costs due to the short pipe runs required. There are fewer unknowns and variables with rock excavation, design approvals, land use and operating agreements which make this option attractive as well. The location of the intake and pump station on the hatchery site allow for improved maintenance access. The largest detriment is with water quality concerns related to the City sewage plant outfall being located 800 feet upstream. If the water quality issue is resolved and water rights for a non-consumptive use can be obtained, this option would be the recommended solution.

APPENDIX A

COSTS

Prosser Hatchery - Alternative River Water Supply Study
Option 1 - Gravity Flow From Dam Pool, Concept Cost Estimate

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	Division 01 - General Requirements							**129,690**
	Mob./Demob., Submittals, Temp Facilities, etc	1	%	0.1	$117,900	10.0%	129,690	
	Division 02 - Existing Conditions							**16,500**
	Selective Demolition or Core Drill for Pipe Through Dam	1	LS	$10,000.00	$10,000	10.0%	11,000	
	Selective Demolition at Flow Control Structure	1	LS	$5,000.00	$5,000	10.0%	5,500	
	Division 03 - Concrete							**30,000**
	Pipe Supports	20	EA	$1,000.00	$20,000	20.0%	24,000	
	Concrete Repair at Dam Penetration	1	LS	$5,000.00	$5,000	20.0%	6,000	
	Division 04 - Masonry							**0**
	(NOT USED)							
	Division 05 - Metals							**12,000**
	Pipe Straps	20	EA	$500.00	$10,000	20.0%	12,000	
	Division 06 - Wood and Plastic							**0**
	(NOT USED)							
	Division 07 - Thermal and Moisture Protection							**0**
	(NOT USED)							
	Division 09 - Finishes							**0**
	(NOT USED)							
	Division 11 - Equipment							**44,400**
	Intake Fish Screen - Self Cleaning Cone Type	1	EA	$35,000.00	$35,000	20.0%	42,000	
	Level Sensors	2	LS	$1,000.00	$2,000	20.0%	2,400	
	Division 26 - Electrical							**0**
	(NOT USED)							
	Division 31 - Earthwork							**365,500**
	Cofferdams and Dewatering at Intake	1	LS	$50,000.00	$50,000	25.0%	62,500	
	Clearing and Grubbing Allowance	1	LS	$2,000.00	$2,000	20.0%	2,400	
	Exc./Backfill and Compact for Trenches	3000	CY	$40.00	$120,000	20.0%	144,000	
	Access Road Base Aggregate Restoration	300	CY	$35.00	$10,500	20.0%	12,600	
	Erosion Control	1	LS	$20,000.00	$20,000	20.0%	24,000	
	Rock Excavation Allowance	1	LS	$100,000.00	$100,000	20.0%	120,000	
	Division 32 - Exterior Improvements							**0**
	(NOT USED)	0	SY		$0	20.0%	0	
	Division 33 - Utilities							**0**
	(NOT USED)	0	LS		$0	20.0%	0	
	Division 40 - Instrumentation and Controls							**11,000**
	Monitoring and Alarm System for Screen	1	LS	$10,000.00	$10,000	10.0%	11,000	
	Division 41 - Matl Processing & Handling							**0**
	(NOT USED)							
	Division 42 - Process Water Systems							**699,600**
	18 -inch Intake Pipe	4400	LF	$125.00	$550,000	20.0%	660,000	
	18-inch Btfy Valves	2	EA	$3,500.00	$7,000	20.0%	8,400	
	Air Vac Valve and Vent	2	EA	$3,000.00	$6,000	20.0%	7,200	
	Pipe Fittings	1	LS	$15,000.00	$15,000	20.0%	18,000	
	Pipe Couplings	1	LS	$5,000.00	$5,000	20.0%	6,000	

Prosser Hatchery - Alternative River Water Supply Study
Option 1 - Gravity Flow From Dam Pool, Concept Cost Estimate

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	Construction Cost Subtotal - 2011 $							**1,179,000**
	Inflation/Escalation 7% to Mid-Point Const. - 2013							**82,530**
	Mob/Demob, General Condtions							**129,690**
	Subtotal							**1,391,220**
	Contingency (Included Above)							**0**
	Taxes 6%							**83,473**
	Option 2- Probable Total Cost - 2013 Dollars							**1,474,693**

Prosser Hatchery - Alternative River Water Supply Study
Option 2 - Pump Flow Supply at Upstream Location, Concept Cost Estimate

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	Division 01 - General Requirements							**94,146**
	Mob./Demob., Submittals, Temp Facilities, etc	1	%	0.1	$85,587	10.0%	94,146	
	Division 02 - Existing Conditions							**3,300**
	Selective Demolition at Flow Control Structure	1	LS	$3,000.00	$3,000	10.0%	3,300	
						10.0%	0	
	Division 03 - Concrete							**48,000**
	Pump Station Wet Well	1	EA	$25,000.00	$25,000	20.0%	30,000	
	Valve Vault	1	LS	$15,000.00	$15,000	20.0%	18,000	
	Division 04 - Masonry							**0**
	(NOT USED)							
	Division 05 - Metals							**0**
	(NOT USED)							
	Division 06 - Wood and Plastic							**0**
	(NOT USED)							
	Division 07 - Thermal and Moisture Protection							**1,200**
	Pipe Insulation in Vault	1	LS	$1,000.00	$1,000	20.0%	1,200	
	Division 09 - Finishes							**0**
	(NOT USED)							
	Division 11 - Equipment							**165,600**
	Intake Fish Screen - Self Cleaning Cone Type	1	EA	$35,000.00	$35,000	20.0%	42,000	
	River Water Pumps, Submersible 60 hp	2	EA	$50,000.00	$100,000	20.0%	120,000	
	Level Switches	1	LS	$1,000.00	$1,000	20.0%	1,200	
	Float Switches	2	EA	$1,000.00	$2,000	20.0%	2,400	
	Division 26 - Electrical							**104,520**
	OH Power from Utility Pole to Site	300	LF	$15.00	$4,500	20.0%	5,400	
	Transformers	1	LS	$25,000.00	$25,000	20.0%	30,000	
	Power to Pumps	100	LF	$26.00	$2,600	20.0%	3,120	
	100 kw Emergency Generator and ATS	1	LS	$50,000.00	$50,000	20.0%	60,000	
	Intake Site Lighting	1	LS	$5,000.00	$5,000	20.0%	6,000	
	Division 31 - Earthwork							**145,750**
	Cofferdams and Dewatering at Intake	1	LS	$50,000.00	$50,000	25.0%	62,500	
	Clearing and Grubbing Allowance	1	LS	$2,000.00	$2,000	20.0%	2,400	
	Earthwork - Pump Station Excavation	100	CY	$20.00	$2,000	20.0%	2,400	
	Exc./Backfill and Compact for Trenches	1400	CY	$40.00	$56,000	20.0%	67,200	
	Access Road Base Aggregate Restoration	75	CY	$35.00	$2,625	20.0%	3,150	
	Structural Fill and Site Base Rock	50	CY	$35.00	$1,750	20.0%	2,100	
	Erosion Control	1	LS	$5,000.00	$5,000	20.0%	6,000	
	Division 32 - Exterior Improvements							**0**
	(NOT USED)	0	SY	$35.00	$0	20.0%	0	
	Division 33 - Utilities							**12,000**
	Communications to Control Panels	1	LS	$10,000.00	$10,000	20.0%	12,000	
	Division 40 - Instrumentation and Controls							**27,500**
	Duplex Pump Control Panel	1	LS	$15,000.00	$15,000	10.0%	16,500	
	Monitoring and Alarm System	1	LS	$10,000.00	$10,000	10.0%	11,000	
	Division 41 - Matl Processing & Handling							**0**
	(NOT USED)							
	Division 42 - Process Water Systems							**348,000**

Prosser Hatchery - Alternative River Water Supply Study
Option 2 - Pump Flow Supply at Upstream Location, Concept Cost Estimate

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	18 -inch Intake Pipe	400	LF	$125.00	$50,000	20.0%	60,000	
	16 -inch Supply Pipe Force Main	2400	LF	$80.00	$192,000	20.0%	230,400	
	16-inch Pump Discharge Piping	30	LF	$100.00	$3,000	20.0%	3,600	
	16-inch Check Valves	2	EA	$5,000.00	$10,000	20.0%	12,000	
	16-inch Btfy Valves	3	EA	$3,000.00	$9,000	20.0%	10,800	
	Air Vac Valve and Vent	2	EA	$3,000.00	$6,000	20.0%	7,200	
	Pipe Fittings	1	LS	$15,000.00	$15,000	20.0%	18,000	
	Pipe Couplings	1	LS	$5,000.00	$5,000	20.0%	6,000	
	Construction Cost Subtotal - 2011 $							**855,870**
	Inflation/Escalation 7% to Mid-Point Const. - 2013							**59,911**
	Mob/Demob, General Condtions							**94,146**
	Subtotal							**1,009,927**
	Contingency (Included Above)							**0**
	Taxes 6%							**60,596**
	Option 2- Probable Total Cost - 2013 Dollars							**1,070,522**

Prosser Hatchery - Alternative River Water Supply Study
Option 3 - Pump Flow Supply at Downstream Location, Concept Cost Estimate

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	Division 01 - General Requirements							**66,325**
	Mob./Demob., Submittals, Temp Facilities, etc	1	%	0.1	$60,296	10.0%	66,325	
	Division 02 - Existing Conditions							**8,800**
	Selective Demolition at Flow Control Structure	1	LS	$3,000.00	$3,000	10.0%	3,300	
	Hatchery Outfall Channel Restoration	1	LS	$5,000.00	$5,000	10.0%	5,500	
	Division 03 - Concrete							**48,000**
	Pump Station Wet Well	1	EA	$25,000.00	$25,000	20.0%	30,000	
	Valve Vault	1	LS	$15,000.00	$15,000	20.0%	18,000	
	Division 04 - Masonry							**0**
	(NOT USED)							
	Division 05 - Metals							**0**
	(NOT USED)							
	Division 06 - Wood and Plastic							**0**
	(NOT USED)							
	Division 07 - Thermal and Moisture Protection							**1,200**
	Pipe Insulation in Vault	1	LS	$1,000.00	$1,000	20.0%	1,200	
	Division 09 - Finishes							**3,600**
	(NOT USED)	1	LS	$3,000.00	$3,000	20.0%	3,600	
	Division 11 - Equipment							**153,600**
	Intake Fish Screen - Self Cleaning Cone Type	1	EA	$35,000.00	$35,000	20.0%	42,000	
	River Water Pumps, Submersible 50 hp	2	EA	$45,000.00	$90,000	20.0%	108,000	
	Level Switches	1	LS	$1,000.00	$1,000	20.0%	1,200	
	Float Switches	2	EA	$1,000.00	$2,000	20.0%	2,400	
	Division 26 - Electrical							**62,496**
	UG Power to Pump Station Control Panel	400	LF	$50.00	$20,000	20.0%	24,000	
	Transformers	1	LS	$25,000.00	$25,000	20.0%	30,000	
	Power to Pumps	80	LF	$26.00	$2,080	20.0%	2,496	
	Emergency Generator and ATS -Use Exist.	1	LS		$0	20.0%	0	
	Intake Site Lighting	1	LS	$5,000.00	$5,000	20.0%	6,000	
	Division 31 - Earthwork							**105,460**
	Cofferdams and Dewatering at Intake	1	LS	$50,000.00	$50,000	25.0%	62,500	
	Clearing and Grubbing Allowance	1	LS	$2,000.00	$2,000	20.0%	2,400	
	Earthwork - Pump Station Excavation	100	CY	$20.00	$2,000	20.0%	2,400	
	Exc./Backfill and Compact for Trenches	600	CY	$40.00	$24,000	20.0%	28,800	
	Access Road Base Aggregate Restoration	30	CY	$35.00	$1,050	20.0%	1,260	
	Structural Fill and Site Base Rock	50	CY	$35.00	$1,750	20.0%	2,100	
	Erosion Control	1	LS	$5,000.00	$5,000	20.0%	6,000	
	Division 32 - Exterior Improvements							**0**
	(NOT USED)	0	SY		$0	20.0%	0	
	Division 33 - Utilities							**12,000**
	Communications to Control Panels	1	LS	$10,000.00	$10,000	20.0%	12,000	
	Division 40 - Instrumentation and Controls							**27,500**
	Duplex Pump Control Panel	1	LS	$15,000.00	$15,000	10.0%	16,500	
	Monitoring and Alarm System	1	LS	$10,000.00	$10,000	10.0%	11,000	
	Division 41 - Matl Processing & Handling							**0**
	(NOT USED)							
	Division 42 - Process Water Systems							**180,300**
	18 -inch Intake Pipe	250	LF	$125.00	$31,250	20.0%	37,500	
	16 -inch Supply Pipe Force Main	950	LF	$80.00	$76,000	20.0%	91,200	

Prosser Hatchery - Alternative River Water Supply Study
Option 3 - Pump Flow Supply at Downstream Location, Concept Cost Estimate

Line Item	Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost	Total
	16-inch Pump Discharge Piping	30	LF	$100.00	$3,000	20.0%	3,600	
	16-inch Check Valves	2	EA	$5,000.00	$10,000	20.0%	12,000	
	16-inch Btfy Valves	3	EA	$3,000.00	$9,000	20.0%	10,800	
	Air Vac Valve and Vent	2	EA	$3,000.00	$6,000	20.0%	7,200	
	Pipe Fittings	1	LS	$12,000.00	$12,000	20.0%	14,400	
	Pipe Couplings	1	LS	$3,000.00	$3,000	20.0%	3,600	
	Construction Cost Subtotal - 2011 $							**602,956**
	Inflation/Escalation 7% to Mid-Point Const. - 2013							**42,207**
	Mob/Demob, General Condtions							**66,325**
	Subtotal							**711,488**
	Contingency (Included Above)							**0**
	Taxes 6%							**42,689**
	Option 2- Probable Total Cost - 2013 Dollars							**754,177**

Life Cycle Analysis (Present Worth Analysis)

Assumptions:

	Interest (Annual Rate)	5.0%
	Term (Years)	20
	Capital Cost Esc. (ref ENR, Annual Rate)	3.4%
	Inflation (applies to O&M & energy - Annual Rate)	5.0%

Option 1 - Gravity Flow

			Estimated 2013 Cost		Present Worth Cost
Capital Costs					
	Base Capital Cost	$	1,474,700	**$**	**1,474,700**
	Intake Capital Cost of Mech/Electrical Equip *(Costs in Year 0, included in Above)*	$	55,000		
(Repl)	Intake Base Mech/Elec Replacement *(Costs in Year 20)*	$	68,600	**$**	**50,460**
		$	-	**$**	**-**
Annual Costs					
	Power Cost	$	-	**$**	**-**
	Annual O & M for Option 1 (Assumed 3% of Equip. Cost)	$	2,058	**$**	**39,298**
		Total Present Worth Option 1*		**$**	**1,560,000**

* Rounded to nearest $10,000

Life Cycle Analysis (Present Worth Analysis)

Assumptions:

	Interest (Annual Rate)	5.0%
	Term (Years)	20
	Capital Cost Esc. (ref ENR, Annual Rate)	3.4%
	Inflation (applies to O&M & energy - Annual Rate)	5.0%

Option 2 - Pumped Suppy with Intake Upstream of City Outfall

		Estimated 2013 Cost		Present Worth Cost	
Capital Costs					
	Base Capital Cost	$	1,070,500	**$**	**1,070,500**
	Base Capital Cost of Mech/Electrical Equip *(Costs in Year 0, included in Above)*	$	371,000		
(Repl)	Base Mech/Elec Replacement *(Costs in Year 20)*	$	371,000	**$**	**272,897**
Annual Costs					
	Power Cost for Pumpstation - 4 weeks	$	1,848	**$**	**35,200**
	Annual O & M for Option 2 (Assumed 3% of Equip. Cost)	$	11,130	**$**	**212,530**
	Total Present Worth Option 2*			**$**	**1,590,000**

* Rounded to nearest $10,000

Life Cycle Analysis (Present Worth Analysis)

Assumptions:

Interest (Annual Rate)	5.0%
Term (Years)	20
Capital Cost Esc. (ref ENR, Annual Rate)	3.4%
Inflation (applies to O&M & energy - Annual Rate)	5.0%

Option 3 - Pumped Supply with Intake Upstream of Hatchery Outfall

		Estimated 2013 Cost		Present Worth Cost
Capital Costs				
	Base Capital Cost	$ 754,200	**$**	**754,200**
	Base Capital Cost of Mech/Electrical Equip *(Costs in Year 20, included in Above)*	$ 216,100		
(Repl)	Base Mech/Elec Replacement *(Costs in Year 20)*	$ 270,000	**$**	**198,604**
		$ -	**$**	**-**
Annual Costs				
		$ -	**$**	**-**
	Base Power Cost	$ 1,600	**$**	**30,500**
	Annual O & M for Option 3 (Assumed 3% of Equip. Cost)	$ 8,100	**$**	**154,671**
		Total Present Worth Option 3*	**$**	**1,140,000**

* Rounded to nearest $10,000

Appendix F

Memorandum of Agreement between Yakama Nation, BPA, Corps of Engineers and Bureau of Reclamation

2008 Columbia Basin Fish Accords
Memorandum of Agreement between the
Three Treaty Tribes and FCRPS Action Agencies

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MEMORANDUM OF AGREEMENT AMONG THE UMATILLA, WARM SPRINGS AND YAKAMA TRIBES, BONNEVILLE POWER ADMINISTRATION, U.S. ARMY CORPS OF ENGINEERS, AND U.S. BUREAU OF RECLAMATION

I. INTRODUCTION

The Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps) and the U.S. Bureau of Reclamation (Reclamation)(the "Action Agencies") and the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes and Bands of the Yakama Nation, and the Columbia River Inter-Tribal Fish Commission (CRITFC) ("the Tribes" or "the Treaty Tribes") (collectively "the Parties") have developed this Memorandum of Agreement ("Agreement" or "MOA") through good faith negotiations. This Agreement addresses direct and indirect effects of construction, inundation, operation and maintenance of the Federal Columbia River Power System[1] and Reclamation's Upper Snake River Projects,[2] on fish resources of the Columbia River Basin.[3] The Action Agencies and the Tribes intend that this Agreement provide benefits to all the Parties. Reasons for this Agreement include the following:

- To resolve issues between the Parties regarding the Action Agencies' compliance with the Endangered Species Act ("ESA") regarding these FCRPS and Upper Snake Projects;

- To resolve issues between the Parties regarding compliance with the Pacific Northwest Electric Power Planning and Conservation Act ("NWPA") and the Clean Water Act ("CWA");

- To address the Parties' mutual concerns for certainty and stability in the funding and implementation of projects for the benefit of fish affected by the FCRPS and Upper Snake Projects, affirming and adding to the actions proposed in the draft FCRPS and Upper Snake Biological Opinions; and

- To foster a cooperative and partnership-like relationship in implementation of the mutual commitments in this Agreement.

[1] For purposes of this Agreement, the FCRPS comprises 14 Federal multipurpose hydropower projects. The 12 projects operated and maintained by the Corps are: Bonneville, the Dalles, John Day, McNary, Chief Joseph, Albeni Falls, Libby, Ice Harbor, Lower Monumental, Little Goose, Lower Granite, and Dworshak dams. Reclamation operates and maintains the following FCRPS projects: Hungry Horse Project and Columbia Basin Project, which includes Grand Coulee Dam.
[2] The Upper Snake River Projects (Upper Snake) are Minidoka, Palisades, Michaud Flats, Ririe, Little Wood River, Boise, Lucky Peak, Mann Creek, Owyhee, Vale, Burnt River and Baker.
[3] This Agreement does not comprehensively address impacts to wildlife from the construction and operations of the FCRPS and Upper Snake Projects. See Section IV terms related to wildlife.

II. HYDRO COMMITMENTS

A. Hydro Performance

A.1. Performance Standards, Targets, and Metrics:

The Tribes concur in the use of the hydro performance standards, targets, and metrics as described in the Main Report, Section 2.1.2.2 of the Action Agencies' August 2007 Biological Assessment (pages 2-3 through 2-6) and the draft FCRPS BiOp at RPA No. 51 (pages 63-64 of 85). Provided that, the Tribes and their representatives may recommend to the Action Agencies actions that may exceed performance standards, which will be considered and may be implemented at the discretion of the Action Agencies.

A.2. Performance and Adaptive Management:

The Parties agree that the BiOps will employ an adaptive management approach, including reporting and diagnosis, as described in Section 2.1 of the Biological Assessment. The Parties agree that if biological or project performance expectations as described above are not being met over time as anticipated, diagnosis will be done to identify causes, and remedies will be developed to meet the established performance standard. The performance standard for species or the federal projects will not be lowered during the terms of the BiOps (although as provided in the BA, tradeoffs among Snake River and lower river dams are allowed). In addition the Parties agree that the current delay and SPE metrics described in Attachment A will not be lowered unless they impede survival.

The Parties recognize that new biological information will be available during the term of the MOA that will inform the methods and assumptions used to analyze the effects of hydro operations on fish species covered by this Agreement. The Parties will work together to seek agreement on methods and assumptions for such analyses, building on analyses performed in development of the FCRPS Biological Opinion as warranted.

As described in the FCRPS BiOp, a comprehensive review will be completed in June, 2012 and June, 2015 that includes a review of the state of implementation of all actions planned or anticipated in the FCRPS and Upper Snake BiOps and a review of the status and performance of each ESU addressed by those BiOps. The Parties agree that they will jointly discuss the development, analyses and recommendations related to these comprehensive evaluations and, in the event performance is not on track, to discuss options for corrective action. This coordination between the Parties is in addition to any coordination that the Action Agencies do with additional regional entities.

John Day Pool Operations

The Action Agencies will meet with the Tribes in the near-term to discuss relevant existing hydraulic and biological information to better understand the biological benefits and/or detriments associated with John Day reservoir operations. JDA MOP is a contingency and so may be decided as a product of the 2015 comprehensive review.

A.3. Research, Monitoring, and Evaluation.

Maintaining and improving research, monitoring, and evaluation programs is critical to informed decision making on population status assessments and improving management action effectiveness. The Action Agencies will implement status and effectiveness research, monitoring and evaluation sufficient to robustly track survival improvements and facilitate rebuilding actions accomplished, in part, through projects and programs identified in Attachment B. The Parties further agree that the Action Agency effort should be coordinated with implementation partners including other fishery managers.

The Tribes rely heavily on the services of the Fish Passage Center, an organization which the Tribes were instrumental in creating. BPA agrees to provide funding to maintain the Fish Passage Center to provide evaluation resources required by the Tribes, as set forth at Section IID.

B. Spring spill/transport

The Parties agree to the initial spill and transportation protocols set out in the draft BiOp with one exception: the Parties have agreed to an adjustment of the initial transportation protocols in order to benefit adult returns of Group B steelhead, while also taking into account spring and fall Chinook.

Initial Transportation Plan

When flows are less than 65 KCFS[4], full transport (no voluntary spill or bypass provided except as needed for research purposes) will be initiated at the Snake River collector projects from April 3 through early June. Summer spill will commence at collector projects when subyearling numbers exceed 50% of the sample at each of the collector projects for a 3 day period after June 1. This low flow transport strategy is unchanged from the draft FCRPS BiOp

When flows are greater than 65 KCFS[1], spill will begin on April 3, 5, and 7 at LGR, LGS, and LMN dams (all fish to remain in-river until April 21 when collection and transport will begin) and continue through May 6 consistent with the draft FCRPS BiOp. From May 7 through May 20 full transport (no voluntary spill or bypass provided except as needed for research purposes) will be initiated at the Snake River collector projects with spring spill and transport operations resuming May 21 and continuing through early June. Summer spill will commence at collector projects when subyearling numbers exceed 50% of the sample at each of the collector projects for a 3 day period after June 1.

All other transport protocols shall be consistent with the draft FCRPS BiOp.

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[4] The seasonal average flow projection will be based on the Corps' STP model and the April final forecast (late March report).

The Parties agree that this transportation adjustment is part of the broader Group B steelhead package that is based on the best available scientific information and is aimed at addressing both FCRPS and *US v. Oregon* objectives. The spill reduction component of this package is the "action of last resort." The Action Agencies agree to fund the implementation of the actions included as part of the Group B steelhead survival improvement package, Attachment C, with specific projects and budgets identified in Attachment B.

Through the adaptive management provisions of the BiOp and otherwise as consistent with the provisions of Section IV of this Agreement, the Parties will review the transportation protocols taking into account new information concerning adult returns, in-river and transportation SARs, and model results. If new information indicates a modified transportation protocol is warranted, adaptive management will be used to make the appropriate adjustments in timing and triggers for transportation, recognizing that spring spill reduction is the "action of last resort". This transport operation would result in a reduction in spring spill compared to the 2006 through 2008 operation. The Group B steelhead survival improvement package is Attachment C.

C. Summer spill

The Parties agree to support the following alternative, based on the summer spill approach described in the draft FCRPS BiOp, recognizing that the alternative would not be implemented until the 2009 season:

> Beginning August 1, curtailment of summer spill may occur first at Lower Granite Dam if subyearling Chinook collection counts fall below 300 fish per day for 3 consecutive days (beginning July 29, 30, and 31 for August 1 curtailment). Using the same 300 fish criterion, the curtailed spill would then progress downstream with each successive dam on the Snake River, with spill at LGS ending no earlier than 3 days after the termination of spill at LGR, and ending at LMN no earlier than 3 days after the termination of spill at LGS assuming the 300 fish criterion has been met at those projects. Spill would be curtailed at IHR no earlier than 2 days after LMN, without use of the 300 fish criterion.
>
> Spill will end at 0600 hours on the day after the necessary curtailment criteria are met. If after cessation of spill at any one of the Snake River projects on or after August 1, subyearling Chinook collection counts again exceed 500fish per day for two consecutive days, spill will resume at that project only. Thereafter, fish collection count numbers will be reevaluated daily to determine if spill should continue using the criteria above (300 fish per day) until August 31.

As this new program is implemented, the Parties will continue to gather data and investigate at least the following issues:

- Adult returns;
- Juvenile passage timing;
- Juvenile fall Chinook salmon life-history diversity traits (i.e. subyearling and yearling emigration attributes);
- Other as agreed to.

The Parties acknowledge that this summer spill is supported by currently available information, and that the operation will be reviewed and may be adjusted to take into account more recent information through the adaptive management provisions of the BiOp and otherwise consistent with the provisions of Section IV of this Agreement. If new information indicates support for a change in timing or triggers to accomplish anticipated coverage of the run (e.g. not a substantially lower percentage of the run as compared to 2005 to 2007 for Snake River fall Chinook), adaptive management and the provisions of Section IV of this Agreement will be used to consider the appropriate adjustments.

D. Monitoring and Verification; Fish Passage Center

The Action Agencies acknowledge that the Tribes' ability to monitor and verify performance of the FCRPS under the BiOps is essential to their participation in this MOA, and the Action Agencies support such monitoring and verification and will so state in any forum.

The Parties agree that monitoring and verification functions are currently provided via funding for the Fish Passage Center. BPA will continue funding the Fish Passage Center, with funds for a manager and for technical and clerical support in order to perform the functions of the Center as stated in the Council's 2003 Mainstem Amendment, for the duration of this MOA unless the Parties agree on an alternative. If the Council changes the Fish Passage Center responsibilities in Program amendments, BPA would consult with the Tribes in advance about what changes BPA would propose, if any, in response to ensure BPA's continued funding is done in a manner consistent with the terms of this Agreement, the Program and Ninth Circuit case law. If a change in Center functions impacts the Tribes' ability to monitor and verify performance of the FCRPS BiOp or this Agreement, BPA would provide funding to the Tribes or an agreed-upon alternative to continue this work.

E. Spring Creek Hatchery Releases

Spring Creek Hatchery commitments are described in Attachment D. The Parties agree that their common priority is to modify Spring Creek Hatchery production so that the early hatchery releases and spill at Bonneville Dam are unnecessary. Consistent with Section IV, the Parties commit to affirmatively support these commitments in appropriate forums.

F. Status of the Lyon's Ferry production program

The parties to *US v. Oregon* have agreed to monitor the Lyon's Ferry production program over the term of the 10-year *US v. Oregon* management plan. Any *US v. Oregon* party may propose changes to that program by invoking the modification provisions of the *US v. Oregon* management plan. The Action Agencies understand that that Tribes' willingness to accept spill operations as outlined above is directly related to their expectation that the Lyon's Ferry production program remains stable and substantially unaltered than as currently designed for the term of this Agreement. Should that fundamental expectation be upset, the Tribes will consider this a material change and grounds for withdrawal from the Agreement, and may, after notice to the Action Agencies, advocate for spill actions that deviate from those contemplated in this Agreement, using the dispute resolution procedures under Section IV.F. Tribal advocacy for spill actions outside the dispute resolution procedures may be considered by the Action Agencies a material change that would trigger withdrawal.

G. Flow Actions (including flow surrogates)

The Parties agree to the following actions in addition to those in the draft FCRPS BiOp:

- Improve forecasting methods and tools to optimize reservoir use for fish operations; see Attachment E.
- Federal Government coordination with Tribes on objectives and strategies for Treaty/Non-Treaty water negotiations; see Attachment F
- Libby/Hungry Horse Operations -- Implementation of the Libby/ Hungry Horse Operations as described in the 2003 Council Mainstem Amendments and the Draft FCRPS BiOp for modifications to the storage reservoirs in Montana.

H. Lamprey protection

The Parties understand that the Pacific Lamprey is a species of fish that is significant to the well-being of the Tribes, who use these fish for food and medicine. Lamprey abundance has diminished in the Columbia Basin in the last 30 years and this diminishment is of high concern to the Parties. The Parties agree to undertake the actions to protect lamprey described below and in Attachment B.

The Parties will work together to combine Action Agency, Tribal, and other agency lamprey actions into a comprehensive lamprey improvement program. Beginning in 2008, the Parties and the Tribes will meet periodically to discuss the lamprey implementation and funding issues including priorities and impediments.

The Parties agree that being proactive for lamprey is critical to seek to avoid ESA listing. The Tribes' commitments to forbearance regarding lamprey as described in Section IV.B are contingent on good faith implementation of the actions described in this lamprey section of this Agreement.

Material modifications of the lamprey implementation and related funding under Section II.H may, after resort to the Dispute Resolution provisions, result in modification of the Forbearance provision regarding lamprey.

Bonneville Power Administration

BPA will fund the Tribal projects for Pacific Lamprey identified in Attachment B, with a total overall programmatic commitment of $1.866 million per year for lamprey projects. This funding commitment is made with the recognition that lamprey funding may be adjusted between fiscal years in a manner consistent with Section III.F.4, so long as the total funding does not exceed $18.66 million (unadjusted for inflation) except as the Parties may agree otherwise.

Corps of Engineers

In accordance with Section IV.D., the Tribes and the Corps will rank Pacific Lamprey items within the Columbia River Fish Mitigation Program and Anadromous Fish Evaluation Program as high priority consistent with ESA responsibilities and accomplishing appropriate lamprey improvements in a reasonable time frame. The Corps will also work with the tribes and the USFWS towards developing its existing 5-year lamprey plan into a 10-year plan, covering both adult and juvenile passage issues, with implementation to begin in 2008.

The Corps and the Tribes will continue to collaborate in the development of a lamprey implementation plan, including consideration of study results, the tribal draft restoration plan, and other available information. The plan will include priority actions, including those listed below, and identification of authority and funding issues. It will be updated annually based on the most recent information.

The Corps will program approximately $1.8 million in 2008 for associated lamprey work identified in the provisions below. The Corps will ramp up funding to $2-5 million per year, as necessary and appropriate to improve lamprey conditions at dams for passage to implement the actions below as they are ultimately detailed in the 10-year plan. The Parties believe that most of the actions below can be implemented within the next 10 years, and, for planning purposes, anticipate an aggregate implementation cost of approximately $50 million. However, the Parties understand that the development of the 10-year plan may lead to adjustments in the implementation term (e.g. perhaps 12 years is more feasible), action priorities, and estimates of total cost to implement the plan.

The Corps will work with the Parties to this Agreement and through the Regional Forum on implementation priorities for lamprey actions annually, and will address options for funding where appropriate.

Adult Lamprey Passage

The Corps will continue improving adult lamprey migratory conditions at mainstem FCRPS hydropower projects. This will include investigating and identifying potential problem areas and implementing both physical and operational changes to adult ladders. Implementation of changes will be followed by evaluations of passage behavior, likely using PIT and/or active-telemetry to determine the overall effectiveness of the changes. Specific actions include:

- Working with Lamprey Technical Workgroups, the Parties will develop meaningful interim numerical passage metrics for juvenile and adult lamprey passage at the FCRPS dams based on available data and reflecting adaptive management principles.

- Conduct site inspections of each dewatered fish ladder with regional lamprey experts to determine passage bottlenecks. Expand active-tag and PIT-Tag work as appropriate for abundance, passage and behavior studies at McNary and Snake River dams. This may include tracking eels to tributary areas, including above mainstem dams. Conduct concurrent hydraulic studies in fishways to further discern problem areas. Conduct post-construction adult telemetry evaluations to determine effects of structural and operational improvements.

- Auxiliary systems (primarily Lamprey Auxiliary Passage Systems LAPS) to pass adult lamprey past the dams will be evaluated and fully developed. In particular, the prototype systems under development at Bonneville Dam will be refined and tested. If the Bonneville auxiliary system has been found to be successful, it will be implemented at other Corps dams as warranted. This is a major part of the Corps' lamprey plan and still has some details to work out.

- Fish ladder entrance areas are problematic passage location at dams for lamprey. Evaluate reducing ladder entrance flows at night to assist with lamprey entrance passage efficiency at Bonneville. As warranted, expand to John Day, McNary and other FCRPS mainstem dam fishways.

- Complete designs for keyhole or alternative ladder entrances for possible installation at Bonneville Dam's Cascade Island ladder in 2009 and John Day Dam's north ladder in 2010/11. If warranted and feasible, expand this design and implementation effort to other FCRPS dams. This would be further developed in the Corps' lamprey plan.

- Inventory all picketed leads, fishway cracks, blind openings, and ladder exits. Also inventory ladder gratings to determine grating type, size, condition, and history of stranding lamprey. Begin replacement of existing gratings with new gratings with ¾ inch spacing in those areas of the fish ladders with the most identified problems. As needed test plates over gratings and proceed until all identified areas are addressed. Modify other fishway areas as appropriate for lamprey passage. Close the McNary – Oregon shore ladder exit false opening if warranted.

- Round sharp corners in and around the fish ladders to aid passage as warranted.

- The Tribes have unique expertise in the field of underwater video enumeration of migratory fish species.

- The Corps will investigate the feasibility, techniques and protocols for counting adult lamprey at mainstem hydropower projects (e.g. Bonneville, McNary, Ice Harbor and Lower Granite Dams). The Corps will count adult lamprey at those projects where counting is reasonably feasible and the Parties agree that such data will be valuable to lamprey management efforts.

Juvenile Lamprey Passage Conditions

The Corps will continue to monitor the passage of juvenile lamprey collected at projects with juvenile fish bypass facilities. When the turbine intake bar screens are in need of replacement, the Corps will replace the existing material with bar screens that have smaller gaps between the bars, as warranted to further protect migrating juvenile lamprey. In consultation with NOAA and the Tribes, the Corps will consider lifting the extended length screens out of the turbine intakes (primarily McNary Dam, but also any Columbia and Snake River dams), during periods of significant juvenile lamprey passage, where lamprey impingement has been documented, considering effects to both salmon and lamprey.

- To prevent juvenile lamprey from becoming stranded or impinged on collector project raceway screens, prototype juvenile lamprey separators will be developed towards aiding in the ability to pass lamprey safely through juvenile fish bypass facilities. Management alternatives using this technology would be further developed in the Corps' lamprey plan.

- The Corps will continue to work actively with industry to further miniaturize active tags with the intent for use in tracking juvenile lamprey.
    - In collaboration with the Tribes, US Fish and Wildlife Service, and the States, the Corps will plan and conduct studies to determine juvenile lamprey active tag criteria, including tag size, shape, and potting material criteria for bio-compatibility.
    - If and when the technology to meet juvenile lamprey active tag criteria becomes available, and as warranted, the Corps will determine passage routes, outmigrant timing and survival of juvenile lamprey through FCRPS mainstem dams. As related to the ability to assess passage and survival, the Corps will work with Tribes, the U.S. Fish and Wildlife Service, and States to develop meaningful numerical juvenile passage standards.

Bureau of Reclamation

Beginning in 2008, and concluding in 2010, Reclamation will conduct a study, in consultation with the Tribes, to identify all Reclamation projects in the Columbia Basin that may affect lamprey. The study will also investigate potential effects of Reclamation facilities on adult and juvenile lamprey, and where appropriate, make recommendations for either further study or for actions that may be taken to reduce effects on lamprey. The priority focus of the study will be the Umatilla and Yakima projects and related facilities.

Beginning in 2008, Reclamation and the Tribes will jointly develop a lamprey implementation plan for Reclamation projects as informed by the study above, the tribal draft restoration plan, and other available information. The plan will include priority actions and identification of authority and funding issues. It will be updated annually based on the most recent information. Reclamation will seek to implement recommended actions from the implementation plan.

I. Emergency Operations for Unlisted Fish

The Action Agencies agree to take reasonable actions to aid non-listed fish during brief periods of time due to unexpected equipment failures or other conditions and when significant detrimental biological effects are demonstrated. When there is a conflict in such operations, operations for ESA-listed fish will take priority.

III. HABITAT AND HATCHERY COMMITMENTS

A. BPA Funding for Habitat and other Non-Hatchery Actions

A.1 General Principles:

- BPA and the Tribes seek to provide certainty and stability regarding BPA commitments to implement fish and wildlife mitigation activities in partnership with the Tribes, including additional and expanded actions which further address the needs of ESA-listed anadromous fish.
- Projects funded under this Agreement are linked to biological benefits based on limiting factors for ESA-listed fish. See Attachment G..
- Projects funded under this Agreement are consistent with recovery plans and subbasin plans now included in the Columbia Basin Fish and Wildlife Program. More specific linkages will be documented as a function of the BPA contracting process.
- Projects may be modified by mutual agreement over time based on biological priorities, feasibility, science review comments, or accountability for results.

A.2. Types of Projects:

BPA is committing to funding a suite of projects and activities that is summarized in Attachment B, with a total average annual funding commitment of $51.61 million/ year for non-hatchery expense projects, plus additional commitments for existing, expanded and new hatchery operations and maintenance expenses as summarized in Attachment B. The projects or actions are categorized as follows:

- Ongoing actions (currently or recently implemented through the Columbia Basin Fish and Wildlife Program), which can be found in Attachment B. The actions include actions addressing ESA-listed salmon and steelhead ("ESA actions") as well as non-listed species.
- Expanded actions in support of FCRPS BiOp and Program implementation, which can be found in Attachment B.
- New actions benefiting ESA-listed and non-listed species, which can be found in Attachment B.

The same projects in the three categories above can also be categorized or sorted with a "Category" system that allows for particular reference to ESA/BiOp or NWPA implementation as follows:

- Category 1 and Category 2c ongoing – Ongoing actions (currently or recently implemented through the Columbia Basin Fish and Wildlife Program). These actions address ESA-listed salmon and steelhead ("ESA actions") as well as non-listed species. The total average annual budget commitment for this category of work is $17.09 million per year, as summarized in Attachment B.

- Category 2a – New or expanded ESA actions in support of FCRPS BiOp implementation. The total average annual budget commitment for this category of work is $8.17 million per year, as summarized in Attachment B.
- Category 2b – Other new actions benefiting ESA-listed species. The total average annual budget commitment for this category of work is $2.24 million per year, as summarized in Attachment B.
- Category 2c and Category 3 - Actions benefiting other fish and wildlife species addressed under the Northwest Power Act and additional RME actions, which can be found in Attachment B under the headings of Category 2c and Category 3. This includes a new programmatic approach for lamprey, with a menu of projects to be selected from those identified in Attachment B under the heading of lamprey. The average annual budget commitment for these categories of work is $3.46 million for Category 2c, $0.49 million for the Umatilla add-ons, and $1.866 million for lamprey projects. Additionally, the annual commitment of Category 3 projects is a total of $4.37 million per year, as noted in Attachment B.
- Capital projects for both ESA-listed and other fish and wildlife species, which can be found in Attachment B under the heading Non-Hatchery Capital.

A.3. Expense Projects:

- BPA's funding commitment in the form of annual expense planning budgets for each project are identified in Attachment B.
- This commitment is also subject to the General Provisions for All Projects below.

A.4. Non-Hatchery Capital Projects:

BPA will commit $52.11 million over the 10 year period to implement the seven non-hatchery capital projects identified in Attachment B. This commitment includes a commitment to dedicate $1 million per year of the Columbia Basin Water Transaction Project budget for water acquisitions in the Umatilla basin.

- Based on reviews to date, BPA finds that the identified projects meet BPA's capital policy for fish and wildlife; if a project is subsequently found not to meet capital requirements, BPA and the Tribe will work together to find a replacement project or alternative project that can be implemented.

Bureau of Reclamation

Bureau of Reclamation tributary habitat technical assistance in the John Day and Grande Ronde sub-basins is expected to continue for the life of the 2008 FCRPS BiOp substantially at current funding levels. If total program appropriations drop below 2008 levels, if new species listings occur, or if biological benefits are in question, then Parties will meet to discuss a revised habitat program subbasin technical assistance allocation.

B. Funding for Hatchery Actions

B.1. General Principles:

- The Action Agencies and the Tribes recognize that hatcheries can provide important benefits to ESA-listed species and to the Tribes in support of their treaty fishing rights.
- The Action Agencies have reviewed the information provided by the Tribes and support implementation of the hatchery actions identified in Attachment B, subject to Sections III.D and III.C.4. Additional or future review by BPA will be in service of BPA NEPA and related duties and specifically will not include independent review of scientific or biological matters already provided for in Sections III.C.4 and III.D.
- BPA and the Tribes seek to provide certainty and stability to BPA funding of hatchery actions by supporting specific on-going hatchery actions implemented by the Tribes, and to make funding available for new hatchery actions (including hatchery reform efforts) by the Tribes and others as they complete required review processes.
- BPA's funding will be in addition to and not replace funding for hatcheries provided by other entities, including but not limited to funding provided by Congress pursuant to the Mitchell Act, and funding required from the mid-Columbia public utility districts implementing habitat conservation plans and other related agreements.
- If a hatchery project identified in this Agreement is not able to be implemented, the Action Agencies are not obligated to fund a replacement or alternative project, and the unused hatchery funds will not be required to be shifted to non-hatchery projects.

B.2. Expense and Capital Hatchery Actions:

BPA will make available a total of approximately $80.11 million over ten years for new facility construction and/or expansions of existing facilities, as described in the Attachment B. Most of this funding is anticipated to qualify as capital funding. The remaining amount is anticipated to be expense funding to provide for planning expenses or other non-capital activities associated with hatchery design, construction, and implementation.

- BPA will ramp-up operation and maintenance funding for expanded and new hatchery actions under this Agreement, to a total (for existing, expanded and new hatchery O&M) of $13.93 million, once all the expansions and new hatchery construction is completed. See Attachment B.
- Starting with the FY2010 rate period, BPA will collaborate with the Tribes to develop a capital spending plan in advance of each new rate period that arises during the Agreement, so as to ensure that adequate rate period capital budgets are available for funding the capital actions in this MOA.
- Listed salmon and steelhead populations affected by the Tribal hatchery proposals in this Agreement and that are located in tributaries of the Upper Columbia River are also populations affected by hatchery programs managed by the Washington Department of Fish and Wildlife on behalf of Grant County PUD, Chelan County PUD and Douglas County PUD. Consistent with the General Principles contained in Section III.B.1, BPA and Tribes want to ensure that any artificial production actions funded under this Agreement are supplemental to and not in substitution of, any actions undertaken by the

PUDs in fulfillment of their responsibilities. In addition, BPA and the Tribes want to ensure that any artificial production actions funded under this Agreement are appropriately coordinated. Therefore, any artificial production actions under this Agreement affecting listed salmon and steelhead populations in the Upper Columbia will be coordinated with the appropriate entities and committees with existing or planned artificial production responsibilities in the same area, including but not limited to the Grant, Chelan, and Douglas County Public Utility Districts. BPA and the Tribes will jointly work on identifying the appropriate projects, and agree that BPA funding will not exceed $5 million barring additional measures the Parties mutually agree to for the benefit of fish of importance to the Parties.

- Yakima Basin/YKFP. The Parties agree as follows:
  Pursuant to this Agreement, BPA is providing funding for several master planning processes under the YKFP project, and is specifically proposing funding (less PUD cost-share) for expense and capital costs for construction of facilities for spring Chinook as well as coho restoration. As a result of the BPA-funded master planning processes, should the Yakama Nation seek additional facilities, BPA agrees to consider funding them in appropriate planning processes during the term of this Agreement. The Yakama Nation, and the Nation may seek other additional funding, in accordance with Section IV.B.2, seek additional funding in year 15.
- Klickitat Project. The Parties agree as follows:
  (a) That they will work diligently together to include development of the Wakiakus facility in the provisions of the Mitchell Act EIS, which is currently being drafted, specifically identifying the need for the facility in support of important tribal fisheries.
  (b) That the Tribe will actively seek congressional appropriations during FY 2010 and FY 2011 for Mitchell Act funding for this facility, in cooperation with other relevant entities such as the Washington Department of Fish and Wildlife. BPA will actively support proposed legislation that is consistent with this Agreement.
  (c) In the event appropriations for all or a part of the Wakiakus facility cannot be obtained, then the following shall occur:
  (i) The Parties will meet to review options for completing both the Klickitat and Wahkiakus facilities utilizing existing Mitchell Act funds, BPA-funds committed under this Agreement, and any other potential cost-sharing sources.
  (ii) As part of this review, the Parties will consider different allocations of the funding from BPA provided in this Agreement and additional cost-sharing formulas, such as ones currently in place with other federal entities, for any funds that are available from sources other than BPA.

B.3. John Day Dam and The Dalles Dam Mitigation:

The U.S. Army Corps of Engineers and *US v. Oregon* parties are working on proposals regarding mitigation for the losses to anadromous fish caused by the construction of John Day and The Dalles dams, in particular the appropriate balance between upriver and downriver stock production. The Corps, as part of this Agreement, commits to resolving this matter with the Tribes through the *US v. Oregon* Policy Committee. As recognized, the resolution of some aspects of John Day/The Dalles mitigation will also involve other parties. No specific plan has been proposed yet. The Corps commits to take all actions necessary and appropriate consistent with the resolution reached between the interested parties regarding John Day/The Dalles mitigation. Any commitment from BPA in support of this resolution would be consistent with this Agreement.

B.4. Implementation Sequence:

The Tribes, BPA, (and other federal agencies where applicable) will, as part of developing a capital plan, develop an implementation sequence for these projects. The overall funding commitment reflected in Section III.B.2 above is shown in 2008 dollars, and an annual inflation adjustment of 2.5 percent, applied beginning in FY10, will be utilized in developing the capital plan and implementation sequence for these (i.e., capital projects that are assumed to begin in FY10 will have a 2.5 percent inflation factor applied to the FY10 budget; projects that are assumed to begin five years later will have five years of a 2.5 percent annual inflation factor applied to the project's first-year budget).

- The Tribes will consider, among other things, the following as they develop the sequence of implementation:
    - Level of agreement in *US v. Oregon*;
    - Equitable distribution of resources among Tribes;
    - Degree of readiness for implementation

- Sequencing will not be guided by project-by-project speculation regarding NOAA's willingness to approve or accept the project. Rather, NOAA input on these actions (to the extent they require it) will be sought consistent with this comprehensive Agreement.

C. General Provisions For All Projects

C.1. The Parties Agree that all projects funded pursuant to this Agreement are consistent with the Council's Program (including sub-basin plans), as amended; applicable draft ESA recovery plans; BPA's In-Lieu Policy; and, the data management protocols incorporated in the project contracts.

C.2. For BPA funded commitments, the Tribes will report results annually (including ongoing agreed upon monitoring and evaluation) via PISCES and/or other appropriate databases.

C.3. For non-hatchery projects identified as providing benefits to listed ESA fish, the Tribes shall:

- Provide estimated habitat quality improvement and survival benefits from the project (or suite of projects) to a population or populations of listed salmon and steelhead based on key limiting factors;
- Refine the estimates during the course of the Agreement if it appears benefits may significantly deviate from the original estimates; and
- Support these estimates of habitat improvement and survival benefits in appropriate forums.

C.4. For hatchery projects, the Tribes will:

- Continue to make available identified biological benefits associated with a hatchery projects included in this Agreement, and will support those biological benefits;
- Obtain a NOAA determination that the hatchery project will not impede and where possible will contribute to recovery;
- Secure or assist in securing all legally necessary permits for hatchery construction and operation.

C.5. The Parties will coordinate their RM&E projects with each other and with regional RM&E processes (particularly those needed to ensure consistency with the FCRPS BiOp RM&E framework), as appropriate and agreed to among the Parties.

C.6. For actions on federal lands, the tribes will consult with the federal land managers and obtain necessary permits and approvals.

D. Council and ISRP Review

D.1. General principles:

- In developing this Agreement, the Parties recognize that the Council's Program is a maturing program, one that through several decades of implementation has established a continuing framework for mitigating the impacts of hydroelectric development in the Columbia River Basin.
- The Parties agree that the BPA funding commitments in this Agreement are ten-year commitments of the Bonneville Fund for implementation of projects. The Parties believe that this Agreement and the specific projects are consistent with the Council's Program.
- The Council's expertise and coordination is valuable in addressing science review and accountability on a region-wide scale.
- The Parties recognize that the current regional process for reviewing and funding projects to meet Action Agency obligations under the NWPA and/or ESA have been designed in large part to prioritize actions for a particular implementation period. As such, that process has reviewed "proposals" that essentially are competing with one another for a funding within a set overall budget. However, this Agreement, along with the BiOps, reflects specific and binding funding commitments to the projects in the attached spreadsheets, subject to the other terms and conditions in this Agreement.

D.2. ISRP review of projects implemented pursuant to this Agreement:

- Subject to the commitments in Section III.E.2, the Parties will actively participate in ISRP review of the projects funded under this Agreement. The Parties will work with the Council to streamline and consolidate ISRP project reviews by recommending that the ISRP: (1) review projects collectively on a subbasin scale, (2) focus reviews for ongoing or longer term projects on future improvements/priorities, and (3) unless there is a significant project scope change since last ISRP review, minimize or abbreviate re-review of ongoing projects.

- Subject to the commitments in Section III.E.2 the Parties may agree to expedited ISRP review of new projects that are not substantially similar to projects or activities previously reviewed by the ISRP.
- The Parties will consider reasonable adjustments to non-hatchery projects based on ISRP and Council recommendations. The decision on whether or not to make such reasonable adjustments will require agreement of the affected Tribe and BPA. If the reasonable adjustment results in a reduction of a project budget, the affected Tribe and BPA will select another project to use the funds equal to the amount of the reduction. If the affected Tribe and BPA cannot agree on whether a recommended adjustment should be made, a replacement project that meets the requirements of this Agreement will be identified. In any event, BPA's financial commitment to non-hatchery projects will not be reduced to an aggregate level below that specified in this Agreement for each tribe and CRITFC so long as a replacement project that meets the requirements of this Agreement could be identified (see replacement project discussion, below).
- The proponent for any new hatchery project will participate in then-applicable streamlined ISRP and Council 3-step review processes recognizing that the ultimate decision to implement the projects is for BPA subject to the terms of this Agreement. Capital funding for any new hatchery project is subject to these review processes. The Parties will consider reasonable adjustments to hatchery projects based on ISRP and Council recommendations. The decision on whether or not to make such reasonable adjustments will require agreement of the affected Tribe and BPA.

E. Replacement Projects and Adaptive Management

E.1. General Principles:

- This section applies to non-hatchery projects
- The Parties agree that a non-hatchery project identified in this Agreement may not ultimately be implemented or completed due to a variety of possible factors, including but not limited to:
    - Problems arising during regulatory compliance (e.g., ESA consultation, NEPA, NHPA review, CWA permit compliance, etc);
    - New information regarding the biological benefits of the project (e.g., new information indicating a different implementation action is of higher priority, or monitoring or evaluation indicates the project is not producing its anticipated benefits);
    - Changed circumstances (e.g., completion of the original project or inability to implement the project due to environmental conditions); or
    - Substantive non-compliance with the implementing contract.
- Should a non-hatchery project not be implemented due to one or more of the above factors, the Action Agencies and the implementing Tribe will promptly negotiate a replacement project.

E.2. Replacement Projects:

- A replacement project should be the same or similar to the one it replaces in terms of target species, limiting factor, mitigation approach, geographic area and/or subbasin and biological benefits.
- A replacement project may not require additional Council or ISRP review if the original project had been reviewed.
- A replacement project would have the same or similar planning budget as the one it replaces (less any expenditures made for the original project) and will take into account carry-forward funding as agreed to by the Parties.

E.3. Adaptive Management

In addition to project-specific adaptation described above, the Parties may mutually agree to adaptively manage this shared implementation portfolio on a more programmatic scale based on new information or changed circumstances.

F. Inflation, Ramp Up, Planning v. Actuals, Carry-over:

F.1. Inflation:

Beginning in fiscal year 2010, BPA will provide an annual inflation adjustment of 2.5 percent.

F.2. Treatment of Ramp-up of new/expanded work:

In recognition of the need to "ramp up" work (timing of Agreement execution, contracting, permitting, etc), the Parties agree that average BPA spending for the new/expanded projects in fiscal year 2008 is expected to be approximately one-third of the average planning level shown in the attached project-specific spreadsheets; and for fiscal year 2009, it is expected to be up to 75 percent of the average planning level, with full planning levels expected for most new/expanded projects starting in fiscal year 2010.

F.3. Assumptions regarding Planning versus Actuals:

Historically, the long-term average difference between BPA's planned expenditures for implementing the expense component of the Power Council's Fish and Wildlife Program, and actual spending (what BPA is invoiced and pays under the individual contracts), has been about seven percent, with the actual spending averaging 93 percent of planned spending. While BPA will plan for spending up to 100 percent of the funding commitments described in this Agreement, nevertheless, due to a variety of factors, BPA's actual expenditures may be less. As a result, the Parties agree that provided BPA's actual spending for the totality of projects commitments in this Agreement averages 93% of the planning amount annually, BPA is in compliance with its funding commitments. If BPA is not meeting the 93% average annually due to circumstances beyond the Parties control, BPA will not be in violation of this Agreement, but the Parties will meet to discuss possible actions to remove the impediments to achieving 93%. The Parties also agree that, for the reasons regarding ramp up in Section III.F.2, new projects and projects expansions during their FY08 and FY09 ramp up phase will be excluded from this calculation.

F.4. Unspent funds, and pre-scheduling/rescheduling:

Annual project budgets may fluctuate plus or minus 20% in relation to the planning budgets for each project, to allow for shifts in work between years (within the scope of the project overall), if work will take longer to perform for reasons beyond the sponsors' control (reschedule) or can potentially be moved to an earlier time (preschedule). Fluctuations within an overall project's scope of work, but outside of the 20 percent band, can also occur if mutually agreeable for reasons such as, but not limited to, floods, fires, or other emergency or *force majeure* events.

Unspent project funds (excluding new/expanded projects subject to ramp-up assumptions covered in Section F.2 above) that are carried over per the reschedule/preschedule provisions above (i.e., within +/- 20% of the annual project budget and within the project's scope of work) may be carried forward from one contract year (e.g., Year 1), to as far as two contract years (e.g., Year 3) into the future before such funds are no longer available. The one exception to this reschedule/preschedule criteria is that for the project expansions and new projects, if actual total FY08 and FY09 spending is less than the sum of 33% of the FY08 budget and up to 75% of the FY09 budgets reflected in the spreadsheet attachments due to circumstances within the Tribes' control, then the increment between what is actually spent in FY08/09 and the sum of 33% of the FY08 budget and up to 75% of the FY09 budgets reflected in the spreadsheet cannot be carried over into FY10.

G. Compliance with the *in lieu* provision of the Northwest Power Act

This Agreement also serves as an agreement addressing Section 4(h)(10)(A) of the Northwest Power Act, which requires that BPA expenditures be "in addition to, not in lieu of other expenditures authorized or required from other entities under other agreements or provisions of law."

The Tribes confirm that no other entity is already *required* by law or agreement to fund the specific projects committed to by BPA under this Agreement. Further, when evaluated at a subbasin scale, the Parties understand that the tribes and others are currently expending substantial funds to protect and enhance fish and wildlife species or their habitats in close proximity to where the BPA funds will be applied. While not strictly an in lieu issue, the Tribes commit to continue their efforts to secure or support funding for fish and wildlife from non-BPA sources

In order to address potential *in lieu* issues, the Tribes have identified the following sources of funding by subbasin as described in Attachment H (tribal and non-tribal funding).

The Parties anticipate that similar levels of funding for these parallel and complementary actions will continue for the duration of the Agreement. If there is a change in the composition or levels of funding described, it will not affect the commitments in this Agreement, but will be addressed in future *in lieu* reviews after the end of this Agreement.

As a result of this documented parallel and complementary funding, BPA agrees that projects committed to in this Agreement satisfy the *in lieu* provision.

IV. FORBEARANCE, WITHDRAWAL, AND DISPUTE RESOLUTION

A. Forbearance

A.1. The Tribes will provide a copy of this Agreement to the court in *NWF v. NMFS*.

A.2. The Tribes covenant that during the term of this Agreement:

a. The Treaty Tribes will not initiate, join in, or support in any manner ESA, Northwest Power Act, Clean Water Act or APA suits against the Action Agencies or NOAA regarding the legal sufficiency of the FCRPS PA, FCRPS BiOp, Upper Snake BiOp and/or conforming implementing RODs.

b. So long as the Agreement is being implemented by the Action Agencies, the Tribes will not initiate, join in, or support in any manner ESA, Northwest Power Act, Clean Water Act or APA suits against the Action Agencies or NOAA regarding the effects on fish resources and water quality (water quality issues addressed in the FCRPS BA and the Draft BiOps or otherwise related to the operation or existence of the 14 FCRPS projects regarding temperature and total dissolved gas[5]) resulting from the operations of the FCRPS and Reclamation dams that are specifically addressed in the FCRPS PA, FCRPS BiOp, Upper Snake BiOp and/or conforming implementing RODs.

c. The Treaty Tribes' participation in ongoing and future BPA rate making/approval/review proceedings will be consistent with the terms of this Agreement. This means, for example, that the Tribes agree not to request additional fish or wildlife funding from BPA in on-going and future BPA rate making/approval/review proceedings during the term of this Agreement, and that the Tribes will not make such requests in ongoing or future rate making/approval/review proceedings based on alleged infirmities in prior rate making/approval/review proceedings, including but not limited to the 2002-2006 rate period.

d. The Tribes agree that breaching will not occur within the term of the Agreement. In addition, the Tribes will not advocate for breaching dams covered by the FCRPS and Upper Snake Biological Opinions during the term of this Agreement. This commitment is made subject to the following mutual understandings and a single exception specified below:

[5] Water quality here is not intended to include matters not specifically addressed in the FCRPS BA and BiOps such as the Corps' 404 regulatory program, toxics clean-up issues.

- It is understood by all Parties that nothing in this Agreement may be interpreted or represented as any tribe rescinding or altering their long-standing policy, scientific, and legal positions regarding breach of federal dams.
- As required by the draft NOAA Fisheries FCRPS Biological Opinion, a comprehensive review will be completed in June, 2012 and June, 2015 that includes a review of the state of implementation of all actions planned or anticipated in the FCRPS and Upper Snake BiOps and a review of the status and performance of each ESU addressed by those BiOps. As described in Section II.A.2 of this Agreement, the Parties agree to meet to discuss the results of the 2012 comprehensive evaluation and, in the event performance is not on track, to discuss options for corrective action. If, after the June, 2015 comprehensive review, the status of Snake River ESUs is not improving and the Tribes review of Diagnostic Performance Framework indicates contingent actions are needed, the Tribes may advocate that actions to implement Snake River dam breaching after 2017 should be initiated.

A.3. The Action Agencies covenant that during the term of this Agreement:

a. The Action Agencies will not support in any manner any suits that challenge the legal sufficiency of the 2008-2017 *United States v. Oregon* Management Plan, its BiOp or implementing RODs.

b. The Action Agencies will not support in any manner actions that undermine the Fish Passage Center provisions of Section II.D.

A.4. Nothing in this Agreement shall be construed by the Parties in any forum to limit or restrict the Parties or their agents or employees from advocating for actions that they believe are required to implement this Agreement. Disputes among the Parties regarding implementation will be handled under the Good Faith and dispute resolutions sections.

A.5. The ability and willingness of the Tribes to enter into an agreement with respect to an FCRPS BiOp is contingent on having a *U.S. v. Oregon* agreement (management plan) of equal duration entered as a Court Order and upon the assumption that NOAA Fisheries will give ESA coverage for the same.[6] In the event the *U.S. v. Oregon* agreement or the implementation of any of its provisions is challenged in Court, the Tribes expect the United States to vigorously defend the final agency action, and the Tribes reserve the right to assert all defenses, counter claims, and to offer any and all evidence, including defenses, counter-claims, cross-claims and evidence related to the FCRPS. If such offers by the Tribes are inconsistent with the forbearance and affirmation of adequacy commitments made in this Agreement, the Action Agencies retain the options of dispute resolution or withdrawal.

[6] "NMFS properly found that, although difficult to quantify, tribal treaty fishing rights were present effects of past federal actions that must be included in the environmental baseline. See 50 C.F.R. 402.02. To quantify (Tribal Treaty fishing) rights and add them to the environmental baseline, NMFS reasonably looked to current harvest levels and assumed that future harvests would be the same." *CSRIA v. Gutierrez,* unpublished memorandum opinion at 2 (9th Cir., April 6, 2007).

B. Affirmation of Adequacy

B.1. This Agreement builds upon and expands the commitments of the Action Agencies called for in the FCRPS and Upper Snake Biological Opinions (the BiOps). This Agreement also takes into account and supports the 2008 - 2017 *United States v. Oregon* Management Plan and its pending BiOp. The Parties support this package of federal and tribal actions as an adequate combined response of these Parties for the ten year duration of the Agreement and BiOps to address the government's duties for:

- conserving listed salmon and steelhead, including avoiding jeopardy and adverse modification of critical habitat under the Endangered Species Act;
- protection, mitigation, enhancement and equitable treatment of fish under the Northwest Power Act; and
- Clean Water Act provisions related to the FCRPS dams.

B.2. The Tribes further agree that:

- the Action Agencies' commitments under this Agreement and the BiOps as to hatchery projects are adequate for 30 years from the effective date of this Agreement, with the exception of the Yakama/Klickitat projects, which are addressed in Section III.B.2, and except that if after year 15 of the 30 year forbearance for hatcheries there is a change in the status of an ESU (e.g., a new listing), or if after year 15 there is new information or changed circumstances that indicate additional hatchery actions are needed to assist in mitigating impacts of the FCRPS consistent with current science and applicable law, the Tribes are not precluded from seeking additional funding from the Action Agencies for hatcheries. If within the year prior to the expiration of this Agreement, due to no fault of the Parties, any capital funded hatchery actions identified in this Agreement have not begun construction, BPA will continue to make the identified capital funding in this Agreement available for the identified project (or projects) for an additional five years at which point the Parties will meet and discuss the disposition of any hatcheries that have not completed construction and the related capital funding.
- the Action Agencies' commitments under this Agreement for lamprey actions are adequate for the duration of this Agreement such that the Tribal parties will not petition to list lamprey or support third party efforts to list lamprey as threatened or endangered pursuant to the ESA.

B.3. The Tribes' determination of adequacy under applicable law is premised on several important assumptions and understandings with which the federal parties to this Agreement concur:

- The specific actions identified in this Agreement and/or funding for such actions is provided by the federal parties in full and timely manner;
- Other actions not specifically identified in this Agreement, but committed to in the FCRPS BiOp, are carried out in a timely manner;
- The biological performance and status of the species affected by the development and operation of the FCRPS and Upper Snake hydroprojects are diligently and comprehensively monitored, analyzed, and reported to the Tribes and others as provided in this Agreement (Sections II.A.1 and II.A.2) and the BiOps; and

- Adaptive management will be used as described in the Section II.A.2 to ensure achievement of performance objectives for the FCRPS. That if during the 2012 or 2015 comprehensive review called for in the BiOps it is found that the status of ESA covered species are not improving as anticipated in the Adaptive Management section of the BA, that the Tribes will have the opportunity to advocate that actions over and above those in the Agreement and/or BiOps should be implemented in the future, consistent with the terms of this Agreement.

B.4. The Tribes agree to affirmatively support the adequacy of the package of federal and tribal actions contained in the BiOps and this Agreement in appropriate forums, including NOAA's administrative record. The Parties expect the United States to continue affirmative support of the *US v. Oregon* BiOp and 2008-2017 Management Plan.

B.5. That the Parties acknowledge that this Agreement does not comprehensively address the Action Agencies' legal obligation related to wildlife under the NWPA. The Parties understand that there are currently differing positions as to what is required to meet NWPA and Program standards for wildlife. The Parties agree that the Tribes may request or advocate for additional terrestrial wildlife protection, mitigation and enhancement funding by BPA under the Northwest Power Act, that BPA may decline such requests, and the Tribes may seek recourse for BPA decisions; none of these actions by the Tribes or BPA will violate the terms of this Agreement.

C. Council Program Amendment Process

C.1. During the term of the Agreement, the Action Agencies and Tribes will submit recommendations or comments or both in relation to Council Program amendments that are consistent with and are intended to effectuate this Agreement. The Tribes and the Action Agencies have agreed to submit the following to the Council in any recommendations or comments each may make for Program amendments solicited in 2008 to describe this Agreement and its role in such Program amendments:

> Description and Rationale: The Action Agencies and the Tribes have agreed to a ten year commitment of actions in support of the Action Agencies' obligations both generally under the Northwest Power Act, as well as specifically for anadromous species listed under the Endangered Species Act. The commitments include support for the actions in the 2008 Biological Opinions for the FCRPS and the Upper Snake. The commitments also include actions already reviewed and recommended by the Council to BPA, as well as expanded and new actions. The Action Agencies and the Tribes have found these commitments consistent with the Program and the Council's intent to integrate Power Act and ESA responsibilities. The expanded and new actions are, moreover, subject to reasonable modifications determined by the Parties to the Agreement based on Council and ISRP review.

The Tribes and the Action Agencies will recommend that the Council amend the Fish and Wildlife Program to incorporate the BiOps and Agreement, consistent with the following approach:

- The actions in the 2008 Biological Opinions for the FCRPS and Upper Snake should be implemented, in conjunction with the FCRPS Action Agencies' Biological Assessment, as measures to protect, mitigate, and enhance listed salmon and steelhead affected by the federal hydro system.
- The actions in the 2008 Memoranda of Agreement between the FCRPS Action Agencies and the Tribes should be implemented per its terms as additional measures to protect, mitigate and enhance both listed and non-listed fish.

C.2. Neither the Tribes, nor the Action Agencies, waive the right to assert that, if adopted by the Council based on its own recommendations, or recommendations of third parties, an amendment that is contrary to this Agreement is either lawful or unlawful under the Northwest Power Act, or any other law, provided they act consistent with the terms of this Agreement.

D. Good Faith Implementation and Support

This Agreement is based on bargained-for consideration. The Parties agree to work together in partnership to implement the mutual commitments in this Agreement. Although neither the Action Agencies nor the Tribes are relinquishing their respective authorities through this Agreement, they commit to make best effort to sit down with each other prior to making decisions in implementation of this Agreement.

The Parties enter into this Agreement cognizant of its scope, duration, and complexity, and commit to its implementation and support at all levels and in all areas, e.g. policy, legal, and technical. Further, the Parties understand that matters explicitly addressed within and/or related to this Agreement are routinely dealt with in a wide variety of contexts and fora, often on short notice and in time-sensitive situations. Even with those understandings, the Parties will vigorously endeavor to implement and support this Agreement in good-faith. Best effort good-faith implementation and support of this Agreement is the general duty to which all Parties agree to be bound. Nonetheless, the Parties understand that from time to time questions or concerns may arise regarding a Party's compliance with the terms of this Agreement. In furtherance of the continuing duty of good faith, each Party agrees that the following specific actions or efforts will be carried out:

D.1 On a continuing basis, it will take steps to ensure that all levels of their government/institution is made aware of the existence of this Agreement and the specific commitments and obligations herein, and emphasize the importance of meeting them;

D.2 Each Party will designate a person to be initially and chiefly responsible for coordinating internal questions regarding compliance with the Agreement;

D.3. Each Party will make best efforts to consult with other Parties prior to taking any action that could reasonably be interpreted as inconsistent with any part of this Agreement. To assist in this, the Parties will designate an initial contact point; the Tribes will designate their legal representatives as their initial contact points, the contacts for the Action Agencies are to be determined. The formality and nature of the consultation will likely vary depending on circumstances. The initial contact points are initially charged with attempting to agree on what form of consultation is required. In some instances, the contacts between representatives may suffice for the consultation, while in others, they may need to recommend additional steps. The Parties agree that consultations should be as informal and with the least amount of process necessary to ensure that the Parties are fulfilling the good-faith obligation to implement and support the Agreement.

D.4. If a Party believes that another has taken action that is contrary to the terms of the Agreement, or may take such action, it has the option of a raising a point of concern with other Parties asking for a consultation to clarify or redress the matter. The Parties will endeavor to agree upon any actions that may be required to redress the point of concern. If after raising a point of concern and having a consultation the Parties are unable to agree that the matter has been satisfactorily resolved, any Party may take remedial actions as it deems appropriate, so long as those remedial actions do not violate the terms of the Agreement.

E. Changed Circumstances, Renegotiation/Modification, Withdrawal

E.1. The Parties enter into this Agreement with the assumption that NOAA will issue final biological opinions for the FCRPS, Upper Snake, and 2008 – 2017 *United States v. Oregon* Management Plan. The Parties assume these BiOps will conclude that the respective proposed actions, with reasonable and prudent alternatives if any, are not likely to jeopardize the continued existence of any ESA-listed salmon and steelhead or result in the destruction or adverse modification of critical habitat of such species.

E.2 If any court, regardless of appeal, finds that the BiOp or agency action is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, and subsequently remands the BiOp to NOAA Fisheries, this Agreement shall remain in force. If any court, regardless of appeal, finds that the BiOp or agency action is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, the Parties will seek to preserve this Agreement and will meet promptly to determine the appropriate response as described below:

- In the event that a portion(s) of this Agreement is in direct conflict with a court order or resulting amended BiOp, the Parties shall meet and agree on an appropriate amendment to that section, or, if such amendment is not possible under the terms of the court order or resulting amended BiOp, then a substitute provision shall be negotiated by the Parties.

- If court-ordered FCRPS operations or resulting amended BiOp require additional actions that are either financially material to an Action Agency or that materially constrain the Corps or Reclamation from meeting FCRPS purposes, Section IV.E.4 below shall apply. The Parties intend that determinations of materiality will only be made in cases of great consequence.

- The Parties will participate in any court-ordered process or remand consultation in concert with IV.D and IV.E of this Agreement.

- Without limiting the other provisions of this Section IV.E.2, in the case of a court order or resulting amended BiOp that constrains actions in the 2008 – 2017 *United States v. Oregon* Management Plan, the Parties agree that this Agreement shall remain in effect unless a court order or resulting amended BiOp materially constrains the actions in the 2008 – 2017 *United States v. Oregon* Management Plan. The Parties intend that determinations of materiality will only be made in cases of great consequence.

E.3. Regardless of any legal challenge, BPA will take steps to:

- Ensure that the commitments in this Agreement are not modified or reduced based on agency-wide streamlining or other cost-cutting efforts;
- Imbed the estimated cost of implementing this Agreement in the agency's revenue requirement to be recovered through base wholesale power rates;
- Propose and, if established after a Northwest Power Act section 7(i) hearing, exercise rate risk mitigation mechanisms as needed to maintain the funding commitments in this Agreement (e.g., cost recovery adjustment clauses); and
- Consider agency cost reductions, or other measures to maintain the funding commitments in this Agreement.

E.4. In the event of the occurrence of any of the material effects in E.2, or in the event of material non-compliance with the Agreement not resolved by dispute resolution, the affected Party or Parties shall notify the other Parties immediately, identifying why the event is considered material. The Parties shall utilize dispute resolution if there is a disagreement as to whether the event is material. In addition, prior to any withdrawal, the Parties shall first make a good faith effort to renegotiate mutually agreeable modifications to the Agreement. If renegotiation is not successful, the affected Party may notify the other Parties in writing of its intent to withdraw by a date certain. A Party may not withdraw from the Agreement on the basis of its own non-compliance. If renegotiation is not successful, at the time the withdrawal is effective, all funding commitments and/or other covenants made by the withdrawing Party cease, and the withdrawing Party shall have no further rights or obligations pursuant to the Agreement, and reserves any existing legal rights under applicable statutes, including all arguments and defenses, and this Agreement cannot be used as an admission or evidence.

If the affected Party does not withdraw, that Party may challenge in any appropriate forum the asserted non-compliance with the terms of this Agreement, provided that judicial review of disputes arising under this Agreement is limited to BPA.

The Parties may, by mutual agreement, consider negotiations or withdrawal for changed circumstances other than those enumerated above.

If one Party withdraws from the Agreement, any other Party has the option to withdraw as well, with prior notice.

The provisions of this Agreement authorizing renegotiation, dispute resolution, withdrawal, or challenge in appropriate forums provide the sole remedies available to the Parties for remedying changed circumstances or disputes arising out of or relating to implementation of this Agreement.

E.5. Savings. In the event of withdrawal, BPA will continue providing funding for projects necessary for support of BiOp commitments (as determined by the Action Agencies), and will provide funding for other on-going projects or programs that the Parties mutually agree are important to continue.

F. Dispute Resolution

F.1. Negotiation

1.a. The Parties shall attempt in good faith to resolve any dispute arising out of or relating to implementation of this Agreement in accordance with this section and without resort to administrative, judicial or other formal dispute resolution procedures. The purposes of this section is to provide the Parties an opportunity to fully and candidly discuss and resolve disputes without the expense, risk and delay of a formal dispute resolution.

1.b. If the Parties are unable to resolve the dispute through informal dispute resolution, then the dispute shall be elevated to negotiating between executives and/or officials who have authority to settle the controversy and who are at a higher level of management than the person with direct responsibility for administration of this Agreement. All reasonable requests for information made by one Party to the other will be honored, with the Action Agencies treating “reasonable” within the context of what would be released under the Freedom of Information Act.

1.c. In the event a dispute over material non-compliance with the Agreement has not been resolved by negotiation, the affected Party may seek to withdraw or seek review in appropriate forums in accordance with Section IV.E, above.

F.2. Mediation

In the event the dispute has not been resolved by negotiation as provided herein, the disputing Parties may agree to participate in mediation, using a mutually agreed upon mediator. To the extent that the disputing Parties seeking mediation do not already include all Parties to this Agreement, the disputing Parties shall notify the other Parties to this Agreement of the mediation. The mediator will not render a decision, but will assist the disputing Parties in reaching a mutually satisfactory agreement. The disputing Parties agree to share equally the costs of the mediation.

G. Modification

The Parties by mutual agreement may modify the terms of this Agreement. Any such modification shall be in writing signed by all Parties.

V. MISCELLANEOUS PROVISIONS

A. Term of Agreement

Except as otherwise provided regarding hatcheries, see Section IV.B.2, the term of this Agreement will extend from its effective date through the end of fiscal year 2018 which is midnight on September 30, 2018.

B. Applicable Law

All activities undertaken pursuant to this Agreement must be in compliance with all applicable laws and regulations. No provision of this Agreement will be interpreted or constitute a commitment or requirement that the Action Agencies take action in contravention of law, including the Administrative Procedure Act, the National Environmental Policy Act, the Endangered Species Act, Federal Advisory Committee Act, Information Quality Act, or any other procedural or substantive law or regulation. Federal law shall govern the implementation of this Agreement and any action, whether mediated or litigated, brought or enforced.

C. Authority

Each Party to this Agreement represents and acknowledges that it has full legal authority to execute this Agreement.

D. Consistency with Trust and Treaty Rights

Nothing in this Agreement is intended to nor shall in any way abridge, abrogate, or resolve any rights reserved to the Tribes by treaty. The Parties agree that this Agreement is consistent with the treaty rights of the signatory Tribes and the United States' trust obligation to tribes, but does not create an independent trust obligation. The Tribes specifically represent and warrant that no approval of this Agreement by the Secretary of the Interior or the Bureau of Indian Affairs or any other federal agency or official is required in order for the Tribes to execute this Agreement or for this Agreement to be effective and binding upon the Tribes.

E. Effective Date & Counterparts

The effective date of this Agreement shall be the date of execution by the last Party to provide an authorized signature to this Agreement. This Agreement may be executed in counterparts, each of which is deemed to be an executed original even if all signatures do not appear on the same counterpart. Facsimile and photo copies of this Agreement will have the same force and effect as an original.

F. Binding Effect

This Agreement shall be binding on the Parties and their assigns and successors. Each Party may seek dispute resolution in accordance with Sections IV.F, or to withdraw in accordance with Sections IV.E, if the dispute is not resolved. The commitments made by the Parties in this Agreement apply to the Parties, their staff, any persons hired or volunteering for a Party, any representative or organization under a Party's guidance or control, and any person or entity that acts as an agent for a Party, and to participation in all forums (e.g., Tribal participation in the Columbia Basin Fish and Wildlife Authority, Action Agency participation in the Pacific Northwest Coordination Agreement processes). The commitments made by the Parties in this Agreement also includes a commitment not to directly or indirectly support third-party efforts to challenge the adequacy of the BiOps, this Agreement, or the Parties efforts to implement them.

G. No third party beneficiaries are intended by this Agreement.

H. All previous communications between the Parties, either verbal or written, with reference to the subject matter of this Agreement are superseded, and this Agreement duly accepted and approved constitutes the entire Agreement between the Parties.

I. Waiver, Force Majeure, Availability of Funds

I.1. The failure of any Party to require strict performance of any provision of this Agreement or a Party's waiver of performance shall not be a waiver of any future performance of or a Party's right to require strict performance in the future.

I.2. No Party shall be required to perform due to any cause beyond its control. This may include, but is not limited to fire, flood, terrorism, strike or other labor disruption, act of God or riot. The Party whose performance is affected by a force majeure will notify the other Parties as soon as practicable of its inability to perform, and will make all reasonable efforts to promptly resume performance once the force majeure is eliminated. If the force majeure cannot be eliminated or addressed, the Party may consider withdrawal pursuant to Sections IV.E and IV.F.

I.3 The actions of the Corps and Reclamation set forth in this Agreement are subject to the availability of appropriated funds. Nothing in this Agreement shall be construed to require the obligation or disbursement of funds in violation of the Anti-Deficiency Act.

J. Notice.

1. Any notice permitted or required by the Good Faith provisions of this Agreement, Section IV.D, may be transmitted by e-mail or telephone to a Party's initial contact points, as that person is defined pursuant to the Good Faith provisions.

2. All other notices permitted or required by this Agreement shall be in writing, delivered personally to the persons listed below, or shall be deemed given five (5) days after deposit in the United States mail, addressed as follows, or at such other address as any Party may from time to time specify to the other Parties in writing. Notices may be

delivered by facsimile or other electronic means, provided that they are also delivered personally or by mail. The addresses listed below can be modified at any time through written notification to the other Parties.

Notices to BPA should be sent to:

Vice President, Environment Fish & Wildlife
Mail Stop KE-4
Bonneville Power Administration
P.O. Box 3621
Portland, OR 97208-3621

Notices to the U.S. Army Corps of Engineers should be sent to:

U.S. Army Corps of Engineers, Northwestern Division
Chief, Planning, Environmental Resources and Fish Policy Support Division
1125 NW Couch Street
Suite 500
P.O. Box 2870
Portland, OR 97208-2870

Notices to the U.S. Bureau of Reclamation should be sent to:

Deputy Regional Director
Bureau of Reclamation
Pacific Northwest Region
1150 N. Curtis Rd., Suite 100
Boise, ID 83706

Notices to the Confederated Tribes of the Umatilla Indian Reservation should be sent to:

Brent H. Hall
Associate Attorney General
Confederated Tribes of the Umatilla Indian Reservation
P.O. Box 638
Pendleton, OR 97801

Notices to the Confederated Tribes of Warm Springs Reservation of Oregon should be sent to:

John W. Ogan
Karnopp Petersen, Attorneys for the Confederated Tribes of the Warm Springs Reservation of Oregon
1201 N.W. Wall Street, Suite 300
Bend, OR 97701-1936

Notices to the Yakama Nation should be sent to:

Ralph Sampson
Chairman
P.O. Box 151
Toppenish, WA 98948

and

Tim Weaver
Attorney for Yakama Nation
Weaver Law Office
The Tower, 402 E Yakima Ave Ste 190
Yakima, WA 98901

Notice Notices to the Columbia River Inter-Tribal Fish Commission should be sent to:

Rob Lothrop
Columbia River Inter-Tribal Fish Commission
729 NE Oregon
Portland, OR 97232

K. List of Attachments

Attachment A: Passage Standards
Attachment B: Project Commitment Spreadsheets
Attachment C: Group B Steelhead Package
Attachment D: Spring Creek Hatchery Commitments
Attachment E: Forecasting Commitments
Attachment F: Canadian Treaty Commitments
Attachment G: Biological Benefits Analysis
Attachment H: In Lieu Requirements

SIGNATURES

/s/ Stephen J. Wright *May 2, 2008*

Stephen J. Wright Date
Administrator and Chief Executive Officer
Bonneville Power Administration

/s/ Steven R. Miles, P.E. *May 2, 2008*

Steven R. Miles, P.E. Date
Colonel, U.S. Army Corps of Engineers
Division Commander

/s/ Tim Personius *May 2, 2008*

(for) J. William MacDonald Date
Regional Director
U.S. Bureau of Reclamation
Pacific Northwest Region

/s/ Antone Minthorn *May 2, 2008*

Antone Minthorn Date
Chairman, Board of Trustees
Confederated Tribes of the Umatilla Indian Reservation

/s/ Ron Suppah *May 2, 2008*

Ron Suppah, Chair Date
Tribal Council
Confederated Tribes of the Warm Springs Reservation

/s/ Ralph Sampson *May 2, 2008*

Ralph Sampson, Chair Date
Tribal Council
Confederated Tribes and Bands of the Yakama Nation

/s/ Fidelia Andy *May 2, 2008*

Fidelia Andy, Chair Date
Columbia River Inter-Tribal Fish Commission

/s/ Rebecca A. Miles *May 9, 2008*

(for) Gary Green, Secretary Date
Columbia River Inter-Tribal Fish Commission

ATTACHMENT A

Attachment A

The following describes the commitment from the Action Agencies for achieving dam performance on a per project basis for the course of the Agreement. The information for each project includes recent operations and dam survival performance standards to be achieved prior to making potential reductions in spill, as well as additional performance metrics to be considered, as provided below.

Dam Survival Performance Standard

Dam survival is the overarching performance standard. The dam passage performance standard is to meet 96% dam passage survival for yearling Chinook and steelhead and 93% for subyearling Chinook and achievement of the standard is based on two years of empirical survival data (see Table 1 on the following page) as set out in FCRPS BA Appendix B.2.6-2-6, section 3.3 and the draft BiOp dated October 30, 2007.

Spill Passage Efficiency and Delay Metrics

Spill passage efficiency (SPE) and delay metrics under current spill conditions, as shown below in the Table 1, are not expected to be degraded ("no backsliding") with installation of new fish passage facilities at the dams. If maintaining SPE and/or passage delay metrics would reduce dam survival or impede achievement of the dam survival performance standards, operations (including spill as necessary) may be adjusted to meet dam survival performance. This provision does not apply at projects where SPE or delay are not currently known and so are not specified in Table 1, but future research, monitoring and evaluation of the metrics is expected at all of those projects.

Future Research, Monitoring and Evaluation

The Action Agencies' dam survival studies for purposes of determining juvenile dam passage performance will also collect information on SPE, BRZ to BRZ survival and delay as well as other distribution and survival information. SPE and delay metrics will be considered in the performance check-ins or with COP updates, but not as principle or priority metrics over dam survival performance standards. Once a dam meets the survival performance standard, SPE and delay metrics may be monitored coincidentally with dam survival testing.

The Action Agencies retain the ability to make adjustments in spill levels as needed to maintain dam survival performance pending further configuration improvements. The specific dam passage testing requirements will continue to be coordinated through the Anadromous Fish Evaluation Program annual process.

ATTACHMENT A

Table 1. Current estimates of dam survival (COMPASS and empirical), spill passage efficiency, and delay.

	Project	Current Survival (COMPASS)	2006 Survival (Empirical)	2007 Survival (Empirical)	Most Recent SPE[4]	Date of SPE Data Source	Most Recent Median Delay*
Yearling Chinook	LGR	96.1	97.5	na	43-66	2002-2005	2.28 -10h
	LGS	95.6	95.5	99.7	57-82	2006-2007	4.4 - 6.5h
	LMN	93.6	94.3	95.2	58-75	2006-2007	2.2 - 3.0h
	IHR[1]	96.6	96.1 / 96.2	94.9 / 95.8	73->90	2005-2007	1.1 - 2.3h
	MCN	94.2	94.0	92.8 /93.0	45-57	2005,2007	1.0 - 3.9 h
	JDA[5]	93.9	92.9/96.3	92.2/94.0	48-75	99,00,02,03	0.2 - 8.5 h
	TDA[6]	91.4	91.0	93.0	70->90	2002-2005	0.51 - 0.70h
	BON[7]	97.1	95.1	96.6	53-54	2004-2005	0.01 - 3.4 h
Steelhead	Project	Current Survival (COMPASS)	2006 Survival (Empirical)	2007 Survival (Empirical)	Most Recent SPE[4]	Date of SPE Data Source	Most Recent Median Delay*
	LGR	96.2	97.6	na	51-74	2002-2005	1.7 - 6.0h
	LGS	95.9	98.5	98.5	36-51	2006-2007	5.5 - 36.3h
	LMN	93.2	100.0	95.5	48-64	2006-2007	5.5 - 19.0h
	IHR[1]	98.8	100 / 100	97.3 / 96.4	61->90	2005-2007	1.1 - 1.9h
	MCN	95.2	na	na	52-78	2005,2007	4.38 - 10.2 h
	JDA[5]	91.7	95.7/90.4	94.0/91.5	45-64	99-00,03	0.3 - 13.4h
	TDA[6]	92.3	na	na	90**	2002-2005	0.23 - 0.8h
	BON[7]	97.2	99.1	96.3	74-75	2004-2005	0.01 - 9.7h
Subyearling Chinook	Project	Current Survival (COMPASS)	2006 Survival (Empirical)	2007 Survival (Empirical)	Most Recent SPE[4]	Date of SPE Data Source	Most Recent Median Delay*
	LGR	na	91.4	na	67-88	2005-2007	8.37 - 15.87
	LGS	na	94.2	90.5	58-84	2006-2007	6.8 - 16.3h
	LMN	na	95.0	84.2	81->90	2005-2007	2.7-3.0h
	IHR	na	95.2	95.6	84->90	2005-2007	2.0- 5.0h
	MCN	na	96.0	96.1 / 89.5	61-64	2005,2007	0.84 - 3.2h
	JDA[5]	na	92.8/99.2	92.2/94.0	58-59	99,00,02,03	1 - 3h
	TDA[6]	na	82.0	90.0	63->90	2002-2005	0.62 - 0.69h
	BON[7]	na	89.1	93.8	55-75	2004-2005	0.01 - 5.7 h

1 – 30% 24-hour spill / 45 kcfs day, Gas Cap night
2- Green shading indicates that the dam survival performance standard has been met at that project for that species.
3 – Current COMPASS survival numbers may change upon completion of final modeling.
4-Sources and assumptions are attached at the end of this document
5-JDA Empirical survival-yearling and subyearling data is from 2002 and 2003. Steelhead is from 2000 and 2002
6-TDA Empirical survival is from 2004 and 2005
7-BON Empirical survival is from 2004 and 2005
*See notes under assumptions regarding specific delay measurements
**-Two years of steelhead data both measured 90% SPE at The Dalles so there is no range

Sources and Assumptions for SPE and Delay Estimates in Table 1:

Lower Granite Dam:

- SPE estimates include both RSW and standard spill.
- Forebay Residence Time measured from 2km upstream to face of dam.
  - 2005 Spring Estimates were based on Figure 26 from Perry et al, 2007. RSW treatment only.
  - Range of point estimates in 2003 was 0.5 hours to 103.8 hours for yearling Chinook, 0.07 to 146.61 hours for steelhead (wild and hatchery combined)
  - 05 range for yearling Chinook was from near 0 to approx 60 h. Steelhead ranged from near zero to approx 42 h.
  - In 2005, delay ranged from 0.89 to 206.17 hours for subyearling Chinook.
  - Forebay estimates only calculated when RSW was operating
  - Sub-yearling estimates are estimated from J. Beeman's 2006 AFEP presentation. 05 and 07 estimates fell with the range of the 03 and 06 estimates.

Beeman, J., T. Counihan, A. Braatz, S. Fielding, J. Hardiman, H. Hansel, A. Pope, A. Puls, J. Schei, C. Walker, and T. Wilkerson. 2006. Migration Characteristics of Juvenile Salmonids in the Forebay of Lower Granite Dam During Removable Spillway Weir (RSW) and Behavioral Guidance Structure (BGS) tests, in 2006. Preliminary Data Presented at 2006 AFEP review in Portland, OR.

Counihan, T., A. Puls, J. Hardiman, C. Walker, and I. Duran. 2007. Survival and Migration Behavior of Subyearling Chinook Salmon Passing Lower Granite Dam, 2007. Preliminary Data presented at 2007 AFEP Review. Walla Walla, WA.

Perry, R.W., T.J. Kock, M.S. Novick, A.C. Braatz, S.D. Fielding, G.S. Hansen, J.M. Sprando, T.S. Wilkerson, G.T. George, J.L. Schei, N.S. Adams, and D.W. Rondorf. 2007. Survival and Migration Behavior of Juvenile Salmonids at Lower Granite Dam, 2005. Final Report.

Plumb, J.M., A.C. Braatz, J.N. Lucchesi, S.D. Fielding, A.D. Cochran, T.K. Nation, J.M. Sprando, J.L. Schei, R.W. Perry, N.S. Adams, and D.W. Rondorf. 2004. Behavior and Survival of Radio-Tagged Juvenile Chinook Salmon and Steelhead Relative to the Performance of a Removable Spillway Weir at Lower Granite Dam, Washington, 2003. Final Report.

Little Goose Dam:

- Forebay Residence Time measured from 2km upstream to face of dam.
  - Yearling Chinook and Steelhead estimates in table 1 represent the ave median residence time of spill, bypass, and turbine estimates during spill. Taken from appendix table C1 in Perry et al. 2007.

- Range of point estimates in 2005 was 1.3 hours to 221.41 hours for yearling Chinook, 0.27 hours to 101.43 hours for steelhead, and 0.7 hours to 100.12 hours for subyearlings. Point estimates ranged from near 0 residence time to over 200 hours in 2007.
- 05 usually set the low end of residence time range for all three species.
- 06 was very close to values that were previously in table and usually fell within 05 and 07 estimates.
- 07 steelhead was high end of range and was estimated from 07 AFEP powerpoint presentation (assumed 22hr median delay for both gas cap and bulk 2 treatment, assumed 63 hr for bulk 1 treatment).
- 07 sub-yearling was high end of range. Also based on 07 AFEP powerpoint. Assumed 18.75h for bypass and 12.5h for spill and turbine.

Beeman, J.W., A.C. Braatz, S.D. Fielding, H.C. Hansel, S.T. Brown, G.T. George, P.V. Haner, G.S. Hansen, and D.J. Shurtleff. 2007. Migration Behavior and Survival of Juvenile Salmonids at Little Goose Dam, 2007. Preliminary data reported at 2007 AFEP review in Walla Walla, WA.

Beeman, J., T. Counihan, A.Braatz, S. Fielding, J. Hardiman, H. Hansel, A. Pope, A. Puls, A. Schei, C. Walker, and T. Wilkerson. 2006. Passage, Survival, and Approach Patterns of Juvenile Salmonids at Little Goose Dam, 2006. Preliminary data reported at 2006 AFEP review in Portland, OR.

Perry, R.W., M.S. Novick, A.C. Braatz, T.J. Kock, A.C. Pope, D.J. Shurtleff, S.N. Lampson, R.K. Burns, N.S. Adams, and D.W. Rondorf. 2007. Survival and migration behavior of juvenile salmonids at Little Goose Dam, 2005. Final Report.

Lower Monumental Dam:

- Forebay Residence Time measured from X km upstream to face of dam.
  - High est. for yearling Chinook came from 06 and 07 AFEP review, and steelhead was from 07 AFEP Review. Highest for subs came from 05 and 07 AFEP review, low was from 06.
  - Range of yearling data from 0 to 42 hrs in 06, from 0 to over 100hrs for steelhead in 07, and for sub-yearlings residence time ranged from near 0 to 156 h in 05.

E.E. Hockersmith, G.A. Axel, D.A. Ogden, R.F. Absolon, and B.P. Sandford. 2007. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2006. Preliminary Data presented at 2006 AFEP review in Portland, OR.

E.E. Hockersmith, G.A. Axel, D.A. Ogden, R.F. Absolon, and B.P. Sandford. 2007. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2007. Preliminary Data presented at 2007 AFEP review in Walla Walla, WA.

R.F. Absolon, E.E. Hockersmith, G.A. Axel, D.A. Ogden, B.P. Sandford, and S.G. Smith. 2007. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2007. Preliminary Data presented at 2007 AFEP review in Walla Walla, WA.

R.F. Absolon, E.E. Hockersmith, G.A. Axel, D.A. Ogden, B.P. Sandford, and S.G. Smith. 2006. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2006. Preliminary Data presented at 2006 AFEP review in Portland, OR.

R.F. Absolon, E.E. Hockersmith, G.A. Axel, D.A. Ogden, B.P. Sandford, and S.G. Smith. 2005. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2005. Preliminary Data presented at 2005 AFEP review in Walla Walla, WA.

Ice Harbor Dam:

- All SPE estimates combine RSW and standard spill efficiency. 2007 preliminary data was considered but all estimates fell within the ranges prescribed by the 2005 and 2006 data.
- Forebay Residence Time measured from upstream BRZ to face of dam.
  - Only RSW treatment was considerend for 05 spring data
  - High est. for yearling Chinook came from 05 RSW treatment, and steelhead was from 06 30% treatment. Low est for both spring species was for 06 BiOp spill. High est for subs came from 05, low was from 06 (based on Ogden's 2007 AFEP presentation).
  - High end of 90% percentile residence times was greater than 25hrs for both yearling chinook and steelhead in 2005. Max. residence times of subs was approx 150hrs in 2005.

Axel, G.A., E.E. Hockersmith, D.A. Ogden, B.J. Burke, K. Frick, B.P. Sandford, and W.D. Muir. 2007. Passage Behavior and Survival of Radio-Tagged Yearling Chinook Salmon and Steelhead at Ice Harbor Dam, 2006. Draft report dated Sept. 2007.

Axel, G.A., E.E. Hockersmith, D.A. Ogden, B.J. Burke, K. Frick, and B.P. Sandford. 2007. Passage Behavior and Survival of Radio-Tagged Yearling Chinook Salmon and Steelhead at Ice Harbor Dam, 2005. Final Report.

Ogden, D.A., E.E. Hockersmith, Axel, G.A., R.F. Absolon, and B.P. Sandford. 2006. Passage Behavior and Survival of Sub-yearling Chinook Salmon at Ice Harbor Dam, 2006. Preliminary Data presented at 2006 AFEP review in Portland, OR.

Ogden, D.A., E.E. Hockersmith, Axel, G.A., R.F. Absolon, B.P. Sandford, S.G. Smith, and D.B. Dey. 2005. Passage Behavior and Survival of Sub-yearling Chinook Salmon at Ice

Harbor Dam, 2005. Preliminary Data presented at 2005 AFEP review in Walla Walla, WA.

McNary Dam:

- 2007 SPE includes TSWs.
- 2006 data was not used due to continued analysis by USGS. The preliminary data previously presented from 2006 is expected to change, possibly significantly with the draft final report.
- High Delay estimates for yearling Chinook, steelhead, and subyearlings were from **2005** and were **measured from 2km upstream**. Low estimates were from **2007** and were **measured from 60m upstream**.
    - 2005 residence times ranged from 0.84 to 171.87 hrs for yearling Chinook, from 1.07 to 135.35 hrs for steelhead, and from 0.78 to 2.28 hours for sub-yearling Chinook during court ordered spill.
    - 2007 residence times ranged from 0.002 to 5.997 hrs for yearling Chinook, 0.003 to 4.176 hours for steelhead, and from 0.001 to 12.838 hours for sub-yearling Chinook.

Adams, N.S. and T.D. Counihan. 2008. Survival and Migration Behavior of Juvenile Salmonids and McNary Dam, 2007. Draft Report dated Feb 12, 2008.

Perry. R.W., A.C. Bratz, M.C. Novick, J.L. Lucchesi, G.L. Rutz, R.C. Koch, J.L.Schei, N.S. Adams, and D.W. Rondorf. 2007. Survival and Behavior of Juvenile Salmonids at McNary Dam, 2005. Final Report.

John Day Dam:

- Chinook SPE estimates are from 1999,2000,2002, and 2003. Steelhead SPE estimates are from 1999,2000, and 2002.
- Forebay Residence Time measured from 100m upstream to face of dam.
    - High est. for yearling Chinook came from 2000 0/45 daytime treatment. High steelhead was from 2004 30% treatment. Low est for yearling Chinook and steelhead were both from 2000 0/45 night treatment. High est for subs came from 2003 0/60 daytime estimate, low was from 2002 0/60 treatment.

John Day Lock and Dam Configuration and Operation Plan. April 2007.

Delay estimates summarized by Mike Langsley and submitted to COMPASS dam passage group.

The Dalles Dam:

- SPE estimates include sluiceway efficiency as well as spill efficiency. Data collected from 2002-2005.
- Forebay Residence Time measured from approx. 100m upstream to face of dam.
    - All estimates are from 2002-2005. There is very little variability among years.

Johnson, G.E., J.W. Beeman, I.N. Duran, and A.L. Puls. 2007. Synthesis of Juvenile Salmonid Passage Studies at The Dalles Dam- Volume II: 2001-2005. Final Report.

Bonneville Dam:

- SPE estimates based on Spill efficiency and B2CC efficiency only. B1 sluiceway is not included in these estimates. Estimates are from 2004 and 2005.
- Forebay Residence Time measured from approx. 100m upstream to face of dam.
    - Data from 2001 was excluded.
    - Yearling and subyearling all had residence times less than one hour for all routes other than B1 when B2 was priority.
    - The high estimate for steelhead was from also from B1, but steelhead had a high estimate of 6.4 hours in the forebay of B2.

Ploskey, G.R., G.E. Johnson, A.E. Giorgi, R.L. Johnson, J.R. Stevenson, C.R. Schilt, P.N. Johnson, and D.S. Pattersion. 2007. Synthesis of Biological Research on Juvenile Fish Passage and Survival at Bonneville Dam through 2005. Final Report.

PROJECT BUDGET SUMMARY

Expense Category	Avg. Annual Expense
Category 1	$15,185,295
Category 2c-ongoing	$1,908,023
Subtotal - Ongoing	$17,093,318
Category 2a	$8,167,217
Category 2b	$2,235,353
Category 2c	$3,462,119
Category 3	$4,372,218
Supplemental	$490,000
Lamprey	$1,866,000
Subtotal - Non AP Expense	$37,686,225
Art Prod Existing/ Expanded	$10,051,971
Art prod new	$3,875,800
Subtotal - AP O&M	$13,927,771
Total	**$51,613,997**

Capital Funding	10- Year Total Amount
Non AP Capital	$52,111,712
Art Prod Capital	$80,112,006
Total	**$132,223,718**

Non-AP Expense Categories

ATTACHMENT B

Existing/ Expanded/ New	Category	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Average 08-17 LRT Budget
Category 1								
Existing	Category 1	199608300	CTUIR Grande Ronde Subbasin Restoration Project	CTUIR	Blue Mountain	Grande Ronde	Habitat	$190,000
Existing	Category 1	200003100	North Fork John Day Basin Anadromous Fish Habitat Enhancement Project	CTUIR	Columbia Plateau	John Day	Habitat	$249,000
Existing	Category 1	198902700	Power Repay Umatilla Basin Project	CTUIR	Columbia Plateau	Umatilla	Habitat	$1,150,000
Existing	Category 1	198710001	Umatilla Anad Fish Hab – CTUIR	CTUIR	Columbia Plateau	Umatilla	Habitat	$326,000
Existing	Category 1	198802200	Umatilla Fish Passage Operations	CTUIR	Columbia Plate	Umatilla	Habitat	$362,164
Existing	Category 1	199601100	Walla Walla Juvenile and Adult Passage Improvements (expense)	CTUIR	Columbia Plate	Walla Walla	Habitat	$21,600
Existing	Category 1	199604601	Walla Walla River Basin Fish Habitat Enhancement	CTUIR	Columbia Plate	Walla Walla	Habitat	$337,710
Existing	Category 1	200003300	Walla Walla River Fish Passage Operations	CTUIR	Columbia Plate	Walla Walla	Habitat	$89,000
Existing	Category 1	200203000	Develop Progeny Marker for Salmonids to Evaluate Supplementation	CTUIR	Columbia Plateau	Umatilla	RM&E	$297,000
Existing	Category 1	199000501	Umatilla Basin Natural Production Monitoring and Evaluation Project	CTUIR	Columbia Plate	Umatilla	RM&E	$420,129
Existing	Category 1	200003900	Walla Walla Subbasin Collaborative Salmonid Monitoring & Evaluation Project (CTUIR & WDFW)	CTUIR	Columbia Plate	Walla Walla	RM&E	$713,796
Existing	Category 1	199506001	Iskuulpa Watershed Project	CTUIR	Columbia Plateau	Umatilla	Wildlife	$200,000
Existing	Category 1	200002600	Rainwater Wildlife Area Operations and Maintenance	CTUIR	Columbia Plate	Walla Walla	Wildlife	$300,000
Existing	Category 1	199009200	Wanaket Wildlife Area	CTUIR	Columbia Plate	Umatilla	Wildlife	$250,000
Existing	Category 1	199802101	Hood River habitat program	CTWSRO	Columbia Gorg	Hood river/ fifteen mile	Habitat	$139,000
Existing	Category 1	200104101	Forrest conservation area	CTWSRO	Columbia Plate	Upper Mainstem John	Habitat	$206,635
Existing	Category 1	199801800	John Day Watershed Restoration program	CTWSRO	Columbia Plate	MF John Day	Habitat	$350,929
Existing	Category 1	200001500	Oxbow Conservation area	CTWSRO	Columbia Plate	MF John Day	Habitat	$200,070
Existing	Category 1	198805303	Hood river Production M&E	CTWSRO	Columbia Gorg	Hood river/ fifteen mile	RM&E	$502,103
Existing	Category 1	199802200	Pine Creek wildlife conservation area	CTWSRO	Columbia Plate	lower John Day	Wildlife	$210,000
Existing	Category 1	199603501	Yakama Reservation Watersheds Project	YN	Columbia Plate	Yakima	Habitat	$1,086,458
Existing	Category 1	199705100	Yakima Basin Side Channels	YN	Columbia Plate	Yakima	Habitat	$500,000
Existing	Category 1	198812035	YKFP Klickitat Management, Data, and Habitat	YN	Columbia Plate	Klickitat	Habitat	$461,666
Existing	Category 1	198812025	YKFP Management, Data, Habitat	YN	Columbia Plate	Yakima	Habitat	$1,237,239
Existing	Category 1	199506325	Yakima Klickitat Fisheries Project - Monitoring And Evaluation	YN	Columbia Plate	Yakima	RM&E	$4,100,251
Existing	Category 1	199506335	YKFP - Klickitat Subbasin Monitoring and Evaluation	YN	Columbia Gorg	Klickitat	RM&E	$520,000
Existing	Category 1	199206200	Yakama Nation - Riparian/Wetlands Restoration (O&M)	YN	Columbia Plate	Yakima	Wildlife	$764,545
								$15,185,295
Category 2a								
Expanded	Category 2.a.	199608300	CTUIR Grande Ronde Subbasin Restoration Project	CTUIR	Blue Mountain	Grande Ronde	Habitat	$399,500
Expanded	Category 2.a.	198710001	Umatilla Anad Fish Hab – CTUIR	CTUIR	Columbia Plate	Umatilla	Habitat	$842,300
Existing	Category 2.a.	199206200	Yakama Nation - Riparian/Wetlands Restoration (acquisition)	YN	Columbia Plate	Yakima	Habitat	$750,000

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Existing/ Expanded/ New	Category	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Average 08-17 LRT Budget
Expanded	Category 2.a.	199705100	Yakima Basin Side Channels	YN	Columbia Plate	Yakima	Habitat	$400,000
New	Category 2.a.	New	BOR Reach Complex Side channel reconnection, LWD recruitment, levee removal, riparian restoration with an emphasis in the lower Twisp River.	YN	Columbia Cascade	Methow	Habitat	$80,000
New	Category 2.a.	New	Design and build in-channel pool forming structures in main stem Entiat for juvenile rearing and spawning habitat.	YN	Columbia Cascade	Entiat	Habitat	$120,000
New	Category 2.a.	New	Reconnect main stem Wenatchee River side channel at Monitor in Lower Wenatchee Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$50,000
New	Category 2.a.	New	Install rock gravel catchers to promote gravel recruitment and spawning gravels on Mad River	YN	Columbia Cascade	Entiat	Habitat	$10,000
New	Category 2.a.	New	Continue hatchery carcass out planting and/or use of nutrient analogs in mid- and lower Entiat main stem.	YN	Columbia Cascade	Entiat	Habitat	$15,000
New	Category 2.a.	New	Add log and rock complexes to identified small tributary channels at key stream locations to reactivate floodplain where appropriate.	YN	Columbia Cascade	Methow	Habitat	$30,000
New	Category 2.a.	New	Install stream structures to increase thalwag depth on lower Peshastin Creek.	YN	Columbia Cascade	Wenatchee	Habitat	$30,000
New	Category 2.a.	New	BOR Reach Complex riparian reconnection / floodplain function - side channel improvements for the Methow River with an emphasis on reaches between Carlton to Weeman Bridge.	YN	Columbia Cascade	Methow	Habitat	$60,000
New	Category 2.a.	New	BOR Reach complexity and side channel development, Early Winters fan to Gate Creek	YN	Columbia Cascade	Methow	Habitat	$200,000
New	Category 2.a.	New	Culvert Replacement (11-13 structures) at private landowner access in Chumstick watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$83,000
New	Category 2.a.	New	BOR Reach Complex - Restore Primarily side channel and increase habitat complexity in the Chewuch River.	YN	Columbia Cascade	Methow	Habitat	$130,000
New	Category 2.a.	New	Add nutrients using hatchery carcasses and/or carcass analogs - 9-watersheds identified	YN	Columbia Cascade	Wenatchee	Habitat	$68,000
New	Category 2.a.	New	Assess and inventory mill ponds in Middle Methow River reaches (and others) in relationship to providing additional main stem spawning and rearing habitat (acclimation, off-channel habitat, etc)	YN	Columbia Cascade	Methow	Habitat	$7,500
New	Category 2.a.	New	BOR Reach Complex - Modify levees, riparian restoration, LWD recruitment and side channel reconnection with an emphasis in the upper Twisp River Watershed.	YN	Columbia Cascade	Methow	Habitat	$80,000
New	Category 2.a.	New	Assess potential temperature refugia, (using FLIR and temperature profiles) to identify important summer/winter juvenile rearing areas for future protection and restoration actions.	YN	Columbia Cascade	Methow	Habitat	$17,500
New	Category 2.a.	New	Protect cottonwood forests, and replant unused riparian agricultural areas where feasible in lower Methow River reaches.	YN	Columbia Cascade	Methow	Habitat	$50,000
New	Category 2.a.	New	Protection Riparian and Floodplain in Middle Methow River with general emphasis from Carlton to Weeman Bridge.	YN	Columbia Cascade	Methow	Habitat	$200,000
New	Category 2.a.	New	Implement Ecosystem Diagnosis and Treatment (EDT) Alternative 5 related to side-channel options.	YN	Columbia Cascade	Entiat	Habitat	$60,000
New	Category 2.a.	New	Culvert replacement Clear Creek (2)	YN	Columbia Cascade	Wenatchee	Habitat	$6,000
New	Category 2.a.	New	Improve Irrigation delivery and use efficiency at Dryden Ditch, Pioneer and Jones/Shotwell (Efficiency)	YN	Columbia Cascade	Wenatchee	Habitat	$50,000

Non-AP Expense Categories

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Existing/ Expanded/ New	Category	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Average 08-17 LRT Budget
New	Category 2.a.	New	Work with willing landowners to protect larger, undisturbed riparian areas by first pursuing conservation easement, lease, and options other than outright property acquisition	YN	Columbia Cascade	Entiat	Habitat	$110,000
New	Category 2.a.	New	Culvert replacement Alder Creek and Misc. for Chiwawa Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$45,000
New	Category 2.a.	New	Programmatic Riparian Floodplain Habitat Protection Program for Wenatchee Subbasin.	YN	Columbia Cascade	Wenatchee	Habitat	$1,200,000
New	Category 2.a.	New	Reconnect main stem Wenatchee River side channel at Sleepy Hollow in Lower Wenatchee Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$50,000
New	Category 2.a.	New	Develop lower Nason Creek Restoration Plan	YN	Columbia Cascade	Wenatchee	Habitat	$41,000
New	Category 2.a.	New	Restoration (on National Forests and Private lands) of riparian and channel conditions to relieve sediment inputs in Chiwawa River Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$6,000
New	Category 2.a.	New	Riparian Floodplain Habitat Protection Program with an emphasis in lower reaches of Methow River.	YN	Columbia Cascade	Methow	Habitat	$1,200,000
New	Category 2.a.	New	UPA Project - Programmatic Methow Basin Riparian Enhancement and re-establishment with an emphasis in key tributary streams.	YN	Columbia Cascade	Methow	Habitat	$110,864
New	Category 2.a.	New	UPA Project - Programmatic Implementation of Habitat Complexity Projects in the Methow River Subbasin in areas not already identified.	YN	Columbia Cascade	Methow	Habitat	$499,500
New	Category 2.a.	New	Assess, design and build large wood structures for habitat diversity in Upper Wenatchee Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$218,000
New	Category 2.a.	New	Reconnect main stem Wenatchee River side channel Cashmere in Lower Wenatchee Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$50,000
New	Category 2.a.	New	North Road culvert passage: provide year-around passage through North Road culvert on Chumstick Creek.	YN	Columbia Cascade	Wenatchee	Habitat	$50,000
New	Category 2.a.	New	Design and implement Engineered Log Jams in the Upper Methow, Early Winters Creek and Lost River; identify areas, to increase and diversify key spawning and rearing habitat.	YN	Columbia Cascade	Methow	Habitat	$60,000
New	Category 2.a.	New	Assess, design and implement Instream structures in various smaller tributary streams	YN	Columbia Cascade	Methow	Habitat	$14,000
New	Category 2.a.	New	Entiat River - UPA - Lower Entiat River Off-Channel Restoration Project	YN	Columbia Cascade	Entiat	Habitat	$15,997
New	Category 2.a.	New	Evaluate NF (National Forest) riparian roads and develop restoration plan in upper Peshastin Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$15,000
New	Category 2.a.	New	Culvert replacement Clear Creek (1)	YN	Columbia Cascade	Wenatchee	Habitat	$3,000
New	Category 2.a.	New	Identify, Protect and Restore areas providing thermal refugia in the lower Methow reaches.	YN	Columbia Cascade	Methow	Habitat	$25,000
New	Category 2.a.	New	Programmatic Stream Bank Restoration in the Icicle Creek Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$65,000
New	Category 2.a.	New	Replace culverts at Beaver Creek in Upper Wenatchee Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$20,000
New	Category 2.a.	New	Riparian Floodplain Habitat Protection Program with an emphasis in upper reaches/tributaries of Methow River.	YN	Columbia Cascade	Methow	Habitat	$130,000
New	Category 2.a.	New	UPA Entiat Subbasin Riparian Enhancement Program	YN	Columbia Cascade	Entiat	Habitat	$73,557
New	Category 2.a.	New	Increase irrigation delivery and on-site efficiencies in Peshastin Creek watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$54,500
New	Category 2.a.	New	Restoration 30%+ of lineal stream area - Upper Methow tributaries with emphasis on Wolf Creek and Hancock Springs.	YN	Columbia Cascade	Methow	Habitat	$12,000
New	Category 2.a.	New	Increase pool quality and quantity in Nason Creek Watershed by installing in-channel structures.	YN	Columbia Cascade	Wenatchee	Habitat	$250,000
New	Category 2.a.	New	Programmatic Side/Off channel reconnections and restoration in the Nason Creek Watershed.	YN	Columbia Cascade	Wenatchee	Habitat	$110,000
								$8,167,217

Category 2b

Existing	Category 2.b.	200139100	Conservation Enforcement	CRITFC	mainstem	Multiple	Harvest	$450,000

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Existing/ Expanded/ New	Category	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Average 08-17 LRT Budget
Expanded	Category 2.b.	200003100	North Fork John Day Basin Anadromous Fish Habitat Enhancement Project	CTUIR	Columbia Plateau	John Day	Habitat	$261,450
Expanded	Category 2.b.	199604601	Walla Walla River Basin Fish Habitat Enhancement	CTUIR	Columbia Plate	Walla Walla	Habitat	$554,596
Expanded	Category 2.b.	200003399	Walla Walla River Fish Passage Operations	CTUIR	Columbia Plate	Walla Walla	Habitat	$35,784
Existing	Category 2.b.	200739000	Conservation Enforcement	CTUIR	Columbia Plateau	UM, WW, GR, JD	Harvest	$150,000
Expanded	Category 2.b.	200104101	Forrest conservation area	CTWSRO	Columbia Plate	Upper Mainstem John	Habitat	$69,581
Expanded	Category 2.b.	199802101	Hood River habitat program	CTWSRO	Columbia Gorg	Hood river/ fifteen mile	Habitat	$188,892
Expanded	Category 2.b.	199801800	John Day Watershed Restoration program	CTWSRO	Columbia Plate	Upper Mainstem John	Habitat	$163,525
Expanded	Category 2.b.	200001500	Oxbow Conservation area	CTWSRO	Columbia Plate	MF John Day	Habitat	$79,675
New	Category 2.b.	New	Deschutes River restoration program	CTWSRO	Columbia Plate	Lower Deschutes	Habitat	$281,850
								$2,235,353
Category 2c								
New	Category 2.c.	new	GSI to Evaluate Catch	CRITFC	Mainstem	Multiple	Harvest	$400,000
New	Category 2.c.	new	Expanded Tribal Catch Sampling	CRITFC	Mainstem	Multiple	Harvest	$75,000
New	Category 2.c.	new	Sockeye Studies	CRITFC	Multi-province	Multiple	RM&E	$225,000
New	Category 2.c.	new	Sturgeon Genetics	CRITFC	Mainstem	Multiple	Sturgeon	$40,000
Expanded	Category 2.c.	200708300	Grande Ronde Cooperative Salmonid Monitoring and Evaluation Project	CTUIR	Blue Mountain	Grande Ronde	RM&E	$44,995
Expanded	Category 2.c.	199000501	Umatilla Basin Natural Production Monitoring and Evaluation Project	CTUIR	Columbia Plate	Umatilla	RM&E	$354,179
Existing	Category 2.c.	200003800	NEOH Walla Walla Hatchery - Three Step Master Planning Process (M&E beginning in 2011)	CTUIR	Columbia Platea	Walla Walla	RM&E	$352,778
Expanded	Category 2.c.	198805303	Hood river Production M&E	CTWSRO	Columbia Gorg	Hood river/ fifteen mile	RM&E	$48,800
Expanded	Category 2.c.	199802200	Pine Creek wildlife conservation area	CTWSRO	Columbia Plate	lower John Day	wildlife	$152,162
New	Category 2.c.	New	siteability index for wildlife habitat on the reservation	CTWSRO	Columbia Plate	Lower Deschutes	wildlife	$9,000
Expanded	Category 2.c.	199705600	Klickitat Watershed Enhancement	YN	Columbia Gorg	Klickitat	Habitat	$162,257
Expanded	Category 2.c.	198812025	YKFP Management, Data, Habitat	YN	Multiple	Yakima	Habitat	$116,500
Expanded	Category 2.c.	200715600	Rock Creek Fish and Habitat Assessment for the Prioritization of Restoration and Protection.	YN	Columbia Gorg	Rock Cr	RM&E	$191,307
Expanded	Category 2.c.	199506325	Yakima Klickitat Fisheries Project - Monitoring And Evaluation	YN	Multiple	Yakima	RM&E	$474,005
Expanded	Category 2.c.	199506335	YKFP - Klickitat Subbasin Monitoring and Evaluation	YN	Columbia Gorg	Klickitat	RM&E	$816,136
								$3,462,119
Category 2c Ongoing								
Existing	Category 2.c. - Ongoing	199803100	Implement Wy-Kan-Ush-Mi Wa-Kish-Witt	CRITFC	systemwide	Multiple	data management /coordination	$225,000
Existing	Category 2.c. -	198810804	Streamnet Library	CRITFC	systemwide	Multiple	data management	$420,060
Existing	Category 2.c. -	200303600	Regional RM&E Coordination	CRITFC	systemwide	Multiple	RM&E	$117,925
Existing	Category 2.c. -	Unknown - 2	PSMFC-SMOLT MONITORING	CRITFC	mainstem	Multiple	RM&E	$75,000
Existing	Category 2.c. -	200203700	Freshwater Mussel Research and Restoration Project	CTUIR	Columbia Plateau	Umatilla	RM&E	$233,000
Existing	Category 2.c. -	200708300	Grande Ronde Cooperative Salmonid Monitoring and Evaluation Project	CTUIR	Blue Mountain	Grande Ronde	RM&E	$147,624
Existing	Category 2.c. - Ongoing	200725200	Multi-scale assessment of hyporheic flow, temperature and fish distribution in Columbia River Tributaries	CTUIR	Multiple	All	RM&E	$77,000

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Existing/ Expanded/ New	Category	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Average 08-17 LRT Budget
Existing	Category 2.c. - Ongoing	200715700	Bull trout status in the lower Deschutes Subasin	CTWSRO	Columbia Plate	Lower Deschutes	RM&E	$115,000
Existing	Category 2.c. - Ongoing	199705600	Klickitat Watershed Enhancement	YN	Columbia Gorg	Klickitat	Habitat	$397,414
Existing	Category 2.c. - Ongoing	200715600	Rock Creek Fish and Habitat Assessment for the Prioritization of Restoration and Protection.	YN	Columbia Casc	Lower Middle Mainsten	RM&E	$100,000
								$1,908,023
Category 3								
New	Category 3.	new	Tribal Monitoring Data	CRITFC	Systemwide	Multiple	data management /coordination	$340,400
New	Category 3.	new	Power Analysis to Determine Catch Sampling Rates	CRITFC	Mainstem	Multiple	Harvest	$50,000
New	Category 3.	199803100	Sea Lion Hazing	CRITFC	Mainstem	Multiple	Hydro	$200,000
New	Category 3.	new	SNP Discovery	CRITFC	Systemwide	Multiple	RM&E	$60,000
New	Category 3.	new	Bonneville GSI	CRITFC	Mainstem	Multiple	RM&E	$250,000
New	Category 3.	new	Habitat Validation Monitoring (formerly Water Quality Monitoring)	CRITFC	Mainstem	Multiple	RM&E	$175,000
New	Category 3.	new	Improved escapement estimation	CRITFC	Multi-province	Multiple	RM&E	$70,000
New	Category 3.	new	Management Scenerios for Climate Change	CRITFC	Systemwide	Multiple	RM&E	$150,000
New	Category 3.	new	Modeling Survival of Spring Chinook	CRITFC	Systemwide	Multiple	RM&E	$250,000
New	Category 3.	new	Climate Change Database (formerly Global Warming Database)	CRITFC	Systemwide	Multiple	RM&E	$114,000
New	Category 3.	new	Develop comparable baselines of habitat conditions across subbasins (formerly monitoring trends in habitat conditions)	CRITFC	Systemwide	Multiple	RM&E	$325,000
New	Category 3.	new	Upstream Migration Timing	CRITFC	Mainstem	Multiple	RM&E	$275,000
New	Category 3.	new	Expression of Traits Related to Recovery	CRITFC	Systemwide	Multiple	RM&E	$100,000
New	Category 3.	new	Genetic Baseline Expansion	CRITFC	Systemwide	Multiple	RM&E	$150,000
New	Category 3.	new	Landscape Genetics (Ch & STHD)	CRITFC	Multi-province	Multiple	RM&E	$40,000
New	Category 3.	new	Basin-wide evaluation of supplementation benefits and risks	CRITFC	Systemwide	Multiple	RM&E	$200,000
New	Category 3.	new	Supplementation monitoring	CRITFC	Systemwide	Multiple	RM&E	$475,000
New	Category 3.	new	Columbia river operations admistration and program implementation	CTWSRO	Columbia Plate	Lower Deschutes	data managem	$182,880
New	Category 3.	New	Warm springs watershed spring chinook production monitoring	CTWSRO	columbia platea	lower deschutes	RM&E	$168,300
New	Category 3.	New	Warm springs reservation steelhead production monitoring	CTWSRO	columbia platea	lower deschutes	RM&E	$115,079

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Existing/ Expanded/ New	Category	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Average 08-17 LRT Budget
New	Category 3.	New	Develop and adopt biologically based escapement goals for Deschutes R. fall Chinook salmon	CTWSRO	Columbia Plate	Lower Deschutes	RM&E	$170,850
New	Category 3.	New	Deschutes River Sockeye development	CTWSRO	columbia platea	upper deschutes	RM&E	$150,710
New	Category 3.	New	Status and Trend	YN	Columbia Cascade	Up Col	data management /coordination	$95,000
New	Category 3.	New	Project Development / Mgt	YN	Columbia Cascade	Up Col	RM&E	$125,000
New	Category 3.	New	RME Existing (Regional RM&E Coordination - Monitoring)	YN	Columbia Cascade	Up Col	RM&E	$140,000
								$4,372,218
Supplemental								
Expanded		198710001 , 199604601 ,	CTUIR Ceded Area Tributary Culvert/Passage Assessment, Prioritization and Implementation	CTUIR	Columbia Plateau, Blue Mountain	Walla Walla, Umatilla, Grande Ronde, John Day, Tucannon	Habitat	$250,000
New			Protect and Restore Tucannon Watershed	CTUIR	Blue Mountain	Umatilla	Habitat	$200,000
New			Inventory and assess fish habitat, passage and screening needs and develop plan for steelhead reintroduction in Willow Creek, Butter Creek and McKay Creek.	CTUIR	Columbia Plateau	Umatilla	Habitat	$20,000
New			Inventory and assess habitat status and needs for anadromous reintroductions in Eastern Oregon tributaries above Hells Canyon Dam	CTUIR	Middle Snake	Powder, Burnt, Malheur	Habitat, RM&E	$20,000
								$490,000

Lamprey

ATTACHMENT B

Existing/ Expanded/ New	Proposal #	Budget Title	Org.	Province	Sub-Basin	Project Type	Average 08-17 LRT Budget
New		Lamprey Mainstem passage design assistance	CRITFC	Mainstem	Multiple	Lamprey	$575,000
Existing	199402600	Pacific Lamprey Research and Restoration Project - including translocaton	CTUIR	Columbia Plateau	Umatilla	Lamprey	$400,000
Expanded	199402600	Lamprey outmigration	CTUIR	Multiple		Lamprey	$100,000
New	New	Willamette Falls lamprey escapement and population status study	CTWSRO	Lower Columbia	Willamette	Lamprey	$150,000
Existing	200201600	Evaluate the status of Pacific Lamprey in the Deschutes Basin	CTWSRO	Columbia Plateau	Lower Deschutes	Lamprey	$132,000
Expanded	200201600	Evaluate the status of Pacific Lamprey in the Deschutes Basin	CTWSRO	Columbia Plateau	Lower Deschutes	Lamprey	$25,000
New	200700700	Determine status and limiting factors of Pacific Lamprey in 15mile and Hood basins	CTWSRO	Columbia Gorge	Hood River/ Fifteen Mile	Lamprey	$234,000
New		Amocoete densities	YN	Multiple		Lamprey	$50,000
New		Lamprey presence /absence and other baseline in Upper Columbia and Yakima	YN	Multiple		Lamprey	$150,000
New		Translocation and other data	YN	Multiple		Lamprey	$50,000
							$1,866,000

Non-Hatchery Capital

Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Total LRT Budget (08-17)	Average 08-17 LRT Budget
Expanded	199801800	John Day Watershed Restoration program	CTWSRO	Columbia Plateau	MF John Day	Habitat	$2,939,452	$293,945
Existing	199802100	Hood River habitat program	CTWSRO	Columbia Gorge	Hood River/ Fifteen Mile	Habitat	$5,606,260	$560,626
Existing	199801800	John Day Watershed Restoration program	CTWSRO	Columbia Plateau	MF John Day	Habitat	$13,776,000	$1,377,600
New	New	Instream flow restoration projects, including water rights purchase from willing sellers and development and replacement of water sources for agricultural uses in Umatilla and Walla Walla tributaries.***	CTUIR	Columbia Plateau	Umatilla	Habitat	$10,000,000	$1,000,000
Existing	199601100	Walla Walla Juvenile and Adult Passage Improvements (capital)	CTUIR	Columbia Plateau	Walla Walla	Habitat	$7,290,000	$729,000
Expanded	200002600	South Fork Touchet Watershed Protection and Restoration (capital acquisition)	CTUIR	Columbia Plateau	Walla Walla	Habitat	$2,500,000	$250,000
New	New	CTUIR Ceded Area Priority Stream Corridor Covservation and Protection (capital acquisition)	CTUIR	Blue Mt., Col. Plateau	Grande Ronde, Umatilla, WW or JD	Habitat	$10,000,000	$1,000,000
							$52,111,712	**$5,211,171**

*** Commitment is dedication of $1 million per year from the Columbia Basin Water Transaction Project budget.

Hatchery Planning, O&M

Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Category	Average 08-17 LRT Proposal
Existing and Expanded					
Existing	200001700 (200306200)	Recondition Wild Steelhead Kelt (and Evaluate their reproductive success)	CRITFC	Artificial Production	$936,425
Existing	200001700	Snake River Kelts - Expense	CRITFC	Artificial Production	$600,000
Existing	199800703	Grande Ronde Supplementation Operations and Maintenance	CTUIR	Artificial Production	$536,830
Existing	200003800	NEOH Walla Walla Hatchery - Three Step Master Planning Process (expense)	CTUIR	Artificial Production	$50,500
Existing	200003800	NEOH Walla Walla Hatchery - Three Step Master Planning Process (O&M beginning in 2011)	CTUIR	Artificial Production	$534,100
Existing	198343500	Umatilla Hatchery Satellite Facilities O&M	CTUIR	Artificial Production	$948,466
Existing	198805307	Hood river Production O&M	CTWSRO	Artificial Production	$396,514
Existing	198811535	Klickitat Fishery YKFP Design	YN	Artificial Production	$70,000
Existing	199604000	Mid-Columbia Coho Restoration	YN	Artificial Production	$1,908,878
Existing	199701325	Yakima/Klickitat Fisheries Project Operations and Maintenance	YN	Artificial Production	$2,666,666
Expanded	198805307	Hood river Production O&M	CTWSRO	Artificial Production	$524,022
Expanded	199701335	Klickitat Fishery YFKP O & M	YN	Artificial Production	$568,852
Expanded	199604000	Mid-Columbia Coho Restoration (expense)	YN	Artificial Production	$49,228
Expanded	199701325	Yakima/Klickitat Fisheries Project Operations and Maintenance	YN	Artificial Production	$261,489
					$10,051,971
New					
New	new	John Day Reprogramming and Construction - Expense	CRITFC	Artificial Production	$200,000

Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Category	Average 08-17 LRT Proposal
New	200715500	Sturgeon Master Planning - Expense	CRITFC	Artificial Production	$150,000
New	New	Snake River Safety Net Program - UGR and CC	CTUIR	Artificial Production	$500,000
New	New	Walla Walla Steelhead Supplementation Hatchery O&M	CTUIR	Artificial Production	$69,500
New	New	White River Supplementation program - operate	CTWSRO	Artificial Production	$82,500
New	New	Methow spring Chinook - Methow, Twisp, Chewuch acclimation - operate facilities	YN	Artificial Production	$60,000
New	New	Methow steelhead - Methow, Twisp, Chewuch acclimation - operate facilities	YN	Artificial Production	$60,000
New	New	Methow steelhead - reprogram Winthrop for release of 100k smolts in upper watershed	YN	Artificial Production	$30,000
New	New	Program coordination & administration	YN	Artificial Production	$1,200,000
New	New	Sturgeon Mgt	YN	Artificial Production	$125,000
New	New	Upper Columbia spring Chinook - nutrient supplementation	YN	Artificial Production	$60,000
New	New	Upper Columbia steelhead - nutrient supplementation	YN	Artificial Production	$60,000
New	New	Upper Columbia Steelhead Kelt Reconditioning	YN	Artificial Production	$510,000
New	New	Wenatchee spring Chinook - Chiwawa River & Nason Ck acclimation - operate acclimation facilities	YN	Artificial Production	$60,000
New	New	Wenatchee spring Chinook - Little Wenatchee 150K smolts - operate	YN	Artificial Production	$90,000
New	New	Wenatchee spring Chinook - Peshastin 100K smolts - operate acclimation facility	YN	Artificial Production	$70,000
New	New	Wenatchee steelhead - Wenatchee, Peshastin, Chumstick, Mission acclimation - operate facilities	YN	Artificial Production	$80,000
New	New	Yakima coho production facility O&M	YN	Artificial Production	$175,000
New	New	Yakima coho production marking	YN	Artificial Production	$156,800
New	New	Yakima fall Chinook - JDM move 1.7M URBs from PR to Prosser - operate	YN	Artificial Production	$45,000

Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Category	Average 08-17 LRT Proposal
New	New	Yakima steelhead - acclimation facilities - operate	YN	Artificial Production	$45,000
New	New	Yakima/Naches coho - mobile acclimation units - operate	YN	Artificial Production	$40,000
New	New	Yakima/Naches coho - nutrient supplementation	YN	Artificial Production	$7,000
					$3,875,800
					$ 13,927,771

Hatchery Capital

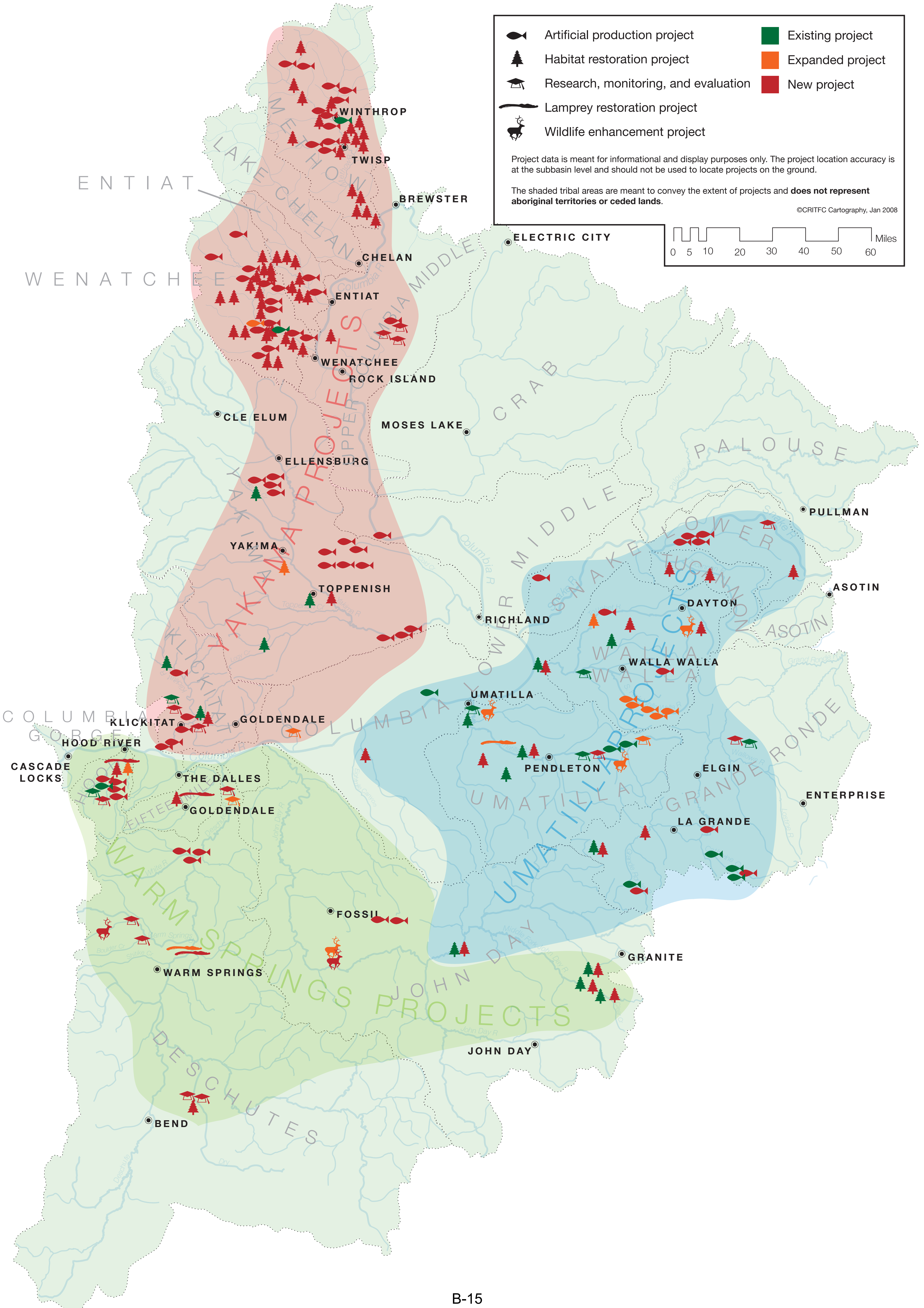
Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Total LRT Budget (08-17)	Average 08-17 LRT Budget
Existing	200001700	Snake River Kelts - Capital	CRITFC	Systemwide	Multiple	Artificial Production	$2,000,000	$200,000
New	new	John Day Reprogramming and Construction - Capital	CRITFC	Columbia Plateau	John Day	Artificial Production	$4,000,000	$400,000
New	200715500	Sturgeon Master Planning - Capital	CRITFC	Mainstem	Multiple	Artificial Production	$6,000,000	$600,000
New	New	Snake River fall Chinook - modify ponds @ Lyons Ferry to improve adult holding	CTUIR	Blue Mountain	Mainstem Snake	Artificial Production	$500,000	$50,000
Existing	200003800	NEOH Walla Walla Hatchery - Three Step Master Planning Process (capital)	CTUIR	Columbia Plateau	Walla Walla	Artificial Production	$11,862,000	$1,186,200
New	New	White River Supplementation program - construct	CTWSRO	Columbia Plateau	Lower Deschutes	Artificial Production	$1,000,000	$100,000
New	new	Master plan expansion and tributary weir development for hood river facitlity	CTWSRO	Columbia Gorge	Hood River	Artificial Production	$5,600,000	$560,000
New	New	Methow spring Chinook - Methow, Twisp, Chewuch acclimation - build facilities	YN	Cascade Columbia	Methow	Artificial Production	$150,000	$15,000
New	New	Methow steelhead - Methow, Twisp, Chewuch acclimation - build facilities	YN	Cascade Columbia	Methow	Artificial Production	$150,000	$15,000
New	New	Wenatchee spring Chinook - Chiwawa River & Nason Ck acclimation - build acclimation facilities	YN	Cascade Columbia	Wenatchee	Artificial Production	$150,000	$15,000
New	New	Wenatchee spring Chinook - Little Wenatchee 150K smolts - construct	YN	Cascade Columbia	Wenatchee	Artificial Production	$100,000	$10,000
New	New	Wenatchee spring Chinook - Peshastin 100K smolts - build acclimation facility	YN	Cascade Columbia	Wenatchee	Artificial Production	$100,000	$10,000
New	New	Wenatchee steelhead - Wenatchee, Peshastin, Chumstick, Mission acclimation - build facilities	YN	Cascade Columbia	Wenatchee	Artificial Production	$200,000	$20,000
New	New	Yakima coho production facility construction	YN	Columbia Plateau	Yakima	Artificial Production	$7,700,000	$770,000
New	New	Yakima fall Chinook - JDM move 1.7M URBs from PR to Prosser - construction	YN	Columbia Plateau	Yakima	Artificial Production	$1,000,000	$100,000
New	New	Yakima steelhead - acclimation facilities - construct	YN	Columbia Plateau	Yakima	Artificial Production	$1,000,000	$100,000
New	New	Yakima/Naches coho - mobile acclimation units - construct	YN	Columbia Plateau	Yakima	Artificial Production	$56,000	$5,600
Expanded	198811525	YKFP - Design & Construction	YN	Columbia Plateau	Yakima	Artificial Production and M&E	$1,800,000	$180,000

Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Province	Sub-Basin	Project Type	Total LRT Budget (08-17)	Average 08-17 LRT Budget
Expanded	198811535	Klickitat Fishery YKFP Design	YN	Columbia Gorge	Klickitat	Artificial Production	$26,775,000	$2,677,500
Expanded	198811525	Monitoring and Evaluation Replacement Facility	YN	Columbia Plate	Yakima	RM&E	$723,006	$72,301
Expanded	199604000	Mid-Columbia Coho Restoration (Capital)	YN	Cascade Columbia	Wenatchee / Methow	Artificial Production	$9,246,000	$924,600
							$80,112,006	**$8,011,201**

ATTACHMENT B

Existing, Expanded, and New Projects made possible by the MOA

FY2008 - FY2017



ATTACHMENT C
GROUP B STEELHEAD
Term Sheet on Group B Steelhead Actions

The Parties agree that the following actions can provide substantial survival benefits to Group B Steelhead. Further details of these actions are included in the MOA or its attachments.

Kelt Reconditioning – Capturing steelhead kelts (mature fish migrating downstream subsequent to spawning) and rearing them to allow for repeat spawning has demonstrated success in the Yakima and other basins. The overall benefit to Snake River Group B steelhead has been estimated to yield an average 6% survival improvement.

Nutrient Enhancement – Treatment of selected Snake River basin streams with nutrients to improve fitness will be evaluated.

Transportation Strategy – Alternative Snake River steelhead transportation operations scenarios are estimated to provide relative survival benefits for steelhead and/or spring Chinook..

Abundance-based Harvest Schedule – The *US v Oregon* parties have agreed to an abundance based Group B Steelhead harvest schedule that reduces Group B harvest rate by 2% at lower run sizes. The Parties understand NOAA Fisheries will incorporate a 1% increase in survival for the 10 year BiOp term, and will further describe longer term survival benefits qualitatively.

Conservation Law Enforcement: Enhanced law enforcement efforts have been correlated to increased compliance rates in non-Indian and Indian fisheries, estimated by NOAA Fisheries to provide survival improvement for Group B Steelhead.

Fall Back Operations – Adult steelhead are known to migrate up and downstream in the mainstem Snake and Columbia rivers. The Action Agencies will conduct fallback studies as described in the FCRPS BiOp and will consider the results through adaptive management.

ATTACHMENT D
Spring Creek Hatchery
March 2008

Introduction
- In response to the SOR, the Federal Agencies have agreed to implement many elements of the request, with the exception of the requested spill.
- We are also operating the Bonneville corner collector as the primary means of passage for the Spring Creek release.
- The Federal agencies are making a proposal today, having reviewed the record and the views of all parties on the SOR.
- We have developed this proposal in conjunction with representatives for the Warms Springs Tribe, the Yakama Indian Nation, the Nez Perce Tribe, and the Umatilla Tribe, and this proposal also has their endorsement and support. We would like to hear from the other sovereign executives in this meeting.

Background
- We remain convinced, based on the available data, that there may be no biological benefit from the additional spill for returning Spring Creek adults. However, we recognize that there is biological uncertainty in the available data, and have heard the differing views of the parties on this. In addition, we have heard from the tribes regarding the importance of these fish for tribal fisheries.
- We believe that our priority is to reprogram the Spring Creek hatchery production so that this release and spill are unnecessary. Under this proposal, the sovereigns and the action agencies will work together to do just that.
- Because the goal is reprogramming that would make this early spill unnecessary, there is not a need for further testing of this additional spill request. Nevertheless, some information may be collected because the fish have been marked.
- One biological consideration we consider relevant is the issue of crowding at the bypass, because of the concentrated fish release. This is not a large concern, but in the interest of compromise and optimizing conditions for fish we are willing to spill for this purpose for one year only, as part of a broader multi-year agreement.

Proposal
- Based on advice from NOAA Fisheries and our biologists, we believe that a spill of 35 kcfs would be appropriate to alleviate the crowding issue. For 2008, we would propose to implement this level of spill from midnight Thursday, 3/6/08, to 6 am Monday, 3/10/08, while maintaining the current chum protection level.
- Next year (2009) and beyond, we would not spill, but would work with the sovereign parties to stagger fish releases to minimize crowding.
- We would expect a mutual commitment from the sovereign parties to join us in supporting and implementing Spring Creek reprogramming as early as 2010, but no later than 2012.
- We will seek to memorialize these understandings in the MOAs we are negotiating with the sovereign parties.

ATTACHMENT E
Actions To Improve Forecasting Methods
And Tools To Optimize Reservoir Use For Fish Operations

- The Action Agencies and Tribes (as defined in the accompanying Treaty Tribes-Action Agency MOA) will convene a Columbia River Forecast and Data Committee described below.[7] The Action Agencies agree to consider the committee outcomes and recommendations in their implementation processes.

The primary function of the group will be to promote and support the advancement of forecasting skill, products and techniques in the Columbia Basin. It will provide an open forum for sharing, discussing, evaluating and potentially implementing new forecasting techniques into the operation and planning of the Columbia Basin system. The term forecasting will refer to both water supply forecasting and streamflow forecasting.

The group will be composed of technical representatives from the Action Agencies and the Tribes, but will be open for participation from any representative of a governmental organization willing to contribute to the effectiveness and success of the group. The group will be chaired by a representative from the core group and will rotate annually. General business meetings of the group will occur no less than quarterly but more frequently if workload and projects require it. In addition to business meetings, there will be an annual meeting in the early fall to review the performance of various operational and experimental forecast procedures over the previous water year, to report on any new approved procedures being implemented next year, and to plan committee work for the coming year.

Responsibilities of the group will include tracking and reviewing the performance of current forecasting procedures and techniques and sharing, discussing, and investigating the potential of new forecasting techniques and modeling. When promising research or techniques are discovered or introduced for consideration, the group will develop a strategy for either investigating the potential improvements with available technical staff or providing recommendations or proposals to the Action Agencies for possible funding and support. The group as a whole will oversee the progress and results of any work initiated and supported by the group. The group will also set up criteria for determining the level of "improvement" to the forecasting required to warrant implementation. The group will participate in the evaluation of new forecast procedures, models, and techniques and provide recommendations on the incorporation of the new procedures into the planning and operation of the Columbia River system.

Also within the scope of the group will be facilitating the sharing of data, where possible, and the monitoring of the data network and systems which enhance and support the forecasting capabilities of the region. When necessary, the group will provide recommendations on improvements and enhancements to the network.

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[7] Possible names: Columbia River Forecast and Data Committee (CRFDC), Columbia River Advancement in Forecasting Team (CRAFT)

The group will also have an educational role, providing forums for the exchange of technical information and research. This will take the shape of open workshops with presenters speaking on current research and forecast projects. The group will also have a role in educating users on forecasting products and on specific forecast areas, providing the technical expertise and platform for conducting seminars on topics such as ESP forecasting, climate change impacts to forecasting, etc.

Potential Initial Items for CRWMG to address:

Forecasting:

1. Evaluation of the NRCS daily statistical water supply forecast procedure
2. Evaluate the benefits/problems with increased frequency of water supply updates
3. Review the indices evaluated and selected when the Libby forecast procedure was last updated. Assess the need and/or merits of updating the procedure with other indices, such as the Trans-Niño index.
4. Consider coordinating several agencies' forecasts into one forecast.
5. Consider climate change impacts on future forecasting needs and priorities.

Data:

1. Evaluate the benefits to additional SNOTEL sites, particularly in the Canadian portion of Columbia drainage.

ATTACHMENT F

Treaty and Tribal Action Agency Consultation Regarding Columbia River Treaty

Consistent with BPA and Corps Tribal Policies, BPA and the Corps will coordinate with the Tribes ("Tribes" as defined in the accompanying Treaty Tribes-Action Agency MOA) concerning annual operations under the Columbia River Treaty of 1964 ("Treaty"), potential future non-Treaty storage use, and BPA and Corps actions related to possible future U.S.-Canada discussions of post-2024 matters under the Treaty, as follows.

Annual Treaty/Non-Treaty Operations and Treaty Operating Plans

Consistent with the Proposed Action identified in the August 2007 FCRPS Biological Assessment, each operating year, BPA and the Corps will coordinate with the Tribes to discuss Treaty and non-Treaty operations and Treaty operating plans. This coordination will include meeting in the fall to discuss Treaty and non-Treaty operations that occurred during the preceding fish passage season, and to seek tribal input, ideas, and information on planned operations for the next fish passage season. BPA and the Corps also will inform the Tribes of the final operating plan and/or planned operations once finalized. Typical agenda items for the fall meeting would include a review of Treaty and non-Treaty operations for preceding year (including supplemental operating agreements), a review of the current year Detailed Operating Plan and possible supplemental operating agreements, an update on the most-recently prepared Assured Operating Plan and upcoming Detailed Operating Plan. One additional meeting will be held during the fish passage season to provide an update on Treaty and non-Treaty operations.

Potential Non-Treaty Storage

Consistent with the Proposed Action identified in the August 2007 FCRPS Biological Assessment, BPA will seek to negotiate a new long-term agreement with BC Hydro regarding non-Treaty storage use once BPA and BC Hydro have made substantial progress in refilling non-Treaty storage space, and the collective U.S. interests in terms of such a new agreement are established. BPA also will seek to negotiate an annual agreement if a new long-term agreement is not in place or does not address flows for fisheries purposes. If BC Hydro is interested in negotiating a new annual or long-term non-Treaty storage agreement, BPA will coordinate with the Tribes prior to any negotiation to obtain ideas and information on possible points of negotiation. If negotiations occur, BPA will report on major developments during negotiations and will report to the Tribes on any new agreement resulting from negotiations.

Post-2024 Treaty Matters

BPA and the Corps will take the following specific measures to coordinate with the Tribes concerning their actions related to possible U.S.-Canada discussions of post-2024 Treaty matters:

1. Consult with the Tribes during planning activities for post-2024 Treaty matters by holding discussions with the Tribes at a government-to-government level to seek tribal input and identify general issues of concern to the Tribes. Although the schedule for these planning

activities is currently uncertain, it is possible that these activities may continue through 2013 or beyond.

2. Coordinate with tribal staff at a technical level during the expected planning activities for post-2024 Treaty matters to identify possible methods for addressing tribal issues of concern.

3. Provide the results of both the government-to-government and technical discussions with the Tribes to the U.S. Entity under the Treaty for consideration.

4. If formal Treaty negotiations occur, report on a periodic basis to affected Tribes on major developments relative to Corps and BPA actions related to tribal interests.

5. If formal Treaty negotiations occur, consult with the Tribes to assure that tribal rights and concerns are considered by BPA or the Corps regarding their actions.

6. If formal Treaty negotiations occur, strive to resolve issues and encourage the U.S. government to arrive at decisions that appropriately consider identified tribal concerns.

As organizational structures are set in place by BPA, the Corps, and possibly the U.S. and Canadian governments to discuss issues related to post-2024 Treaty matters, BPA and the Corps will coordinate with the Tribes and discuss mutually acceptable changes in the role of the Tribes in post-2024 matters related to BPA and Corps actions.

Corps and BPA consultation and coordination with the Tribes on post-2024 Treaty matters as set forth herein will be conducted to the extent appropriate and permitted under applicable policies, procedures, laws and regulations including United States principles of international treaty discussions and negotiations and to the extent permitted by the U.S. Department of State.

Population Productivity Benefits Summary

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Population	10-Year Improved Rate	25-Year Improved Rate
Middle Columbia River Steelhead		
All Yakima Steelhead (Mainstem Effects)	1.1	1.17
Deschutes River Eastside Tributaries Summer Steelhead	1.02	1.03
Deschutes River Westside Tributaries Summer Steelhead	1.31	1.62
Hood River Winter Steelhead	2.07	2.3
Klickitat River Steelhead	1.13	1.23
Lower John Day Summer Steelhead	1.6	1.91
Middle Columbia Tributaries Steelhead	2.25	2.38
Middle Fork John Day Summer Steelhead	2.04	2.37
Naches River Summer Steelhead	1.09	1.22
North Fork John Day Summer Steelhead	1.17	1.32
Rock Creek Steelhead	1.2	1.52
Satus Creek Summer Steelhead	1.07	1.14
South Fork John Day Summer Steelhead	1.47	1.52
Toppenish Creek Summer Steelhead	1.13	1.23
Umatilla River Summer Steelhead	1.37	1.74
Upper John Day Summer Steelhead	1.84	2.22
Upper Yakima River Summer Steelhead	1.1	1.22
Walla Walla River Summer Steelhead	1.43	1.9
Snake River Basin Steelhead		
Tucannon River Summer Steelhead	1.08	1.09
Upper Grande Ronde Summer Steelhead	1.28	1.59
Snake River Spring/Summer Chinook		
Tucannon River Spring Chinook	1.04	1.05
Upper Grande Ronde Spring Chinook	1.28	1.59
Upper Columbia River Spring Chinook		
Entiat River Spring Chinook	1.19	1.26
Methow River Spring Chinook	1.01	1.06
Wenatchee River Spring Chinook	1.07	1.11
Upper Columbia River Steelhead		
Entiat River Summer Steelhead	1.13	1.18
Methow River Summer Steelhead	1.02	1.08
Wenatchee River Summer Steelhead	1.06	1.12

Estimated Habitat Quality Improvement and Survival Benefits of MOA Projects on Populations of Listed Salmon and Steelhead

- *3 Treaty Tribe – Action Agency Agreement*
- *April 21, 2008*

The following attached reports and spreadsheets comprise the 3 Treaty Tribes' estimate of habitat quality improvements and survival benefits of the habitat projects included under the MOA:

- Summary Report: *Population Biological Benefits Summary*
- Populations Reports: *Estimated Biological Benefits from Habitat Actions by Watershed/Population*. Show estimated egg-to-smolt productivity improvements by watershed based on estimated watershed function improvements.
- Watershed Reports*: Estimated Benefits to Primary Limiting Factors (PLFs) from Habitat Actions by Population and Watershed.* Show changes in limiting factor function based on implementation of MOA projects in that watershed
- Project Spreadsheet: *LRT Project X Populations Benefited.* Associates projects with watersheds and populations benefited.

Benefits Analysis:

Benefits were estimated with a method used in an earlier NOAA/Nez Perce assessment of Clearwater habitat. The method conforms to the "Hillman method" which is in use by the action agencies. Tribal biologists considered the positive effects that full implementation of the Tribal MOA projects would have to improve limiting factors at the watershed scale. These estimates were collected and compiled into a database and used to generate the benefit reports. The process of calculating these estimates is as follows:

First, assessments of the improvements to limiting factors for a given watershed are provided from the best professional judgments of local (and in some cases, only Tribal) biologists. Assessments are based on habitat projects included in the MOA that benefit listed salmon and steelhead. The *LRT Project X Populations Benefited* spreadsheet identifies the watersheds and populations associated with each project. [1]

[1] NOTE: The project spreadsheet includes the columns "In BiOp/ Funded (07-09)" and "In PA." A "Y" for yes is indicated in the former if the project / proposal # is identified in the BA's Tributary Habitat Action Tables or the project was otherwise funded for FY07-09. A "Y*" notes a discrepancy in the funding amount. A "N*" notes some funding, but limited (e.g., bridge funding for 2007 only). A "Y" in the "In PA" column indicates that the project is contemplated in the BiOp either specifically or generally (e.g, for out year, habitat restoration efforts in X watershed). This information is included to aid in identification of possible duplicate benefit counting with the BiOp's tributary habitat analysis.

Each limiting factor is weighted proportionally to its overall impact on the population within the watershed. Each limiting factor is estimated at its current function and function in 10 years and 25 years if all MOA actions are implemented to improve habitat. These functions are quantified at a rate that is below a hypothetical non-limited function of 100%. These limiting factor functions are multiplied by their weight and summed for the watershed to produce the overall watershed function (also out of a hypothetical 100% function):

Watershed Function = Σ(Limiting Factor Function * (Limiting Factor Weight/100)).

The example below shows this for summer steelhead in Icicle Creek:

Icicle Creek – Estimated Limiting Factors Function Improvements

Watershed (WS)	Limiting Factor (LF)	LF_Weight	LF_Funct_Current	LF_Funct_10Year	LF_Funct_25Year	WS_Funct_Current	WS_Funct_10Year	WS_Funct_25Year
Icicle Creek	In-channel Characteristics	35	70	75	80			
	Passage / Entrainment	10	55	55	55			
	Riparian / Floodplain	20	70	75	85			
	Sediment	20	90	92	95			
	Water Quantity – Flow	15	55	55	55			
						70.2	**73.4**	**77.8**

Estimated limiting factor function improvements and combined watershed function improvements are shown in the reports entitled *Estimated Benefits to Primary Limiting Factors (PLFs) from Habitat Actions by Population and Watershed* (reported by ESU).

Next, the watershed functions are combined to calculate the overall biological egg-to-smolt productivity benefit for a population. All watersheds in a population are weighted according to their intrinsic potential for production, and the overall function for a population is calculated where:

Population Survival = Σ(Watershed Survival * (Watershed Weight/100))).

Because actual egg-to-smolt productivity rates are modeled through more complex means such as EDT or TRT analysis, we did not attempt to estimate these current rates here, but instead simply applied a rate of 1.0 to represent the current rate for each population, and showed 10-yr and 25-yr improvements as percentage increases to productivity above this current rate. In the example below, the Wenatchee River Summer Steelhead population is estimated to show an improved productivity from current conditions of 1.06 (6% improvement) at 10 years and 1.12 (12% improvement) at 25 years, which is derived from the weighted watershed-level benefits of all actions:

Wenatchee River Summer Steelhead – Estimated Egg-to-Smolt Surval Improvements

Watershed	WS_Surv_Current	WS_Surv_Year10	WS_Surv_Year25	WS_Weight	Pop_Surv_Current	Pop_Surv_Year10	Pop_Surv_Year25
Chiwawa River	91.8	93.4	95.1	18			
Chumstick Creek	67.5	68.5	71.5	5			
Icicle Creek	70.2	73.4	77.8	5			

Wenatchee River Summer Steelhead – Estimated Egg-to-Smolt Surval Improvements							
Watershed	**WS_Surv_Current**	**WS_Surv_Year10**	**WS_Surv_Year25**	**WS_Weight**	**Pop_Surv_Current**	**Pop_Surv_Year10**	**Pop_Surv_Year25**
Little Wenatchee	90.2	92.2	94.2	3			
Mission Creek	43.8	43.8	43.8	5			
Nason Creek	65	72.3	78.8	19			
North Side Tributaries	60	60	60	1			
Peshastin Creek	62.8	76.2	80	15			
Wenatchee River (Lower)	68	68	68	7			
Wenatchee River (Upper + Chiwaukum)	80.5	85.2	90	18			
White River	89.8	91.5	93.2	3			
Population Total:					**1.00**	**1.06**	**1.12**

Estimated egg-to-smolt productivity improvements by watershed based on estimated watershed function improvements and combined population productivity improvement are shown in the reports entitled *Estimated Biological Benefits from Habitat Actions by Watershed/Population* (reported by ESU). The estimated productivity improvements of all populations are then show in the report *Population Biological Benefits Summary.*

Estimated Productivity Benefit from Habitat Actions by Watershed/Population

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

All Yakima Steelhead (Mainstem Effects)

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Lower Yakima River	73.8	81.4	86.2	1.1	1.17

Total Estimated Improvement for	All Yakima Steelhead (Mainstem Effects)	Year 10 Impr.	Year 25 Impr.
		1.1	**1.17**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Deschutes River Eastside Tributaries Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Buck Hollow Creek	61.2	61.2	61.2	1	1
Deschutes River (Mainstem Effects)	76.5	85.8	90	1.12	1.18
Trout Creek	33.5	33.5	33.5	1	1

Total Estimated Improvement for **Deschutes River Eastside Tributaries Summer Steelhead**

Year 10 Impr.	Year 25 Impr.
1.02	**1.03**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Deschutes River Westside Tributaries Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Badger/Boulder/Eagle/Nena/Skookum	47.2	69.8	81.5	1.48	1.73
Beaver Creek	46.6	63	84.2	1.35	1.81
Oak Creek	30	92.5	96.2	3.08	3.21
Shitike Creek	45	77.4	83.6	1.72	1.86
Warm Springs River	84.5	90	94.5	1.07	1.12

Total Estimated Improvement for		Year 10 Impr.	Year 25 Impr.
	Deschutes River Westside Tributaries Summer Steelhead	**1.31**	**1.62**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Hood River Winter Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
East Fork Hood River	70	80.8	85.8	1.15	1.23
Middle Fork Hood River	70	80	90	1.14	1.29
Middle Fork Hood River (Clear Branch)	15	80	90	5.33	6
Middle Fork Hood River (Eliot Branch)	10	85	95	8.5	9.5

Total Estimated Improvement for **Hood River Winter Steelhead**

Year 10 Impr.	Year 25 Impr.
2.07	**2.3**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Klickitat River Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Klickitat Canyon	78.8	78.8	78.8	1	1
Lower Klickitat River	51	52.5	52.5	1.03	1.03
Lower Little Klickitat River	61.5	62	63.5	1.01	1.03
Middle Klickitat River	62.4	73.2	80.3	1.17	1.29
Swale Creek	39.2	47.6	53	1.21	1.35
Trout Creek	55.5	60.2	65.8	1.08	1.19
Upper Klickitat River	56.8	66.2	72.8	1.17	1.28
Upper Little Klickitat River	47.4	47.8	48.5	1.01	1.02
Upper Middle Klickitat River	75.8	76.4	77	1.01	1.02
West Fork Klickitat River	90	92	95	1.02	1.06
White Creek	45	52.2	59.2	1.16	1.32

Total Estimated Improvement for Klickitat River Steelhead	Year 10 Impr.	Year 25 Impr.
	1.13	**1.23**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Lower John Day Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Butte Creek	36.5	62.2	69	1.7	1.89
Pine Creek	68.5	76.2	86.8	1.11	1.27
Pine Hollow	47	64	84	1.36	1.79
Thirtymile Creek	40.5	64.5	77.8	1.59	1.92

Total Estimated Improvement for **Lower John Day Summer Steelhead**

Year 10 Impr.	Year 25 Impr.
1.6	**1.91**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Middle Columbia Tributaries Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Alder Creek	64.2	69.2	77	1.08	1.2
Glade Creek	62	67	71	1.08	1.15
Major Creek	52.5	61	75.2	1.16	1.43
Pine Creek (Jupiter Cyn to Headwaters)	45.8	54	61.5	1.18	1.34
Pine Creek (Mouth to Jupiter Cyn)	14	95.5	96.2	6.82	6.87
Wood Gulch	63.8	69.2	77.2	1.08	1.21

Total Estimated Improvement for **Middle Columbia Tributaries Steelhead**

Year 10 Impr.	Year 25 Impr.
2.25	**2.38**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Middle Fork John Day Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Big Boulder Creek	38	76	88	2	2.32
Big Creek	36	76	93	2.11	2.58
Butte Creek	29.5	57.8	77.8	1.96	2.64
Camp Creek	13.8	65.8	77.5	4.77	5.62
Dead Cow Gulch	17	87	92	5.12	5.41
Granite Boulder Creek	28.2	66.8	86.8	2.37	3.08
Middle Fork John Day River	44.8	80	91	1.79	2.03
Ragged Creek	32.5	61.2	85	1.88	2.62
Rubby Creek	28.5	62	86.5	2.18	3.04
Vincent Creek	47.5	72	90	1.52	1.89
Vinegar Creek	38.2	83.2	88.2	2.18	2.31

Total Estimated Improvement for	Middle Fork John Day Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		2.04	**2.37**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Naches River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Naches River	70.1	76.2	85.3	1.09	1.22

Total Estimated Improvement for **Naches River Summer Steelhead**

Year 10 Impr.	Year 25 Impr.
1.09	**1.22**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

North Fork John Day Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Lower N Fk. JD and tribs (mouth to M Fk.)	36.5	37.3	38.5	1.02	1.05
Mid N Fk. JD and tribs (M Fk. to and including Camas Cr.)	45	56.5	68	1.26	1.51
Upper N Fk. JD and tribs above Camas Cr.	62	72	82	1.16	1.32

Total Estimated Improvement for	North Fork John Day Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.17	**1.32**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Rock Creek Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Luna Gulch	65.5	70.5	76	1.08	1.16
Quartz Creek	40.5	51.2	70	1.26	1.73
Rock Creek (Bickleton Road to Headwaters)	38	47.5	66.8	1.25	1.76
Rock Creek (Mouth to Bickleton Road)	35.8	45.5	59	1.27	1.65
Squaw Creek (including Harrison Creek)	65.5	70.5	76	1.08	1.16

Total Estimated Improvement for Rock Creek Steelhead	Year 10 Impr.	Year 25 Impr.
	1.2	**1.52**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Satus Creek Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Satus Creek	75	80	85.8	1.07	1.14

Total Estimated Improvement for	Satus Creek Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.07	**1.14**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

South Fork John Day Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
South Fork John Day River	53	78	80.4	1.47	1.52

Total Estimated Improvement for	South Fork John Day Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.47	**1.52**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Toppenish Creek Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Toppenish Creek	63	71	77.8	1.13	1.23

Total Estimated Improvement for	Toppenish Creek Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.13	**1.23**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Umatilla River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Birch Creek	36	55.8	73	1.55	2.03
Meacham Creek	37.5	55.5	74.5	1.48	1.99
Umatilla above McKay Creek	43	53	63	1.23	1.47
Umatilla below McKay Creek	43	53	63	1.23	1.47

Total Estimated Improvement for	Umatilla River Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.37	**1.74**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Upper John Day Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Canyon Creek	10	12	13	1.2	1.3
John Day River	33	53	66	1.61	2
Strawberry Creek	14.5	62.5	70.5	4.31	4.86

Total Estimated Improvement for	Upper John Day Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.84	**2.22**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Upper Yakima River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Upper Yakima River	61.6	67.6	75.4	1.1	1.22

Total Estimated Improvement for **Upper Yakima River Summer Steelhead**

Year 10 Impr.	Year 25 Impr.
1.1	**1.22**

ESU: Middle Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Walla Walla River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Mill Creek	25	56	76	2.24	3.04
Touchet Below Forks	30	38	48	1.27	1.6
Touchet N & S Forks	32	38	56	1.19	1.75
Walla Walla below Forks	28	40	54	1.43	1.93
Walla Walla N & S forks	56	61	66	1.09	1.18

Total Estimated Improvement for	Walla Walla River Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.43	**1.9**

Estimated Benefits to Primary Limiting Factors (PLFs) from Habitat Actions by Population and Watershed

Future improvements to limiting factors are estimates from the best professional judgement of tribal biologists, assuming the implementation of all tribal habitat actions in the MOA. Limiting factors are weighted as to their relative importance in order to calculate watershed improvements.

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
All Yakima Steelhead (Mainstem Effects)							
Lower Yakima River	Ecologic – Community	80	85	90	**73.8**	**81.4**	**86.2**
	In-channel Characteristics	70	75	80			
	Passage / Entrainment	100	100	100			
	Pools	90	91	92			
	Riparian / Floodplain	70	75	80			
	Sediment	70	75	80			
	Side Channel Reconnection	80	82	85			
	Water Quality – Chemistry	80	90	92			
	Water Quality - Temperature	70	80	85			
	Water Quality - Toxics	80	90	92			
	Water Quantity – Flow	50	70	80			
	Watershed - Hydrology	75	85	90			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Deschutes River Eastside Tributaries Summer Steelhead							
Buck Hollow Creek	In-channel Characteristics	60	60	60	**61.2**	**61.2**	**61.2**
	Water Quality - Temperature	65	65	65			
	Water Quantity – Flow	60	60	60			
Deschutes River (Mainstem Effects)	Riparian / Floodplain	75	85	90	**76.5**	**85.8**	**90**
	Sediment	85	90	90			
Trout Creek	In-channel Characteristics	35	35	35	**33.5**	**33.5**	**33.5**
	Riparian / Floodplain	25	25	25			
	Water Quantity – Flow	40	40	40			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Deschutes River Westside Tributaries Summer Steelhead							
Badger/Boulder/Eagle/Nena/Skookum	In-channel Characteristics	40	65	85	**47.2**	**69.8**	**81.5**
	Passage / Entrainment	90	95	100			
	Riparian / Floodplain	35	70	80			
	Watershed - Hydrology	65	70	80			
Beaver Creek	In-channel Characteristics	40	60	75	**46.6**	**63**	**84.2**
	Sediment	55	70	85			
	Water Quality – Chemistry	50	60	95			
	Water Quality - Temperature	30	50	85			
	Water Quality - Toxics	50	65	95			
Oak Creek	Passage / Entrainment	0	100	100	**30**	**92.5**	**96.2**
	Riparian / Floodplain	40	90	95			
Shitike Creek	In-channel Characteristics	40	80	85	**45**	**77.4**	**83.6**
	Riparian / Floodplain	35	55	60			
	Water Quality – Chemistry	70	80	85			
	Water Quality - Temperature	60	70	80			
Warm Springs River	In-channel Characteristics	85	90	95	**84.5**	**90**	**94.5**
	Riparian / Floodplain	80	90	90			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Hood River Summer Steelhead							
West Fork Hood River	In-channel Characteristics	75	80	85	**75**	**80**	**85**

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Hood River Winter Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function: Estimate 10-Years	Estimated Future Function: Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed: Estimate 10-Years	Est. Future Funct. for Watershed: Estimate 25-Years
East Fork Hood River	In-channel Characteristics	70	80	85	**70**	**80.8**	**85.8**
	Riparian / Floodplain	70	85	90			
Middle Fork Hood River	In-channel Characteristics	70	80	90	**70**	**80**	**90**
Middle Fork Hood River (Clear Branch)	Passage / Entrainment	15	80	90	**15**	**80**	**90**
Middle Fork Hood River (Eliot Branch)	Passage / Entrainment	10	85	95	**10**	**85**	**95**

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Klickitat River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimate 10-Years	Estimate 25-Years	Estimated Current Watershed Function	Estimate 10-Years	Estimate 25-Years
Klickitat Canyon	Ecologic – Community	80	80	80	**78.8**	**78.8**	**78.8**
	Sediment	90	90	90			
	Watershed - Hydrology	75	75	75			
Lower Klickitat River	Ecologic – Community	30	30	30	**51**	**52.5**	**52.5**
	In-channel Characteristics	40	40	40			
	Passage / Entrainment	90	90	90			
	Pools	60	60	60			
	Riparian / Floodplain	30	35	35			
	Sediment	90	90	90			
	Side Channel Reconnection	20	30	30			
	Water Quality - Temperature	80	80	80			
	Water Quantity – Flow	90	90	90			
	Watershed - Hydrology	90	90	90			
Lower Little Klickitat River	Ecologic – Community	80	80	80	**61.5**	**62**	**63.5**
	In-channel Characteristics	60	60	60			
	Pools	80	80	80			
	Riparian / Floodplain	60	60	65			
	Sediment	70	75	80			
	Water Quality - Temperature	70	70	70			
	Water Quantity – Flow	50	50	50			
	Watershed - Hydrology	60	60	65			
Middle Klickitat River	Ecologic – Community	30	50	60	**62.4**	**73.2**	**80.3**
	In-channel Characteristics	60	70	80			
	Passage / Entrainment	95	95	95			
	Pools	70	80	85			
	Riparian / Floodplain	60	70	80			
	Sediment	90	90	90			
	Side Channel Reconnection	70	85	90			
	Water Quality - Temperature	90	90	90			
	Watershed - Hydrology	80	82	85			
Swale Creek	Ecologic – Community	40	45	50	**39.2**	**47.6**	**53**
	In-channel Characteristics	20	30	40			
	Pools	10	30	40			
	Sediment	80	85	90			
	Water Quality - Temperature	70	70	70			
	Water Quantity – Flow	60	60	60			
	Watershed - Hydrology	90	90	90			
Trout Creek	In-channel Characteristics	60	70	80	**55.5**	**60.2**	**65.8**

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Trout Creek	Passage / Entrainment	80	80	80	**55.5**	**60.2**	**65.8**
	Pools	70	75	75			
	Riparian / Floodplain	50	55	65			
	Sediment	50	55	60			
	Watershed - Hydrology	50	50	50			
Upper Klickitat River	Ecologic – Community	30	50	60	**56.8**	**66.2**	**72.8**
	In-channel Characteristics	50	60	65			
	Passage / Entrainment	90	90	90			
	Pools	70	80	85			
	Riparian / Floodplain	50	60	70			
	Sediment	60	65	70			
	Side Channel Reconnection	60	70	80			
	Water Quality - Temperature	80	80	80			
	Watershed - Hydrology	60	65	70			
Upper Little Klickitat River	Ecologic – Community	60	60	60	**47.4**	**47.8**	**48.5**
	In-channel Characteristics	50	50	50			
	Passage / Entrainment	85	85	85			
	Pools	70	70	70			
	Riparian / Floodplain	30	30	30			
	Sediment	65	65	65			
	Side Channel Reconnection	0	0	0			
	Water Quality – Chemistry	70	70	70			
	Water Quality - Temperature	40	40	40			
	Water Quantity – Flow	50	50	50			
	Watershed - Hydrology	50	55	65			
Upper Middle Klickitat River	Ecologic – Community	70	70	70	**75.8**	**76.4**	**77**
	In-channel Characteristics	85	85	85			
	Pools	85	85	85			
	Riparian / Floodplain	75	75	75			
	Sediment	90	92	94			
	Watershed - Hydrology	70	75	80			
West Fork Klickitat River	Sediment	90	92	95	**90**	**92**	**95**
White Creek	Ecologic – Community	80	85	85	**45**	**52.2**	**59.2**
	In-channel Characteristics	40	50	60			
	Passage / Entrainment	60	80	90			
	Pools	35	35	35			
	Riparian / Floodplain	30	40	55			
	Sediment	50	55	70			
	Water Quality - Temperature	60	65	65			
	Watershed - Hydrology	50	55	60			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Lower John Day Summer Steelhead							
Butte Creek	Passage / Entrainment	45	65	70	**36.5**	**62.2**	**69**
	Riparian / Floodplain	35	60	70			
	Water Quality - Temperature	30	65	70			
	Water Quantity – Flow	25	55	65			
Pine Creek	Riparian / Floodplain	85	90	95	**68.5**	**76.2**	**86.8**
	Watershed - Hydrology	55	65	80			
Pine Hollow	In-channel Characteristics	45	60	80	**47**	**64**	**84**
	Riparian / Floodplain	50	70	90			
Thirtymile Creek	Passage / Entrainment	35	75	90	**40.5**	**64.5**	**77.8**
	Pools	45	60	70			
	Riparian / Floodplain	45	70	80			
	Sediment	55	65	70			
	Water Quality - Temperature	45	55	75			
	Water Quantity – Flow	40	55	60			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function Estimate 10-Years	Estimated Future Function Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed Estimate 10-Years	Est. Future Funct. for Watershed Estimate 25-Years
Middle Columbia Tributaries Steelhead							
Alder Creek	In-channel Characteristics	65	70	80	**64.2**	**69.2**	**77**
	Riparian / Floodplain	60	65	75			
	Sediment	60	65	70			
	Water Quality - Temperature	60	65	70			
	Watershed - Hydrology	70	75	80			
Glade Creek	Ecologic – Community	75	80	80	**62**	**67**	**71**
	In-channel Characteristics	70	75	80			
	Riparian / Floodplain	65	70	75			
	Sediment	60	65	70			
	Water Quality - Temperature	65	70	75			
	Water Quality - Toxics	65	70	70			
	Watershed - Hydrology	50	55	60			
Major Creek	In-channel Characteristics	40	50	70	**52.5**	**61**	**75.2**
	Pools	40	50	70			
	Riparian / Floodplain	65	75	85			
	Sediment	65	70	80			
	Water Quality - Temperature	70	75	80			
	Watershed - Hydrology	70	75	80			
Pine Creek (Jupiter Cyn to Headwaters)	In-channel Characteristics	60	65	70	**45.8**	**54**	**61.5**
	Sediment	70	75	75			
	Water Quality - Temperature	80	85	85			
	Watershed - Hydrology	35	45	55			
Pine Creek (Mouth to Jupiter Cyn)	In-channel Characteristics	70	75	80	**14**	**95.5**	**96.2**
	Passage / Entrainment	5	100	100			
	Water Quality - Temperature	60	65	70			
	Watershed - Hydrology	65	70	75			
Wood Gulch	In-channel Characteristics	60	70	80	**63.8**	**69.2**	**77.2**
	Riparian / Floodplain	50	60	75			
	Sediment	60	65	70			
	Water Quality - Temperature	60	65	70			
	Watershed - Hydrology	75	75	80			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Middle Fork John Day Summer Steelhead							
Big Boulder Creek	In-channel Characteristics	40	80	90	**38**	**76**	**88**
	Pools	35	70	85			
Big Creek	In-channel Characteristics	40	80	95	**36**	**76**	**93**
	Pools	30	70	90			
Butte Creek	In-channel Characteristics	35	55	75	**29.5**	**57.8**	**77.8**
	Pools	25	60	80			
Camp Creek	In-channel Characteristics	50	70	85	**13.8**	**65.8**	**77.5**
	Passage / Entrainment	0	70	75			
	Pools	20	45	85			
	Water Quality - Temperature	10	60	75			
	Water Quantity – Flow	25	45	65			
Dead Cow Gulch	Pools	15	85	90	**17**	**87**	**92**
	Riparian / Floodplain	20	90	95			
Granite Boulder Creek	Passage / Entrainment	30	65	85	**28.2**	**66.8**	**86.8**
	Pools	25	70	90			
Middle Fork John Day River	In-channel Characteristics	35	90	95	**44.8**	**80**	**91**
	Riparian / Floodplain	55	90	95			
	Water Quality – Chemistry	60	85	90			
	Water Quality - Temperature	45	75	90			
	Water Quantity – Flow	55	75	85			
Ragged Creek	In-channel Characteristics	35	60	85	**32.5**	**61.2**	**85**
	Pools	25	65	85			
Rubby Creek	In-channel Characteristics	30	65	85	**28.5**	**62**	**86.5**
	Pools	25	55	90			
Vincent Creek	In-channel Characteristics	55	75	90	**47.5**	**72**	**90**
	Pools	30	65	90			
Vinegar Creek	In-channel Characteristics	40	85	90	**38.2**	**83.2**	**88.2**
	Pools	35	80	85			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Naches River Summer Steelhead							
Naches River	Ecologic – Community	90	92	95	**70.1**	**76.2**	**85.3**
	In-channel Characteristics	70	75	85			
	Passage / Entrainment	85	90	95			
	Pools	70	75	80			
	Riparian / Floodplain	60	65	75			
	Sediment	70	75	85			
	Side Channel Reconnection	70	75	80			
	Water Quality – Chemistry	95	95	95			
	Water Quality - Temperature	80	85	90			
	Water Quality - Toxics	98	98	98			
	Water Quantity – Flow	40	55	75			
	Watershed - Hydrology	70	77	92			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
North Fork John Day Summer Steelhead							
Lower N Fk. JD and tribs (mouth to M Fk.)	In-channel Characteristics	40	40	40	**36.5**	**37.3**	**38.5**
	Passage / Entrainment	30	30	30			
	Riparian / Floodplain	40	42	45			
	Sediment	40	42	45			
Mid N Fk. JD and tribs (M Fk. to and including Camas Cr.)	In-channel Characteristics	40	50	60	**45**	**56.5**	**68**
	Passage / Entrainment	50	70	90			
	Riparian / Floodplain	40	50	60			
	Sediment	50	60	70			
	Water Quality - Temperature	50	60	70			
Upper N Fk. JD and tribs above Camas Cr.	In-channel Characteristics	60	70	80	**62**	**72**	**82**
	Passage / Entrainment	70	80	90			
	Riparian / Floodplain	60	70	80			
	Sediment	60	70	80			
	Water Quality - Temperature	60	70	80			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Rock Creek Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimate 10-Years	Estimate 25-Years	Estimated Current Watershed Function	Estimate 10-Years	Estimate 25-Years
Luna Gulch	In-channel Characteristics	70	75	80	**65.5**	**70.5**	**76**
	Riparian / Floodplain	70	75	80			
	Sediment	60	65	75			
	Water Quality - Temperature	60	65	70			
	Water Quality - Toxics	65	70	75			
	Watershed - Hydrology	60	65	70			
Quartz Creek	In-channel Characteristics	40	55	70	**40.5**	**51.2**	**70**
	Riparian / Floodplain	40	50	70			
	Sediment	70	80	85			
	Water Quality - Temperature	60	65	75			
	Watershed - Hydrology	30	40	65			
Rock Creek (Bickleton Road to Headwaters)	In-channel Characteristics	35	45	55	**38**	**47.5**	**66.8**
	Riparian / Floodplain	40	50	70			
	Sediment	75	80	85			
	Water Quality - Temperature	60	65	75			
	Watershed - Hydrology	30	40	65			
Rock Creek (Mouth to Bickleton Road)	Ecologic – Community	60	65	70	**35.8**	**45.5**	**59**
	In-channel Characteristics	25	40	60			
	Riparian / Floodplain	30	40	60			
	Water Quality – Chemistry	70	75	80			
	Water Quality - Temperature	50	55	55			
	Water Quantity – Flow	40	45	50			
Squaw Creek (including Harrison Creek)	In-channel Characteristics	70	75	80	**65.5**	**70.5**	**76**
	Riparian / Floodplain	70	75	80			
	Sediment	60	65	75			
	Water Quality - Temperature	60	65	70			
	Water Quality - Toxics	65	70	75			
	Watershed - Hydrology	60	65	70			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Satus Creek Summer Steelhead							
Satus Creek	Ecologic – Community	90	92	95	**75**	**80**	**85.8**
	In-channel Characteristics	85	90	95			
	Passage / Entrainment	90	100	100			
	Pools	80	85	90			
	Riparian / Floodplain	65	70	80			
	Sediment	85	90	95			
	Side Channel Reconnection	80	85	90			
	Water Quality – Chemistry	85	92	95			
	Water Quality - Temperature	70	75	80			
	Water Quality - Toxics	98	98	99			
	Water Quantity – Flow	60	65	75			
	Watershed - Hydrology	60	63	70			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
South Fork John Day Summer Steelhead							
South Fork John Day River	In-channel Characteristics	70	85	87	**53**	**78**	**80.4**
	Riparian / Floodplain	45	90	95			
	Water Quality - Temperature	60	80	80			
	Water Quantity – Flow	45	45	45			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Toppenish Creek Summer Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimate 10-Years	Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed Estimate 10-Years	Est. Future Funct. for Watershed Estimate 25-Years
Toppenish Creek	Ecologic – Community	90	92	95	**63**	**71**	**77.8**
	In-channel Characteristics	50	60	70			
	Passage / Entrainment	65	75	75			
	Pools	70	75	80			
	Riparian / Floodplain	55	60	70			
	Sediment	50	55	65			
	Side Channel Reconnection	70	75	80			
	Water Quality – Chemistry	82	87	92			
	Water Quality - Temperature	65	75	85			
	Water Quality - Toxics	95	96	97			
	Water Quantity – Flow	40	60	70			
	Watershed - Hydrology	70	75	80			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Umatilla River Summer Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function: Estimate 10-Years	Estimated Future Function: Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed: Estimate 10-Years	Est. Future Funct. for Watershed: Estimate 25-Years
Birch Creek	In-channel Characteristics	40	60	80	**36**	**55.8**	**73**
	Passage / Entrainment	50	75	90			
	Riparian / Floodplain	20	35	50			
	Sediment	40	55	70			
	Water Quality - Temperature	30	50	70			
Meacham Creek	In-channel Characteristics	40	60	80	**37.5**	**55.5**	**74.5**
	Riparian / Floodplain	30	50	70			
	Sediment	50	60	80			
	Water Quality - Temperature	40	55	70			
Umatilla above McKay Creek	In-channel Characteristics	50	60	70	**43**	**53**	**63**
	Riparian / Floodplain	40	50	60			
	Sediment	40	50	60			
	Water Quality - Temperature	40	50	60			
Umatilla below McKay Creek	In-channel Characteristics	50	60	70	**43**	**53**	**63**
	Riparian / Floodplain	40	50	60			
	Sediment	40	50	60			
	Water Quality - Temperature	40	50	60			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Upper John Day Summer Steelhead							
Canyon Creek	Passage / Entrainment	10	12	13	**10**	**12**	**13**
John Day River	In-channel Characteristics	5	25	30	**33**	**53**	**66**
	Passage / Entrainment	40	60	75			
Strawberry Creek	Passage / Entrainment	10	70	75	**14.5**	**62.5**	**70.5**
	Water Quantity – Flow	25	45	60			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Upper Yakima River Summer Steelhead

Upper Yakima River	Ecologic – Community	80	85	90	**61.6**	**67.6**	**75.4**
	In-channel Characteristics	60	65	70			
	Passage / Entrainment	70	75	75			
	Pools	70	75	80			
	Riparian / Floodplain	40	45	55			
	Sediment	80	82	87			
	Side Channel Reconnection	70	75	80			
	Water Quality – Chemistry	90	92	95			
	Water Quality - Temperature	80	85	90			
	Water Quality - Toxics	95	96	97			
	Water Quantity – Flow	40	55	75			
	Watershed - Hydrology	40	45	55			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Walla Walla River Summer Steelhead

Mill Creek	In-channel Characteristics	25	60	80	**25**	**56**	**76**
	Passage / Entrainment	25	60	80			
	Riparian / Floodplain	25	40	60			
Touchet Below Forks	In-channel Characteristics	25	30	40	**30**	**38**	**48**
	Passage / Entrainment	50	70	80			
	Riparian / Floodplain	25	30	40			
Touchet N & S Forks	In-channel Characteristics	25	30	50	**32**	**38**	**56**
	Passage / Entrainment	60	70	80			
	Riparian / Floodplain	25	30	50			
Walla Walla below Forks	In-channel Characteristics	25	35	50	**28**	**40**	**54**
	Passage / Entrainment	50	70	80			
	Riparian / Floodplain	20	30	45			
Walla Walla N & S forks	In-channel Characteristics	50	55	60	**56**	**61**	**66**
	Passage / Entrainment	80	85	90			
	Riparian / Floodplain	50	55	60			

ESU: Middle Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Estimated Productivity Benefit from Habitat Actions by Watershed/Population

ESU: Snake River Spring/Summer Chinook

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Tucannon River Spring Chinook

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Tucannon River	55.6	57.8	58.5	1.04	1.05

Total Estimated Improvement for	Tucannon River Spring Chinook	Year 10 Impr.	Year 25 Impr.
		1.04	**1.05**

ESU: Snake River Spring/Summer Chinook

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Upper Grande Ronde Spring Chinook

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Catherine Creek	44	54	70	1.23	1.59
Mid Grande Ronde River and tribs	28	36	44	1.29	1.57
Upper Grande Ronde River and tribs	34	44	54	1.29	1.59

Total Estimated Improvement for **Upper Grande Ronde Spring Chinook**

Year 10 Impr.	Year 25 Impr.
1.28	**1.59**

Estimated Benefits to Primary Limiting Factors (PLFs) from Habitat Actions by Population and Watershed

Future improvements to limiting factors are estimates from the best professional judgement of tribal biologists, assuming the implementation of all tribal habitat actions in the MOA. Limiting factors are weighted as to their relative importance in order to calculate watershed improvements.

ESU: Snake River Spring/Summer Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Tucannon River Spring Chinook							
Tucannon River	Barriers and Screens	95	96	96	**55.6**	**57.8**	**58.5**
	Floodplain confinement	67	70	70			
	Habitat diversity (LWD)	50	50	50			
	High water temperature	34	34	34			
	High water turbidity	50	65	70			
	Low stream flow	85	86	88			
	Riparian degradation	44	44	44			

ESU: Snake River Spring/Summer Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Upper Grande Ronde Spring Chinook							
Catherine Creek	In-channel Characteristics	40	50	70	**44**	**54**	**70**
	Riparian / Floodplain	50	60	70			
	Water Quality - Temperature	40	50	70			
Mid Grande Ronde River and tribs	In-channel Characteristics	25	35	45	**28**	**36**	**44**
	Riparian / Floodplain	35	45	55			
	Sediment	25	30	35			
	Water Quality - Temperature	25	30	35			
Upper Grande Ronde River and tribs	In-channel Characteristics	40	50	60	**34**	**44**	**54**
	Riparian / Floodplain	40	50	60			
	Sediment	30	40	50			
	Water Quality - Temperature	20	30	40			

ESU: Snake River Spring/Summer Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Estimated Productivity Benefit from Habitat Actions by Watershed/Population

ESU: Snake River Basin Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Tucannon River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Tucannon River	57.8	62.4	63	1.08	1.09

Total Estimated Improvement for		Year 10 Impr.	Year 25 Impr.
	Tucannon River Summer Steelhead	**1.08**	**1.09**

ESU: Snake River Basin Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Upper Grande Ronde Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Catherine Creek	44	54	70	1.23	1.59
Mid Grande Ronde River and tribs	28	36	44	1.29	1.57
Upper Grande Ronde River and tribs	34	44	54	1.29	1.59

Total Estimated Improvement for	Upper Grande Ronde Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.28	**1.59**

Estimated Benefits to Primary Limiting Factors (PLFs) from Habitat Actions by Population and Watershed

Future improvements to limiting factors are estimates from the best professional judgement of tribal biologists, assuming the implementation of all tribal habitat actions in the MOA. Limiting factors are weighted as to their relative importance in order to calculate watershed improvements.

ESU: Snake River Basin Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Tucannon River Summer Steelhead							
Tucannon River	Barriers and Screens	95	96	96	**57.8**	**62.4**	**63**
	Floodplain confinement	60	70	70			
	Habitat diversity (LWD)	40	50	50			
	High water temperature	65	65	65			
	High water turbidity	60	65	70			
	Low stream flow	95	96	97			
	Riparian degradation	44	44	44			

ESU: Snake River Basin Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Upper Grande Ronde Summer Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimate 10-Years	Estimate 25-Years	Estimated Current Watershed Function	Estimate 10-Years	Estimate 25-Years
Catherine Creek	In-channel Characteristics	40	50	70	**44**	**54**	**70**
	Riparian / Floodplain	50	60	70			
	Water Quality - Temperature	40	50	70			
Mid Grande Ronde River and tribs	In-channel Characteristics	25	35	45	**28**	**36**	**44**
	Riparian / Floodplain	35	45	55			
	Sediment	25	30	35			
	Water Quality - Temperature	25	30	35			
Upper Grande Ronde River and tribs	In-channel Characteristics	40	50	60	**34**	**44**	**54**
	Riparian / Floodplain	40	50	60			
	Sediment	30	40	50			
	Water Quality - Temperature	20	30	40			

ESU: Snake River Basin Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Estimated Productivity Benefit from Habitat Actions by Watershed/Population

ESU: Upper Columbia River Spring Chinook

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Entiat River Spring Chinook

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Entiat River (Lower)	48.2	61.4	65.2	1.27	1.35
Entiat River (Middle - Stillwater)	65.4	77.2	81.9	1.18	1.25
Mad River	90.8	97.1	98.9	1.07	1.09

		Year 10 Impr.	Year 25 Impr.
Total Estimated Improvement for	**Entiat River Spring Chinook**	**1.19**	**1.26**

ESU: Upper Columbia River Spring Chinook

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Methow River Spring Chinook

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Beaver/Bear Creek	62.9	65.1	67.6	1.03	1.07
Black Canyon - Squaw Creek	80.3	81.9	82.9	1.02	1.03
Chewuch River (Lower)	72.3	75	76.8	1.04	1.06
Chewuch River (Upper)	81.5	81.5	81.5	1	1
Goat Creek/ Little Boulder Creek	68	68	68	1	1
Gold/Libby Creek	67.2	71.2	75	1.06	1.12
Methow River (Lower, to Carlton)	84.1	85	87.5	1.01	1.04
Methow River (Middle, Carlton to Weeman Br)	64	66.8	71.8	1.04	1.12
Methow River (Middle, Weeman Br to Lost R)	90.5	95.1	95.3	1.05	1.05
Methow River (Upper - Early Winters/Lost)	87.6	89.3	92.2	1.02	1.05
Twisp River (Lower)	50.5	53	55	1.05	1.09
Twisp River (Upper)	85.5	89	93.8	1.04	1.1
Wolf Creek / Hancock Creek	50.5	56.2	61.8	1.11	1.22

Total Estimated Improvement for	Methow River Spring Chinook	Year 10 Impr.	Year 25 Impr.
		1.01	**1.06**

ESU: Upper Columbia River Spring Chinook

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Wenatchee River Spring Chinook

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Chiwawa River	91.8	93.4	95.1	1.02	1.04
Chumstick Creek	67.5	68.5	71.5	1.01	1.06
Icicle Creek	70.2	73.4	76	1.05	1.08
Little Wenatchee	90.2	92.2	94.2	1.02	1.04
Mission Creek	43.8	43.8	43.8	1	1
Nason Creek	65	72.3	78.8	1.11	1.21
North Side Tributaries	60	60	60	1	1
Peshastin Creek	59.8	75.5	79.2	1.26	1.32
Wenatchee River (Lower)	68	68	68	1	1
Wenatchee River (Upper + Chiwaukum)	80.5	85.2	90	1.06	1.12
White River	89.8	91.5	93.2	1.02	1.04

		Year 10 Impr.	Year 25 Impr.
Total Estimated Improvement for	**Wenatchee River Spring Chinook**	**1.07**	**1.11**

Estimated Benefits to Primary Limiting Factors (PLFs) from Habitat Actions by Population and Watershed

Future improvements to limiting factors are estimates from the best professional judgement of tribal biologists, assuming the implementation of all tribal habitat actions in the MOA. Limiting factors are weighted as to their relative importance in order to calculate watershed improvements.

ESU: Upper Columbia River Spring Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Entiat River Spring Chinook							
Entiat River (Lower)	Ecologic – Community	80	85	90	**48.2**	**61.4**	**65.2**
	In-channel Characteristics	15	50	50			
	Passage / Entrainment	90	90	90			
	Riparian / Floodplain	25	35	50			
	Sediment	70	72	75			
	Side Channel Reconnection	10	15	15			
	Water Quality – Chemistry	80	80	80			
	Water Quality - Temperature	80	83	90			
	Water Quantity – Flow	80	80	80			
Entiat River (Middle - Stillwater)	Ecologic - Community	75	80	85	**65.4**	**77.2**	**81.9**
	In-channel Characteristics	60	75	80			
	Passage / Entrainment	93	93	93			
Mad River	In-channel Characteristics	90	97	99	**90.8**	**97.1**	**98.9**
	Passage / Entrainment	98	98	98			

ESU: Upper Columbia River Spring Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function Estimate 10-Years	Estimated Future Function Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed Estimate 10-Years	Est. Future Funct. for Watershed Estimate 25-Years
Methow River Spring Chinook							
Beaver/Bear Creek	Ecologic - Community	80	83	85	**62.9**	**65.1**	**67.6**
	In-channel Characteristics	60	65	70			
	Passage / Entrainment	68	68	68			
	Riparian / Floodplain	60	70	85			
	Sediment	75	75	75			
	Water Quantity – Flow	40	40	40			
Black Canyon - Squaw Creek	In-channel Characteristics	90	93	93	**80.3**	**81.9**	**82.9**
	Passage / Entrainment	91	91	91			
	Pools	90	90	90			
	Riparian / Floodplain	80	85	90			
	Water Quantity – Flow	50	50	50			
Chewuch River (Lower)	Ecologic - Community	80	85	90	**72.3**	**75**	**76.8**
	In-channel Characteristics	55	65	70			
	Passage / Entrainment	88	88	88			
	Riparian / Floodplain	55	55	55			
	Sediment	90	90	90			
	Water Quality - Temperature	80	80	80			
	Water Quantity – Flow	75	75	75			
Chewuch River (Upper)	Ecologic - Community	85	85	85	**81.5**	**81.5**	**81.5**
	In-channel Characteristics	80	80	80			
	Riparian / Floodplain	80	80	80			
	Sediment	80	80	80			
Goat Creek/ Little Boulder Creek	In-channel Characteristics	50	50	50	**68**	**68**	**68**
	Passage / Entrainment	70	70	70			
	Pools	80	80	80			
	Water Quantity – Flow	80	80	80			
Gold/Libby Creek	Ecologic - Community	80	80	80	**67.2**	**71.2**	**75**
	In-channel Characteristics	45	55	60			
	Passage / Entrainment	95	100	100			
	Pools	45	45	45			
	Riparian / Floodplain	45	55	75			
	Water Quantity – Flow	80	80	80			
Methow River (Lower, to Carlton)	Ecologic - Community	70	70	80	**84.1**	**85**	**87.5**
	In-channel Characteristics	93	93	93			
	Pools	85	85	85			
	Water Quality - Temperature	70	72	80			
	Water Quantity – Flow	93	95	95			

ESU: Upper Columbia River Spring Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Methow River (Middle, Carlton to Weeman Br)	Ecologic - Community	70	70	75	**64**	**66.8**	**71.8**
	In-channel Characteristics	55	60	65			
	Passage / Entrainment	70	70	70			
	Pools	60	65	75			
	Water Quantity – Flow	75	75	75			
Methow River (Middle, Weeman Br to Lost R)	Ecologic - Community	90	95	95	**90.5**	**95.1**	**95.3**
	In-channel Characteristics	85	95	95			
	Water Quality - Temperature	95	96	98			
	Water Quantity – Flow	95	95	95			
Methow River (Upper - Early Winters/Lost)	Ecologic - Community	90	95	95	**87.6**	**89.3**	**92.2**
	In-channel Characteristics	85	85	85			
	Passage / Entrainment	98	98	98			
	Riparian / Floodplain	75	80	90			
	Sediment	90	90	95			
Twisp River (Lower)	Ecologic – Community	80	85	90	**50.5**	**53**	**55**
	In-channel Characteristics	55	65	70			
	Passage / Entrainment	55	55	55			
	Pools	55	55	55			
	Riparian / Floodplain	55	65	75			
	Sediment	80	80	80			
	Water Quality - Temperature	60	60	60			
	Water Quantity – Flow	20	20	20			
Twisp River (Upper)	Ecologic - Community	80	85	90	**85.5**	**89**	**93.8**
	In-channel Characteristics	93	95	97			
	Riparian / Floodplain	80	85	95			
	Sediment	95	95	95			
	Water Quantity – Flow	95	95	95			
Wolf Creek / Hancock Creek	In-channel Characteristics	40	55	65	**50.5**	**56.2**	**61.8**
	Pools	40	40	40			
	Riparian / Floodplain	50	55	65			
	Water Quantity – Flow	80	80	80			

ESU: Upper Columbia River Spring Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Wenatchee River Spring Chinook							
Chiwawa River	Ecologic – Community	85	90	95	**91.8**	**93.4**	**95.1**
	In-channel Characteristics	95	95	95			
	Passage / Entrainment	93	93	93			
	Pools	95	95	95			
	Riparian / Floodplain	93	95	97			
Chumstick Creek	In-channel Characteristics	55	55	55	**67.5**	**68.5**	**71.5**
	Passage / Entrainment	70	70	70			
	Riparian / Floodplain	55	60	75			
	Water Quality – Chemistry	85	85	85			
	Water Quality - Temperature	80	80	80			
	Water Quantity – Flow	70	70	70			
Icicle Creek	In-channel Characteristics	70	75	75	**70.2**	**73.4**	**76**
	Passage / Entrainment	55	55	55			
	Riparian / Floodplain	70	75	85			
	Sediment	90	92	95			
	Water Quantity – Flow	55	55	55			
Little Wenatchee	Ecologic – Community	85	90	95	**90.2**	**92.2**	**94.2**
	In-channel Characteristics	97	97	97			
	Riparian / Floodplain	90	90	90			
	Sediment	95	95	95			
Mission Creek	In-channel Characteristics	20	20	20	**43.8**	**43.8**	**43.8**
	Passage / Entrainment	70	70	70			
	Riparian / Floodplain	55	55	55			
	Sediment	70	70	70			
	Water Quality - Temperature	55	55	55			
	Water Quantity – Flow	20	20	20			
Nason Creek	Ecologic – Community	55	70	80	**65**	**72.3**	**78.8**
	In-channel Characteristics	55	65	75			
	Passage / Entrainment	93	93	93			
	Water Quality - Temperature	80	80	80			
North Side Tributaries	Passage / Entrainment	60	60	60	**60**	**60**	**60**
Peshastin Creek	In-channel Characteristics	55	75	80	**59.8**	**75.5**	**79.2**
	Passage / Entrainment	93	98	98			
	Water Quality - Temperature	98	98	98			
	Water Quantity – Flow	20	40	45			
Wenatchee River (Lower)	In-channel Characteristics	60	60	60	**68**	**68**	**68**

ESU: Upper Columbia River Spring Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function Estimate 10-Years	Estimated Future Function Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed Estimate 10-Years	Est. Future Funct. for Watershed Estimate 25-Years
Wenatchee River (Lower)	Water Quality - Temperature	80	80	80	**68**	**68**	**68**
	Water Quantity – Flow	70	70	70			
Wenatchee River (Upper + Chiwaukum)	In-channel Characteristics	80	85	90	**80.5**	**85.2**	**90**
	Passage / Entrainment	90	90	90			
White River	Ecologic – Community	80	85	90	**89.8**	**91.5**	**93.2**
	In-channel Characteristics	95	95	95			

ESU: Upper Columbia River Spring Chinook

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Estimated Productivity Benefit from Habitat Actions by Watershed/Population

ESU: Upper Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Entiat River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Entiat River (Lower)	48.2	61.4	65.2	1.27	1.35
Entiat River (Middle - Stillwater)	72.4	77.2	81.9	1.07	1.13
Mad River	90.8	97.1	98.9	1.07	1.09

Total Estimated Improvement for **Entiat River Summer Steelhead**

Year 10 Impr.	Year 25 Impr.
1.13	**1.18**

ESU: Upper Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Methow River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Beaver/Bear Creek	62.9	65.1	67.6	1.03	1.07
Black Canyon - Squaw Creek	80.3	81.9	82.9	1.02	1.03
Chewuch River (Lower)	72.3	75	76.8	1.04	1.06
Chewuch River (Upper)	81.5	81.5	81.5	1	1
Goat Creek/ Little Boulder Creek	68	68	68	1	1
Gold/Libby Creek	67.2	71.2	75	1.06	1.12
Methow River (Lower, to Carlton)	82.8	83.8	86.2	1.01	1.04
Methow River (Middle, Carlton to Weeman Br)	64	66.8	71.8	1.04	1.12
Methow River (Middle, Weeman Br to Lost R)	90.5	93.6	95.3	1.03	1.05
Methow River (Upper - Early Winters/Lost)	75	80	90	1.07	1.2
Twisp River (Lower)	50.5	53	55	1.05	1.09
Twisp River (Upper)	85.5	89	93.8	1.04	1.1
Wolf Creek / Hancock Creek	50.5	56.2	61.8	1.11	1.22

Total Estimated Improvement for **Methow River Summer Steelhead**

Year 10 Impr.	Year 25 Impr.
1.02	**1.08**

ESU: Upper Columbia River Steelhead

Estimates of future improvements to population egg-to-smolt productivity are based on estimated watershed improvements from the implementation of all tribal habitat actions in the MOA. Population improvements are standardized where 1.0 = the current production rate. For example a productivity improvement of 1.54 = 54% improvement over current conditions. Watersheds are weighted according to their relative importance.

Wenatchee River Summer Steelhead

Watershed	Est. Future Function for Watershed (Calculated from all Limiting Factors)			Estimated Future Productivity	
	Current	10-Yr Est.	25-Yr Est.	10-Yr Impr.	25-Yr Impr.
Chiwawa River	91.8	93.4	95.1	1.02	1.04
Chumstick Creek	67.5	68.5	71.5	1.01	1.06
Icicle Creek	70.2	73.4	77.8	1.05	1.11
Little Wenatchee	90.2	92.2	94.2	1.02	1.04
Mission Creek	43.8	43.8	43.8	1	1
Nason Creek	65	72.3	78.8	1.11	1.21
North Side Tributaries	60	60	60	1	1
Peshastin Creek	62.8	76.2	80	1.21	1.27
Wenatchee River (Lower)	68	68	68	1	1
Wenatchee River (Upper + Chiwaukum)	80.5	85.2	90	1.06	1.12
White River	89.8	91.5	93.2	1.02	1.04

Total Estimated Improvement for	Wenatchee River Summer Steelhead	Year 10 Impr.	Year 25 Impr.
		1.06	**1.12**

Estimated Benefits to Primary Limiting Factors (PLFs) from Habitat Actions by Population and Watershed

Future improvements to limiting factors are estimates from the best professional judgement of tribal biologists, assuming the implementation of all tribal habitat actions in the MOA. Limiting factors are weighted as to their relative importance in order to calculate watershed improvements.

ESU: Upper Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Entiat River Summer Steelhead							
Entiat River (Lower)	Ecologic – Community	80	85	90	**48.2**	**61.4**	**65.2**
	In-channel Characteristics	15	50	50			
	Passage / Entrainment	90	90	90			
	Riparian / Floodplain	25	35	50			
	Sediment	70	72	75			
	Side Channel Reconnection	10	15	15			
	Water Quality – Chemistry	80	80	80			
	Water Quality - Temperature	80	83	90			
	Water Quantity – Flow	80	80	80			
Entiat River (Middle - Stillwater)	Ecologic - Community	75	80	85	**72.4**	**77.2**	**81.9**
	In-channel Characteristics	70	75	80			
	Passage / Entrainment	93	93	93			
Mad River	In-channel Characteristics	90	97	99	**90.8**	**97.1**	**98.9**
	Passage / Entrainment	98	98	98			

ESU: Upper Columbia River Steelhead

Methow River Summer Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function Estimate 10-Years	Estimated Future Function Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed Estimate 10-Years	Est. Future Funct. for Watershed Estimate 25-Years
Beaver/Bear Creek	Ecologic - Community	80	83	85	**62.9**	**65.1**	**67.6**
	In-channel Characteristics	60	65	70			
	Passage / Entrainment	68	68	68			
	Riparian / Floodplain	60	70	85			
	Sediment	75	75	75			
	Water Quantity – Flow	40	40	40			
Black Canyon - Squaw Creek	In-channel Characteristics	90	93	93	**80.3**	**81.9**	**82.9**
	Passage / Entrainment	91	91	91			
	Pools	90	90	90			
	Riparian / Floodplain	80	85	90			
	Water Quantity – Flow	50	50	50			
Chewuch River (Lower)	Ecologic - Community	80	85	90	**72.3**	**75**	**76.8**
	In-channel Characteristics	55	65	70			
	Passage / Entrainment	88	88	88			
	Riparian / Floodplain	55	55	55			
	Sediment	90	90	90			
	Water Quality - Temperature	80	80	80			
	Water Quantity – Flow	75	75	75			
Chewuch River (Upper)	Ecologic - Community	85	85	85	**81.5**	**81.5**	**81.5**
	In-channel Characteristics	80	80	80			
	Riparian / Floodplain	80	80	80			
	Sediment	80	80	80			
Goat Creek/ Little Boulder Creek	In-channel Characteristics	50	50	50	**68**	**68**	**68**
	Passage / Entrainment	70	70	70			
	Pools	80	80	80			
	Water Quantity – Flow	80	80	80			
Gold/Libby Creek	Ecologic - Community	80	80	80	**67.2**	**71.2**	**75**
	In-channel Characteristics	45	55	60			
	Passage / Entrainment	95	100	100			
	Pools	45	45	45			
	Riparian / Floodplain	45	55	75			
	Water Quantity – Flow	80	80	80			
Methow River (Lower, to Carlton)	Ecologic - Community	70	70	70	**82.8**	**83.8**	**86.2**
	In-channel Characteristics	93	93	95			
	Pools	80	80	80			
	Water Quality - Temperature	70	72	80			
	Water Quantity – Flow	93	95	95			

ESU: Upper Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Methow River (Middle, Carlton to Weeman Br)	Ecologic - Community	70	70	75	**64**	**66.8**	**71.8**
	In-channel Characteristics	55	60	65			
	Passage / Entrainment	70	70	70			
	Pools	60	65	75			
	Water Quantity – Flow	75	75	75			
Methow River (Middle, Weeman Br to Lost R)	Ecologic - Community	90	95	95	**90.5**	**93.6**	**95.3**
	In-channel Characteristics	85	90	95			
	Water Quality - Temperature	95	96	98			
	Water Quantity – Flow	95	95	95			
Methow River (Upper - Early Winters/Lost)	Riparian / Floodplain	75	80	90	**75**	**80**	**90**
Twisp River (Lower)	Ecologic – Community	80	85	90	**50.5**	**53**	**55**
	In-channel Characteristics	55	65	70			
	Passage / Entrainment	55	55	55			
	Pools	55	55	55			
	Riparian / Floodplain	55	65	75			
	Sediment	80	80	80			
	Water Quality - Temperature	60	60	60			
	Water Quantity – Flow	20	20	20			
Twisp River (Upper)	Ecologic - Community	80	85	90	**85.5**	**89**	**93.8**
	In-channel Characteristics	93	95	97			
	Riparian / Floodplain	80	85	95			
	Sediment	95	95	95			
	Water Quantity – Flow	95	95	95			
Wolf Creek / Hancock Creek	In-channel Characteristics	40	55	65	**50.5**	**56.2**	**61.8**
	Pools	40	40	40			
	Riparian / Floodplain	50	55	65			
	Water Quantity – Flow	80	80	80			

ESU: Upper Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Wenatchee River Summer Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function – Estimate 10-Years	Estimated Future Function – Estimate 25-Years	Estimated Current Watershed Function	Est. Future Funct. for Watershed – Estimate 10-Years	Est. Future Funct. for Watershed – Estimate 25-Years
Chiwawa River	Ecologic – Community	85	90	95	**91.8**	**93.4**	**95.1**
	In-channel Characteristics	95	95	95			
	Passage / Entrainment	93	93	93			
	Pools	95	95	95			
	Riparian / Floodplain	93	95	97			
Chumstick Creek	In-channel Characteristics	55	55	55	**67.5**	**68.5**	**71.5**
	Passage / Entrainment	70	70	70			
	Riparian / Floodplain	55	60	75			
	Water Quality – Chemistry	85	85	85			
	Water Quality - Temperature	80	80	80			
	Water Quantity – Flow	70	70	70			
Icicle Creek	In-channel Characteristics	70	75	80	**70.2**	**73.4**	**77.8**
	Passage / Entrainment	55	55	55			
	Riparian / Floodplain	70	75	85			
	Sediment	90	92	95			
	Water Quantity – Flow	55	55	55			
Little Wenatchee	Ecologic – Community	85	90	95	**90.2**	**92.2**	**94.2**
	In-channel Characteristics	97	97	97			
	Riparian / Floodplain	90	90	90			
	Sediment	95	95	95			
Mission Creek	In-channel Characteristics	20	20	20	**43.8**	**43.8**	**43.8**
	Passage / Entrainment	70	70	70			
	Riparian / Floodplain	55	55	55			
	Sediment	70	70	70			
	Water Quality - Temperature	55	55	55			
	Water Quantity – Flow	20	20	20			
Nason Creek	Ecologic – Community	55	70	80	**65**	**72.3**	**78.8**
	In-channel Characteristics	55	65	75			
	Passage / Entrainment	93	93	93			
	Water Quality - Temperature	80	80	80			
North Side Tributaries	Passage / Entrainment	60	60	60	**60**	**60**	**60**
Peshastin Creek	In-channel Characteristics	55	75	80	**62.8**	**76.2**	**80**
	Passage / Entrainment	93	98	98			
	Water Quality - Temperature	98	98	98			
	Water Quantity – Flow	40	45	50			
Wenatchee River (Lower)	In-channel Characteristics	60	60	60	**68**	**68**	**68**

ESU: Upper Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years
Wenatchee River (Lower)	Water Quality - Temperature	80	80	80	**68**	**68**	**68**
	Water Quantity – Flow	70	70	70			
Wenatchee River (Upper + Chiwaukum)	In-channel Characteristics	80	85	90	**80.5**	**85.2**	**90**
	Passage / Entrainment	90	90	90			
White River	Ecologic – Community	80	85	90	**89.8**	**91.5**	**93.2**
	In-channel Characteristics	95	95	95			

ESU: Upper Columbia River Steelhead

Watershed	Primary Limiting Factors (PLFs)	Estimated Current Function of PLFs	Estimated Future Function		Estimated Current Watershed Function	Est. Future Funct. for Watershed	
			Estimate 10-Years	Estimate 25-Years		Estimate 10-Years	Estimate 25-Years

Habitat Projects

ATTACHMENT G

Population(s)	Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Watershed	Project Type
			Lower Columbia Steelhead			
Hood R Summer Steelhead; HR Winter Steelhead	Existing	199802101	Hood River habitat program	CTWSRO	West Fork Hood River; East Fork Hood River	Habitat
Hood R Summer Steelhead; HR Winter Steelhead	Expanded	199802101	Hood River habitat program	CTWSRO	West Fork Hood River; East Fork Hood River	Habitat
Hood R Summer Steelhead; HR Winter Steelhead	Existing	199802100	Hood River habitat program	CTWSRO	West Fork Hood River; East Fork Hood River	Habitat - Capital
			Mid Columbia Steelhead			
Multiple Mid C. Populations: Lower JD Summer Steelhead; Middle Fork JD Summer Steelhead; North Fork JD Summer Steelhead; South Fork JD Summer Steelhead; Upper John Day Summer Steelhead; Umatilla R. Summer Steelhead; Walla Walla R Summer Steelhead; (NOTE: Also, Upper Grande Ronde Summer Steelhead/ Spring Chinook; Tucannon R. Summer Steelhead/ Spring Chinook;)	Expanded	198710001, 199604601, 199608300, 200003100	CTUIR Ceded Area Tributary Culvert/Passage Assessment, Prioritization and Implementation	CTUIR	All UM, WW, GR, JD Subbasin watersheds	Habitat
Descutes R. Westside Tributaries Summer Steelhead; Descutes R. Eastside Tributaries Summer Chinook	New	New	Deschutes River restoration program	CTWSRO	Warm Springs River; Lower Descutes	Habitat
Lower JD Summer Steelhead	Existing	199802200	Pine Creek wildlife conservation area	CTWSRO	Lower John Day/ Muddy Creek	Wildlife
Lower JD Summer Steelhead	Expanded	199802200	Pine Creek wildlife conservation area	CTWSRO	Lower John Day/ Muddy Creek	wildlife
Middle Fork JD Summer Steelhead	Existing	199801800	John Day Watershed Restoration program	CTWSRO	Strawberry Creek	Habitat
Middle Fork JD Summer Steelhead	Existing	200001500	Oxbow Conservation area	CTWSRO	Camp Creek	Habitat
Middle Fork JD Summer Steelhead	Expanded	200001500	Oxbow Conservation area	CTWSRO	Camp Creek	Habitat
Middle Fork John Day Summer Steelhead	Expanded	199801800	John Day Watershed Restoration program	CTWSRO	Middle Fork John Day River	Habitat - Capital
Middle Fork John Day Summer Steelhead	Existing	199801800	John Day Watershed Restoration program	CTWSRO	Middle Fork John Day River	Habitat - Capital
North Fork JD Summer Steelhead	Existing	200003100	North Fork John Day Basin Anadromous Fish Habitat Enhancement Project	CTUIR	Lower N Fk. JD & tribs, Middle N Fk. JD & tribs, Upper N Fk, JD & tribs.	Habitat
North Fork JD Summer Steelhead	Expanded	200003100	North Fork John Day Basin Anadromous Fish Habitat Enhancement Project	CTUIR	Lower N Fk. JD & tribs, Middle N Fk. JD & tribs, Upper N Fk, JD & tribs.	Habitat
Upper Mainstem JD Summer Steelhead	Existing	200104101	Forrest conservation area	CTWSRO	(Upper) John Day River	Habitat
Upper Mainstem JD Summer Steelhead	Expanded	200104101	Forrest conservation area	CTWSRO	(Upper) John Day River	Habitat
Upper Mainstem JD Summer Steelhead	Expanded	199801800	John Day Watershed Restoration program	CTWSRO	(Upper) John Day River	Habitat
Umatilla R. Summer Steelhead	New	New	Inventory and assess fish habitat, passage and screening needs and develop plan for steelhead reintroduction in Willow Creek, Butter Creek and McKay Creek.	CTUIR	All Willow Subbasin watersheds and Butter and McKay in Umatilla	Habitat
Umatilla R. Summer Steelhead	Existing	198902700	Power Repay Umatilla Basin Project	CTUIR	Umatilla below McKay Creek	Habitat
Umatilla R. Summer Steelhead	Existing	198710001	Umatilla Anad Fish Hab – CTUIR	CTUIR	All Umatilla Subbasin watersheds	Habitat
Umatilla R. Summer Steelhead	Expanded	198710001	Umatilla Anad Fish Hab – CTUIR	CTUIR	All Umatilla Basin watersheds	Habitat
Umatilla R. Summer Steelhead	Existing	198802200	Umatilla Fish Passage Operations	CTUIR	Umatilla below McKay Creek	Habitat

Population(s)	Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Watershed	Project Type
Umatilla R. Summer Steelhead	Existing	199506001	Iskuulpa Watershed Project	CTUIR	Umatilla above McKay Creek	Wildlife
Umatilla River Summer Steelhead (Note: also Walla Walla River Summer Steelhead)	New	New	Instream flow restoration projects, including water rights purchase from willing sellers and development and replacement of water sources for agricultural uses in Umatilla and Walla Walla tributaries.***	CTUIR	All Umatilla and Walla Walla Subbasin watersheds	Habitat - Capital
Walla Walla River Summer Steelhead (Note: also Umatllla Rive Steelhead)	New	New	Instream flow restoration projects, including water rights purchase from willing sellers and development and replacement of water sources for agricultural uses in Umatilla and Walla Walla tributaries.***	CTUIR	All Umatilla and Walla Walla Subbasin watersheds	Habitat - Capital
Walla Walla River Summer Steelhead	Existing	199601100	Walla Walla Juvenile and Adult Passage Improvements (capital)	CTUIR	Walla Walla below Forks and Mill Creek	Habitat - Capital
Walla Walla Summer Steelhead	Existing	199601100	Walla Walla Juvenile and Adult Passage Improvements (expense)	CTUIR	All Walla Walla Subbasin watersheds	Habitat
Walla Walla Summer Steelhead	Existing	199604601	Walla Walla River Basin Fish Habitat Enhancement	CTUIR	All Walla Walla Subbasin watersheds	Habitat
Walla Walla Summer Steelhead	Expanded	199604601	Walla Walla River Basin Fish Habitat Enhancement	CTUIR	All Walla Walla Subbasin watersheds	Habitat
Walla Walla Summer Steelhead	Existing	200003300	Walla Walla River Fish Passage Operations	CTUIR	Walla Walla below Forks	Habitat
Walla Walla Summer Steelhead	Expanded	200003399	Walla Walla River Fish Passage Operations	CTUIR	Walla Walla below Forks	Habitat
Walla Walla (Touchet) Summer Steelhead	Existing	200002600	Rainwater Wildlife Area Operations and Maintenance	CTUIR	Touchet N & S Forks	Wildlife
Walla Walla River (Touchet) Summer Steelhead	Expanded	200002600	South Fork Touchet Watershed Protection and Restoration (capital acquisition)	CTUIR	Touchet N & S Forks	Habitat - Capital
Rock Cr. Steelhead	Expanded	200715600	Rock Creek Fish and Habitat Assessment for the Prioritization of Restoration and Protection.	YN	Rock Cr.	RM&E/ Habitat
Rock Cr. Steelhead	Expanded	200715600	Rock Creek Fish and Habitat Assessment for the Prioritization of Restoration and Protection.	YN	Rock Cr.	RM&E/ Habitat
Klickitat R. Steelhead	Expanded	199705600	Klickitat Watershed Enhancement	YN	All Klickitat Watersheds except Klickitat Canyon	Habitat
Klickitat R. Steelhead	Existing	199705600	Klickitat Watershed Enhancement	YN	All Klickitat Watersheds except Klickitat Canyon	Habitat
Klickitat R. Steelhead	Existing	198812035	YKFP Klickitat Management, Data, and Habitat	YN	All Klickitat Watersheds except Klickitat Canyon	Habitat
Klickitat R. Steelhead (Note: also Yakima Steelhead MPG)	Expanded	198812025	YKFP Management, Data, Habitat	YN	All Klickitat Watersheds except Klickitat Canyon; Upper Yakima, Naches, Toppenish, Stutus; Lower Yakima	Habitat
Yakima Steelhead MPG (Noe: also Klickitat R. Steelhead)	Expanded	198812025	YKFP Management, Data, Habitat	YN	All Klickitat Watersheds except Klickitat Canyon; Upper Yakima, Naches, Toppenish, Stutus; Lower Yakima	Habitat
Yakima Steelhead MPG	Existing	198812025	YKFP Management, Data, Habitat	YN	Upper Yakima, Naches, Toppenish, Status	Habitat
Yakima Steelhead MPG	Existing	199206200	Yakama Nation - Riparian/Wetlands Restoration (acquisition)	YN	Upper Yakima, Naches, Toppenish, Status	Habitat
Yakima Steelhead MPG	Existing	199206200	Yakama Nation - Riparian/Wetlands Restoration (O&M)	YN	Upper Yakima, Naches, Toppenish, Status, Lower Yakima	Wildlife
Yakima Steelhead MPG	Existing	199603501	Yakama Reservation Watersheds Project	YN	Toppenish, Status, Ahtanum, Lower Yakima	Habitat

Population(s)	Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Watershed	Project Type
Yakima Steelhead MPG	Existing	199705100	Yakima Basin Side Channels	YN	Upper Yakima, Naches, Toppenish, Status; Lower Yakima	Habitat
Yakima Steelhead MPG	Expanded	199705100	Yakima Basin Side Channels	YN	Upper Yakima, Naches, Toppenish, Status; Lower Yakima	Habitat
		Snake River Steelhead/ Spring Chinook				
Multiple Snake R. Populations; Upper Grande Ronde Summer Steelhead / spring Chinook; Tucannon R. Summer / Spring Chinook; Upper Grand Ronde Spring Chinook (Note, also Lower JD Summer Steelhead; Middle Fork JD Summer Steelhead; North Fork JD Summer Steelhead; South Fork JD Summer Steelhead; Upper John Day Summer Steelhead; Umatilla R. Summer Steelhead; Walla Walla R Summer Steelhead)	Expanded	198710001, 199604601, 199608300, 200003100	CTUIR Ceded Area Tributary Culvert/Passage Assessment, Prioritization and Implementation	CTUIR	All UM, WW, GR, JD Subbasin watersheds	Habitat
Tucannon R. Summer Steelhead/ Cninook	New	New	Protect and Restore Tucannon Watershed	CTUIR	Tucannon River Pataha to Panjab	Habitat
Upper Grand Ronde Summer Steelhead/ Spring Chinook	Existing	199608300	CTUIR Grande Ronde Subbasin Restoration Project	CTUIR	Upper Grande Ronde River and tribs	Habitat
Upper Grand Ronde Summer Steelhead/ Spring Chinook	Expanded	199608300	CTUIR Grande Ronde Subbasin Restoration Project	CTUIR	Upper Grande Ronde River and tribs	Habitat
Upper Grande Ronde Summer Steelhead/ Spring Chinook; possible others (see watershed)	New	New	CTUIR Ceded Area Priority Stream Corridor Covservation and Protection (capital acquisition)	CTUIR	Priority is Upper Grande Ronde but could be in and UM, WW, N. Fk. JD or GR subbasin watersheds	Habitat - Capital
		Upper Columbia Steelhead/ Spring Chinook				
Entiat R. Summer Steelhead / Spring Chinook	New	New	Continue hatchery carcass out planting and/or use of nutrient analogs in mid- and lower Entiat main stem.	YN	Mid and lower Entiat mainstem	Habitat
Entiat R. Summer Steelhead / Spring Chinook	New	New	Design and build in-channel pool forming structures in main stem Entiat for juvenile rearing and spawning habitat.	YN	Mainstem Entiat	Habitat
Entiat R. Summer Steelhead / Spring Chinook	New	New	Entiat River - UPA - Lower Entiat River Off-Channel Restoration Project	YN	Lower Entiat	Habitat
Entiat R. Summer Steelhead / Spring Chinook	New	New	Implement Ecosystem Diagnosis and Treatment (EDT) Alternative 5 related to side-channel options.	YN		Habitat
Entiat R. Summer Steelhead / Spring Chinook	New	New	Install rock gravel catchers to promote gravel recruitment and spawning gravels on Mad River	YN	Mad River	Habitat
Entiat R. Summer Steelhead / Spring Chinook	New	New	UPA Entiat Subbasin Riparian Enhancement Program	YN		Habitat
Entiat R. Summer Steelhead / Spring Chinook	New	New	Work with willing landowners to protect larger, undisturbed riparian areas by first pursuing conservation easement, lease, and options other than outright property acquisition	YN		Habitat
Methow R. Summer Steelhead / Spring Chinook	New	New	Add log and rock complexes to identified small tributary channels at key stream locations to reactivate floodplain where appropriate.	YN		Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Assess and inventory mill ponds in Middle Methow River reaches (and others) in relationship to providing additional main stem spawning and rearing habitat (acclimation, off-channel habitat, etc.)	YN		Habitat

Habitat Projects

ATTACHMENT G

Population(s)	Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Watershed	Project Type
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Assess potential temperature refugia, (using FLIR and temperature profiles) to identify important summer/winter juvenile rearing areas for future protection and restoration actions.	YN		Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Assess, design and implement Instream structures in various smaller tributary streams	YN		Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	BOR Reach Complex - Modify levees, riparian restoration, LWD recruitment and side channel reconnection with an emphasis in the upper Twisp River Watershed.	YN	Upper Twisp River	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	BOR Reach Complex - Restore Primarily side channel and increase habitat complexity in the Chewuch River.	YN	Chewuch River	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	BOR Reach Complex riparian reconnection / floodplain function - side channel improvements for the Methow River with an emphasis on reaches between Carlton to Weeman Bridge.	YN	Middle Methow - Carlton to Weeman Bridge	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	BOR Reach Complex Side channel reconnection, LWD recruitment, levee removal, riparian restoration with an emphasis in the lower Twisp River.	YN	Lower Twisp	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	BOR Reach complexity and side channel development, Early Winters fan to Gate Creek	YN	Upper Methow - Winters fan to Gate Creek	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Design and implement Engineered Log Jams in the Upper Methow, Early Winters Creek and Lost River; identify areas, to increase and diversify key spawning and rearing habitat.	YN	Upper Methow - Early Winters/ Lost	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Identify, Protect and Restore areas providing thermal refugia in the lower Methow reaches.	YN	Lower Methow	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Protect cottonwood forests, and replant unused riparian agricultural areas where feasible in lower Methow River reaches.	YN	Lower Methow	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Protection Riparian and Floodplain in Middle Methow River with general emphasis from Carlton to Weeman Bridge.	YN	Middle Methow - Carlton to Weeman Bridge	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Restoration 30%+ of lineal stream area - Upper Methow tributaries with emphasis on Wolf Creek and Hancock Springs.	YN	Wolf Creek/ Hancock Springs	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Riparian Floodplain Habitat Protection Program with an emphasis in lower reaches of Methow River.	YN	Lower Methow	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	Riparian Floodplain Habitat Protection Program with an emphasis in upper reaches/tributaries of Methow River.	YN	Upper Methow; Wolf Creek/ Hancock Creek	Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	UPA Project - Programmatic Implementation of Habitat Complexity Projects in the Methow River Subbasin in areas not already identified.	YN		Habitat
Methow R. Summer Steelhead; Methow R. Spring Chinook	New	New	UPA Project - Programmatic Methow Basin Riparian Enhancement and re-establishment with an emphasis in key tributary streams.	YN		Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Add nutrients using hatchery carcasses and/or carcass analogs - 9-watersheds identified	YN	9 Wenatchee watersheds	Habitat

Habitat Projects

Population(s)	Existing/ Expanded/ New	Proposal #	Proposal Title	Org.	Watershed	Project Type
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Assess, design and build large wood structures for habitat diversity in Upper Wenatchee Watershed.	YN	Upper Wenatchee	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Culvert Replacement (11-13 structures) at private landowner access in Chumstick watershed.	YN	Chumstick Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Culvert replacement Alder Creek and Misc. for Chiwawa Watershed.	YN	Chiwawa Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Culvert replacement Clear Creek (1)	YN	Clear Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Culvert replacement Clear Creek (2)	YN	Clear Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Develop lower Nason Creek Restoration Plan	YN	Nason Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Evaluate NF (National Forest) riparian roads and develop restoration plan in upper Peshastin Watershed.	YN	Peshastin Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Improve Irrigation delivery and use efficiency at Dryden Ditch, Pioneer and Jones/Shotwell (Efficiency)	YN		Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Increase irrigation delivery and on-site efficiencies in Peshastin Creek watershed.	YN	Peshastin Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Increase pool quality and quantity in Nason Creek Watershed by installing in-channel structures.	YN	Nason Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Install stream structures to increase thalwag depth on lower Peshastin Creek.	YN	Peshastin Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	North Road culvert passage: provide year-around passage through North Road culvert on Chumstick Creek.	YN	Chumstick Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Programmatic Riparian Floodplain Habitat Protection Program for Wenatchee Subbasin.	YN	Entire Wenatchee	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Programmatic Side/Off channel reconnections and restoration in the Nason Creek Watershed.	YN	Nason Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Programmatic Stream Bank Restoration in the Icicle Creek Watershed.	YN	Icicle Creek	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Reconnect main stem Wenatchee River side channel at Monitor in Lower Wenatchee Watershed.	YN	Lower Wenatchee	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Reconnect main stem Wenatchee River side channel at Sleepy Hollow in Lower Wenatchee Watershed.	YN	Lower Wenatchee	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Reconnect main stem Wenatchee River side channel Cashmere in Lower Wenatchee Watershed.	YN	Lower Wenatchee	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Replace culverts at Beaver Creek in Upper Wenatchee Watershed.	YN	Upper Wenatchee	Habitat
Wenatchee R. Summer Steelhead / Spring Chinook	New	New	Restoration (on National Forests and Private lands) of riparian and channel conditions to relieve sediment inputs in Chiwawa River Watershed.	YN	Chiwawa Creek	Habitat

Biological Benefits of Hatchery Actions in LRT MOA

Population	MOA Project Title	Proposed Hatchery Action	Course Screen Categorization	VSP Parameters Positively Affected				Summary of Potential Benefits (L,M,H)	Timeframe to Implement and benefit to be realized
				A	P	SS	D		
Lower Columbia Spring Chinook ESU Hatchery Benefits Summary									
Hood River	**Master plan expansion and tributary weir development for hood river facitlity (Capital & O&M); Hood River Production O&M**	Release up to 200k smolt for harvest augmentation and supplementation. Release up to 200 k smolt from 1 acclimation site in West Fork Hood River.	Group A Category 2	X		X		H -Produce approx. 2000 adults for harvest, brood stock and supplementation Important to maintaining naturally spawning population and tribal harvest opportunities.	Revised Master Plan and HGMP submitted spring, 2008. Parkdale hatchery improvements and one new acclimation site and two trapping facilities proposed to come on line during 2010 Ongoing program releases 125k smolt at 2 sites in West Fork Hood River and 1 site in Rogers Creek
Lower Columbia Steelhead ESU Hatchery Benefits Summary									
Hood River (winter)	**Hood River Production O&M**	Release up to 50k StW smolt for supplementation. Release at one acclimation site in East Fork Hood River and one site in Middle Fork. 2% SAR	Group A Category 3	X		X		H - Produce approx. 1000 adults for harvest and supplementation. Important to maintaining naturally spawning population and tribal/sport harvest opportunities.	Program is on-going

Mid Columbia Steelhead ESU Hatchery Benefits Summary									
Klickitat River	**Klickitat Fishery YKFP Design (Capital & Expense) & O&M**	Construct trap at Lyle Falls to collect local broodstock:Reconstruct Lyle Falls Fishway & Trap to meet Fed and State criteria.	Group A Category 3	X	X	X	X	H- Improves passage at Lyle Falls. Adds monitoring and steelhead broodstock capabilities for a newly developed conservation/integrated hatchery program. Install video digital imagery and PIT tag detection equipment to monitor escapement. Allows collection of wild brood per prudent HSRG/ YKFP protocals.	Design 90% complete. EIS process underway (dEIS issued March 2008). Final EIS and Permitting 0.75 years away. Possible construction mid 2008(9). Steelhead return 3-4 years post implementation.
	Klickitat Fishery YKFP Design (Capital & Expense) & O&M	Klickitat Hatchery Upgrades to reprogram 120,000 Skamania to local origin	Group A Category 3	X	X		X	H - Upgrade existing Klickitat Hatchery infrastructure (circa 1949) to incorporate YKFP/HSRG hatchery reforms for new conservation/integrated steelhead hatchery program using optimal rearing densities, increased adult holding capacity. Benefits allow for phased elimination of Skamania hatchery stock, which will help improve the native stock productivity, while continuing economically vital sports harvest in local community.	Preliminary Assessment completed. Final design, EIS, and permitting within 1.5 years. Full construction over a period of 3 years. Infrastructure to initiate test of initial phase (10+ wild steelhead) anticipated within 2 years. Steelhead return 3-4 years post implementation.
	Klickitat Fishery YKFP Design (Capital & Expense) & O&M	Castile Trap & Counting Station: Construct Castile Falls Counting Station and Trap in newly re-constructed Castile Falls Fishway; Install video digital imagery and PIT tag detection equipment to monitor escapement		X	X	X		H- Augments broodstock collection from Lyle Falls for 1^{st} and 2^{nd} phase of steelhead conservation/integrated hatchery program. Recent fishway improvements at Castille Falls opens apprx. 50 miles of high quality spawning and rearing habitat which will increase abundance and spatial structure.	Design 90% complete. BPA completing NEPA - Categorical Exclusion by 6/07. Tribal water code permits 2-mths. Construction of structure and PIT antenna approximately 4-mths. Steelhead return 3-4 years post implementation.

Upper Yakima & Naches	**Yakima steelhead - acclimation facilities (Capital and O&M)**	Construct acclimation sites adjacent to habitat improvement areas of emphasis and in tributaries where passage problems have been alleviated	Group A Category 4	X	X	X		M - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement and in areas where tributary access has been restored	Acclimation sites may be subject to permitting; NOH adults return within 5 yrs of funding, F2 natural smolts emigrate within 7 yrs of funding.
	Program coordination & administration	Program coordination, administration, and data management functions for program implementation	Group A Category1						
	Recondition Wild Steelhead Kelt (and Evaluate their reporductive success)	Continue kelt reconditioning program and investigate reproductive success	Group A Category1	X	X		X	H - reduces high mortalities on repeat spawners and may rapidly increase abundance & productivity of natural spawning population	On-going pilot program. Annual escapements bolstered by 3-5% based on results to date. Long term benefits to be determined from reproductive success study. Study results available in two years for smolt production from reconditioned spawers and 5 years for adult returns.
Umatilla River	**Umatilla Fish Passage Operations*; Umatilla Hatchery Satellite Facilites O&M****	Collect and transport broodstock (*), and provide eggs and acclimate smolts (**) for current program that uses local broodstock to produce 150,000 smolts released at three locations in the mid/upper Umatilla Subbasin		X	X	X	X	H - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions. Also provides significant in-basin harvest.	Ongoing
Walla Walla River	**Walla Walla Steelhead Supplementation Hatchery O&M**	Initiate local broodstock program of 50K smolts - 25K direct stream released in both upper Walla Walla River and Mill Ck		X	X	X	X	H - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions.	Brood could be collected in 2008. F1 returns would begin in 2011, F2 natural smolt emigration would begin in 2013.

Upper Columbia Spring Chinook ESU Hatchery Benefits Summary									
Wenatchee River	**Wenatchee spring Chinook - Chiwawa River & Nason Ck acclimation - operate acclimation facilities (Capital & OM)**	Construct semi-natural acclimation sites in upper Chiwawa River and upper Nason Creek in coordination with anticipated habitat improvements.	Supplementation Group A Category 3	X		X		M- Important in maximizing utilization of available spawning habitat in these 2 basins. Will also enhance spatial structure.	Acclimation sites may be subject to permitting; Adults return within 5 yrs of funding, F2 natural smolts emigrate within 7 yrs of funding.
	Wenatchee spring Chinook - Peshastin 100K smolts - operate acclimation facility (Capital & OM)	Develop incubation and rearing for 100k smolts to be released from acclimation sites in Peshastin Creek in coordination with habitat actions. Collect broodstock at Tumwater Dam or Peshastin Cr.	Supplementation Group B Category 3	X		X	X	M- Important in maximizing utilization of available spawning habitat. Will enhance spatial structure and diversity by restoring production to vacant habitat. 100-1,000 natural spawners at current SARs.	Incubation and rearing may be available currently; otherwise, construction could take two years. Acclimation sites may be subject to permitting; Adults return within 5 yrs of funding, F2 natural smolts emigrate within 7 yrs of funding.
	Upper Columbia spring Chinook - nutrient supplementation	Use nutrient analogs in upper watershed.	Group A Category 3	X	X			L - low-cost method to increase food production; intended to increase egg-smolt survival	Improves overwinter survival of juveniles. Can be implemented immediately, benefits accrue immediately.
	Wenatchee spring Chinook - Little Wenatchee 150K smolts - operate (Capital & OM)	Develop incubation and rearing for 150k smolts to be released from acclimation sites in Little Wenatchee River.	Supplementation Group B Category 3	X		X	X	M- Important in maximizing utilization of available spawning habitat. Will enhance spatial structure and diversity by restoring production to vacant habitat. 150-1,500 natural spawners at current SARs.	Incubation and rearing may be available currently; otherwise, construction could take two years. Acclimation sites may be subject to permitting; Adults return within 5 yrs of funding, F2 natural smolts emigrate within 7 yrs of funding.
Entiat River	**Upper Columbia spring Chinook - nutrient supplementation**	Use nutrient analogs in upper watershed.	Group B Category 4	X	X			L - low-cost method to increase food production; intended to increase egg-smolt survival	Improves overwinter survival of juveniles. Can be implemented immediately, benefits accrue immediately.

Methow River	**Methow spring Chinook - Methow, Twisp, Chewuch acclimation - operate facilities (Capital & OM)**	Construct semi-natural acclimation sites adjacent to habitat improvement areas of emphasis in the upper Methow, Twisp, and Chewuch watersheds.	Group B Category 3	X	X	X		M - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions.	Acclimation sites may be subject to permitting; NOH adults return within 5 yrs of funding, F2 natural smolts emigrate within 7 yrs of funding.
	Upper Columbia spring Chinook - nutrient supplementation	Use nutrient analogs in upper watershed.	Group A Category 3	X	X			L - low-cost method to increase food production; intended to increase egg-smolt survival	Improves overwinter survival of juveniles. Can be implemented immediately, benefits accrue immediately.
Upper Columbia Steelhead ESU Hatchery Benefits Summary									
Wenatchee River	**Wenatchee steelhead - Wenatchee, Peshastin, Chumstick, Mission acclimation - operate facilities (Capital & OM)**	Construct semi-natural acclimation sites adjacent to habitat improvement areas of emphasis in the upper Wenatchee watershed, Peshatin, Chumstick, and Mission creeks.	Group A Category 3	X	X	X		M - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions.	Acclimation sites may be subject to permitting; NOH adults return within 5 yrs of funding, F2 natural smolts emigrate within 7 yrs of funding.
	Upper Columbia Steelhead Kelt Reconditioning	Develop kelt reconditioning program using RID, PRD and wild broodstock collections.	Group A Category 4	X			X	H - reduces high mortalities on repeat spawners and may rapidly increase the abundance of natural spawners in the natural escapement	200 wild kelts taken at RIS, PRD, and recovered after use as broodstock may produce 175-575 wild adult offspring at current SARs.
	Upper Columbia steelhead - nutrient supplementation	Use nutrient analogs in upper watershed.	Group A Category 3	X	X			L - low-cost method to increase food production; intended to increase egg-smolt survival	Improves overwinter survival of juveniles. Can be implemented immediately, benefits accrue immediately.
Entiat River	**Upper Columbia Steelhead Kelt Reconditioning**	Reprogram Entiat NFH to support UCR kelt reconditioning.	Group A Category 2	X			X	H - reduces high mortalities on repeat spawners and may rapidly increase the abundance of natural spawners in the natural escapement	200 wild kelts taken at RIS, PRD, and recovered after use as broodstock may produce 175-575 wild adult offspring at current SARs.

	Upper Columbia steelhead - nutrient supplementation	Use nutrient analogs in upper watershed.	Group A Category 3	X	X			L - low-cost method to increase food production; intended to increase egg-smolt survival	Improves overwinter survival of juveniles. Can be implemented immediately, benefits accrue immediately.
Methow River	**Upper Columbia Steelhead Kelt Reconditioning**	Develop kelt reconditioning program using Wells and RRD broodstock collections.	Group A Category 3	X			X	H - reduces high mortalities on repeat spawners and may rapidly increase the abundance of natural spawners in the natural escapement	100 wild kelts collected at Wells, RRD, and recovered from broodstock may produce 85-290 wild adult offspring at current SARs.
	Methow steelhead - Methow, Twisp, Chewuch acclimation (Capital and O&M)	Construct semi-natural acclimation sites adjacent to habitat improvement areas of emphasis in the upper Methow, Twisp, and Chewuch watersheds.	Group A Category 3	X	X	X		M - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions.	Acclimation sites may be subject to permitting; NOH adults return within 5 yrs of funding, F2 natural smolts emigrate within 7 yrs of funding.
	Methow steelhead - reprogram Winthrop for release of 100k smolts in upper watershed	Reprogram Winthrop NFH on-station release of 100k smolts to acclimated releases in upper watershed	Group B Category 1	X		X		M - distributes hatchery production to natural habitats; increases natural spawner abundance, spatial diversity, and potential for local adaptation.	Adults return to spawning grounds within 1-3 yrs of release; F2 natural smolts emigrate within 5 yrs of initial action.
	Upper Columbia steelhead - nutrient supplementation	Use nutrient analogs in upper watershed.	Group A Category 3	X	X			L - low-cost method to increase food production; intended to increase egg-smolt survival	Improves overwinter survival of juveniles. Can be implemented immediately, benefits accrue immediately.
Snake River Spring Chinook ESU Hatchery Benefits Summary									

Upper Grande Ronde	**Snake River Safety Net Program**	Initiate a small scale "safety net" program for these three individual stocks in order to provide a production source in extreme low run years	New project - Not in Coarse Screen list	X		X	X	H - these two populations experienced conditions which necessitated implementation of captive broodstock programs in the 90's and have a TRT A/P rating of "High Risk". By maintaining a small scale captive brood program with each of these stocks it would provide an immediate production source in case run levels return to those observed in the 90's.	All three of these stocks have ongoing captive brood programs associated with them but are in various stages of being phased out. Maintain captive programs at the 100 fish/brood year level.
	Grande Ronde Supplementation Operations and Maintenance	Assist in captive brood par collection and provide in-basin smolt acclimation for partnership project that continues captive broodstock smolt production for Upper Grande Ronde and Catherine Creek until phased out by comanagers.	Safety Net - Group A, Category 2	X		X	X	H - Important to sustaining population and increasing abundance. Benefit is to ESA listed population. This population is at high risk of extinction with low productivity and abundance.	During term of BiOp - First release of juveniles in 2000. F1 return in 2002, F2 adults begin return in 2006-07
	Grande Ronde Supplementation Operations and Maintenance	The MOA Project provides a critical element of the overall actions benefitting this population by collecting broodstock and providing in basin smolt acclimation for partnership project that continues conventional broodstock smolt production for Upper Grande Ronde.	Supplementation - Group A, Category 2	X		X	X	H - Important to sustaining population and increasing abundance. Benefit is to ESA listed population. Increases abundance of fish spawning naturally. Operates weir for collection of conventional broodstock (hatchery and natural) and acclimation facility for juveniles.	During term of BiOp - First release of juveniles in 2000. F1 adults began returning in 2002. F2 adults begin return in 2006-07.

	Grande Ronde Supplementation Operations and Maintenance	The MOA Project provides a critical element of the overall actions benefitting this population by collecting broodstock and providing in basin smolt acclimation for partnership project that implements NEOH.	Supplementation - Group A, Category 3	X		X	X	L to M - increases abundance of UGR production by 10,000. Improves hatchery rearing environment. This project will improve rearing conditions by freeing up space at Lookingglass Hatchery - fish will no longer have to be transported to Bonneville, Irrigon for rearing. Rearing of captive broodstock progeny will also benefit. Increases abundance of fish spawning naturally.	During term of BiOp - Construction complete by 2009. BY09 would return F1 adults in 2013. F2 adults would return in 2015-17
Catherine Creek	**Snake River Safety Net Program**	Initiate a small scale "safety net" program for these three individual stocks in order to provide a production source in extreme low run years	New project - Not in Coarse Screen list	X		X	X	H - these two populations experienced conditions which necessitated implementation of captive broodstock programs in the 90's and have a TRT A/P rating of "High Risk". By maintaining a small scale captive brood program with each of these stocks it would provide an immediate production source in case run levels return to those observed in the 90's.	All three of these stocks have ongoing captive brood programs associated with them but are in various stages of being phased out. Maintain captive programs at the 100 fish/brood year level.
	Grande Ronde Supplementation Operations and Maintenance	Assist in captive brood par collection and provide in-basin smolt acclimation for partner project that continues captive broodstock smolt production for Upper Grande Ronde and Catherine Creek until phased out by comanagers.	Safety Net - Group A, Category 2	X		X	X	H - increases abundance of integrated population and fish spawning naturally, lowers risk of extinction. Benefit is to ESA listed population. This population is at high risk of extinction with low productivity and abundance.	During term of BiOp - First release of juveniles in 2000. F1 return in 2002, F2 adults begin return in 2006-07.

	Grande Ronde Supplementation Operations and Maintenance	The MOA Project provides a critical element of the overall actions benefitting this population by collecting broodstock and providing in basin smolt acclimation for partnership project that implements NEOH.	Supplementation - Group A, Category 3	X		X	X	L to M - increases abundance of CC production by 10,000. Improves hatchery rearing environment. This project will increase production for Lostine stock, improve survival in hatchery rearing environment and keep all rearing of stock in natal basin - instead of being shipped to Bonneville, Irrigon, Lookingglass and back to Lostine. Rearing of captive broodstock progeny will also benefit. Increases abundance of fish spawning naturally.	During term of BiOp - Construction complete by 2009. BY09 would return F1 adults in 2013. F2 adults begin return in 2015-17
	Grande Ronde Supplementation Operations and Maintenance	The MOA Project provides a critical element of the overall actions benefitting this population by collecting broodstock and providing in basin smolt acclimation for partnership project that continues conventional broodstock smolt production for Catherine Creek.	Supplementation - Group A, Category 2	X		X	X	H - increases abundance of integrated population and fish spawning naturally, lowers risk of extinction. Benefit is to ESA listed population. Increases abundance of fish spawning naturally. Operates weir for collection of conventional broodstock (hatchery and natural) and acclimation facility for juveniles.	During term of BiOp - First release of juveniles in 2000. F1 return in 2002, F2 adults begin return in 2006-07.

Lookingglass Creek	**Grande Ronde Supplementation Operations and Maintenance**	The MOA Project may contribute to the overall actions benefitting this population by collecting broodstock for this partnership progam that implements NEOH. NEOH will include about 400,000 more smolts for total program of 1.4M and implements operational improvements that improve hatchery survival. Target use of up to 250,000 of these hatchery parr/smolts for use into Lookingglass Creek using Catherine Creek stock. Constructs new hatchery on Lostine River, modifies Lostine River weir and modifies Imnaha satellite facility.	Supplementation - Group A, Category 3	X		X	X	H - increases abundance of integrated population and fish spawning naturally, reintroduction of Lookingglass population - increases spatial structure of MPG. Increases production 250,000 smolts. Benefit is to ESA listed MPG - reintroduction and restoration of functionally extirpated population.	D - Construction complete by 2009. BY09 would return F1 adults in 2013. F2 adults begin return in 2015-17
Snake River Steelhead ESU Hatchery Benefits Summary									
Average "B" population									
Average "A" population									
	Snake River Kelts (Capital & Expense)	Expand the kelt reconditioning program and research activities into the Snake River	Group A Category1	X	X		X	H - reduces high mortalities on repeat spawners and may rapidly increase abundance & productivity of natural spawning population. Maintains the natural life-history trait.	Based on the on-going Yakima River pilot program results. Annual escapements improvements are estimated at 3-5% . Long term benefits to be determined from reproductive success study.
Snake River Fall Chinook ESU Hatchery Benefits Summary									

Snake River	**Snake River fall Chinook - modify ponds @ Lyons Ferry to improve adult holding**	Modify adult holding ponds at Lyons Ferry Hatchery to increase fall Chinook brood holding capacity and flexibility. LSRCP program. Supported by local co-managers. Submitted by Umatilla.	Group A, Category 3					Facility improvement - should increase hatchery survival. Benefit is to ESA listed population and survival benefits could help achieve mitigation goals	During term of BiOp
Non-ESA Species									
Mid Columbia Spring Chinook ESU Hatchery Benefits Summary									
Klickitat River	**Klickitat Fishery YKFP Design (Capital & Expense) & O&M**	Integrate hatchery reform measures using local broodstock of Spring Chinook		x		x		Integrated spring Chinook production will increase abundance of natural spawwners, associated ecological benefits, and Harvest. Recent fishway improvements at Castille Falls opens apprx. 50 miles of high quality spawning and rearing habitat which will increase abundance and spatial structure.	
Deschutes River	**White River Supplementation program (spring Chinook)**	Raise approx. 300k smolts at WSNFH. Acclimate and release at one site in White River. Assume a SAR of 0.03%	Group B Category 3	X		X		M- Produces 500-1,000 fish for tribal harvest	Acclimation sites may require 2 years for permitiing and construction. Will require construction of additional raceways at WSNFH
Umatilla River	**Umatilla Fish Passage Operations*; Umatilla Hatchery Satellite Facilites O&M****	Collect and transport broodstock (*), and provide eggs and acclimate smolts (**) for current program that uses local broodstock to produce 810,000 smolts released into the upper Umatilla Subbasin		X	X	X	X	H - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions. Also provides significant in-basin harvest.	Ongoing

Walla Walla River	**NEOH Walla Walla Hatchery - Three Step Master Planning Process (capital); NEOH Walla Walla Hatchery - Three Step Master Planning Process (expense); NEOH Walla Walla Hatchery - Three Step Master Planning Process (O&M beginning in 2011); Umatilla Hatchery Satellite Faclities O&M***	Increase CHS program form 250K to 500K - build SFWW Hatchery and transfer program from LWS. Provide eggs and smolt acclimation for program once established (*)		X	X	X	X	H - enhances reintroduction effort for CHS in the Walla Walla Basin by increasing hatchery production available for natural spawning in near pristine habitat that is under seeded. Also anticipate an increase in SARs over existing out of basin direct stream release program by rearing fish in basin at a high water quality facility.	The WW Hatchery Master Plan has identified 2011 as the completion date for the hatchery. Brood year 2011 fish would be released in 2013 with adults returning from 2014-2016.
Columbia River Fall Chinook ESU Hatchery Benefits Summary									
Klickitat River	**Klickitat Fishery YKFP Design (Capital & Expense) & O&M**	of fall Chinook for a segregated hatchery program and transition releases releases into the lower basin to protect high quality spawning and rearing habitat in the mid basin for native spring chinook and steelhead.		x				Fall Chinook rearing and release at WHAF will reduce species interactions and ecological impacts on natural steelhead and spring chinook populations from harvest augmentation production	Transitioned in in later years.
Lower Yakima	**Yakima fall Chinook - JDM move 1.7M URBs from PR to Prosser - operate**	Move 1.7m URB in JDM program from Priest Rapids Hatchery to the Prosser Hatchery and Acclimation Facility	Group B Category 4					Provides proven hatchery facility above McNary Dam to take over John Day Mitigation program that must be removed from PRH when new FERC license issued to Grant Co. PUD.	Immediate

Lower Columbia River Chinook (Bonneville Pool Hatchery Fall Chinook) and Mid-Columbia Upriver Bright Fall Chinook	**John Day Reprogramming and Construction**	This project includes tribal participation in a multibenefit strategy for Columbia River fall Chinook production, ESA hatchery reform, and hydrosystem management including planning, improvements and operations needed to reprogram production at Spring Creek, Little White and Bonneville hatcheries and transition to long term in-place in-kind actions to mitigate impacts of spawning habitat lost from construction of John Day and The Dalles dams.	Group A Category 3	X	X		X	Because BPH Fall Chinook are the most representative of the historical Columbia Gorge tule population whose habitats were inundated by mainstem dams, preserving their genetic resources is an important function of these programs.	Immediate
Umatilla River	**Umatilla Fish Passage Operations*; Umatilla Hatchery Satellite Facilites O&M****	Collect and transport broodstock (*), and provide eggs and acclimate smolts (**) for current program that uses local broodstock to produce 480,000 1+ and 600,000-age smolts released at three locations in the mid/upper Umatilla Subbasin		X	X	X	X	M - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions. Also provides in-basin harvest.	Ongoing
Lower Columbia River Coho Salmon									
Klickitat River	**Klickitat Fishery YKFP Design (Capital & Expense) & O&M**	Construct the Wahkiacus Hatchery and Acclimation Facility (WHAF)	Group A Category 1				X	M - Providing acclimation site for 1M coho smolts released pursuant to US v OR agreements will reduce identified straying problem into the lower river ESU by increasing homing fidelity to Klickitat River.	Design 60% complete. NOAA BA complete. Portion of water right obtained. Final design and NEPA permitting 1.5 years away. Construction 2.5 years away.
Mid/ Upper Columbia River Coho Salmon									

Umatilla River	**Umatilla Hatchery Satellite Facilites O&M**	Acclimate smolts(*) for current program produces 1,500,000 smolts released into the mid Umatilla Subbasin		X	X	X	X	M - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions. Also provides in-basin harvest.	Ongoing
Upper Yakima River-Naches River	**Yakima coho production facility (Constructin and O&M)**	Construct one small scale satellite watershed hatchery, with facilities capable of rearing 300,000 coho pre-smolts.	Not reviewed - new project	X		X	X	H - distributes hatchery production to natural habitats capable of supporting natural spawning in conjunction with habitat improvement actions. By having a small satellite facility, coho would be raised from egg to smolt on Upper Yakima River water thus possibly increasing adult returns with full acclimation covering all life stages	Acclimation sites may be subject to permitting; NOH adults return within 18 months. Funding benefit would be realized immediately. Construction in one year, raise fish to smolt the second year and first adult return 3 year.
	Yakima/Naches coho - mobile acclimation units (Capital and O&M)	Develop and deploy a series of small mobile acclimation units capable of holding up to 10,000 coho smolts for up to 4 weeks adjacent to small tributaries	Not reviewed - new project	X		X	X	H - Ability to use mobile acclimation on small tributaries would utilize the higher smolt to smolt and smolt to adult survival for adult spawners. This would be a stream seeding proposal used for 3 generations in each target tributary.	10,000 coho smolts released at each site may produce up to 120 returning adults using current 1.2% SAR for hatchery coho.
	Yakima/Naches coho - nutrient supplementation	Utilize hatchery carcasses to increase productivity in spawning/rearing tributaries.	Not reviewed - new project	X	X			H- Low-cost method to increase food production; intended to increase egg-smolt survival in areas where marine-derived nutrients have been absent for up to 100 years.	Improves overwinter survival of juveniles. Can be implemented immediately, benefits accrue immediately.
	Yakima coho production marking	Mark hatchery smolts to exclude from broodstock as returning adults.	Not reviewed - new project		X		X	M - intended to prevent hatchery-line broodstock collection at upriver capture sites.	Feasibility study can be implemented immediately; results in first year. Program implementation immediate with immediate benefits.

Wenatchee River	**Mid Columbia Coho Restoration (Capital and O&M)**	Implement Broodstock Development Phase II of the Mid-Columbia Coho Restoration Master Plan	Group A Category 1	X	X	X	X	H- Encourage continued local adaptation of the broodstock by moving broodstock capture sites further upstream where stamina and run-timing constrains of the founding stock may be reaching their limits.	We expect the minimum duration of Broodstock Development Phase II to last 4 years. The actual time line will be influence by permitting, the rate of continued selection, and out-of basin factors beyond the control of this program.
	Mid Columbia Coho Restoration (Capital and O&M)	Implement Habitat Restoration Phase of the Mid-Columbia Coho Restoration Master Plan	Group A Category 3	X	X			Will seek funding and implement habitat improvement projects which are expected to improve productivity an capacity for coho salmon. This action will be closely coordinated with the implementation schedule being developed for the UCSRB.	The Habitat Improvement Phase is expected to last 10-15 years. The timeframe to realize the full extent of benefits is unknown but some benefits would be realized immediately.
	Mid Columbia Coho Restoration (Capital and O&M)	Implement the Natural Production Phases (Natural Production Implementation and Natural Production Support phases) of the Mid-Columbia Coho Restoration Master Plan	Group A Category 3	X	X	X	X	Hatchery coho will be introduced into habitat areas predicted by EDT to be the most successful for coho . The Natural Production Phases (Implementation and Support) will focus on decreasing domestication selection and increasing the fitness of Wenatchee coho in the natural environment through furthering local adaptation and naturalization. We will accomplish this through the steady increase of NORs in the broodstock and decrease in hatchery release numbers to ultimate achieve a PNI value greater than 0.50.	The duration of the Natural Production Implementation Phase will last three years. The duration of the Natural production Support Phase is unknown but expected to be no less than 4 generations (12 years)
Methow River	**Mid Columbia Coho Restoration (Capital and O&M)**	Complete Broodstock Development Phase I as described in the Mid-Columbia Coho Restoration Master Plan	Group A Category 1	X	X	X	X	H- This action is designed to develop a Methow broodstock from lower Columbia River coho so that they become increasingly adapted to the longer migration to the Methow River. This phase focuses on elimination reliance on lower Columbia stocks and transitioning to a local broodstock.	BDPI is currently ongoing, the expect duration until this phase is complete is three years.

	Mid Columbia Coho Restoration (Capital and O&M)	Implement Broodstock Development Phase II of the Mid-Columbia Coho Restoration Master Plan	Group A Category 3	X	X	X	X	H- Encourage continued local adaptation of the broodstock by moving broodstock capture sites further upstream where stamina and run-timing constrains of the founding stock may be reaching their limits.	duration of Broodstock Development Phase II to last 4 years. The actual time line will be influence by permitting, the rate of continued selection, and out-of basin factors beyond the control of this program. Benefits will accrue
	Mid Columbia Coho Restoration (Capital and O&M)	Implement Habitat Restoration Phase of the Mid-Columbia Coho Restoration Master Plan	Group A Category 3	X	X			Will seek funding and implement habitat improvement projects which are expected to improve productivity an capacity for coho salmon. This action will be closely coordinated with the implementation schedule being developed for the UCSRB.	The Habitat Improvement Phase is expected to last 10-15 years. The timeframe to realize the full extent of benefits is unknown but some benefits would be realized immediately.
	Mid Columbia Coho Restoration (Capital and O&M)	Implement the Natural Production Phases (Natural Production Implementation and Natural Production Support phases) of the Mid-Columbia Coho Restoration Master Plan	Group A Category 3	X	X	X	X	habitat areas predicted by EDT to be the most successful for coho . The Natural Production Phases (Implementation and Support) will focus on decreasing domestication selection and increasing the fitness of Wenatchee coho in the natural environment through furthering local adaptation and naturalization. We will accomplish this through the steady increase of NORs in the broodstock and decrease in hatchery release numbers to ultimate achieve a PNI value greater than 0.50.	The duration of the Natural Production Implementation Phase will last three years. The duration of the Natural production Support Phase is unknown but expected to be no less than 4 generations (12 years)
Sturgeon									

The Dalles Reservoir	**Sturgeon Master Planning (Capital and Expense)**	Provides for releases of yearling hatchery white sturgeon in years of poor/absent natural recruitment	N/A	X	X		X	Augments natural production to provide for continued recruitment to broodstock and stable recruitment to tribal and sport fisheries.	Likely 3-5 years of Master Planning and associated construction efforts necessary prior to initial year of production. Additional 15-20 years of growth by at large fish for fishery benefits and 25+ years for broodstock recruitment.
John Day Reservoir	**Sturgeon Master Planning (Capital and Expense)**	See above The Dalles	N/A	X	X		X	Augments natural production to provide for continued recruitment to broodstock and stable recruitment to tribal and sport fisheries.	See above
McNary Reservoir	**Sturgeon Master Planning (Capital and Expense)**	See above The Dalles	N/A	X	X		X	Augments natural production to provide for continued recruitment to broodstock and stable recruitment to tribal and sport fisheries.	See above
Ice Harbor Reservoir	**Sturgeon Master Planning (Capital and Expense)**	See above The Dalles	N/A	X	X		X	Augments natural production to provide for continued recruitment to broodstock and stable recruitment to tribal and sport fisheries.	See above
Lower Monumental Reservoir	**Sturgeon Master Planning (Capital and Expense)**	See above The Dalles	N/A	X	X		X	Augments natural production to provide for continued recruitment to broodstock and stable recruitment to tribal and sport fisheries.	See above
Little Goose Reservoir	**Sturgeon Master Planning (Capital and Expense)**	See above The Dalles	N/A	X	X		X	Augments natural production to provide for continued recruitment to broodstock and stable recruitment to tribal and sport fisheries.	See above
Mid Columbia Reservoirs	**Sturgeon Management**	YN effort coordinated with CRITFC sturgeon project. Provides for releases of yearling hatchery white sturgeon in Mid C reservoirs in years of poor/absent natural recruitment	N/A	X	X		X	Augments natural production to provide for continued recruitment to broodstock and stable recruitment to tribal and sport fisheries.	See above
Note: Associated RME Projects have not been identified in the above tables									

ATTACHMENT H
IN LIEU REQUIREMENTS

MEMORANDUM OF AGREEMENT AMONG THE UMATILLA, WARM SPRINGS AND YAKAMA TRIBES, BONNEVILLE POWER ADMINISTRATION, U.S. ARMY CORPS OF ENGINEERS, AND U.S. BUREAU OF RECLAMATION

I. INTRODUCTION

The Bonneville Power Administration (BPA), the U.S. Army Corps of Engineers (Corps) and the U.S. Bureau of Reclamation (Reclamation)(the "Action Agencies") and the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes and Bands of the Yakama Nation, and the Columbia River Inter-Tribal Fish Commission (CRITFC) ("the Tribes" or "the Treaty Tribes") (collectively "the Parties") have developed this Memorandum of Agreement ("Agreement" or "MOA") through good faith negotiations. This Agreement addresses direct and indirect effects of construction, inundation, operation and maintenance of the Federal Columbia River Power System[1] and Reclamation's Upper Snake River Projects,[2] on fish resources of the Columbia River Basin.[3] The Action Agencies and the Tribes intend that this Agreement provide benefits to all the Parties. Reasons for this Agreement include the following:

To resolve issues between the Parties regarding the Action Agencies compliance with the Endangered Species Act ("ESA") regarding these FCRPS and Upper Snake Projects;

- To resolve issues between the Parties regarding compliance with the Pacific Northwest Electric Power Planning and Conservation Act ("NWPA") and the Clean Water Act ("CWA");

- To address the Parties' mutual concerns for certainty and stability in the funding and implementation of projects for the benefit of fish affected by the FCRPS and Upper Snake Projects, affirming and adding to the actions proposed in the draft FCRPS and Upper Snake Biological Opinions; and

- To foster a cooperative and partnership-like relationship in implementation of the mutual commitments in this Agreement.

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[1] For purposes of this Agreement, the FCRPS comprises 14 Federal multipurpose hydropower projects. The 12 projects operation and maintained by the Corps are: Bonneville, the Dalles, John Day, McNary, Chief Joseph, Albeni Falls, Libby, Ice Harbor, Lower Monumental, Little Goose, Lower Granite, and Dworshak dams. Reclamation operates and maintains the following FCRPS projects: Hungry Horse Project and Columbia Basin Project, which includes Grand Coulee Dam.
[2] The Upper Snake River Projects (Upper Snake) are Minidoka, Palisades, Michaud Flats, Ririe, Little Wood River, Boise, Lucky Peak, Mann Creek, Owyhee, Vale, Burnt River and Baker.
[3] This Agreement does not comprehensively address impacts to wildlife from the construction and operations of the FCRPS and Upper Snake Projects. See Section IV terms related to wildlife.

II. HYDRO COMMITMENTS

A. Hydro Performance

A.1. Performance Standards, Targets, and Metrics:

The Tribes concur in the use of the hydro performance standards, targets, and metrics as described in the Main Report, Section 2.1.2.2. of the Action Agencies' August 2007 Biological Assessment (pages 2-3 through and 2-6) and the draft FCRPS BiOp at RPA No. 51 (pages 63-64 of 85). Provided that, the Tribes and their representatives may recommend to the Action Agencies actions that may exceed performance standards, which will be considered and may be implemented at the discretion of the Action Agencies.

A.2 Performance and Adaptive Management:

The Parties agree that the BiOps will employ an adaptive management approach, including reporting and diagnosis, as described in Section 2.1 of the Biological Assessment. The Parties agree that if biological or project performance expectations as described above are not being met over time as anticipated, diagnosis will be done to identify causes, and remedies will be developed to meet the established performance standard. The performance standard for species or the federal projects will not be lowered during the terms of the BiOps, (although as provided in the BA, tradeoffs among Snake River and lower river dams are allowed). In addition the Parties agree that the current delay and SPE metrics described in Attachment A will not be lowered unless they impede survival.

The Parties recognize that new biological information will be available during the term of the MOA that will inform the methods and assumptions used to analyze the effects of hydro operations on fish species covered by this agreement. The Parties will work together to seek agreement on methods and assumptions for such analyses, building on analyses performed in development of the FCRPS Biological Opinion as warranted.

As described in the FCRPS BiOp, a comprehensive review will be completed in June, 2012 and June, 2015 that includes a review of the state of implementation of all actions planned or anticipated in the FCRPS and Upper Snake BiOps and a review of the status and performance of each ESU addressed by those BiOps. The Parties agree that they will jointly discuss the development, analyses and recommendations related to these comprehensive evaluations and, in the event performance is not on track, to discuss options for corrective action. This coordination between the Parties is in addition to any coordination that the Action Agencies do with additional regional entities.

John Day Pool Operations

The Action Agencies will meet with the Tribes in the near-term to discuss relevant existing hydraulic and biological information to better understand the biological benefits and/or detriments associated with John Day reservoir operations. JDA MOP is a contingency and so may be decided as a product of the 2015 comprehensive review.

A.3. Research, Monitoring, and Evaluation.

Maintaining and improving research, monitoring, and evaluation programs is critical to informed decision making on population status assessments and improving management action effectiveness. The Action Agencies will implement status and effectiveness research, monitoring and evaluation sufficient to robustly track survival improvements and facilitate rebuilding actions accomplished, in part, through projects and programs identified in Attachment B. The Parties further agree that the Action Agency effort should be coordinated with implementation partners including other fishery managers.

The Tribes rely heavily on the services of the Fish Passage Center, an organization which the Tribes were instrumental in creating. BPA agrees to provide funding to maintain the Fish Passage Center to provide evaluation resources required by the Tribes, as set forth at Section IID.

B. Spring spill/transport

The Parties agree to the initial spill and transportation protocols set out in the draft BiOp with one exception: the Parties have agreed to an adjustment of the initial transportation protocols in order to benefit adult returns of Group B steelhead, while also taking into account spring and fall Chinook.

Initial Transportation Plan

When flows are less than 65 KCFS[4], full transport (no voluntary spill or bypass provided except as needed for research purposes) will be initiated at the Snake River collector projects from April 3 through early June. Summer spill will commence at collector projects when subyearling numbers exceed 50% of the sample at each of the collector projects for a 3 day period after June 1. This low flow transport strategy is unchanged from the draft FCRPS BiOp

When flows are greater than 65 KCFS[1], spill will begin on April 3, 5, and 7 at LGR, LGS, and LMN dams (all fish to remain in-river until April 21 when collection and transport will begin) and continue through May 6 consistent with the draft FCRPS BiOp. From May 7 through May 20 full transport (no voluntary spill or bypass provided except as needed for research purposes) will be initiated at the Snake River collector projects with spring spill and transport operations resuming May 21 and continuing through early June. Summer spill will commence at collector projects when subyearling numbers exceed 50% of the sample at each of the collector projects for a 3 day period after June 1.

All other transport protocols shall be consistent with the draft FCRPS BiOp.

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[4] The seasonal average flow projection will be based on the Corps' STP model and the April final forecast (late March report).

The Parties agree that this transportation adjustment is part of the broader Group B steelhead package that is based on the best available scientific information and is aimed at addressing both FCRPS and *US v. Oregon* objectives. The spill reduction component of this package is the "action of last resort." The Action Agencies agree to fund the implementation of the actions included as part of the Group B steelhead survival improvement package, Attachment C, with specific projects and budgets identified in Attachment B.

Through the adaptive management provisions of the BiOp and otherwise as consistent with the provisions of Section IV of this Agreement, the Parties will review the transportation protocols taking into account new information concerning adult returns, in-river and transportation SARs, and model results. If new information indicates a modified transportation protocol is warranted, adaptive management will be used to make the appropriate adjustments in timing and triggers for transportation, recognizing that spring spill reduction is the "action of last resort". This transport operation would result in a reduction in spring spill compared to the 2006 through 2008 operation. The Group B steelhead survival improvement package is Attachment C.

C. Summer spill

The Parties agree to support the following alternative, based on the summer spill approach described in the draft FCRPS BiOp, recognizing that the alternative would not be implemented until the 2009 season:

> Beginning August 1, curtailment of summer spill may occur first at Lower Granite Dam if subyearling Chinook collection counts fall below 300 fish per day for 3 consecutive days (beginning July 29, 30, and 31 for August 1 curtailment). Using the same 300 fish criterion, the curtailed spill would then progress downstream with each successive dam on the Snake River, with spill at LGS ending no earlier than 3 days after the termination of spill at LGR, and ending at LMN no earlier than 3 days after the termination of spill at LGS assuming the 300 fish criterion has been met at those projects. Spill would be curtailed at IHR no earlier than 2 days after LMN, without use of the 300 fish criterion.
>
> Spill will end at 0600 hours on the day after the necessary curtailment criteria are met. If after cessation of spill at any one of the Snake River projects on or after August 1, subyearling Chinook collection counts again exceed 500fish per day for two consecutive days, spill will resume at that project only. Thereafter, fish collection count numbers will be reevaluated daily to determine if spill should continue using the criteria above (300 fish per day) until August 31.

As this new program is implemented, the Parties will continue to gather data and investigate at least the following issues:

- Adult returns;
- Juvenile passage timing;
- Juvenile fall Chinook salmon life-history diversity traits (i.e. subyearling and yearling emigration attributes);

- Other as agreed to.

The Parties acknowledge that this summer spill is supported by currently available information, and that the operation will be reviewed and may be adjusted to take into account more recent information through the adaptive management provisions of the BiOp and otherwise consistent with the provisions of Section IV of this Agreement. If new information indicates support for a change in timing or triggers to accomplish anticipated coverage of the run (e.g. not a substantially lower percentage of the run as compared to 2005 to 2007 for Snake River fall Chinook), adaptive management and the provisions of Section IV of this Agreement will be used to consider the appropriate adjustments.

D. Monitoring and Verification; Fish Passage Center

The Action Agencies acknowledge that the Tribes' ability to monitor and verify performance of the FCRPS under the BiOps is essential to their participation in this MOA, and the Action Agencies support such monitoring and verification and will so state in any forum.

The Parties agree that monitoring and verification functions are currently provided via funding for the Fish Passage Center. BPA will continue funding the Fish Passage Center with funds for a manager and for technical and clerical support in order to perform the functions of the Center as stated in the Council's 2003 Mainstem Amendment, for the duration of this MOA unless the Parties agree on an alternative. If the Council changes the Fish Passage Center responsibilities in Program amendments, BPA would consult with the Tribes in advance about what changes BPA would propose, if any, in response to ensure BPA's continued funding is done in a manner consistent with the terms of this Agreement, the Program and Ninth Circuit case law. If a change in Center functions impacts the Tribes' ability to monitor and verify performance of the FCRPS BiOp or this Agreement, BPA would provide funding to the Tribes or an agreed-upon alternative to continue this work.

E. Spring Creek Hatchery Releases

Spring Creek Hatchery commitments are described in Attachment D. The Parties agree that their common priority is to modify Spring Creek Hatchery production so that the early hatchery releases and spill at Bonneville Dam are unnecessary. Consistent with Section IV, the Parties commit to affirmatively support these commitments in appropriate forums.

F. Status of the Lyon's Ferry production program

The parties to *US v. Oregon* have agreed to monitor the Lyon's Ferry production program over the term of the 10-year *US v. Oregon* management plan. Any *US v. Oregon* party may propose changes to that program by invoking the modification provisions of the *US v. Oregon* management plan. The Action Agencies understand that that Tribes' willingness to accept spill operations as outlined above is directly related to their expectation that the Lyon's Ferry production program remains stable and substantially unaltered than as currently designed for the term of this Agreement. Should that fundamental expectation be upset, the Tribes will consider this a material change and grounds for withdrawal from the Agreement, and may, after notice to the Action Agencies, advocate for spill actions that deviate from those contemplated in this Agreement, using the dispute resolution procedures under Section IV.F. Tribal advocacy for spill actions outside the dispute resolution procedures may be considered by the Action Agencies a material change that would trigger withdrawal.

G. Flow Actions (including flow surrogates)

The Parties agree to the following actions in addition to those in the draft FCRPS BiOp:

- Improve forecasting methods and tools to optimize reservoir use for fish operations, see Attachment E.
- Federal Government coordination with Tribes on objectives and strategies for Treaty/Non-Treaty water negotiations; see Attachment F
- Libby/Hungry Horse Operations -- Implementation of the Libby/ Hungry Horse Operations as described in the 2003 Council Mainstem Amendments and the Draft FCRPS BiOp for modifications to the storage reservoirs in Montana.

H. Lamprey protection

The Parties understand that the Pacific Lamprey is a species of fish that is significant to the well-being of the Tribes, who use these fish for food and medicine. Lamprey abundance has diminished in the Columbia Basin in the last 30 years and this diminishment is of high concern to the Parties. The Parties agree to undertake the actions to protect lamprey described below and in Attachment B.

The Parties will work together to combine Action Agencies, Tribal, and other agency lamprey actions into a comprehensive lamprey improvement program. Beginning in 2008, the Parties and the Tribes will meet periodically to discuss the lamprey implementation and funding issues including priorities and impediments.

The Parties agree that being proactive for lamprey is critical to seek to avoid ESA listing. The Tribes' commitments to forbearance regarding lamprey as described in Section IV.B are contingent on good faith implementation of the actions described in this lamprey section of this Agreement.

Material modifications of the lamprey implementation and related funding under Section II.H may, after resort to the Dispute Resolution provisions, result in modification of the Forbearance provision regarding lamprey.

Bonneville Power Administration

BPA will fund the Tribal projects for Pacific Lamprey identified in Attachment B, with a total overall programmatic commitment of $1.866 M/yr for lamprey projects. This funding commitment is made with the recognition that lamprey funding may be adjusted between fiscal years in a manner consistent with Section III.F.4, so long as the total funding does not exceed $18.66 million (unadjusted for inflation) except as the Parties may agree otherwise.

Corps of Engineers

In accordance with Section IV.D., the Tribes and the Corps will rank Pacific Lamprey items within the Columbia River Fish Mitigation Program and Anadromous Fish Evaluation Program as high priority consistent with ESA responsibilities and accomplishing appropriate lamprey improvements in a reasonable time frame. The Corps will also work with the tribes and the USFWS towards developing its existing 5-year lamprey plan into a 10-year plan, covering both adult and juvenile passage issues, with implementation to begin in 2008.

The Corps and the Tribes will continue collaborate in the development of a lamprey implementation plan, including consideration of study results, the tribal draft restoration plan, and other available information. The plan will include priority actions, including those listed below, and identification of authority and funding issues. It will be updated annually based on the most recent information.

The Corps will program approximately $1.8 million in 2008 for associated lamprey work identified in the provisions below. The Corps will ramp up funding to $2-5 million per year, as necessary and appropriate to improve lamprey conditions at dams for passage to implement the actions below as they are ultimately detailed in the 10-year plan. The Parties believe that most of the actions below can be implemented within the next 10 years, and, for planning purposes, anticipate an aggregate implementation cost of approximately $50 million. However, the Parties understand that the development of the 10-year plan may lead to adjustments in the implementation term (e.g. perhaps 12 years is more feasible), action priorities, and estimates of total cost to implement the plan.

The Corps will work with the parties of this agreement and through the Regional Forum on implementation priorities for lamprey actions annually, and will address options for funding where appropriate.

Adult Lamprey Passage

The Corps will continue improving adult lamprey migratory conditions at mainstem FCRPS hydropower projects. This will include investigating and identifying potential problem areas and implementing both physical and operational changes to adult ladders. Implementation of changes will be followed by evaluations of passage behavior, likely using PIT, and/or active-telemetry to determine the overall effectiveness of the changes. Specific actions include:

- Working with Lamprey Technical Workgroups, the Parties will develop meaningful interim numerical passage metrics for juvenile and adult lamprey passage at the FCRPS dams based on available data and reflecting adaptive management principles.

- Conduct site inspections of each dewatered fish ladder with regional lamprey experts to determine passage bottlenecks. Expand active-tag and PIT-Tag work as appropriate for abundance, passage and behavior studies at McNary and Snake River dams. This may include tracking eels to tributary areas, including above mainstem dams. Conduct concurrent hydraulic studies in fishways to further discern problem areas. Conduct post-construction adult telemetry evaluations to determine effects of structural and operational improvements.

- Auxiliary systems (primarily Lamprey Auxiliary Passage Systems LAPS) to pass adult lamprey past the dams will be evaluated and fully developed. In particular, the prototype systems under development at Bonneville Dam will be refined and tested. If the Bonneville auxiliary system has been found to be successful, it will be implemented at other Corps dams as warranted. This is a major part of the Corps' lamprey plan and still has some details to work out.

- Fish ladder entrance areas are problematic passage location at dams for lamprey. Evaluate reducing ladder entrance flows at night to assist with lamprey entrance passage efficiency at Bonneville. As warranted, expand to John Day, McNary and other FCRPS mainstem dam fishways.

- Complete designs for keyhole or alternative ladder entrances for possible installation at Bonneville Dam's Cascade Island ladder in 2009 and John Day Dam's north ladder in 2010/11. If warranted and feasible, expand this design and implementation effort to other FCRPS dams. This would be further developed in the Corps' lamprey plan.

- Inventory all picketed leads, fishway cracks, blind openings, and ladder exits. Also inventory ladder gratings to determine grating type, size, condition, and history of stranding lamprey. Begin replacement of existing gratings with new gratings with ¾ inch spacing in those areas of the fish ladders with the most identified problems. As needed test plates over gratings and proceed until all identified areas are addressed. Modify other fishway areas as appropriate for lamprey passage. Close the McNary – Oregon shore ladder exit false opening if warranted.

- Round sharp corners in and around the fish ladders to aid passage as warranted.

- The Tribes have unique expertise in the field of underwater video enumeration of migratory fish species.

- The Corps will investigate the feasibility, techniques and protocols for counting adult lamprey at mainstem hydropower projects (e.g. Bonneville, McNary, Ice Harbor and Lower Granite Dams). The Corps will count adult lamprey at those projects where counting is reasonably feasible and the Parties agree that such data will be valuable to lamprey management efforts.

Juvenile Lamprey Passage Conditions

The Corps will continue to monitor the passage of juvenile lamprey collected at projects with juvenile fish bypass facilities. When the turbine intake bar screens are in need of replacement, the Corps will replace the existing material with bar screens that have smaller gaps between the bars, as warranted to further protect migrating juvenile lamprey. In consultation with NOAA and the Tribes, the Corps will consider lifting the extended length screens out of the turbine intakes (primarily McNary Dam, but also any Columbia and Snake River dams), during periods of significant juvenile lamprey passage, where lamprey impingement has been documented, considering effects to both salmon and lamprey.

- To prevent juvenile lamprey from becoming stranded or impinged on collector project raceway screens, prototype juvenile lamprey separators will be developed towards aiding in the ability to pass lamprey safely through juvenile fish bypass facilities. Management alternatives using this technology would be further developed in the Corps' lamprey plan.

- The Corps will continue to work actively with industry to further miniaturize active tags with the intent for use in tracking juvenile lamprey.
    - In collaboration with the Tribes, US Fish and Wildlife Service, and the States, the Corps will plan and conduct studies to determine juvenile lamprey active tag criteria, including tag size, shape, and potting material criteria for bio-compatibility.
    - If and when the technology to meet juvenile lamprey active tag criteria becomes available, and as warranted, determine passage routes, outmigrant timing and survival of juvenile lamprey through FCRPS mainstem dams. As related to the ability to assess passage and survival, work with Tribes, US Fish and Wildlife Service, and States to develop meaningful numerical juvenile passage standards.

Bureau of Reclamation

Beginning in 2008, and concluding in 2010, Reclamation will conduct a study, in consultation with the Tribes, to identify all Reclamation projects in the Columbia Basin that may affect lamprey. The study will also investigate potential effects of Reclamation facilities on adult and juvenile lamprey, and where appropriate, make recommendations for either further study or for actions that may be taken to reduce effects on lamprey. The priority focus of the study will be the Umatilla and Yakima projects and related facilities.

Beginning in 2008, Reclamation and the Tribes will jointly develop a lamprey implementation plan for Reclamation projects as informed by the study above, the tribal draft restoration plan, and other available information. The plan will include priority actions and identification of authority and funding issues. It will be updated annually based on the most recent information. Reclamation will seek to implement recommended actions from the implementation plan.

I. Emergency Operations for Unlisted Fish

The Action Agencies agree to take reasonable actions to aid non-listed fish during brief periods of time due to unexpected equipment failures or other conditions and when significant detrimental biological effects are demonstrated. When there is a conflict in such operations, operations for ESA-listed fish will take priority.

III. HABITAT AND HATCHERY COMMITMENTS

A. BPA Funding for Habitat and other Non-Hatchery Actions

A.1. General Principles:

- BPA and the Tribes seek to provide certainty and stability regarding BPA commitments to implement fish and wildlife mitigation activities in partnership with the Tribes, including additional and expanded actions which further address the needs of ESA-listed anadromous fish.
- Projects funded under this Agreement are linked to biological benefits based on limiting factors for ESA-listed fish. See Attachment G [in development].
- Projects funded under this Agreement are consistent with recovery plans and subbasin plans now included in the Columbia Basin Fish and Wildlife Program. More specific linkages will be documented as a function of the BPA contracting process.
- Projects may be modified by mutual agreement over time based on biological priorities, feasibility, science review comments, or accountability for results.

A.2. Types of Projects: BPA is committing to funding a suite of projects and activities that is summarized in Attachment B, with a total funding commitment of $51.61 for non-hatchery expense projects, plus additional commitments for existing, expanded and new hatchery operations and maintenance expenses as summarized in Attachment B. The projects or actions are categorized as follows:

- Ongoing actions (currently or recently implemented through the Columbia Basin Fish and Wildlife Program), which can be found in Attachment B. The actions include actions addressing ESA-listed salmon and steelhead ("ESA actions") as well as non-listed species.
- Expanded actions in support of FCRPS BiOp and Program implementation, which can be found in Attachment B.
- New actions benefiting ESA-listed and non-listed species, which can be found in Attachment B.

The same projects in the three categories above can also be categorized or sorted with a "Category" system that allows for particular reference to ESA/BiOp or NWPA implementation as follows:

- Category 1 and Category 2c ongoing – Ongoing actions (currently or recently implemented through the Columbia Basin Fish and Wildlife Program), these actions address ESA-listed salmon and steelhead ("ESA actions") as well as non-listed species. The total average annual budget commitment for this category of work is $17.09M/year, as summarized in Attachment B.
- Category 2a – New or expanded ESA actions in support of FCRPS BiOp implementation. The total average annual budget commitment for this category of work is $8.17M/year, as summarized in Attachment B.

- Category 2b – Other new actions benefiting ESA-listed species. The total average annual budget commitment for this category of work is $2.24M/year, as summarized in Attachment B.
- Category 2c and Category 3 - Actions benefiting other fish and wildlife species addressed under the Northwest Power Act, which can be found in Attachment B under the headings of Category 2c and Category 3. This includes a new programmatic approach for lamprey, with a menu of projects to be selected from those identified in Attachment B under the heading of lamprey. The average annual budget commitment for these categories of work is $3.46 M for Category 2c, $0.49M for the Umatilla add-ons, and $1.866M for lamprey projects. Additionally, the annual commitment of Category 3 projects is a total of $4.37M/year, as noted in Attachment B.
- Capital projects for both ESA-listed and other fish and wildlife species, which can be found in Attachment B under the heading Non-Hatchery Capital.

A.3. Expense Projects:
- BPA's funding commitment, in the form of annual expense planning budgets for each project are identified in Attachment B.
- This commitment is also subject to the General Provisions for All Projects below.

A.4. Non-Hatchery Capital Projects: BPA will commit $52.11 million over the 10 year period to implement the seven non-hatchery capital projects identified in Attachment B. This commitment includes a commitment to dedicate $1 million per year of the Columbia Basin Water Transaction Project budget for water acquisitions in the Umatilla basin.
- Based on reviews to date, BPA finds that the identified projects meet BPA's capital policy for fish and wildlife; if a project is subsequently found not to meet capital requirements, BPA and the Tribe will work together to find a replacement project or alternative project that can be implemented.

Bureau of Reclamation

Bureau of Reclamation tributary habitat technical assistance in the John Day and Grande Ronde sub-basins is expected to continue for the life of the 2008 FCRPS BiOp substantially at current funding levels. If total program appropriations drop below 2008 levels, if new species listings occur, or if biological benefits are in question, then Parties will meet to discuss a revised habitat program subbasin technical assistance allocation.

B. Funding for Hatchery Actions

B.1. General Principles:
- The Action Agencies and the Tribes recognize that hatcheries can provide important benefits to ESA-listed species and to the Tribes in support of their treaty fishing rights.
- The Action Agencies have reviewed the information provided by the Tribes and support implementation of the hatchery actions identified in Attachment B, subject to sections III.D and III.C.4. Additional or future review by BPA will be in service of BPA NEPA

and related duties and specifically will not include independent review of scientific or biological matters already provided for in sections III.C.4 and III.D.

- BPA and the Tribes seek to provide certainty and stability to BPA funding of hatchery actions by supporting specific on-going hatchery actions implemented by the Tribes, and to make funding available for new hatchery actions (including hatchery reform efforts) by the Tribes and others as they complete required review processes.
- BPA's funding will be in addition to and not replace funding for hatcheries provided by other entities, including but not limited to funding provided by Congress pursuant to the Mitchell Act, and funding required from the mid-Columbia public utility districts implementing habitat conservation plans and other related agreements.
- If a hatchery project identified in this Agreement is not able to be implemented, the Action Agencies are not obligated to fund a replacement or alternative project, and the unused hatchery funds will not be required to be shifted to non-hatchery projects.

B.2. Expense and Capital Hatchery Actions: BPA will make available a total of approximately $80.11 million over ten years for new facility construction and/or expansions of existing facilities, as described in the Attachment B. Most of this funding is anticipated to qualify as capital funding. The remaining amount is anticipated to be expense funding to provide for planning expenses or other non-capital activities associated with hatchery design, construction, and implementation.

- BPA will ramp-up operation and maintenance funding for expanded and new hatchery actions under this Agreement, to a total (for existing expanded and new hatchery O&M) of $13.93 million, once all the expansions and new hatchery construction is completed. See Attachment B.
- Starting with the FY2010 rate period, BPA will collaborate with the Tribes to develop a capital spending plan in advance of each new rate period that arises during the Agreement, so as to ensure that adequate rate period capital budgets are available for funding the capital actions in this MOA.
- Listed salmon and steelhead populations affected by the Tribal hatchery proposals in this Agreement and that are located in tributaries of the Upper Columbia River are also populations affected by hatchery programs managed by the Washington Department of Fish and Wildlife on behalf of Grant County PUD, Chelan County PUD and Douglas County PUD. Consistent with the General Principles contained in section III.B.1, BPA and Tribes want to ensure that any artificial production actions funded under this Agreement are supplemental to and not in substitution of, any actions undertaken by the PUDs in fulfillment of their responsibilities. In addition, BPA and the Tribes want to ensure that any artificial production actions funded under this Agreement are appropriately coordinated. Therefore, any artificial production actions under this Agreement affecting listed salmon and steelhead populations in the Upper Columbia will be coordinated with the appropriate entities and committees with existing or planned artificial production responsibilities in the same area, including but not limited to the Grant, Chelan, and Douglas County Public Utility Districts. BPA and the Tribes will jointly work on identifying the appropriate projects, and agree that BPA funding will not exceed $5M barring additional measures the Parties mutually agree to for the benefit of fish of importance to the Parties.

- Yakima Basin/YKFP. The Parties agree as follows:
  Pursuant to this Agreement, BPA is providing funding for several master planning processes under the YKFP project, and is specifically proposing funding (less PUD cost-share) for expense and capital costs for construction of facilities for spring Chinook as well as coho restoration. As a result of the BPA-funded master planning processes, should the Yakama Nation seek additional facilities, BPA agrees to consider funding them in appropriate planning processes during the term of this Agreement. The Yakama Nation, and the Nation may seek other additional funding, in accordance with section IV.B.2, seek additional funding in year 15.
- Klickitat Project. The Parties agree as follows:
  (a) That they will work diligently together to include development of the Wakiakus facility in the provisions of the Mitchell Act EIS, which is currently being drafted, specifically identifying the need for the facility in support of important tribal fisheries.
  (b) That the Tribe will actively seek congressional appropriations during FY 2010 and FY 2011 for Mitchell Act funding for this facility, in cooperation with other relevant entities such as the Washington Department of Fish and Wildlife. BPA will actively support proposed legislation that is consistent with this Agreement.
  (c) In the event appropriations for all or a part of the Wakiakus facility cannot be obtained, then the following shall occur:
  (i) The Parties will meet to review options for completing both the Klickitat and Wahkiakus facilities utilizing existing Mitchell Act funds, BPA-funds committed under this Agreement, and any other potential cost-sharing sources.
  (ii) As part of this review, the Parties will consider different allocations of the funding from BPA provided in this Agreement and additional cost-sharing formulas, such as ones currently in place with other federal entities, for any funds that are available from sources other than BPA.

B.3. John Day Dam and The Dalles Dam Mitigation: The U.S. Army Corps of Engineers and *US v. Oregon* parties are working on proposals regarding mitigation for the losses to anadromous fish caused by the construction of John Day and The Dalles dams, in particular the appropriate balance between upriver and downriver stock production. The Corps, as part of this Agreement, commits to resolving this matter with the Tribes through the *US v. Oregon* Policy Committee. As recognized, the resolution of some aspects of John Day/The Dalles mitigation will also involve other parties. No specific plan has been proposed yet. The Corps commits to take all actions necessary and appropriate consistent with the resolution reached between the interested parties regarding John Day/The Dalles mitigation. Any commitment from BPA in support of this resolution would be consistent with this Agreement.

B.4. Implementation Sequence: The Tribes, BPA, (and other federal agencies where applicable) will, as part of developing a capital plan, develop an implementation sequence for these projects. The overall funding commitment reflected in Section III.B.2 above is shown in 2008 dollars, and an annual inflation adjustment of 2.5 percent applied beginning in FY10, will be utilized in developing the capital plan and implementation sequence for these (i.e., capital projects that are assumed to begin in FY10 will have a 2.5% inflation factor applied to the FY10 budget; projects that are assumed to begin five years later will have five years of a 2.5% annual inflation factor applied to the project's first-year budget).

- The Tribes will consider, among other things, the following as they develop the sequence of implementation:
  - Level of agreement in *US v. Oregon*;
  - Equitable distribution of resources among Tribes;
  - Degree of readiness for implementation

- Sequencing will not be guided by project-by-project speculation regarding NOAA's willingness to approve or accept the project. Rather, NOAA input on these actions (to the extent they require it) will be sought consistent with this comprehensive Agreement.

C. General Provisions For All Projects

C.1. The Parties Agree that all projects funded pursuant to this Agreement are consistent with the Council's Program (including sub-basin plans), as amended; applicable draft ESA recovery plans; BPA's In-Lieu Policy, and the data management protocols incorporated in the project contracts.

C.2. For BPA funded commitments, the Tribes will report results annually (including ongoing agreed upon monitoring and evaluation) via PISCES and/or other appropriate databases.

C.3. For non-hatchery projects identified as providing benefits to listed ESA fish, the Tribes shall:

- Provide estimated habitat quality improvement and survival benefits from the project (or suite of projects) to a population or populations of listed salmon and steelhead based on key limiting factors;
- Refine the estimates during the course of the Agreement if it appears benefits may significantly deviate from the original estimates; and
- Support these estimates of habitat improvement and survival benefits in appropriate forums.

C.4. For hatchery projects, the Tribes will:

- Continue to make available identified biological benefits associated with a hatchery projects included in this Agreement, and will support those biological benefits;
- Obtain a NOAA determination that the hatchery project will not impede and where possible will contribute to recovery;
- Secure or assist in securing all legally necessary permits for hatchery construction and operation.

C.5. The Parties will coordinate their RM&E projects with each other and with regional RM&E processes (particularly those needed to ensure consistency with the FCRPS BiOp RM&E framework), as appropriate and agreed to among the Parties.

C.6. For actions on federal lands, the tribes will consult with the federal land managers and obtain necessary permits and approvals.

D. Council and ISRP Review

D.1. General principles:

- In developing this Agreement, the Parties recognize that the Council's Program is a maturing program, one that through several decades of implementation has established a continuing framework for mitigating the impacts of hydroelectric development in the Columbia River Basin.
- The Parties agree that the BPA funding commitments in this Agreement are ten-year commitments of the Bonneville Fund for implementation of projects. The Parties believe that this Agreement and the specific projects are consistent with the Council's Program.
- The Council's expertise and coordination is valuable in addressing, science review and accountability on a region-wide scale.
- The Parties recognize that the current regional process for reviewing and funding projects to meet Action Agency obligations under the NWPA and/or ESA have been designed in large part to prioritize actions for a particular implementation period. As such, that process has reviewed "proposals" that essentially are competing with one another for a funding within a set overall budget. However, this Agreement, along with the BiOps, reflects specific and binding funding commitments to the projects in the attached spreadsheets, subject to the other terms and conditions in this Agreement.

D.2. ISRP review of projects implemented pursuant to this Agreement:

- Subject to the commitments in section F2, the Parties will actively participate in ISRP review of the projects funded under this Agreement. The Parties will work with the Council to streamline and consolidate ISRP project reviews by recommending that the ISRP: (1) review projects collectively on a subbasin scale, (2) focus reviews for ongoing or longer term projects on future improvements/priorities, and (3) unless there is a significant project scope change since last ISRP review, minimize or abbreviate re-review of ongoing projects.
- Subject to the commitments in section F2 the Parties may agree to expedited ISRP review of new projects that are not substantially similar to projects or activities previously reviewed by the ISRP.
- The Parties will consider reasonable adjustments to non-hatchery projects based on ISRP and Council recommendations. The decision on whether or not to make such reasonable adjustments will require agreement of the affected Tribe and BPA. If the reasonable adjustment results in a reduction of a project budget, the affected Tribe and BPA will select another project to use the funds equal to the amount of the reduction. If the affected Tribe and BPA cannot agree on whether a recommended adjustment should be made, a replacement project that meets the requirements of this Agreement will be identified. In any event, BPA's financial commitment to non-hatchery projects will not be reduced to an aggregate level below that specified in this Agreement for each tribe and

CRITFC so long as a replacement project that meets the requirements of this Agreement could be identified (see replacement project discussion, below).

- The proponent for any new hatchery project will participate in then-applicable streamlined ISRP and Council 3-step review processes recognizing that the ultimate decision to implement the projects is for BPA subject to the terms of this Agreement. Capital funding for any new hatchery project is subject to these review processes. The Parties will consider reasonable adjustments to hatchery projects based on ISRP and Council recommendations. The decision on whether or not to make such reasonable adjustments will require agreement of the affected Tribe and BPA.

E. Replacement Projects and Adaptive Management

E.1. General Principles:

- This section applies to non-hatchery projects
- The Parties agree that a non-hatchery project identified in this Agreement may not ultimately be implemented or completed due to a variety of possible factors, including but not limited to:
    - Problems arising during regulatory compliance (e.g., ESA consultation, NEPA, NHPA review, CWA permit compliance, etc);
    - New information regarding the biological benefits of the project (e.g., new information indicating a different implementation action is of higher priority, or monitoring or evaluation indicates the project is not producing its anticipated benefits);
    - Changed circumstances (e.g., completion of the original project or inability to implement the project due to environmental conditions); or
    - Substantive non-compliance with the implementing contract.

- Should a non-hatchery project not be implemented due to one or more of the above factors, the Action Agencies and the implementing Tribe will promptly negotiate a replacement project.

E.2. Replacement Projects:

- A replacement project should be the same or similar to the one it replaces in terms of target species, limiting factor, mitigation approach, geographic area and/or subbasin and biological benefits.
- A replacement project may not require additional Council or ISRP review if the original project had been reviewed.
- A replacement project would have the same or similar planning budget as the one it replaces (less any expenditures made for the original project) and will take into account carry-forward funding as agreed to by the Parties.

E.3. Adaptive Management

In addition to project-specific adaptation described above, the Parties may mutually agree to adaptively manage this shared implementation portfolio on a more programmatic scale based on new information or changed circumstances.

F. Inflation, Ramp Up, Planning v. Actuals, Carry-over:

F.1. Inflation: Beginning in fiscal year 2010, BPA will provide an annual inflation adjustment of 2.5 percent.

F.2. Treatment of Ramp-up of new/expanded work: In recognition of the need to "ramp up" work (timing of Agreement execution, contracting, permitting, etc), the Parties agree that average BPA spending for the new/expanded projects in fiscal year 2008 is expected to be approximately one-third of the average planning level shown in the attached project-specific spreadsheets; and for fiscal year 2009, it is expected to be up to 75 percent of the average planning level, with full planning levels expected for most new/expanded projects starting in fiscal year 2010.

F.3. Assumptions regarding Planning versus Actuals: Historically, the long-term average difference between BPA's planned expenditures for implementing the expense component of the Power Council's Fish and Wildlife Program, and actual spending (what BPA is invoiced and pays under the individual contracts), has been about seven percent, with the actual spending averaging 93 percent of planned spending. While BPA will plan for spending up to 100 percent of the funding commitments described in this Agreement, nevertheless, due to a variety of factors, BPA's actual expenditures may be less. As a result, the Parties agree that provided BPA's actual spending for the totality of projects commitments in this Agreement averages 93% of the planning amount annually, BPA is in compliance with its funding commitments. If BPA is not meeting the 93% average annually due to circumstances beyond the Parties control, BPA will not be in violation of this Agreement, but the Parties will meet to discuss possible actions to remove the impediments to achieving 93%. The Parties also agree that, for the reasons regarding ramp up in Section III.F.2, new projects and projects expansions during their FY08 and FY09 ramp up phase will be excluded from this calculation.

F.4. Unspent funds, and pre-scheduling/rescheduling: Annual project budgets may fluctuate plus or minus 20% in relation to the planning budgets for each project, to allow for shifts in work between years (within the scope of the project overall), if work will take longer to perform for reasons beyond the sponsors' control (reschedule), or can potentially be moved to an earlier time (preschedule). Fluctuations within an overall project's scope of work, but outside of the 20 percent band, can also occur if mutually agreeable for reasons such as, but not limited to, floods, fires, or other emergency or *force majeure* events.

Unspent project funds (excluding new/expanded projects subject to ramp-up assumptions covered in Section F.2 above) that are carried over per the reschedule/preschedule provisions above (i.e., within +/- 20% of the annual project budget and within the project's scope of work) may be carried forward from one contract year (i.e., Year 1), to as far as two contract years (i.e, Year 3) into the future before such funds are no longer available. The one exception to this reschedule/preschedule criteria is that for the project expansions and new projects, if actual total FY08 and FY09 spending is less than the sum of 33% of the FY08 budget and up to 75% of the FY09 budgets reflected in the spreadsheet attachments due to circumstances within the Tribes' control, then the increment between what is actually spent in FY08/09 and the sum of 33% of the FY08 budget and up to 75% of the FY09 budgets reflected in the spreadsheet cannot be carried over into FY10.

G. Compliance with the *in lieu* provision of the Northwest Power Act

This Agreement also serves as an agreement addressing section 4(h)(10)(A) of the Northwest Power Act, which requires that BPA expenditures be "in addition to, not in lieu of other expenditures authorized or required from other entities under other agreements or provisions of law."

The Tribes confirm that no other entity is already *required* by law or agreement to fund the specific projects committed to by BPA under this Agreement. Further, when evaluated at a subbasin scale, the Parties understand that the tribes and others are currently expending substantial funds to protect and enhance fish and wildlife species or their habitats in close proximity to where the BPA funds will be applied. While not strictly an in lieu issue, the Tribes commit to continue their efforts to secure or support funding for fish and wildlife from non-BPA sources

In order to address potential *in lieu* issues, the Tribes have identified the following sources of funding by subbasin as described in Attachment H (tribal and non-tribal funding, in development).

The Parties anticipate that similar levels of funding for these parallel and complementary actions will continue for the duration of the Agreement. If there is a change in the composition or levels of funding described, it will not affect the commitments in this Agreement, but will be addressed in future *in lieu* reviews after the end of this Agreement.

As a result of this documented parallel and complementary funding, BPA agrees that projects committed to in this Agreement satisfy the *in lieu* provision.

IV. FORBEARANCE, WITHDRAWAL, AND DISPUTE RESOLUTION

A. Forbearance

A.1. The Tribes will provide a copy of this Agreement to the court in *NWF v. NMFS*.

A.2. The Tribes covenant that during the term of this Agreement:

a. The Treaty Tribes will not initiate, join in, or support in any manner ESA, Northwest Power Act, Clean Water Act or APA suits against the Action Agencies or NOAA regarding the legal sufficiency of the FCRPS PA, FCRPS BiOp, Upper Snake BiOp and/or conforming implementing RODs.

b. So long as the Agreement is being implemented by the Action Agencies, the Tribes will not initiate, join in, or support in any manner ESA, Northwest Power Act, Clean Water Act or APA suits against the Action Agencies or NOAA regarding the effects on fish resources and water quality (water quality issues addressed in the FCRPS BA and the Draft BiOps or otherwise related to the operation or existence of the 14 FCRPS projects regarding temperature and total dissolved gas[5]) resulting from the operations of the FCRPS and BuRec dams that are specifically addressed in the FCRPS PA, FCRPS BiOp, Upper Snake BiOp and/or conforming implementing RODs.

c. The Treaty Tribes' participation in ongoing and future BPA rate making/approval/review proceedings will be consistent with the terms of this Agreement. This means, for example, that the Tribes agree not to request additional fish or wildlife funding from BPA in on-going and future BPA rate making/approval/review proceedings during the term of this Agreement, and that the Tribes will not make such requests in ongoing or future rate making/approval/review proceedings based on alleged infirmities in prior rate making/approval/review proceedings, including but not limited to the 2002-2006 rate period.

d. The Tribes agree that breaching will not occur within the term of the Agreement. In addition, the Tribes will not advocate for breaching dams covered by the FCRPS and Upper Snake Biological Opinions during the term of this Agreement. This commitment is made subject to the following mutual understandings and a single exception specified below:

- It is understood by all Parties that nothing in this Agreement may be interpreted or represented as any tribe rescinding or altering their long-standing policy, scientific, and legal positions regarding breach of and federal dams.
- As required by the draft NOAA Fisheries FCRPS Biological Opinion, a comprehensive review will be completed in June, 2012 and June, 2015 that includes a review of the state of implementation of all actions planned or anticipated in the FCRPS and Upper Snake Bips and a review of the status and performance of each ESU addressed by those BiOps As described in Section II.A.2 of this Agreement, the Parties agree to meet to discuss the results of the 2012 comprehensive evaluation and, in the event performance is not on track, to discuss options for corrective action. If, after the June, 2015 comprehensive review, the status of Snake River ESUs is not improving and the Tribes review of Diagnostic Performance Framework indicates contingent actions are needed, the

[5] Water quality here is not intended to include matters not specifically addressed in the FCRPS BA and BiOps such as the Corps' 404 regulatory program, toxics clean-up issues.

Tribes may advocate that actions to implement Snake River dam breaching after 2017 should be initiated.

A.3. The Action Agencies covenant that during the term of this Agreement:

a. The Action Agencies will not support in any manner any suits that challenge the legal sufficiency of the 2008 *U.S. v Oregon* Columbia River Fish Management Plan, its BiOp or implementing RODs.

b. The Action Agencies will not support in any manner actions that undermine the Fish Passage Center provisions of Section IID.

A.4. Nothing in this Agreement shall be construed by the Parties in any forum to limit or restrict the Parties or their agents or employees from advocating for actions that they believe are required to implement this Agreement. Disputes among the Parties regarding implementation will be handled under the Good Faith and dispute resolutions sections.

A.5. The ability and willingness of the Tribes to enter into an agreement with respect to an FCRPS BiOp is contingent on having a *U.S. v Oregon* agreement (CRFMP) of equal duration entered as a Court Order and upon the assumption that NOAA Fisheries will give ESA coverage for the same.[6] In the event the CRFMP or the implementation of any of its provisions is challenged in Court, the Tribes expect the United States to vigorously defend the final agency action, and the Tribes reserve the right to assert all defenses, counter claims, and to offer any and all evidence, including defenses, counter-claims, cross-claims and evidence related to the FCRPS. If such offers by the Tribes are inconsistent with the forbearance and affirmation of adequacy commitments made in this Agreement, the Action Agencies retain the options of dispute resolution or withdrawal.

B. Affirmation of Adequacy

B.1. This Agreement builds upon and expands the commitments of the Action Agencies called for in the FCRPS, Upper Snake Biological Opinions (the BiOps). This Agreement also takes into account and supports the 2008 - 2017 Columbia River Fisheries Management Plan and its pending BiOp. The Parties support this package of federal and tribal actions as an adequate combined response of these Parties for the ten year duration of the Agreement and BiOps to address the government's duties for:

- conserving listed salmon and steelhead, including avoiding jeopardy and adverse modification of critical habitat under the Endangered Species Act;
- protection, mitigation, enhancement and equitable treatment of fish under the Northwest Power Act; and
- Clean Water Act provisions related to the FCRPS dams.

[6] "NMFS properly found that, although difficult to quantify, tribal treaty fishing rights were present effects of past federal actions that must be included in the environmental baseline. See 50 C.F.R. 402.02. To quantify (Tribal Treaty fishing) rights and add them to the environmental baseline, NMFS reasonably looked to current harvest levels and assumed that future harvests would be the same." *CSRIA v. Gutierrez,* unpublished memorandum opinion at 2 (9th Cir., April 6, 2007).

B.2. The Tribes further agree that:

- the Action Agencies' commitments under this Agreement and the BiOps as to hatchery projects are adequate for 30 years from the effective date of this Agreement, with the exception of the Yakama/Klickitat projects, which are addressed in Section III.B.2, and except that after year 15 of the 30 year forbearance for hatcheries, there is a change in the status of an ESU (e.g., a new listing) or if after year 15 there is new information or changed circumstances that indicate additional hatchery actions are needed to assist in mitigating impacts of the FCRPS consistent with current science and applicable law, the Tribes are not precluded from seeking additional funding from the Action Agencies for hatcheries. If within the year prior to the expiration of this Agreement, due to no fault of the Parties, if any capital funded hatchery actions identified in this Agreement have not begun construction, BPA will continue to make the identified capital funding in this Agreement available for the identified project (or projects) for an additional five years at which point the Parties will meet and discuss the disposition of any hatcheries that have not completed construction and the related capital funding.
- the Action Agencies' commitments under this Agreement for lamprey actions are adequate for the duration of this Agreement such that the Tribal parties will not petition to list lamprey or support third party efforts to list lamprey as threatened or endangered pursuant to the ESA.

B.3. The Tribes' determination of adequacy under applicable law is premised on several important assumptions and understandings with which the federal parties to this Agreement concur:

- The specific actions identified in this Agreement and/or funding for such actions is provided by the federal parties in full and timely manner;
- Other actions not specifically identified in this Agreement, but committed to in the FCRPS BiOp are carried out in a timely manner;
- The biological performance and status of the species affected by the development and operation of the FCRPS and Upper Snake hydroprojects are diligently and comprehensively monitored, analyzed, and reported to the Tribes and others as provided in this Agreement (Sections II.A.1 and II.A.2) and the BiOps; and
- Adaptive management will be used as described in the Section II.A.2 to ensure achievement of performance objectives for the FCRPS. That if during the 2012 or 2015 comprehensive review called for in the BiOps it is found that the status of ESA covered species are not improving as anticipated in the Adaptive Management section of the BA, that the Tribes will have the opportunity to advocate that actions over and above those in the Agreement and/or BiOps should be implemented in the future, consistent with the terms of this Agreement.

B.4. The Tribes agree to affirmatively support the adequacy of the package of federal and tribal actions contained in the BiOps and this Agreement in appropriate forums, including NOAA's administrative record. The Parties expect the United States to continue affirmative support of the US v. Oregon BiOp and CRFMP.

B.5. That the Parties acknowledge that this Agreement does not comprehensively address the Action Agencies' legal obligation related to wildlife under the NWPA. The Parties understand that there are currently differing positions as to what is required to meet NWPA and Program standards for wildlife. The Parties agree that the Tribes may request or advocate for additional terrestrial wildlife protection, mitigation and enhancement funding by BPA under the Northwest Power Act, that BPA may decline such requests, and the Tribes may seek recourse for BPA decisions; none of these actions by the Tribes or BPA will violate the terms of this Agreement.

C. Council Program Amendment Process

C.1. During the term of the Agreement, the Action Agencies and Tribes will submit recommendations or comments or both in relation to Council Program amendments that are consistent with and are intended to effectuate this Agreement. The Tribes and the Action Agencies have agreed to submit the following to the Council in any recommendations or comments each may make for Program amendments solicited in 2008 to describe this Agreement and its role in such Program amendments:

> Description and Rationale: The Action Agencies and the Tribes have agreed to a ten year commitment of actions in support of the Action Agencies' obligations both generally under the Northwest Power Act, as well as specifically for anadromous species listed under the Endangered Species Act. The commitments include support for the actions in the 2008 Biological Opinions for the FCRPS and the Upper Snake. The commitments also include actions already reviewed and recommended by the Council to BPA, as well as expanded and new actions. The Action Agencies and the Tribes have found these commitments consistent with the Program and the Council's intent to integrate Power Act and ESA responsibilities. The expanded and new actions are, moreover, subject to reasonable modifications determined by the Parties to the Agreement based on Council and ISRP review.

The Tribes and the Action Agencies will recommend that the Council amend the Fish and Wildlife Program to incorporate the BiOps and Agreement, consistent with the following approach:

- The actions in the 2008 Biological Opinions for the FCRPS and Upper Snake should be implemented, in conjunction with the FCRPS Action Agencies' Biological Assessment, as measures to protect, mitigate, and enhance listed salmon and steelhead affected by the federal hydro system.
- The actions in the 2008 Memoranda of Agreement between the FCRPS Action Agencies and the Tribes should be implemented per its terms as additional measures to protect, mitigate and enhance both listed and non-listed fish.

C.2. Neither the Tribes, nor the Action Agencies, waive the right to assert that, if adopted by the Council based on its own recommendations, or recommendations of third parties, an amendment that is contrary to this Agreement is either lawful or unlawful under the Northwest Power Act, or any other law, provided they act consistent with the terms of this Agreement.

D. Good Faith Implementation and Support

This Agreement is based on bargained-for consideration. The Parties agree to work together in partnership to implement the mutual commitments in this Agreement. Although neither the Action Agencies nor the Tribes are relinquishing their respective authorities through this Agreement, they commit to make best effort to sit down with each other prior to making decisions in implementation of this Agreement.

The Parties enter into this Agreement cognizant of its scope, duration, and complexity, and commit to its implementation and support at all levels and in all areas, e.g. policy, legal, and technical. Further, the Parties understand that matters explicitly addressed within and/or related to this Agreement are routinely dealt with in a wide variety of contexts and fora, often on short notice and in time-sensitive situations. Even with those understandings, the Parties will vigorously endeavor to implement and support this Agreement in good-faith. Best effort good-faith implementation and support of this Agreement is the general duty to which all Parties agree to be bound. Nonetheless, the Parties understand that from time to time questions or concerns may arise regarding a Party's compliance with the terms of this Agreement. In furtherance of the continuing duty of good faith, each Party agrees that the following specific actions or efforts will be carried out:

D.1 On a continuing basis, it will take steps to ensure that all levels of their government/institution is made aware of the existence of this Agreement and the specific commitments and obligations herein, and emphasize the importance of meeting them;

D.2 Each Party will designate a person to be initially and chiefly responsible for coordinating internal questions regarding compliance with the Agreement;

D.3. Each Party will make best efforts to consult with other Parties prior to taking any action that could reasonably be interpreted as inconsistent with any part of this Agreement. To assist in this, the Parties will designate an initial contact point; the Tribes will designate their legal representatives as their initial contact points, the contacts for the Action Agencies are to be determined. The formality and nature of the consultation will likely vary depending circumstances. The initial contact points are initially charged with attempting to agree on what form of consultation is required. In some instances, the contacts between representatives may suffice for the consultation, while in others, they may need to recommend additional steps. The Parties agree that consultations should be as informal and with the least amount of process necessary to ensure that the Parties are fulfilling the good-faith obligation to implement and support the Agreement.

D.4. If a Party believes that another has taken action that contrary to the terms of the Agreement, or may take such action, it has the option of a raising a point of concern with other Parties asking for a consultation to clarify or redress the matter. The Parties will endeavor to agree upon any actions that may be required to redress the point of concern. If after raising a point of concern and having a consultation the Parties are unable to agree that the matter has been satisfactorily resolved, any Party may take remedial actions as it deems appropriate, so long as those remedial actions do not violate the terms of the Agreement.

E. Changed Circumstances, Renegotiation/Modification, Withdrawal

E.1. The Parties enter into this Agreement with the assumption that NOAA will issue final biological opinions for the FCRPS, Upper Snake, and a Columbia River Fish Management Plan developed among *US v. Oregon* parties. The Parties assume these BiOps will conclude that the respective proposed actions, with reasonable and prudent alternatives if any, are not likely to jeopardize the continued existence of any ESA-listed salmon and steelhead or result in the destruction or adverse modification of critical habitat of such species.

E.2 If any court, regardless of appeal, finds that the BiOp or agency action is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, and subsequently remands the BiOp to NOAA Fisheries this Agreement shall remain in force. If any court, regardless of appeal, finds that the BiOp or agency action is arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, the Parties will seek to preserve this Agreement, and will meet promptly to determine the appropriate response as described below:

> * In the event that a portion(s) of this Agreement is in direct conflict with a court order or resulting amended BiOp, the Parties shall meet and agree on an appropriate amendment to that section, or, if such amendment is not possible under the terms of the court order or resulting amended BiOp, then a substitute provision shall be negotiated by the Parties.
>
> * If court-ordered FCRPS operations or resulting amended BiOp require additional actions that are either financially material to an Action Agency or that materially constrain the Corps or Reclamation from meeting FCRPS purposes, section IV.E.4 below shall apply. The Parties intend that determinations of materiality will only be made in cases of great consequence.
>
> * The Parties will participate in any court-ordered process or remand consultation in concert with IV.D and IV.E of this Agreement.
>
> * Without limiting the other provisions of this section IV.E.2, in the case of a court order or resulting amended BiOp that constrains actions in the CRFMP, the Parties agree that this Agreement shall remain in effect unless a court order or resulting amended BiOp materially constrains the actions in the CRFMP. The Parties intend that determinations of materiality will only be made in cases of great consequence

E.3. Regardless of any legal challenge, BPA will take steps to:

- Ensure that the commitments in this Agreement are not modified or reduced based on agency-wide streamlining or other cost-cutting efforts
- Imbed the estimated cost of implementing this Agreement in the agency's revenue requirement to be recovered through base wholesale power rates

- Propose and, if established after a Northwest Power Act section 7(i) hearing, exercise rate risk mitigation mechanisms as needed to maintain the funding commitments in this Agreement (e.g., cost recovery adjustment clauses); and
- Consider agency cost reductions, or other measures to maintain the funding commitments in this Agreement.

E.4. In the event of the occurrence of any of the material effects in E.2, or in the event of material non-compliance with the Agreement not resolved by dispute resolution, the affected Party or Parties shall notify the other Parties immediately, and identifying why the event is considered material. The Parties shall utilize dispute resolution if there is a disagreement as to whether the event is material. In addition, prior to any withdrawal, the Parties shall first make a good faith effort to renegotiate mutually agreeable modifications to the Agreement. If renegotiation is not successful, the affected Party may notify the other Parties in writing of its intent to withdraw by a date certain. A Party may not withdraw from the Agreement on the basis of its own non-compliance. If renegotiation is not successful, at the time the withdrawal is effective, all funding commitments and/or other covenants made by the withdrawing Party cease, and the withdrawing Party shall have no further rights or obligations pursuant to the Agreement, and reserves any existing legal rights under applicable statutes, including all arguments and defenses, and this Agreement cannot be used as an admission or evidence.

If the affected Party does not withdraw, that Party may challenge in any appropriate forum the asserted non-compliance with the terms of this Agreement, *provided* that judicial review of disputes arising under this agreement is limited to BPA.

The Parties may, by mutual agreement, consider negotiations or withdrawal for changed circumstances other than those enumerated above.

If one Party withdraws from the Agreement, any other Party has the option to withdraw as well, with prior notice.

The provisions of this Agreement authorizing renegotiation, dispute resolution, withdrawal, or challenge in appropriate forums provide the sole remedies available to the Parties for remedying changed circumstances or disputes arising out of or relating to implementation of this Agreement.

E.5. Savings. In the event of withdrawal, BPA will continue providing funding for projects necessary for support of BiOp commitments (as determined by the Action Agencies), and will provide funding for other on-going projects or programs that the Parties mutually agree are important to continue.

F. Dispute Resolution

F.1. Negotiation

1.a. The Parties shall attempt in good faith to resolve any dispute arising out of or relating to implementation of this Agreement in accordance with this section and without resort to administrative, judicial or other formal dispute resolution procedures. The purposes of this section is to provide the Parties an opportunity to fully and candidly discuss and resolve disputes without the expense, risk and delay of a formal dispute resolution.

1.b. If the Parties are unable to resolve the dispute through informal dispute resolution, then the dispute shall be elevated to negotiating between executives and/or officials who have authority to settle the controversy and who are at a higher level of management than the person with direct responsibility for administration of this Agreement. All reasonable requests for information made by one Party to the other will be honored, with the Action Agencies treating "reasonable" within the context of what would be released under the Freedom of Information Act.

1.c. In the event a dispute over material non-compliance with the Agreement has not been resolved by negotiation, the affected Party may seek to withdraw or seek review in appropriate forums in accordance with section IV.E, above.

F.2. Mediation

In the event the dispute has not been resolved by negotiation as provided herein, the disputing Parties may agree to participate in mediation, using a mutually agreed upon mediator. To the extent that the disputing Parties seeking mediation do not already include all Parties to this Agreement, the disputing Parties shall notify the other Parties to this Agreement of the mediation. The mediator will not render a decision, but will assist the disputing Parties in reaching a mutually satisfactory agreement. The disputing Parties agree to share equally the costs of the mediation.

G. Modification

The Parties by mutual agreement may modify the terms of this Agreement. Any such modification shall be in writing signed by all Parties.

V. MISCELLANEOUS PROVISIONS

A. Term of Agreement

Except as otherwise provided regarding hatcheries, see section IV.B.2, the term of this Agreement will extend from its effective date through the end of fiscal year 2018 which is midnight on September 30, 2018.

B. Applicable Law

All activities undertaken pursuant to this Agreement must be in compliance with all applicable laws and regulations. No provision of this Agreement will be interpreted or constitute a commitment or requirement that the Action Agencies take action in contravention of law, including the Administrative Procedure Act, the National Environmental Policy Act, the Endangered Species Act, Federal Advisory Committee Act, Information Quality Act, or any other procedural or substantive law or regulation. Federal law shall govern the implementation of this Agreement and any action, whether mediated or litigated, brought or enforced.

C. Authority

Each Party to this Agreement represents and acknowledges that it has full legal authority to execute this Agreement.

D. Consistency with Trust and Treaty Rights

Nothing in this Agreement is intended to nor shall in any way abridge, abrogate, or resolve any rights reserved to the Tribes by treaty. The Parties agree that this Agreement is consistent with the treaty rights of the signatory Tribes and the United States' trust obligation to tribes, but does not create an independent trust obligation. The Tribes specifically represent and warrant that that no approval of this Agreement by the Secretary of the Interior or the Bureau of Indian Affairs or any other federal agency or official is required in order for the Tribes to execute this Agreement or for this Agreement to be effective and binding upon the Tribes.

E. Effective Date & Counterparts

The effective date of this Agreement shall be the date of execution by the last Party to provide an authorized signature to this Agreement. This Agreement may be executed in counterparts, each of which is deemed to be an executed original even if all signatures do not appear on the same counterpart. Facsimile and photo copies of this Agreement will have the same force and effect as an original.

F. Binding Effect

This Agreement shall be binding on the Parties and their assigns and successors. Each Party may seek dispute resolution in accordance with Sections IV.F, or to withdraw in accordance with Sections IV.E if the dispute is not resolved. The commitments made by the Parties in this Agreement apply to the Parties, their staff, any persons hired or volunteering for a Party, any representative or organization under a Party's guidance or control, and any person or entity that acts as an agent for a Party, and to participation in all forums (e.g., Tribal participation in the Columbia Basin Fish and Wildlife Authority, Action Agency participation in the Pacific Northwest Coordination Agreement processes). The commitments made by the Parties in this Agreement also includes a commitment not to directly or indirectly support third-party efforts to challenge the adequacy of the BiOps, this Agreement, or the Parties efforts to implement them.

G. No third party beneficiaries are intended by this Agreement.

H. All previous communications between the Parties, either verbal or written, with reference to the subject matter of this Agreement are superseded, and this Agreement duly accepted and approved constitutes the entire Agreement between the Parties.

I. Waiver, Force Majeure, Availability of Funds

I.1. The failure of any Party to require strict performance of any provision of this Agreement or a Party's waiver of performance shall not be a waiver of any future performance of or a Party's right to require strict performance in the future**.**

I.2. No Party shall be required to perform due to any cause beyond its control. This may include, but is not limited to fire, flood, terrorism, strike or other labor disruption, act of God or riot. The Party whose performance is affected by a force majeure will notify the other Parties as soon as practicable of its inability to perform, and will make all reasonable efforts to promptly resume performance once the force majeure is eliminated. If the force majeure cannot be eliminated or addressed, the Party may consider withdrawal pursuant to Sections IV.E and IV.F.

I.3 The actions of the Corps and Reclamation set forth in this Agreement are subject to the availability of appropriated funds. Nothing in this Agreement shall be construed to require the obligation or disbursement of funds in violation of the Anti-Deficiency Act.

J. Notice. ***[TBD]***

K. List of Attachments

Attachment A: Passage Standards
Attachment B: Project Commitment Spreadsheets
Attachment C: Group B Steelhead Package
Attachment D: Spring Creek Hatchery Commitments
Attachment E: Forecasting Commitments
Attachment F: Canadian Treaty Commitments
Attachment G: Biological Benefits Analysis
Attachment H: In Lieu Requirements

SIGNATURES:

____
Stephen J. Wright
For the Bonneville Power Administration

____

J. William MacDonald
For the U.S. Bureau of Reclamation

Colonel Steven R. Miles
For the U.S. Army Corps of Engineers

Antone Minthorn
For the Confederated Tribes of the Umatilla Indian Reservation

Ron Suppah
For the Confederated Tribes of the Warm Springs Reservation of Oregon

Ralph Sampson
For the Confederated Tribes and Bands of the Yakama Nation

Olney Patt, Jr.
For the Columbia River Inter-Tribal Fish Commission

Attachment A

The following describes the commitment from the Action Agencies for achieving dam performance on a per project basis for the course of the agreement. The information for each project includes recent operations and dam survival performance standards to be achieved prior to making potential reductions in spill, as well as additional performance metrics to be considered, as provided below.

Dam Survival Performance Standard

Dam survival is the overarching performance standard. The dam passage performance standard is to meet 96% dam passage survival for yearling Chinook and steelhead and 93% for subyearling Chinook and achievement of the standard is based on two years of empirical survival data (see Table 1 on the following page) as set out in FCRPS BA Appendix B.2.6-2-6, section 3.3 and the draft BiOp dated October 30, 2007.

Spill Passage Efficiency and Delay Metrics

Spill passage efficiency (SPE) and delay metrics under current spill conditions, as shown below in the Table 1, are not expected to be degraded ("no backsliding") with installation of new fish passage facilities at the dams. If maintaining SPE and/or passage delay metrics would reduce dam survival or impede achievement of the dam survival performance standards, operations (including spill as necessary) may be adjusted to meet dam survival performance. This provision does not apply at projects where SPE or delay are not currently known and so are not specified in Table 1, but future research, monitoring and evaluation of the metrics is expected at all of those projects.

Future Research, Monitoring and Evaluation

The Action Agencies' dam survival studies for purposes of determining juvenile dam passage performance will also collect information on SPE, BRZ to BRZ survival and delay as well as other distribution and survival information. SPE and delay metrics will be considered in the performance check-ins or with COP updates, but not as principle or priority metrics over dam survival performance standards. Once a dam meets the survival performance standard, SPE and delay metrics may be monitored coincidentally with dam survival testing.

The Action Agencies retain the ability to make adjustments in spill levels as needed to maintain dam survival performance pending further configuration improvements. The specific dam passage testing requirements will continue to be coordinated through the Anadromous Fish Evaluation Program annual process.

Table 1. Current estimates of dam survival (COMPASS and empirical), spill passage efficiency, and delay.

Species	Project	Current Survival (COMPASS)	2006 Survival (Empirical)	2007 Survival (Empirical)	Most Recent SPE[4]	Date of SPE Data Source	Most Recent Median Delay*
Yearling Chinook	LGR	96.1	97.5	na	43-66	2002-2005	2.28 -10h
	LGS	95.6	95.5	99.7	57-82	2006-2007	4.4 - 6.5h
	LMN	93.6	94.3	95.2	58-75	2006-2007	2.2 - 3.0h
	IHR[1]	96.6	96.1 / 96.2	94.9 / 95.8	73->90	2005-2007	1.1 - 2.3h
	MCN	94.2	94.0	92.8 /93.0	45-57	2005,2007	1.0 - 3.9 h
	JDA[5]	93.9	92.9/96.3	92.2/94.0	48-75	99,00,02,03	0.2 - 8.5 h
	TDA[6]	91.4	91.0	93.0	70->90	2002-2005	0.51 - 0.70h
	BON[7]	97.1	95.1	96.6	53-54	2004-2005	0.01 - 3.4 h
Steelhead	Project	Current Survival (COMPASS)	2006 Survival (Empirical)	2007 Survival (Empirical)	Most Recent SPE[4]	Date of SPE Data Source	Most Recent Median Delay*
	LGR	96.2	97.6	na	51-74	2002-2005	1.7 - 6.0h
	LGS	95.9	98.5	98.5	36-51	2006-2007	5.5 - 36.3h
	LMN	93.2	100.0	95.5	48-64	2006-2007	5.5 - 19.0h
	IHR[1]	98.8	100 / 100	97.3 / 96.4	61->90	2005-2007	1.1 - 1.9h
	MCN	95.2	na	na	52-78	2005,2007	4.38 - 10.2 h
	JDA[5]	91.7	95.7/90.4	94.0/91.5	45-64	99-00,03	0.3 - 13.4h
	TDA[6]	92.3	na	na	90**	2002-2005	0.23 - 0.8h
	BON[7]	97.2	99.1	96.3	74-75	2004-2005	0.01 - 9.7h
Subyearling Chinook	Project	Current Survival (COMPASS)	2006 Survival (Empirical)	2007 Survival (Empirical)	Most Recent SPE[4]	Date of SPE Data Source	Most Recent Median Delay*
	LGR	na	91.4	na	67-88	2005-2007	8.37 - 15.87
	LGS	na	94.2	90.5	58-84	2006-2007	6.8 - 16.3h
	LMN	na	95.0	84.2	81->90	2005-2007	2.7-3.0h
	IHR	na	95.2	95.6	84->90	2005-2007	2.0- 5.0h
	MCN	na	96.0	96.1 / 89.5	61-64	2005,2007	0.84 - 3.2h
	JDA[5]	na	92.8/99.2	92.2/94.0	58-59	99,00,02,03	1 - 3h
	TDA[6]	na	82.0	90.0	63->90	2002-2005	0.62 - 0.69h
	BON[7]	na	89.1	93.8	55-75	2004-2005	0.01 - 5.7 h

1 – 30% 24-hour spill / 45 kcfs day, Gas Cap night
2- Green shading indicates that the dam survival performance standard has been met at that project for that species.
3 – Current COMPASS survival numbers may change upon completion of final modeling.
4-Sources and assumptions are attached at the end of this document
5-JDA Empirical survival-yearling and subyearling data is from 2002 and 2003. Steelhead is from 2000 and 2002
6-TDA Empirical survival is from 2004 and 2005
7-BON Empirical survival is from 2004 and 2005
*See notes under assumptions regarding specific delay measurements
**-Two years of steelhead data both measured 90% SPE at The Dalles so there is no range

Sources and Assumptions for SPE and Delay Estimates in Table 1:

Lower Granite Dam:

- SPE estimates include both RSW and standard spill.
- Forebay Residence Time measured from 2km upstream to face of dam.
  - 2005 Spring Estimates were based on Figure 26 from Perry et al, 2007. RSW treatment only.
  - Range of point estimates in 2003 was 0.5 hours to 103.8 hours for yearling Chinook, 0.07 to 146.61 hours for steelhead (wild and hatchery combined)
  - 05 range for yearling Chinook was from near 0 to approx 60 h. Steelhead ranged from near zero to approx 42 h.
  - In 2005, delay ranged from 0.89 to 206.17 hours for subyearling Chinook.
  - Forebay estimates only calculated when RSW was operating
  - Sub-yearling estimates are estimated from J. Beeman's 2006 AFEP presentation. 05 and 07 estimates fell with the range of the 03 and 06 estimates.

Beeman, J., T. Counihan, A. Braatz, S. Fielding, J. Hardiman, H. Hansel, A. Pope, A. Puls, J. Schei, C. Walker, and T. Wilkerson. 2006. Migration Characteristics of Juvenile Salmonids in the Forebay of Lower Granite Dam During Removable Spillway Weir (RSW) and Behavioral Guidance Structure (BGS) tests, in 2006. Preliminary Data Presented at 2006 AFEP review in Portland, OR.

Counihan, T., A. Puls, J. Hardiman, C. Walker, and I. Duran. 2007. Survival and Migration Behavior of Subyearling Chinook Salmon Passing Lower Granite Dam, 2007. Preliminary Data presented at 2007 AFEP Review. Walla Walla, WA.

Perry, R.W., T.J. Kock, M.S. Novick, A.C. Braatz, S.D. Fielding, G.S. Hansen, J.M. Sprando, T.S. Wilkerson, G.T. George, J.L. Schei, N.S. Adams, and D.W. Rondorf. 2007. Survival and Migration Behavior of Juvenile Salmonids at Lower Granite Dam, 2005. Final Report.

Plumb, J.M., A.C. Braatz, J.N. Lucchesi, S.D. Fielding, A.D. Cochran, T.K. Nation, J.M. Sprando, J.L. Schei, R.W. Perry, N.S. Adams, and D.W. Rondorf. 2004. Behavior and Survival of Radio-Tagged Juvenile Chinook Salmon and Steelhead Relative to the Performance of a Removable Spillway Weir at Lower Granite Dam, Washington, 2003. Final Report.

Little Goose Dam:

- Forebay Residence Time measured from 2km upstream to face of dam.
  - Yearling Chinook and Steelhead estimates in table 1 represent the ave median residence time of spill, bypass, and turbine estimates during spill. Taken from appendix table C1 in Perry et al. 2007.

  - Range of point estimates in 2005 was 1.3 hours to 221.41 hours for yearling Chinook, 0.27 hours to 101.43 hours for steelhead, and 0.7 hours to 100.12 hours for subyearlings. Point estimates ranged from near 0 residence time to over 200 hours in 2007.
  - 05 usually set the low end of residence time range for all three species.
  - 06 was very close to values that were previously in table and usually fell within 05 and 07 estimates.
  - 07 steelhead was high end of range and was estimated from 07 AFEP powerpoint presentation (assumed 22hr median delay for both gas cap and bulk 2 treatment, assumed 63 hr for bulk 1 treatment).
  - 07 sub-yearling was high end of range. Also based on 07 AFEP powerpoint. Assumed 18.75h for bypass and 12.5h for spill and turbine.

Beeman, J.W., A.C. Braatz, S.D. Fielding, H.C. Hansel, S.T. Brown, G.T. George, P.V. Haner, G.S. Hansen, and D.J. Shurtleff. 2007. Migration Behavior and Survival of Juvenile Salmonids at Little Goose Dam, 2007. Preliminary data reported at 2007 AFEP review in Walla Walla, WA.

Beeman, J., T. Counihan, A.Braatz, S. Fielding, J. Hardiman, H. Hansel, A. Pope, A. Puls, A. Schei, C. Walker, and T. Wilkerson. 2006. Passage, Survival, and Approach Patterns of Juvenile Salmonids at Little Goose Dam, 2006. Preliminary data reported at 2006 AFEP review in Portland, OR.

Perry, R.W., M.S. Novick, A.C. Braatz, T.J. Kock, A.C. Pope, D.J. Shurtleff, S.N. Lampson, R.K. Burns, N.S. Adams, and D.W. Rondorf. 2007. Survival and migration behavior of juvenile salmonids at Little Goose Dam, 2005. Final Report.

Lower Monumental Dam:

- Forebay Residence Time measured from X km upstream to face of dam.
  - High est. for yearling Chinook came from 06 and 07 AFEP review, and steelhead was from 07 AFEP Review. Highest for subs came from 05 and 07 AFEP review, low was from 06.
  - Range of yearling data from 0 to 42 hrs in 06, from 0 to over 100hrs for steelhead in 07, and for sub-yearlings residence time ranged from near 0 to 156 h in 05.

E.E. Hockersmith, G.A. Axel, D.A. Ogden, R.F. Absolon, and B.P. Sandford. 2007. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2006. Preliminary Data presented at 2006 AFEP review in Portland, OR.

E.E. Hockersmith, G.A. Axel, D.A. Ogden, R.F. Absolon, and B.P. Sandford. 2007. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower

Monumental Dam, 2007. Preliminary Data presented at 2007 AFEP review in Walla Walla, WA.

R.F. Absolon, E.E. Hockersmith, G.A. Axel, D.A. Ogden, B.P. Sandford, and S.G. Smith. 2007. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2007. Preliminary Data presented at 2007 AFEP review in Walla Walla, WA.

R.F. Absolon, E.E. Hockersmith, G.A. Axel, D.A. Ogden, B.P. Sandford, and S.G. Smith. 2006. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2006. Preliminary Data presented at 2006 AFEP review in Portland, OR.

R.F. Absolon, E.E. Hockersmith, G.A. Axel, D.A. Ogden, B.P. Sandford, and S.G. Smith. 2005. Passage Behavior and Survival for Radio-Tagged Sub-yearling Chinook Salmon at Lower Monumental Dam, 2005. Preliminary Data presented at 2005 AFEP review in Walla Walla, WA.

Ice Harbor Dam:

- All SPE estimates combine RSW and standard spill efficiency. 2007 preliminary data was considered but all estimates fell within the ranges prescribed by the 2005 and 2006 data.
- Forebay Residence Time measured from upstream BRZ to face of dam.
  - Only RSW treatment was considerend for 05 spring data
  - High est. for yearling Chinook came from 05 RSW treatment, and steelhead was from 06 30% treatment. Low est for both spring species was for 06 BiOp spill. High est for subs came from 05, low was from 06 (based on Ogden’s 2007 AFEP presentation).
  - High end of 90% percentile residence times was greater than 25hrs for both yearling chinook and steelhead in 2005. Max. residence times of subs was approx 150hrs in 2005.

Axel, G.A., E.E. Hockersmith, D.A. Ogden, B.J. Burke, K. Frick, B.P. Sandford, and W.D. Muir. 2007. Passage Behavior and Survival of Radio-Tagged Yearling Chinook Salmon and Steelhead at Ice Harbor Dam, 2006. Draft report dated Sept. 2007.

Axel, G.A., E.E. Hockersmith, D.A. Ogden, B.J. Burke, K. Frick, and B.P. Sandford. 2007. Passage Behavior and Survival of Radio-Tagged Yearling Chinook Salmon and Steelhead at Ice Harbor Dam, 2005. Final Report.

Ogden, D.A., E.E. Hockersmith, Axel, G.A., R.F. Absolon, and B.P. Sandford. 2006. Passage Behavior and Survival of Sub-yearling Chinook Salmon at Ice Harbor Dam, 2006. Preliminary Data presented at 2006 AFEP review in Portland, OR.

Ogden, D.A., E.E. Hockersmith, Axel, G.A., R.F. Absolon, B.P. Sandford, S.G. Smith, and D.B. Dey. 2005. Passage Behavior and Survival of Sub-yearling Chinook Salmon at Ice Harbor Dam, 2005. Preliminary Data presented at 2005 AFEP review in Walla Walla, WA.

McNary Dam:

- 2007 SPE includes TSWs.
- 2006 data was not used due to continued analysis by USGS. The preliminary data previously presented from 2006 is expected to change, possibly significantly with the draft final report.
- High Delay estimates for yearling Chinook, steelhead, and subyearlings were from **2005** and were **measured from 2km upstream**. Low estimates were from **2007** and were **measured from 60m upstream**.
    - 2005 residence times ranged from 0.84 to 171.87 hrs for yearling Chinook, from 1.07 to 135.35 hrs for steelhead, and from 0.78 to 2.28 hours for sub-yearling Chinook during court ordered spill.
    - 2007 residence times ranged from 0.002 to 5.997 hrs for yearling Chinook, 0.003 to 4.176 hours for steelhead, and from 0.001 to 12.838 hours for sub-yearling Chinook.

Adams, N.S. and T.D. Counihan. 2008. Survival and Migration Behavior of Juvenile Salmonids and McNary Dam, 2007. Draft Report dated Feb 12, 2008.

Perry. R.W., A.C. Bratz, M.C. Novick, J.L. Lucchesi, G.L. Rutz, R.C. Koch, J.L.Schei, N.S. Adams, and D.W. Rondorf. 2007. Survival and Behavior of Juvenile Salmonids at McNary Dam, 2005. Final Report.

John Day Dam:

- Chinook SPE estimates are from 1999,2000,2002, and 2003. Steelhead SPE estimates are from 1999,2000, and 2002.
- Forebay Residence Time measured from 100m upstream to face of dam.
    - High est. for yearling Chinook came from 2000 0/45 daytime treatment. High steelhead was from 2004 30% treatment. Low est for yearling Chinook and steelhead were both from 2000 0/45 night treatment. High est for subs came from 2003 0/60 daytime estimate, low was from 2002 0/60 treatment.

John Day Lock and Dam Configuration and Operation Plan. April 2007.

Delay estimates summarized by Mike Langsley and submitted to COMPASS dam passage group.

The Dalles Dam:

- SPE estimates include sluiceway efficiency as well as spill efficiency.   Data collected from 2002-2005.
- Forebay Residence Time measured from approx. 100m upstream to face of dam.
    - All estimates are from 2002-2005. There is very little variability among years.

Johnson, G.E., J.W. Beeman, I.N. Duran, and A.L. Puls. 2007. Synthesis of Juvenile Salmonid Passage Studies at The Dalles Dam- Volume II: 2001-2005. Final Report.

Bonneville Dam:

- SPE estimates based on Spill efficiency and B2CC efficiency only. B1 sluiceway is not included in these estimates. Estimates are from 2004 and 2005.
- Forebay Residence Time measured from approx. 100m upstream to face of dam.
    - Data from 2001 was excluded.
    - Yearling and subyearling all had residence times less than one hour for all routes other than B1 when B2 was priority.
    - The high estimate for steelhead was from also from B1, but steelhead had a high estimate of 6.4 hours in the forebay of B2.

Ploskey, G.R., G.E. Johnson, A.E. Giorgi, R.L. Johnson, J.R. Stevenson, C.R. Schilt, P.N. Johnson, and D.S. Pattersion. 2007. Synthesis of Biological Research on Juvenile Fish Passage and Survival at Bonneville Dam through 2005. Final Report.

Attachment C

GROUP B STEELHEAD
Term Sheet on Group B Steelhead Actions

The Parties agree that the following actions can provide substantial survival benefits to Group B Steelhead. Further details of these actions are included in the MOA or its attachments.

Kelt Reconditioning – Capturing steelhead kelts (mature fish migrating downstream subsequent to spawning) and rearing them to allow for repeat spawning has demonstrated success in the Yakima and other basins. The overall benefit to Snake River Group B steelhead has been estimated to yield an average 6% survival improvement.

Nutrient Enhancement – Treatment of selected Snake River basin streams with nutrients to improve fitness will be evaluated.

Transportation Strategy – Alternative Snake River steelhead transportation operations scenarios are estimated to provide relative survival benefits for steelhead and/or spring Chinook..

Abundance-based Harvest Schedule – The *US v Oregon* parties have agreed to an abundance based Group B Steelhead harvest schedule that reduces Group B harvest rate by 2% at lower run sizes. The Parties understand NOAA Fisheries will incorporate a 1% increase in survival for the 10 year BiOp term, and will further describe longer term survival benefits qualitatively.

Conservation Law Enforcement: Enhanced law enforcement efforts have been correlated to increased compliance rates in non-Indian and Indian fisheries, estimated by NOAA Fisheries to provide survival improvement for Group B Steelhead.

Fall Back Operations – Adult steelhead are known to migrate up and downstream in the mainstem Snake and Columbia rivers. The Action Agencies will conduct fallback studies as described in the FCRPS BiOp and will consider the results through adaptive management.

Attachment D

Spring Creek Hatchery
March 2008

Introduction

- In response to the SOR, the Federal Agencies have agreed to implement many elements of the request, with the exception of the requested spill.
- We are also operating the Bonneville corner collector as the primary means of passage for the Spring Creek release.
- The Federal agencies are making a proposal today, having reviewed the record and the views of all parties on the SOR.
- We have developed this proposal in conjunction with representatives for the Warms Springs Tribe, the Yakama Indian Nation, the Nez Perce Tribe, and the Umatilla Tribe, and this proposal also has their endorsement and support. We would like to hear from the other sovereign executives in this meeting.

Background

- We remain convinced, based on the available data, that there may be no biological benefit from the additional spill for returning Spring Creek adults. However, we recognize that there is biological uncertainty in the available data, and have heard the differing views of the parties on this. In addition, we have heard from the tribes regarding the importance of these fish for tribal fisheries.
- We believe that our priority is to reprogram the Spring Creek hatchery production so that this release and spill are unnecessary. Under this proposal, the sovereigns and the action agencies will work together to do just that.
- Because the goal is reprogramming that would make this early spill unnecessary, there is not a need for further testing of this additional spill request. Nevertheless, some information may be collected because the fish have been marked.
- One biological consideration we consider relevant is the issue of crowding at the bypass, because of the concentrated fish release. This is not a large concern, but in the interest of compromise and optimizing conditions for fish we are willing to spill for this purpose for one year only, as part of a broader multi-year agreement.

Proposal

- Based on advice from NOAA Fisheries and our biologists, we believe that a spill of 35 kcfs would be appropriate to alleviate the crowding issue. For 2008, we would propose to implement this level of spill from midnight Thursday, 3/6/08, to 6 am Monday, 3/10/08, while maintaining the current chum protection level.
- Next year (2009) and beyond, we would not spill, but would work with the sovereign parties to stagger fish releases to minimize crowding.
- We would expect a mutual commitment from the sovereign parties to join us in supporting and implementing Spring Creek reprogramming as early as 2010, but no later than 2012.
- We will seek to memorialize these understandings in the MOAs we are negotiating with the sovereign parties.

Attachment E

Actions To Improve Forecasting Methods And Tools To Optimize Reservoir Use For Fish Operations

- The Action Agencies and Tribes (as defined in the accompanying Treaty Tribes-Action Agency MOA) will convene a Columbia River Forecast and Data Committee described below.[7] The Action Agencies agree to consider the committee outcomes and recommendations in their implementation processes.

The primary function of the group will be to promote and support the advancement of forecasting skill, products and techniques in the Columbia Basin. It will provide an open forum for sharing, discussing, evaluating and potentially implementing new forecasting techniques into the operation and planning of the Columbia Basin system. The term forecasting will refer to both water supply forecasting and streamflow forecasting.

The group will be composed of technical representatives from the Action Agencies and the Tribes, but will be open for participation from any representative of a governmental organization willing to contribute to the effectiveness and success of the group. The group will be chaired by a representative from the core group and will rotate annually. General business meetings of the group will occur no less than quarterly but more frequently if workload and projects require it. In addition to business meetings, there will be an annual meeting in the early fall to review the performance of various operational and experimental forecast procedures over the previous water year, to report on any new approved procedures being implemented next year, and to plan committee work for the coming year.

Responsibilities of the group will include tracking and reviewing the performance of current forecasting procedures and techniques and sharing, discussing, and investigating the potential of new forecasting techniques and modeling. When promising research or techniques are discovered or introduced for consideration, the group will develop a strategy for either investigating the potential improvements with available technical staff or providing recommendations or proposals to the Action Agencies for possible funding and support. The group as a whole will oversee the progress and results of any work initiated and supported by the group. The group will also set up criteria for determining the level of "improvement" to the forecasting required to warrant implementation. The group will participate in the evaluation of new forecast procedures, models, and techniques and provide recommendations on the incorporation of the new procedures into the planning and operation of the Columbia River system.

Also within the scope of the group will be facilitating the sharing of data, where possible, and the monitoring of the data network and systems which enhance and support the forecasting capabilities of the region. When necessary, the group will provide recommendations on improvements and enhancements to the network.

[7] Possible names: Columbia River Forecast and Data Committee (CRFDC), Columbia River Advancement in Forecasting Team (CRAFT)

The group will also have an educational role, providing forums for the exchange of technical information and research. This will take the shape of open workshops with presenters speaking on current research and forecast projects. The group will also have a role in educating users on forecasting products and on specific forecast areas, providing the technical expertise and platform for conducting seminars on topics such as ESP forecasting, climate change impacts to forecasting, etc.

Potential Initial Items for CRWMG to address:

Forecasting:

1. Evaluation of the NRCS daily statistical water supply forecast procedure
2. Evaluate the benefits/problems with increased frequency of water supply updates
3. Review the indices evaluated and selected when the Libby forecast procedure was last updated. Assess the need and/or merits of updating the procedure with other indices, such as the Trans-Niño index.
4. Consider coordinating several agencies' forecasts into one forecast.
5. Consider climate change impacts on future forecasting needs and priorities.

Data:

1. Evaluate the benefits to additional SNOTEL sites, particularly in the Canadian portion of Columbia drainage.

Attachment F

Treaty and Tribal Action Agency Consultation Regarding Columbia River Treaty

Consistent with BPA and Corps Tribal Policies, BPA and the Corps will coordinate with the Tribes ("Tribes" as defined in the accompanying Treaty Tribes-Action Agency MOA) concerning annual operations under the Columbia River Treaty of 1964 ("Treaty"), potential future non-Treaty storage use, and BPA and Corps actions related to possible future U.S.-Canada discussions of post-2024 matters under the Treaty, as follows.

Annual Treaty/Non-Treaty Operations and Treaty Operating Plans

Consistent with the Proposed Action identified in the August 2007 FCRPS Biological Assessment, each operating year, BPA and the Corps will coordinate with the Tribes to discuss Treaty and non-Treaty operations and Treaty operating plans. This coordination will include meeting in the fall to discuss Treaty and non-Treaty operations that occurred during the preceding fish passage season, and to seek tribal input, ideas, and information on planned operations for the next fish passage season. BPA and the Corps also will inform the Tribes of the final operating plan and/or planned operations once finalized. Typical agenda items for the fall meeting would include a review of Treaty and non-Treaty operations for preceding year (including supplemental operating agreements), a review of the current year Detailed Operating Plan and possible supplemental operating agreements, an update on the most-recently prepared Assured Operating Plan and upcoming Detailed Operating Plan. One additional meeting will be held during the fish passage season to provide an update on Treaty and non-Treaty operations.

Potential Non-Treaty Storage

Consistent with the Proposed Action identified in the August 2007 FCRPS Biological Assessment, BPA will seek to negotiate a new long-term agreement with BC Hydro regarding non-Treaty storage use once BPA and BC Hydro have made substantial progress in refilling non-Treaty storage space, and the collective U.S. interests in terms of such a new agreement are established. BPA also will seek to negotiate an annual agreement if a new long-term agreement is not in place or does not address flows for fisheries purposes. If BC Hydro is interested in negotiating a new annual or long-term non-Treaty storage agreement, BPA will coordinate with the Tribes prior to any negotiation to obtain ideas and information on possible points of negotiation. If negotiations occur, BPA will report on major developments during negotiations and will report to the Tribes on any new agreement resulting from negotiations.

Post-2024 Treaty Matters

BPA and the Corps will take the following specific measures to coordinate with the Tribes concerning their actions related to possible U.S.-Canada discussions of post-2024 Treaty matters:

1. Consult with the Tribes during planning activities for post-2024 Treaty matters by holding discussions with the Tribes at a government-to-government level to seek tribal input and identify general issues of concern to the Tribes. Although the schedule for these planning

activities is currently uncertain, it is possible that these activities may continue through 2013 or beyond.

2. Coordinate with tribal staff at a technical level during the expected planning activities for post-2024 Treaty matters to identify possible methods for addressing tribal issues of concern.

3. Provide the results of both the government-to-government and technical discussions with the Tribes to the U.S. Entity under the Treaty for consideration.

4. If formal Treaty negotiations occur, report on a periodic basis to affected Tribes on major developments relative to Corps and BPA actions related to tribal interests.

5. If formal Treaty negotiations occur, consult with the Tribes to assure that tribal rights and concerns are considered by BPA or the Corps regarding their actions.

6. If formal Treaty negotiations occur, strive to resolve issues and encourage the U.S. government to arrive at decisions that appropriately consider identified tribal concerns.

As organizational structures are set in place by BPA, the Corps, and possibly the U.S. and Canadian governments to discuss issues related to post-2024 Treaty matters, BPA and the Corps will coordinate with the Tribes and discuss mutually acceptable changes in the role of the Tribes in post-2024 matters related to BPA and Corps actions.

Corps and BPA consultation and coordination with the Tribes on post-2024 Treaty matters as set forth herein will be conducted to the extent appropriate and permitted under applicable policies, procedures, laws and regulations including United States principles of international treaty discussions and negotiations and to the extent permitted by the U.S. Department of State.

Attachment G

Biological Benefits Analysis

(In Development)

Attachment H

In Lieu Requirements

(In Development)

2018 EXTENSION OF THE 2008 COLUMBIA BASIN FISH ACCORDS MEMORANDUM OF AGREEMENT AMONG THE CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION, THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON, THE CONFEDERATED TRIBES AND BANDS OF THE YAKAMA NATION, COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION, BONNEVILLE POWER ADMINISTRATION, U.S. ARMY CORPS OF ENGINEERS, AND U.S. BUREAU OF RECLAMATION

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2018 EXTENSION OF THE 2008 COLUMBIA BASIN FISH ACCORDS MEMORANDUM OF AGREEMENT AMONG THE CONFEDERATED TRIBES OF THE UMATILLA INDIAN RESERVATION, THE CONFEDERATED TRIBES OF THE WARM SPRINGS RESERVATION OF OREGON, THE CONFEDERATED TRIBES AND BANDS OF THE YAKAMA NATION, COLUMBIA RIVER INTER-TRIBAL FISH COMMISSION, BONNEVILLE POWER ADMINISTRATION, U.S. ARMY CORPS OF ENGINEERS, AND U.S. BUREAU OF RECLAMATION

I. INTRODUCTION

This 2018 Extension and Restatement of the 2008 Columbia Basin Fish Accords Memorandum of Agreement ("**Extension**") updates and extends the 2008 Columbia Basin Fish Accords Memorandum of Agreement ("**2008 Agreement**") developed through good faith negotiations by the Bonneville Power Administration ("**Bonneville**"), the U.S. Army Corps of Engineers ("**Corps**") and the U.S. Bureau of Reclamation ("**Reclamation**") (together the "**Action Agencies**") and the Confederated Tribes of the Warm Springs Reservation of Oregon, the Confederated Tribes of the Umatilla Indian Reservation, the Confederated Tribes and Bands of the Yakama Nation, and the Columbia River Inter-Tribal Fish Commission ("**CRITFC**") ("**Tribes**" or "**Treaty Tribes,**" and each of the Tribes may be individually referred to as an "**entity**"). Collectively the Treaty Tribes and the Action Agencies are "**the Parties**" to this Extension.

This Extension continues to address direct and indirect effects of construction, inundation, operation, and maintenance of the fourteen federal multiple-purpose dam and reservoir projects in the Federal Columbia River Power System that are operated by the Action Agencies as a coordinated water management system for multiple congressionally authorized public purposes and referred to as the **Columbia River System**,[1] as well as Reclamation's Upper Snake River Projects on fish and some wildlife resources of the Columbia River Basin. The Action Agencies and the Tribes intend that the 2008 Agreement, as continued by this extension, will provide benefits to all the Parties.

[1] This Accord extension covers the Columbia River System, which is comprised of 14 Federal multipurpose dam and reservoir projects operated as a coordinated water management system, and the Upper Snake River Projects. The 12 projects operated and maintained by the Corps are: Bonneville Dam, The Dalles, John Day, McNary, Chief Joseph, Albeni Falls, Libby, Ice Harbor, Lower Monumental, Little Goose, Lower Granite, and Dworshak dams. Reclamation operates and maintains the Hungry Horse Project; the Columbia Basin Project, which includes Grand Coulee Dam; and the Upper Snake River Projects which are Minidoka, Palisades, Michaud Flats, Ririe, Little Wood River, Boise, Lucky Peak, Mann Creek, Owyhee, Vale, Burnt River, and Baker.

The Parties' purposes for this Extension, like the 2008 Agreement, include, among others:

- To address the Parties' mutual concerns for certainty and stability in the funding and implementation of projects for the benefit of fish and wildlife affected by the Columbia River System;
- To foster a cooperative relationship and partnership in implementation of the mutual commitments in the 2008 Agreement and this Extension; and
- To resolve issues between the Parties regarding the Action Agencies' responsibilities under certain laws applicable to the Columbia River System for the duration of this Extension.

Accomplishments realized from the Parties' pursuit of these purposes during the initial term of the 2008 Agreement are summarized in Section II, below. Based on those accomplishments and the purposes stated above, the Parties elect to extend the 2008 Agreement to continue the commitments they made to each other in 2008. This Extension updates and modernizes certain terms and conditions to reflect the evolution of the environmental, legal, and economic context of Columbia River System operations and impacts, and also the status and focus of the Treaty Tribes' resource restoration, protection and enhancement projects, including the Tribes' artificial production projects.

This Extension is intended to further the purposes of the Pacific Northwest Electric Power Planning and Conservation Act ("**Northwest Power Act"**), including its assurance to the Pacific Northwest of an adequate, efficient, economical, and reliable power supply as well as its commitments to protect, mitigate, and enhance the fish and wildlife, including related spawning grounds and habitat, of the Columbia River and its tributaries that have been affected by the Columbia River System development and operations. This Extension helps provide a means to achieve the overall balance between fish and wildlife, power, and other project purposes for which the Northwest Power Act makes the Action Agencies responsible.

This Extension builds on the foundation of the partnership and mutual commitments developed by the Parties during the term of the 2008 Agreement. This Extension reflects the Parties' intention to continue the productive and proven approach to alignment and project implementation for fish and wildlife mitigation while reasonably accounting for ongoing legal, financial, and operational uncertainties confronting the Action Agencies.

Due to developments in the energy market and increased spring spill operations such as those following the 2018 order of the U.S. District Court for the District of Oregon, Bonneville expects reductions in its near-term revenue. For Bonneville, this extension is part of its approach to improved cost management of the Bonneville Fish and Wildlife Program.

The provisions in the 2008 Agreement that are unchanged and remain effective under this Extension are listed in **Attachment B: Provisions from the 2008 Agreement that Remain in Effect**.

II. ACCOMPLISHMENTS UNDER THE 2008 AGREEMENT

The 2008 Agreement contains commitments related to Columbia River System operations and funding of certain tribally-sponsored fish and wildlife habitat protection and enhancement projects and fish production facility construction and operation. The 2008 Agreement promotes meaningful tribal participation and alignment among the Parties in decision-making about system operations, including spill, transport and flow management, biological performance, and adaptive management in a manner consistent with tribal sovereign interests in fisheries management and general federal trust obligations with respect to treaty resources.

On the strength of 2008 Agreement commitments, the Tribes have implemented projects throughout the Columbia River Basin that protect, restore, and improve tributary fish habitat to benefit Endangered Species Act ("**ESA**") listed salmonids and other species. Tribal steelhead kelt reconditioning facilities have demonstrably improved the productivity of listed steelhead in the mid- and upper Columbia River. Furthermore, both the habitat projects and the tribal fish production facilities supported by the Agreement are addressing federal responsibilities and helping to develop management strategies for mitigation of the Columbia River System's impacts to non-listed species, including lamprey, sturgeon, and wildlife.

A. RESULTS OF THE OVERHAUL OF THE COLUMBIA RIVER SYSTEM

The Action Agencies have overhauled the Columbia River System to protect, mitigate, and enhance fish and wildlife, to ensure system operations are not likely to jeopardize ESA-listed species or destroy or adversely modify their designated critical habitat, and to contribute to the conservation of listed species. System improvements also successfully addressed the broad anadromous fish mandates in the Northwest Power Act.[2] Together with changes to fisheries management pursuant to the *U.S. v. Oregon* Fisheries Management Plans, Pacific Salmon

[2] *See* 16 U.S.C. § 839b(h)(6)(E) (mandating "improved survival" at the Columbia River System dams and "flows of sufficient quality and quantity . . . to improve production, migration, and survival of such fish as necessary to meet sound biological objectives").

Treaty, and other actions, the following improvements have contributed to a contemporary record of 2.4 million adult salmon and steelhead passing Bonneville Dam in 2014.[3]

- **Juvenile fish passage survival** at the Columbia River System dams for spring and summer migrants now meets or exceeds juvenile dam passage survival performance standards of 96% and 93%, respectively.[4]

- **Travel time improved** for yearling Chinook and juvenile steelhead through the system through the combination of spill and spillway weirs and other surface passage routes, even in low flow years such as 2015.[5]

- **Total In-River survival** has improved for migrating juvenile salmon and steelhead. Comparing two time periods reported in National Oceanic and Atmospheric Administration's ("**NOAA**") reach study[6], (1997-2007 and 2008 – 2016), there has been a 10% survival increase for hatchery and wild sockeye salmon, a 2% increase in hatchery and wild Chinook (4% for wild), and a 25% survival increase for hatchery and wild steelhead (13% for wild).

- **For Pacific lamprey, the Corps accomplished the following during the last 10 years:**

  - Implemented fish ladder improvements at all eight lower Columbia and Snake River dams, including two ladder entrance modifications and two prototype bypass flumes that are still being evaluated;

  - Modified juvenile bypass screen operations at McNary Dam and redesigned bypass collection raceway screens at transportation projects;

  - Developed juvenile lamprey tag criteria, tagging protocol, and a prototype acoustic tag that was field tested in 2017;

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[3] The 2014 returns were five times higher than the 471,119 salmonids that passed Bonneville Dam in 1938 when it was completed. Data for 1938 adult salmonid returns is available from the Fish Passage Center's website http://www.fpc.org/environment/fcounts.asp?fr_cdy=1938&fr_cdm=1&fr_cdd=1&to_cdm=12&to_cdd=31&prj=BON&subbtn=salmon&op=runsum
Contemporary salmonid return numbers reported in *Endangered Species Act Federal Columbia River Power System 2016 Comprehensive Evaluation*—Section 1 at page 5 (Jan. 2017) (*hereinafte*r 2016 Comprehensive Evaluation).
[4] 2016 Comprehensive Evaluation at page 4. When Congress passed the Northwest Power Act the estimated average juvenile mortality at each main-stem dam and reservoir complex was 15-20% with losses recorded as high as 30%. *See NW Res. Info. Center v. NW Power Planning Council*, 35 F.3 1371, 1374 (9th Cir. 1994) (*citing* the U.S. General Accounting Office, *Impacts and Implications of the Pacific Northwest Power Bill* at page 22 (Sept. 4, 1979)).
[5] 2016 Comprehensive Evaluation at page 20.
[6] James R. Faulkner, Daniel L. Widener, Steven G. Smith, Tiffani M. Marsh, and Richard W. Zabel. 2017. Survival Estimates for the Passage of Spring-Migrating Juvenile Salmonids through Snake and Columbia River Dams and Reservoirs, 2016. Report of research for Bonneville Power Administration, Contract 40735, Project 199302900.

- Identified potential future priorities to improve lamprey passage at Corps dams.

- **For Pacific lamprey, Reclamation accomplished the following during the last 10 years:**

  - Completed the "Assessment of U.S. Bureau of Reclamation Projects in the Columbia River Basin: Effects on Pacific Lamprey *(Lampetra tridentata)."*

  - Worked with Tribes and federal partners to implement actions in the Yakima and Umatilla basins where Reclamation project facilities affect lamprey. Installed adult passage structures in the Umatilla (Three Mile Falls, Maxwell, and Feed Diversion Dams) and Yakima (Prosser Diversion). Reclamation is also working with Tribes on experimental solutions to reduce entrainment of juvenile lamprey into canals. Additionally, Reclamation participated in studies of screen materials and lamprey protection and conducted canal salvage operations.

B. ACTION AGENCY OFF-SITE MITIGATION ACCOMPLISHMENTS

- Bonneville and the Corps have worked with mitigation partners to protect and **restore tidal functions** to over 8,800 acres in the estuary as of 2016.

- Since 2007, Action Agency partnerships have made over 3,445 miles of **tributary habitat accessible to anadromous fish** and protected over 397,636 acre-feet of water for instream fish flows.

- **For wildlife** affected by dams and reservoirs that covered 378,000 acres, Bonneville has funded partners to protect, mitigate, and enhance over 1,000,000 acres.

- **Safety net and conservation hatcheries** increased the abundance of and reduced the extinction risk for Snake River spring/summer Chinook and Snake River sockeye.[7]

C. TRIBAL ACCOMPLISHMENTS UNDER THE 2008 AGREEMENT

The ten-year Fish Accords have provided substantial certainty and stability in funding for a wide variety of tribal projects benefiting listed and non-listed fish.

[7] 2016 Comprehensive Evaluation at page 34.

- **Habitat Restoration:** The Tribes have implemented nearly 15,000 habitat improvement actions (e.g. installing restorative instream structures, building stream crossings, implementing sediment and erosion control actions, etc.), which resulted in increased habitat protection for salmon, steelhead, and lamprey. The stable funding allowed the Tribes to implement larger and more complex projects, including landscape scale habitat improvements that emphasize natural floodplain functions benefiting fish habitat and water quality and quantity.

- **Salmon Propagation:** Accord funding has fostered tribal restoration or supplementation programs for many anadromous fish populations in the Columbia River, resulting in increased returns to natural production as well as harvest areas.

- **Genetics:** The Tribes operate the Hagerman, Idaho genetics laboratory with Accord funding. Lab operations include developing genetic tools for understanding abundance and run-timing of specific stocks to support regional fisheries conservation and management.

- **Lamprey:** Tribal Accord funds are used for reintroduction and augmentation of lamprey. The Tribes participated and contributed to the 2012 Conservation Agreement for Pacific Lamprey produced by the U.S. Fish and Wildlife Service ("**USFWS**"). Tribal scientific investigations have provided a better understanding of lamprey life history. This understanding and Accord funds have supported activities such as:

  - A translocation program, habitat restoration projects, and capital improvements in the hydrosystem;
  - Tributary adult passage structures and planning for additional propagation facilities; and
  - Gaining greater understanding of juvenile passage issues and solutions.

- **Sturgeon:** The Tribes completed strategic planning for sturgeon conservation, restoration, and management that includes habitat protection and restoration, natural and hatchery production, fishery management, research, monitoring, and evaluation.

- **Sea Lion Predation:** Using Accords funding, the tribes have helped quantify the extent of the impact sea lions are having on the Columbia Basin salmon runs to further strategic control of this predation.

III. EXTENSION OF THE 2008 AGREEMENT

This section sets forth the updates of the 2008 Agreement based on the key considerations that have emerged since its development. The Parties continue to take a comprehensive mitigation approach that includes the following components: Columbia River System configuration and operations; habitat protection and enhancement; hatchery management; and research, monitoring, and evaluation. Bonneville manages the costs of these separate components under a unified fish and wildlife mitigation budget, and the Action Agencies coordinate their mitigation funding and budgets. The comprehensive mitigation commitments adopted in this extension reflect current financial conditions facing Bonneville's unified budget, and the Action Agencies' efforts to address those conditions, while serving the Parties' desire to provide equitable treatment to all purposes for which the Action Agencies operate the Columbia River System. The commitments in this Extension allow the Tribes and Bonneville greater budget flexibility and rate certainty by reducing solicitation, oversight, implementation, and review costs and by providing a mechanism to find savings if necessary.

A. HIGH PRIORITY ACTIONS

1. During the term of this Extension, the Parties will work together and support the following time-sensitive and critical goals and milestones:

    a. Issuance of NOAA Fisheries and USFWS Biological Opinions covering the coordinated water management of the Columbia River System beginning in 2019, including operations and maintenance of the dam and reservoir projects.

    b. Agreeing on spring and summer spill and other fish operations for the 2019-2021 period.

    c. Collaborating to seek alignment of regional sovereigns in support of Columbia River System Biological Opinions, including system operations, in appropriate forums.

    d. Coordinating and submitting complementary recommendations for amendments to the Columbia Basin Fish and Wildlife Program.

    e. Finding efficiencies in project implementation that reduce administrative obligations related to project contracting and reporting, and where appropriate environmental compliance.

2. The Parties will meet annually during the term of this Extension to consider the results of their efforts to meet the milestones above and report on their respective efforts, including specific actions taken and future strategies, for meeting these milestones.

B. FISH OPERATIONS IMPLEMENTATION ACTIONS

1. The Parties are currently collaborating on updated spill, transportation, avian predation, adult passage, and other fish operations that are identified in **Attachment C**: **Columbia River System Operations.** The Parties will work toward regional agreement on these matters. The Parties acknowledge that new biological information will be available during the term of this Extension, which will inform the operations of Columbia River System for fish and wildlife species affected by this Extension. The Parties commit to make best efforts to collaboratively seek alignment on such actions building on the Parties' analyses. Under this Extension, the Parties retain their ability under the 2008 Agreement to respond and adapt to relevant new information regarding survival, flow, spill, and other relevant indicators of fish and wildlife impacts; provided, all such new information is reviewed and discussed collaboratively amongst the Parties in advance of any response in an effort to support alignment.

2. The Action Agencies remain committed to continue coordinating and collaborating on Pacific Lamprey issues through participation in the Pacific Lamprey Conservation Agreement activities and participation in interagency meetings and Pacific lamprey technical workgroup meetings. The Corps will continue counting adult lamprey that pass Lower Columbia and Snake River dams; provide access to the Tribes to collect adult lamprey at Corps' dams in support of tribal restoration actions; and operate and maintain existing lamprey passage facilities. In addition, the Corps will integrate lamprey design considerations into future Columbia River Basin plans for adult and juvenile salmonid passage facilities and participate in the Lamprey Technical Workgroup and USFWS Pacific Lamprey Conservation teams.

   In consultation with the Tribes, the Corps is currently drafting a status report documenting Pacific Lamprey improvements made during 2008-2018 and identifying potential activities to improve Pacific Lamprey passage conditions at Corps dams. The Tribes view these activities as necessary priority actions which should be funded at a level commensurate with Lamprey funding levels from the 2008 Agreement. The Corps will seek funding to finalize and implement the plan which is expected to address the following actions during the term of this Extension:

   - Additional adult lamprey passage improvements at Corps dams,

- Develop/implement a strategy to obtain more accurate adult lamprey counts at Corps dams,
- Develop/implement a Research, Monitoring and Evaluation (RM&E) plan regarding adult lamprey migration behavior and fate above Bonneville, and
- Develop/implement juvenile lamprey RM&E plan.

In the event that these actions are not implemented during this Extension, any Party may support listing Pacific lamprey under the ESA to overcome administrative barriers that forestall survival improvements.

3. The Tribes continue to rely heavily on the services of the Fish Passage Center ("**FPC**") for the analysis and evaluation of the effects of Columbia River System operations and configuration, including on salmonid survival productivity and abundance. Bonneville agrees to continue to provide funding through the Pacific States Marine Fisheries Commission to ensure that the FPC continues to provide evaluation resources required by the Tribes. The commitments in Section II.D of the 2008 Agreement remain as stated, with the added commitment from the Tribes that they will help ensure that any final or review draft FPC analysis based on the request of the Tribes (individually or collectively) or other sovereign entities, as well as underlying data and assumptions, are available upon request to the Action Agencies. In furtherance of the Parties' commitments under this Section III.B, the Tribes shall coordinate with the Action Agencies, and other fisheries co-managers as appropriate, on any request from the Tribes to the FPC to perform studies or analyses.

C. BONNEVILLE'S BUDGET AND BUDGET MANAGEMENT

1. Entity-level funding commitments beginning in FY 2019 are set out in **Attachment A: Lower River Tribes Project Portfolios,** to this Extension. The funding commitments reflect joint discussions between each tribal party and Bonneville on each Tribe's project portfolios as they have evolved through implementation of the 2008 Agreement, including consideration of (a) actions for improving the effectiveness of certain entity projects, (b) promoting mitigation that directly protects and mitigates fish and wildlife and deemphasizing redundant or unnecessary research, monitoring and evaluation as appropriate, and (c) the Tribes' agreement to certain reductions in budgets during the term of the Extension made out of consideration for Bonneville's current financial circumstances.

2. Annual budgets as shown in Attachment A reflect agreed-upon reductions that apply during the term of this Extension. Attachment A budgets are not binding on the Parties beyond the term of this Extension. The parties understand that if this agreement is further

extended or otherwise replaced, the Tribes intend to pursue funding sufficient to implement planned work, including work that the Tribes have deferred.

3. For expense funding commitments by Bonneville in the 2008 Agreement, funds that remain unspent at the time of closeout of the FY 2017 intergovernmental contracts implementing the 2008 Agreement are carried forward to future years, with no further inflation adjustments and subject to the Budget Rules in Section III.C.4 below.

4. The total amount of funds that can be spent in a single fiscal year – including any unspent carry-forward funds from any prior fiscal years – shall not exceed 120% of the budgeted amount for that year set forth in Attachment A, unless Bonneville and Tribe(s) agree otherwise. This cap governs request for changes in the timing of implementation and distribution of Accord dollars, through preschedules, reschedules, or budget transfers, as defined below.

   a. **Out-year Pre/Reschedules –** Preschedule and reschedule are defined as the transfer of funds for a project to an earlier or future period, respectively. Preschedules and reschedules of a projects' working budget (e.g., changes to budget timing) will be allowed so long as the funds are not currently obligated in a contract and adjustment is consistent with the Tribe's/CRITFC's annual budget cap.

   b. **Budget transfers** – Budget transfer means the transfer of funding from one project to another in the same or different years. Budget transfer may be allowed through mutual agreement so long as the funds are not currently obligated in a contract and the adjustment is consistent with the Tribe's/CRITFC's budget cap.

   c. **Obligated Funds –** Funds included in a currently open contract are considered obligated funds and may not be rescheduled or transferred until they are de-obligated. Upon completion of contract deliverables (including status and annual reports) and payment of final invoice, any savings (i.e., remaining contract balance) will be de-obligated from the contract and returned to the project budget and may at that point be moved to another contract or fiscal year. Project managers should expect a delay between the end of a contract and the return of excess funds to the project budget. Uncompleted work element deliverables and funds associated with them may be rescheduled from one year to the next via modification to the current contract and inclusion in the subsequent contract.

5. Capital budgets for hatchery facilities shall comply with budget commitments made in the 2008 Agreement, as adjusted per prior or future agreement between the sponsoring entity and Bonneville. For hatchery projects identified in the 2008 Agreement that have

been subjected to Step 1 of the Northwest Power and Conservation Council ("**Council**") step review process but have not yet proceeded to Step 2 review, the project capital budget shall be developed through good faith negotiations between the sponsoring entity and Bonneville to provide sufficient capital funds to meet the purposes of the project as described in the project Master Plan. For any hatchery projects identified in the 2008 Agreement, as listed in Section III.E.3 below, that are not complete by the end of this Extension, Bonneville will extend the funding commitments for five years after this Extension expires.

6. The Parties acknowledge that Bonneville's financial situation can vary from year to year. Consistent with past practice under the 2008 Agreements, in the case of deteriorating Bonneville financial circumstances due to events such as poor water conditions, depressed power marketing conditions, court orders, or similar conditions beyond Bonneville's control, Bonneville may call on the Parties to voluntarily reduce expenditures under this Extension on an annual basis. (Such a request shall not be viewed as a waiver of the right to exercise a Section IV.D off-ramp, if applicable.) Any additional savings would be selected by mutual agreement so as to not compromise and to preserve the Action Agencies' ability to comply with the ESA and other applicable laws, preserve the Treaty Tribes' staff and capacity, and reasonably reflect each affected entity's expertise, responsibilities and commitments. Funds called upon for savings in one year would be available in the following years consistent with existing budget rules above. If it appears that expense funding commitments made by Bonneville in this Extension will remain unspent at the closeout of the last fiscal year of the Extension, Bonneville and the appropriate Tribes or Tribe will meet to discuss and attempt to mutually agree on the allocation of such unspent funds. Conversely, in the case of strengthening Bonneville financial circumstances and in recognition of budget reductions agreed to by the Treaty Tribes in this Extension, the Treaty Tribes may call on Bonneville to voluntarily increase funding or expenditures under this Extension on an annual basis, including providing relief from the Budget Rules in Section III.C.4 above.

D. ATTACHMENT A PROJECT ADMINISTRATION AND EFFICIENCIES

1. In support of the purposes of this Agreement, the Parties intend to implement this Agreement and engage in project administration in a way that recognizes and respects their respective expertise, roles, and responsibilities. The Tribes, as long-term cultural stewards of their treaty resources and legal co-managers of treaty fisheries, have developed extensive project and resource management expertise. The Action Agencies recognize the Tribes' substantial expertise regarding the biological, physical, cultural, and social environments within which they operate to manage treaty fisheries and implement projects.

2. The Parties intend to implement and administer projects in a manner that:

   - Is timely and efficient,
   - Is consistent with the legal rights of the Treaty Tribes,
   - Complements the Tribes' current and future management actions,
   - Recognizes the Action Agencies' general trust responsibility to the Treaty Tribes and the Tribes' federally protected fishing rights and fisheries management authorities and responsibilities,
   - Fulfills or helps to fulfill Bonneville's legal compliance responsibilities, and
   - Is consistent with Bonneville's obligations to conduct its affairs, including its legal compliance responsibilities, in a sound and businesslike manner.

3. As partners in project implementation, the Parties will seek efficiencies in project administration that will:

   - Reduce delay in project implementation,
   - Increase certainty in accomplishing project goals,
   - Support coordination with project cosponsors,
   - Comply with applicable federal acquisition regulations,
   - Fulfill Action Agencies' environmental compliance responsibilities, and
   - Comply with applicable tribal financial policies.

   In addition, the Parties will seek efficiency in project management and implementation by working together to streamline requirements for contracting and reporting, and where appropriate environmental compliance, and through project bundling, multi-year contracting, and other actions, including pursuit and tracking of cost-sharing opportunities, particularly for habitat improvement (sometimes called enhancement or restoration) projects.

4. To the extent that differences of opinion arise in project implementation, the Parties will promptly seek resolution of those differences by elevating the matter to higher levels within their respective organizations. In so doing, the Parties will collaborate to pursue a mutually agreeable solution, while respecting each other's expertise, roles, responsibilities, and rights.

5. The Parties will work to find regular opportunities for in-person meetings between their staff and leadership to foster effective working relationships. Bonneville will also work with the Tribes to identify and implement appropriate measures for promoting effective working relationships between project and contract managers and other key staff. Such

measures may include, for example, quarterly review meetings, on-site project review meetings, and attendance at Tribal cultural events as invited.

E. HATCHERY IMPLEMENTATION ACTIONS

1. The Parties acknowledge that hatcheries can provide important benefits to ESA-listed species, the region, and, in particular, to the Tribes in support of their treaty fishing rights. Bonneville and the Tribes seek to continue fulfilling their commitments under the 2008 Agreement. Additionally, the Action Agencies intend to provide ongoing stability for hatchery operations and maintenance and monitoring required to fulfill federal mitigation obligations and ESA compliance responsibilities.

2. Hatchery funding will remain available as provided in the 2008 Agreement and discussed in Section III.C.5 above. Bonneville's funding will continue to be in addition to, and not replace, funding for hatcheries that are the legal responsibility of other entities, including but not limited to NOAA Fisheries' hatchery -related responsibilities for facilities established under the Mitchell Act or other appropriated programs, the mid-Columbia public utility districts Habitat Conservation Plans, and other related agreements. The Tribes acknowledge their 2008 Agreement commitment to not seek any new or expanded hatchery actions until after May 2, 2038, except as may be provided in Section IV.B.2 of the 2008 Agreement.

3. The unfinished 2008 Agreement hatchery actions include the following:

    - CRITFC's Marion Drain Sturgeon Facilities
    - CRITFC's Kelt Reconditioning Facilities
    - CRITFC's Zone 6/Reprogramming Facilities
    - Umatilla Tribe's Walla Walla Facility
    - Warm Springs' Hood River Facility
    - Warm Springs' White River (Deschutes) Enhancement
    - Yakama Nation's M. R. Sampson Facility
    - Yakama Nation's Natapoc Facility
    - Yakama Nation's Klickitat Facility
    - Yakama Nation's Yakima Subbasin Summer/Fall Chinook Production Facilities

4. For hatchery projects, the Parties will collaboratively seek to identify a method to document the biological benefits associated with hatchery projects included in this Extension. The Parties will coordinate to ensure and incorporate each other's input before sharing draft or final ESA compliance documents with any regulatory agency when consulting on a proposed action, genetic and management plan, or tribal management

plan for new or existing hatchery programs funded or proposed for funding by Bonneville. For such projects, the Tribe will:

a. Ensure that the hatchery project will not impede and, where possible, will contribute to recovery; and

b. Secure, or assist in securing, all permits required by law for hatchery construction or operation.

5. The *U.S. v. Oregon* parties and the Corps have agreed that the John Day Mitigation production goal will be based on the agreed-to calculation of 107,000 TAP (Total Adult Production) using the recent 15 brood year SAS average for sizing the program going forward. The Corps will continue to coordinate with the *U.S. v. Oregon* parties to facilitate aligning support for completion of this project, and the Corps commits to undertaking efforts consistent with the resolution reached between the interested parties regarding John Day/The Dalles mitigation. Any commitment from BPA in support of this resolution should be consistent with this Extension.

F. HABITAT PROJECT IDENTIFICATION AND IMPLEMENTATION ACTIONS

1. The Parties have developed updated Tribal portfolios of habitat projects for this Extension as identified in Attachment A. These projects are supported by the Parties because they reflect and address the following criteria:

a. Preserving and building on past accomplishments and lessons learned;

b. Protecting fish and wildlife with a recognition of the importance of habitat as a means for the Action Agencies to both (1) carry out their responsibilities to protect, mitigate, and enhance ESA-listed and non-listed salmon and steelhead and aid in their conservation, and (2) protect and enhance treaty resources consistently with their Treaty and Trust obligations to the Tribes;

c. Addressing water temperature issues in a manner that is expected to promote resiliency in the face of climate change;

d. Fulfilling legal objectives;

e. Complying with other applicable legal mandates, such as the prohibition against augmentation of appropriations, or the in-lieu funding prohibition of the Northwest Power Act.

2. The Tribes will implement habitat project activities or actions within their respective portfolios pursuant to an intergovernmental contract with Bonneville, as further described in Section IV.G of this Extension, below.

3. Reclamation will continue to provide technical assistance on tributary habitat projects in existing subbasins covered by its Tributary Habitat program.

4. The habitat projects in Attachment A are based on the best available science and have been reviewed and recommended for funding by the Council. These projects continue to support BiOp tributary habitat improvement metrics (such as miles of floodplain or side channel created or improved, miles of access opened, in-stream flow provided, etc.) for listed salmon and steelhead.

5. Any new or expanded tribal habitat projects beyond what is included in Attachment A will provide or facilitate on-the-ground benefits through mitigation, enhancement, or protection that will address one or more of the following priorities:

   a. Water transactions, leases, etc. to augment in-stream flows to benefit fish;

   b. In-stream, riparian, and floodplain restoration;

   c. Culvert or other fish passage improvements;

   d. Protection and enhancement of habitat through land acquisitions and easements; and

   e. Other habitat enhancement actions important for the survival and enhancement of listed species.

   Similarly, the Action Agencies may request that additional habitat projects be undertaken to address commitments under applicable biological opinions.

6. Bonneville and the Tribes will work together, and with other regional partners, to establish a regional understanding of the needs, priorities, and respective roles and responsibilities in addressing research, monitoring, and evaluation for the habitat actions set forth in this Agreement. For specific and cumulative habitat actions, the Tribes will

continue to summarize and report implementation metrics and observed biological responses to assist the Action Agencies' decision making and legal compliance processes.

G. INTERGOVERNMENTAL CONTRACT ADMINISTRATION

All of the 2008 Agreement projects currently rely on separate and discrete intergovernmental agreements for goods or services, and the Parties intend to handle all of the Tribes' Extension projects in the same manner. Bonneville shall enter into intergovernmental agreements for projects listed in Attachment A with the respective Tribes under terms consistent with this Extension and following the procedures in Bonneville Purchasing Instructions. Once Bonneville and a Tribe execute an intergovernmental agreement for a project, that agreement governs all activities under that project. In recognition of the bilateral nature of the commitments in such agreements, any decision to change project implementation, including termination, must follow the terms of the applicable intergovernmental agreement. Bonneville cannot and will not terminate project funding under an intergovernmental agreement without first complying with the procedures identified in the Bonneville Purchasing Instructions.

H. COLUMBIA BASIN FISH AND WILDLIFE PROGRAM

1. In developing this Extension, the Parties recognize that the Council's Fish and Wildlife Program ("**Program**") is over 35-years old and has an established framework for mitigating the impacts of hydroelectric development in the Columbia River Basin. Bonneville has relied on guidance in past Council Programs in making extensive funding commitments for long-term fish and wildlife mitigation projects. This Extension builds on those commitments. The Parties intend to ensure the benefits to fish and wildlife continue to accrue while maintaining cost stability.

2. The Parties agree that the Bonneville funding commitments in this Agreement are commitments of the Bonneville Fund[8] for implementation of projects that support protection, mitigation, and enhancement of fish and wildlife. The Parties believe that this Agreement and the specific projects are consistent with the Northwest Power Act and the Council's current Program. The Parties will recommend that the Council amend its Program to incorporate the commitments in this Agreement.

3. The Parties will coordinate regarding the following actions relating to the Council, for efficiency and effectiveness:

[8] 16 U.S.C. § 838i(a).

a. Recommend that the Council largely retain the 2014 Program except as needed to incorporate this Agreement, including:

   - Project administration and efficiencies
   - Habitat monitoring and evaluation

b. Each Party shall share with the other Parties all draft recommendations for amendments, comments on recommendations, and comments on the draft amendments in a timely manner that upholds the commitments under the Agreement and this Extension to coordinate and avoid surprises.

4. Translocation of Anadromous Fish above Chief Joseph and Grand Coulee Dams. The Council's 2014 Program included a three-phase approach for investigating passage and reintroduction of anadromous fish above Chief Joseph and Grand Coulee dams. Passage and reintroduction of anadromous fish above Chief Joseph and Grand Coulee dams touches on many issues that are important to the Tribes. The Action Agencies have legal, economic, and policy concerns with specific proposals for passage and reintroduction above Chief Joseph and Grand Coulee dams. Consequently, the Parties agree that all aspects and stages of this issue require the greatest sensitivity and adherence to the no surprises protocol under the Extension.

I. COLUMBIA RIVER TREATY

The Parties agree to continue coordinating on matters regarding the Columbia River Treaty as described in **Attachment D**: **Consultation Regarding the Columbia River Treaty**.

IV. GOOD FAITH, AFFIRMATIVE SUPPORT, AFFIRMATION OF ADEQUACY, AND TERM

A. GOOD FAITH IMPLEMENTATION and AFFIRMATIVE SUPPORT

The Parties reaffirm their commitments to the terms of Section IV.D of the 2008 Agreement.

B. AFFIRMATION of ADEQUACY

1. The Parties intend to continue collaborating and seeking each other's input on strategic considerations regarding the Action Agencies' compliance with the ESA, the National

Environmental Policy Act ("**NEPA**"), the Northwest Power Act, the Clean Water Act ("**CWA**"), and other regional compliance processes. During the term of this Extension and as further described below, the Tribes will affirmatively support, in all appropriate forums (including legal, policy, and technical), the actions agreed to in this Extension and the additional actions committed to in ESA Proposed Actions/Biological Opinions. The Tribes further agree that these actions and the Parties' support of the *U.S. v. Oregon* Management Plan are an adequate combined response to address the Action Agencies' duties for compliance with the ESA, the Northwest Power Act, CWA, [9] and NEPA, with respect to the Columbia River System.

2. The Tribes anticipate that the Action Agencies will work with NOAA Fisheries and the United States Fish and Wildlife Service to secure Biological Opinions on Columbia River System operations that comply with the ESA. The Action Agencies will continue to collaborate with the Tribes throughout these ESA consultation processes as they develop system operations and related conservation measures. The Parties anticipate that the actions analyzed in these Biological Opinions will include Columbia River System operations, as well as other conservation measures (e.g. predator control, tributary habitat and estuary actions, artificial production, monitoring and evaluation) that are consistent with, and some of which are in addition to, the actions that the Action Agencies commit to in this Extension. The Action Agencies will continue to collaborate with the Tribes about the content of these actions with the shared objective of Action Agency ESA commitments at the conclusion of these consultation processes that the Tribes fully understand and support.

3. The Action Agencies will affirmatively support in all appropriate forums the 2018 – 2027 *U.S. v. Oregon* Management Plan.

4. The Parties will collaborate in seeking to attract other regional sovereigns to support Columbia River System operations that preserve and enhance Bonneville's ability to sustain its statutory obligations to continue providing competitive cost-based electric power and transmission services and fulfilling other valuable public services, including the protection, mitigation and enhancement of fish and wildlife affected by the development and operation of the Columbia River System as required by Bonneville's organic statutes including the Northwest Power Act.

5. With respect to the Columbia River System Environmental Impact Statement ("**CRSO EIS**"), the Tribes support the Action Agencies' approach to complying with the Court's orders regarding NEPA. The relationship of the Action Agencies to the Tribes is

[9] Excepting the unpermitted releases of oil or toxic materials from Columbia River System projects or operations.

described in the Cooperating Agency MOUs signed by those parties, with this 2018 Extension superseding the reference to “the Three Treaty Tribe MOA” in those MOUs. In accordance with the Cooperating Agency MOUs, the Action Agencies agree to provide the Tribes with advance notice and copies of the draft and final EIS, including the identified preferred alternative.[10]

6. The Tribes support the Action Agencies’ efforts to address their CWA responsibilities for the Columbia River System. The Parties’ understanding as well as the nature of these obligations has changed since 2008. The Action Agencies and Tribes will coordinate their efforts in addressing:

   - Hazardous waste clean-up and oil spills at Columbia River System dams
   - Actions to address water temperatures that are lethal to salmon
   - Total dissolved gas requirements, including state water quality standards
   - Harmful plant growth in Columbia River System reservoirs

7. Each Party will make best efforts to consult with other Parties prior to taking any action that could reasonably be interpreted as inconsistent with any part of this Extension to assure its consistency with this Extension. The Parties agree that such discussions should be as informal and with the least amount of process necessary to ensure that the Parties are fulfilling the good-faith obligation to implement and support the Extension.

C. TERM OF EXTENSION

1. Unless otherwise decided by a Party pursuant to this Section IV, this Extension will be in force until the earlier of when the Action Agencies issue their final decisions on the CRSO EIS and any associated consultation under the ESA for the Columbia River System, or September 30, 2022,[11]

2. The Parties will meet to review further extensions during September 2021. Amendments, including further modification of the 2008 Agreement and this Extension, will be considered at least one year prior to the expiration of this Extension.

D. OFF-RAMPS

[10] The Warm Springs Tribe does not yet have a Cooperating Agency MOU.

[11] This Extension may expire before the expirations of some individual project contracts between Bonneville and the Tribes. Bonneville and the Tribes intend that such individual project contracts continue through their terms subject to all provisions of this Extension.

1. Any Party may withdraw or seek to renegotiate this Extension or the operative provisions of the 2008 Agreement in the following circumstances:

   a. The Parties enter into this Extension with the assumption that NOAA Fisheries will issue a new Biological Opinion for the operation of the Columbia River System in 2019 and beyond that, combined with this Extension, will meet the Action Agencies obligations under the ESA, Northwest Power Act and NEPA for the term of this Extension. Should the Biological Opinion fail to meet any Party's expectations, the Party may exercise one of the off-ramps of this Extension.
      - In particular, if as part of a biological opinion for the Columbia River System, NOAA Fisheries or USFWS recommends a Reasonable and Prudent Alternative ("**RPA**"), or includes Terms and Conditions in an Incidental Take Statement, where the RPA and/or Terms and Conditions specify additional or different actions from those proposed by the Action Agencies during the consultation process that are financially material to a Party or Parties.

   b. If any court finds a Columbia River System biological opinion or related Action Agency decision document arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law, and the court orders additional or different actions that are either financially material to a Party or Parties or materially constrain the Action Agencies from fulfilling congressionally-authorized Columbia River System purposes.

   c. In the event of material noncompliance with this Extension, or the initiation of litigation by one or more of the Parties challenging the sufficiency of the measures or actions included within the scope of the 2008 Agreement, as modified by this Extension, to meet Federal obligations, including under the ESA, NEPA, Northwest Power Act, or the CWA.

   d. In the event of a material change, positive or negative, in Bonneville's financial conditions due to energy market, river flows, litigation, or other conditions outside of Bonneville's reasonable control, from those conditions assumed by Bonneville as a matter of prudent business judgment in rate setting, and which materially affect Bonneville's financial health and its associated ability to sustain the fulfillment of any of its multiple statutory responsibilities.

   e. In the event of unforeseen and material environmental conditions or events that negatively impact the Tribes' reasonable expectations regarding near-term biological conditions or performance of key fish populations.

2. In such circumstances, the Parties will first seek to preserve this Extension and the operative provisions of the underlying 2008 Agreement and will meet promptly to determine the appropriate response. The affected Party or Parties will notify the other Parties immediately in writing, identifying why the event is considered material and potential options for resolution, including financial rebalancing through prioritization of fish and wildlife spending. Prior to withdrawing from this Extension, the Parties shall first make a 90-day good faith effort to renegotiate mutually agreeable modifications to this Extension, with a priority placed on establishing the funding levels for the projects listed in Attachment A. A Party may not withdraw from this Extension on the basis of its own noncompliance.

3. If renegotiation is not successful, the affected Party may notify the other Parties in writing of its intent to withdraw by a date certain. At the time the withdrawal is effective, all funding commitments and covenants made by the withdrawing Party cease; however, the withdrawing Party's liabilities and obligations under intergovernmental contracts effective on the date of withdrawal remain in effect until addressed as provided in the intergovernmental contract.

4. The withdrawing Party reserves any existing legal rights under applicable law, including all arguments and defenses. Other Parties also reserve all existing legal rights under applicable law, including all arguments and defenses. This includes the ability to advocate in all forums (e.g. judicial, administrative, in proceedings before the Council, and in rate-related proceedings) on any issue relating to the Action Agencies' legal obligations for additional, fewer, or different fish and wildlife mitigation actions, greater or lesser fish and wildlife funding, or other mitigation actions.

E. EFFECTIVE DATE

This Extension will be in effect upon the signature of the last Party.

V. SIGNATURES

/s/ Elliot E. Mainzer	*October 3, 2018*
Elliot E. Mainzer Administrator and Chief Executive Officer Bonneville Power Administration	Date

/s/ D. Peter Helmlinger	*October 9, 2018*
D. Peter Helmlinger Brigadier General, USA Division Commander	Date

/s/ Lorri J. Gray	*October 10, 2018*
Lorri J. Gray U.S. Bureau of Reclamation Pacific Northwest Region	Date

/s/ Jeremy Wolf, VC	*September 25, 2018*
(for) Gary Burke Chair Confederated Tribes of the Umatilla Indian Reservation	Date

/s/ E. Austin Greene, Jr.	*October 4, 2018*
E. Austin Greene, Jr. Chairman Tribal Council Confederated Tribes of the Warm Springs Reservation of Oregon	Date

/s/ JoDe L. Goudy	*October 1, 2018*
JoDe L. Goudy Chairman Yakama Nation Tribal Council Confederated Tribes and Bands of the Yakama Nation	Date

/s/ Ryan Smith, Sr.	*October 4, 2018*
Ryan Smith, Sr. Chair Columbia River Inter-Tribal Fish Commission	Date

/s/ Leland H. Bill	*October 4, 2018*
Leland H. Bill Secretary Columbia River Inter-Tribal Fish Commission	Date

ATTACHMENT A: Lower River Tribes Project Portfolios

ATTACHMENT A

UMATILLA TRIBE -- FISH and WILDLIFE PROJECTS

#	PROJECT No.*	PROJECT NAME	Base Value	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	Comments
#	Expense								
1	198343500	Umatilla Hatchery Satellite Facilities Operations	$ 1,155,614	$ 825,925	$ 825,925	$ 836,249	$ 846,702	$ 3,334,801	
2	198710001	Umatilla Anadromous Fish Habitat-Umatilla Tribe	$ 1,423,460	$ 1,423,460	$ 1,423,460	$ 1,441,253	$ 1,459,269	$ 5,747,442	
3	198802200 (&	Umatilla and Walla Walla Fish Passage Operations	$ 593,299	$ 622,824	$ 622,824	$ 630,609	$ 638,492	$ 2,514,749	
4	199000501	Umatilla Basin Natural Production Monitoring and Evaluation	$ 943,419	$ 1,090,318	$ 989,153	$ 1,001,517	$ 1,014,036	$ 4,095,025	
5	199009200	Wanaket Wildlife Area	$ 304,601	$ 382,000	$ 304,601	$ 308,409	$ 312,264	$ 1,307,273	
6	199402600	Pacific Lamprey Research and Restoration Project	$ 609,201	$ 898,550	$ 844,829	$ 855,389	$ 866,082	$ 3,464,850	
7	199506001	Iskuulpa Watershed Project	$ 243,681	$ 306,076	$ 306,076	$ 309,902	$ 313,776	$ 1,235,830	
8	199601100	Umatilla Tribe Accord Administration & Implementation Coordination	$ -	$ 539,216	$ 539,216	$ 545,956	$ 552,781	$ 2,177,169	
9	199604601	Walla Walla River Basin Fish Habitat Enhancement	$ 1,087,188	$ 1,087,188	$ 1,087,188	$ 1,100,778	$ 1,114,538	$ 4,389,691	
10	199608300	Grand Ronde Watershed Restoration	$ 718,249	$ 1,157,648	$ 1,111,582	$ 1,125,477	$ 1,139,545	$ 4,534,252	
11	199800703	Grande Ronde Supplementation Satellite Facilities O&M - Upp GR & CC	$ 654,075	$ 654,075	$ 654,075	$ 662,251	$ 670,529	$ 2,640,930	
12	200002600	Rainwater Wildlife Area Operations	$ 365,521	$ 365,521	$ 365,521	$ 370,090	$ 374,716	$ 1,475,848	
13	200003100	Enhance Habitat in the North Fork John Day River	$ 621,934	$ 886,998	$ 886,998	$ 898,085	$ 909,312	$ 3,581,393	
14	200003800	Walla Walla Hatchery Complete Design & Construction	$ -	$ -	$ -	$ -	$ -	$ -	
15	200003802	Walla Walla River Hatchery Operations and Maintenance	$ 1,108,747	$ 425,000	$ 1,127,500	$ 1,141,594	$ 1,155,864	$ 3,849,957	
16	200003900	Walla Walla River Basin Collaborative Monitoring and Evaluation	$ 1,483,728	$ 913,656	$ 913,656	$ 925,077	$ 936,640	$ 3,689,029	
17	200203000	Salmonid Progeny Markers	$ 361,866	$ -	$ -	$ -	$ -	$ -	
18	200203700	Freshwater Mussel Research and Restoration	$ 283,888	$ 393,000	$ 393,000	$ 397,913	$ 402,886	$ 1,586,799	
19	200708300	Grande Ronde Supplementation Monitoring and Evaluation	$ 234,688	$ 284,981	$ 284,981	$ 288,543	$ 292,150	$ 1,150,655	
#	200725200	Hyporheic Flow Assessment in Columbia River Tribut	$ 93,817	$ 179,563	$ 179,563	$ 181,808	$ 184,080	$ 725,014	
21	200739000	Tribal Conservation Enforcement-Umatilla Tribe	$ 182,760	$ 182,760	$ 182,760	$ 185,045	$ 187,358	$ 737,922	
#	200820200	Protect and Restore Tucannon Watershed	$ 243,681	$ 466,428	$ 466,428	$ 472,258	$ 478,162	$ 1,883,276	
#	200820300	Reintro. Assess. Priority Actions for McKay, Wiilow, Butter, B, P & Malheur	$ 40,000	$ -	$ 66,666	$ 67,499	$ 68,343	$ 202,508	
#	200820600	Umatilla and Walla Walla Basin Water Transactions (administration portion)	$ 167,250	$ 167,250	$ 167,250	$ 169,341	$ 171,457	$ 675,298	
25	200820700	Ceded Area Stream Corridor Consv., Protection & Mgmt (admin. portion)	$ 50,000	$ 50,000	$ 50,000	$ 50,625	$ 51,258	$ 201,883	
#	200820800	Snake River Safety Net Prgrm	$ 609,201	$ -	$ -	$ -	$ -	$ -	
27	200820900	Walla Walla Stlhd Hatchery O&M	$ 91,380	$ -	$ -	$ -	$ -	$ -	
#	200821000	Lyons Ferry Hatchery Upgrades	$ -	$ -	$ -	$ -	$ -	$ -	
#	200901400	Biomonitoring of Habitat Ehnancement Effectiveness	$ -	$ 361,866	$ 361,866	$ 366,389	$ 370,969	$ 1,461,091	
#	200902600 (&	Umatilla Tribe Ceded Area Juv. & Adult Passage Improvement/Culvert	$ 1,200,950	$ 1,007,895	$ 517,080	$ 523,544	$ 530,088	$ 2,578,606	
31	201300300	Regional Coordination	$ 80,926	$ 80,926	$ 80,926	$ 80,926	$ 80,926	$ 323,704	
		YEARLY EXPENSE TOTAL:	$ 14,953,124	$ 14,753,124	$ 14,753,124	$ 14,936,526	$ 15,122,221	$ 59,564,996	

#	PROJECT No.*	PROJECT NAME	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	
	Capital							
1	200820700	Ceded Area Stream Corridor Conservation, Protection & Mgmt	$ 1,168,403	$ 1,168,403	$ 1,167,778	$ 1,167,145	$ 4,671,729	
2	200902600	Umatilla Tribe Ceded Area Juv. & Adult Passage Improvement/Culvert	$ 193,055	$ 683,870	$ 677,407	$ 670,862	$ 2,225,194	
		YEARLY CAPITAL TOTAL:	$ 1,361,458	$ 1,852,273	$ 1,845,185	$ 1,838,007	$ 6,896,923	

* Note: BPA Project numbers may change over time

ATTACHMENT A

WARM SPRINGS TRIBE -- FISH and WILDLIFE PROJECTS

#	PROJECT No.*	PROJECT NAME	Base Value	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	Comments
	Expense								
1	198805303	Hood River Production Monitoring and Evaluation (M&E)-Warm Springs	$ 703,806	$ 703,806	$ 703,806	$ 712,604	$ 721,511	$ 2,841,727	
2	198805307	Hood River Production Operations and Maintenance (O&M)-Warm Springs	$ 1,192,525	$ 1,176,549	$ 1,176,549	$ 1,191,256	$ 1,206,147	$ 4,750,500	
3	199802100	Hood River Fish Habitat	$ 996,814	$ 996,814	$ 996,814	$ 1,009,274	$ 1,021,890	$ 4,024,792	
4	199802200	Pine Creek Conservation Area	$ 441,259	$ 441,259	$ 441,259	$ 446,775	$ 452,359	$ 1,781,652	
5	200001500	Upper John Day Conservation Lands Program	$ 661,974	$ 661,974	$ 661,974	$ 670,249	$ 678,627	$ 2,672,823	
6	200715700	Bull Trout Status and Abundance on Warm Springs Reservation	$ 140,116	$ 140,116	$ 140,116	$ 141,867	$ 143,641	$ 565,740	
7	200739700	John Day Watershed Restoration	$ 2,305,071	$ 2,305,071	$ 2,305,071	$ 2,333,884	$ 2,363,058	$ 9,307,084	
8	200830100	Habitat Restoration Planning/Design/Implementation within boundaries of Warm Springs Reservation, lower Deschutes River, Oregon	$ 343,407	$ 343,407	$ 343,407	$ 347,700	$ 352,046	$ 1,386,559	
9	200830300	Columbia and Willamette Rivers Operations Administration	$ 347,579	$ 347,579	$ 347,579	$ 351,924	$ 356,323	$ 1,403,405	
10	200830600	Deschutes River Fall Chinook Research and Monitoring	$ 222,968	$ 222,968	$ 222,968	$ 225,755	$ 228,577	$ 900,268	
11	200830700	Deschutes River Sockeye Development	$ 204,028	$ 204,028	$ 204,028	$ 206,578	$ 209,161	$ 823,795	
12	200830800	Willamette Falls Lamprey Escapement Estimate	$ 182,760	$ 182,760	$ 182,760	$ 185,045	$ 187,358	$ 737,922	
13	200831100	Natural Production Management and Monitoring	$ 383,632	$ 383,632	$ 383,632	$ 388,427	$ 393,283	$ 1,548,974	
14	200901800	Determine the Feasibility of Improving Anadromous Fish Production on Warm Springs Reservation	$ 134,024	$ -	$ -	$ -	$ -	$ -	
15	201101400	Evaluate Status & Limiting Factors of Pacific Lamprey in the lower Deschutes River, Fifteenmile Creek and Hood River Subbasins	$ 476,395	$ 476,395	$ 476,395	$ 482,350	$ 488,379	$ 1,923,519	
		YEARLY EXPENSE TOTAL:	$ 8,736,358	$ 8,586,358	$ 8,586,358	$ 8,693,687	$ 8,802,359	$ 34,668,762	

#	PROJECT No.*	PROJECT NAME	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	Comments
	Capital							
1								
		YEARLY CAPITAL TOTAL:						

* Note: BPA Project numbers may change over time

ACCORD EXTENSION MOA – LOWER RIVER TRIBES / ACTION AGENCIES

ATTACHMENT A

Yakama Nation -- FISH WILDLIFE PROJECTS

#	PROJECT No.*	PROJECT NAME	Base Value	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	Comments
	Expense								
1	198811535	Klickitat River Design and Construction-Yakima/Klickitat Fisheries Project (YKFP)	$ -	$ -	$ -	$ -	$ -	$ -	
2	198812025	Yakima River Management, Data-Yakima/Klickitat Fisheries Project (YKFP) (1997-051-00)	$ 1,237,239	$ 1,200,122	$ 1,200,122	$ 1,215,124	$ 1,230,313	$ 4,845,680	
3	198812035	Klickitat River Management, Data and Habitat-Yakima/Klickitat Fisheries Project (YKFP)	$ 562,495	$ 545,620	$ 545,620	$ 552,440	$ 559,346	$ 2,203,026	
4	199206200	Lower Yakima Valley Riparian Wetlands Restoration	$ 1,845,326	$ 1,789,966	$ 1,789,966	$ 1,812,341	$ 1,834,995	$ 7,227,267	
5	199506325	Yakima River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	$ 5,518,459	$ 5,352,905	$ 5,352,905	$ 5,419,816	$ 5,487,564	$ 21,613,190	
6	199506335	Klickitat River Monitoring and Evaluation-Yakima/Klickitat Fisheries Project (YKFP)	$ 1,627,952	$ 1,579,113	$ 1,579,113	$ 1,598,852	$ 1,618,838	$ 6,375,915	
7	199603501	Yakama Reservation Watershed Project	$ 1,323,744	$ 1,284,032	$ 1,284,032	$ 1,300,082	$ 1,316,333	$ 5,184,480	
8	199604000	Mid-Columbia Reintroduction Feasibility Study	$ 2,729,222	$ 2,677,479	$ 2,677,479	$ 2,710,947	$ 2,744,834	$ 10,810,740	
9	199701325	Yakima River Operations and Maintenance (O&M) for Hatcheries and Acclimation Sites-Yakima/Klickitat Fisheries Project (YKFP)	$ 3,969,745	$ 3,936,478	$ 3,936,478	$ 3,985,684	$ 4,035,505	$ 15,894,145	
10	199701335	Klickitat River Operations and Maintenance (O&M) for Hatcheries and Acclimation Sites-Yakima/Klickitat Fisheries Project (YKFP)	$ 1,392,721	$ 960,000	$ 960,000	$ 972,000	$ 984,150	$ 3,876,150	
11	199705100	Yakima Basin Side Channels Land Acquisition	$ 1,488,620	$ 1,443,961	$ 1,443,961	$ 1,462,011	$ 1,480,286	$ 5,830,218	
12	199705600	Klickitat Watershed Enhancement	$ 681,905	$ 661,448	$ 661,448	$ 669,716	$ 678,088	$ 2,670,700	
13	200715600	Rock Creek Fish and Habitat Assessment	$ 354,929	$ 344,281	$ 344,281	$ 348,585	$ 352,942	$ 1,390,088	
14	200845500	Sturgeon Management	$ 152,300	$ 147,731	$ 147,731	$ 149,578	$ 151,447	$ 596,487	
15	200845800	Steelhead Kelt Reconditioning	$ 609,201	$ 597,651	$ 597,651	$ 605,122	$ 612,686	$ 2,413,109	
16	200845900	Coho Nutrient Supplementation	$ 12,184	$ -	$ -	$ -	$ -	$ -	
17	200846500	Coho Prod. Facility & Marking	$ 577,523	$ 598,997	$ 605,173	$ 612,738	$ 620,397	$ 2,437,305	
18	200846700	Yakima Steelhead Acclimation Facilities	$ 54,828	$ -	$ -	$ -	$ -	$ -	
19	200847000	Yakama Nation Ceded Lands Lamprey Evaluation and Restoration	$ 304,601	$ 495,463	$ 495,463	$ 501,656	$ 507,927	$ 2,000,509	
20	200847100	Upper Columbia Nutrient Supplementation	$ 247,336	$ -	$ -	$ -	$ -	$ -	
21	200900100	Upper Columbia Spring Chinook and Steelhead Acclimation	$ 548,281	$ 537,886	$ 537,886	$ 544,610	$ 551,417	$ 2,171,799	
22	200900200	Status and Trend Annual Reporting	$ 365,521	$ 354,555	$ 354,555	$ 358,987	$ 363,474	$ 1,431,571	
23	200900300	Upper Columbia Habitat Restoration	$ 5,843,765	$ 5,668,452	$ 5,668,452	$ 5,739,308	$ 5,811,049	$ 22,887,261	
24	200900600	Program Coordination & Administration	$ 1,629,614	$ 1,361,455	$ 1,355,279	$ 1,372,220	$ 1,389,373	$ 5,478,327	
25	201700300	Yakama Action Effectiveness Monitoring	$ -	$ 239,916	$ 239,916	$ 242,915	$ 245,951	$ 968,698	
26	201900400	Conservation Enforcement	$ -	$ 300,000	$ 300,000	$ 303,750	$ 307,547	$ 1,211,297	
		YEARLY EXPENSE TOTAL:	$ 33,077,511	$ 32,077,511	$ 32,077,511	$ 32,478,480	$ 32,884,461	$ 129,517,963	

#	PROJECT No.*	PROJECT NAME	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	Comments
	Capital							
1								
		YEARLY CAPITAL TOTAL:						

* Note: BPA Project numbers may change over time

ATTACHMENT A

CRITFC -- FISH and WILDLIFE PROJECTS

#	PROJECT No.*	PROJECT NAME	Base Value	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	Comments
	Expense								
1	199803100	Implement Wy-Kan-Ush-Mi Wa-Kish-Wit	$ 274,141	$ 225,354	$ 264,678	$ 228,171	$ 228,171	$ 946,374	
2	200715500	Develop a Master Plan for a Rearing Facility to Enhance Selected Populations of White Sturgeon in the Columbia River Basin	$ 182,760	$ 142,674	$ 142,674	$ 144,457	$ 144,457	$ 574,263	
3	200739100	Tribal Conservation Enforcement-Columbia River Inter-tribal Fish Commission (CRITFC)	$ 548,281	$ 578,899	$ 575,802	$ 583,130	$ 588,149	$ 2,325,980	
4	200740100	Kelt Reconditioning and Reproductive Success Evaluation Research	$ 1,871,985	$ 1,658,912	$ 1,658,912	$ 1,679,648	$ 1,679,648	$ 6,677,121	
5	200800400	Sea Lion Non-Lethal Hazing	$ 243,681	$ 245,878	$ 245,878	$ 248,951	$ 248,951	$ 989,659	
6	200850200	Expanded Tribal Catch Sampling	$ 91,380	$ 96,774	$ 96,774	$ 97,984	$ 97,984	$ 389,515	
7	200850300	Studies into Factors Limiting the Abundance of Okanagan and Wenatchee Sockeye Salmon	$ 274,141	$ 246,718	$ 246,718	$ 249,802	$ 249,802	$ 993,040	
8	200850400	Sturgeon Genetics	$ 48,736	$ 43,675	$ 43,675	$ 44,221	$ 44,221	$ 175,792	
9	200850500	Streamnet Library	$ 511,802	$ 448,000	$ 448,000	$ 453,600	$ 453,600	$ 1,803,200	
10	200850600	Smolt Monitoring Video Feasibility Project	$ 91,380	$ -	$ -	$ -	$ -	$ -	
11	200850700	CRITFC Inter-Tribal Monitoring Data	$ 414,744	$ 491,301	$ 428,315	$ 437,340	$ 442,044	$ 1,799,001	
12	200850800	Release Mortality Analysis	$ 60,920	$ -	$ -	$ -	$ -	$ -	
13	200851800	Upstream Migration Timing	$ 335,061	$ 309,331	$ 309,331	$ 313,198	$ 313,198	$ 1,245,057	
14	200852400	Implement Tribal Pacific Lamprey Restoration Plan	$ 700,582	$ 703,222	$ 703,222	$ 712,012	$ 712,012	$ 2,830,469	
15	200852700	Zone 6 Fisheries CRITFC Accord project	$ 243,681	$ 158,932	$ 158,932	$ 160,919	$ 160,919	$ 639,701	
16	200890700	Genetic Assessment of Columbia River Stocks	$ 1,047,827	$ 930,938	$ 930,938	$ 942,575	$ 942,575	$ 3,747,025	
17	200900400	Monitoring Recovery Trends in Key Spring Chinook Habitat Variables and Validation of Population Viability Indicators	$ 1,057,482	$ 817,669	$ 817,669	$ 827,890	$ 827,890	$ 3,291,118	
18	200900500	Influence of Environment and Landscape on Salmonid Genetics	$ 170,576	$ 152,863	$ 152,863	$ 154,774	$ 154,774	$ 615,274	
19	200900800	Climate Change Impacts	$ 321,658	$ 294,701	$ 294,701	$ 298,385	$ 298,385	$ 1,186,172	
20	200900900	Basinwide Supplementation Evaluation	$ 822,422	$ 775,000	$ 775,000	$ 784,688	$ 784,688	$ 3,119,375	
21	200902200	Accord Administration - Columbia River Inter-Tribal Fish Commission (CRITFC)	$ -	$ 527,852	$ 527,852	$ 534,450	$ 534,450	$ 2,124,604	
		YEARLY EXPENSE TOTAL:	$ 9,313,240	$ 8,848,693	$ 8,821,934	$ 8,896,195	$ 8,905,918	$ 35,472,739	

#	PROJECT No.*	PROJECT NAME	2019	2020	2021	2022	TOTAL 2019-2022 (Base)	Comments
	Capital							
1								
		YEARLY CAPITAL TOTAL:						

* Note: BPA Project numbers may change over time

ATTACHMENT B: Provisions from the 2008 Agreement that Remain in Effect

The following provisions in the 2008 Agreement remain unchanged and in effect during the term of this Extension.

- II.I—Emergency Operations for Unlisted Fish
- III.D—Council and ISRP Review
- III.E—Replacement Projects and Adaptive Management
- III.G—Compliance with the In Lieu Provision of the Northwest Power Act
- IV.B.5—Affirmation of Adequacy [regarding wildlife obligation under Northwest Power Act]
- IV.D—Good Faith Implementation and Support
- IV. F.1.a and F.1.b—Dispute Resolution/Negotiation
- IV.G—Modification
- V.B—Applicable Law
- V.C—Authority
- V.D—Consistency with Treaty Rights
- V.F—Binding Effect, with reference to Section IV.F replaced with a reference to Sections IV.F.1.a and IV.F.1.b; and with reference to Section IV.E. replaced with a reference to Section IV.D of this Extension
- V.G—No Third Party Beneficiaries
- V.J—Notice

ATTACHMENT C: Columbia River System Operations

This 2018 Extension commits the Parties to collaborative engagement on the development of Columbia River System operations and to seek regional alignment on fish operations. Attachment C describes considerations for updating spill, transportation, avian predation, adult passage, and other key fish operations for the Columbia River System that reflect the current status of the Action Agencies' ESA consultation process with NOAA. Attachment C serves as a working foundation to support ongoing efforts to incorporate new information and ideas for key components of fish operations beginning in 2019. The Parties' overarching commitments regarding fish operations are those described in Sections III.A-B and Section IV.B of this Extension.

The Tribal Parties' commitment to the fish operations described in this 2018 Extension are premised on the Action Agencies' continued collaboration with them as the Agencies complete consultation on Columbia River System operations, as called for in Section IV.B.2. Through this consultation process, the Parties' shared objective is that the Tribes fully understand and support Columbia River System fish operations. In the event that the Columbia River System operations resulting from these ESA interagency consultation processes fail to meet any Party's expectations, the Party may exercise its rights under one of the extension off-ramps (Section IV.D.1.a). This 2018 Extension thus provides a roadmap and vehicle for the development of future system operations that have the Parties' support, and potentially broader regional support as well.

A. THE PARTIES ARE COLLABORATING ON SUPPORT OF THE FOLLOWING PROPOSED ACTIONS[12] FOR OPERATION OF THE COLUMBIA RIVER SYSTEM

During the spring and summer juvenile fish migration, the Action Agencies will continue to provide spill to facilitate juvenile fish passage for ESA-listed salmon and steelhead species, while seeking to minimize any adverse effects on adult migrants. Juvenile dam passage survival performance standard test results from studies conducted under the 2008 BiOp will serve as the baseline for Columbia River System operations covered by this Extension Attachment C. See Table 1. The summarized results shown in Table 1 will also serve as a reference in future latent mortality studies.

[12] This Attachment describes key fish operations the Parties are aligned around. A broader description of all Columbia River System operations, including further detail on fish operations, will be in the consultation package that the Action Agencies will submit to NOAA Fisheries.

B. SPRING SPILL

Spring spill operations are planned as follows:

- For the four lower Snake River dams, spill will begin on April 3 and continue through June 20.

- For the four lower Columbia River dams, spill will begin on April 10 and continue through June 15.

There are differing views among regional technical experts regarding the biological value of further increases in spring spill levels relative to those spill levels informed by the results of performance standard testing conducted under the 2008 BiOp. These divergent viewpoints are linked to differing interpretations of existing data regarding delayed mortality, the effects of exposure to high total dissolved gas ("**TDG**") levels, and the use of smolt-to-adult return ratios ("**SARs**") as a performance metric for evaluating Columbia River System operations. To address this uncertainty, beginning in 2019 the Action Agencies will conduct research to test the hypothesis that further increasing system-wide spill levels (up to the current applicable state water quality standards of 115/120% TDG) will have the effect of substantially increasing adult salmonid return rates (i.e., increased SARs due to decreased latent mortality). The most recent CSS 2017 Annual Report hypothesizes increases of 23 percent or more. The Action Agencies are planning to conduct research by alternating spill levels between the Base Operation (informed by performance standard test results 2008-2018) and the Test Operation (spill to meet but not exceed the 115 percent/120 percent TDG). Additional details on the study design for a spill operation will be developed with NOAA Fisheries based on the Independent Scientific Advisory Board ("**ISAB**") review of the Columbia River latent mortality test power analysis that was completed in the spring of 2018.The Parties will discuss and seek alignment on any modifications to the study design.

C. SPRING JUVENILE TRANSPORTATION

Spring transportation will be initiated at Lower Granite, Little Goose, and Lower Monumental Dams no later than May 1; however, consistent with program implementation in 2018, the start of transport may begin as early as April 24 to provide data on earlier transported fish. These transport operations will continue to be coordinated with the Regional Implementation Oversight Group ("**RIOG**") and Technical Management Team ("**TMT**"). Coordination and adaptive management between Parties and other regional sovereigns through the Regional Forum, as appropriate, during the migration season may result in modified transportation protocols, such as during atypical low flow years. Transportation protocols will be reviewed annually, taking into account new information concerning adult returns, in-river and transportation SARs, and model results. If new information indicates a modified transportation protocol is warranted, the Parties will use existing adaptive management procedures to make the appropriate adjustments in timing and criteria for spring spill and transportation.

In the adaptive management process, the Parties may consider the exposure of fish to TDG during transport (or lack of) versus in-river conditions experienced by control fish throughout the Columbia River System during increased spill operations.

D. SUMMER SPILL

Spill operations developed to facilitate safe passage of subyearling Chinook salmon will occur at the lower Snake River dams beginning on June 21 and at lower Columbia River dams on June 16, as shown in Tables 2 and 3 below. The Action Agencies will adjust summer spill timing at the lower Snake River projects according to when this species is actively migrating past those projects, as follows:

- Spill will continue at each project until the criteria below are met for that dam, or until August 31, whichever comes first.
- The Action Agencies will provide juvenile fish passage spill in August at Lower Granite Dam until subyearling fall Chinook collection counts at that dam fall below 300 fish per day for 4 consecutive days (with counting beginning on July 28).
- The Action Agencies will provide juvenile fish passage spill in August at Little Goose Dam until subyearling fall Chinook collection counts at that dam fall below 300 fish per day for 4 consecutive days (with counting beginning on July 28).
- The Action Agencies will provide spill in August at Lower Monumental and Ice Harbor Dams[13] until subyearling fall Chinook collection counts at Lower Monumental Dam fall below 300 fish per day for 4 consecutive days (with counting beginning on July 28).
- In the event that fish collection counts increase above 500 fish for 2 consecutive days at a project where spill has ended prior to August 31, the Parties agree to work together to develop an adaptive strategy to assess options and determine if an alternative spill operation is warranted until the criteria above are met again.

[13] Daily collection does not occur at Ice Harbor Dam, so spill at that project will follow criteria for Lower Monumental Dam and continue until the same day.

The Parties will meet annually before March 1 to determine whether to increase the quantity of PIT-tagged natural production (or hatchery reared surrogates for) subyearling fall Chinook salmon required to examine run timing. Special emphasis may be applied to the Clearwater fall Chinook salmon subgroup, which present a split life history strategy and variability in run-timing.

The Parties will continue to discuss and explore other potential changes to summer spill focusing on spill during the month of August for each of the lower Columbia River dams. In particular, the decrease in PIT-tagged fall Chinook passing the lower Columbia River dams will be investigated with regards to run-timing and reductions in August spill. Proposals under consideration include:

- Subyearling fall Chinook salmon count criteria (e.g., less than 1,200-1,500 fish) for a minimum of three consecutive sampling dates (current sampling rate varies at each site by date and water temperature, but without water temperature restrictions, sample in August occurs every other day at McNary and Bonneville dams and every three to four days at John Day Dam, yielding a minimum of 6-12 consecutive days);

- Continue to spill during the first half of August (August 1-15) at a reduced rate of spill and then provide only day spill (also a reduced level of spill) between August 16-31; and,

- Combined fish count criteria with reduced levels of spill during August.

E. SUMMER TRANSPORTATION

Transport operations targeting fall Chinook will continue until approximately September 30 at Lower Monumental Dam and through October 31 at Lower Granite and Little Goose Dams, in accordance with all relevant Fish Passage Plan operating criteria. The Parties and other regional sovereigns, through the Regional Forum, will review the transportation protocols annually, taking into account new information concerning adult returns, in-river and transportation SARs, and model results. If new information indicates a modified transportation protocol is warranted, adaptive management will be used to make the appropriate adjustments in timing and criteria for summer transportation.

Test results of in-river versus transported subyearling fall Chinook salmon on the lower Snake River suggest the primary benefit of transportation, as it relates to increases in SARs, occurs in the months of August-October. One proposed consideration by the Action Agencies is to transport subyearling fall Chinook by trucks beginning August 1 and continue through the fall (with actual dates and criteria to be defined).

F. AVIAN PREDATION

The objective of avian predator deterrence is to reduce avian predation on juvenile salmonids. The Corps will continue to implement and improve, as needed, avian predator deterrent programs at lower Snake and Columbia River dams. This program will be coordinated through the Fish Passage Operations and Maintenance ("**FPOM**") Team and included in the annual Fish Passage Plan ("**FPP**"). Avian monitoring and deterrence action plans are implemented annually at lower Snake and Columbia River dams and are included in the FPP (see Appendix L in the 2018 FPP for an example). At each dam, bird numbers are monitored, feeding birds are hazed, and passive predation deterrents, such as irrigation sprinklers and bird wires are deployed. Hazing typically involves launching long-range pyrotechnics at concentrations of feeding birds and occurs primarily near the spillway and powerhouse discharge areas, and juvenile bypass outfall areas.

G. ADULT PASSAGE

The increase in proposed spring spill during the Spring Test Spill Operation may delay upstream migrating adult salmon and steelhead, specifically adult spring and summer Chinook salmon. If adult delay at any project is observed, existing adaptive management processes will be used to address the issue.

During low flow conditions, similar to the flows observed in 2015, with or without warm water temperatures, the Parties and other regional sovereigns, through the Regional Forum, will evaluate the appropriate balance between providing spill for juvenile passage, while not delaying upstream adult passage.

H. HYDRO OPERATIONS FLEXIBILITY

Increased flexibility in hydro operations is being discussed regionally, and several adjustments to operations are being considered, including:

1. The Action Agencies have proposed to increase the useable forebay range at lower Snake River projects by 6 inches (Minimum Operating Pool ["**MOP**"] +1.5-foot) to allow a full usable foot. Currently, project operators limit actual operations to the middle two-thirds of the MOP +1.0-foot range to avoid unintentionally going above or below the prescribed elevation. Beginning April 3, all lower Snake River projects (Ice Harbor, Lower Monumental, Little Goose, and Lower Granite projects) will be operated within the MOP +1.5-foot reservoir operations with very limited instances in which the pool would be within 0.25 feet of the bottom or top of the MOP range. The Lower Granite Reservoir

may be raised as needed after September 1, in order to operate the adult fish holding facilities to support brood stock collection.

- As with the 6-inch expansion of operating range described for the lower Snake River projects, the Action Agencies plan to operate John Day Dam forebay within 2 feet of MIP—the lowest elevation range. This action will allow full utilization of 1.5-foot operating range (262.5 to 264.5 feet) that will continue to allow irrigation withdrawals from April 10 through September 30. Slight deviations from these levels, based on navigation needs, flood risk management, load following, and operation sensitivity, may be required on occasion. These reservoir operations may also have ancillary biological benefits that complement the avian predation reduction actions noted above.

2. The parties will work together to evaluate other emerging issues on an as needed, site-specific basis. Examples of emerging issues that may warrant additional site specific monitoring include new turbine testing at Ice Harbor and/or alternate methods of implementing spill programs (e.g. 24 hour spill averaging) while allowing for integration of intermittent power sources such as solar or wind which could also potentially be tested at a single project like Ice Harbor. Any of these types of RM&E efforts would need to be further developed and defined so that they could be integrated into and be complementary with the BiOp spill program.

Table 1. Juvenile dam passage survival estimates, passage times, and spill passage efficiency for yearling Chinook salmon and juvenile steelhead are derived from performance standard tests from 2010-2014. Spill passage efficiency is the percent of all downstream migrating juvenile salmon or steelhead that passed a dam through the spillway and other surface passage routes.

Dam	Year	Species	Dam Passage Survival (percent with Standard Error)	Median Forebay Passage Time (hours)	Spill Passage Efficiency (percent)	Spill Operation (Target / Actual)
Lower Columbia River						
Bonneville	2010	Yearling Chinook Salmon	95.69 (0.42)	n/a	n/a	100 kcfs / 100 kcfs (30 Apr – 13 May)
Bonneville	2011	Yearling Chinook Salmon	95.97 (1.76)	0.55	59.59	100 kcfs / 181 kcfs (season-wide)
Bonneville	2010	Steelhead	97.55 (1.80)	n/a	n/a	100 kcfs / 100 kcfs (30 Apr – 13 May)
Bonneville	2011	Steelhead	96.47 (2.12)	0.85	64.06	100 kcfs / 181 kcfs (season-wide)
Bonneville	2012	Subyearling Chinook Salmon	97.39 (0.69)	0.48	57.06	85 kcfs day 121 kcfs night / 149 kcfs 95 kcfs 24 hrs / 149 kcfs
The Dalles	2010	Yearling Chinook Salmon	96.41 (0.96)	1.28	94.66	40% / 39.9%
The Dalles	2010	Steelhead	95.34 (0.97)	1.28	95.36	40% / 39.9%
The Dalles	2010	Subyearling Chinook Salmon	94.04 (0.91)	1.20	82.98	40% / 39.8%
The Dalles	2011	Yearling Chinook Salmon	96.00 (0.72)	0.97	83.10	40% / 43.1%
The Dalles	2011	Steelhead	99.52 (0.83)	0.81	89.10	40% / 43.1%
The Dalles	2012	Subyearling Chinook Salmon	94.69 (0.59)	1.08	78.39	40% / 40.4%
John Day	2011	Yearling Chinook Salmon	96.66 (1.03) 97.84 (1.07) 96.76 (0.71)	2.00 1.50 1.42	61.20 66.40 63.68	30% / 30% 40% / 40% Season-wide
John Day	2011	Steelhead	98.36 (0.90) 98.97 (0.96) 98.67 (0.61)	4.30 3.20 2.91	61.20 66.40 62.78	30% / 30% 40% / 40% Season-wide

Table 1. *(continued)* Juvenile dam passage survival estimates, passage times, and spill passage efficiency for yearling Chinook salmon and juvenile steelhead are derived from performance standard tests from 2010-2014. Spill passage efficiency is the percent of all downstream migrating juvenile salmon or steelhead that passed a dam through the spillway and other surface passage routes.

Dam	Year	Species	Dam Passage Survival (percent with Standard Error)	Median Forebay Passage Time (hours)	Spill Passage Efficiency (percent)	Spill Operation (Target / Actual)
John Day	2012	Yearling Chinook Salmon	96.73 (0.65)	1.15	74.56	30% / 37.1% 40% / 37.1%
John Day	2012	Steelhead	97.44 (0.28)	2.39	74.52	30% / 37.1% 40% / 37.1%
John Day	2014	Subyearling Chinook Salmon	91.96 (0.74) 91.31 (0.77)	2.28 1.91	55.52 71.26	30% / 30% 40% / 40%
McNary	2012	Yearling Chinook Salmon	96.16 (1.40)	1.76	72.46	40% / 50.9%
McNary	2012	Steelhead	99.08 (1.83)	1.78	83.15	40% / 50.9%
McNary	2012	Subyearling Chinook Salmon	97.47 (1.14)	1.77	78.32	50% / 61.6%
McNary	2014	Yearling Chinook Salmon	96.10 (1.27)	1.73	71.40	40% / 52.6%
McNary	2014	Steelhead	96.98 (1.36)	2.57	84.33	40% / 52.6%
Lower Snake River						
Lower Monumental	2012	Yearling Chinook Salmon	98.68 (0.90)	2.35	78.89	Gas Cap (26 kcfs) / 29.7 kcfs
Lower Monumental	2012	Steelhead	98.26 (0.21)	2.17	65.85	Gas Cap (26 kcfs) / 29.7 kcfs
Lower Monumental	2012	Subyearling Chinook Salmon	97.89 (0.79)	2.60	83.56	17 kcfs / 25.2 kcfs
Lower Monumental	2013	Subyearling Chinook Salmon	92.97 (1.05)	2.99	89.10	17 kcfs / 19.8 kcfs
Little Goose	2012	Yearling Chinook Salmon	98.22 (0.76)	2.58	65.28	30% / 31.8%
Little Goose	2012	Steelhead	99.48 (0.81)	2.67	56.09	30% / 31.8%
Little Goose	2012	Subyearling Chinook Salmon	95.08 (0.97)	2.80	72.49	30% / 38.5%
Little Goose	2013	Subyearling Chinook Salmon	90.76 (1.39)	3.66	76.83	30% / 30%

Table 2. Initial juvenile fish passage spill operations at lower Snake River dams.

Project	Spring base spill operation[4]	Spring test spill operation[14,15,16]	Spring dates	Summer operation	Summer dates[17]
Lower Granite	20 kcfs	TDG Spill Cap	April 3 – June 20	18 kcfs	June 21 – Aug 31
Little Goose	30%	TDG Spill Cap	April 3 – June 20	30%	June 21 – Aug 31
Lower Monumental	TDG Spill Cap	TDG Spill Cap	April 3 – June 20	17 kcfs	June 21 – Aug 31
Ice Harbor	30%	TDG Spill Cap	April 3 – June 20	30%	June 21 – Aug 31

[14] Spring spill levels will be systematically alternated between "base spill" and "test spill" as part of a latent mortality study.

[15] If adult delay at any project is observed, existing adaptive management processes will be used to address the issue.

[16] The 120%/115% TDG spill cap refers to spill to the maximum level that meets, but does not exceed, the current TDG criteria allowed under state law (120% TDG in the project's tailwater and 115% TDG in the next downstream forebay. Manage juvenile fish spill on an hourly basis to meet but not exceed the state water quality standards for WA and OR. Implementation of the daily spill averaging would include ± hourly variation in spill amounts within a day to facilitate integration of renewable power including solar and wind.

[17] The Action Agencies will adjust the timing of August spill based on the timing of the juvenile fall Chinook migration according to the following criteria. Beginning August 1, the Action Agencies will adjust summer spill operations to juvenile outmigration at Lower Granite, Little Goose, or Lower Monumental, or Ice Harbor Dams if subyearling Chinook collection counts fall below 300 fish per day for four consecutive days (beginning July 28, 29, 30, and 31 for August 1 summer spill completion). Spill will continue at Ice Harbor until the same day as at Lower Monumental, since daily collection does not occur at that project. Additionally, in any year where natural-origin adult returns of Snake River fall Chinook salmon are equal to or less than 400 fish, summer spill in the following year would continue at Snake River projects through August 31, even in years where subyearling Chinook counts fall below the 300 fish per day for four consecutive days as stated above. In the event that fish collection counts increase above 500 fish for 2 consecutive days at a project where spill has ended prior to August 31, the Parties agree to work together to develop an adaptive strategy to assess options and determine if an alternative spill operation is warranted until the criteria above are met again.

Table 3. Initial juvenile fish passage spill operations at Columbia River dams.

Project	Spring base spill operation	Spring test spill operation[18,19,20]	Spring dates	Summer spill operation	Summer dates
McNary	48%	TDG Spill Cap	April 10 – June 15	57%	June 16 – Aug 31
John Day	32%	TDG Spill Cap	April 10 – June 15	35%	June 16 – Aug 31
The Dalles	40%	TDG Spill Cap	April 10 – June 15	40%	June 16 – Aug 31
Bonneville	100 kcfs	TDG Spill Cap[21]	April 10 – June 15	95 kcfs	June 16 – Aug 31

[18] Spring spill levels will be systematically alternated between "base spill" and "test spill" as part of the Action Agencies' latent mortality research plan.
[19] If adult delay at any project is observed, existing adaptive management processes will be used to address the issue.
[20] The 120%/115% TDG spill cap refers to spill to the maximum level that meets, but does not exceed, the current TDG criteria allowed under state law (120% TDG in the project's tailwater and 115% TDG in the next downstream forebay. Manage juvenile fish spill on an hourly basis to meet but not exceed the state water quality standards for WA and OR. Implementation of the daily spill averaging would include ± hourly variation in spill amounts within a day to facilitate integration of renewable power including solar and wind.
[21] Spill to the TDG Spill Cap, not to exceed 150 kcfs.

ATTACHMENT D: Consultation Regarding the Columbia River Treaty

Consistent with Bonneville and Corps Tribal Policies, Bonneville and the Corps will coordinate with the Tribes concerning annual operations under the Columbia River Treaty of 1964 ("Treaty"), as well as the 2012 Non-Treaty Storage Agreement and Bonneville and Corps actions related to United States-Canada discussions of the modernization of the Treaty regime post-2024, as follows.

Annual Treaty/Non-Treaty Operations and Treaty Operating Plans

Each operating year during the term of this extension agreement, Bonneville and the Corps will coordinate with the Tribes to discuss Treaty and non-Treaty operations and Treaty operating plans. This coordination will include meeting in the fall to discuss Treaty and non-Treaty operations that occurred during the preceding fish passage season and to seek tribal input, ideas, and information on planned operations for the next fish passage season. Bonneville and the Corps also will inform the Tribes of the final operating plan once finalized. Typical agenda items for the fall meeting would include a review of Treaty and non-Treaty operations for the preceding year (including supplemental operating agreements), a review of the current year Detailed Operating Plan and possible supplemental operating agreements, and a summary of the applicable Assured Operating Plan and upcoming Detailed Operating Plan. One additional meeting will be held during the fish passage season to provide an update on Treaty and non-Treaty operations.

Matters Related to Post-2024 Columbia River Treaty Negotiation

Bonneville and the Corps agree to conduct government-to-government consultation with the Tribes under this subsection as appropriate and consistent with applicable policies, procedures, laws and regulations. Such consultation or other coordination with the Tribes related to the U.S. and Canadian discussions regarding modernizing the Treaty regime post-2024 will be coordinated with the U.S. Department of State.

Appendix G

Preliminary Design Drawings

Yakama Nation

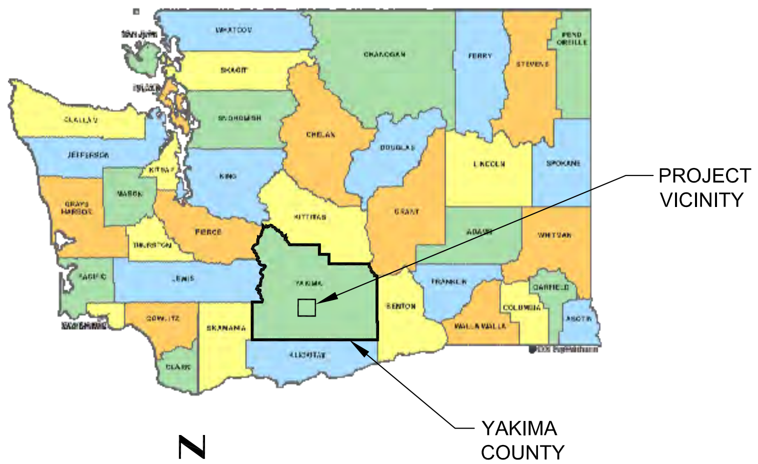
YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

VOLUME 1 - MASTER PLAN DRAWINGS

2019 MASTER PLAN UPDATE

YAKAMA NATION FISHERIES
PROSSER HATCHERY
CONCEPT DESIGN



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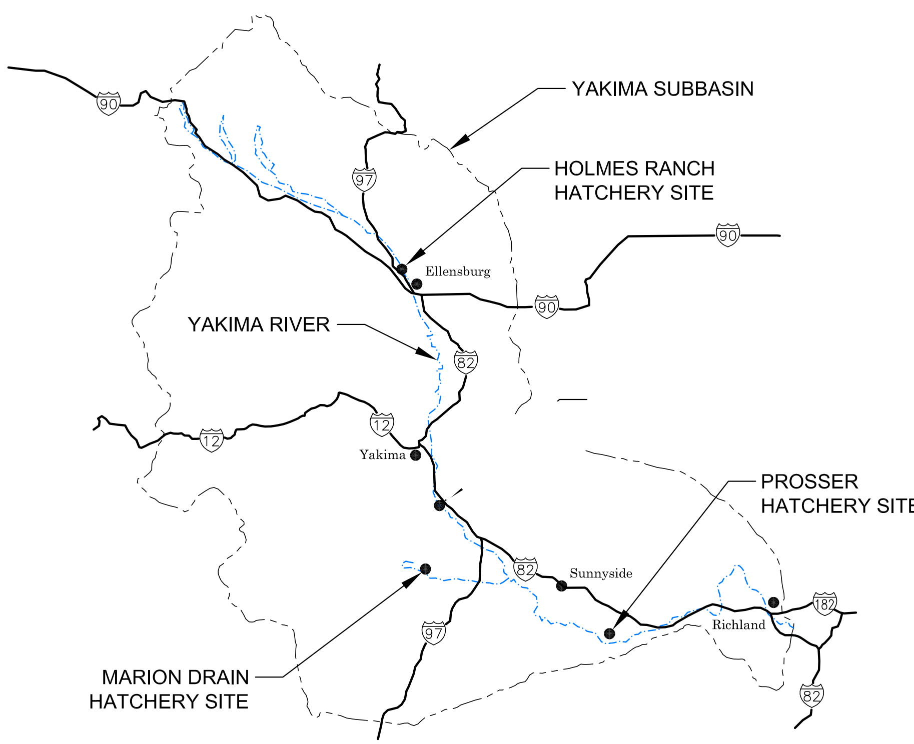
LOCATION MAP
NTS



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VICINITY MAP
NTS

REV	DATE	BY	DESCRIPTION

WARNING
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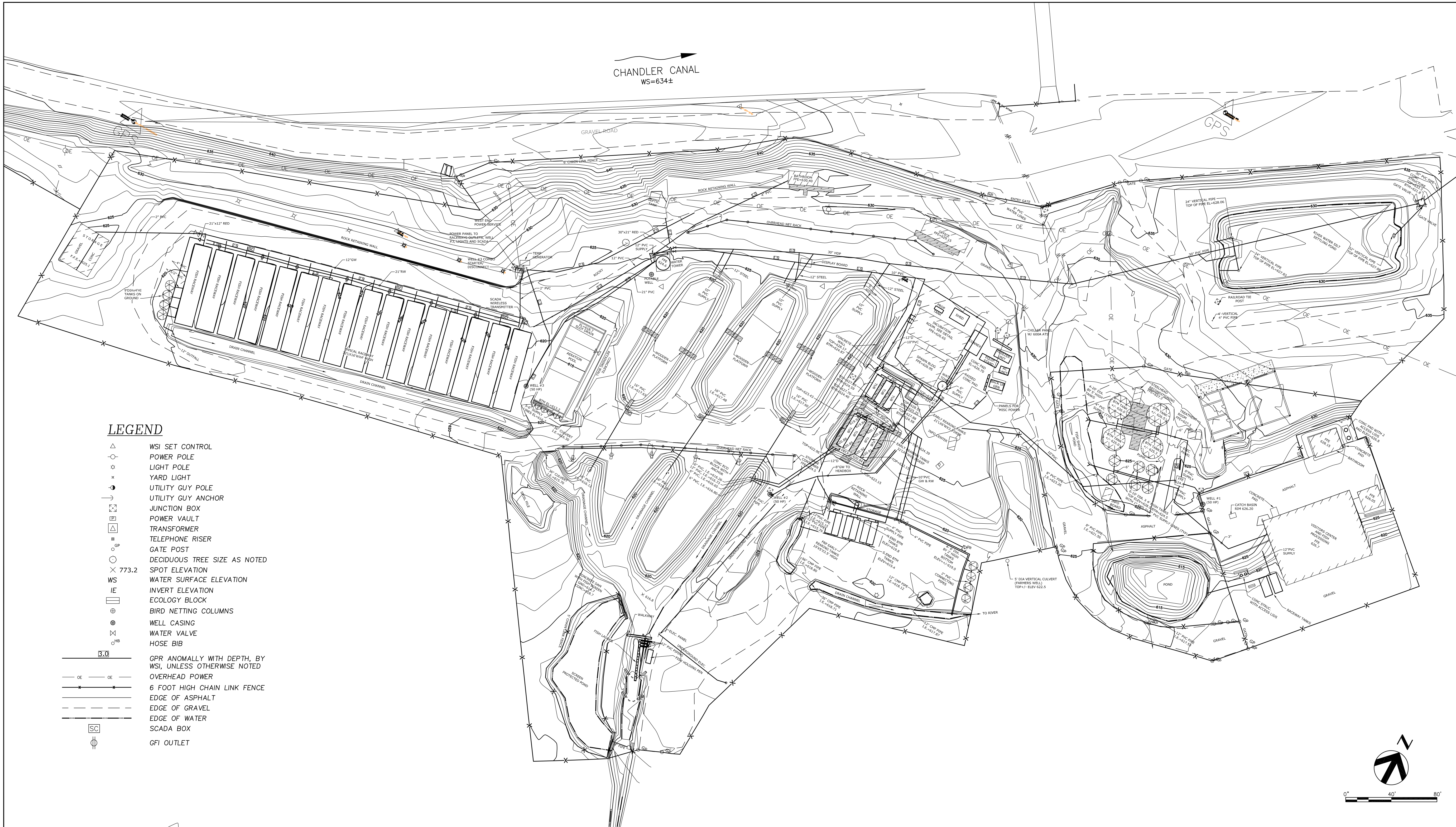
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES
PROSSER HATCHERY CONCEPT DESIGN
LOCATION MAP, VICINITY MAP AND DRAWING INDEX

DESIGNED M. REISER
DRAWN D. LITA
CHECKED
ISSUED DATE

DRAWING
1

SCALE: AS NOTED



LEGEND

△	WSI SET CONTROL
-○-	POWER POLE
☼	LIGHT POLE
×	YARD LIGHT
◑	UTILITY GUY POLE
—→	UTILITY GUY ANCHOR
⊠	JUNCTION BOX
⊡	POWER VAULT
△	TRANSFORMER
▪	TELEPHONE RISER
○GP	GATE POST
⊙	DECIDUOUS TREE SIZE AS NOTED
× 773.2	SPOT ELEVATION
WS	WATER SURFACE ELEVATION
IE	INVERT ELEVATION
▭	ECOLOGY BLOCK
⊕	BIRD NETTING COLUMNS
⊗	WELL CASING
⋈	WATER VALVE
○HB	HOSE BIB
3.0	GPR ANOMALLY WITH DEPTH, BY WSI, UNLESS OTHERWISE NOTED
— OE — OE —	OVERHEAD POWER
—×—×—	6 FOOT HIGH CHAIN LINK FENCE
———	EDGE OF ASPHALT
— — —	EDGE OF GRAVEL
———	EDGE OF WATER
SC	SCADA BOX
⏀	GFI OUTLET

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

EXISTING CONDITIONS SITE PLAN

DESIGNED M. REISER

DRAWN D. LITA

CHECKED

ISSUED DATE

DRAWING 2

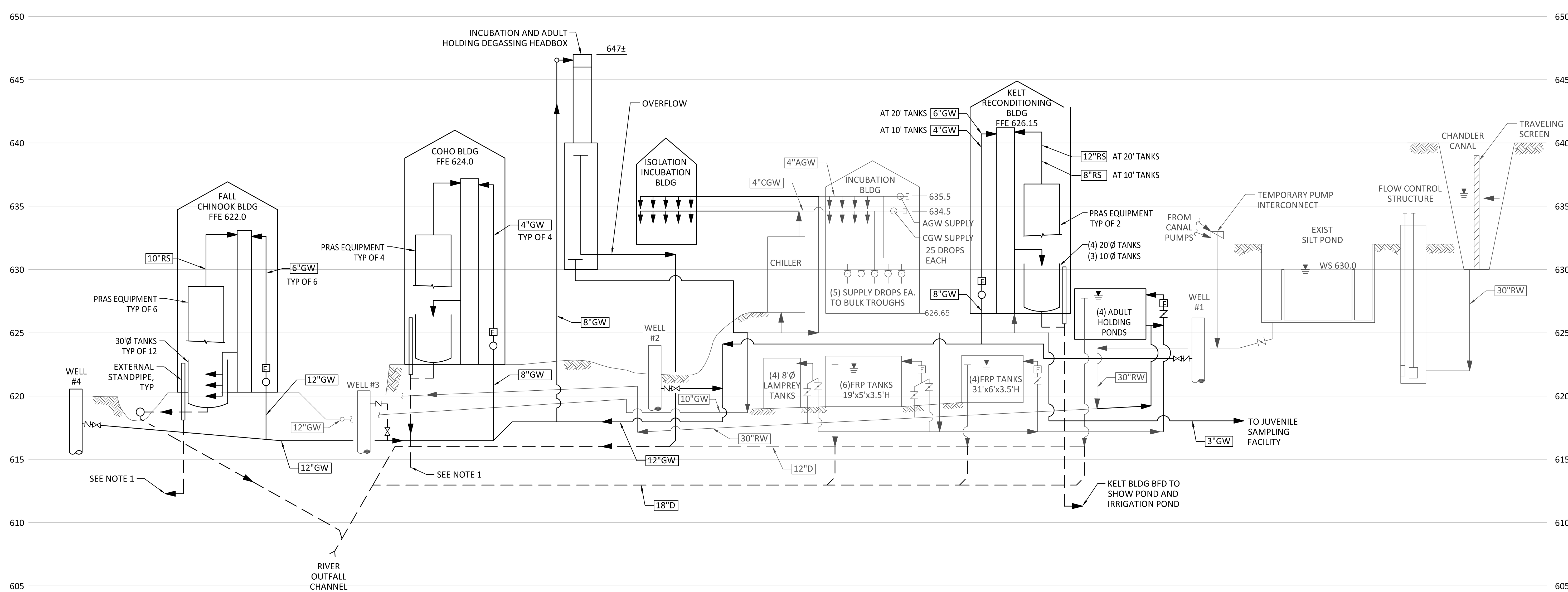
SCALE: AS NOTED

LEGEND:

BP BYPASS
BW BACKWASH
CWE CLEANING WASTE EFFLUENT
D DRAIN
DO DISSOLVED OXYGEN PROBE
F FLOW METER
GW GROUND WATER
OFD OVERFLOW DRAIN
RR REUSE RETURN
RS REUSE SUPPLY
RW RIVER WATER

SHEET NOTES:

1. ROUTE TANK BOTTOM DRAINS TO EFFLUENT MICROSTRAINER.



PROPOSED HYDRAULIC PROFILE

SCALE: NTS

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

PROPOSED HYDRAULIC PROFILE

DESIGNED M. REISER

DRAWN

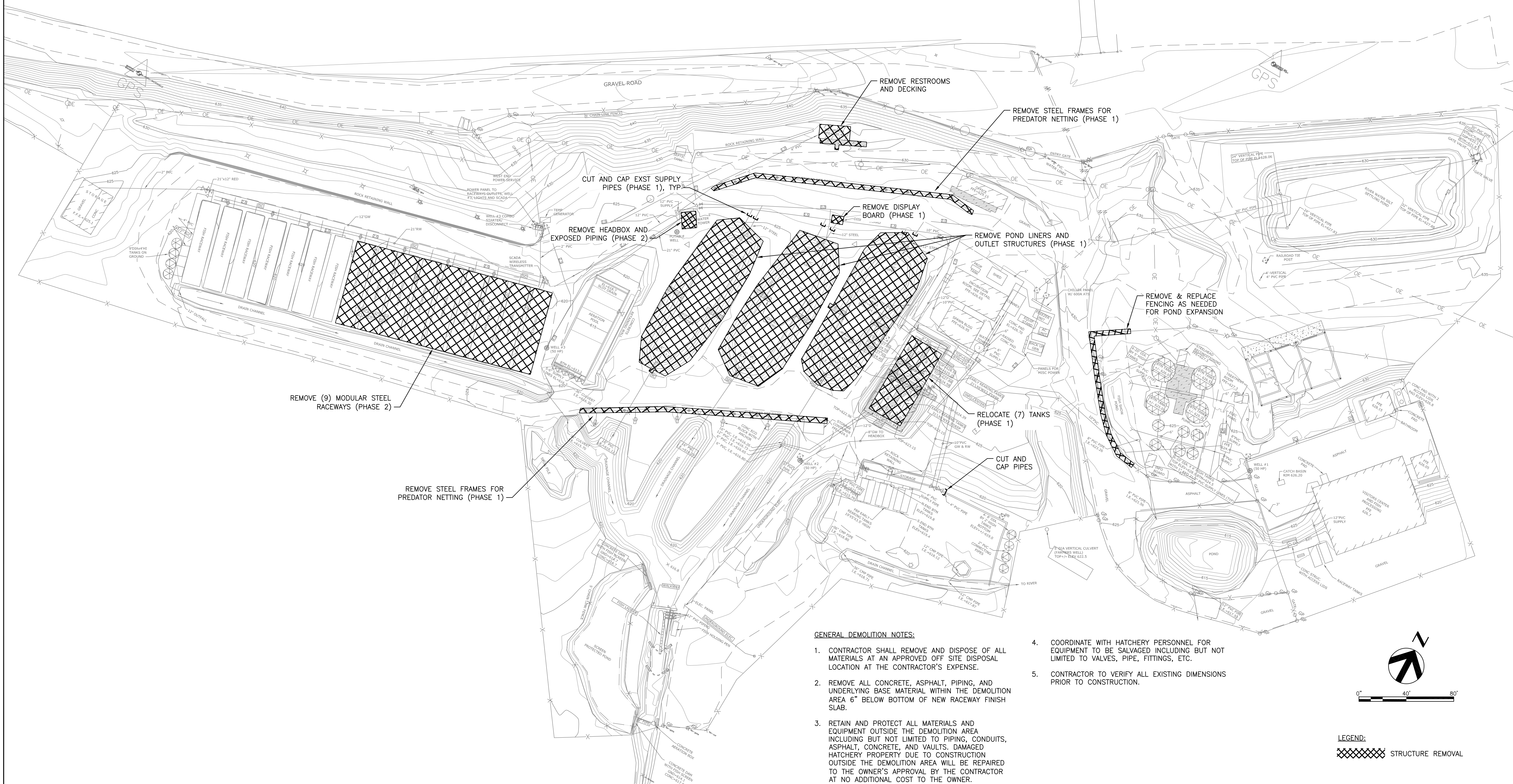
CHECKED

PROJECT DATE 04/30/19

DRAWING

3

JOB NO: 000000



GENERAL DEMOLITION NOTES:

1. CONTRACTOR SHALL REMOVE AND DISPOSE OF ALL MATERIALS AT AN APPROVED OFF SITE DISPOSAL LOCATION AT THE CONTRACTOR'S EXPENSE.
2. REMOVE ALL CONCRETE, ASPHALT, PIPING, AND UNDERLYING BASE MATERIAL WITHIN THE DEMOLITION AREA 6" BELOW BOTTOM OF NEW RACEWAY FINISH SLAB.
3. RETAIN AND PROTECT ALL MATERIALS AND EQUIPMENT OUTSIDE THE DEMOLITION AREA INCLUDING BUT NOT LIMITED TO PIPING, CONDUITS, ASPHALT, CONCRETE, AND VAULTS. DAMAGED HATCHERY PROPERTY DUE TO CONSTRUCTION OUTSIDE THE DEMOLITION AREA WILL BE REPAIRED TO THE OWNER'S APPROVAL BY THE CONTRACTOR AT NO ADDITIONAL COST TO THE OWNER.
4. COORDINATE WITH HATCHERY PERSONNEL FOR EQUIPMENT TO BE SALVAGED INCLUDING BUT NOT LIMITED TO VALVES, PIPE, FITTINGS, ETC.
5. CONTRACTOR TO VERIFY ALL EXISTING DIMENSIONS PRIOR TO CONSTRUCTION.

LEGEND:

STRUCTURE REMOVAL

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

DEMOLITION SITE PLAN

DESIGNED M. REISER

DRAWN D. LITA

CHECKED

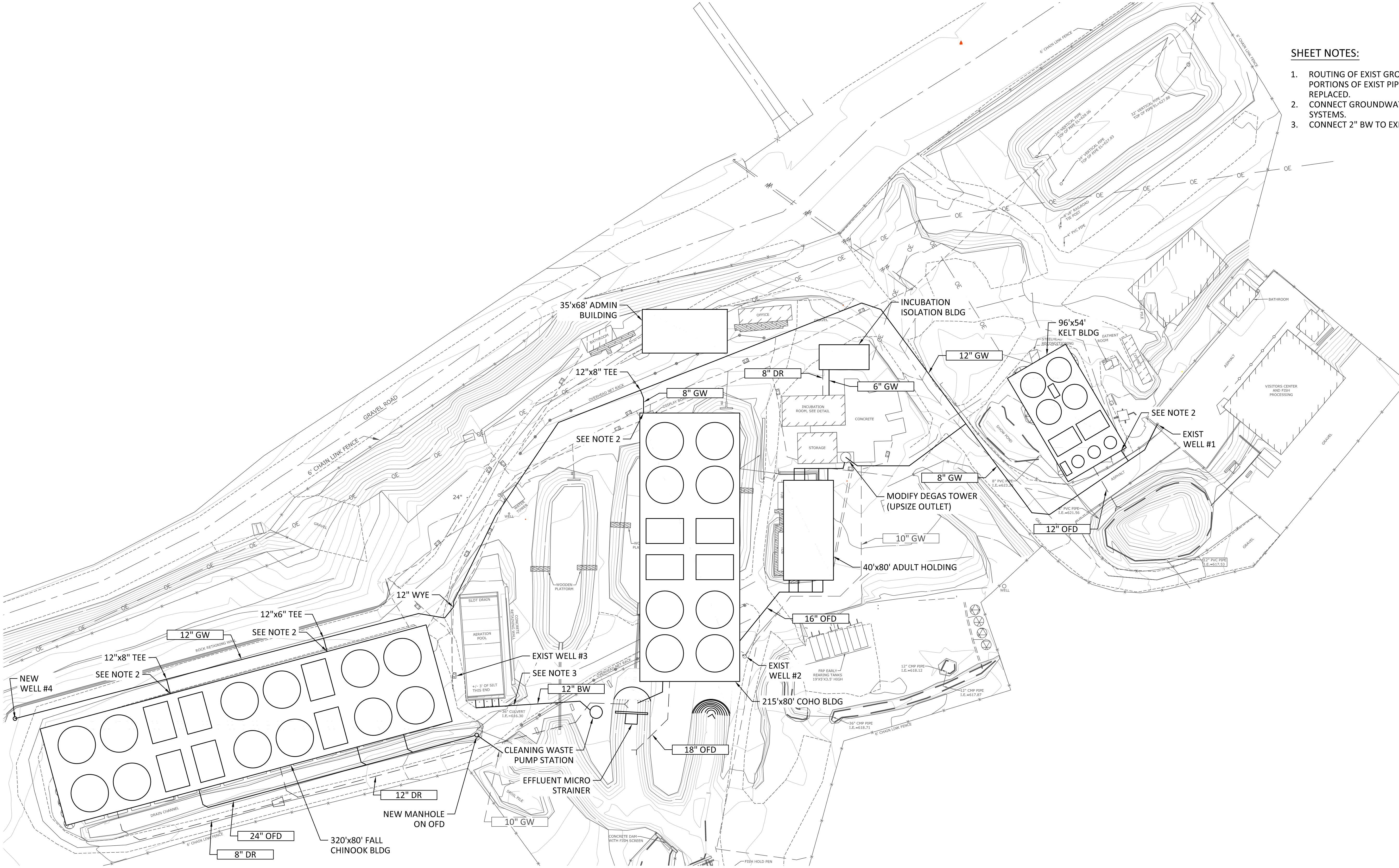
ISSUED DATE 3/16/12

DRAWING 4

SCALE: AS NOTED

SHEET NOTES:

1. ROUTING OF EXIST GROUNDWATER PIPING IS TO BE VERIFIED. PORTIONS OF EXIST PIPING MAY BE RETAINED RATHER THAN REPLACED.
2. CONNECT GROUNDWATER PIPING TO NEW BUILDING PRAS SYSTEMS.
3. CONNECT 2" BW TO EXIST ABATEMENT POND PIPE MANIFOLD.



PROPOSED SITE PIPING PLAN

SCALE: 1"= 40'

0' 40' 80'

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WARNING

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

PROPOSED SITE PIPING PLAN

DESIGNED M. REISER

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PROJECT DATE 04/30/19

DRAWING

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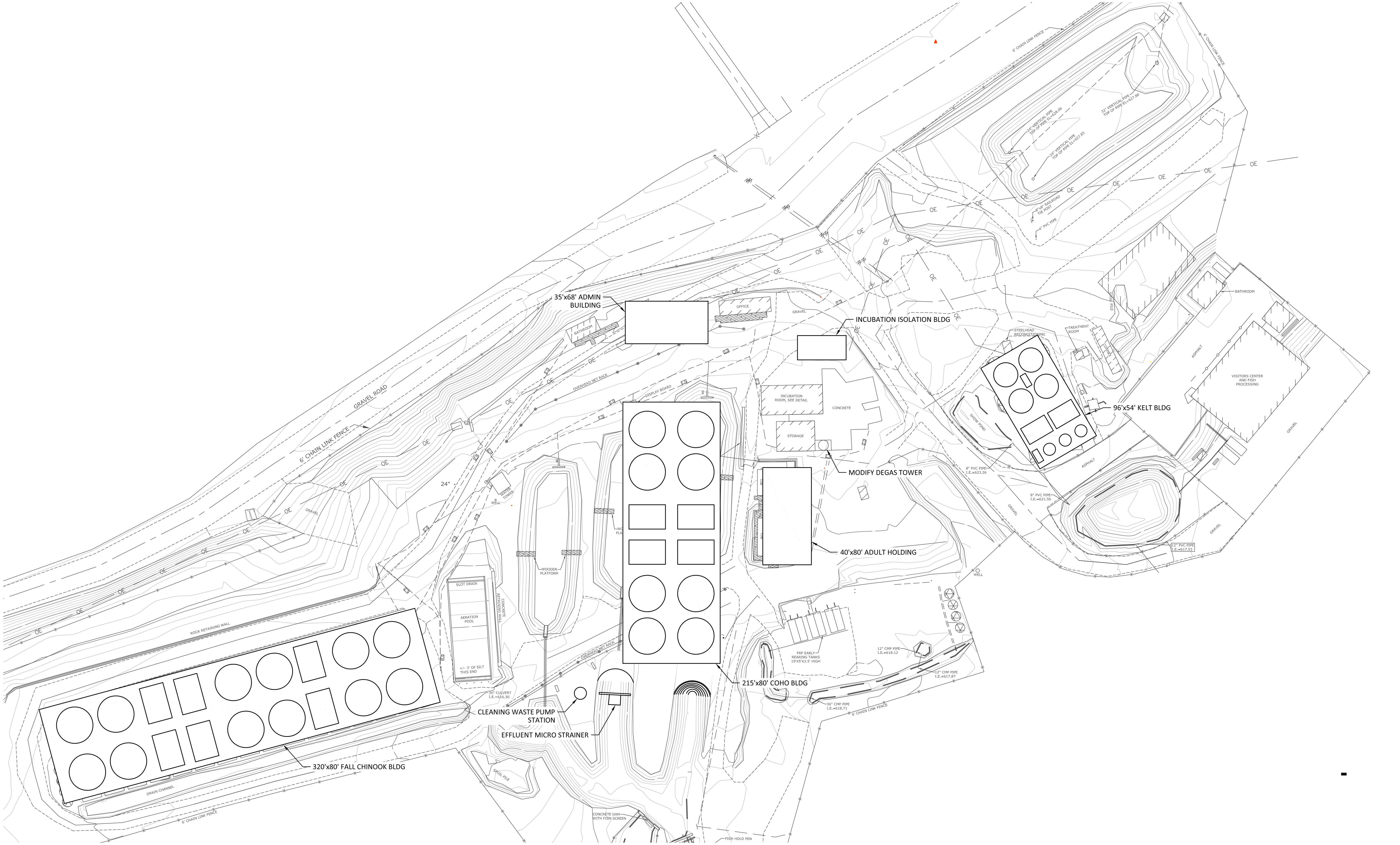
JOB NO: 000000



PROPOSED SITE PLAN

SCALE: 1"= 40'

0' 40' 80'

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REV	DATE	BY	DESCRIPTION

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IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

FISHERIES YKFP YAKAMA NATION

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

PROPOSED SITE PLAN

DESIGNED M. REISER

DRAWN B. ROONEY

CHECKED D. NELSON

PROJECT DATE 04/30/19

DRAWING

6

JOB NO: 000000

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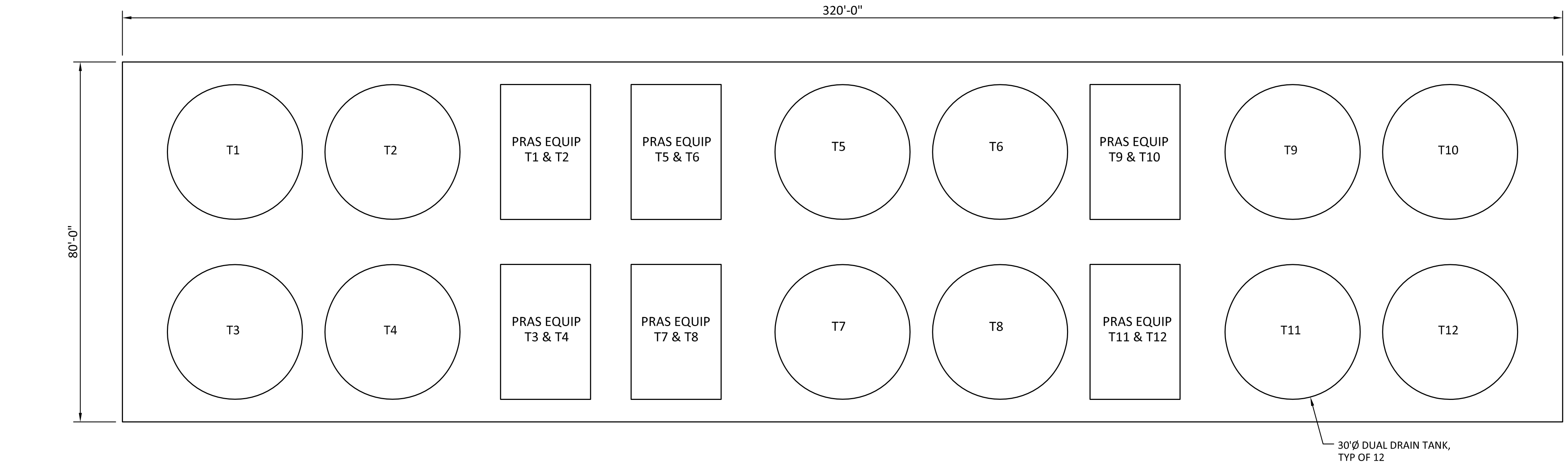
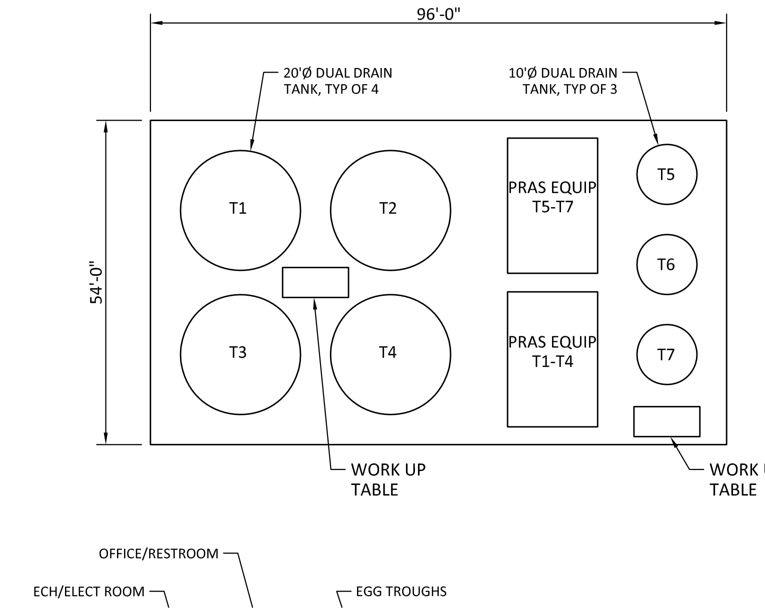


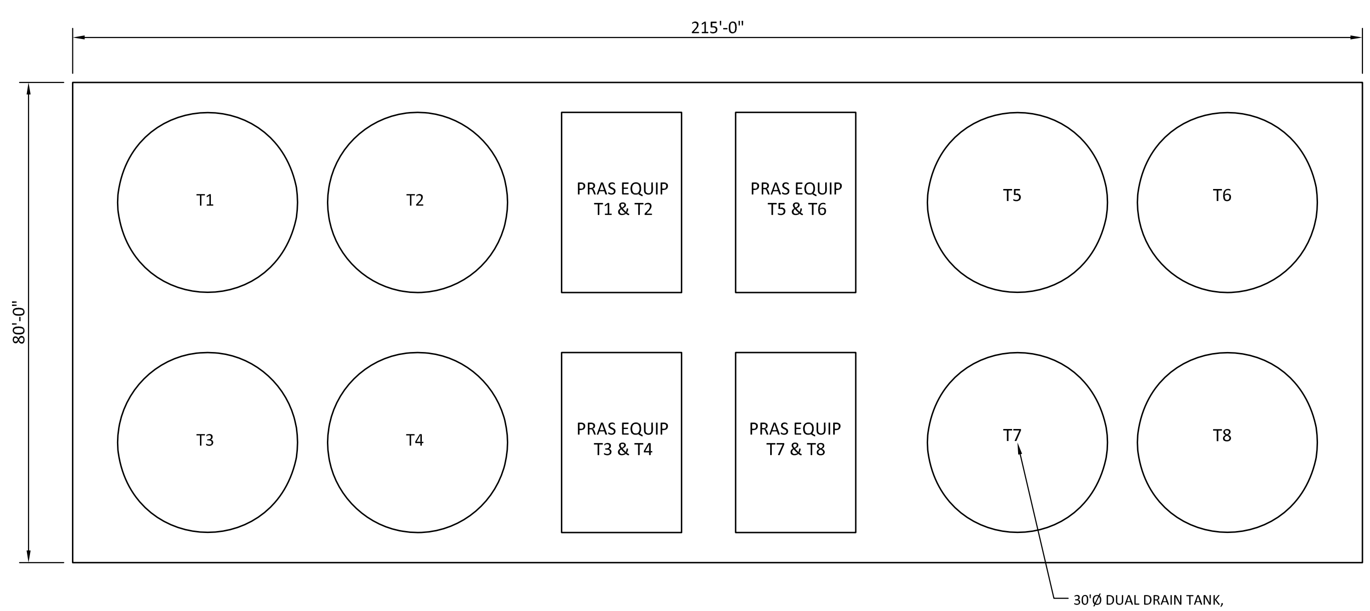
FALL CHINOOK BUILDING

SCALE: 1/16"= 1'-0"



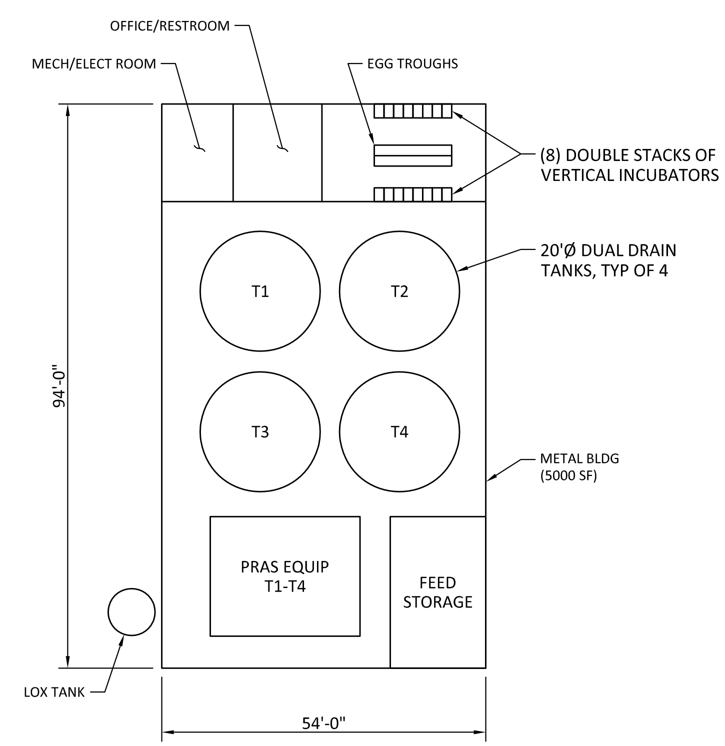
STEELHEAD KELT BUILDING

SCALE: 1/16"= 1'-0"



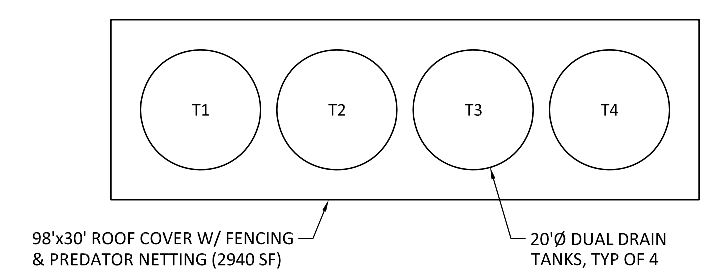
COHO BUILDING

SCALE: 1/16"= 1'-0"



SUMMER CHINOOK - UPSTREAM HATCHERY

SCALE: 1/16"= 1'-0"



SUMMER CHINOOK - ACCLIMATION (LONG TERM)

SCALE: 1/16"= 1'-0"

REV	DATE	BY	DESCRIPTION
A	04/30/19	DSN	CONCEPT DESIGN

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

BUILDING PLANS - PROSSER

DESIGNED M. REISER

DRAWN B. ROONEY

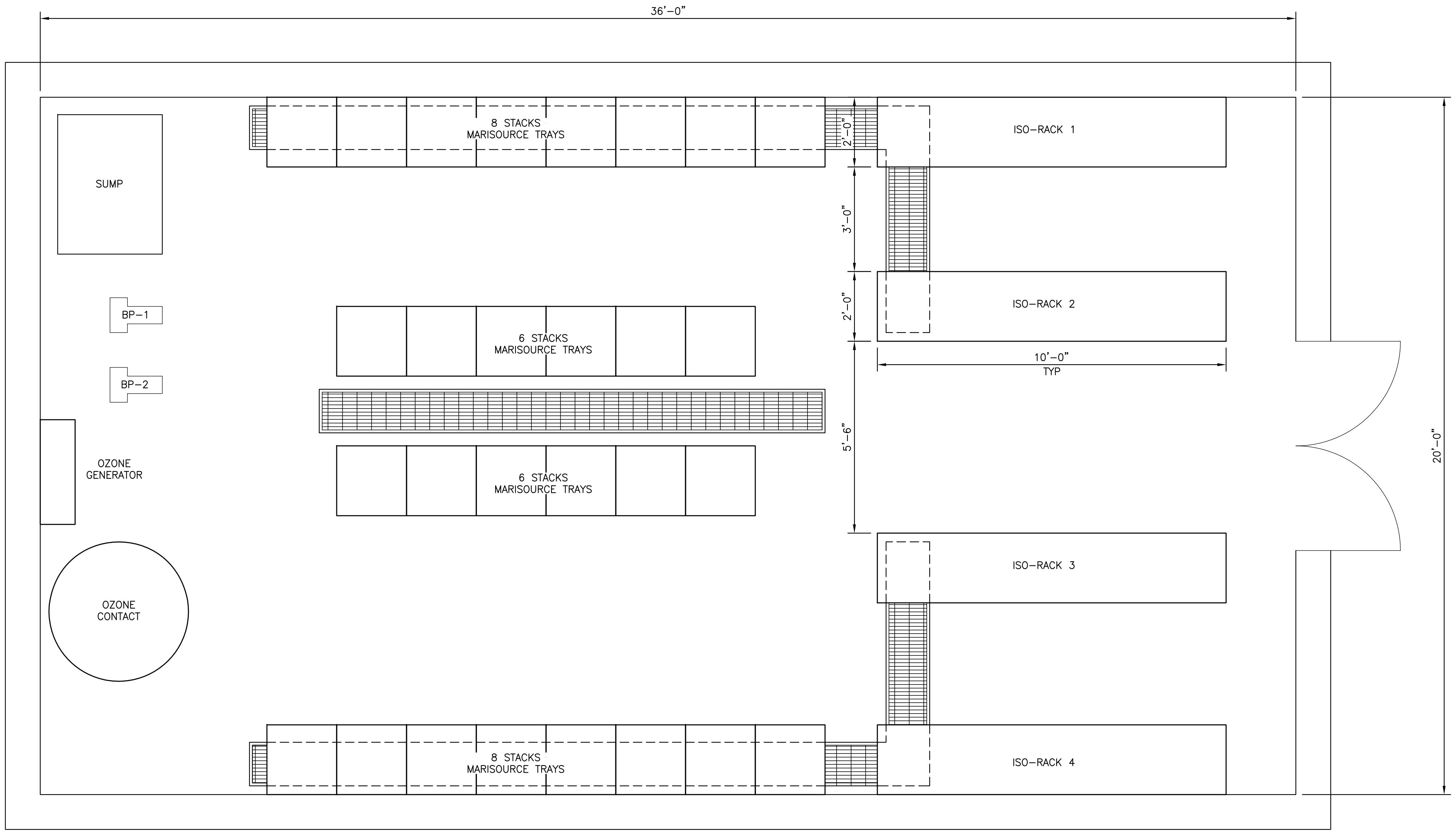
CHECKED D. NELSON

PROJECT DATE 04/30/19

DRAWING 7

JOB NO: 000000

Path: C:\Users\lahmon\Box\Projects\Yakama Nation\Master Plan\6.0 Plans and Specs\6.3 CAD\2019 Master Plan Update_S100.dwg Plot date: Jul 22, 2019 04:02pm, CAD User: Lahmon



ISOLATION INCUBATION FLOOR PLAN

SCALE: 1/2" = 1'-0"   0' 2' 4'

1
—

REV	DATE	BY	DESCRIPTION

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

1 S B

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

ISOLATION INCUBATION BUILDING FLOOR PLAN

DESIGNED M. REISER

DRAWN D. LITA

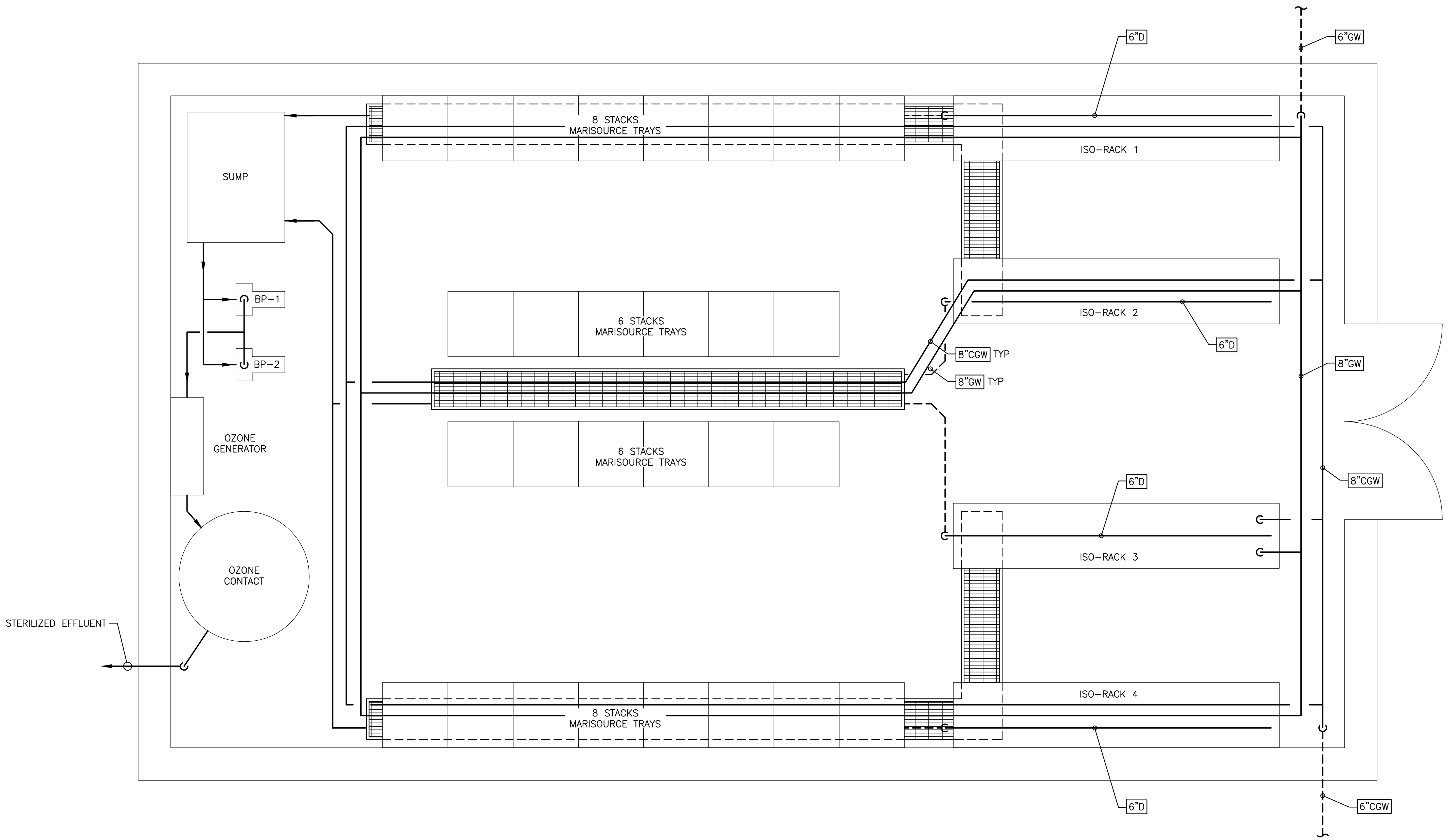
CHECKED

ISSUED DATE

DRAWING

8

SCALE: AS NOTED



ISOLATION INCUBATION ROOM PIPING PLAN

SCALE: 1/2" = 1'-0"   0' 2' 4'   1/—

REV	DATE	BY	DESCRIPTION

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

FISHERIES YKFP YAKAMA NATION

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

ISOLATION INCUBATION ROOM PIPING PLAN

DESIGNED M. REISER

DRAWN D. LITA

CHECKED

ISSUED DATE

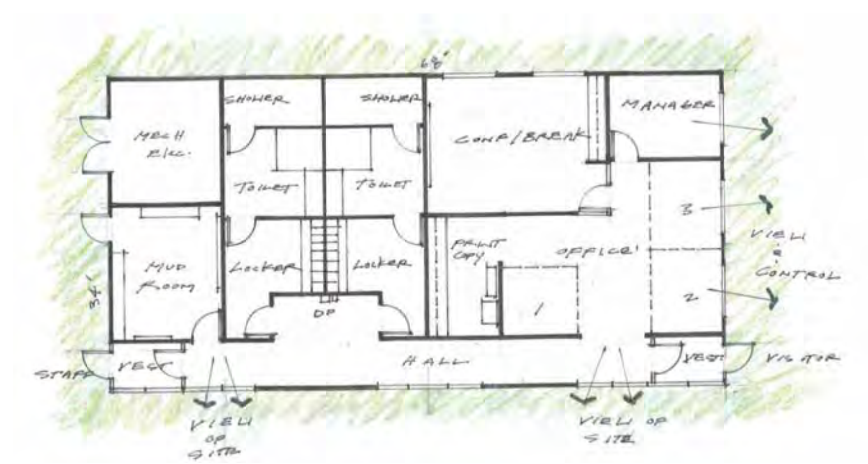
DRAWING

9

SCALE: AS NOTED

SOUTH ELEVATION (A)
SCALE: 3/32"=1'-0"
0' 8' 16'

SOUTH ELEVATION (B)
SCALE: 3/32"=1'-0"
0' 8' 16'



FLOOR PLAN (A)
SCALE: 3/32"=1'-0"
0' 8' 16'

FLOOR PLAN (B)
SCALE: 3/32"=1'-0"
0' 8' 16'

REV	DATE	BY	DESCRIPTION

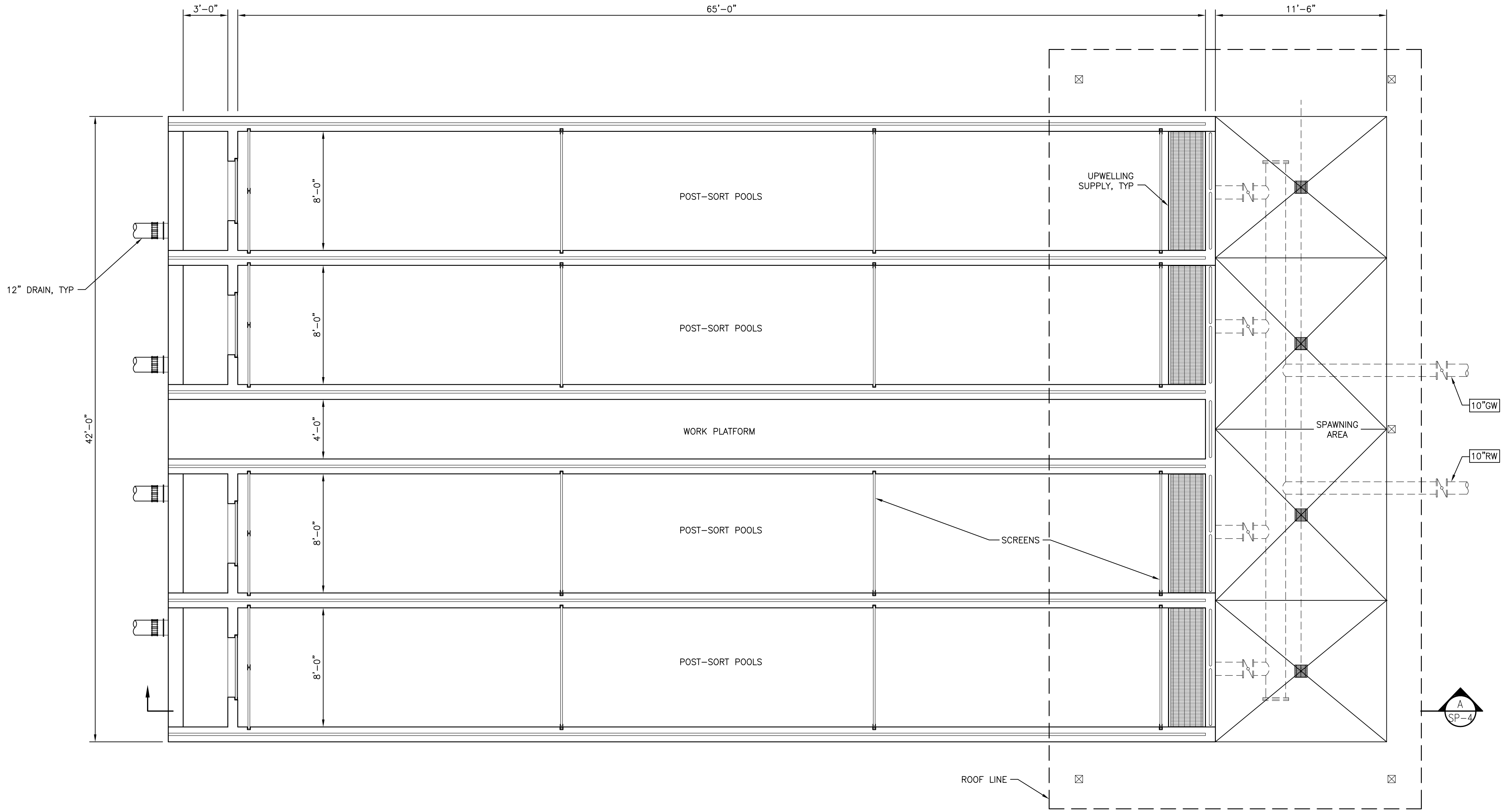
LCA Architects

WARNING
0 1/2 1
IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES
PROSSER HATCHERY CONCEPT DESIGN
ADMIN BUILDING FLOOR PLANS AND ELEVATIONS

DESIGNED M. REISER
DRAWN D. LITA
CHECKED
ISSUED DATE

DRAWING
10
SCALE: AS NOTED



Z ADULT HOLDING RACEWAYS PLAN 1

SCALE: 1/4"=1'-0" 0' 4' 8'

REV	DATE	BY	DESCRIPTION

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

ADULT HOLDING POND PLAN

DESIGNED M. REISER

DRAWN D. LITA

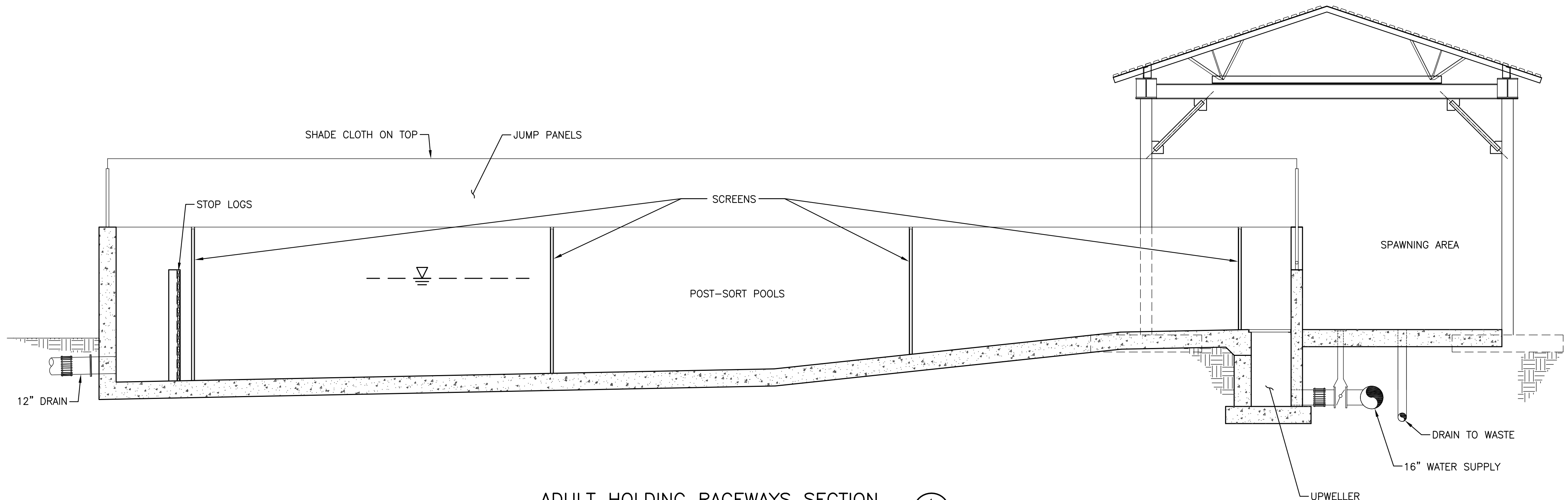
CHECKED

ISSUED DATE

DRAWING

11

SCALE: AS NOTED



ADULT HOLDING RACEWAYS SECTION (1)

SCALE: 1/4"=1'-0"   0' 4' 8'

REV	DATE	BY	DESCRIPTION

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

1 S B

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPT DESIGN

ADULT HOLDING POND SECTION

DESIGNED M. REISER

DRAWN D. LITA

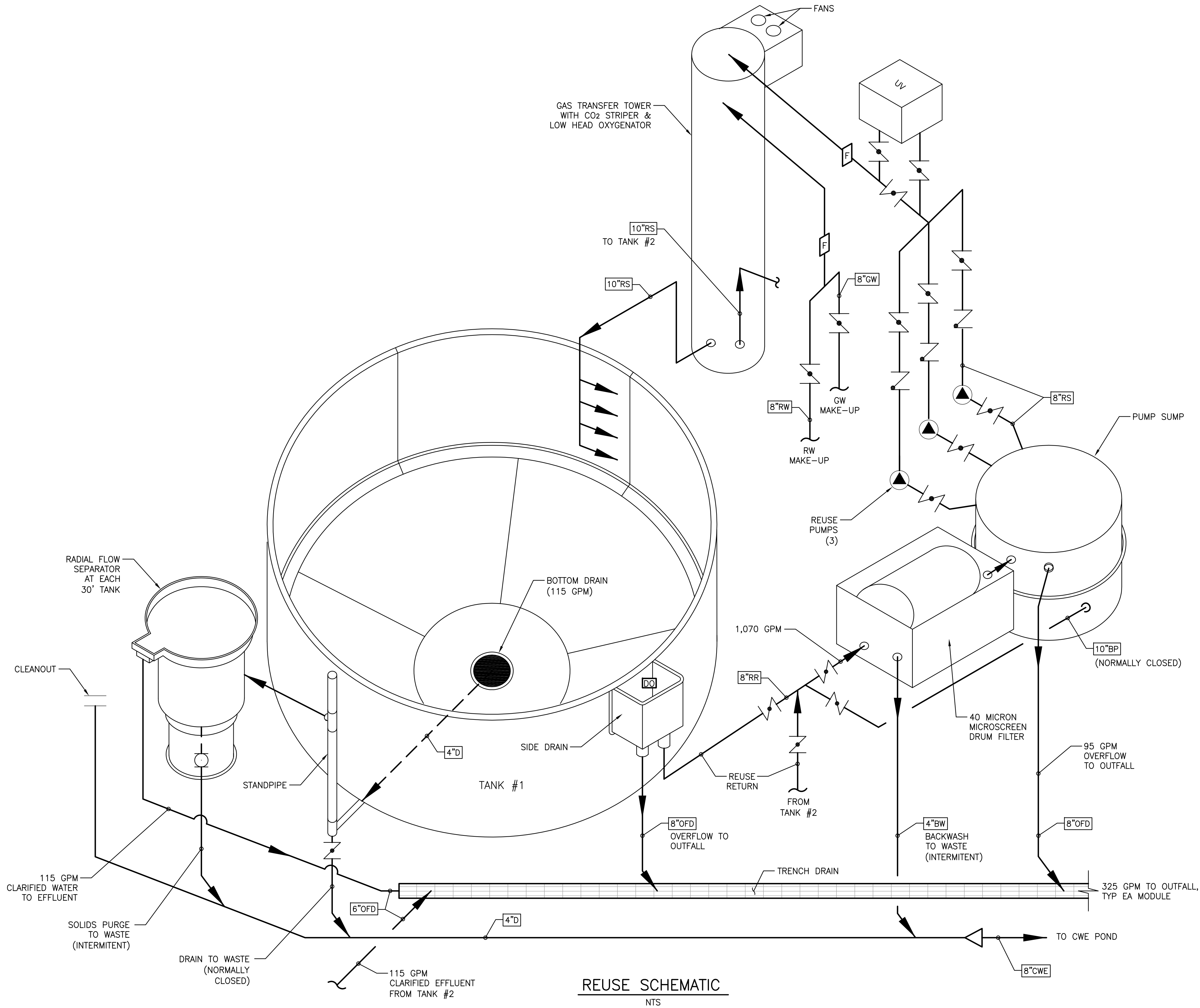
CHECKED

ISSUED DATE

DRAWING

12

SCALE: AS NOTED



REUSE SCHEMATIC

NTS

LEGEND:

- BP BYPASS
- BW BACKWASH
- CWE CLEANING WASTE EFFLUENT
- D DRAIN
- DO DISSOLVED OXYGEN PROBE
- F FLOW METER
- GW GROUND WATER
- OFD OVERFLOW DRAIN
- RR REUSE RETURN
- RS REUSE SUPPLY
- RW RIVER WATER
- UV ULTRAVIOLET DISINFECTION

NOTES:

1. ONE OF TWO CULTURE TANKS AND RADIAL FLOW SEPARATORS SHOWN.
2. REUSE TREATMENT SYSTEM MODULE SHARED BETWEEN TWO CULTURE TANKS.

REV	DATE	BY	DESCRIPTION

WARNING

0 1/2 1

IF THIS BAR DOES NOT MEASURE 1" THEN DRAWING IS NOT TO SCALE.

MCMILLEN, LLC
1401 SHORELINE DRIVE
SUITE 100
BOISE, ID 83702
OFFICE: 208.342.4214
FAX: 208.342.4216

YAKAMA NATION FISHERIES

PROSSER HATCHERY CONCEPTUAL DESIGN

REUSE SCHEMATIC

DESIGNED M. REISER

DRAWN D. LITA

CHECKED

ISSUED DATE 3/16/12

DRAWING 13

SCALE: AS NOTED

Appendix H

Detailed Program Cost Estimates

Appendix H-1. Updated Prosser Hatchery Conceptual Cost Detail.

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Division 01 - General Requirements						
Mobilization/Demobilization, Bond, Ins, etc.	1	%	10%	$2,329,789	10.0%	2,562,768
Division 02 - Existing Conditions						$ 78,000
Pond/Netting Demolition	2	EA	$7,500.00	$15,000	20.0%	18,000
Demolition of Existing Metal Raceways	1	LS	$40,000.00	$40,000	20.0%	48,000
Kelt Tank Salvage/Demolition	1	LS	$8,000.00	$8,000	20.0%	9,600
Headbox Salvage	2	EA	$1,000.00	$2,000	20.0%	2,400
Division 03 - Concrete						$ 975,804
Concrete in Place - FC Hatchery Floor Slab - 5" thk.	400	CY	$600.00	$240,000	20.0%	288,000
Concrete in Place - FC Iso-Inc Floor Slab - 5" thk.	12	CY	$600.00	$7,200	20.0%	8,640
Concrete in Place - Coho Hatchery Floor Slab - 5" thk.	270	CY	$600.00	$162,000	20.0%	194,400
Concrete in Place - Kelt Facilty Floor Slab - 5" thk.	80	CY	$600.00	$48,000	20.0%	57,600
Concrete in Place -FC Hatchery Bldg. Footings	50	CY	$1,000.00	$50,000	20.0%	60,000
Concrete in Place - FC Iso-Inc Footings	5	CY	$1,000.00	$5,000	20.0%	6,000
Concrete in Place -Coho Hatchery Bldg. Footings	18	CY	$1,000.00	$18,000	20.0%	21,600
Concrete in Place -Kelt Facilty Footings	10	CY	$1,000.00	$10,000	20.0%	12,000
Admin Bldg Footing/Stem Wall	206	LF	$120.00	$24,720	20.0%	29,664
Concrete in Place Adult Holding Pond Walls	167	CY	$1,000.00	$167,000	20.0%	200,400
Concrete in Place Adult Holding Pond Slabs	125	CY	$650.00	$81,250	20.0%	97,500
Division 05 - Metals (or FRP)						$ 459,600
FC Hatchery Bldg Platforms, Gratings and Railings	1	LS	$165,000.00	$165,000	20.0%	198,000
FC Iso Inc Bldg Misc Metals	1	LS	$15,000.00	$15,000	20.0%	18,000
Coho Bldg Platforms, Gratings, and Railings	1	LS	$110,000.00	$110,000	20.0%	132,000
Kelt Bldg Platforms, Gratings, and Railings	1	LS	$45,000.00	$45,000	20.0%	54,000
Adult Holding Screens, Embeds and Railings	1	LS	$48,000.00	$48,000	20.0%	57,600
Division 07 - Thermal and Moisture Protection						$ 490,579
FC Hatchery Building	25,600	SF	$8.00	$204,800	20.0%	245,760
FC ISO Inc	720	SF	$8.00	$5,760	20.0%	6,912
Coho Building	17,200	SF	$8.00	$137,600	20.0%	165,120
Kelt Building	5,184	SF	$8.00	$41,472	20.0%	49,766

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Admin Building	2,398	SF	$8.00	$19,184	20.0%	23,021
Division 08 - Openings						$ 127,200
FC Hatchery Building - Doors and Windows	1	LS	$40,000.00	$40,000	20.0%	48,000
FC Iso-Inc Building - Doors and Windows	1	LS	$6,000.00	$6,000	20.0%	7,200
Coho Building - Doors and Windows	1	LS	$25,000.00	$25,000	20.0%	30,000
Kelt Building - Doors and Windows	1	LS	$15,000.00	$15,000	20.0%	18,000
Admin Building - Doors and Windows	1	LS	$20,000.00	$20,000	20.0%	24,000
Division 09 - Finishes						$ 87,221
FC Hatchery Building - Floor Selant and Misc Painting	25,600	SF	$1.00	$25,600	20.0%	30,720
FC Iso-Inc Building - Floor Selant and Misc Painting	720	SF	$1.00	$720	20.0%	864
Coho Building - Floor Selant and Misc Painting	17,200	SF	$1.00	$17,200	20.0%	20,640
Kelt Building - Floor Selant and Misc Painting	5,184	SF	$1.00	$5,184	20.0%	6,221
Admin Building - Flooring and Misc Painting	2,398	SF	$10.00	$23,980	20.0%	28,776
Division 11 - Equipment						$ 6,832,800
FC Bldg PRAS Equipment Modules	6	EA	$350,000.00	$2,100,000	20.0%	2,520,000
FC Bldg 30-Foot Dia Dual Drain Tanks and Accessories	12	EA	$65,000.00	$780,000	20.0%	936,000
FC Iso Inc Bldg Marisource Stacks	28	EA	$3,000.00	$84,000	20.0%	100,800
FC Iso Inc Bldg Egg Racks	4	EA	$8,000.00	$32,000	20.0%	38,400
FC Iso Inc Bldg Ozone Disinfection System	1	LS	$50,000.00	$50,000	20.0%	60,000
Coho Bldg PRAS Equipment Modules	4	LS	$350,000.00	$1,400,000	20.0%	1,680,000
Coho Bldg 30-Foot Dia Dual Drain Tanks and Accessories	8	EA	$65,000.00	$520,000	20.0%	624,000
Kelt Bldg PRAS Main Equipment Module	1	LS	$200,000.00	$200,000	20.0%	240,000
Kelt Bldg PRAS QT Equipment Module	1	LS	$100,000.00	$100,000	20.0%	120,000
Kelt Bldg 20-Foot Dia Dual Drain Tanks and Accessories	4	EA	$45,000.00	$180,000	20.0%	216,000
Kelt Bldg 10-Foot Dia Dual Drain Tanks and Accessories	3	LS	$20,000.00	$60,000	20.0%	72,000
FC Hatchery Bldg Flow Meters	6	EA	$6,000.00	$36,000	20.0%	43,200
FC Iso-Inc Building Flow Meters	1	EA	$6,000.00	$6,000	20.0%	7,200
Coho Building Flow Meters	4	EA	$6,000.00	$24,000	20.0%	28,800
Kelt Building Flow Meters	2	EA	$6,000.00	$12,000	20.0%	14,400
Effluent Microstrainer - 40 um	1	LS	$65,000.00	$65,000	20.0%	78,000
Backwash Duplex Pumpstation - 25 gpm	1	LS	$45,000.00	$45,000	20.0%	54,000

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Division 13 - Special Construction						$ 4,660,080
FC PEMB	25600	SF	$75.00	$1,920,000	20.0%	2,304,000
FC Iso Inc PEMB	720	SF	$85.00	$61,200	20.0%	73,440
Coho PEMB	17200	SF	$75.00	$1,290,000	20.0%	1,548,000
Kelt Facility PEMB	5184	SF	$75.00	$388,800	20.0%	466,560
Admin Building Structure	2380	SF	$80.00	$190,400	20.0%	228,480
Adult Holding Roof Cover	600	SF	$55.00	$33,000	20.0%	39,600
Division 22 - Plumbing						$ 236,280
Water/ Sanitary Plumbing and Fixtures - FC Hatchery	1	LS	$75,000.00	$75,000	20.0%	90,000
Water/ Sanitary Plumbing and Fixtures - Iso Inc Bldg	1	LS	$10,000.00	$10,000	20.0%	12,000
Water/ Sanitary Plumbing and Fixtures - Coho Hatchery	1	LS	$50,000.00	$50,000	20.0%	60,000
Water/ Sanitary Plumbing and Fixtures - Kelt Bldg	1	LS	$20,000.00	$20,000	20.0%	24,000
Water/ Sanitary Plumbing and Fixtures - Admin Bldg	1	LS	$25,000.00	$25,000	20.0%	30,000
Fire Sprinkler Headers - Admin	1	LS	$5,000.00	$5,000	20.0%	6,000
Fire Sprinklers - Admin	2380	SF	$5.00	$11,900	20.0%	14,280
Division 23 - Heating, Ventilating and AC						$ 930,672
Heat and Ventilate FC Hatchery Bldg	25600	SF	$15.00	$384,000	20.0%	460,800
Heat and Ventilate FC Iso-Inc Bldg	720	SF	$18.00	$12,960	20.0%	15,552
Heat and Ventilate Coho Bldg	17200	SF	$15.00	$258,000	20.0%	309,600
Heat and Ventilate Kelt Bldg	5184	SF	$15.00	$77,760	20.0%	93,312
Heat and Ventilate and AC Admin Bldg	2380	SF	$18.00	$42,840	20.0%	51,408
Division 26 - Electrical						$ 2,285,616
Power and Lighting - FC Hatchery Bldg	25600	SF	$20.00	$512,000	20.0%	614,400
Power to FC PRAS Equip	6	EA	$65,000.00	$390,000	20.0%	468,000
Power and Lighting - FC Iso-Inc	720	SF	$20.00	$14,400	20.0%	17,280
Power to Iso Inc Ozone System	1	LS	$8,000.00	$8,000	20.0%	9,600
Power and Lighting - Coho Bldg	17200	SF	$20.00	$344,000	20.0%	412,800
Power to Coho PRAS Equip	4	EA	$65,000.00	$260,000	20.0%	312,000
Power and Lighting - Kelt Bldg	5184	SF	$20.00	$103,680	20.0%	124,416
Power to Kelt PRAS Equip	2	EA	$40,000.00	$80,000	20.0%	96,000
Power and Lighting - Admin Bldg	2380	SF	$20.00	$47,600	20.0%	57,120
Power to Well Pump #4	1	EA	$30,000.00	$30,000	20.0%	36,000

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Power to Eff Micro Strainer & Pumps	1	EA	$25,000.00	$25,000	20.0%	30,000
Yard Lighting	1	LS	$50,000.00	$50,000	20.0%	60,000
Emergency Generator Panel Expansion	1	LS	$40,000.00	$40,000	20.0%	48,000
Division 31 - Earthwork						$ 576,840
FC Hatchery Bldg Cut and Fill	5,200	CY	$30.00	$156,000	20.0%	187,200
FC Iso Inc Bldg Cut and Fill	20	CY	$30.00	$600	20.0%	720
Coho Hatchery Bldg Cut and Fill	2,800	CY	$30.00	$84,000	20.0%	100,800
Adult Holding Ponds Cut and Fill	150	CY	$30.00	$4,500	20.0%	5,400
Admin Bldg Cut and Fill	200	CY	$30.00	$6,000	20.0%	7,200
Kelt Bldg Cut and Fill	250	CY	$30.00	$7,500	20.0%	9,000
FC Hatchery Bldg - Structural Fill	950	CY	$50.00	$47,500	20.0%	57,000
FC Iso Inc Bldg - Structural Fill	30	CY	$50.00	$1,500	20.0%	1,800
Coho Hatchery Bldg - Structural Fill	640	CY	$50.00	$32,000	20.0%	38,400
Kelt Bldg - Structural Fill	192	CY	$50.00	$9,600	20.0%	11,520
Adult Holding Ponds Structural Fill	140	CY	$50.00	$7,000	20.0%	8,400
Admin Bldg - Structural Fill	30	CY	$50.00	$1,500	20.0%	1,800
Erosion Control Facility	1	LS	$30,000.00	$30,000	20.0%	36,000
Erosion Control Drain Line	1	LS	$15,000.00	$15,000	20.0%	18,000
8" Thk Roadway Base (1-1/2" Gravel)	1200	CY	$40.00	$48,000	20.0%	57,600
4" Thk Roadway Top Fill (3/4" Gravel)	600	CY	$50.00	$30,000	20.0%	36,000
Division 32 - Exterior Improvements						$ 284,400
Bollards	16	EA	$750.00	$12,000	20.0%	14,400
LOX Pads and Fencing	3	EA	$20,000.00	$60,000	20.0%	72,000
3" Hot Mix Asphalt	5500	SY	$30.00	$165,000	20.0%	198,000
Division 33 - Utilities						$ 186,000
Upgrade Power Service	1	LS	$50,000.00	$50,000	20.0%	60,000
Communications	1	LS	$15,000.00	$15,000	20.0%	18,000
Potable Water System Extensions	1	LS	$50,000.00	$50,000	20.0%	60,000
Stormwater Allowance	1	LS	$40,000.00	$40,000	20.0%	48,000
Division 40 - Instrumentation and Controls						$ 444,000
Facility Monitoring and Controls	1	LS	$250,000.00	$250,000	20.0%	300,000
Security Camera System	1	LS	$120,000.00	$120,000	20.0%	144,000

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Division 42 - Process Water Systems						$ 4,894,800
FC Hatchery Bldg Valves and Piping - Indoors	1	LS	$1,850,000	$1,850,000	20.0%	2,220,000
FC Hatchery Bldg Piping - 24" Outdoor Overflow Drain	250	LF	$240.00	$60,000	20.0%	72,000
FC Hatchery Bldg Piping - 8" Outdoor Bottom Drain	470	LF	$80.00	$37,600	20.0%	45,120
FC Iso Inc Bldg Valves and Piping - Indoors	1	LS	$65,000.00	$65,000	20.0%	78,000
FC Iso Inc Bldg Piping -8" Outdoor Drain	20	LF	$80.00	$1,600	20.0%	1,920
Coho Hatchery Bldg Valves and Piping - Indoors	1	LS	$1,240,000	$1,240,000	20.0%	1,488,000
Coho Hatchery Bldg Piping - 18"Outdoor Overflow Drain	60	LF	$180.00	$10,800	20.0%	12,960
Coho Hatchery Bldg Piping - 12"Outdoor Bottom Drain	20	LF	$120.00	$2,400	20.0%	2,880
Kelt Bldg Valves and Piping - Indoors	1	LS	$350,000.00	$350,000	20.0%	420,000
Kelt Bldg Piping - 12" Outdoors Drain to Pond	50	LF	$120.00	$6,000	20.0%	7,200
Groundwater Supply Piping(Buried Outdoors)	1	LS	$137,600.00	$137,600	20.0%	165,120
LOX Piping	1	LS	$150,000.00	$150,000	20.0%	180,000
Headbox Piping Modications	1	LS	$18,000.00	$18,000	20.0%	21,600
Adult Holding Supply Valves and Piping	1	LS	$90,000.00	$90,000	20.0%	108,000
Adult Holding Drain Piping	1	LS	$60,000.00	$60,000	20.0%	72,000
Project Subtotal (without Division 01)						23,549,892
Project Subtotal						

Notes & Assumptions:

- Costs shown in 2019 dollars

Appendix H-2. Updated Summer Chinook Detail

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Division 01 - General Requirements						
Mobilization/Demobilization, Bond, Ins, etc.	1	%	10%	$478,348	10.0%	526,183
Division 02 - Existing Conditions						$ 105,600
UYH Site Clearing and Grubbing	1	LS	$3,000.00	$3,000	20.0%	3,600
Acclimation Site Clearing and Grubbing	1	LS	$5,000.00	$5,000	20.0%	6,000
UYH Dewatering Allowance	1	LS	$30,000.00	$30,000	20.0%	36,000
Acclimation Site Dewatering Allowance	1	LS	$50,000.00	$50,000	20.0%	60,000
Division 03 - Concrete						$ 415,620
Concrete in Place - UYH Floor Slab - 5" thk.	78	CY	$600.00	$46,800	20.0%	56,160
Concrete in Place - UYH Footings	10	CY	$1,000.00	$10,000	20.0%	12,000
Concrete in Place -Acclimation Roof Footings	8	CY	$1,000.00	$8,000	20.0%	9,600
Concrete in Place Adult Holding Pond Walls	94	CY	$1,000.00	$94,000	20.0%	112,800
Concrete in Place Adult Holding Pond Slabs	62	CY	$650.00	$40,300	20.0%	48,360
Concrete Intake Screen Structure at Acclimation	1	LS	$50,000.00	$50,000	20.0%	60,000
UYH Concrete in Place OLSB Walls	30	CY	$1,100.00	$33,000	20.0%	39,600
UYH Concrete in Place OLSB Slabs	25	CY	$600.00	$15,000	20.0%	18,000
Acclimation Concrete in Place OLSB Walls	30	CY	$1,100.00	$33,000	20.0%	39,600
Acclimation Concrete in Place OLSB Slabs	25	CY	$650.00	$16,250	20.0%	19,500
Division 05 - Metals						$ 94,800
UYH Hatchery Bldg Gratings and Railings	1	LS	$45,000.00	$45,000	20.0%	54,000
UYH Adult Holding Screens, Embeds and Railings	1	LS	$24,000.00	$24,000	20.0%	28,800
UYH Effluent Treatment OLSB Metals	1	LS	$5,000.00	$5,000	20.0%	6,000
Acclimation Effluent Treatment OLSB Metals	1	LS	$5,000.00	$5,000	20.0%	6,000
Division 06 - Wood and Plastic						$ 1,650
Stop Logs	1	LS	$1,500.00	$1,500	10.0%	1,650
FRP Service Platform for Gas Tower	1	LS	$15,000.00	$15,000	10.0%	16,500
Division 07 - Thermal and Moisture Protection						$ 48,000
UYH Early Rearing Bldg	5,000	SF	$8.00	$40,000	20.0%	48,000
Division 08 - Openings						$ 24,000
Doors and Windows -UYH Early Rearing Bldg	1	LS	$20,000.00	$20,000	20.0%	24,000

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Division 09 - Finishes						$ 13,500
UYH Early Rearing Bldg.Floor Sealant	5,000	SF	$0.25	$1,250	20.0%	1,500
Misc Painting	1	LS	$10,000.00	$10,000	20.0%	12,000
Division 11 - Equipment						$1,399,200
UYH Early Rearing Bldg PRAS Module Equip	1	LS	$200,000.00	$200,000	20.0%	240,000
UYH 20-Foot Dia Dual Drain Tanks and Accessories	4	EA	$40,000.00	$160,000	20.0%	192,000
UYH Effluent Microstrainer	1	LS	$45,000.00	$45,000	20.0%	54,000
UYH Goundwater Supply Wells (300 gpm)	1	LS	$300,000.00	$300,000	20.0%	360,000
UYH Flow Meters	8	EA	$6,000.00	$48,000	20.0%	57,600
Acclimation 20-Foot Dia Tanks and Accessories	4	EA	$40,000.00	$160,000	20.0%	192,000
Acclimation Grit Settling Allowance	1	LS	$100,000.00	$100,000	20.0%	120,000
Acclimation Effluent Microstrainer	1	EA	$45,000.00	$45,000	20.0%	54,000
Acclimation Surface Water Pumps	3	EA	$30,000.00	$90,000	20.0%	108,000
Acclimation Portable Intake Screens - Passive	2	EA	$3,000.00	$6,000	20.0%	7,200
Acclimation Flow Meters	2	EA	$6,000.00	$12,000	20.0%	14,400
Division 13 - Special Construction						$ 721,200
UYH PEMB	5,000	SF	$75.00	$375,000	20.0%	450,000
UYH Adult Holding/Spawning Roof Cover	600	SF	$65.00	$39,000	20.0%	46,800
Acclimation Roof Cover	2,940	SF	$50.00	$147,000	20.0%	176,400
Acclimation Feed Storage Shed	1	LS	$15,000.00	$15,000	20.0%	18,000
Acclimation Predator Barrier Fence and Netting	1	LS	$25,000.00	$25,000	20.0%	30,000
Division 22 - Plumbing						$ 36,000
Water/ Sanitary Plumbing and Fixtures - UYH Hatchery	1	LS	$30,000.00	$30,000	20.0%	36,000
Division 23 - Heating, Ventilating and AC						$ 90,000
Heat and Ventilate UYH Bldg	5,000	SF	$15.00	$75,000	20.0%	90,000
Division 26 - Electrical						$ 347,280
Power and Lighting - UYH Bldg	5,000	SF	$20.00	$100,000	20.0%	120,000
UYH PRAS Equipment Connections	1	LS	$65,000.00	$65,000	20.0%	78,000
Acclimation Pumpstation Power and Lighting	1	LS	$45,000.00	$45,000	20.0%	54,000
Acclimation Tank Area Power and Lighting	2,940	SF	$10.00	$29,400	20.0%	35,280
Acclimation Emergency Generator	1	LS	$50,000.00	$50,000	20.0%	60,000

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
Division 31 - Earthwork						$ 224,232
UYH Hatchery Bldg Earthwork Cut and Fill	160	CY	$30.00	$4,800	20.0%	5,760
UYH Adult Pond Earthwork Cut and Fill	450	CY	$30.00	$13,500	20.0%	16,200
UYH OLSB Earthwork Cut and Fill	166	CY	$30.00	$4,980	20.0%	5,976
Acclimation Rearing Tanks Cut and Fill	470	CY	$30.00	$14,100	20.0%	16,920
Acclimation OLSB Cut and Fill	166	CY	$30.00	$4,980	20.0%	5,976
UYH Hatchery Bldg/Tanks Struct Fill	160	CY	$30.00	$4,800	20.0%	5,760
Acclimation Rearing Tanks - Structural Fill	240	CY	$30.00	$7,200	20.0%	8,640
UYH Erosion Control Facility	1	CY	$20,000.00	$20,000	20.0%	24,000
Acclimation Erosion Control Facility	1	LS	$30,000.00	$30,000	20.0%	36,000
UYH Roadway Base (1-1/2" Gravel)	1150	CY	$20.00	$23,000	20.0%	27,600
UYH Roadway Top Fill (3/4" Gravel)	380	CY	$25.00	$9,500	20.0%	11,400
Acclimation Roadway Base (1-1/2" Gravel)	1	LS	$30,000.00	$30,000	20.0%	36,000
Acclimation Roadway Top Fill (3/4" Gravel)	1	LS	$20,000.00	$20,000	20.0%	24,000
Division 32 - Exterior Improvements						$ 5,400.0
UYH Bollards	6	EA	$750.00	$4,500	20.0%	5,400
UYH LOX Tank Pad and Fencing	1	LS	$20,000.00	$20,000	20.0%	24,000
Division 33 - Utilities						$ 186,000
UYH Upgrade Power Service	1	LS	$50,000.00	$50,000	20.0%	60,000
Acclimation Power Service	1	LS	$25,000.00	$25,000	20.0%	30,000
UYH Stormwater Allowance	1	LS	$40,000.00	$40,000	20.0%	48,000
Acclimation Stormwater Allowance	1	LS	$40,000.00	$40,000	20.0%	48,000
Division 40 - Instrumentation and Controls						$ 120,000
UYH Facility Monitoring and Alarms	1	LS	$60,000.00	$60,000	20.0%	72,000
Acclimation Monitoring and Alarms	1	LS	$40,000.00	$40,000	20.0%	48,000
Division 42 - Process Water Systems						$ 951,000
UYH Hatchery Bldg Valves and Piping - Indoors	1	LS	$250,000.00	$250,000	20.0%	300,000
UYH Hatchery Bldg Piping - 12" Outdoor Overflow Drain	100	LF	$120.00	$12,000	20.0%	14,400
UYH Microstrainer 4" BW Forcemain to Land App.	300	LF	$45.00	$13,500	20.0%	16,200
UYH Microstrainer BW Pump	1	LS	$10,000.00	$10,000	20.0%	12,000
UYH 6" GW Supply Piping (Buried Outdoors)	50	LS	$80.00	$4,000	20.0%	4,800
UYH LOX Piping	1	LS	$25,000.00	$25,000	20.0%	30,000
UYH Headbox Piping	1	LS	$15,000.00	$15,000	20.0%	18,000

Item	Quantity	Unit	Unit Cost	Subtotal	Contingency	Cost
UYH Adult Holding GW Supply Valves and Piping	1	LS	$30,000.00	$30,000	20.0%	36,000
UYH Adult Holding SW Supply Valves and Piping	1	LS	$65,000.00	$65,000	20.0%	78,000
UYH Adult Holding Drain Piping to Exist Outfall Pipe	50	LF	$120.00	$6,000	20.0%	7,200
Acclimation SW Supply Piping Allowance	1	LS	$300,000.00	$300,000	20.0%	360,000
Acclimation Piping - 12" Overflow Drain Allowance	500	LF	$120.00	$60,000	20.0%	72,000
Acclimation Effluent Microstrainer 4" BW	50	LF	$40.00	$2,000	20.0%	2,400
Project Subtotal (without Division 01)						4,783,482
Project Subtotal						

Notes & Assumptions:

- Costs shown in 2019 dollars

Appendix I

Floodplain Evaluation

TECHNICAL MEMORANDUM 003

MCMILLEN, LLC

To:	Yakama Nation	Project:	Master Plan
From:	Mark Reiser, Senior Project Manager Chris Runyan, EIT McMillen, LLC	Cc:	Mort McMillen, PE (McMillen) George Robison, PE (McMillen)
Date:	March 6, 2012	Contract No:	
Subject:	Analysis of the 100- and 50-year FEMA Floodplain at the Prosser Hatchery Location.		

1.0 OVERVIEW

This Technical Memorandum (TM) summarizes findings from the FEMA floodplain analysis with regards to the proposed modifications at the Prosser Hatchery site. McMillen determined these findings by utilizing the following sources:

- Flood Insurance Study, Benton County, Washington, June 1994.
- Flood Insurance Rate Map, Benton County, WA. Panel 485 of 1075. July 1982.
- FEMA Flood Profile, Benton County, WA. Sheet 06P. June 1984.
- FEMA Provided HEC-2 Model, February 1977.
- CAD Surface of Hatchery Site, McMillen 2011.

1.1 PURPOSE

The purpose of the FEMA Floodplain analysis was to determine if the hatchery location was in the federally regulated 100-year floodplain. Any modifications and or new development proposed in the 100-year floodplain requires an hydraulic analysis to be completed to determine the impact of the proposed development on the current 100-year water surface elevation. This analysis utilized the above referenced sources to determine the level of hydraulic analysis required to meet FEMA requirements for the proposed modifications to the Prosser Hatchery currently being developed under the Master Plan work task. The following section will summarize these findings.

1.2 ANALYSIS FINDINGS

The Flood Insurance Study (FIS, 1994) determined the following discharges and water surface elevations at the hatchery location:

Table 1. Flood Insurance Study Discharges and Water Surface Elevations At Hatchery Location.

Return Interval	Discharge (cfs)	WSEL (ft. NAVD88)
100-Year	55,500	622.77
50-Year	44,000	621.16

The FEMA Flood Rate Insurance Map (Figure 1) developed in July, 1982 identified that the Prosser Hatchery was located in the floodplain. Additional work effort was completed to determine if current elevations of the Prosser Hatchery agreed with the floodplain boundary illustrated in the FIRM. Based on the water surface elevations in Table 1 and the survey completed by McMillen in 2011, the western and southern portions of the hatchery were determined to be within the floodplain (Figure 2). Some of proposed modifications to the hatchery are located in these areas and therefore will require a hydraulic model to be developed to determine the effect of the hatchery modifications on the floodplain water surface elevation. In addition, Figure 2 includes the general location of the FEMA Regulatory Floodway where any development in this area cannot cause any rise in the 100-year water surface elevation and requires a “No-Rise Certificate”. Outside of the Regulatory Floodway referred to as the Floodway Fringe, FEMA requires that all proposed developments shall not cause a rise in the 100-year water surface elevation of more than 1 foot. The proposed Prosser Hatchery modifications are not within the Regulatory Floodway and therefore all development must demonstrate through hydraulic analysis to not cause more than 1 foot of rise in the 100-year water surface elevation.

McMillen obtained the original HEC-2 model from FEMA and re-created this model in HEC-RAS, now referred to as the Duplicate Effective Model. The HEC-2 model was developed in 1977 and did not include any infrastructure of the Prosser Hatchery or the City of Prosser Wastewater facilities located upstream of the site. The HEC-2 model was utilized by FEMA to determine the floodplain elevations shown in the FIRM (Figure 1) and therefore does not account for the development of the present infrastructure at this location. To accurately model the proposed modifications of the hatchery and to meet FEMA requirements, a Pre-Project Model would need to be developed to first determine present floodplain water surface elevation based on the current development in this area.

McMillen recommends that additional survey data be collected to more accurately model the surrounding area. The 2011 survey only included the Prosser Hatchery site and access road along the canal dike. In areas where the survey was not completed, the only surface data available are 10-meter Digital Elevation Models (DEM) that have a vertical accuracy of +/- 8 feet and will not be sufficient to accurately model these surrounding areas. Areas where the surrounding terrian has been modified will need to be included in the Pre-Project model and in particular include around the wastewater treatment facilities and the southwestern location of the Prosser site where there is a large pile of rocks extending approximately 200 feet perpendicular to the river. The new survey would start upstream of the City of Prosser Wastewater facilities at the Grant Street Bridge and continue downstream to the eastern extent of the hatchery property. The survey would also include one channel cross section south of the wastewater treatment plant to accurately model the river pool in this area. The new survey, combined with the existing 2011 survey, would create a more accurate terrain model of the entire floodplain around the wastewater treatment plant and hatchery and would allow meeting FEMA expectations for hydraulic modeling of the Pre-Project condition and Post-Project condition models.

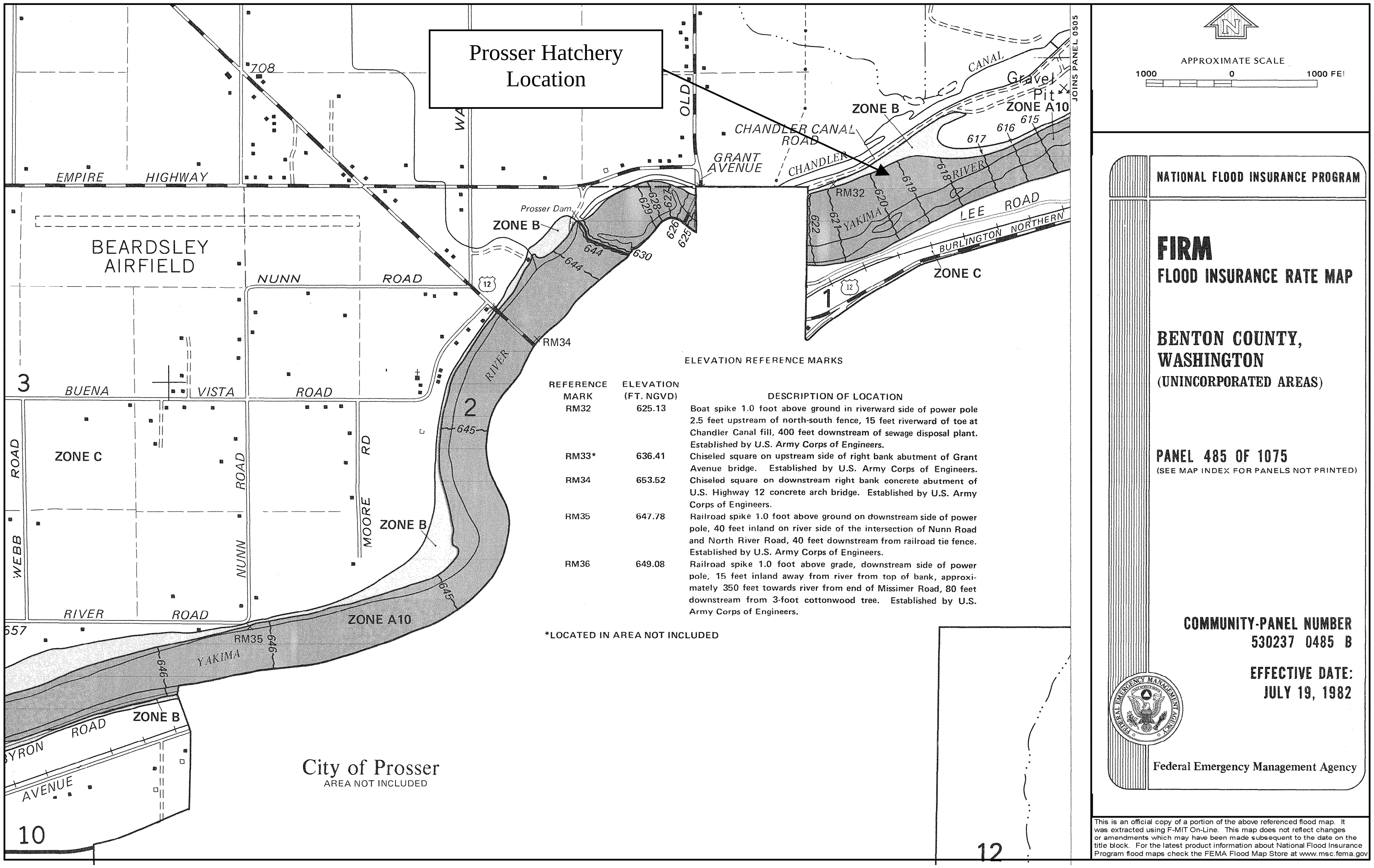


Figure 1. FEMA Flood Insurance Rate Map with Elevations in Northern Geodetic Vertical Datum of 1929 (NGVD29).

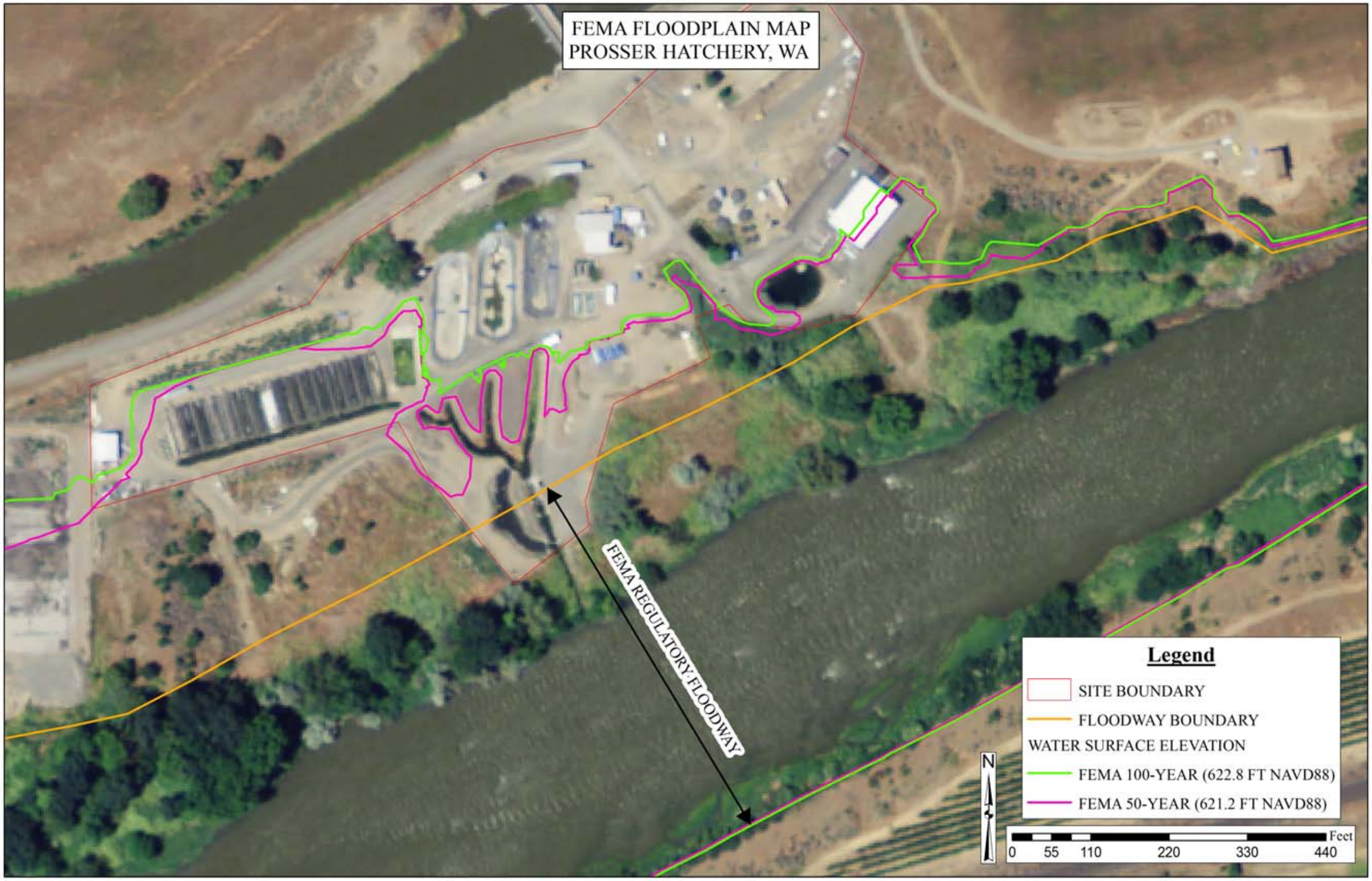


Figure 2. Picture Showing Extent of FEMA Defined Floodplain Utilizing the 2011 Survey.

Appendix J

Monitoring and Evaluation Plan

APPENDIX A. YAKIMA BASIN MONITORING AND EVALUATION PLAN

The proposed monitoring and evaluation program is part of the long-term, comprehensive project (199506325) with BPA and includes hatchery, harvest, and species interactions components of the Master Plan. Habitat action effectiveness monitoring is being conducted on an opportunistic basis such as during species interactions work and through cooperative work with other scientists as part BPA's Columbia Basin-wide Action Effectiveness Monitoring Program (e.g., see Clark and Roni 2017).

The results of M&E activities under the Master Plan will be presented in annual reports (e.g., https://www.cbfish.org/Document.mvc/Viewer/P161679). A science conference is held annually to present study findings to other agencies and interested members of the public. Study results and conference materials will be stored on the web (currently here). Data will also continue to be presented in peer-reviewed scientific publications.

YKFP's M&E data collection and reporting protocols will be consistent with the Columbia River Basin regional strategies including Monitoring, Evaluation, Research, and Reporting (MERR); Anadromous Salmonid Monitoring Strategy (ASMS); Coordinated Assessments (CA), and Pacific Northwest Aquatic Monitoring Partnership (PNAMP).

The Columbia River Basin Research Plan (NPCC 2017), which was developed with input from the Independent Scientific Advisory Board (ISAB), ISRP, and PNAMP, identified a number of critical uncertainties regarding hatchery management that are relevant to this proposed program:

> Question 1. Are current propagation efforts successfully meeting harvest and conservation objectives while managing risks to natural populations?
>
> 1.2. Can hatchery production programs meet adult production and harvest goals (integrated and segregated) while protecting naturally spawning populations?
>
> 1.3. What are the interactions, by life stage, between hatchery-origin and natural-origin populations with respect to competition, predation (direct and indirect), and disease including harvest in fisheries targeting hatchery-origin adults; and from hatchery effluent?
>
> 1.4. What is the magnitude of any demographic benefit or detriment to the production of natural-origin juveniles and adults from natural spawning of hatchery-origin supplementation adults?
>
> 1.5. What are the range, magnitude and rates of change of natural spawning fitness of integrated (supplemented) populations, and how are these related to management rules including the proportion of hatchery fish permitted on the spawning grounds, and the proportion of natural origin adults in the hatchery broodstock?

The M&E plan for the proposed project is intended to address all of the uncertainties at least to some extent. The M&E activities described below focus on determining the success of the hatchery program, the effects on native stocks, and the critical uncertainties.

A.1 Hatchery Monitoring and Evaluation

Objective A.1.1. Operate adult trap(s) at Prosser Denil ladder and Roza adult fish monitoring facility to collect brood stock and/or to sample returning fish for stock composition. Hold and spawn fish maintaining established fish health standards.

Approach: YN biologists and technical staff will operate adult fish traps at the Prosser Hatchery swim-in denil ladder, and the right bank river denil ladder above Prosser Dam and Roza ladder for broodstock development. Other possibilities for capturing and/ or monitoring adult returns to the Naches River will be explored as resources allow. YN staff have operated the Prosser right bank denil facility to collect data from returning fish in the fall as well as collect brood stock. Factors such as weir/trap impedance/avoidance, run timing, spawn timing, population demographics, phenotypic and genetic characteristics, and return rates are part of the necessary evaluation that will be conducted to facilitate future adaptive management of this program. Additionally, the Prosser Hatchery swim-in denil has been operating since 2006 and has been instrumental in further developing our in-basin broodstock. The structure was built to guarantee the capture of in-basin broodstock that were reared and released from the hatchery. Evaluation staff is responsible for daily record keeping of all species captured, passed, or hauled for broodstock, along with any biological samples collected. These adult traps are also used for estimating adult returns (see A.3). Feasibility studies for broodstock collection in the Naches subbasin will be conducted in the future as resources allow.

Task A.1.1.1. Operate adult trap(s) at the Prosser denil ladder and Roza Adult Monitoring Facility (RAMF).

Task A.1.1.2. Collect scale samples on all fish processed both sites. Scales from each fish will be used to document age-structure.

Task A.1.1.3. Collect and transport broodstock for the Prosser, Melvin R. Sampson (MRS) Coho, and summer-run Chinook salmon hatcheries.

Task A.1.1.4. Hold broodstock and document mortalities during holding.

Task A.1.1.5. Compile all data from trapping and spawning, and calculate return rates (using CWT, PIT tag, and mark-recapture analysis) for program evaluation.

Task A.1.1.6. Utilize USFWS fish health professionals during spawning to collect and analyze appropriate fish health samples. Cull fish as necessary per established USFWS and YKFP fish health protocols (See A.7 Disease monitoring).

Objective A.1.2. Determine the origin and stock of salmon used as broodstock. Monitor and evaluate changes in the phenotypic and genotypic characteristics of salmon used at the YN Hatchery facilities.

Approach: YN, WDFW co-managers and NMFS desire to maintain the integrity of salmon stocks in the Yakima Basin and to minimize the potential negative effects of hatchery operations on ESA listed populations. In addition, the project has goals of protecting the health of natural populations while also providing fish for harvest mitigation production.

Broodstock Management

To monitor the phenotypic and genotypic integrity of populations cultured for the program, YN staff strives to collect and mate adults for broodstock to monitor stock demographics (e.g. run/spawn timing, age structure, sex ratios and size of fish) for gametes retained for production. Ideally this would be accomplished by selecting broodstock from throughout the run/spawning season.

YN will use PIT tags, CWTs, fin clips, scale readings, and DNA sampling to identify natural-origin fish for broodstock for the Master Plan programs. The Prosser segregated program(s) may use returning hatchery-origin fish from either the integrated or segregated program for broodstock.

Since all natural-origin fish will be unmarked/untagged, any external or internal marks will be used to identify hatchery-origin fish so that fish can be properly managed according to the appropriate integrated or segregated program protocols.

Task A.1.2.1. Examine all salmon for marks and tags, and determine sex. Recover and decode all tags from all spawned hatchery-origin carcasses.

Task A.1.2.2. Select natural-origin salmon (per protocols described in the Master Plan, generally no more than one of every two or three returning NOR fish) for use as integrated program brood stock.

Task A.1.2.3. Calculate the rate at which natural origin salmon are included in broodstock.

Task A.1.2.4. Estimate stock composition (e.g., integrated or segregated hatchery- and natural-origin) of fish retained for broodstock.

Task A.1.2.5. Examine salmon for marks, wire (CWT), sex, and collect scales to determine age composition after spawning.

Task A.1.2.6. Collect length and weight samples from hatchery and natural origin spawned females. Estimate fecundity for each and create relationships with body size information to track for long-term changes.

Task A.1.2.7. Enumerate jacks retained in broodstock each week to assist with reporting and to assure jacks are incorporated in broodstock within the spawning protocol guideline.

Task A.1.2.8. Document brood year specific phenotypic characteristics for salmon used at the Master Plan Hatchery facilities (natural-origin, segregated, or integrated), and compare and report changes that have occurred over time. Methods will be similar to those described in Knudsen et al. (2006) and Knudsen et al. (2008).

Objective A.1.3. Monitor and evaluate the survival of hatchery salmon produced and reared at Master Plan facilities.

Approach: YN staff will collect data on growth and survival of salmon produced and reared at the Master Plan Hatchery facilities by life stage, from egg to release as pre-smolts.

Task A.1.3.1. Using gravimetric methods, estimate the number of eggs spawned.

Task A.1.3.2. Enumerate live eggs at "shock" time using an egg counter.

Task A.1.3.3. Document fry mortalities during incubation.

Task A.1.3.4. Estimate the number of fish ponded as the live egg count less documented fry mortalities.

Task A.1.3.5. Document mortalities during rearing by pond and month.

Task A.1.3.6. Document size of fish (length and weight) using sub-sample by rearing pond and month.

Task A.1.3.7. Document feed type and food conversion (weight gained divided by pounds of food fed) by rearing pond and month.

Task A.1.3.8. Estimate the number of fish released (e.g., if 100% of the fish are marked, this is the number of fish marked (see A.1.4) less documented mortalities from ponding to release).

Objective A.1.4. Comply with HSRG guidelines and program goals for natural stock restoration and local, natural-origin brood stock development.

Approach: Establish and maintain program marking protocols that allow returning fish to be distinguished by origin and stock. Marking strategies (Table A-1) are preliminary and may change pending further review of available budgets and logistical feasibility. Fish in programs targeted for harvest will be 100% adipose fin-clipped to facilitate harvest in all fisheries. Sufficient staff is available to mark-sample all fish that are handled at the Prosser denil and Roza adult trap facilities. Fisheries will strive to achieve a 20% mark-sample rate for at least adipose presence or absence. These mark and adult return sample rates are equivalent to or exceed those used in most other Columbia Basin programs with similar purposes. Therefore, we believe they will be sufficient to provide reasonable confidence in the parameters (e.g., fishery contribution, survival to Yakima River mouth, pHOS, pNOB, etc.) we are attempting to evaluate. We expect to detect and correct any insufficiencies through our annual review process.

Task A.1.4.1. Mark hatchery-origin salmon produced at the Master Plan Hatchery facilities as documented in Table A-1.

Task A.1.4.2. Estimate the total number of fish on hand at marking.

Task A.1.4.3. Observe marks on returning fish and use these data to manage proportion of natural fish in brood stock (pNOB – Objective A.1.2) and proportion of hatchery fish on the spawning grounds (pHOS – Objective A.3.1) per guidelines established by the YKFP Policy Group (as recommended by technical implementation teams).

Table A-1: Hatchery release numbers, number marked, and mark type by species and hatchery component

Species	Facility	Component	# Released	# Marked	Tag or Mark
Coho	Prosser	Segregated smolts	500,000	100%	100% AD-Clip of which 100% CWT 5-10% PIT
Coho	MRS	Integrated smolts	200,000	100%	0% AD-Clip 100% CWT post-dorsal 5-10% PIT
Coho	MRS	Integrated parr	500,000	100%	0% AD-Clip 100% CWT snout 5-10% PIT
Summer- and Fall-Run Chinook	Prosser/ Upriver	Integrated subyearling smolts	1,500,000	100%	0% AD-Clip 100% CWT snout[1] 5-10% PIT
Fall-Run Chinook	Prosser	Segregated smolts	1,700,000 Subyearlings 210,000 yearlings	100%	100% AD-Clip[1] 10% CWT snout[1]

[1] Requires purchase of Northwest Marine Technologies' AutoFish system (https://www.nmt.us/autofish-system/)

Objective A.1.5. Monitor and evaluate the quality and release of salmon produced at the Master Plan Hatchery facilities.

Approach: Evaluation staff will analyze marking data and releases of juvenile salmon to determine survival rates between life stages and examine potential variables that may influence observed survivals. To document PIT tag loss that occurs between tagging and release of salmon, we will install and maintain PIT tag arrays in the outlet channels at all release sites.

Task A.1.5.1. Evaluate mark quality and tag retention before release.

Task A.1.5.2. Evaluate fish health of a sub-sample of fish at release. Document and report release size and general condition of juvenile salmonids prior to release.

Task A.1.5.3. Summarize hatchery records for each brood year to document and report green egg-to-fry, fry-to-smolt, and green egg-to-smolt survival rates for each release strategy where appropriate (e.g. – parr or presmolt).

Task A.1.5.4. Based on above monitoring, recommend changes in rearing, marking, and/or tagging protocols to hatchery and YKFP management.

Task A.1.5.5. Install and maintain PIT tag antenna array in the outlets of all final rearing and release locations.

Task A.1.5.6. Document the number of PIT tagged fish in the release and calculate the number of PIT tags shed between tagging and release.

Task A.1.5.7. Document the number of CWT tagged fish in the release and calculate the number of CWT tags shed between tagging and release.

Task A.1.5.8. Report tagged release data to regional PTAGIS and RMIS data bases.

Objective A.1.6: Evaluate release strategies, release sites, and smolt out-migration timing and survival from the Master Plan Hatchery facility releases to downstream detection sites.

<u>Approach</u>: Acclimation facilities are located throughout the Yakima River basin to promote homing to historical spawning grounds. In addition, PIT arrays have been installed and are operated throughout the Yakima Basin on a year-round or seasonal basis as access and flows allow. Out-migration timing can be derived from PIT tag detections at smolt monitoring facilities at Prosser and in the Columbia basin. Our primary evaluations will be performed on fish released from tributary streams in the upper Yakima and Naches basins as well as those released on station from the Prosser Hatchery. Smolt releases will primarily occur in mobile acclimation sites located throughout the Yakima Basin. PIT tags will be used to document arrival, duration, and travel times between dams. These data along with size at release data, projected flow data, and projected spill data will be used to determine the optimal release date. PIT tags will be used for adult return calculations and for spawning procedures. Calculated SARs for the releases will be used to compare and contrast performance, and will be the primary metric for determining relative success of subyearling and yearling releases. Marking strategies were given above in Table A-1.

A subsample of outmigrating smolts is also evaluated at both Roza and Prosser/Chandler during annual juvenile sampling operations. Environmental and trap data are recorded along with biological data on a subsample of each salmonid species represented. The excess and non-salmonid fish are tallied by species. Biodata consists of fork lengths, weights and smoltification stage. Environmental and trap data recorded includes weather conditions, and water temperature and clarity.

Task A.1.6.1. Maintain services of a qualified biometrician with experience in estimating smolt trap efficiency rates as well as smolt-to-smolt and smolt-to-adult survival rates for Yakima Basin fish.

Task A.1.6.2. PIT tag juvenile fish in canal or trap operations for use in entrainment, survival and smolt-to-adult survival rate estimation.

Task A.1.6.3. Collect fork lengths, weights, smoltification state, genetic samples, and scale samples from hatchery- and natural-origin juvenile salmon obtained in juvenile sampling operations.

Task A.1.6.4. PIT tag groups of salmon released from acclimation sites, mobile acclimation or on station Master Plan facilities. Total PIT tag groups may vary from year to year depending on size and timing of releases.

Task A.1.6.5. Document migration timing and survival for yearling and subyearling salmon on a daily, seasonal and annual basis using PIT tag detections at Columbia River dams.

Task A.1.6.6. Track enzyme levels of hatchery juveniles released from hatchery facilities and acclimation sites to determine their migratory status. Compare with enzyme levels of natural-origin fish. Use this information to refine hatchery rearing practices and the hatchery release schedule.

Task A.1.6.7. Maintain a database of all biological data for yearling and subyearling releases from Master Plan hatchery facilities and for natural-origin fish.

Objective A.1.7. Assist in the planning, spawning, record keeping, and summarizing data for spawned salmon at Master Plan Hatchery Facilities.

<u>*Approach*</u>: YN biologists will annually assist in the spawning operations of salmon and steelhead at the Master Plan Hatchery facilities. The role of the evaluation staff has been and will be to collect the biological data (date of spawning, sex, length, scales, marks/tags, extraction of CWTs, DNA and scale sampling, fecundity estimation, etc.) from all fish retained/spawned for broodstock. This collaborative role will be critical for optimizing production strategies. In addition, evaluation staff will work closely with the hatchery staff to provide weekly /monthly /yearly summaries of the data for hatchery reports and permit compliance as necessary.

Task A.1.7.1. Develop or update spawning protocols as needed for review and approval by YKFP technical teams and Fish Management staffs prior to the onset of spawning for all species.

Task A.1.7.2. Assist in the spawning of salmon at the Master Plan Hatchery facilities.

Task A.1.7.3. Collect biological data from all (or representative sample) spawned fish (sex, length, scales, DNA, marks/tags, CWT extraction and verification, PIT tag detection, fecundity estimation).

Task A.1.7.4. Where applicable, assist or provide hatchery staff with the necessary data summaries for completion of hatchery records from spawning activities.

A.2 Harvest Monitoring and Evaluation

Harvest monitoring of Yakima River-origin salmonids will be performed by WDFW and the Yakama Nation. The WDFW is responsible for monitoring non-tribal sport and commercial fisheries in the Columbia River, Yakima River, and ocean. The fisheries monitoring methodologies used by WDFW and other state and federal agencies are outside the scope of this document.

The Tribal harvest monitoring program is designed to achieve project goals through:

- sampling subsistence fisheries below Bonneville Dam and at Cascade Locks, The Dalles Dam, John Day Dam, and McNary Dam on the mainstem Columbia River

- sampling all Tribal fisheries in the Yakima River

Objective A.2.1. Monitor Tribal Subsistence Fisheries in the Columbia River

Approach: YN biologists and technicians annually monitor tribal ceremonial and subsistence fisheries in the Columbia River from the newly established tribal fishing area below Bonneville Dam upstream to McNary Dam. Fishing areas are observed to record total effort in a monitored time frame, with a subsample of effort monitored for observed catch. Biologists expand recorded data for each fishing area and time frame to estimate total catch.

Task A.2.1.1. Monitor Tribal fisheries below Bonneville Dam and at Cascade Locks, The Dalles, John Day, and McNary dams daily whenever fisheries are conducted.

Task A.2.1.2. Each fishing day will be divided into three 8-hour periods. A different observer will be used to monitor each 8-hour period.

Task A.2.1.3. Every 2 hours, the observer will record the number of active gear, the number of fish captured per gear type, and the length of the observation period.

Task A.2.1.4. Catch estimates will be calculated by expanding the counts for both time and gear.

Task A.2.1.5. Caught fish will be randomly sub-sampled for marks. Fish species and (if possible) sex will be identified for each fish and each fish will be examined for marks. Length measurements will be taken for each fish caught. Scale samples will be collected on each fish for aging. DNA samples will also be collected on a sub-sample of fish if required as part of genetic studies being undertaken by YN or other research groups.

Task A.2.1.6. Recovered CWTs will be sent to WDFW for processing. WDFW will report tag recoveries and information to the appropriate regional databases.

Task A.2.1.7. YN will be responsible for reporting PIT-tag recoveries to PITAGIS (the PIT-Tag Information System) and other regional databases.

Task A.2.1.8. YN reports estimated harvest in these fisheries through the *U.S. v Oregon* Technical Advisory Committee (TAC). Annual harvest in these fisheries is maintained as part of the TAC record.

Task A.2.1.9. YN biologists will analyze available data and estimate the number of Yakima released salmon and steelhead by origin caught in these fisheries.

Objective A.2.2. Monitor Fisheries in the Yakima River Basin

Approach: The majority of Tribal fishing activities in the Yakima River occur mainly at the Wapato, Sunnyside, Prosser, and Horn Rapids irrigation diversion dams. These fisheries will be monitored in a manner similar to that described in Objective A.2.1. Non-tribal recreational fisheries also occur in the Yakima River and are monitored by WDFW using standard creel methods.

Task A.2.2.1. YN staff will monitor tribal subsistence fisheries in the Yakima Basin using methods described in Objective A.2.1.

Task A.2.2.2. YN staff will conduct interviews with Tribal fishers. Their catch may be subsampled as described in Objective A.2.1 above.

Task A.2.2.3. WDFW will monitor recreational fisheries in the Yakima River using standard creel methods.

Objective A.2.3. Estimate harvest of Yakima Basin salmon in Marine Fisheries.

Approach: The Regional Mark Information System (RMIS) will be queried regularly for any CWT recoveries of Master Plan hatchery facility salmon releases in ocean or Columbia River mainstem fisheries. The results of these queries will be analyzed to estimate the number of fish harvested in marine and lower Columbia River non-tribal fisheries.

Task A.2.3.1. YN staff will maintain a database of CWT codes released from the Master Plan hatchery facility programs.

Task A.2.3.2. YN staff will run annual queries of the regional RMIS database, searching for recoveries of Master Plan hatchery facility salmon CWT codes.

Task A.2.3.3. YN staff will estimate harvest of Master Plan hatchery facility salmon in marine and lower Columbia River fisheries and report these estimates in annual reports.

A.3 Escapement Monitoring and Evaluation

Objective A.3.1. Estimate escapement of salmon to the mouth of the Yakima River by origin.

Approach: YN staff utilize video cameras at all ladders at Prosser Dam and maintain a database of counts of fish by date, ladder, and species. In addition, YN biologists and technical staff will operate adult fish traps at the Prosser denil ladder and Roza for broodstock development and biological sampling (Objective A.1.1). As discussed earlier, sites in the Naches subbasin may be brought online in the future as resources allow. YN staff has been operating the Prosser and Roza facilities for years to sample returning fish and to collect broodstock. Adult trap data and Prosser/Roza PIT and CWT detection data will also be used for estimating adult return composition (stock and origin).

Task A.3.1.1. Enumerate returning fish using ladder count data, other databases, and present methods.

Task A.3.1.2. Operate Prosser denil and Roza trapping operations and conduct fish sampling per established protocols.

Task A.3.1.3. Evaluate trapping operation and tag detection databases to estimate composition of returning fish by stock and origin.

Task A.3.1.4. Evaluate harvest estimates for Yakima Basin fisheries and spawning survey data to estimate escapement.

Task A.3.1.5. Summarize and report above data.

Objective A.3.2: Estimate adult returns, collect life history characteristics, and document distribution of adults to spawning areas.

<u>*Approach:*</u> Measuring adult returns to the point of release and to other intermediate areas is necessary to determine program success. YN monitors the returns of salmon and steelhead throughout the Yakima Basin via video counts and adult trap operations at Prosser and Roza dams and hatchery swim-in ladders, spawning ground surveys, mark-recapture estimation (as warranted using PITs or CWTs for substock determination), and harvest monitoring. Trapped and/or spawned broodstock fish and carcasses provide data concerning origin, stray rates, sex ratios, and composition of each year's run. Spawning surveys provide numbers of redds, spawn timing, and distribution of fish in each of the surveyed reaches and tributaries. These are primary actions to track program performance and progress toward meeting goals.

Task A.3.2.1. Conduct spawning ground surveys to count redds, determine distribution of spawners, and sample carcasses (sex, length, scales for age composition, and tissue for genetic typing) to document life history characteristics of salmon in the Yakima Basin.

Task A.3.2.2. Process scales and CWTs for age composition.

Task A.3.2.3. Estimate stray rates from the PTAGIS and RMIS regional databases and DNA sampling.

A.4 Productivity Monitoring and Evaluation

Objective A.4.1. Estimate juvenile smolt production of salmon by species, stock and origin.

<u>*Approach:*</u> YN staff will maintain and operate the Roza and Prosser/Chandler juvenile sampling facilities, and instream PIT arrays, and potentially, rotary screw traps in the Yakima Subbasin. A number of salmon juvenile migrants will be sub-sampled annually. Staff will maintain a database containing length, weight, marks, DNA, etc. information collected from these samples. These and available PIT data will be analyzed to estimate smolt outmigration past Prosser Dam and smolt-to-adult productivity (return) rates.

Task A.4.1.1. Operate Chandler juvenile monitoring facility and collect phenotypic and genotypic data from a subsample of migrating juveniles.

Task A.4.1.2. Maintain a database of these sample data.

Task A.4.1.3. Use PIT or acoustic tags and technologies to evaluate flow and entrainment relationships to estimate annual smolt outmigration at Prosser by species and origin.

Task A.4.1.4. Evaluate available PIT data to estimate smolt-to-smolt and smolt-to-adult survival indices (see objective A.1.6), using analysis techniques such as those in Buchanan and Skalski (2007) or similar.

Objective A.4.2. Estimate adult-to-adult productivity of salmon in the Yakima Basin.

Approach: YN staff will compile and maintain annual run reconstruction tables using the data collected from the objectives and tasks described above. Available age-at-return data will be used to develop brood/cohort return tables and adult return per spawner productivity.

Task A.4.2.1. Compile available escapement, harvest, and age-at-return data. Update and maintain these data annually in appropriate databases and spreadsheets.

Task A.4.2.2. Report these data in annual reports and other appropriate technical fora.

A.5 Ecological Interactions Monitoring and Evaluation

Objective A.5.1. Monitor inter- and intra-specific interactions and evaluate potential negative influence on the abundance and productivity of natural populations.

Approach: WDFW staff will continue non-target taxa of concern monitoring conducted under the YKFP M&E umbrella project, 199506325 (see https://www.cbfish.org/Document.mvc/Viewer/P155169 for an example annual report). YN staff will use information from the literature as well as in-basin demographic and migratory data collected from other tasks identified in this appendix as indicators of potential survival or productivity bottlenecks for natural populations.

Task A.5.1.1. Establish criteria for demographic or migratory parameters that would indicate potential bottlenecks. Criteria development may include risk assessment of competition and other ecological interactions as described in Pearsons and Hopley (1999), Ham and Pearsons (2001), and Kostow (2009).

Task A.5.1.2. Using PIT or acoustic tagging of hatchery juveniles prior to release, generate travel time and smolt-to-smolt survival estimates to the mouth of the Yakima River (from objective A.1.5 and A.4.1, using PIT tag detections at the Yakima juvenile sampling operations, and Bonneville Dam, or alternatively using acoustic tagging and monitoring). Evaluate data on hatchery juvenile distribution and duration of presence in the subbasin from this effort as well as from Tasks A.1.5.8 and A.4.1.4, and from expanded fish presence/absence sampling in the mainstem and tributaries.

Task A.5.1.3 Investigate feasible alternative methods for monitoring certain ecological interactions (such as competition) relative to conditions in the Yakima subbasin (i.e. direct observations of competition via snorkeling is impractical due to glacially-induced visibility limitations, extensive electrofishing in certain river reaches introduces risk to adult salmonids).

Task A.5.1.4. Annually review results from Yakima Subbasin Monitoring and Evaluation activities. Evaluate results relative to established criteria. Work with YKFP policy and technical teams to design and implement changes to Yakima production programs when criteria are exceeded.

Task A.5.1.5. Periodically review results from other ongoing Columbia Basin interactions studies for recommendations. Implement recommendations deemed practical and relevant to Yakima production programs.

A.6 Predation

Objective A.6.1. Estimate juvenile smolt mortalities of salmon and identify mortality "hot spots" in the Yakima system during outmigration. Utilize collected data to develop and make recommendations to policy makers that will improve juvenile survival through the Yakima system migration corridor.

<u>Approach:</u> YN staff will continue avian and northern pikeminnow predation studies conducted under the YKFP M&E umbrella project, 199506325.

Task A.6.1.1. Monitor, evaluate, and index the impact of avian predation on annual salmon and steelhead smolt production in the Yakima Subbasin. The index consists of two main components: 1) an index of bird abundance along sample reaches of the Yakima River and 2) an index of consumption along both sample reaches and at key dam and bypass locations (called hotspots).

Task A.6.1.2. Examine roosting and nesting sites for the presence of salmon PIT tags. Link tag detections to sources of release and correlate with river flows. Analyze and utilize these data to recommend changes in present water and irrigation facility management practices to policy makers that will improve juvenile survival through the Yakima River system migration corridor.

Task A.6.1.3. Monitor, evaluate, and index impact of piscivorous fish on annual smolt production of Yakima Subbasin salmon and steelhead.

Task A.6.1.4. Develop methods to remove some salmonid predators from the Yakima system.

A.7 Disease Monitoring and Evaluation

Objective A.7.1. Maintain Master Plan hatchery operation protocols that minimize potential disease transmission within and outside of the hatchery, assuring that fish reared at the Master Plan facilities have high survival rates with little chance of pathogen transmission to naturally-rearing fishes and aquatic organisms.

<u>Approach:</u> YN staff will work with USFWS fish health specialists to implement disease management protocols and monitor hatchery operations for specific fish pathogens in accordance with the Washington Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines.

Task A.7.1.1. On at least a monthly basis, both healthy and clinically diseased fish from each fish lot will be given a health exam. The samples will include a minimum of 10 fish per lot.

Task A.7.1.2. At spawning, a minimum of 150 ovarian fluids and 60 kidney/spleens will be examined for viral pathogens from on-station broodstock. The enzyme linked immunosorbent assay (ELISA) sampling will be performed on all spawned salmon females to reduce potential vertical transmission of *Renibacterium salmoninarum* (causative agent of bacterial kidney disease) to the progeny. Additional fish health samples will be collected to assess the incidence of other bacterial and parasitic pathogens.

Task A.7.1.3. Prior to transfer or release, fish will be given a health exam. This exam may be in conjunction with the routine monthly visit. This sample will consist of a minimum of 60 fish per lot.

Task A.7.1.4. Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures, such as optimal fish-rearing densities.

Task A.7.1.5. Movements of fish and eggs will be conducted in accordance with the Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines. As needed, fish transferred from other facilities to the Yakima Basin will be given a health inspection.

Task A.7.1.6. At spawning, eggs will be water-hardened in iodophor as a disinfectant. All eggs transferred to the facility will be surface-disinfected with iodophor as per the USFWS Fish Health Policy.

Task A.7.1.7. Juvenile fish will be administered antibiotics orally when needed for the control of bacterial infections.

Task A.7.1.8. Formalin (37% formaldehyde) will be dispensed into water for the control of fungus on eggs and the control of parasites on juveniles and adult salmon. Treatment dosage and time of exposure may vary with species, life-stage and condition being treated.

Task A.7.1.9. All equipment (nets, tanks, rain gear) will be disinfected with iodophor between different fish/egg lots.

Task A.7.1.10. Different fish/egg lots will be kept in separate ponds or incubation units.

Task A.7.1.11. Tank trucks or tagging trailers will be disinfected when brought onto the station. Foot baths containing iodophor will be strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Task A.7.1.12. Therapeutants approved by the U.S. Food and Drug Administration or those under Investigative New Animal Drug permits will be used for treatments. Under special circumstances, extra-label usage of other animal drugs may be prescribed by a veterinarian to control resistant disease organisms.

A.8 Genetic Monitoring and Evaluation

Objective A.8.1. Gain a thorough understanding of the genetic make-up of target stocks in order to maintain long term genetic variability and minimize the impacts of domestication on supplemented stocks.

Approach: YN staff will collect genetic samples from adult and juvenile salmon. Analysis of genetic markers will be used to evaluate the relationship of salmon populations in the Yakima River relative to others in the Columbia River Basin and estimate origin of salmon returning to the Yakima River. Subpopulation structure within the Yakima subbasin will also be evaluated for changes over time.

Task A.8.1.1. Collect genetic samples from adult salmon at the Prosser and Roza adult sampling facilities, and from fish used for broodstock.

Task A.8.1.2. Collect genetic samples from juvenile salmon at juvenile sampling facilities.

Task A.8.1.3. Send samples for analysis by CRITFC geneticists or other similarly qualified lab with information added to existing databases.

Task A.8.1.4. Evaluate results with particular interest to the following questions:

1. How is the genetic composition of natural-origin salmon in the Yakima Basin changing over time (e.g., see Williamson et al. 2010 and Hess et al. 2011)?
2. Are there differences in genetic composition between segregated and integrated hatchery-origin and natural-origin salmon? How is genetic composition of these various components changing over time?

Task A.8.1.5. Incorporate information into future reports and management actions through review with YKFP policy and technical teams.

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Appendix K

Responses to ISRP Comments on the 2012 Step 1 Master Plan and Responses to 2013 and 2018 ISRP Response Comments

APPENDIX K Responses to ISRP Comments on the 2012 Master Plan

This Appendix includes the following:

- September 17, 2012 ISRP comments on the 2012 Yakima Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan (ISRP 2012-13)
- July 16, 2013 ISRP response comments to 2012 YN responses (ISRP 2013-8)
- July 26, 2018 ISRP response review for 2018 YN responses on Coho program (ISRP 2018-6)
- 2019 YN responses to 2013 ISRP response comments on Chinook program and 2018 ISRP response comments on Coho program

The YN Response comments (2013 and 2018) are attached as Appendices.

Program Goals and Objectives

Our response to ISRP comments is consistent with the goals and objectives established for each artificial production program. For easy reference, these goals and objectives are provided below by species.

The program goals and objectives for the Yakima Integrated and Segregated Coho programs are:

- **Yakima Integrated Coho Program:** The primary objective of the integrated Coho program is to increase harvest of Coho in the Zone 6 and Yakima River basin fisheries. The integrated program is also expected to increase the number of fish spawning naturally in the Yakima River basin, which will contribute to the Yakama Nation's cultural objective of seeing Coho complete their life cycle in the wild. In addition, the integrated program is designed to reestablish a locally adapted Coho population above Prosser Dam in the Yakima and Naches River subbasins and increase the spatial diversity of the naturally spawning population.

- **Yakima Segregated Coho Program:** The primary objective of the segregated program is to increase harvest of Coho in the Zone 6 and Yakima River basin fisheries consistent with *U.S. v Oregon* agreements.

The proposed programs for Yakima summer/fall Chinook and URB fall Chinook have distinct objectives.

- **Yakima Integrated Summer/Fall Chinook Program:** The primary objective of the integrated summer/fall Chinook program is to expand harvest opportunities temporally and spatially within the Yakima Basin. The integrated program is also expected to increase the number of fish spawning naturally in the Yakima River basin, which will contribute to the Yakama Nation's cultural objective of seeing Chinook salmon complete their life cycle in the wild. In addition, the integrated program is designed to reestablish a locally adapted summer/fall Chinook population to historical spawning areas upstream of Prosser Dam in the middle reaches of the Yakima and Naches River subbasins increasing the spatial and temporal diversity of the naturally spawning population.

- **Yakima Segregated URB Harvest Program:** The primary objective of the segregated program is to increase harvest of URB fall Chinook in the Zone 6 and Yakima River basin fisheries consistent with *U.S. v Oregon* agreements.

ISRP 2012 Comment 1*: Habitat capacity standards for Coho salmon were developed, but the values need clarification. In the Master Plan (page 90) habitat improvement is identified as having the potential to increase Yakima River Coho production by 26 percent. In Appendix E, recent past productivity is given as 34 Coho smolts per spawner and capacity of smolts is 72,059. Under Phase 4, smolts per spawner is 93 and capacity is 256,720 smolts. This future performance is substantially more than the 26 percent increase that was estimated on page 90. The Master Plan needs to provide a reasonable likelihood that habitat restoration will lead to this level of improvement or modify the future production values.* ***Back to INDEX******.***

ISRP 2013 Response Comment 1:
The sponsors state that two factors – habitat improvement and fitness gains in Coho caused by implementing an integrated hatchery program – will significantly increase the capacity of the Yakima River to produce smolts. Estimates for how habitat improvements in the Yakima River may increase Coho smolt abundance were based on data presented in the Yakima River Basin Integrated Water Resource Management Plan. In the Integrated Plan, the potential production of Coho in the Yakima River was estimated for three different levels of habitat restoration. In the first instance, it is assumed that the Integrated Plan is not implemented but that ongoing restoration activities are continued.

In the second scenario, the habitat restoration actions in the Integrated Plan are implemented but fish passage into the basin's upper reservoirs has not taken place. The final estimate assumes that all seven parts of the Integrated Plan have occurred including passage into upper reservoir habitats. A gain of 36% from a baseline figure of 8,806 adult Coho is predicted to occur under option one while gains of 63.5% and 71.1% are expected to occur under options two and three. The Master Plan assumes that option three will occur. This assumption is highly uncertain because implementing the full Integrated Plan is expected to cost $4 billion and depends upon federal funding that has yet to be secured. The YN also assigned a 50% fitness value to the current Coho salmon used in the restoration program and anticipates a 91% fitness value when the integrated program is fully implemented with a PNI of 0.75 and pHOS of 30%.

EDT modeling was used to estimate the productivity and capacity of the habitat to produce Coho under each phase of the Integrated Plan. These estimates were used in the All-H Analyzer (AHA model) to predict the effects of various levels of habitat restoration on Coho abundance. The reliability of these estimates depends upon the quality of the data inputs used. In Step 2, the analysis should identify whether the inputs into the model were based on empirical data or expert opinion. In either case, the gains in Coho abundance presented in the Integrated Plan should be regarded as hypotheses and not certainties. Additionally, restoration actions specifically designed for Coho were not included in the Integrated Plan. Instead, estimated benefits to Coho abundance were based on the presumed effects of habitat actions in the Yakima steelhead recovery plan.

The Master Plan includes the untested assumption that locally adapted Coho from an integrated hatchery program would be twice as fit as Coho from out-of-basin populations. Currently, Coho returning to the Yakima River originate from parents that came from out- of basin populations or were produced by fish that had returned to the Yakima River and were allowed to spawn naturally or were used as hatchery broodstock. The YN anticipates that an integrated hatchery program will facilitate the incorporation of locally adapted traits into the Yakima River Coho population which will bring about an increase in their overall productivity. Based on these assumptions, the YN estimates that the current smolts-per-spawner of 34 fish would increase to 58 fish through habitat improvement and implementation of integrated water management (34 x 1.71). If using an integrated hatchery strategy with a PNI of 0.75 improves relative fitness from 0.50 to 0.91, the anticipated smolts-per-spawner would be 105. The YN should reference literature on wild Coho smolts per spawner, including populations of wild Coho that meet or exceed the assumed 93 smolts per spawner.

The response to the ISRP provides an adequate explanation for the basis for improved capacity and productivity under Phase 4, assuming the Integrated Plan was fully implemented. However, because the habitat improvements identified in the Integrated Plan may not be fully implemented or may not provide the anticipated benefits to fish, the ISRP concludes that an experimental framework for decision-making and fish production should be employed to establish limits to artificial production consistent with guidelines based on empirical evidence from within the subbasin. Similarly, the guidelines used for fitness improvement under an integrated hatchery strategy were extracted from HSRG assumptions. These assumptions have not been subject to empirical testing or rigorous modeling. There is evidence from the mid-Columbia Coho reintroduction project that selection (re-adaptation) is taking place, but the pace of improvement and level where performance will plateau are unknown. Consequently, at this time, it is unknown what size the natural population might be under restored conditions. Under the Fish and Wildlife Program's artificial production strategies, hatchery releases need to reflect the capacity and productivity of habitat and reintroduction should lead eventually to self-sustaining natural production. Furthermore, under an integrated harvest program with PNI >0.50, the size of the artificial production program is limited by the size of the natural population. The harvest plan should demonstrate how harvest rate will be adjusted to match varying levels of productivity of natural-origin Coho. These uncertainties and constraints need to be considered in the Master Plan and decision framework, and described in Step 2.

In Step 2, the sponsors need to clearly indicate how their Monitoring and Evaluation (M&E) plan will be used to test the results of their earlier modeling efforts and assumptions. How much habitat has been restored, and did the habitat restoration activities actually provide expected benefits? Will ISEMP, CHaMP, and/or AEM methods or programs be employed in the basin to help quantify the effects of the habitat restoration activities that have taken place? If not, how will the relationships among habitat restoration efforts and salmonid abundance be examined and assessed? Additionally, the M&E plan should indicate the statistical designs or approaches that will be employed to measure the degree of fitness benefit actually gained by Yakima River Coho by using an integrated hatchery program.

For completeness, the Master Plan should describe and provide background information on the data that were used to support the EDT and AHA modeling efforts. For example, as indicated above, a baseline abundance level of 8,806 Coho was used for the basin in the Integrated Plan. Where did this value come from? The HGMP for Coho shows that the greatest number of adult Coho returning to the Yakima based on counts at Prosser Dam was 6,424 fish which occurred in 2010 (Table 3, page 18 in the HGMP; Master Plan Volume 2). Conversely, Table 2.4 (page 15 in Master Plan Volume 1) has different values for total Coho returns for years 2008 – 2010. In this Table, almost 10,000 adult Coho returned to the Prosser Dam in 2008 and a little more than 8,000 returned in 2010. Which values are correct?

ISRP 2018 Response Comment 1:
At the time of the ISRP's 2012 review, funding to implement the Yakima Basin Integrated Plan seemed uncertain. The YN response indicates that the plan is being funded by nine federal agencies with additional support from state agencies and local entities. It also provides an update on the status of restoration projects listed in the Plan. To date, 17 of 26 habitat projects and 8 of 16 water conservation projects have been completed at a total cost of about $200 million. When the Plan was being developed, the total cost to completion was estimated at between $4 billion and $5.6 billion (excluding costs of land

acquisition). Half to three quarters of this expected cost was associated with five projects: Wymer Reservoir with Thorp Intake and Roza delivery - $1.6 billion; enhanced agricultural conservation - $0.4 billion; Bumping Lake enlargement - $0.4 billion; fish passage at Tieton, Kachess, and Keechelus Dams - $0.3 billion; and mainstem floodplain restoration program - $0.27 billion.

Specific ISRP questions have still not been addressed about the amount of habitat that will be restored, how such actions might increase productivity and capacity, and how anticipated gains in fitness will be measured. For example, the proponents have not yet adequately responded to ISRP concerns that projected increases in both productivity (from 34 to 93 smolts per spawner) and smolt capacity (from 72,059 to 256,720 smolts) are based on assumptions in the 2012 Master Plan (Table 3-2) that may be overly optimistic. Further, the proponents have not responded to the ISRP recommendation that *"Step 2 should model a scenario that is more likely to occur in the next 25 years than the ambitious option three and describe the anticipated Phase 4 outcome of a more likely habitat scenario, perhaps option one"* (ISRP 2013). The 2012 Master Plan states that the full ($4 billion plus) "Integrated Plan" will be implemented. The YN response does not provide any assurance that the Integrated Plan will be fully implemented, nor does it reevaluate benefits from less optimistic restoration scenarios or describe changes in the Master Plan if components of the Integrated Plan do not occur.

The ISRP also found it difficult to reconcile updated data provided in Tables 1-3 of the YN response with the optimistic projections of increased productivity and capacity in the 2012 Master Plan. Data in Table 1 lead us to conclude that the most recent 5-year (2011-2015) geometric mean SAR index for natural origin smolts is only 1.0%, with the last 2 years being the lowest on record (since 2000). (Note that the SAR value of 1.3% specified in Table 3 appears to have been calculated as the geometric mean of 2010-2014). Also, of concern, the time series of SAR for natural origin smolts (or more precisely the log of the SAR index) is significantly negatively correlated with the number natural origin smolts. The correlation is driven largely (but not entirely) by the record low SAR (0.2%) in 2014 which is associated with a record high number of natural origin smolts (i.e., 159,642). That record high smolt abundance is only 62% of the estimate of smolt capacity (i.e., 256,720) used in the 2012 projections. If we have interpreted these data correctly, the negative correlation might indicate that current (or recent) carrying capacity is limiting smolt survival. However, it is not clear from the data presented how or when density dependence might occur for these natural origin smolts. Accordingly, we urge the proponents to further investigate the strength of correlations among smolt size, abundance, and survival and to discuss the strength of the evidence for (or against) density dependence and the implications for smolt capacity.

The YN response states (page 7) that benefits from habitat restoration and the integrated hatchery program will be evaluated. The revised Master Plan should explicitly state that one objective of the program is to track the productivity of natural origin Coho in response to restoration actions over time. The comprehensive monitoring and evaluation plan described in Appendix A appears adequate to evaluate changes in the productivity of natural origin Coho.

Key metrics that should be monitored over time include smolts produced per spawning adult (or female), smolt size, smolt-to-adult survival, and abundance of mature natural origin Coho. It will also be important to evaluate changes in Coho productivity in relation to indices of Coho density (e.g., Coho spawners by origin, hatchery smolt and parr abundances, and natural smolt abundances) as a means to detect and account for density dependence, as described above.

***YN 2019 Response*: *Back to INDEX*.**

- **Is the Integrated Plan likely to be fully implemented?**

  The ISRP is correct that full implementation of the Integrated Plan will be costly (>$4-5 billion) and take decades to achieve. However, as documented in our response to the ISRP in June 2018 and summarized in Dave Fast's presentation to the NPCC in September 2018, the level of commitment to implementation of the Integrated Plan is very strong and in fact, many actions have been or are already being implemented. On March 12, 2019, Congress passed legislation and the President signed Public Law 116-9, the John Dingell Jr. Conservation Management and Recreation Act, authorizing YRBWEP Phase III, the Yakima Basin Integrated Plan. As part of this legislation, approval was granted to begin the appropriations process for a 10-year implementation phase for the Yakima Basin Integrated Plan.

  A presentation by Urban Eberhart of the Kittitas Reclamation District (KRD) to the Yakima Basin Science and Management Conference in 2018 provides a good example of the Basin's commitment to enhanced agricultural conservation. During the severe drought of 2015, the KRD secured outside funding to help save endangered fish through tributary supplementation by transporting water through KRD canals to downstream tributaries in the Yakima River. Throughout the summer, the KRD spilled water into multiple tributaries that were going dry due to extraordinary drought condition in the Yakima Basin. The KRD continues to work with the Yakima Basin Integrated Plan partners to implement additional conservation measures, which will free up more capacity in the KRD canal system to continue and expand the water supplementation program.

  While the Wymer Reservoir, Bumping Lake enlargement, and fish passage at Tieton, Kachess, and Keechelus Dams will take many more years to come to fruition, a large (>$75 million) project is under way to fully restore juvenile and adult fish passage to the Cle Elum river watershed above Cle Elum Dam. Many activities are also already occurring to secure mainstem and tributary floodplain restoration throughout the Yakima Basin. Examples include the Teanaway community forest project, the Wapato Reach project, the Yakima Tributary Access and Habitat program (>$30 million), the Yakima Basin "wood fiesta" (~$2 million), and the Nelson dam removal project (>$11 million) on the lower Naches river.

- **Where did the baseline value of 8,806 Coho in the Integrated Plan come from?**

  As stated in the Final EIS for the Integrated Plan, "The values provided…are 'recruitment' population values. Recruitment population values are an estimate of the ocean population at the mouth of the Columbia River" (USDI and WDOE 2012). The baseline run size for Coho in the Integrated Plan is 8,806 fish at the mouth of the Columbia River. This is the total run size after accounting for ocean harvest, but before accounting for freshwater harvest and adult fish passage mortality through the FCRPS. The future run size for Coho at the mouth of the Columbia River under the Integrated Plan is 15,069, which represents a 71% increase from the baseline value of 8,806 fish (USDI and WDOE 2012).

  In recent years, the average adult run size at Prosser Dam has been approximately 5,300 (NOR + HOR) (Table 2-7). Assuming a freshwater exploitation rate of 40% and adult fish passage survival rate of 92% through the FCRPS[1], the run size of Yakima Coho at the mouth of the Columbia River has been approximately 9,600 adults (5,300/(1-40%)/92% = 9,600), which is similar to the baseline run size assumed in the Integrated Plan. The forecast of future run size during Phase 4 is presented in the response to Comment 3 below (Tables 2-24 and 2-25). The total run size before ocean harvest during Phase 4 is projected to be about 18,000, and the run size at the mouth of the Columbia is projected to be about 14,000, which is very similar to the future run size presented in the Integrated Plan and discussed above.

Table 2-7. Estimated counts of marked (presumed hatchery-origin) and unmarked (presumed natural-origin) adult and jack Coho at Prosser Dam and Prosser Hatchery Denil, 1986-2018.

Adult Return Year	Total Adults		Total Jacks	
	HORs	NORs	HORs	NORs
1986	230	0	0	0
1987	82	0	1	0
1988	18	0	0	0
1989	282	0	9	0
1990	289	0	0	0
1991	230	0	39	0
1992	137	0	53	0
1993	162	0	3	0
1994	532	0	28	0
1995	651	0	74	0
1996	921	0	417	0
1997	1,241	0	71	0
1998	4,625	0	54	0
1999	3,852	0	91	0
2000	4,390	0	249	1,577
2001	3,546	1,432	47	21
2002	166	309	98	245
2003	669	1,523	27	135
2004	505	1,820	39	25
2005	2,418	472	105	120
2006	2,898	1,562	61	114
2007	2,404	1,049	32	32
2008	4,131	459	1,280	587
2009	8,835	982	700	173
2010	5,153	573	530	37
2011	7,216	802	147	24
2012	4,948	550	231	33
2013	2,703	424	728	79
2014	24,178	1,082	566	18
2015	2,943	362	291	9
2016	3,280	103	329	45
2017	2,693	1,162	241	15
2018	2,020	170	747	58
Average (2001-2018)	*4,484*	*824*	*344*	*98*

[1] Key assumptions about harvest rates and fish passage survival are documented in Section 2.5.2 of the document.

- **The analysis should identify whether the inputs into the AHA model were based on empirical data or expert opinion.**

  In the Revised Master Plan, Sections 2.5.2 (Coho) and 3.5.2 (Chinook) identify the key assumptions used in the AHA model and document the source of these values. Inputs into the AHA model are based on empirical data when this information is available (i.e., SARs, harvest rates, broodstock needs and hatchery release numbers). Productivity and capacity assumptions are based on EDT modeling of basin habitat conditions, which relies on a combination of empirical data and expert opinion. Extensive development of the EDT model occurred within the Yakima Basin, so much of the data is empirical as opposed to expert opinion. Sensitive model attributes based mostly on empirical data include (but are not limited to) temperature, habitat composition, flow, anthropogenic confinement, wood densities, gradient, and natural confinement. The EDT assumptions used in AHA for the baseline, Phase 3 and Phase 4 scenarios are based on input values used to examine scenarios in the Integrated Plan (USDI and WDOE 2012). Smolt (or parr) to adult survival (SAR) data are based on the most recent PIT tag data for the Yakima River Coho and Chinook populations. These data are provided in Sections 2 and 3 of the revised Master Plan.

  Harvest rate assumptions for Coho and Chinook ocean and Columbia River fisheries are based on empirical data to the extent this information is available (e.g., WDFW and ODFW 2018a, 2018b; PFMC 2019). Because few Yakima summer/fall Chinook are marked, harvest rate data from indicator stocks were used to estimate ocean, lower Columbia and upper Columbia (through McNary Dam) harvest rates. Terminal harvest rate assumptions for Coho and Chinook are based on recreational fisheries data collected by WDFW and reported in the Master Plan in Sections 2 and 3. Hatchery production assumptions are based on in-hatchery data from Prosser Hatchery for the Coho and Chinook programs (e.g., fecundity and egg to smolt survival data).

- **The YN should reference literature on wild Coho smolts per spawner, including populations of wild Coho that meet or exceed the assumed 93 smolts per spawner.**

  The EDT productivity assumption used in the Coho AHA model is for low spawner abundance (i.e., no density dependent effects). In addition, the EDT productivity and capacity assumptions assume no hatchery fish in the system. The estimates are intended to reflect the quantity and quality of available habitat and do not account for fitness loss due to the presence of hatchery fish. In AHA, they are adjusted for the size of the proposed hatchery program via the fitness multiplier, which accounts for the genetic effects of hatchery fish on the spawning grounds. In AHA, the Phase 3 fitness assumption is 0.5 and the Phase 4 assumption is 0.80 to account for the genetic effects of hatchery fish spawning naturally (based on the pHOS value for each phase). The fitness assumptions for the integrated Coho population are described in detail in Section 2.5.2 of the document.

  In AHA modeling, the current and Phase 3 productivity assumption for the integrated Coho program is 34 smolts per spawner after being adjusted by the fitness multiplier (0.5). The Phase 4 assumption, which assumes full implementation of the Integrated Plan for habitat restoration, is 93 smolts per spawner after the fitness multiplier (0.80) is applied.

  Most estimates of wild Coho smolt production per spawner reported in the literature are from coastal populations and not interior populations like the Yakima River. For example, smolt production in the Queets (Olympic peninsula) Coho population ranged from 10-90 smolts per female spawner from 1979-1999 (PFMC 2001). In that system, peak fall flows during egg incubation contributed to the variability in smolt production per spawner, with high flows leading to high egg and fry mortality. Bradford et al. (2000) estimated average natural production of 85 smolts per female spawner (at low spawner density) in coastal British Columbia streams where the habitat was not fully seeded (i.e., spawning and rearing capacity had not been reached). In Minter Creek (Puget Sound), Ford et al. 2006 reported an average of 60 smolts per female spawner (range 16-244; based on data in Table 7 in Ford et al. 2006) using data sets from the 1940s-50s, 1980s, and early 2000s. The highest smolts per female (182-284) occurred at low adult escapement levels. The 93 smolts per spawner (186 per female) expected for Yakima River Coho at low density is within the range identified by Ford et al. (2006).

- **Step 2 should model a scenario that is more likely to occur in the next 25 years than the ambitious option three (for habitat restoration) and describe the anticipated Phase 4 outcome of a more likely habitat scenario, perhaps option one.**

  Please see the response to Comment 3 below. Tables 2-24 and 2-25 shows the expected outcomes for Phases 3 and 4 in terms of harvest, escapement, and broodstock management.

  The expected Phase 3 outcomes are an improvement on the current scenario in terms of adult escapement, harvest, and the broodstock management strategy, which would incorporate up to 30% NORs and use only local broodstock. Should the habitat restoration scenario modeled in Phase 4 not be realized, an outcome midway between Phases 3 and 4 would result in an increase in the number of natural-origin spawners, increased harvest in all fisheries, and additional NORs incorporated into the broodstock. This outcome would still meet YN's goal of increasing harvest in the Zone 6 and terminal fisheries, increasing the number of naturally-spawning Coho above Prosser Dam, and providing Coho for subsistence and ceremonial purposes.

- **Low SARs in recent years also show apparent negative correlation between smolt production and SAR. The correlation is driven largely (but not entirely) by the record low SAR (0.2%) in 2014 which is associated with a record high number of natural origin smolts (i.e., 159,642). Is this evidence of density dependence? We urge the proponents to further investigate the strength of correlations among smolt size, abundance, and survival and to discuss the strength of the evidence for (or against) density dependence and the implications for smolt capacity.**

  Table K-1 shows smolt passage and adult return estimates at Prosser Dam and SAR indices calculated based on these estimates presented in previous versions of the plan. The ISRP made a comment about inconsistencies in adult return data at Prosser Dam. Note that Table K-1 shows estimated age 2 and 3 adult returns by juvenile migration year and is reported this way to allow brood-year SAR calculations. These adult returns are not directly comparable to counts at Prosser based on adult return year (i.e., the adult return tables in the 2019 Master Plan, Tables 2-6 and 2-7).

  We removed the Prosser smolt passage and SAR estimates in Table K-1 from the revised Master Plan because the estimates of smolt numbers at the Chandler facility are associated with a great deal of uncertainty. Smolt accounting at Prosser is based on statistical expansion of Chandler smolt trap sampling data using available PIT-detection and flow data and estimated Chandler entrainment rates. Chandler smolt passage estimates are prepared primarily for the purpose of comparing marked versus unmarked juvenile passage estimates and assessing the overall population trend, not for making comparisons of SARs. While these Chandler smolt passage estimates represent the best available data, there may be a high degree of error associated with these estimates due to inherent complexities, assumptions, and uncertainties in the statistical expansion process. Instead of reporting these Prosser to Prosser SAR estimates, we report PIT-tag based SAR estimates in the revised 2019 Master Plan.

Data on survival of Coho parr and smolts from release to return as adults to Bonneville Dam are provided in Table 2-9 (below) and in the 2019 Master Plan. Please see the response to ISRP comment 2 (below) for a discussion of the differences in SARS among release groups.

Note that a discussion of smolt vs. parr SARs is included in the response to ISRP question 2 below.

Table 2-9. Estimated juvenile to adult survival rate (to Bonneville Dam) index for Coho released as smolts or parr in the Upper Yakima and Naches subbasins, brood years 2005-2014.

Brood Year	Hatchery-Origin					Natural-origin parr
	Smolt Releases			Parr Releases		
	Prosser	Upper Yakima	Naches	Upper Yakima	Naches	Taneum Creek (Upper Yakima River)
2005	2.63%	0.25%	0.78%			
2006	5.52%	0.90%	2.00%			
2007	5.36%	0.42%	1.12%			
2008	2.15%	0.18%	1.47%	1.23%	1.01%	0.86%
2009	0.07%	0.15%	0.43%	0.60%	0.36%	0.31%
2010	0.57%	0.21%	0.69%	0.54%	0.15%	0.66%
2011	4.42%	1.34%	2.44%	2.03%	0.63%	1.21%
2012	0.90%	0.30%	0.66%	0.36%	0.13%	
2013	1.25%	0.57%	0.15%	0.08%	0.00%	
2014	0.15%	0.50%	0.53%	0.64%	0.29%	
Mean	*2.30%*	*0.48%*	*1.03%*	*0.78%*	*0.37%*	*0.76%*
Geomean	*1.17%*	*0.38%*	*0.79%*	*0.55%*	*0.33%*	*0.68%*

While we agree that smolt size data would be useful for evaluating whether there is evidence of density dependence on the spawning and rearing grounds, size data on natural-origin smolts passing Prosser are not available. Another factor explaining low SARs in recent years is poor ocean conditions. Counts of returning adult Coho at Bonneville have been depressed during the same years that Yakima Coho SARs have been very low (Table K-2).

Table K-1. Estimated smolt passage at Chandler, adult returns to Prosser Dam, and post-harvest smolt to adult survival index for Yakima Basin natural and hatchery-origin Coho. Note that this table reports returns by juvenile migration year, not adult return year.

Juvenile Migration Year	Hatchery-origin			Natural-origin		
	Chandler Smolts[a]	Prosser Adults[b]	SAR Index[c]	Chandler Smolts[a]	Prosser Adults[b]	SAR Index[c]
2000	331,503	3,546	1.1%	37,359	1,432	3.8%
2001	134,574	166	0.1%	40,605	309	0.8%
2002	155,814	669	0.4%	19,859	1,523	7.7%
2003	139,135	505	0.4%	9,092	1,820	20.0%
2004	148,810	2,405	1.6%	18,787	472	2.5%
2005	204,728	2,646	1.3%	31,631	1,562	4.9%
2006	204,602	2,203	1.1%	8,298	1,049	12.6%
2007	260,455	4,132	1.6%	18,772	459	2.4%[d]
2008	416,708	8,835	2.1%	40,170	982	2.4%[d]
2009	496,594	5,153	1.0%	23,858	573	2.4%[d]
2010	341,145	7,216	2.1%	33,408	802	2.4%[d]
2011	333,891	4,948	1.5%	22,908	550	2.4%[d]
2012	244,503	1,865	0.8%	17,667	424	2.4%
2013	483,122	19,913	4.1%	56,947	1,082	1.9%
2014	337,988	2,943	0.9%	159,642	362	0.2%
2015	134,084	1,590	1.2%	20,757	103	0.5%
2016	233,374	1,889	0.8%	227,163	1,162	0.5%
2017	85,458	831	1.0%	8,011	88	1.1%
Average	260,360	3,970	1.3%	44,163	820	3.0%[e]

[a] Yakama Nation estimates of Coho smolt passage at Chandler.
[b] Yakama Nation estimates of age-2 and age-3 Coho returns to Prosser Dam for this juvenile migration Cohort.
[c] Post-harvest SAR. Does not adjust adult returns to account for harvest in the ocean, Columbia River, or terminal fisheries.
[d] Average estimate derived from PIT-tag detections of Taneum Creek natural Coho for juvenile migration years 2009-2011.
[e] Excludes migration year 2003.

Table K-2. Annual adult and jack Coho salmon counts at Bonneville Dam, 2010-2018.

Return Year	Adult	Jacks
2010	120,915	6,940
2011	145,299	4,584
2012	54,968	5,055
2013	59,610	7,148
2014	279,717	14,801
2015	37,402	4,865
2016	42,020	5,489
2017	75,936	4,820
2018	40,889	8,578

Source: Fish Passage Center website, June 2019.

- **The M&E program should track the productivity of natural origin Coho in response to restoration actions over time, in addition to smolts produced per spawning adult (or female), smolt size, smolt-to-adult survival, and abundance of mature natural origin Coho.**

  One of the key priorities of the program has been, and will continue to be, tracking productivity of natural origin Coho in response to restoration actions over time. In the M&E Plan (Appendix J of the Revised Master Plan), YN proposes to monitor the number of natural- and hatchery-origin smolts at Prosser Dam, smolt size, develop PIT tag based survival estimates, and quantify the number of returning adults and jacks (NORs and HORs). This information may be used to estimate productivity of naturally spawning Coho. For example, the number of adult spawners (NORs and HORs) and natural-origin returns may be used in a spawner-recruit analysis to estimate the Beverton-Holt parameters for productivity and capacity. This will allow YN to monitor changes in these parameters over time as restoration actions are implemented.

***ISRP 2012 Comment 2**. Additionally, the assumed SAR of 5% for natural Coho production during Phase 3 (Table 3-2) is considerably higher than the observed SAR (avg. 3.6%) during 2000-2010. This assumption likely leads to an overestimation of project benefits. **Back to INDEX**.*

ISRP 2013 Response Comment 2:
The sponsors clarified that the 5% SAR is pre-harvest, whereas the currently observed 3.6% SAR for Coho includes a harvest rate of ~40% (20% below Bonneville and in ocean fisheries and 20% above Bonneville). Consistent use of terminology is needed in the Master Plan and in the response to comments (e.g., Fig. 2). For example, in the Columbia Basin smolt to adult survival (SAS) is typically used to describe survival prior to harvests, whereas SAR is typically reserved for survival after most harvest and dam passage.

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In the revised 2019 Master Plan, we present PIT-tag based estimates of smolt-to-adult survival and parr-to-adult survival for Coho. These are post-harvest SAR estimates (Table 2-9 and Table 2-10). We also present pre-harvest survival estimates, which are adjusted to account for adults harvested in ocean and freshwater fisheries (Table 2-11). We estimated comparable natural-origin (NOR) release to Bonneville Dam adult return indices (Table 2-9) for PIT-tagged juvenile parr from the Taneum Creek adult outplant study.

Beginning with the hatchery-origin smolt and parr release data presented in Table 2-1 in the 2019 Revised Master Plan, we estimated post-harvest release to Bonneville adult return survival (SAR) indices (Table 2-9) using the following steps:

1. Apply average estimates for smolt survival to McNary Dam from Neeley 2018 (smolts) and Neeley 2019 (parr) to the Table 2-1 Upper Yakima and Naches smolt and parr release estimates.

2. Apply PIT-based McNary Dam smolt to Bonneville Dam adult return survival estimates (Table 2-3) to the resulting Upper Yakima and Naches release by life stage to McNary smolt survival estimates from step 1.

We recognize that the SAR indices presented in Table 2-9 run counter to general scientific expectations about parr versus smolt survival and beg some questions about present and future management. We provide the following additional information for clarification.

- Fish released in the Upper Yakima River travel up to 4 times farther than fish released in the Naches River from release to the confluence of these two rivers just north of the city of Yakima. Travel distance is a significant survival factor for coho smolt survival as fish are subjected to additional mortality factors (e.g., increased stress, additional predation risk, etc.) as they migrate downstream as smolts (YN unpublished data). Upper Yakima fish must navigate Roza Dam and the Roza reach which has also been documented to be a significant factor limiting juvenile survival (Kock et al. 2016).
- Parr are generally released in July (in the summer prior to their migration year), and their lower survival in the Naches subbasin from release to smolt migration the following spring is likely due to environmental conditions. This is a colder system and does not provide overwintering conditions

that are as conducive to juvenile rearing, growth and survival as those in the Upper Yakima subbasin.

- We are still experimenting with release locations for parr in the Naches subbasin. One goal of releasing parr in smaller, upper tributaries (higher in the watershed) has been to increase the geographic distribution of spawners. There are potential release locations lower in the Naches subbasin with shorter travel distances that have not yet been tried, but could provide better parr-to-smolt survival.
- Implementation of the Yakima Basin Integrated Plan will result in changes in habitat and migration conditions throughout the Basin; we do not yet know how these improvements will affect the various release strategies but we do expect improved survival for all releases in the future.
- The YN believes the diversity in release locations and life stages that have been used and are proposed to continue provide a hedge against environmental variability that is likely to increase with climate change. We will continue to monitor and evaluate survival by release stage and location over time and expect to modify the program in the future as we accumulate more information and the costs and benefits of our various strategies become clearer.

Finally, pre-harvest SARs were estimated by adjusting the SARs in Table 2-9 and Table 2-10 by the exploitation rate below Prosser Dam (smolts) and below Bonneville Dam (parr) (Table 2-11). These are the estimated survival rates before accounting for harvest removals.

Table 2-9. Estimated post-harvest release to Bonneville Dam adult survival (SAR) index for Coho released as smolts or parr in the Upper Yakima and Naches Basins, brood years 2005-2014.

Brood Year	Hatchery-Origin					Natural-origin parr
	Smolt Releases			Parr Releases		
	Prosser	Upper Yakima	Naches	Upper Yakima	Naches	Taneum Creek
2005	2.63%	0.25%	0.78%			
2006	5.52%	0.90%	2.00%			
2007	5.36%	0.42%	1.12%			
2008	2.15%	0.18%	1.47%	1.23%	1.01%	0.86%
2009	0.07%	0.15%	0.43%	0.60%	0.36%	0.31%
2010	0.57%	0.21%	0.69%	0.54%	0.15%	0.66%
2011	4.42%	1.34%	2.44%	2.03%	0.63%	1.21%
2012	0.90%	0.30%	0.66%	0.36%	0.13%	
2013	1.25%	0.57%	0.15%	0.08%	0.00%	
2014	0.15%	0.50%	0.53%	0.64%	0.29%	
Mean	*2.30%*	*0.48%*	*1.03%*	*0.78%*	*0.37%*	*0.76%*
Geomean	*1.17%*	*0.38%*	*0.79%*	*0.55%*	*0.33%*	*0.68%*

Table 2-10. Estimated post-harvest release to Prosser Dam adult survival (SAR) index for Coho released as smolts in the Upper Yakima and Naches Basins, brood years 2005-2014.

Brood Year	Hatchery-Origin		
	Smolt Releases		
	Prosser	Upper Yakima	Naches
2005	1.68%	0.16%	0.50%
2006	2.61%	0.43%	0.95%
2007	1.52%	0.12%	0.32%
2008	1.84%	0.16%	1.25%
2009	0.16%	0.33%	0.94%
2010	0.52%	0.20%	0.63%
2011	3.93%	1.20%	2.17%
2012	0.53%	0.17%	0.39%
2013	0.57%	0.26%	0.07%
2014	0.10%	0.33%	0.36%
Mean	*1.35%*	*0.34%*	*0.76%*
Geomean	*0.81%*	*0.26%*	*0.54%*

Table 2-11. Estimated pre-harvest release to Prosser Dam adult survival (SAR) index for Coho released as smolt or parr in the Upper Yakima and Naches Basins.

Index	Hatchery-Origin				
	Smolt Releases[1]			Parr Releases[2]	
	Prosser	Upper Yakima	Naches	Upper Yakima	Naches
Mean	*2.54%*	*0.63%*	*1.43%*	*0.87%*	*0.41%*
Geomean	*1.53%*	*0.49%*	*1.03%*	*0.61%*	*0.37%*

1 Values in Table 2-10 adjusted to account for total exploitation rate (47%), i.e., value/(1-0.47); see Table 2-23.
2 Values in Table 2-9 adjusted to account for adult fish passage survival from Bonneville through McNary Dam (92%) and ocean and lower Columbia River (below Bonneville Dam) harvest (17%), i.e., value*0.92/0.83.

***ISRP 2012 Comment 3**. The objective of >5,000 Coho spawners during Phase 3 should identify the proportion of NOR and HOR spawners that is consistent with the transition to an integrated program.*
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ISRP 2013 Response Comment 3:
The response to the ISRP identifies that under Phase 3, on average, 2,541 natural-origin and 4,881 hatchery-origin adults will return to spawn in the Yakima River (from Figure 2. Key assumptions and outcomes for the Yakima River integrated and segregated Coho programs (based on AHA analysis)). The ISRP is unable to reconcile Figure 2 in the response with Table 3-1 on page 24 of the Master Plan, as described below. Further, the ISRP finds the biological objective(s) vague with regard to a definition of "Coho spawners," and finds inconsistencies in objectives in various places in the Master Plan and response.

Specifically, the reference to >5000 (NOR+HOR) spawners does not indicate whether this is spawning escapement, spawning escapement plus hatchery broodstock, or some other composite of natural spawning fish, hatchery broodstock, and terminal harvest. This confusion stems from inconsistent numbers. Figure 2 shows a terminal run of hatchery-origin adults of 6779, with 4881 allowed to spawn naturally, 655 hatchery broodstock, and 904 hatchery surplus. But, this does not sum: 6779-4881-655 = 1243, not 904. Further, the Expected Catch All Fisheries value of 13,896 in Fig. 2 is very different from the value 203 in the Master Plan Appendix E, without explanation for the change.

The Master Plan and response do not provide a clear path from a Phase 3 program releasing 700,000 smolts with a PNI of 0.32 to a Phase 4 program releasing 300,000 smolts with a PNI of 0.75. The Master Plan indicates the transition will begin when 5000 NOR adults are returning to the watershed, but there is no justification for this number. It is assumed that during Phase 3, 7422 Coho will be spawning naturally, whereas during Phase 4, only 5347 Coho will be spawning naturally. How were these target numbers for Phase 3 and 4 determined, and are they consistent with the capacity of the habitat? The plan to have more spawners during Phase 3, when habitat is not yet restored, in comparison to Phase 4, requires explanation. The initial production assumptions used in the Master Plan indicate that spawning abundance is near optimal at somewhat over 2000 adults.

It would be very helpful in Step 2 to elaborate further on the "stepping stone program" that will be used to provide broodstock to each of these programs. For example, it is indicated that a pNOB of 30% would be targeted during Phase 3. Does this mean that NORs would be incorporated into the segregated program when it was initially established, and if so for how many years would this occur? The PNI for Phase 3 is expected to be 0.32 while in Phase 4 a 0.75 PNI goal has been established. How will this transition take place; in other words how will pNOB and pHOS be adjusted over time? Additionally, HORs originating from the integrated and segregated programs will apparently be used as broodstock in the segregated program. Step 2 should indicate what proportion of the broodstock in the segregated program will originate from each of these sources and whether that proportion will change over time. Some discussion about why the proportions of integrated and segregated broodstock were chosen would also be helpful. Providing the above information would help clarify how the Coho program will transition from Phase 3, which is primarily a harvest augmentation effort, to Phase 4 which is a harvest and conservation endeavor.

The YN response states that approximately 2500 NOR and 4900 HOR Coho will spawn naturally each year (7400 total), on average, during Phase 3. These spawners are expected to produce 72,059 smolts

(Fig. 2), which yields only 9.7 smolts per spawner, a productivity estimate that is much lower than the assumed Phase 3 estimate of 34 smolts per spawner. Even with a 0.5 fitness factor this value does not make sense. Fig. 2 in the response is confusing because the 5% SAR for natural production is the SAS value (prior to fisheries), whereas the 1.27% SAR for hatchery fish must be a value after removing harvested fish (700,031*1.27%=8,890), which is much lower than the reported harvest in all fisheries: 13,896 Coho). Complete and consistent reporting of the statistics for natural and hatchery Coho is needed so that the entire life cycle can be easily tracked and evaluated to make sure the values are consistent, reasonable, and comparable with values determined during monitoring and evaluation.

ISRP 2018 Response Comment:
The YN response provides a general overview and describes some significant changes to both the segregated and integrated Coho programs that are described in much greater detail in the 2012 Master Plan. These changes raise additional questions that the proponents should address as they revise the Master Plan for Coho.

The YN response indicates that approximately 1,200 locally returning Coho will be collected for use as broodstock in the segregated program (Table 2, page 11). Assuming half of the collected fish are females with a mean fecundity of 3,000 eggs (as stated), the total egg take of 1.8 million seems to be considerably more than needed to achieve the release target of 500,000 smolt for the segregated program. Why collect so many adults as broodstock? Are some to be translocated to subbasin tributaries?

The proponents have already made good progress toward creating an integrated hatchery Coho program in the Yakima subbasin. The ISRP agrees that existing habitat restoration efforts coupled with a phased approach to integrated supplementation are likely to produce substantial benefits. However, the proposal still lacks some important details about the transition from Phase 3 to Phase 4. In particular, the YN response does not adequately explain the mechanisms by which the proportion of natural origin adults in the broodstock (pNOB), the proportion of hatchery origin adults on the natural spawning grounds (pHOS), and proportionate natural influence (PNI) will change during the transition from Phase 3 to Phase 4. This issue is potentially confusing for the ISRP because the values in Table 3 of the current proposal differ from those in the 2012 Master Plan. More detail is required in Table 3 to explain how the transition from Phase 3 to Phase 4 might occur. Why is parr-to-adult survival (3.0%) greater than smolt-to-adult survival (1.7%)? If hatchery smolts are marked and subject to additional selective fishing mortality, why is mean smolt-to-adult survival greater for hatchery origin smolts (1.7%) than for natural origin smolts (1.3%)?

It would also help to clearly specify 1) the number of hatchery origin adult returns (HOR) and natural origin adult returns (NOR) in the integrated (MRS) broodstock; 2) numbers of parr and smolt released from the hatchery and their expected probability of survival; 3) the numbers of HOR and NOR spawning in the streams; 4) the expected number of smolts and adults produced by natural spawners; and 5) the PNI calculated for the overall integrated population.

The proponents correctly point out that the PNI index does not take into account the length of time juveniles spend in the hatchery prior to release, and they wonder if PNI could be calculated to reflect these differences. The PNI concept is not sufficiently precise to track differences in the extent of natural selection on parr and smolt, but it is still a useful heuristic for balancing natural and artificial selection in the integrated population as a whole. Ultimately, more sophisticated analysis based on procedures described in the M&E plan to track changes in genetic composition may shed light on differences in the influence of natural selection on parr and smolt releases.

To justify the overall size of the integrated hatchery program, the proposed number of parr and spawners should be compared with the estimated capacity of the watershed for parr and adult spawners, respectively. The 2012 Master Plan specifies an increase in the yearly smolt release target from 200,000 in Phase 3 to 300,000 in Phase 4 whereas the YN response indicates a single target of 200,000 in both phases. Has the Phase 4 target changed? The YN response does not explain (as requested in ISRP 2013-8) why the number of natural spawners is expected to be greater during Phase 3 than Phase 4. Furthermore, Table 3 indicates that escapement will be greater during Phase 4 than Phase 3, but it is unclear whether "escapement" is synonymous with "number of spawners" and to what extent it would include hatchery adults released upstream. Table 3 should specify Phase 3 and Phase 4 targets for both natural origin and hatchery origin spawners.

The fish cultural aspects of the program are well described. Appendix A includes adequate detail about the goals, approaches, and specific tasks associated with collecting and handling broodstock, fertilizing and incubating eggs, and rearing parr and smolts. In contrast, the YN response does not provide enough detail about where and how progeny from the integrated program will be dispersed in tributaries, how these release sites will be selected and prioritized, and how the numbers of fish to be released at each site will be determined. Will the mobile raceways previously developed for reintroduction efforts in the Yakima subbasin be used in the integrated program, perhaps as acclimation sites for parr release? Or alternatively, will mobile raceways be used in the segregated program for smolt release downstream of Prosser Dam? These details are important because the overall goal of the program is to reintroduce Coho into tributaries and mainstem areas of the Yakima and Naches rivers that once supported Coho.

Environmental conditions in the Naches and upper Yakima rivers are distinct enough to have apparently produced tributary-specific adaptations in spring Chinook salmon. Spring Chinook salmon returning to the Naches River are typically older at maturity, larger at maturity within the same age class, and often spawn earlier in the season than Chinook salmon returning to the upper Yakima (e.g., Knudsen et al. 2004; ykfp.org/par04/PAR2004%20Abs%20Demog.pdf). These differences have been attributed to the higher gradient and flow conditions that Chinook salmon encounter during migration to spawning locations in the Naches River compared to the upper Yakima River. Similar adaptations in size at maturity and timing of migration might be possible and desirable in Coho returning to these major tributaries. Tributary-specific adaptation could be facilitated by segregating broodstock and progeny destined for release into the Naches and upper Yakima rivers (more on this below).

In the current integrated hatchery proposal, it seems that natural origin returns (NOR) collected as broodstock at Prosser Dam would be a mixture of fish that originated from acclimation sites in both the Naches and Upper Yakima rivers, and from adult translocations to both rivers. Without knowing the origin of NORs collected at Prosser Dam, it seems likely that some fish bound for Naches spawning areas would inadvertently be crossed with fish bound for upper Yakima spawning areas and that their progeny would be released back into tributaries that are mismatched to any incipient adaptations inherited from their parents. Because Prosser Dam is more than 80 km downstream of the confluence of the Naches River, it will be challenging to distinguish NORs that reared in the Naches River from those that reared in the upper Yakima River.

In contrast, any Coho collected at the Roza Dam Adult Fish Monitoring Facility (RAMF) are probably destined for the upper Yakima River. The proponents also mention adult trapping locations in the

Naches, at the Wapatox and Cowiche dams. We urge the proponents to consider collecting prospective broodstock at these Naches locations and at the RAMF as originally planned, as opposed to obtaining all broodstock for the integrated program just at Prosser Dam. To hasten fine-scale genetic adaptation, adults from the two major tributaries (i.e., Naches and upper Yakima) could be kept in separate groups and mated only to others within their group. Parr produced from these crosses could then be released back to the major tributary from which their parents were collected.

At present the proponents plan to release 500,000 parr/year produced at the integrated hatchery. None of these parr will be ad-clipped, but all will be marked by CWTs placed in their snouts. The proponents also plan to transfer 200,000 juveniles produced at the integrated hatchery to the Prosser Hatchery where they will be reared and released as smolts. None of the fish transferred to the Prosser Hatchery will be ad-clipped, but all will be tagged with CWTs placed in the post-dorsal region. Will unique CWT codes be used to distinguish CWT inserted into each body position to more reliably distinguish parr and smolt release groups?

As previously noted, the integrated hatchery program might be able to promote adaptation to physically distinct habitats of the Yakima subbasin by identifying and segregating broodstock by major tributary of release (i.e., Naches with Naches, upper Yakima with upper Yakima). If the major tributary of release could be identified from tags or genetic analyses, it would be possible to mate broodstock assortatively, regardless of where they were collected as broodstock. We encourage the proponents to consider the feasibility of marking parr produced at the integrated hatchery to distinguish releases into the Naches and upper Yakima areas. Perhaps CWTs could be inserted in the right versus the left side of the body rather than just in the snout. Perhaps the body location of a CWT could also be used in combination with visible implanted elastomer tags to distinguish not only Naches and upper Yakima release sites but also other release sites. Alternatively, perhaps the parental origins of the juveniles transported below Prosser Dam for release could be identified genetically by parent-based tagging (PBT).

If feasible, we encourage the proponents to evaluate and compare indices of productivity among release areas, both in terms of parr-to-smolt survival and number of smolts produced per translocated adult. We also encourage the use of rotary screw traps (RST), mentioned in the proposal, to estimate the productivity and capacity of major tributaries rather than relying only on total smolt numbers at the mouth of the Yakima River. Collecting this information at the tributary scale would help to identify habitat attributes that are conducive to re-establishing self-sustaining Coho populations and to guide future habitat restoration efforts.

YN 2019 Response: ***Back to INDEX*.**

- **For both Coho programs and all phases, use AHA modeling to show: 1) the number of hatchery origin adult returns (HOR) and natural origin adult returns (NOR) in the integrated (MRS) broodstock; 2) numbers of parr and smolt released from the hatchery and their expected probability of survival; 3) the numbers of HOR and NOR spawning in the streams; 4) the expected number of smolts and adults produced by natural spawners; and 5) the PNI calculated for the overall integrated population.**

The expected outcomes of the hatchery program in each phase were calculated using the All-H Analyzer (AHA) model based on the proposed hatchery strategies and key assumptions about in-basin and out-of-basin conditions. Expected outcomes for the current program, integrated program (Phase 3 and 4) and segregated program are shown in Tables 2-24 and 2-25. These are the average outcomes expected during each program phase based on the key assumptions about habitat, fish passage, harvest, and SARs described in section 2.5.2. These assumptions are used as inputs in the AHA model, which calculates the equilibrium status of the population in terms of adult abundance (escapement and harvest) and run composition (NORs and HORs). AHA also incorporates assumptions about density dependence in the freshwater portion of the life cycle using the Beverton-Holt survival function, ocean survival (including effects of annual variability), and fitness effects due to hatchery influence on the natural spawning population. AHA is static in the sense that harvest rates and hatchery production do not vary as a function of run size. However, the model is flexible enough to accommodate the inputs desired. Documentation for the AHA model is provided in HSRG (2009), found at: http://hatcheryreform.us/wp-content/uploads/2016/05/4_appendix_c_analytical_methods_and_info_sources.pdf.

Table 2-24. Expected outcomes for the current and proposed Yakima Coho programs based on All-H Analyzer modeling.

	Current (all releases)	Integrated Coho – Phase 3	Integrated Coho – Phase 4	Lower Yakima River Segregated
Adult Outplants	30-100	Up to 1,000 segregated HORs	Up to 1,000 segregated HORs	NA
Hatchery Smolts	810,000	200,000	200,000	500,000
Hatchery Parr	100,000	500,000	500,000	0
Natural-origin Smolts	46,226	60,084	122,474	0
Ocean Harvest	1,172	793	1,118	2,743
Lower Columbia Harvest	664	449	633	1,536
Zone 6 Harvest	3,088	1,194	2,945	1,703
Terminal Harvest	53	44	50	29
Total Harvest	4,977	2,480	4,746	6,012
Natural-origin Returns to Basin (brood + escapement)	851	1,512	2,676	0
Hatchery-origin Returns to Basin (brood + escapement + hatchery surplus)	4,070	3,915	2,664	2,448
Total Adult Returns to Yakima Basin	4,921	5,427	5,340	2,448
Imported Broodstock (HOR)	1,010	0	0	0
Local Broodstock (NOR)	4	243	810	0
Local Broodstock (HOR)	67	567	-	600
Natural-origin Escapement	848	1,269	1,866	0

	Current (all releases)	Integrated Coho – Phase 3	Integrated Coho – Phase 4	Lower Yakima River Segregated
Hatchery-origin Escapement (includes in-basin strays from seg. program)	1,986	3,191	2,203	1,440
Total Escapement	2,834	4,460	4,069	1,440
In-basin Strays from Segregated program	101	1,008*	360	1,008**
Out-of-basin Strays (segregated fish straying to other basins)	302			432
Hatchery Surplus	2,017	158	462	841
pNOB	0%	30%	100%	NA
Effective pHOS***	65%	67%	49%	
PNI	0.01	0.31	0.67	NA
Total Run Size (harvest + returns to Basin; includes in-basin strays/adult outplants and out-of-basin strays from seg. program)	10,199	7,907	10,086	8,892

* Includes adult outplants; assumes outplants will take place during Phase 3 and be discontinued in Phase 4.
** Using assumptions for Phase 3 (up to 1,000 segregated HORs outplanted).
*** Assumes HORs have 80% relative reproductive success compared to NORs; i.e., effective pHOS = (HORs*80%)/(HORs*80% + NORs).

Table 2-25. Combined outcomes (by phase) for the current and proposed Yakima Coho programs based on All-H Analyzer modeling.

	Current (includes all releases)	Phase 3 – Integrated and Segregated Programs Combined	Phase 4 – Integrated and Segregated Programs Combined
Adults Outplanted	30-100	Up to 1,000	Up to 1,000
Hatchery Smolts	810,000	700,000	700,000
Hatchery Parr	100,000	500,000	500,000
Natural-origin Smolts	46,226	60,084	122,474
Ocean Harvest	1,172	3,537	3,862
Lower Columbia Harvest	664	1,986	2,170
Zone 6 Harvest	3,088	2,897	4,647

	Current (includes all releases)	Phase 3 – Integrated and Segregated Programs Combined	Phase 4 – Integrated and Segregated Programs Combined
Terminal Harvest	53	73	79
Total Harvest	4,977	8,492	10,758
Natural-origin Returns to Basin (brood + escapement)	851	1,512	2,676
Hatchery-origin Returns to Basin (brood + escapement + hatchery surplus)	4,070	6,364	5,113
Total Adult Returns to Basin	4,921	7,876	7,789
Imported Broodstock (HOR)	1,010	0	0
Local Broodstock (NOR)	4	243	810
Local Broodstock (HOR)	67	1,167	600
Natural-origin Escapement	848	1,269	1,866
Hatchery-origin Escapement (includes in-basin strays from seg. program)	1,986	3,191	2,203
Total Escapement	2,834	4,460	4,069
In-basin Strays from Segregated program	101	1,008	360
Out-of-basin Strays (segregated fish straying to other basins)	302	432	432
Hatchery Surplus	2,017	998	1,302
Total Run Size (harvest + returns to Basin; includes in-basin strays/adult outplants and out-of-basin strays from seg. program)	10,199	16,799	18,978

* Includes adult outplants; assumes outplants will take place during Phase 3 and be discontinued in Phase 4.

- **Clarify the number of broodstock needed for the segregated program (1,200 seems too high).**

  The number of broodstock needed for the integrated and segregated Coho programs are presented in Section 2.5.2 of the 2019 Master Plan (see Table 2-21 below). The segregated program will require approximately 600 broodstock to produce 500,000 smolts. The integrated program will require approximately 810 broodstock to produce 500,000 parr and 200,000 smolts. Estimates of the number of broodstock required for each program are based on in-hatchery data from the Prosser program. The fecundity and egg-to-parr or smolt survival assumptions are based on data in

Table 2-3 in the 2019 Master Plan. Pre-spawning mortality is minimal because adults are spawned within one week of being collected.

Table 2-21. Broodstock requirements, in-hatchery metrics, and smolt/parr release numbers for Yakima Coho programs.

	Current	Upper Yakima River Integrated - Phase 3	Upper Yakima River Integrated - Phase 4	Lower Yakima River Segregated
Brood Source	Local + Imported	Local	Local	Local HORs
Broodstock Required	1,090	810	810	600
Pre-spawn Mortality	2.0%	2.0%	2.0%	2.0%
Fecundity	2,322	2,322	2,322	2,322
Eggs	1,240,180	921,602	921,602	682,668
Egg-to-Parr/Smolt Survival	73.5%	76%*	76%*	73.5%
Smolts and Parr Released	~910,000	~700,000	~700,000	~500,000

- **Why is parr-to-adult survival (3.0%) greater than smolt-to-adult survival (1.7%)? If hatchery smolts are marked and subject to additional selective fishing mortality, why is mean smolt-to-adult survival greater for hatchery origin smolts (1.7%) than for natural origin smolts (1.3%)?**

  The parr and smolt survival estimates referenced in the ISRP's comment above were McNary (smolt) to Bonneville (adult) SARs, and did not account for mortality from release sites in the upper Yakima and Naches subbasins to outmigration as smolts at McNary Dam, which is higher for NOR parr than /for hatchery smolts. Data on survival of Coho parr and smolts from <u>release</u> to return as adults to Bonneville Dam are provided in Table 2-9 (below) and in the 2019 Master Plan. <u>A discussion of parr vs. smolt SARs is included in the response to ISRP comment 2 (above)</u>.

  Hatchery-origin releases are not currently externally marked (adipose fin-clipped); this has been the case since BY 2007. Thus, hatchery-origin Yakima Coho returns are not currently subject to additional selective fishing mortality. Under the proposed program, segregated (Prosser Hatchery) releases would be adipose fin-clipped and subject to higher harvest rates than unmarked fish. The 2019 Master Plan presents updated SAR estimates for hatchery and natural-origin Coho returns.

Table 2-9. Estimated juvenile to adult survival rate (to Bonneville Dam) index for Coho released as smolts or parr in the Upper Yakima and Naches subbasins, brood years 2005-2014.

Brood Year	Hatchery-Origin					Natural-origin parr
	Smolt Releases			Parr Releases		
	Prosser	Upper Yakima	Naches	Upper Yakima	Naches	Taneum Creek (Upper Yakima River)
2005	2.63%	0.25%	0.78%			
2006	5.52%	0.90%	2.00%			
2007	5.36%	0.42%	1.12%			
2008	2.15%	0.18%	1.47%	1.23%	1.01%	0.86%
2009	0.07%	0.15%	0.43%	0.60%	0.36%	0.31%
2010	0.57%	0.21%	0.69%	0.54%	0.15%	0.66%
2011	4.42%	1.34%	2.44%	2.03%	0.63%	1.21%
2012	0.90%	0.30%	0.66%	0.36%	0.13%	
2013	1.25%	0.57%	0.15%	0.08%	0.00%	
2014	0.15%	0.50%	0.53%	0.64%	0.29%	
Mean	*2.30%*	*0.48%*	*1.03%*	*0.78%*	*0.37%*	*0.76%*
Geomean	*1.17%*	*0.38%*	*0.79%*	*0.55%*	*0.33%*	*0.68%*

- **For the integrated program, clearly describe the Phase 3 – Phase 4 transition.**

  During Phase 3, the integrated Coho program will use 30% natural-origin broodstock (NOB). In Phase 4, the program will use 100% NOB. We have provided a sliding scale broodstock collection table that shows the number of NOB to be collected for various NOR run sizes. This table illustrates the transition from Phase 3 to Phase 4. The 100% pNOB goal for Phase 4 is achieved at an escapement of about 3,000 adult Coho. The maximum percentage of the NOR run size to be collected for broodstock is 30% in each phase. The remainder of NORs will be allocated to escapement or terminal harvest. Table 2-16 displays the transition from 30% pNOB to 100% pNOB based on the NOR run size. To ensure that no more than 30% of the NOR run is collected for brood, the program will collect no more than one in three NORs returning to Prosser Dam for brood.

Table 2-16. Sliding scale broodstock collection table for Phases 3 and 4 of the Yakima integrated Coho program (assumes 810 broodstock are needed for a full program). Phase 3 pNOB goal is 30%, even if run size exceeds 810 NORs. Phase 4 pNOB goal is 100%.

NOR Run Size at Prosser	NOB	HOB	pNOB	Percent of NOR Run Size Collected for Brood	Approx. NOR Escapement	NOR Terminal Harvest
300	90	720	11%	30%	200	0%
500	150	660	19%	30%	350	0%
810	243	567	30%	30%	550	<2%
1,200	360	450	44%	30%	800	<2%
1,800	540	270	67%	30%	1,200	<2%
2,400	720	90	89%	30%	1,600	<5%
3,000	810	0	100%	27%	1,900	10%
3,600	810	0	100%	22%	2,400	12%

- **To justify the overall size of the integrated hatchery program, the proposed number of parr and spawners should be compared with the estimated capacity of the watershed for parr and adult spawners, respectively.**

  The proposed numbers of integrated program parr and smolt releases were selected to produce the number of naturally-spawning adults needed to establish a locally adapted population, given current estimates of SARs, harvest rates, ocean survival, and fish passage survival through the FCRPS.

Table K-3. Adult, smolt and parr capacity for Yakima Basin Coho.

Life Stage	Current	Phase 3	Phase 4
Adult capacity	5,101	5,101	8,723
Smolt capacity	72,000	72,000	197,000
Parr capacity	1.3 million	1.3 million	2.8 million

Currently and during Phase 3 of the program, adult spawning capacity is assumed to be 5,101 Coho. During Phase 4, following implementation of the Integrated Plan, spawning capacity is assumed to increase to 8,723 Coho. During Phase 3, natural spawning escapement (NORs + HORs) is expected to be 4,460. During Phase 4, escapement (NORs + HORs) is expected to be 4,069[2]. The number of effective spawners is lower if we assume HORs have lower reproductive success than NORs (AHA assumes a relative reproductive success value of 80%). In either case, these escapement values are less than the adult spawning capacity of the watershed. Because adult spawning escapement is below modeled capacity, hatchery parr are released to make up for lost juvenile production as well as increase Coho geographic distribution in the basin.

[2] Total natural spawning escapement decreases in Phase 4 because we assume the Zone 6 harvest rate increases in Phase 4 and the number of NORs collected for broodstock increases.

Smolt capacity after adjusting for fitness of hatchery-origin spawners in the system is 72,000 in Phase 3 and 197,000 in Phase 4. Average natural smolt production is expected to be approximately 60,000 in Phase 3 and 122,000 in Phase 4. These values are the number of smolts leaving at the mouth of the Yakima River. Hatchery-origin smolts released in the upper subbasins will be held in acclimation ponds for approximately 4 weeks. Once they are released, they are expected to migrate quickly out of the Yakima subbasin to the ocean and are unlikely to compete with naturally produced smolts while they are in the upper subbasins.

The proposed integrated Coho program would release more parr and fewer smolts than the current program. Because parr spend more time in freshwater than smolts, and therefore more time interacting with nontarget fish, it is assumed that releasing parr poses more competitive risk than releasing smolts (Pearsons and Temple 2007). Parr released into the tributaries have the potential to compete with wild parr, but release sites have been selected to target underseeded streams. Summer parr capacity in the Yakima subbasin is approximately 1.3 million during Phase 3 and 2.8 million during Phase 4 based on EDT modeling.

During the start of Phase 3, parr releases (500,000) in addition to natural parr production have the potential to exceed total subbasin parr capacity by 50% in some years, depending on adult return numbers. The level of parr capacity exceedance decreases as habitat improvement actions are implemented and become effective. Because of inefficiency in stocking fry into streams and unavoidable mortality during release, competition effects will be lower than assumed based on numbers released. Also, as described in the 2019 Revised Master Plan, parr will be released in the tributaries for 6 years, then releases will be re-evaluated based on the results of M&E (e.g., SARs of parr vs. smolt plants, recolonization of seeded streams with HOR adults, etc.).

In Phase 4, parr capacity is expected to increase to 2.8 million and parr releases in addition to natural production are expected to exceed this level by about 18%, again dependent on adult returns and survival rates of planted fish.

To reduce the effects of competition on naturally produced fish, hatchery parr releases in both phases are prioritized to 1) streams with low adult escapement or 2) to portions of the streams where spawner abundance is low or non-existent. The latter is a means to extend the geographic range of Coho in the basin.

- **The 2012 Master Plan specifies an increase in the yearly smolt release target from 200,000 in Phase 3 to 300,000 in Phase 4 whereas the YN response indicates a single target of 200,000 in both phases. Has the Phase 4 target changed?**

  The number of smolts and parr to be released during Phase 3 and Phase 4 of the integrated and segregated programs are shown below in Tables 2-14 and 2-18. These release numbers are consistent with those in the Final EIS for the Melvin R. Sampson Hatchery (BPA 2017) completed after the 2012 Master Plan submittal. The integrated program at the MRS Hatchery will release up to 200,000 smolts and 500,000 parr. The segregated program at Prosser Hatchery will release up to 500,000 smolts.

Table 2-14. Release goals and broodstock management strategy for the Yakima integrated Coho program at the Melvin R. Sampson Hatchery.

Program Goal	Current	Phase 3	Phase 4
Hatchery-origin brood (HOB)	720	570	0
Natural-origin brood (NOB)	40	240	810
Smolts released	540,000	200,000	200,000
Parr Released	100,000	500,000	500,000
Adult Outplants	30-100	1,000	1,000
pNOB	5%	30%	100%

Table 2-18. Release goals and broodstock management strategy for the Yakima segregated Coho program at Prosser Hatchery.

Program Goal	Current	Phase 3 and Phase 4
Hatchery-origin brood (HOB)	< 600 (imported)	600 (local)
Smolts released	270,000 (average)	500,000

- **The YN response does not provide enough detail about where and how progeny from the integrated program will be dispersed in tributaries, how these release sites will be selected and prioritized, and how the numbers of fish to be released at each site will be determined.**

  Agreed. This information has been provided in the 2019 update to the plan. No integrated program (MRS-produced) fish will be released downstream of the confluence of the Yakima and Naches Rivers. Segregated (Prosser Hatchery) program fish will be released into the hatchery outflow stream that flows into the Yakima R. about ¼ mile below Prosser Dam.

  Integrated program fish will be released into targeted tributaries in the upper Yakima and Naches watersheds (Figure 2-5). The prioritized list of tributaries identified for Coho reintroduction is provided in Table 2-15, along with release strategies that may be used in the particular location. We do not intend to use the same release strategy in the same location in any given year. Adult outplants are the preferred strategy in tributaries where ESA-listed species are present to minimize negative interactions. Juvenile releases will continue to focus on tributaries where bull trout and steelhead are not present or occur at low abundance. In tributaries that support spawning and rearing habitat for bull trout, Coho adults will be outplanted well downstream of known bull trout spawning and rearing habitat to minimize the risk of Coho adults competing with bull trout. In the future, additional tributaries could be subject to juvenile acclimation and release, in consultation with the U.S. Fish and Wildlife Service (USFWS) and NMFS. The number and life stage of Coho released would depend on a number of factors that include habitat conditions and presence of sensitive species within the tributaries. The Yakama Nation would review drought reports on an annual basis and focus releases of Coho parr into streams that are not expected to experience dewatering during summer months.

  Parr will be released directly into streams. Smolts will be acclimated for approximately 4 weeks prior to release. Smolts will be acclimated in ponds next to tributaries in which they will be released to help encourage their return as adults to these locations. A number of existing ponds, including Jack Creek, Hundley, Boone, and Easton will continue to be used to acclimate Coho smolts from the

MRS Hatchery. Mobile acclimation units will be used for a small number of Coho smolts in the basin. Similar to the mobile acclimation units currently being used by the Yakama Nation, these units will consist of portable aluminum raceways that are 20 feet long, 5 feet wide, and 4 feet tall.

The selection of one or more release strategies for individual tributaries considered both abiotic and biotic factors including the size and quality of available habitat, presence or absence of other sensitive species, and logistical constraints (i.e., accessibility). The foundation and biological justification for generating optimal release numbers are based on natural production estimates from the Ecosystem Diagnosis and Treatment (EDT) model. Adjustments were made to release numbers to account for a reduced fitness factor of hatchery fish that may lack the natural productivity and relative fitness of a fully adapted natural population. In a review of relative fitness of hatchery and natural salmon, Berejikian and Ford (2004) reported the relative fitness of hatchery salmon ranges from approximately 20% to as high as 100% depending on the species, brood source, and number of generations the hatchery line has experienced. For our purposes, we assumed a 50% relative fitness factor for hatchery origin Coho.

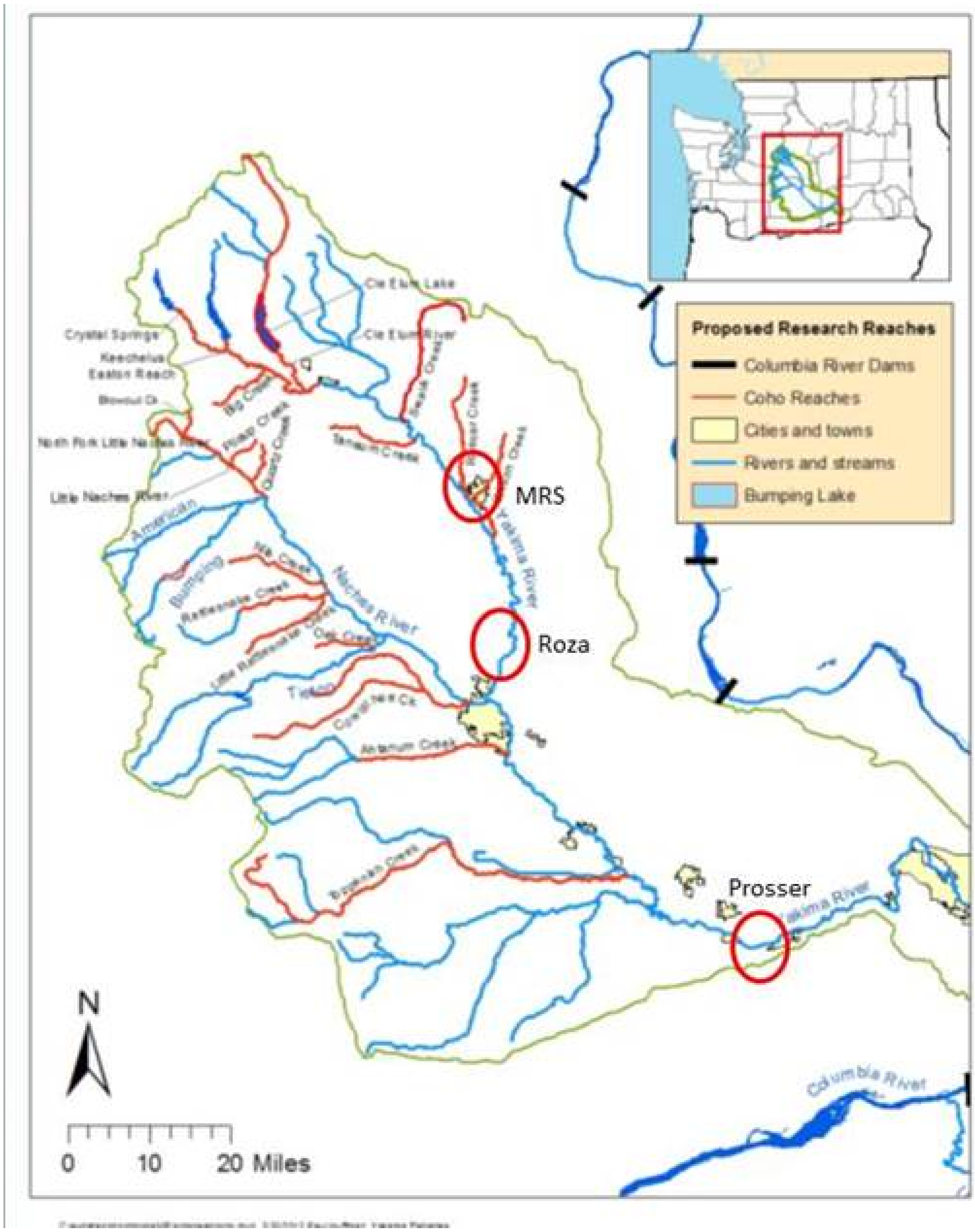

Figure 2-5. Location of proposed release sites for integrated Coho program smolts and parr in targeted tributaries above the confluence of the Naches and Yakima Rivers.

Table 2-15. Prioritized list of Yakima Basin tributaries identified for Coho reintroduction under the proposed Upper Yakima integrated Coho program.

Location	Activity			Priority
	Parr Releases	Adult Outplants	Smolt Releases	
Naches River				
Cowiche Creek, including South Fork	x	x	x	First
Rattlesnake Creek		x	x (may be decommissioned)	First
Little Naches	x	x		First
Quartz Creek	x			First
Nile Creek	x			First
Tieton River		x		First
South Fork Tieton River		x		Second
North Fork Tieton River		x		Second
Rock Creek	x			Second
North Fork Little Naches	x	x		Second
Bumping River		x		Second
American River	x	x		Second
Upper Yakima River				
Wilson Creek	x	x		First
Reecer Creek	x	x		First
Swauk Creek	x	x		First
Iron Creek	x			First
First Creek	x			First
Blue Creek	x			Second
Williams Creek			x	First
Taneum Creek		x		First
Big Creek		x		First
Mainstem Upper Yakima (including acclimation sites)	x	x	x (four existing sites)	First
Upper Cle Elum River	x	x		First
Cabin Creek	x			First
Lower Cle Elum River (below dam)	x			First
Manastash	x	x		Second
Cherry Creek	x			Second
Mercer Creek	x			Second
Coleman Creek	x	x		Second
Naneum Creek	x			Second
Little Creek	x	x		Second
Teanaway River	x	x		Second
Jack Creek			x (existing)	Second
Indian Creek	x			First
Stafford Creek	x			Second
Jungle Creek	x			Second
Mainstem Yakima River				
Ahtanum Creek	x	x	x (smolt release)	Second

- **For the integrated program, will unique CWT codes be used to distinguish CWT inserted into each body position to more reliably distinguish parr and smolt release groups?**
  All juveniles from the integrated program will be coded wire-tagged. and we will use PIT tags to evaluate the various release groups. Approximately 5-10% of juveniles from each release group will receive PIT tags. We intend to evaluate survival differences among the release groups (parr vs. smolts) using PIT tags (for example, see Tables 2-3 and 2-5) and will use this information to adaptively manage the release groups. Harvest rates will be determined using CWT data and information from fishery monitoring programs.

Table 2-3. McNary Dam smolt to Bonneville Dam age-3 adult return (SAR) indices for PIT-tagged Coho released as smolts or parr[1] in Lower Yakima, Naches, and Upper Yakima mainstem or tributary areas, brood years 2003-2014. SAR indices are inclusive of ocean and lower Columbia River harvests.

Brood Year	Smolt Releases			Parr Releases[1]	
	Lower Yakima[2]	Naches	Upper Yakima	Naches	Upper Yakima
2003	3.78%	6.14%	2.92%		
2004	2.28%	3.16%	3.67%	1.09%	
2005	3.11%	3.31%	2.36%	1.41%	1.96%
2006	9.76%	6.81%	4.17%	5.52%	7.84%
2007	8.16%	2.84%	4.35%	0.52%	3.16%
2008	4.10%	7.59%	8.80%	5.84%	8.30%
2009	0.20%	1.89%	3.37%	1.99%	3.20%
2010	1.67%	1.80%	1.76%	0.98%	3.23%
2011	6.57%	7.15%	11.64%	6.11%	10.49%
2012	1.15%	1.48%	2.58%	1.01%	2.59%
2013	3.35%	2.33%	4.91%		3.03%
2014	0.66%	3.01%	3.05%	3.73%	6.74%
Average	*3.73%*	*3.96%*	*4.46%*	*2.82%*	*5.05%*
Geomean	*2.46%*	*3.40%*	*3.85%*	*2.03%*	*4.33%*

[1] PIT-tagged fish released as parr in brood year 2003, 2004 (Upp. Yak.), and 2013 (Naches) experienced very poor (<1%) survival to McNary Dam as juvenile smolts and were omitted from this analysis.
[2] Primarily Prosser Hatchery releases and some Chandler canal releases used to study entrainment rate.

Table 2-5. Results from Taneum Creek adult outplant study, 2007-2014.

Outplant/ Brood Year	Number of Adult Females Outplanted	Redds	Number of Juvenile Coho PIT Tagged	McNary Juvenile Detections	Bonneville or upstream Adult Detections	McNary Juvenile & Adult Detections	McNary Juvenile to Bonneville Adult SAR Index[1]
2007	150	75	1,299	94	1		
2008	150	50	1,868	82	16	7	8.54%
2009	150	130	4,515	177	14	4	2.26%
2010	150	134	1,054	73	7	3	4.11%

Outplant/ Brood Year	Number of Adult Females Outplanted	Redds	Number of Juvenile Coho PIT Tagged	McNary Juvenile Detections	Bonneville or upstream Adult Detections	McNary Juvenile & Adult Detections	McNary Juvenile to Bonneville Adult SAR Index[1]
2011	150	100	743	30	9	4	13.33%
2012	60	54	1,941	70	0		
2013	9	5	231	0	0		
2014	360	200	752	12	1		
Pooled			*12,403*	*538*	*48*	*18*	*3.35%*

1 Post-harvest SAR index (i.e., after adults removed in ocean and Lower Columbia River freshwater harvest). Post-harvest survival from tagging (parr) to adult returns at McNary was 0.76% during the study.

- **We urge the proponents to consider collecting prospective broodstock for the integrated program at these Naches locations and at the RAMF as originally planned, as opposed to obtaining all broodstock for the integrated program just at Prosser Dam.**

  We understand that local adaptation of Coho in the Naches and Upper Yakima systems is possible. Management at the scale suggested by the ISRP would probably best be implemented and most successful if separate brood collection, spawning, rearing, and release facilities could be constructed in the Naches subbasin. However, we believe that current regional budgets and priorities, as well as local logistical considerations likely preclude management at finer scales than we have described. Since the development of the 2012 Master Plan there have been several changes to potential monitoring and broodstock collection structures in the Naches system. Cowiche (Nelson) Dam is scheduled for removal likely within the next 2-3 years, and we have learned that entrainment of fish at the Wapatox facility is primarily downstream juvenile migrants; adult collection at this facility would require substantial modification. The differential marking schemes employed in this Plan revision may allow incorporation of some level of local adaptation into the integrated program. We will continue to explore these further as we implement the 2019 Master Plan (e.g., potential for broodstock collection and mark-based differentiation at the Prosser Denil facility as well as other potential collection sites and means in the Naches system). However, these considerations will necessarily be constrained by the budgetary and logistical issues described above.

- **We also encourage the use of rotary screw traps (RST), mentioned in the proposal, to estimate the productivity and capacity of major tributaries rather than relying only on total smolt numbers at the mouth of the Yakima River.**

  While we understand the value of RST data, logistical constraints in the Yakima Subbasin make these data difficult to obtain. Trapping in the mainstem is not feasible due to high flows, debris loads, and the difficulty of obtaining a large enough sample size of outmigrating smolts due to low trap efficiency. Traps would need to be deployed and maintained in numerous tributaries to capture a meaningful sample of naturally produced smolts. This effort would consume a substantial portion of the M&E budget available.

ISRP 2012 Comment 4*. A response is also requested for a succinct and complete summary table showing recent program performance for Coho and Chinook salmon along with a table that provides proposed program metrics. The summary table should include metrics such as numbers of broodstock required, anticipated fecundity and eggs required, numbers of progeny produced and released, required post release life-stage survival. These data requirements, or "report card" metrics, were recently summarized by the ISRP in its review of the Lower Snake River Compensation Plan's spring Chinook program (ISRP 2011-14). An example of the information needed by the ISRP are Tables 8, 9, and 10 on pages 33, 34, 37, and 38 in the Revised Master Plan for the Hood River Production Program (see Tables below). Some, but not all, of this information is distributed throughout the Master Plan. One of the ISRP's responsibilities in conducting a Step Review for a hatchery master plan is to confirm that the values (numbers) provided for abundance, SARs, and harvest fractions are computationally accurate across life stages. This confirmation is not possible when the necessary information is presented across different sections of the plan. For example, it is not possible for the ISRP to establish a conclusion for initiation of phase 3 of the Lower Yakima Segregated Coho Program using Tables 3-1, 3-3, 2-4, and the discussion of the Coho program in section 5.2.2. Additionally, when reporting status and trends of the program such as in Table 3- 10, a comparison of observations with the program objectives should be provided so that program progress can be readily monitored. Finally, the Master Plan claims that the proposed programs will not lead to increased hatchery production, but this is not clearly shown in the Master Plan because there is no table directly comparing recent with proposed production of hatchery Chinook and Coho salmon.*
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ISRP 2013 Response Comment 4:
Coho Tables, such as in the Hood River program, are needed by the ISRP, and we believe they would serve the sponsor in future program evaluation and adaptive management.

Some of the requested data and project goals were reported for Coho. For example, adult escapement of NORs and HORs to Prosser Dam from 2000 through 2010 was shown in Table 3, but no estimates of the number reaching the spawning grounds in the Yakima basin were provided. Goals for broodstock collection by phase are provided, but specific numbers used in the past and the ratio of out-of-basin fish (or eggs) to in-basin fish are not provided. No information on harvest numbers is given although expected harvest rates in various parts of the Columbia, starting at the mouth and working up to terminal areas are given for each phase of the project. No data are given for pre-spawning mortality, but 5% was assumed for Phases 3 and 4. Smolt production for both NORs and HORs from 2000 to 2010 is presented along with index SAR values. No specific data on hatchery egg-to-smolt survival was provided for either NOR or HOR parents although 70% is assumed for Phases 3 and 4. An average fecundity value is provided and a range of egg numbers used in the past along with goals for Phases 3 and 4 are shown. In Step 2, the sponsors should combine the information they provided into one or two tables per the examples given and include, whenever possible, the additional information requested.

A critical issue is the need for, first, a clear statement of whether the program is currently able to go to Phase 3 using only adults returning to the Yakima River for broodstock while maintaining a PNI of 0.32 with pHOB of 20%; and second, a decision framework for the size of the program based on NOR and HOR abundances. How the program will transition from PNI = 0.32 to PNI = 0.75 has not been explained. A plan with a scientifically justified rationale is required for various levels of hatchery and natural origin Coho abundance and the anticipated harvests of those fish.

It is not clear from Table 1 and Fig. 2 how a broodstock of 655 Coho (equal male/female ratio according to Master Plan) with fecundity of 3,000 and pre-spawn mortality of 5% yields 1.1 million eggs. Assuming an equal sex ratio, the reported values only produce 0.93 million eggs, on average. The assumed values for this project need to make sense across all life stages.

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- **Provide recent program data on escapement, SARs, hatchery production, terminal harvest, etc.**

  In the 2019 Master Plan, we have included the requested data on annual hatchery releases, including the number produced from in-basin and out-of-basin eggs (Table 2-1); in-hatchery data (e.g., fecundity and egg-to-smolt survival) (Table 2-2); adult returns to Prosser Dam (Tables 2-6 and 2-7), natural and hatchery-origin SAR estimates (Table 2-9), and terminal harvest data (Table 2-12).

Table 2-1. Total releases of Coho hatchery juveniles in the Naches and Upper Yakima subbasins by brood year and acclimation site.

	Release Sites					Broodstock Source			
Brood Year	Smolts			Parr		Local Brood		Out of Basin Smolts	Total Smolts[1]
	Upper Yakima	Naches	Prosser	Upper Yakima	Naches	Smolts	Parr		
1997	436,000	1,257,000	-						1,693,000
1998	502,155	502,239	-						1,004,394
1999	498,872	429,318	-						928,190
2000	187,659	379,904	-						567,563
2001	263,288	357,530	-						620,818
2002	403,000	407,002	-						810,002
2003	313,207	291,494	-						604,701
2004	322,417	332,455	-						654,872
2005	338,127	554,784	50,000						942,911
2006	426,632	516,753	81,114						1,024,499
2007	358,412	440,783	219,098						1,018,293
2008	304,638	269,936	182,719	12,000	25,000	324,598	37,000	432,695	757,293
2009	407,184	341,414	245,455	13,000	12,000	610,423	25,000	383,630	994,053
2010	443,030	131,972	190,836	15,000	15,000	522,027	30,000	243,811	765,838
2011	311,102	359,067	322,100	365,035	73,572	992,269	438,607	-	992,269
2012	339,034	305,197	221,567	10,555	29,565	446,295	40,120	419,503	865,798
2013	353,139	373,072	367,382	9,000	18,232	524,967	27,232	568,626	1,093,593
2014	408,112	298,619	267,830	93,525	92,023	974,561	185,548	-	974,561
2015	141,000	141,000	204,358	-	-	204,358	-	282,000	486,358
2016	407,196	369,521	205,967	-	-	205,967	-	776,717	982,684
2017	438,331	267,211	470,000	114,141	138,624	641,589	252,765	533,953	1,175,542
2008-17 Average	*355,277*	*285,701*	*267,821*	*63,226*	*40,402*	*544,705*	*103,627*	*364,094*	*908,799*

1 Releases from 1997-2007 were from approximately 90% out-of-basin and 10% in-basin broodstock.

Table 2-2. In hatchery data for Coho parr and smolts reared at Prosser Hatchery using local broodstock.

Brood Year	Females Spawned	Males Spawned	Total eggs	Average Fecundity	Eyed eggs	Smolts Released	Smolt Size (fish/lb)	Parr Released	Parr size (fish/lb)	Egg to Parr or Smolt Survival
2010	343	360	920,737	2,684	762,342	522,027	10.5	30,000	165	72.41%
2011	651	641	1,970,078	3,026	1,859,406	992,269	11.2	438,607	180	54.98%
2012	425	455	775,494	1,824	646,465	446,295	11.9	40,120	165	73.55%
2013	328	301	823,513	2,510	724,207	524,967	14.5	27,232	152	78.03%
2014	570	525	1,388,800	2,240	1,249,920	974,561	15.1	185,548	154	92.57%
2015	174	180	363,015	2,086	287,781	204,358	14.5	0	167	71.01%
2016	198	212	428,270	2,162	352,153	205,967	12.4	0	162	58.49%
2017	490	515	1,163,940	2,042	1,024,267	641,589	14.3	252,765	155	87.24%
Average	*397*	*399*	*979,231*	*2,322*	*863,318*	*564,004*	*13.1*	*121,780*	*163*	*73.54%*

Table 2-6. Estimated Coho returns and escapement in the Yakima River, 1999-2018. Note that this table reports returns by adult return year.

Adult Return Year	Total Returns (NORs + HORs)		Escapement (after terminal harvest; NORs + HORs)			
			Prosser Dam		Hatchery Denil	
	Adult	Jack	Adult	Jack	Adult	Jack
1999	3,906	91	3,852	91		
2000	4,444	1,841	4,390	1,826		
2001	5,032	68	4,978	68		
2002	515	343	475	343		
2003	2,192	162	2,192	162		
2004	2,367	74	2,325	64		
2005	2,897	225	2,890	225		
2006	4,478	175	4,335	175	125	0
2007	3,461	64	3,153	60	300	4
2008	4,636	1,917	3,890	1,809	700	58
2009	9,843	873	8,517	573	1,300	300
2010	5,776	567	4,811	183	915	384
2011	8,073	171	6,424	121	1,594	50
2012	5,511	264	4,298	164	1,200	100
2013	3,173	848	2,290	395	837	412
2014	25,368	584	20,997	427	4,263	157
2015	3,314	300	2,210	105	1,095	195
2016	3,383	374	1,693	188	1,690	186
2017	3,920	274	3,051	222	804	34
2018	2,218	835	1,672	440	518	365
Average	*5,225*	*503*	*4,422*	*382*	*1,180*	*173*

Table 2-7. Estimated counts of marked (presumed hatchery-origin) and unmarked (presumed natural-origin) adult and jack Coho at Prosser Dam and Prosser Hatchery Denil, 1986-2018.

Adult Return Year	Total Adults		Total Jacks	
	HORs	NORs	HORs	NORs
1986	230	0	0	0
1987	82	0	1	0
1988	18	0	0	0
1989	282	0	9	0
1990	289	0	0	0
1991	230	0	39	0
1992	137	0	53	0
1993	162	0	3	0
1994	532	0	28	0
1995	651	0	74	0

Adult Return Year	Total Adults		Total Jacks	
	HORs	NORs	HORs	NORs
1996	921	0	417	0
1997	1,241	0	71	0
1998	4,625	0	54	0
1999	3,852	0	91	0
2000	4,390	0	249	1,577
2001	3,546	1,432	47	21
2002	166	309	98	245
2003	669	1,523	27	135
2004	505	1,820	39	25
2005	2,418	472	105	120
2006	2,898	1,562	61	114
2007	2,404	1,049	32	32
2008	4,131	459	1,280	587
2009	8,835	982	700	173
2010	5,153	573	530	37
2011	7,216	802	147	24
2012	4,948	550	231	33
2013	2,703	424	728	79
2014	24,178	1,082	566	18
2015	2,943	362	291	9
2016	3,280	103	329	45
2017	2,693	1,162	241	15
2018	2,020	170	747	58
Average (2001-2018)	*4,484*	*824*	*344*	*98*

Table 2-9. Estimated post-harvest release to Bonneville Dam adult survival (SAR) index for Coho released as smolts or parr in the Upper Yakima and Naches Basins, brood years 2005-2014.

Brood Year	Hatchery-Origin					Natural-origin parr
	Smolt Releases			Parr Releases		
	Prosser	Upper Yakima	Naches	Upper Yakima	Naches	Taneum Creek
2005	2.63%	0.25%	0.78%			
2006	5.52%	0.90%	2.00%			
2007	5.36%	0.42%	1.12%			
2008	2.15%	0.18%	1.47%	1.23%	1.01%	0.86%
2009	0.07%	0.15%	0.43%	0.60%	0.36%	0.31%
2010	0.57%	0.21%	0.69%	0.54%	0.15%	0.66%
2011	4.42%	1.34%	2.44%	2.03%	0.63%	1.21%
2012	0.90%	0.30%	0.66%	0.36%	0.13%	
2013	1.25%	0.57%	0.15%	0.08%	0.00%	
2014	0.15%	0.50%	0.53%	0.64%	0.29%	
Mean	*2.30%*	*0.48%*	*1.03%*	*0.78%*	*0.37%*	*0.76%*
Geomean	*1.17%*	*0.38%*	*0.79%*	*0.55%*	*0.33%*	*0.68%*

Table 2-12. Estimated Coho returns and recreational harvest in the Yakima River, 1999-2018.

Adult Return Year	Total Returns		WA Recreational Harvest		
	Adult	Jack	Adult	Jack	Harvest Rate
1999	3,906	91	54	0	1.4%
2000	4,444	1,841	54	15	1.1%
2001	5,032	68	54	0	1.1%
2002	515	343	40	0	4.7%
2003	2,192	162	0	0	0.0%
2004	2,367	74	42	10	2.1%
2005	2,897	225	7	0	0.2%
2006	4,478	175	18	0	0.4%
2007	3,461	64	8	0	0.2%
2008	4,636	1,917	46	50	1.5%
2009	9,843	873	26	0	0.2%
2010	5,776	567	50	0	0.8%
2011	8,073	171	55	0	0.7%
2012	5,511	264	13	0	0.2%
2013	3,173	848	46	41	2.2%
2014	25,368	584	108	0	0.4%
2015	3,314	300	9	0	0.2%
2016	3,383	374	0	0	0.0%
2017	3,920	274	65	18	2.0%
2018	2,218	835	28	30	1.9%
Average	*5,225*	*503*	*36*	*8*	*1.1%*

- **Provide additional details on the transition from Phase 3 to Phase 4.**

  In the response to Comment 3 above, we have provided additional information on the transition from Phase 3 to Phase 4. During Phase 3, the integrated Coho program will use 30% natural-origin broodstock (NOB). In Phase 4, the program will use 100% NOB. We have provided a sliding scale broodstock collection table that shows the number of NOB to be collected for various NOR run sizes (see Table 2-16). This provides a decision framework for allocating NOR returns to broodstock, escapement, and harvest based on the NOR run size at Prosser Dam, and limits the percentage of the NOR run size collected for brood to 30% by collecting no more than one in three NORs for brood. The sliding scale table (Table 2-16) also shows the percentage of NORs to be harvested depending on the NOR run size. The priority for NORs is 1) broodstock collection, 2) escapement, and 3) harvest.

- **Present revised/corrected hatchery numbers (broodstock needed, life stage survival rates, etc. for proposed hatchery program releases).**

  Broodstock requirements for the integrated and segregated Coho programs and in-hatchery data (e.g., fecundity and egg to smolt survival) are provided in the response to Comment 3 above (see Table 2-21).

ISRP 2012 Comment 5*. How will the program keep hatchery salmon straying to less than 5%, and what is the disposition of returning hatchery adults that are not used for broodstock in the hatchery?* ***Back to INDEX.***

ISRP 2013 Response Comment 5:
The response identifies that the YN will use release locations, weirs, and harvest policies to reduce straying. The final bullet point states that a reduction in production will be considered if pHOS is not kept within limits. Production levels, and how that might be used to limit pHOS in critical Yakima River and tributary habitats, need to be included in a Step 2 decision framework. The ISRP recognizes that contemplating reduced production is undesirable, so the time to do it is before the hatchery and production levels are approved and implemented.

The response indicates that a unique water source will facilitate homing, HOR fish can be culled at Roza Dam and downstream locations, and hatchery fish (segregated stock) may be selectively harvested using the adipose fin clip. Surplus hatchery fish may be used for subsistence or for stream nutrients. Will YN fishers use selective gears in which hatchery fish (Coho marked with adipose clip) are retained and unmarked fish are released when there is a need to maintain escapement of unmarked salmon? Selective fishing in the terminal area is implied in the response, but it is not clearly stated.

All the Coho produced from the segregated program will be adipose clipped and some will receive CWTs. As the program progresses, CWTs will not be applied. We suggest that some level of tagging continue to help document possible straying of these fish into other portions of the Columbia basin. Additionally, the YN may wish to collect DNA from all the parental fish used in their Coho programs. This material could be archived and used in future Parent Based Tagging programs to further document the straying rates of project fish. Coho from the integrated hatchery program will not be adipose clipped. However, 100% of these fish will receive CWTs linked to their release location. Acclimation sites will be used in the integrated program to help reduce straying. Second, fish trapping facilities exist at Prosser Dam, at the Prosser Hatchery Denil ladder and trap, and at the Sunnyside and Roza dams. At Roza 100% of the fish are examined before they are allowed over the dam making it possible to remove unwanted hatchery origin Coho. Third, the sponsors state that they will work with WDFW to develop harvest strategies in the Yakima that target hatchery origin Coho. And finally, if necessary, the number of smolts released can be reduced to decrease the occurrence of strays. An important monitoring goal should be to monitor straying rates both inside and outside of the Yakima basin. In Step 2, a monitoring plan for hatchery strays and a decision framework should be described.

YN 2018 Response to ISRP 2013 Response Comment 5:
We believe that YN responses to other comments in this document as well as the monitoring and evaluation strategies described in Appendix A of this response address the ISRP's concerns. The marking programs we intend to employ (100% CWT integrated program releases and ad-clipping segregated program releases so that returning adults from the two programs may be identified visually) and the efficiency of the Roza adult trap will allow us to preclude any segregated-program Coho that do return to Roza Dam from passing upstream of the dam. Thus, the only hatchery-origin spawners above Roza will be returns from the MRS integrated program.

We queried the PTAGIS information system in March 2014 and analyzed adult detection data for all PIT-tagged Coho released in the Yakima River Basin since 1997. Based on this analysis, we estimate there were a total of 2,045 unique detections of Yakima River-released Coho migrating upstream at Bonneville Dam as adults since 1998 (adult Coho generally return at age-3, one year after their release). We could find only 19 Yakima River-released Coho detected at locations outside of the Yakima River Basin and not subsequently detected within the Yakima River Basin. These 19 fish represent 0.93% of the PIT-tagged adult Yakima River-released Coho that were detected at Bonneville Dam over this period. We could find no detections of Yakima River-released Coho as adult migrants downstream of Hood River (the area designated as critical habitat for ESA-listed lower Columbia River Coho) other than upstream migrating Coho detected at Bonneville Dam. We conclude that homing behavior for this reintroduction program has thus far been well within scientific guidelines (McElhany et al. 2000).

YN 2019 Response: ***Back to INDEX*****.**

Please see the 2018 YN response (above).

Additionally, all Coho from the segregated program will be reared at Prosser and released into the lower Yakima River downstream of the hatchery. Adult homing to the facility is expected to be high, with few Coho migrating the long distances to reach spawning habitat in the Naches River and Upper Yakima River. Again, stray segregated Coho will be removed at Roza Dam as necessary to achieve program goals.

***ISRP 2012 Comment 6**. What is the current level of mini-jack production, how do they affect existing population metrics, and what efforts are being used to reduce mini-jacks?* ***Back to INDEX*.**

ISRP 2013 Response Comment 6:
We agree that the occurrence of precociously maturing Coho in hatchery programs is extremely rare and infrequently or never monitored. However, we urge the YN to evaluate the occurrence of mini-jacks in the yearling summer Chinook they are planning to release as part of the summer/fall integrated program. Whenever possible, these examinations should be based on plasma levels of the reproductive steroid ketotestosterone (11-K-T). Males with 11-K-T levels greater than 0.8 ng/ml are considered to be maturing mini-jacks. A less sensitive method, determination of the gonadosomatic index (GSI) of sampled male smolts, may also be employed. GSI values are ascertained by dividing the testes weight by the body weight of a male and multiplying the quotient by 100. Individuals with GSI ratios >0.1% are considered to be maturing males. At present it is unknown if precocious development will occur in the project's yearling summer Chinook. Nevertheless, a discussion about how the presence of such Chinook would be considered when population metrics for the project are being determined should be included in Step 2.

YN 2019 Response. ***Back to INDEX*.**

We used PIT detection data for returning adults at Bonneville Dam to estimate age composition of returning summer and fall-run Chinook (Table 3-7). Subyearling releases of summer and fall-run Chinook return mostly as 3- and 4-year old adults. Yearling releases of fall-run Chinook have had a substantially higher proportion of Age-2 returns than subyearling releases.

The proposed integrated summer/fall Chinook program releases only subyearlings, which will likely minimize the number of mini-jack returns. The segregated program releases about 10% yearlings (210,000 of 1.9 million releases), which produce a much higher return of age-2 jacks than subyearling releases, but also have a substantially higher SAR. The trade-off between these two factors was considered when designing the segregated program.

Table 3-7. Age composition of returning hatchery-origin PIT-tagged summer and fall-run Chinook released in the Yakima subbasin as subyearlings or yearlings (data from PTAGIS query run May 1, 2019).

Brood Year	Age at Return				
	2	3	4	5	6
	Summer Chinook Subyearlings				
2008	12.5%	12.5%	50.0%	25.0%	0.0%
2009	5.4%	16.3%	63.6%	14.7%	0.0%
2010	0.2%	27.5%	61.4%	10.6%	0.2%
2011	0.0%	12.1%	67.5%	20.4%	0.0%
2012	1.0%	50.0%	40.8%	8.2%	0.0%
2013	5.6%	11.1%	77.8%	5.6%	0.0%
Mean	4.1%	21.6%	60.2%	14.1%	0.0%

Brood Year	Age at Return				
	2	3	4	5	6
	Fall Chinook Subyearlings				
2007	9.7%	47.9%	35.8%	6.6%	
2008	13.3%	53.3%	33.3%	0.0%	
2009	18.9%	40.5%	32.4%	8.1%	
2010	0.0%	66.7%	16.7%	16.7%	
2011	11.6%	34.9%	50.0%	3.5%	
2012	9.7%	61.1%	26.4%	2.8%	
Mean	10.6%	50.7%	32.4%	6.3%	
	Summer Chinook Yearlings				
2010[1]	13.6%	31.2%	44.2%	3.9%	0.6%
	Fall Chinook Yearlings				
2006	96.4%	0.0%	3.6%	0.0%	0.0%
2007	63.8%	15.9%	8.7%	11.6%	0.0%
2008	31.3%	36.1%	26.9%	5.8%	0.0%
2009	26.1%	18.0%	37.8%	18.0%	0.0%
2010	40.3%	26.4%	27.4%	6.0%	0.0%
2011	11.0%	15.9%	54.3%	14.0%	4.9%
Mean	44.8%	18.7%	26.4%	9.2%	0.8%

[1] 10 of 154 (6.5%) of detections occurred about 90 days post-release in adult ladders at Bonneville Dam and were assumed to be age-1 returns. However, only 2 of these 10 were confirmed as upstream detections based on later detections at dams upstream of Bonneville. The other 8 detections at Bonneville could have been late-migrating juveniles.

ISRP 2012 Comment 7*. How will harvest rates be controlled in order to rebuild the natural populations in the upriver basin? What is the planned harvest rate in relation to run size and how will this objective be achieved? Is there a plan to allocate harvests in the Yakima River to non-tribal sport anglers as well as Tribal anglers?* ***Back to INDEX*****.**

ISRP 2013 Response Comment 7:
The YN response indicates that annual harvest rates will be set with WDFW each year, including allocations to non-tribal fishers. Coho harvest rates will be set to ensure 5,000 NOR + HOR spawners in Phase 3 and 3,500 NOR spawners in Phase 4 are achieved whenever possible. In Step 2, scientific justification for these spawning targets and detailed harvest rate and harvest allocation decision rules for varying levels of hatchery and natural origin salmon abundance should be described.

The ISRP agrees that a good approach will be to establish a minimum spawning escapement goal for both Coho and Chinook such that harvests in the lower river will be greatly reduced if the returns to the upper Yakima River appear to be at or below the escapement target. However, it is not clear how the fishery will harvest the segregated stocks co-mingling with upriver stocks if non-selective fishing methods are used. This should be described in Step 2.

2018 ISRP Response Comment:
The 2012 Master Plan indicates that Coho harvest rates would be set to ensure a total of 5,000 spawners (NOR + HOR) in Phase 3 and 3,500 NOR spawners in Phase 4. It is unclear in the YN response if these targets still hold. The targets should be specified clearly in the revised Master Plan and should be based on the estimated current capacity of the Yakima River watershed.

Maintaining a specified PNI target (e.g., PNI >0.50) requires that harvest from an integrated hatchery population be regulated in accordance with the size of the natural spawning component. The revised Master Plan should specify a decision rule for allocating NOR among terminal harvest, broodstock for the integrated hatchery, and natural spawning in the river when NOR are insufficient to meet the spawning escapement goal. Will abundances of NOR and total integrated hatchery Coho be monitored in-season as a means to adjust terminal area harvests when needed? If so, will the terminal fishery in the Yakima River be reduced to achieve a minimum escapement goal for the unclipped (NOR) spawning component of the integrated population? In other words, the harvest plan should describe if and how the harvest rate will be adjusted, at least in the terminal area, to match the productivity of natural origin Coho and to meet the escapement targets.

The YN response provides an estimate of the approximate harvest rate on fin-clipped (HOR) Coho but does not mention the harvest rate on unclipped Coho caught by non-selective gear such as gillnets or killed incidentally following catch and release. Will tribal commercial and subsistence fisheries retain unclipped Coho? What is the current harvest rate on unclipped Coho?

Appendix A adequately covers most tasks related to harvest monitoring and evaluation proposed by the proponents. The marking of Coho with fin clips, CWT, and PIT tags should facilitate selective fishing on segregated hatchery Coho while enabling accurate monitoring of HOR and NOR in the integrated population. However, the proponents still need to clarify how the monitoring and evaluation activities will influence decision making under adaptive management (i.e., update section 3 of the 2012 Master

Plan). A few of the tasks in Appendix A (e.g., A.5.1.4, A6.1, A.8.1.5) indicate that M&E findings would influence future decision making, but decision trees or contingency plans are not presented.

Appendix A describes all tribal fisheries in the mainstem Columbia and Yakima rivers but states that *"The fisheries monitoring methodologies used by WDFW and other state and federal agencies are outside the scope of this document."* Even so, the Master Plan should include a brief description of the level of monitoring effort by non-tribal agencies to demonstrate that the overall data set expected from monitoring will be adequate to evaluate the success of the plan. The ISRP is concerned that non-tribal fisheries (commercial and sport) in the ocean, mainstem Columbia, and Yakima River, if not managed appropriately, might undermine the success of the project by significantly reducing Coho returns to the Yakima River. Documenting this information would also help to demonstrate co-management of Yakima River Coho by YN and the agencies.

YN 2019 Response: ***Back to INDEX.***

- **The 2012 Master Plan indicates that Coho harvest rates would be set to ensure a total of 5,000 spawners (NOR + HOR) in Phase 3 and 3,500 NOR spawners in Phase 4. It is unclear in the YN response if these targets still hold. The targets should be specified clearly in the revised Master Plan and should be based on the estimated current capacity of the Yakima River watershed.**

  AHA modeling results were updated to incorporate the most recent data on SARs, broodstock requirements for the program, and current and expected future harvest rates in the ocean and freshwater fisheries. Ocean and lower Columbia River Coho fisheries are mark-selective. Harvest rates for unmarked Coho are limited by the ESA and have averaged 15-20% (for the two fisheries combined) in recent years. Marked fish are harvested at two to three times this rate in the ocean and lower Columbia River fisheries. Upper Columbia River (Zone 6) tribal and subsistence harvests are not mark-selective. In AHA modeling, we assumed that in Phase 3, the Zone 6 harvest rate would be reduced from its current level (35%) to 20% to allow more adult Coho to reach the spawning grounds. In Phase 4, we assumed the Zone 6 harvest rate would increase to 35% (the current harvest rate) to meet the program's tribal harvest goals.

  The updated SARs for both NORs and HORs are lower than the assumptions used in the 2012 Master Plan. Therefore, the escapement estimates for Phases 3 and 4 are lower than in the 2012 Master Plan AHA results. In Phase 3, an average of 4,400 spawners (NOR+HOR, including 1,200 NORs) are expected in the Yakima River basin. In Phase 4, an average of 4,100 spawners (NOR+HOR, including 1,800 NORs) are expected (see Tables 2-24 and 2-25 in the response to Comment 3 above). As explained above, these results assume ocean, Lower Columbia River, and terminal harvest rates in Phases 3 and 4 are the same as current harvest rates in these fisheries, and the Zone 6 harvest rate is 20% in Phase 3 and 35% in Phase 4. The Zone 6 harvest rate may be adjusted as needed to meet Yakima integrated program escapement goals.

- **The revised Master Plan should specify a decision rule for allocating NOR among terminal harvest, broodstock for the integrated hatchery, and natural spawning in the river when NOR are insufficient to meet the spawning escapement goal.**

During Phase 3, the integrated Coho program will use 30% natural-origin broodstock (NOB). In Phase 4, the program will use 100% NOB. We have provided a sliding scale broodstock collection table that shows the number of NOB to be collected for various NOR run sizes. This table illustrates the transition from Phase 3 to Phase 4. The maximum percentage of the NOR run size to be collected for broodstock is 30%. The remainder of returning NORs will be allocated to escapement or terminal harvest. Table 2-16 displays the transition from 30% pNOB to 100% pNOB based on the NOR run size. To ensure that no more than 30% of the NOR run is collected for brood, the program will collect no more than one in three NORs returning to Prosser Dam for brood.

Table 2-16. Sliding scale broodstock collection table for Phases 3 and 4 of the Yakima integrated Coho program (assumes 810 broodstock are needed for a full program). Phase 3 pNOB goal is 30%, even if run size exceeds 810 NORs. Phase 4 pNOB goal is 100%.

NOR Run Size at Prosser	NOB	HOB	pNOB	Percent of NOR Run Size Collected for Brood	Approx. NOR Escapement	NOR Terminal Harvest
300	90	720	11%	30%	200	0%
500	150	660	19%	30%	350	0%
810	243	567	30%	30%	550	<2%
1,200	360	450	44%	30%	800	<2%
1,800	540	270	67%	30%	1,200	<2%
2,400	720	90	89%	30%	1,600	<5%
3,000	810	0	100%	27%	1,900	10%
3,600	810	0	100%	22%	2,400	12%

- **The YN response provides an estimate of the approximate harvest rate on fin-clipped (HOR) Coho but does not mention the harvest rate on unclipped Coho caught by non-selective gear such as gillnets or killed incidentally following catch and release. Will tribal commercial and subsistence fisheries retain unclipped Coho? What is the current harvest rate on unclipped Coho?**

Estimated harvest rates on Coho under the current, Phase 3, and Phase 4 scenarios are provided in Table 2-23. Currently, Yakima hatchery releases are not externally marked. In Phases 3 and 4 of the proposed program, segregated (Prosser Hatchery) releases will be adipose fin-clipped. Integrated program releases will be code-wire tagged (CWT) but will not be adipose fin-clipped. Marked Coho are subject to additional selective harvest in the ocean and Lower Columbia River fisheries. The harvest rates on marked Coho in these fisheries are approximately three times the harvest rate on unmarked Coho (i.e., harvest rates on segregated HORs in Phases 3 and 4). The Zone 6 tribal fisheries will not be selective for marked Coho, thus we assumed the same harvest rates for marked and unmarked fisheries. Similarly, terminal tribal fisheries are not selective. The current harvest rate on unmarked Coho is 47% (current scenario for NORs and HORs).

Current harvest rate assumptions for Coho are based on information in the Joint Staff report (WDFW and ODFW 2018b), adult returns of marked Coho to Bonneville Dam, adult returns of marked Coho to Prosser Dam, and terminal harvest rate data collected by WDFW. The total exploitation rate for

NORs in the ocean and non-tribal mainstem Columbia River fisheries, which primarily take place in the lower Columbia River (zones 1-5), is approximately 15-20% (WDFW and ODFW 2018). In AHA, we assume a total exploitation rate of 17% for these two fisheries combined. The harvest rate on Yakima Coho in the upper Columbia River was estimated as 35% based on the average number of Coho harvested in Zone 6 and the terminal fishery between Bonneville and Prosser Dams (calculated as the difference between Yakima-destined adult returns to Bonneville and adult returns to Prosser) divided by the number of adults passing Bonneville Dam. The terminal harvest rate assumption of 1% is based on recreational harvest data from WDFW (Table 2-23). Tribal terminal harvest is negligible.

The Phase 3 and 4 harvest rate assumptions are based on the current harvest rate assumptions for these fisheries, with two exceptions. First, during Phase 3, it is assumed that Zone 6 harvest of unmarked (integrated program) fish would be reduced to 20% to allow more adult returns to recolonize the spawning grounds in the Yakima Basin. Second, segregated program releases will be ad-clipped during Phases 3 and 4 (they are not currently externally marked). Therefore, the harvest rates in ocean and lower Columbia fisheries for segregated HORs are assumed to be three times the harvest rates for unmarked fish. Integrated HORs will not be externally marked, and therefore harvest rates for integrated HORs are the same as for NORs in Phases 3 and 4.

Table 2-23. Harvest rate assumptions for Yakima Coho during Phase 3 and Phase 4.

	Current		NORs		Integrated HORs		Segregated HORs	
	NORs	HORs	Phase 3	Phase 4	Phase 3	Phase 4	Phase 3	Phase 4
Ocean Harvest Rate	11%	11%	11%	11%	11%	11%	30%	30%
Lower Columbia Harvest Rate (Zone 1-5)	7%	7%	7%	7%	7%	7%	24%	24%
Upper Columbia Harvest Rate (Zone 6)	35%	35%	20%	35%	20%	35%	35%	35%
Terminal Harvest Rate	1%	1%	1%	1%	1%	1%	1%	1%
Total Exploitation Rate	47%	47%	34%	47%	34%	47%	66%	66%

- **The proponents still need to clarify how the monitoring and evaluation activities will influence decision making under adaptive management (i.e., update section 3 of the 2012 Master Plan).**

  Coho parr and smolt release to adult survival rates will be used to adaptively manage the hatchery release strategy (for example, we may choose to adjust the proportion of parr vs. smolt releases, release locations, release timing, and/or release numbers based on information learned). Adjustments to the release strategy will take place if insufficient HOR adults return to meet program goals (i.e., broodstock collection, escapement, and harvest). Additional information is provided in Chapter 5 of the revised Master Plan.

  Adult returns to Prosser Dam (NOR and HOR counts) will be used to determine pNOB. The program goal is to collect no more than 30% of NORs as broodstock. The sliding scale broodstock table provided above (Table 2-16) will be used to allocate NORs among broodstock, escapement and harvest.

- **The Master Plan should include a brief description of the level of monitoring effort by non-tribal agencies to demonstrate that the overall data set expected from monitoring will be adequate to evaluate the success of the plan.**

  Non-tribal fisheries in the ocean, lower Columbia, and upper Columbia River are monitored by state and federal agencies, and harvest is reported in annual PFMC and Joint Staff reports, such as the most recent reports cited in this Appendix and the updated Master Plan (i.e., PFMC 2019, WDFW and ODFW 2018a, WDFW and ODFW 2018b). A wide array of public and private entities in the Yakima Basin are collaborating on the implementation of the Integrated Plan. These include the U.S. Bureau of Reclamation, the Washington Dept. of Fish and Wildlife, NOAA Fisheries, the U.S. Fish and Wildlife Service, the U.S. Forest Service, the U.S. Army Corps of Engineers, the Mid-Columbia Fisheries Enhancement Group, the Kittitas Conservation Trust, the Yakima Basin Fish and Wildlife Recovery Board, a host of irrigation associations and irrigators, Central Washington University, Heritage University, and many more. Every year the Yakama Nation hosts a 2-day Yakima River Basin Science and Management Conference to review implementation and monitoring efforts and results. Anyone interested in learning more about collaborative entities and monitoring efforts in the Basin is more than welcome to attend.

Yakima River Summer/Fall Chinook

ISRP Comment No. 8: *As currently framed, the integrated summer/fall run Chinook and Coho salmon reintroduction and harvest programs are not consistent with guidelines in the 2009 Fish and Wildlife Program (hereafter "Program"). For the summer/fall Chinook program, there is not clear evidence that the habitat will be suitable to maintain a self-sustaining population for the foreseeable future. Also the Master Plan clearly identifies that anticipated overall harvest level of 63% (transition phase; based on values in Table 3-7) is likely incompatible with restoring a self-sustaining population, and is therefore inconsistent with the Program. As described in the Program under Artificial Production Primary Strategies (pages 18-19), integrated programs can be used to complement habitat improvements by supplementing populations up to the sustainable carrying capacity of the habitat. For restoration, the Program states, "that eventually, after appropriate habitat improvements, they [the populations] will become self-sustaining."*

AND

Under these guidelines, the ISRP expects that Ecosystem Diagnosis and Treatment (EDT), or some other modeling, will be used to demonstrate a reasonable likelihood that habitat restoration will lead to capacity sufficient for the population to be self-sustaining. Under Harvest Strategies (pages 19-20), the Program states "there is little point in recommending funding for implementation of a subbasin plan when the objectives of the plan cannot be reached under current harvest regimes. If, for example, a wildlife mitigation project aims to re-establish an elk herd in a subbasin and existing regulations allow for overly aggressive harvest of the herd while it is first being established, there is good reason to doubt that the project will succeed." Under monitoring and reporting in the Harvest Strategies section the Program states "manage harvest to ensure that risk of imprecision and error in predicted run size does not threaten the survival and recovery of naturally spawning populations."

Therefore, the Master Plan should describe an experimental approach to evaluate natural spawning by hatchery returns and natural fish with recent hatchery pedigree to gain the information needed to determine a sustainable harvest rate for the natural population.

ISRP 2013 Response Comment 8: Some of the ISRP comment was not included in the YN response, so we included the text in the ISRP comment above.

EDT values, which are typically based on expert opinion, were presented as a means to justify the recruitment curves for transition and long-term periods. A modest increase in productivity and a large increase in capacity are expected, if the $4 billion Integrated Plan is implemented. EDT results should be viewed with a high degree of uncertainty, especially when they are linked with a very expensive Plan that has yet to be approved for funding. For the current period, EDT values indicate a sustainable Chinook summer/fall population (Table 6). It would be worthwhile to estimate adult return per spawner for natural Chinook and Coho salmon that exist today and compare this with values assumed by EDT (e.g., approximately 3 for the fall Chinook run according to Table 6—a fairly productive stock). Are these stocks sustainable today and at current harvest rates, and if not, when will a sustainable population occur?

The YN response agrees that the harvest rate on summer run Chinook will be very high and likely not sustainable in the near term. However, they suggest the overall run, which includes the summer and fall components, will be maintained with hatchery fish. This approach does not meet Fish and Wildlife Program guidelines because the early component of the salmon run would be over-harvested. Harvest rates should be tailored to the productivity of each component of the run during both the transition phase and the long-term phase.

However, the YN response also states that it will work with WDFW to ensure a minimum early (summer) Chinook escapement of 500 fish in the transition period and 1000 fish in the long-term. An escapement goal approach, such as this, is preferable because it provides some protection for the sustainability of the natural population. The escapement goal approach is also consistent with the Fish and Wildlife Program. But it is not clear how an escapement goal approach would be implemented while also harvesting surplus hatchery fish produced by the segregated programs. In Step 2, the harvest strategy for Coho and Chinook (integrated and segregated programs) should clearly demonstrate that the natural populations will be sustainable, including all migration timing components.

Fig. 4 shows an assumed long-term exploitation rate of 67.7%. It would be worthwhile to check this assumption by providing references for wild Chinook populations that support a 68% harvest rate over the long-term, e.g., 30 or more years. Harvest rates must be based on populations that have accurate escapement counts rather than indices that often underestimate escapement leading to high harvest rate estimates.

The YN cite results from the Integrated Plan that estimate proposed habitat improvements in the basin will provide a 123% increase in baseline numbers of summer Chinook. This latter estimate assumes that all the habitat restoration actions proposed in a recovery plan for Yakima steelhead have been implemented. A small gain in summer Chinook from a baseline value of 3,308 to 3,694 (~12%) was predicted if only ongoing habitat improvements were completed. The Master Plan should consider both of these possibilities instead of assuming that full habitat restoration will occur.

Finally, the sponsors indicate that continued releases of Wells Dam Chinook will occur, if necessary during the transition phase, to maintain the summer or early portion of the summer/fall integrated program. The Master Plan indicates that the summer/fall integrated program has two goals: 1) to mitigate for lost harvest opportunities and 2) to reintroduce summer Chinook back into the Yakima River. As we understand it, Chinook salmon captured at Wells Dam will be the summer run founders. As progeny from these fish return to the Yakima River, some will be allowed to spawn naturally and others will be used as hatchery broodstock. Fish used as broodstock will be mated with individuals with similar maturation timing. Over time, fish originating from summer Chinook collected at Wells are expected to cross with early returning fall Chinook to create a single homogenized summer/fall population. As indicated above, harvest rates and other factors may significantly reduce early run fish necessitating a continual reinsertion of hatchery fish to keep this life history strategy present in the Yakima River. The Master Plan should indicate what contingencies will be implemented to restore harvest opportunities if a natural summer or early run of Chinook cannot persist in the Yakima River. Will the early run be discontinued, or will the early run program rely entirely on hatchery production?

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- **It would be worthwhile to estimate adult returns per spawner for natural Chinook and Coho salmon that exist today and compare this with values assumed by EDT (e.g., approximately 3 for the fall Chinook run according to Table 6—a fairly productive stock). Are these stocks sustainable today and at current harvest rates, and if not, when will a sustainable population occur?**

  The adult productivity values assumed by EDT and used in the AHA model are adults recruits per spawner, rather than adult returns to the basin per spawner. This metric is based on the total number of adults recruited to the population before harvest removals. Currently, summer and fall-run Chinook hatchery releases are not marked or tagged and it is not possible to distinguish hatchery and natural-origin returns. Therefore, we were unable to estimate the number of recruits or returns per natural spawner for Yakima River summer/fall Chinook.

  Coho adult returns per spawner were estimated to be 0.89 for return years 2004-2018 (Fiander et al. 2019). The Coho population has averaged slightly less than 1 adult return per spawner and is not currently sustainable. The habitat restoration work currently underway in the Yakima Basin would increase the productivity and capacity of the Yakima subbasin for both Coho and Chinook.

- **The YN response agrees that the harvest rate on summer run Chinook will be very high and likely not sustainable in the near term. This approach does not meet Fish and Wildlife Program guidelines because the early component of the salmon run would be over-harvested. Harvest rates should be tailored to the productivity of each component of the run during both the transition phase and the long-term phase.**

  Currently, the total exploitation rate on Yakima River summer-run Chinook is estimated to be 60%. Based on AHA modeling for the current scenario, we estimate that approximately 1,500 Yakima-destined summer-run Chinook (out of a total run size of about 2,500) are harvested in the ocean and freshwater fisheries. Of these 1,500 harvest fish, more than 1,250 are harvested in the ocean and lower Columbia River fisheries, which are not managed by the YN. The Yakama Nation will continue to work with fisheries managers to establish harvest rates in these areas that maintain the sustainability of impacted stocks.

  We have, however, adjusted the summer-run Chinook terminal harvest rate assumption for the Transition Phase in response to the ISRP's comments. Currently, the terminal fishery is closed during the time when the majority of summer-run Chinook pass through the lower Yakima River. The terminal fishery opens on Sept. 1 annually and mostly harvests fall-run Chinook. Therefore, the current terminal harvest rate assumptions in AHA are 14% for fall-run Chinook and 3% for summer-run Chinook. When sufficient summer-run Chinook return to support a terminal fishery, the opening date of this fishery may be changed and terminal harvest of summer-run Chinook may increase. Until then, the total exploitation rate on summer-run Chinook during the transition phase is assumed to be 60%. This is similar to the harvest rate of Okanogan River summer/fall Chinook (58% for NORs and 70% for HORs) which appears to be sustainable.

- **The escapement goal approach is consistent with the Fish and Wildlife Program. But it is not clear how an escapement goal approach would be implemented while also harvesting surplus hatchery fish produced by the segregated programs. In Step 2, the harvest strategy for Coho and Chinook (integrated and segregated programs) should clearly demonstrate that the natural populations will be sustainable, including all migration timing components.**

  Segregated program Coho and Chinook will be adipose fin-clipped and will be subject to additional mark-selective fishing in the Columbia River sport fisheries. Surplus segregated fish returning to the hatchery may be easily identified and removed for distribution to tribal members for subsistence purposes. Integrated program fish will be coded-wire tagged but will not be externally marked. The harvest rate on these fish will be lower in selective fisheries allowing them to escape in higher numbers to the basin.

  In addition, the Tribe has provided sliding scale broodstock collection tables for both the integrated Coho and Chinook programs that show terminal harvest levels for various run-sizes, with no harvest occurring at a defined level and increasing harvest as run size increases (Tables 2-16, 3-12 and 3-13). These criteria will help ensure that NOR escapement and broodstock collection goals are achieved and population fitness increases over time by achieving a higher PNI.

Table 2-16. Sliding scale broodstock collection table for Phases 3 and 4 of the Yakima integrated Coho program (assumes 810 broodstock are needed for a full program). Phase 3 pNOB goal is 30%, even if run size exceeds 810 NORs. Phase 4 pNOB goal is 100%.

NOR Run Size at Prosser	NOB	HOB	pNOB	Percent of NOR Run Size Collected for Brood	Approx. NOR Escapement	NOR Terminal Harvest
300	90	720	11%	30%	200	0%
500	150	660	19%	30%	350	0%
810	243	567	30%	30%	550	<2%
1,200	360	450	44%	30%	800	<2%
1,800	540	270	67%	30%	1,200	<2%
2,400	720	90	89%	30%	1,600	<5%
3,000	810	0	100%	27%	1,900	10%
3,600	810	0	100%	22%	2,400	12%

Table 3-12. Sliding scale broodstock collection table for the transition and long-term phases of the Yakima integrated summer-run Chinook program (assumes 620 broodstock are needed for a full program).

NOR Run Size	NOB	HOB	pNOB	Percent of NOR Run Size Collected for Brood	NOR Terminal Harvest	Approx. NOR Escapement
150	0	620	0%	0	0	150
250	0	620	0%	0	0	250
300	0	620	0%	0	0	300
400	120	500	20%	30%	0	280
500	120	500	20%	24%	50	330
600	180	440	30%	30%	50	370
800	180	440	30%	23%	50	570
1,000	310	310	50%	31%	100	590
1,200	310	310	50%	26%	100	790

Table 3-13. Sliding scale broodstock collection table for the transition/long-term phase of the Yakima integrated fall-run Chinook program (assumes 310 broodstock are needed for a full program).

NOR Run Size	NOB	HOB	pNOB	Percent of NOR Run Size Collected for Brood	NOR Terminal Harvest	Approx. NOR Escapement
150	0	310	0%	0	0	150
250	0	310	0%	0	0	250
300	0	310	0%	0	0	300
400	60	250	20%	15%	0	340
500	60	250	20%	12%	50	390
600	90	220	30%	15%	50	460
800	90	200	30%	11%	50	660
1,000	155	155	50%	16%	100	745
1,200	155	155	50%	13%	100	945

- **Fig. 4 shows an assumed long-term exploitation rate for summer Chinook of 67.7%. It would be worthwhile to check this assumption by providing references for wild Chinook populations that support a 68% harvest rate over the long-term, e.g., 30 or more years.**

  As noted above, the harvest rate assumptions for summer-run Chinook have been modified. During the Transition Phase, the total exploitation rate will be 60%, the vast majority of which takes place in the ocean and Lower Columbia River fisheries, which are not managed by YN. During the Long-term

Phase, the total exploitation rate could potentially increase to 64% if the terminal fishery opens earlier and more summer-run Chinook are harvested during the terminal fishery.

Okanogan River summer/fall Chinook harvest rates have exceeded 60% for at least the past eight years (2011-2018; DJWA 2019). The total exploitation rate averaged 68% for HORs and 58% for NORs during this time frame. During this same time period, the number of natural-origin spawners averaged 6,050, exceeding the management target of 5,250 natural-origin spawners.

- **The Master Plan should indicate what contingencies will be implemented to restore harvest opportunities if a natural summer or early run of Chinook cannot persist in the Yakima River. Will the early run be discontinued, or will the early run program rely entirely on hatchery production?**

  The purpose of the summer Chinook program is mitigation for unavoidable project impacts in the FCRPS. The primary purpose of the mitigation program is to provide harvest opportunity. The Yakama Nation prefers mitigation to restore/replace natural populations where feasible, and if proven not feasible, mitigation can be implemented as hatchery production.

ISRP Comment No. 9: *In the long-term phase of the proposed Master Plan, the assumed average harvest rate is 68% on summer Chinook salmon, a level that seems unrealistic even if significant habitat improvements are made in the watershed. The ISRP believes that natural spawning Chinook populations would not be sustainable at this high harvest rate.* ***Back to INDEX*****.**

ISRP 2013 Response Comment 9: The ISRP appreciates the new analyses to address this issue. We agree that an escapement goal approach, as stated in the response, is preferred as a means to ensure that the early Chinook run is not over-harvested. The Fish and Wildlife Program requires that harvest not impede progress on achieving restoration, and restoration needs to have a self-sustaining natural population as an end point. The ISRP encourages the YN and WDFW to adopt an escapement goal approach, and we look forward to the Step 2 analysis on this subject. In Step 2, the information should identify fisheries and actions that can be used to achieve minimum escapement goals. Scientific justification of the minimum escapement goals is also needed.

The ISRP remains skeptical that this run can sustain a harvest rate of 68% during the transitional or the long-term period. Please provide evidence that wild Chinook can sustain a 68% harvest rate over the long period, i.e., a population with accurate data. As noted above, a detailed harvest strategy that provides for sustainable natural populations is needed for both Coho and Chinook.

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Please see the response to Comment 8 (above), which addresses the harvest strategy for the summer Chinook program.

ISRP Comment No. 10: *In the near term, maintaining the current high harvest rate on the integrated population is not compatible with the Fish and Wildlife Program. The Master Plan should demonstrate, using existing data, how it will achieve a PNI of 0.5 or higher through harvest management, broodstock management, and habitat rehabilitation efforts. Objectives for the target proportion of NOR versus HOR on the spawning grounds should be stated and should be consistent with establishing a self- sustaining population (e.g., see Table 3-6).*

ISRP 2013 Response Comment 10: The YN response notes that a key assumption is a major improvement in habitat condition that supports higher Chinook productivity and similar or higher SAR in the future. The ISRP remains skeptical that the PNI >0.5 can be achieved along with the high average harvest rates (68%) and 5,000 spawners (average) because it is unlikely that the population, especially the early component, will be as productive as assumed in the analysis. The PNI objective might have a better chance of success if harvest rate is allowed to be lower and escapement levels are maintained above some minimum level. Specific plans for harvest, population sustainability, and PNI achievement under various hatchery and natural origin salmon abundances should be addressed in Step 2.

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- **Specific plans for harvest, population sustainability, and PNI achievement under various hatchery and natural origin salmon abundances should be addressed in Step 2.**

The expected outcomes of the hatchery program in each phase were calculated using the All-H Analyzer (AHA) model based on the proposed hatchery strategies and key assumptions about in-basin and out-of-basin conditions. Expected outcomes for the current summer- and fall-run Chinook program and the proposed integrated and segregated programs are shown in Tables 3-23 and 3-24. Total outcomes (from the summer-run, fall-run and URB Chinook programs combined) are summarized in Table 3-23 for the current programs and projected Transition and Long-term Phase outcomes. These are the average long-term outcomes based on AHA modeling using the key assumptions about habitat, fish passage, harvest, and SARs described in section 3.5.2. As noted previously, documentation for the AHA model is provided in HSRG (2009), found at: http://hatcheryreform.us/wp-content/uploads/2016/05/4_appendix_c_analytical_methods_and_info_sources.pdf.

There is substantial uncertainty associated with the SAR assumptions for NORs and HORs used in AHA. This uncertainty has an impact on the program's ability to achieve its harvest and conservation goals.

Table 3-23. Expected outcomes for the current and proposed Yakima Summer/Fall Chinook programs based on All-H Analyzer modeling.

	Current (all releases)	Integrated Summer Chinook – Transition	Integrated Fall Chinook – Transition	Integrated Summer Chinook – Long Term	Integrated Fall Chinook – Long Term	Lower Yakima River Segregated
Hatchery Yearlings	210,000	0	0	0	0	210,000
Hatchery Subyearlings	1,900,000	1,000,000	500,000	1,000,000	500,000	1,700,000
Natural-origin Smolts	84,431	278,146	163,860	697,619	292,096	0

	Current (all releases)	Integrated Summer Chinook – Transition	Integrated Fall Chinook – Transition	Integrated Summer Chinook – Long Term	Integrated Fall Chinook – Long Term	Lower Yakima River Segregated
Ocean Harvest	4,742	5,268	1,264	7,697	1,731	3,618
Lower Columbia Harvest	778	629	225	918	308	644
Zone 6 Harvest	1,461	1,290	414	1,885	567	1,186
Terminal Harvest	831	140	280	953	383	802
Total Harvest	**7,813**	**7,327**	**2,183**	**11,453**	**2,990**	**6,250**
Natural-origin Returns to Basin (brood + escapement)	403	1,357	810	3,050	1,445	0
Hatchery-origin Returns to Basin (brood + escapement + hatchery surplus)	5,116	3,175	1,415	2,804	1,370	4,875
Total Adult Returns to Yakima Basin	**5,519**	**4,532**	**2,225**	**5,855**	**2,815**	**4,875**
Imported Broodstock (HOR)	1,310	-	-	-	-	-
Local Broodstock (NOR)	-	186	93	310	155	-
Local Broodstock (HOR)	-	434	217	310	155	1,200
Natural-origin Escapement	403	1,171	717	2,740	1,290	0
Hatchery-origin Escapement (includes in-basin strays from seg. program)	3,772	2,530	1,170	2,243	1,170	492
Total Escapement	**4,175**	**3,701**	**1,887**	**4,983**	**2,460**	**492**
In-basin Strays from segregated program	3,323	-	443	-	443	443
Out-of-basin Strays (segregated fish straying to other basins)	369					49
Hatchery Surplus	1,344	211	28	251	45	3,232
pNOB	0%	30%	30%	50%	50%	NA
Effective pHOS*	47%	63%	57%	40%	42%	NA
PNI	-	0.32	0.35	0.56	0.54	NA

	Current (all releases)	Integrated Summer Chinook – Transition	Integrated Fall Chinook – Transition	Integrated Summer Chinook – Long Term	Integrated Fall Chinook – Long Term	Lower Yakima River Segregated
Total Run Size (harvest + returns to Basin; includes in-basin and out-of-basin strays from seg. program)	13,701	11,859	4,408	17,307	5,805	11,174

*Assumes HORs have 80% relative reproductive success compared to NORs; i.e., effective pHOS = (HORs*80%)/(HORs*80% + NORs).

Table 3-24. Combined outcomes (by program phase) for the current and proposed Yakima Summer/Fall Chinook programs based on All-H Analyzer modeling.

	Current (includes all releases)	Transition – Integrated and Segregated Programs Combined	Long Term – Integrated and Segregated Programs Combined
Hatchery Yearlings	210,000	210,000	210,000
Hatchery Subyearlings	1.9 million	3,200,000	3,200,000
Natural-origin Smolts	84,431	442,006	989,715
Ocean Harvest	4,742	10,151	13,046
Lower Columbia Harvest	778	1,498	1,871
Zone 6 Harvest	1,461	2,890	3,637
Terminal Harvest	831	1,221	2,138
Total Harvest	7,813	15,759	20,692
Natural-origin Returns to Basin (brood + escapement)	403	2,167	4,496
Hatchery-origin Returns to Basin (brood + escapement + hatchery surplus)	5,116	9,465	9,049
Total Adult Returns to Basin	5,519	11,632	13,545
Imported Broodstock (HOR)	1,310	0	0
Local Broodstock (NOR)	-	279	465
Local Broodstock (HOR)	-	1,851	1,665
Natural-origin Escapement	403	1,888	4,031

	Current (includes all releases)	Transition – Integrated and Segregated Programs Combined	Long Term – Integrated and Segregated Programs Combined
Hatchery-origin Escapement (includes in-basin strays from seg. program)	3,772	3,700	3,413
Total Escapement	4,175	5,588	7,443
In-basin Strays from segregated program	3,323	443	443
Out-of-basin Strays (segregated fish straying to other basins)	369	49	49
Hatchery Surplus	1,344	3,471	3,529
Total Run Size (harvest + returns to Basin; includes in-basin and out-of-basin strays from seg. program)	13,701	27,441	34,287

ISRP Comment No. 11: *For Step 1, the ISRP would also like data on recent program performance and a general timeframe for achieving the transition to the integrated program. This information can then be used in the Master Plan to describe more realistic potential benefits of the project.* ***Back to INDEX.***

ISRP 2013 Response Comment 11:
The YN provided recent performance data for fall Chinook such as total return (NOR and HOR combined) and SAR values for hatchery summer/fall Chinook since 1998. The program should develop metrics for the natural Chinook component by appropriately marking the hatchery fish (e.g., CWT or thermal marks if adipose clip is not used). The YN noted that NOR could not be estimated because hatchery Chinook were not 100% marked.

The YN response noted that the key assumption in the analysis for the summer/fall program is the improvement in Chinook productivity (survival) in response to habitat restoration. The YN stated that habitat restoration will likely take 25 years assuming consistent and full funding is available. The YN also noted that 5000 spawners (average) are needed to trigger Phase 4 and this could be achieved within 10 years assuming SARs similar or better than present. As stated previously, Step 2 will need to include an M&E plan that can be used to evaluate the reliability of the assumptions used to create these results. Step 2 should also include a more realistic scenario for habitat restoration given that the $4 billion Integrated Plan has not been funded and it is highly uncertain whether it would be fully funded and implemented in the near future.

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- **The program should develop metrics for the natural Chinook component by appropriately marking the hatchery fish (e.g., CWT or thermal marks if adipose clip is not used).**

  The proposed program will coded-wire tag (CWT) all integrated program Chinook hatchery releases. All segregated program releases will be adipose fin-clipped and 10% will be coded-wire tagged. This will allow the program to estimate NOR returns to Prosser Dam, collect NOR broodstock for the integrated program, and estimate pHOS and PNI.

- **Step 2 will need to include an M&E plan that can be used to evaluate the reliability of the assumptions used to create these results.**

  The Monitoring and Evaluation Plan for Chinook and Coho is provided as Appendix J of the updated Master Plan.

- **Step 2 should also include a more realistic scenario for habitat restoration given that the $4 billion Integrated Plan has not been funded and it is highly uncertain whether it would be fully funded and implemented in the near future.**

  This comment was addressed in the response to ISRP Comment 1.

Comments by ISRP that were not addressed in the YN response: ***Back to INDEX*.**
The YN did not respond to several ISRP comments. These comments are restated here so that they can be revisited during Step 2.

During Step 2, the ISRP anticipates a comprehensive monitoring and evaluation plan that can document progress against the goals and objectives of the program and will provide information necessary for adaptively managing the program. In particular, the ISRP expects that the sponsors will describe how they will assess possible competition and predation interactions between project Coho and summer Chinook on spring Chinook, steelhead, and other juvenile fishes in the basin, including predation by warm-water fishes and birds in the lower Yakima River. Water reuse at Marion Drain and Holmes Ranch along with salmon incubation at those same sites may increase the risk of disease; therefore, a plan should include monitoring of fish health at these sites. Step 2 should also address the status of the surface water supply at Prosser and describe the final location for the Upriver Bright (UBR) fall Chinook rearing and acclimation site in the lower River. Results of such work should be incorporated into the Yakama Nation adaptive management plan framework.

The ISRP noted that sockeye may bring IHN into the watershed. However, the YN did not provide a response to this issue, such as the steps needed to protect project fish from this virus and the protocols that will be followed if it is found on fish being reared by the project's facilities.

Proposed new and remodeled infrastructure was described and justified to some extent. However, the ISRP did identify some issues that needed additional information. For example, the Master Plan states that 31 concrete raceways (10' wide x 100' long x 3.5' deep) will be built at Prosser for supporting 500,000 Coho salmon. Rationale for 31 raceways should be described, including what the rearing density goal is and why this goal was chosen. Additionally, the YN proposed to add another well at Marion Drain where the current ground water capacity is 800+ gallons per minute. However, the reported maximum use of well water is only 500+ gallons. Additional justification for the new well is needed.

Management plans for spring Chinook, sockeye, and resident fish are not in the Master Plan. The Master Plan should describe the effects of the enhanced in-river salmon fishery on the resident trout population and other salmonids that might co-occur in the fishery.

ISRP 2018 Response Comment:

The ISRP appreciates the comprehensiveness of the M&E plan described in Appendix A. We believe this plan is critical for addressing questions and uncertainties identified in previous ISRP and ISAB reviews. Appendix A appropriately includes objectives, a general approach to address each objective, and a list of tasks. The revised Master Plan should also specify sample sizes and the amount of effort needed to adequately achieve each objective and task. Improvements in genetic techniques like parentage-based tagging (PBT) have provided more powerful monitoring options than were foreseen at the time of writing the 2012 Master Plan. Accordingly, the monitoring and evaluation section of the 2012 Master Plan should be updated to include details of the proposed PBT work.

In addition, the following list of specific questions and comments should be addressed (see YN responses below).

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Specific questions and comments under M&E objective A.1 (Hatchery Monitoring and Evaluation):

1) What is the policy for including jacks in hatchery matings?

   YN Response: The YN has typically used a policy whereby jacks are incorporated into artificial spawning operations in approximate proportion to their abundance in the return and on the natural spawning grounds.

2) What are the performance standards for: (a) broodstock survival prior to spawning, (b) green-egg to eyed-egg survival, (c) eyed-egg to ponding survival, and (d) ponding to parr or smolt release?

   YN Response: Performance standards for in-hatchery and other M&E metrics are summarized in Section 5 of the updated Master Plan in Table 5-1.

Table 5-1. Field and in-hatchery monitoring and evaluation indicators, metrics, methods, and benchmarks for the Yakima Coho and Summer/Fall Chinook hatchery programs.

Monitoring Area	Indicators	Metric	Method	Benchmark
Natural Production	Smolt to adult survival	Adults at Bonneville and Prosser Dams/Smolts at McNary	PIT Tags are used to estimate the total number of NOR juveniles arriving at McNary Dam, and resulting adult production is estimated at Bonneville and Prosser Dams. A spawner recruit analysis will be used to determine total recruitment of NORs.	See Tables 2-20 (Coho) and 3-16 (Chinook) for SAR assumptions. CV < 15%[3]
	Smolts per pre-spawner at Prosser and McNary	Smolts and adults at Prosser Dam (brood year specific), and smolts at McNary.	PIT Tags are used to estimate the total number of juvenile Chinook produced by brood year based on adult and juvenile detections at McNary Dam and Prosser. A spawner recruit analysis will be used to calculate productivity and capacity for the population over time.	See Tables 2-20 (Coho) and 3-16 (Chinook) for productivity and capacity assumptions.
	Natural spawner abundance	NOS + HOS	Coho spawners estimated based on adult returns to Prosser Dam, minus any adults removed for broodstock; Chinook spawners estimated based on adult returns to Prosser plus estimated number of adults spawning below Prosser based on redd expansion.	See Tables 2-19 (Coho) and 3-15 (Chinook) for program goals. CV < 15%
	Relative Reproductive Success (NOS and HOS)	Recruits produced per HOR spawner/recruits produced per NOR spawner.	Genetic samples will continue to be taken from all adults handled at Prosser Dam, all of the hatchery brood, and a subset of juveniles captured in following years at juvenile trapping facilities (primarily Chandler).	HOR RRS of 0.8 that of NORs.
Hatchery Production	Smolt to adult survival	Adult returns to the Yakima Subbasin	CWTs and PIT tags are used to estimate survival rates based on adult returns to the Yakima Subbasin.	See Tables 2-22 (Coho) and 3-19 (Chinook) for SAR assumptions. CV < 15%
	In-hatchery survival	Survival rate by life stage	Hatchery staff will use standard inventory to track the number and survival rates of cultured fish by life stage.	See Tables 2-21 (Coho), 3-17 and 3-18 (Chinook) for in-hatchery assumptions.

[3] Based on guidance from Crawford and Rumsey (2011).

Monitoring Area	Indicators	Metric	Method	Benchmark
	Ecological effects (in-basin predation, competition, disease)	Index of Predation, Competition and Disease Risk	PCDRISK modeling will be used to estimate ecological risk of HORs on naturally produced salmonids and other species.	Index <5%
	Genetic effects (primarily straying to other populations)	Proportion of returning HOR adults that do not return to the Yakima subbasin	PIT Tags and CWTs used to track and identify program fish captured/detected in areas outside of the Yakima subbasin	<5%
	Predation	Piscivory index for HOR juveniles.	Stomach sampling and genetic analysis of stomach content used to develop a piscivory index for HORs	Index <1%
	Minijack Production	Proportion of juvenile hatchery production consisting of minijacks.	Blood samples and visual inspection of gonads will be used to estimate proportion of minijacks in juveniles produced at the hatchery.	<10% of males; CV < 15%
Harvest	Out-of-basin harvest rate and number	Proportion and number of adults harvested in pre-terminal fisheries outside of the Yakima subbasin.	Program fish will be tagged with CWTs and PIT tags. Pre-terminal harvest rates will be developed based on analyses by PFMC and state fisheries management agencies.	Variable based on NOR run size of Columbia River Coho and summer/fall Chinook
	In-basin harvest rate and number	Proportion and number of adults returning to the Yakima subbasin harvested in fisheries within the subbasin.	Fisheries surveys will be used to determine the number of HOR and NOR adults harvested (or incidentally killed) as a result of in-basin fisheries.	See Table 2-23 (Coho) and 3-20 (Chinook) for harvest rates; Tables 2-19 (Coho) and 3-15 (Chinook) for program goals. CV < 15%
Decision Rules	Adult abundance (NOR and HOR)	Number of HOR and NOR returns to Prosser.	Fish arriving at Prosser will be counted daily based on origin (HOR/NOR), age (adults, jacks) and sex.	See Tables 2-19 (Coho) and 3-15 (Chinook) for program goals. CV < 15%
	Run forecast: to determine disposition of adult NORs for in-season management	Return of NORs and HORs to Prosser Dam.	Pre-season adult run-size estimates developed by the co-managers, combined with in-season updates and tracking of program PIT tagged fish will be used to develop the run forecast.	Varies by year
Out-of-basin	Status and Trends	Reporting of PDO, Mainstem Hydropower Operations, Survival rate of other populations, Columbia River Estuary improvements	Summarize and track data reported by others	Variable

3) The proponents state that the general condition of project fish will be assessed prior to release. We assume that this will be conducted by the USFWS pathologists associated with the project. What protocols will be used to make such assessments?

   YN Response: The protocols are described in section A.7 of the M&E Plan (attached). YN staff will work with USFWS fish health specialists to implement disease management protocols and monitor hatchery operations for specific fish pathogens in accordance with the Washington Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines. Specific tasks, including sampling protocols, are described in the M&E plan.

4) Tag retention assessments are planned at release. Procedures to evaluate tag retention are described for PIT tags but not CWT. How will CWT retention be estimated, and will retention be compared for groups tagged in different body positions? Will CWT and PIT tag retention from release to adult return also be assessed? Additionally, 100% of the segregated smolts are supposed to be adipose clipped. What procedures will be used to determine the number of segregated smolts that received adequate adipose clips—those recognizable at the adult stage? Correctly estimating rates of CWT retention and adipose clip quality are important because these data are needed to determine the percentage and number of segregated hatchery Coho that may be misclassified as integrated Coho. Retention of CWTs in integrated Coho is also important since it can be used to estimate how many integrated Coho may be misidentified as natural origin recruits.

   YN Response: As described in Objective A.1.5.7 of the M&E Plan, both PIT tag and CWT retention will be monitored prior to release, including groups tagged in different body locations. Protocols used will be similar to those documented in Knudsen et al. (2009).

5) Include a map of the acclimation sites that will be used in the project.

   YN Response: The release sites are described in detail in the response to ISRP comment 3, including a table listing the location of the acclimation and release sites and a figure showing the sites on a map.

6) It is stated (page 6) that smolt releases will occur primarily from mobile acclimation sites located throughout the Yakima Basin. Yet, elsewhere the proponents state that smolts will only be released below Prosser Dam. Clarification is needed to correct or reconcile these conflicting statements.

   YN Response: Smolts from the integrated program residing at MRS Hatchery will be released from acclimation sites located in the upper subbasins above Prosser Dam. Smolts from the segregated program at Prosser Hatchery will be released below Prosser Dam.

7) Currently the proponents plan to use PIT tag recoveries to estimate adult return rates. Why is this being done if all project fish will be tagged with CWTs? Previous work done on Yakima

spring Chinook, in part by Tribal biologists, demonstrated mortality and tag loss effects in PIT-tagged fish. Both effects may substantially reduce estimated SAR values.

YN Response: Because integrated program fish will not be adipose clipped to minimize selective fishery mortality, CWT presence/absence will be used to enumerate returning integrated fish (with confidence bounds due to potential tag loss or tagging effects). PIT tags are used to estimate juvenile survival to McNary Dam. This is an important metric in evaluating the success of Coho parr vs. smolt releases. Currently, PIT tag detections will also be used to estimate SAR values until we are able to estimate total smolt passage at Prosser Dam annually with reasonable confidence. We understand that tagging effects as documented in Knudsen et al. (2009) apply, and will take those into account in our evaluation and adaptive management efforts.

Specific questions and comments under M&E objective A.4 (Productivity Monitoring and Evaluation):

1) Will genetic analysis (PBT) be used to identify the origin of sampled smolts?

   YN Response: Genetic monitoring and evaluation sampling plans are described in Appendix J under objective A.8. Tasks including collecting genetic samples from adults and juveniles at sampling facilities and from adults used as broodstock. Results will be used to address the following questions:

   1. How is the genetic composition of natural-origin salmon in the Yakima Basin changing over time (e.g., see Williamson et al. 2010 and Hess et al. 2011)?
   2. Are there differences in genetic composition between segregated and integrated hatchery-origin and natural-origin salmon? How is genetic composition of these various components changing over time?
   3. What proportion of the unmarked fish returning to the basin are mis-clipped/tagged hatchery fish.

2) Will adult return-per-spawner (R/S) indices of productivity be calculated for each release strategy (i.e., parr versus smolts)? Because jack returns can complicate R/S assessments of productivity, we urge the proponents to consider basing assessments of productivity on adult female returns per female spawner.

   YN Response: Coho parr and smolts will be differentially marked, allowing indices of productivity such as returns-per-spawner to be calculated for each release strategy. This is a primary objective of the M&E program. We will report female returns per female spawner as well. The release strategy of the integrated Coho program will be adaptively managed based on the M&E results (i.e., adult R/S indices).

3) Will habitat monitoring be adequate to assess the effects of habitat restoration actions and environmental conditions on Coho productivity and the overall benefits from this project?

YN Response: Habitat action effectiveness monitoring is beyond the scope of this Master Plan. The YN will continue to monitor results from ongoing habitat restoration programs throughout the region and monitor the literature for relevance to our work here in the Yakima Basin. For example, Clark and Roni (2018) specifically included some of the habitat restoration actions in the Upper Yakima watersheds in their study demonstrating positive results from such actions. As described in Appendix J, we intend to assess benefits from habitat restoration actions and the integrated Coho, integrated Chinook, and wild steelhead kelt reconditioning programs largely through monitoring and evaluation of trends in natural-origin Coho, Chinook and steelhead juvenile and adult return abundance. The Upper Columbia program, which is very similar to that in the Yakima Basin, is already doing genetic evaluation (empirically testing gains in fitness) in cooperation with a CRITFC basin-wide supplementation evaluation project (see Campbell et al. 2017). Parentage-based tagging may be used to supplement the information being gained from the CRITFC/YN Upper Columbia Coho program in the future. As habitat actions and the proposed hatchery programs progress and additional information is gained, adaptive management will be used to modify program parameters as necessary.

Specific questions and comments under M&E objective A.5 (Ecological Interactions Monitoring and Evaluation):

1) Will project fish be released into areas covered by current surveys to examine possible impacts on Non-Target Taxa of Concern (NTTOC)? A map showing the areas being sampled for such impacts should be included in the Master Plan.

   YN Response: During the Phase 1 period, the YN completed several studies to evaluate predation and competition by hatchery coho with listed and sensitive species (Dunnigan 1999; Murdoch and Dunnigan 2002; Murdoch and LaRue 2002; Murdoch et al. 2004; Murdoch et al. 2005). Results of these studies indicate low predation rates and species-specific habitat segregation (YN 2007). These findings are also consistent with Pearsons and Temple (2007) and Temple et al. (2017) who studied ecological impacts of spring Chinook and Coho supplementation in the upper Yakima Basin and concluded that early stages of salmon supplementation did not impact non-target taxa studied beyond predetermined containment objectives (e.g., abundance, condition, size, biomass). Monitoring and evaluation will continue to the extent that resources allow.

2) What efforts will be made to investigate interactions between released Coho parr and other resident native fish species while the project parr reside in the areas of reintroduction? The risks and impacts to native fishes should be taken into account when choosing the location of release sites and the number of parr to be released at each site.

   YN Response: Coho release strategies were described in detail in the response to ISRP Comment 3 (above). The selection of one or more release strategies for individual tributaries considered both abiotic and biotic factors including the size and quality of available habitat, presence or absence of other sensitive species, and logistical constraints (i.e., accessibility). The foundation and biological justification for generating optimal release numbers are based on natural production estimates from the Ecosystem Diagnosis and Treatment (EDT) model. Adjustments were made to release numbers to account for a reduced fitness factor of hatchery fish that may lack the natural productivity and relative fitness of a fully adapted natural population (i.e., resulting in higher mortality rates than NOR parr). In a review of relative fitness of hatchery and natural salmon, Berejikian and Ford (2004) reported the relative fitness of hatchery salmon ranges from approximately 20% to as high as 100% depending on the species, brood source, and number of generations the hatchery line has experienced. For our purposes, we assumed a 50% relative fitness factor for hatchery origin Coho.

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This submittal provides the response of the Yakama Nation to the comments offered by the Independent Scientific Review Panel following their review of the Yakima Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan (Project No. 1988-115-25; ISRP 2012-13). These responses first address comments on the Yakima coho program followed by the summer/fall Chinook program.

Yakima River Coho Program

ISRP Comment No. 1 - Habitat capacity standards for coho salmon were developed, but the values need clarification. In the Master Plan (page 90) habitat improvement is identified as having the potential to increase Yakima River coho production by 26 percent. In Appendix E, key assumptions under recent past productivity is given as 34 coho smolts per spawner and capacity of smolts is 72,059. Under Phase 4, smolts per spawner is 93 and capacity is 256,720 smolts. This future performance is substantially more than the 26 percent increase that was estimated on page 90. The Master Plan needs to provide a reasonable likelihood that habitat restoration will lead to this level of improvement or modify the future production values.

Yakama Nation Response No. 1:

The increase in coho abundance described in the Master Plan results from two factors: 1) habitat improvement (as noted by the ISRP), and 2) increased fitness due to program integration consistent with HSRG guidelines. Each of these factors is discussed below.

Habitat Improvement

The expected increase in coho production from habitat improvement actions in the basin were obtained from the Yakima River Basin Study (USDI BOR 2011)[1]. This study estimated the change in anadromous fish production with the implementation of the Integrated Water Resource Plan (Integrated Plan) for the Yakima River. The Integrated Plan proposes an approach to improving water management in the Yakima River Basin. The goals of the Integrated Plan are to protect, mitigate, and enhance fish and wildlife habitat; provide increased operational flexibility to manage instream flows to meet ecological objectives; and improve the reliability of the water supply for irrigation, municipal supply and domestic uses.

[1] USDI BOR 2011. Yakima River Basin Study: Volume 1-Proposed Integrated Water Resource Management Plan.

The analysis was performed by the Bureau of Reclamation using both AHA and EDT modeling of proposed habitat actions incorporated in the Integrated Plan. These model runs are consistent with those used in the Yakama Nation's Master Plan.

The study looked at the change in baseline coho production for three scenarios:

- Future Without Integrated Plan (FWIP) – Represents fish population increases from habitat improvements that would continue under current programs and funding levels
- Restoration – Represents fish population increases from habitat improvements that would result from implementing the Integrated Plan's fish habitat enhancement program. The actions identified in the Yakima Steelhead Recovery Plan were used as a surrogate in the modeling effort to characterize these habitat improvements.
- Restoration with Fish Passage (Integrated Plan) – Represents fish population increases from the habitat restoration scenario plus providing fish passage at Cle Elum, Keechelus, Kachess, Bumping, and Tieton dams.

The study concluded[2]:

- Habitat conditions under the FWIP would increase baseline coho production by 36 percent.
- Implementing the Integrated Plan would increase coho production compared to the FWIP condition by an additional 26 percent.
- Implementing the Integrated Plan plus the FWIP would increase coho production by 71 percent compared to baseline.

The Master Plan assumes that the Integrated Plan plus the FWIP would be implemented and that habitat would improve as assumed in modeling[3]. The EDT runs for this scenario were incorporated into the Master Plan.

The probability of attaining FWIP habitat conditions are quite high as most of this work has been completed or is in the process of being implemented. Implementation of the Integrated Plan is highly dependent on federal funding. A lack of timely funding could result in its implementation being delayed or extended over a longer time horizon.

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[2] The percent increase for each scenario was calculated from data found in Table 4-7, page 84 of the report and is based on escapement to Yakima River mouth.

[3] Note that the FWIP will be implemented regardless of the outcome of the Integrated Plan.

Increased Fitness

In the past, hatchery releases of coho consisted of fish originating outside of the Yakima River Basin (i.e., not locally adapted). The Master Plan assumes that these fish have a fitness factor 50 percent that of a locally adapted Yakima River population[4]. It is then assumed that by following an integrated hatchery strategy (as defined by the HSRG), population fitness can be improved over time.

The HSRG defines an integrated program as:

> *A hatchery program is an **Integrated Type** if the intent is for the natural environment to drive the adaptation and fitness of a composite population of fish that spawns both in a hatchery and in the wild*. (HSRG et al. 2004)

They further state:

> *For a natural/hatchery composite population at equilibrium (Ford 2002), the influence of the hatchery and natural environments on the adaptation of the composite population is determined by the proportion of natural-origin broodstock in the hatchery (pNOB) and the proportion of hatchery-origin fish in the natural spawning escapement (pHOS). The larger the ratio pNOB/ (pHOS+pNOB), the greater the strength of selection in the natural environment relative to that of the hatchery environment. In order for the natural environment to dominate selection, this ratio must exceed 0.5…*

This ratio is referred to as the proportionate natural influence (PNI). The Master Plan sets broodstock management (pNOB and PHOS) targets such that a PNI greater than 0.67 (actually 0.77) is achieved in Phase 4. AHA modeling indicates that if this PNI value is achieved, fitness can be increased to approximately 91 percent.

ISRP Comment No. 2- Additionally, the assumed SAR of 5% for natural coho production during Phase 3 (Table 3-2) is considerably higher than the observed SAR (avg. 3.6%) during 2000-2010. This assumption likely leads to an overestimation of project benefits.

Yakama Nation Response No. 2:

[4] Note that the historical Yakima River coho population has been extirpated. The focus of the Master Plan is to create a locally adapted coho population in the Yakima River. The 50 percent fitness assumption is the standard value used by the HSRG in AHA modeling.

The 5 percent SAR presented in Table 3-2 of the Master Plan is the SAR that would occur absent harvest, while the 3.6 percent SAR is an index value (Table 2-4) based on adults returning to Prosser Dam (i.e., after the majority of harvest has occurred). Although data on NOR Yakima River coho are not available, it is assumed that ocean and lower Columbia River fisheries historically harvested approximately 15-25 percent of Yakima River NOR coho (PFMC 2012)[5]. Because Yakima River coho are not ESA listed, fisheries above Bonneville Dam harvest approximately an additional 20 percent of the NOR run (unpublished Yakama Nation data files). For this reason, AHA modeling used a 40 percent exploitation rate on NOR coho. After accounting for harvest rates, the two SARs identified above are consistent. The SAR definition in Table 3-2 will be clarified to reflect the harvest assumption in the Step 2 submittal.

ISRP Comment No. 3- Finally, the objective of >5,000 coho spawners during Phase 3 should identify the proportion of NOR and HOR spawners that is consistent with the transition to an integrated program.

Yakama Nation Response No. 3:

We assume this comment refers to the biological objectives presented in Table 3-1. Here we note that Phase 3 has a biological objective of > 5,000 NOR+ HOR spawners. AHA modeling results for Phase 3 indicate that given habitat, harvest, hatchery and hydro assumptions, we expect to have, on average, about 2,500 NOR and about 4,900 HOR coho spawning naturally each year (Figure 1). The program will have a pNOB of 30 percent, pHOS of 63 percent and a PNI of 0.32.

Phase 3 broodstock management is a period of transition to an integrated program (as defined by the HSRG). The target for an integrated program is to achieve a PNI greater than 0.5 and have a pHOS less than 30 percent. These target values will be achieved in Phase 4 of the program (Figure 2). The trigger to move to Phase 4 is a 3 year average run size of 5,000 NOR+HOR[6] coho adults as estimated at Prosser Dam[7]. The data in Figure 1 show how the program uses HOR adults to recolonized stream habitat in Phase

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[5] PFMC 2012. Preseason Report 1- Stock Abundance Analysis and Environmental Assessment Part 1 for 2012 Ocean Salmon Fishery Regulations. Prepared by Pacific Fishery Management Council.

[6] Decision rules for moving between phases will be re-evaluated in Step 2.

[7] Note that the data presented in Figure 1 is the number of spawners. This number will be less than the coho run-size observed at Prosser Dam due to terminal harvest and adult losses as fish migrate from Prosser to the Naches River and Upper Yakima River above Rosa Dam.

3 and then how hatchery influence is reduced in Phase 4 through decreased hatchery production and broodstock management.

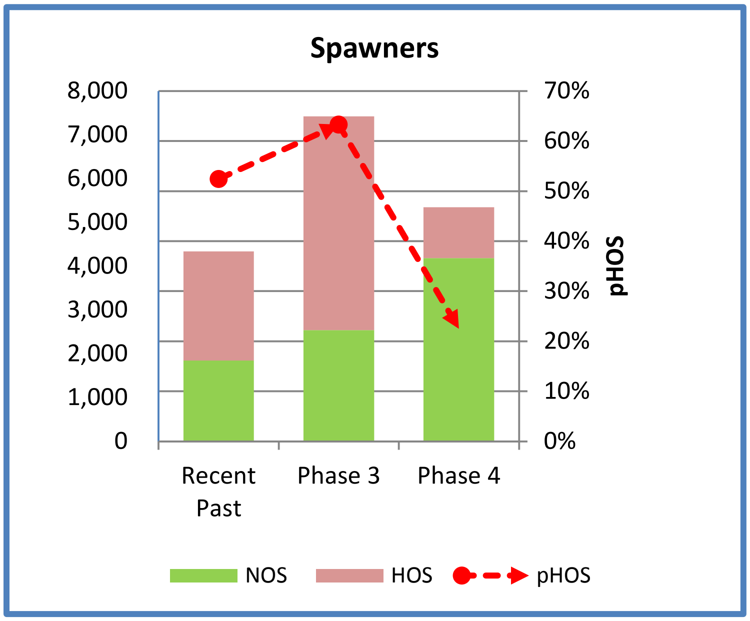


Figure 1. Estimated pHOS, natural-origin (NOS) and hatchery-origin spawning coho for the recent past, Phase 3 and Phase 4 of the Yakama program.

ISRP Comment No. 4- A response is also requested for a succinct and complete summary table showing recent program performance for coho and Chinook salmon along with a table that provides proposed program metrics. The summary table should include metrics such as numbers of broodstock required, anticipated fecundity and eggs required, numbers of progeny produced and released, required post release life-stage survival. These data requirements, or "report card" metrics, were recently summarized by the ISRP in its review of the Lower Snake River Compensation Plan's spring Chinook program (ISRP 2011-14).

Yakama Nation Response No. 4:

The information requested by the ISRP is presented below. The data presented for current conditions are based on observed data, EDT habitat analysis or assumed values.

Coho

The key assumptions used in AHA modeling are the metrics that will be monitored for the coho program. These data are presented in Figure 2. The in-hatchery data specifically requested by the ISRP are included in Table 1. Table 2 contains the biological objectives for the program and recent coho performance data is included in Table 3.

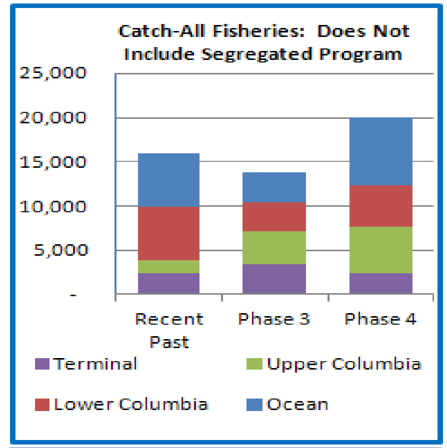
Harvest data are lacking on Yakima River-origin coho because few fish have been coded wire-tagged. AHA modeling assumed that NOR and HOR Yakima River coho have an exploitation rate of approximately 40 and 60 percent, respectively. These estimates include coho caught in marine, Columbia River and Yakima River fisheries.

Table 1. In-hatchery production requirements and performance metrics for Yakima River HOR coho.

	Recent Past	Phase 3	Phase 4-Integrated	Lower Yakima River Segregated
Broodstock Required	456	655	300	502
Pre-spawn Mortality	0.05	0.05	0.05	0.05
Fecundity	3,000	3,000	3,000	3,000
Eggs Required	600,000 to 2.0 million	1,100,000	450,000	770,000
Egg-to-Smolt Survival Rate	0.7 +/- 10%	0.7 +/- 10%	0.7 +/- 10%	0.7 +/- 10%
Juveniles Released	500,000 (range 400,000 to 1.6 million parr and yearling combined)	700,000 (30 percent yearling, 70 percent parr)	300,000 (Yearling)	500,000 (Yearling)
Juvenile to Adult Total Survival Rate (HOR)	1.51%	1.27%	2.09%	2.09%

Yakima Coho [Return](#)

	Imported Broodstock	Biological	Transition Local Brood	Adapt Integrated Local Brood	Harvest Segregated Stepping Stone
Natural Production	**Recent Past**	**Targets**	**Phase 3**	**Phase 4**	**Prosser**
Productivity (Smolts/Spawner)	34		34	93	
Capacity (Smolts)	72,059		72,059	256,720	
SAR	5.00%		5.00%	5.00%	
Fitness	0.50		0.50	0.91	
PNI	0.04	> 0.75	0.32	0.77	
pHOS	52%	< 30%	63%	22%	
Ocean Harvest Rate	5%		8%	8%	
Lower Columbia Harvest Rate	23%		8%	8%	
Upper Columbia Harvest Rate	10%		10%	30%	
Terminal Harvest Rate	10%		10%	20%	
Natural Origin Spawners	1,848	> 3,488	2,541	4,183	
Hatchery Production					
Local Brood	100		655	300	502
Imported Brood	356		-	-	-
Total Release	477,603		700,031	299,250	500,745
SAR	1.51%		1.27%	2.09%	2.09%
% HORs spawning naturally	80%		80%	80%	20%
pNOB	2%		30%	75%	
NOB	10		197	225	
NOB as % of NOR escapement	1%		8%	5%	
Ocean Harvest Rate	24%		8%	33%	33%
Lower Columbia Harvest Rate	30%		8%	29%	29%
Upper Columbia Harvest Rate	10%		10%	30%	30%
Terminal Harvest Rate	19%		10%	20%	20%
Expected Catch All Fisheries	15,898		13,896	19,967	9,229
Hatchery Surplus	538		904	297	1,983
Average Terminal HOR Run	3,462		6,779	2,079	3,479
Expected HOS	2,493		4,881	1,164	487
Expected HOS	1,848		2,541	4,183	



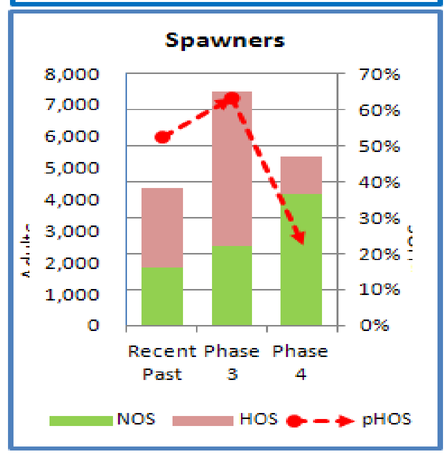


Figure 2. Key assumptions and outcomes for the Yakima River integrated and segregated coho programs (based on AHA analysis).

Table 2. Biological objectives for the two Yakima coho programs in Phases 3 and 4.

Phase 3		Phase 4	
Lower Yakima Segregated Program	Upper Yakima Integrated Program	Lower Yakima Segregated Program	Upper Yakima Integrated Program
	>5,000 (NOR+HOR) spawners		>3,500 NOR spawners
All local broodstock	All local broodstock	All brood from upper Yakima integrated HORs	Integrated broodstock resulting in PNI > 0.75 and pHOS < 30%
Average annual harvest contribution from both programs to all fisheries > 14,000 coho		Average annual harvest contribution from both programs to all fisheries > 20,000 coho	
Average annual harvest contribution from both programs to Zone 6 and Yakima River fisheries > 5,000 coho		Average annual harvest contribution from both programs to Zone 6 and Yakima River fisheries > 8,000 coho	

Table 3. Summary of Yakima River coho smolt and adult production and adult SAR for migration years 2000-2010.

Juvenile Migration Year	Hatchery-origin Coho			Natural-origin Coho			Total Smolts	Total Adults
	Chandler Smolts[a]	Prosser Adults[b]	SAR Index	Chandler Smolts[a]	Prosser Adults[b]	SAR Index[c]		
2000	317,655	3,546	1.12%	61,587	1,432	2.33%	379,242	4,978
2001	102,283	166	0.16%	40,605	309	0.76%	142,888	475
2002	197,938	669	0.34%	42,605	1,523	3.57%	240,543	2,192
2003	121,802	505	0.41%	19,970	1,820	9.11%	141,773	2,325
2004	172,611	2,341	1.36%	18,787	472	2.51%	191,398	2,813
2005	353,433	2,612	0.74%	48,393	1,562	3.23%	401,826	4,174
2006	256,572	2,211	0.86%	17,699	1,049	5.93%	274,270	3,260
2007	259,797	3,925	1.51%	16,375	665	4.06%	276,171	4,590
2008	354,973	7,962	2.24%	57,090	1,855	3.25%	412,063	9,817
2009	456,477	3,300	0.72%	110,958	2,408	2.17%	567,435	5,708
2010	307,530	5,615	1.83%	107,539	2,403	2.23%	415,069	8,018
Average	263,734	2,987	1.0%	49,237	1,409	3.6%	312,971	4,395

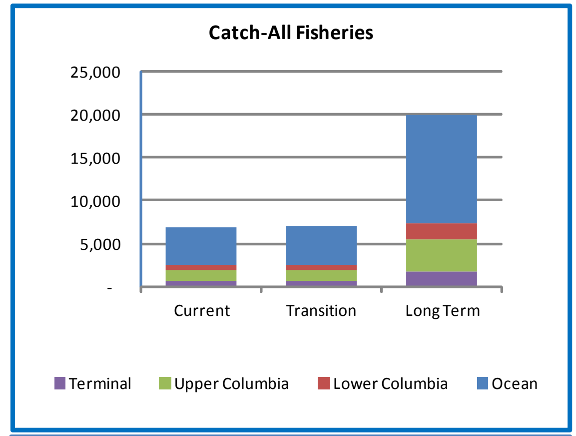
[a] Yakama Nation estimates of coho smolt passage at Chandler
[b] Yakama Nation estimates of age-2 and age-3 coho returns to Prosser Dam for this juvenile migration cohort
[c] Measured as adults at Prosser/ estimated juveniles at Chandler

Summer/Fall Chinook

The following data tables are provided below: AHA modeling assumptions for summer/fall Chinook are shown in Figure 3; in-hatchery production performance metrics are listed in Table 4; and biological objectives are identified in Table 5. Additional performance information is included in Comment Responses 8 through 11.

Yakima Summer-Fall Chinook

			Transition		Long Term		
		Long Term Biological Targets	Summer Early Comp.	Fall Late Comp	Summer Early Comp.	Fall Late Comp	
Natural Production	**Current**		**Transition**	**Transition**	**Integrated**	**Integrated**	**Segregated**
Productivity (Smolts/Spawner)	120		114	120	271	209	
Capacity (Smolts)	573,200		838,396	515,880	2,304,732	1,313,332	
SAR	1.60%		0.98%	1.58%	0.98%	1.58%	
Fitness	0.50		0.50		0.82		
PNI	0.00	> **0.5**	**0.00**		**0.69**		
Total pHOS	43%	< **30%**	**50%**		**25%**		
Seg pHOS	43%	< **10%**	**25%**		**8%**		
Ocean Harvest Rate	35%		43%	35%	43%	35%	
Lower Columbia Harvest Rate	8%		9%	8%	9%	8%	
Upper Columbia Harvest Rate	16%		20%	16%	30%	16%	
Terminal Harvest Rate	11%		12%	11%	11%	11%	
Natural Origin Spawners	2,390	> **7,000**	**444**	**2,277**	**1,418**	**5,619**	
Hatchery Production							
Local Brood	-		237	191	450	191	-
Imported Brood	614		-		-		647
Total Release	1,700,391		500,605	502,000	1,028,075	502,000	1,700,491
SAR	0.3%		0.57%	0.34%	0.45%	0.34%	0.34%
%HORs spawning naturally	80%		75%	75%	95%	75%	95%
% of Seg. Strays spawning above Prosser/Marion			0%	50%	0%	40%	
pNOB	0%		0%	0%	60%	50%	0%
NOB	-		-	-	270	96	-
NOB as % of NOR escapement	0%		0%	0%	19%	2%	0%
Ocean Harvest Rate	35%		43%	35%	43%	35%	35%
Lower Columbia Harvest Rate	8%		9%	8%	9%	8%	8%
Upper Columbia Harvest Rate	16%		20%	16%	30%	16%	16%
Terminal Harvest Rate	11%		12%	11%	11%	11%	11%
Hatchery Surplus	563		76	50	4	119	145
Average Terminal HOR Run	3,662		1,182	860	1,683	860	2,914
Expected HOS	2,461		870	2,013	1,593	1,739	
Expected NOS	2,390		444	2,277	1,418	5,619	



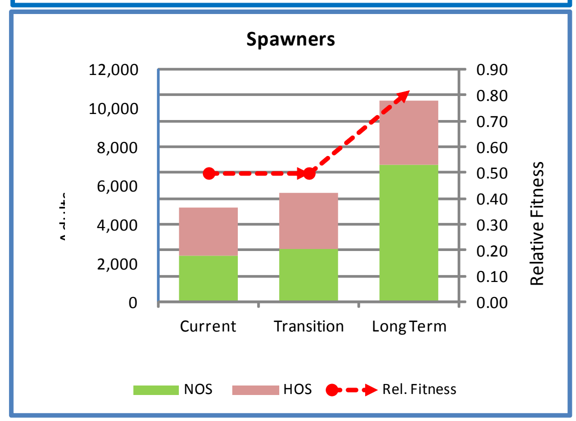


Figure 3. Key assumptions and outcomes for the Yakima River summer/fall Chinook program

Table 4. In-hatchery production requirements and performance metrics for Yakima River summer/fall Chinook.

		Recent/Past	Transition			Long Term		
	Parameter	Falls-Subyearlings	Summer-Yearling	Summer-Subyearling	Fall-Subyearling	Summer-subyearling	Fall-Subyearling	Upriver Bright
Hatchery Parameters	Broodstock Required	614	118	118	191	450	191	647
	Pre-spawn Mortality	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	Fecundity Eggs Required	5,300 2,145,000-2,900,000	4,930 340,000	4,930 280,000	5,300 556,000	4,930 600,000-1,156,000	5,300 556,000	5,300 2,145,000
	Egg-to-Smolt Survival Rate	0.9 +/- 5%	0.74 +/- 10%	0.9 +/- 5%	0.9 +/- 5%	0.9 +/- 5%	0.9 +/- 5%	0.9 +/- 5%
	Juveniles Released (assumes yearlings)	1,700,000 (range 900,000 to 2.4 million)	250,000	250,000	500,000	1,000,000 (Option 2) 500,000 (Option 1)	500,000	1,700,000
	Juvenile to Adult Total Survival Rate (HOR)	0.34%	0.77%	0.38%	0.34%	0.45%	0.34%	0.34%

Table 5. Biological objectives for the Yakima summer/fall Chinook program and the Yakima Upriver Bright (URB) harvest program by phase.

Transition Phase		Long-Term Phase	
Yakima Summer/Fall Chinook Program	Yakima URB Harvest Program	Yakima Summer/Fall Chinook Program	Yakima URB Harvest Program
5,000 natural- and hatchery-origin adults past Prosser on average	Meet US vs. Oregon combined URB fall Chinook escapement targets to McNary Dam	7,000 natural-origin adults past Prosser on average	Meet U.S. vs. Oregon combined URB fall Chinook escapement targets to McNary Dam
Average >6,000 adult contribution to all fisheries from both programs combined		Average >18,000 adult contribution to all fisheries from both programs combined	
Average of 1,800 adults harvested in Zone 6 and terminal fishery from both programs combined		Average of 5,000 adults harvested in Zone 6 and terminal fishery from both programs combined	
Adult run timing from July 1 to December 1; population of summer/fall Chinook spawning between Prosser Dam and Roza Dam in the Yakima River and up to the mouth of the Tieton River in the Naches River subbasin; achieve sustainable natural production long term.			
Expand harvest opportunities temporally and spatially within the Yakima Basin.			

ISRP Comment No. 5: How will the program keep hatchery salmon straying to less than 5%, and what is the disposition of returning hatchery adults that are not used for broodstock in the hatchery?

Yakama Nation Response No. 5:

Multiple methods are proposed to maintain the pHOS levels defined in the Master Plan for both the integrated and segregated coho programs.

- Release Location: The segregated fish will be reared and released from the Prosser facility in the lower portion of the Yakima River, downstream of historical natural coho production areas. As a result of rearing fish on a unique water source, coho homing rates to the hatchery are expected to be high.

- Use of Adult Trapping Facilities: Adult trapping facilities will be located at Prosser Dam, Prosser Hatchery denil ladder and trap, Sunnyside Dam and Roza Dam. Although the trapping efficiency of the Prosser (37 percent) and Sunnyside (unknown) dams will be less than 100 percent, the facility at Roza Dam can remove 100 percent of the HOR adult population if needed.
- Harvest Policy: Harvest policies will be crafted to manage HOR removal from the system. The Yakama Nation and the WDFW will use time, origin (HOR/NOR), gear guidelines and daily bag limits to remove HORs.
- Program Size: If pHOS levels are exceeded, the Yakama Nation will consider reducing hatchery production levels (or release locations) to achieve the standards.

Surplus hatchery fish may be distributed to Tribal members for subsistence purposes or used in stream nutrient enhancement projects in the basin.

ISRP Comment No. 6- What is the current level of mini-jack production, how do they affect existing population metrics, and what efforts are being used to reduce mini-jacks?

Yakama Nation Response No. 6:

Yakama Nation biologists have not observed coho mini-jacks returning to hatchery facilities or when conducting stream population surveys. They have observed some coho juveniles remaining in fresh water in the colder systems and migrating out as age 2 or 3 year smolts. The Yakama Nation is aware that the production of mini-jacks from hatchery operations is a concern and future operations will be monitored for the production of mini-jacks. In the Klickitat River, mini-jack production for spring Chinook was reduced by altering fish size at release and modulating growth rates (YN unpublished data). In the Yakima River Basin, research has shown that the production of mini-jack spring Chinook could be reduced with a more naturalized (slower) growth regime (Larson et al. 2004 and 2006) [8]. If coho mini-jacks become an issue, similar strategies would be tested.

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[8] Larson et al. 2004. Assessment of High Rates of Precocious Male Maturation in a Spring Chinook Salmon Supplementation Hatchery Program. Transactions of the Am Fisheries Society 133:98-120.
Larson et al. 2006**.** Growth Modulation Alters the Incidence of Early Male Maturation and Physiological Development of Hatchery-Reared Spring Chinook Salmon: A Comparison with Wild Fish. Transactions of the Am Fisheries Society 135:1017-1032

ISRP Comment No. 7- How will harvest rates be controlled in order to rebuild the natural populations in the upriver basin? What is the planned harvest rate in relation to run size and how will this objective be achieved? Is there a plan to allocate harvests in the Yakima River to non-tribal sport anglers as well as Tribal anglers?

Yakama Nation Response No. 7:

Annual harvest rates are established each year based on legal agreements and policy direction provided by the treaty, Yakama Nation and state and federal entities. The parties set harvest rates based on run abundance as well as the status of the population (e.g., ESA listings). The Yakama Nation will work within the existing system to achieve harvest rates consistent with program objectives. Additionally, the Yakama Nation has the authority to reduce its share of the coho harvest in any year to meet escapement objectives.

For terminal harvest within the Yakama River Basin, the Yakama Nation works with WDFW to set harvest regulations (including the use of HOR selective sport fisheries). The number of coho caught each year will be apportioned to both tribal and non-tribal fishers.

A sliding scale harvest rate based on run size will be developed for the program, with lower rates corresponding to low run-size and vice versa. Based on the biological objectives for the program (Table 5), harvest rates will be set to ensure that 5,000 NOR + HOR spawners in Phase 3 and 3,500 NOR spawners in Phase 4 are achieved whenever possible. A more detailed harvest schedule will be provided in the Step 2 submittal after consultation with WDFW.

Yakima River Summer/Fall Chinook

ISRP Comment No. 8: As currently framed, the integrated summer/fall run Chinook and coho salmon reintroduction and harvest programs are not consistent with guidelines in the 2009 Fish and Wildlife Program (hereafter "Program"). For the summer/fall Chinook program, there is not clear evidence that the habitat will be suitable to maintain a self-sustaining population for the foreseeable future.

AND

Under these guidelines, the ISRP expects that Ecosystem Diagnosis and Treatment (EDT), or some other modeling, will be used to demonstrate a reasonable likelihood that habitat restoration will lead to capacity sufficient for the population to be self-sustaining.

Yakama Nation Response No. 8:

EDT modeling results for Yakima River summer/fall Chinook were used in AHA modeling of the program (see Appendix E to the Master Plan- Population Tab; Row 10). The EDT data are presented in Table 6 below.

Table 6. EDT generated Beverton-Holt adult productivity and capacity values for Yakama River summer and fall Chinook for the transition and long-term periods.

EDT Output	Transition Period		Long Term	
	Summer	Fall	Summer	Fall
Adult Productivity	1.52	3.00	2.20	3.20
Adult Capacity	11,134	12,897	18,719	20,081

The values for the transition period represent current habitat conditions, while the long-term values reflect expected improvement in habitat with initiation of actions underway or proposed.

As noted by the ISRP, as a separate population, summer Chinook (early adult migration timing) are likely not sustainable given expected harvest rates, SAR and passage survival rates. Fall Chinook (late adult migration timing) on the other hand are sustainable given the EDT/AHA analysis. However, the goal of the program is not to create two separate populations but instead to reestablish historic life history diversity and spatial structure of natural spawning summer/fall Chinook in the Yakima River upstream of Prosser; and begin to expand harvest opportunities temporally and spatially within the Yakima Basin (see page 27 of the Master Plan). In the transition phase, these goals are met through the continued release of hatchery fish in the basin. Long term, the goals are expected to be met by significantly improving habitat and reducing program reliance on naturally spawning hatchery fish. Although harvest rates are high for the summer component of the run, rates for the combined summer/fall population are such that a sustainable population can be maintained but spatial structure and life-history diversity goals may not be achieved.

However, since the completion of the Step 1 submittal, it appears that Columbia River harvest management for Chinook may change. Indications are that HOR selective fisheries may be implemented in the lower Columbia River to increase escapement of NOR fish. To take advantage of the policy change, the summer portion of the program will not be ad-clipped. Non-ad-clipped fish would have to be released by sport and commercial fishers, resulting in increased escapement of the summer component of the run to the Yakima River.

To help ensure program success, the Yakama Nation will collaborate with the WDFW to set terminal harvest policy in the transition and long-term periods to achieve a minimum early (summer) Chinook adult escapement target of 500 NOR and 1,000 NOR adults, respectively (see Response 9 below for rationale). An analysis of the likely increase in summer/fall Chinook adult returns will be developed in Step 2 after consultation with WDFW.

Habitat Improvement

The level of habitat improvement required to achieve long term summer/fall Chinook goals is consistent with that predicted by the Bureau of Reclamation in the Integrated Water Resource Management Plan (USDI BOR 2011). In that document the Bureau assumes that the proposed water and habitat improvement actions would increase summer and fall Chinook abundance over the baseline condition (our transition phase) by 123 percent and 57 percent, respectively (See Table 4-7 of the 2011 report). The EDT inputs developed by the Bureau were used as the data for the Master Plan.

ISRP Comment No. 9: In the long-term phase of the proposed Master Plan, the assumed average harvest rate is 68% on summer Chinook salmon, a level that seems unrealistic even if significant habitat improvements are made in the watershed. The ISRP believes that natural spawning Chinook populations would not be sustainable at this high harvest rate.

Yakama Nation Response No.9:

As stated in the Master Plan, the EDT and AHA models were run to estimate program performance for both the transition and long-term phases and also to determine broodstock management required to achieve PNI greater than 0.5 in the long term. This analysis was included in Appendix E (AHA Files) of the Master Plan.

The assumptions used in the long-term analysis are shown in Figure 4 below, followed by an analysis of spawning escapement, harvest, etc. (Figure 5). These results show that all objectives for the program will be achieved if the assumptions are accurate. Part of the M&E plan being developed for the program will focus on these key assumptions.

The ISRP does not believe that the Chinook population will be sustainable at the high harvest rate assumed for early (summer) Chinook (68 percent). However, the Tribe will not manage summer Chinook as a separate population but instead as a single summer/fall Chinook population made up of both components. The data in Figure 5 indicate that when combined, the summer/fall Chinook population will be sustainable long term even if the early component of the run (summer) fails to meet expectations[9].

The summer component is designed to restore historical run-timing, spatial structure and life history diversity traits. Our current assumptions show that, on average, about 3,000 summer Chinook will spawn naturally each year. Of these, about 50 percent will be NOR adults produced by either NOR or HOR fish spawning naturally. This analysis indicates that the program can achieve its purpose and is therefore consistent with the Fish and Wildlife Program.

Regardless of the above conclusion, to examine the sustainability question posed by the ISRP we ran the AHA model with all hatchery production eliminated in the long-term condition (Figure 6). The analysis showed that, on average, 236 (range of 25 to 966) summer Chinook could spawn naturally under the current set of assumptions.

To explore how a reduction in harvest rate might affect adult production, the AHA model was rerun with terminal fishery harvest rate set to zero. This is a reasonable scenario because the Tribe has the greatest amount of control in establishing regulations for this fishery. Hatchery production was also set to zero. The results of this analysis are presented in Figure 7. Resulting NOR abundance for the long term condition averaged 1,394 fish and ranged from 221 to 3,901; a substantial increase in NOR abundance[10].

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[9] One outcome may be that hatchery production of the early component needs to continue for the foreseeable future to meet spatial structure and life history objectives. Even if the summer component was not successful, the establishment of a naturally spawning Chinook population would still achieve the sustainability goal, although not the spatial structure/diversity objectives. As habitat improves, the fall component may naturally expand run-timing.

[10] Assumes fully fit Chinook population.

Based on this analysis, the Yakama Nation will set (with WDFW) terminal harvest policy in the transition and long term periods to achieve a minimum early (summer) Chinook adult escapement target of 500 and 1,000 NOR adults, respectively[11]. Additionally, the Tribe will provide a sliding scale harvest table that shows harvest rates for various run-sizes; with no harvest occurring at a defined level and increasing as run size increases. These criteria will help ensure that run-timing, spatial structure and broodstock goals are achieved and that population fitness increases over time (by achieving a higher PNI).

This information will be provided in the Step 2 submittal as it requires coordination with WDFW.

[11] Time, location and gear regulations will be used to ensure that the minimum NOR escapement targets are achieved.

Biological Significance: LOW					LOW PNI: 0.58		LOW PNI: 0.72		LOW PNI: -	
Subregion/Subbasin: Yakima River	*Species/Race*: Summer-Fall Chinook			*Population Management Intent:*	Harvest Adaptation		Harvest Adaptation		Harvest Cons w Habitat	
				Harvest&Hatchery Strategy:	Integrated Harvest Program		Integrated Harvest Program		Integrated Harvest Program	
Yakima Summer-Fall Chinook				*Population Component*	Early (Summer)		Late (Fall)		Lower River Hatchery	
					Integrated		Integrated		Segregated Program	
Hab	Productivity (Adult)	Ad. Capacity			2.20	18,719	3.20	20,081	0.00	0
	Min NOR Escape	% Kelt			1		1		1	
	Smolt Productivity	Sm. Capacity			331.3	2,819,141.6	256.0	1,606,464.0	0.0	0.0
Hydro	Ocean Surv Baseline SAR	Vary? (Y/N)			0.012 / 0.010	y	0.033 / 0.016	y	0.033 / 0.016	Y
	Juv Passage Surv.	Adult Passage			0.84	0.97	0.52	0.92	0.52	0.92
	Adjusted Productivity	Adj. Capacity			3.24	27,564	4.04	25,362	0.00	0
Harv	*Active parameter documentation to see assumptions for selective and non-selective fisheries.*	Harv - Marine	NORs	HORs	0.430	0.430	0.350	0.350	0.350	0.350
		Harv - L. Mainstem	NORs	HORs	0.090	0.090	0.080	0.080	0.080	0.080
		Harv - U. Mainstem	NORs	HORs	0.300	0.300	0.160	0.160	0.160	0.160
		Harv-Terminal	NORs	HORs	0.110	0.110	0.110	0.110	0.110	0.110
		Total Exploitation Rate	NORs	HORs	0.677	0.677	0.553	0.553	0.553	0.553
Hatch	Broodstock Composition		pNOB-Goal	pHOS-Goal	60%	25%	50%	25%		
			pNOB-Realized	pHOS-Realized	66%	47%	50%	20%		100%
	Purpose	Type	Cons/Harv/Both	Int/Seg/Step/None	Both	Int	Both	Int	Harv	Int
	Broodstock by Source		Local / Imported	Smolt Release	450 /	1,028,075	191 /	502,000	/ 647	1,700,491
	Brood Exported (from HOR Surplus)		Export Goal/Realized	Strays				1,100		
	Destination for HOR Returns		% to Hatchery	% to Nat. Spawn.	5%	95%	25%	75%	5%	95%
	Productivity of Hatchery Fish		Recruits/Spawner	Fitness? [Y / N]	10.5	y	9.0	y	9.0	y

Figure 4. Summer/fall Chinook AHA analysis assumptions for the long-term period (Appendix E of Master Plan).

	Early (Summer)			Late (Fall)			Lower River Hatchery		
	Integrated			Integrated			Segregated Program		
	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave
NOR Escapement	5,562	217	1,418	21,253	2,250	5,619	0	0	0
HoS Total Escapement (plus strays)	4,921	854	1,593	5,310	921	1,739	8,395	1,458	2,749
HoS Effective Escapement	3,937	683	1,275	3,435	803	1,392	5,877	1,021	1,924
Total Natural Escapement (NoS & All HoS)	10,483	1,139	3,012	26,563	3,259	7,357	8,395	1,458	2,749
Total Harvest	23,736	3,142	7,256	31,950	3,790	8,760	11,786	2,047	3,860
Hatchery Broodstock (includes imported)	450	408	443	191	191	191	647	647	647
Surplus at Hatchery	79	-	4	557	19	119	443	77	145
Total Runsize (minus external strays & imported BS)	34,748	4,621	10,715	58,161	6,072	15,327	20,624	3,582	6,754

Figure 5. AHA estimates of HOR and NOR early (summer) and late (fall) Chinook escapement, harvest, broodstock, surplus broodstock and total run-size for the long term (assumes 11% terminal harvest rate and a 68% exploitation rate on the early (summer) component of the summer/fall population).

	Early (Summer)			Late (Fall)			Lower River Hatchery		
	Integrated			Integrated			Segregated Program		
	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave
NOR Escapement	966	25	236	18,291	2,158	5,449	0	0	0
HoS Total Escapement (plus strays)	-	-	-	-	-	-	-	-	-
HoS Effective Escapement	-	-	-	-	-	-	-	-	-
Total Natural Escapement (NoS & All HoS)	966	25	236	18,291	2,158	5,449	0	0	0
Total Harvest	2,082	55	508	24,394	2,878	7,267	0	0	0
Hatchery Broodstock (includes imported)	-	-	-	-	-	-	-	-	-
Surplus at Hatchery	-	-	-	-	-	-	-	-	-
Total Runsize (minus external strays & imported BS)	3,049	80	743	42,685	5,037	12,716	0	0	0

Figure 6. AHA estimates of NOR early (summer) and late (fall) Chinook escapement, harvest, broodstock, surplus broodstock and total run-size for the long term (assumes 11% terminal harvest rate; 68% exploitation rate on the early (summer) component of the summer/fall population).

	Early (Summer)			Late (Fall)			Lower River Hatchery		
	Integrated			Integrated			Segregated Program		
	Max	Min	Ave	Max	Min	Ave	Max	Min	Ave
NOR Escapement	3,901	221	1,394	18,291	2,158	5,449	0	0	0
HoS Total Escapement (plus strays)	-	-	-	-	-	-	-	-	-
HoS Effective Escapement	-	-	-	-	-	-	-	-	-
Total Natural Escapement (NoS & All HoS)	3,901	221	1,394	18,291	2,158	5,449	0	0	0
Total Harvest	7,054	400	2,521	24,394	2,878	7,267	0	0	0
Hatchery Broodstock (includes imported)	-	-	-	-	-	-	-	-	-
Surplus at Hatchery	-	-	-	-	-	-	-	-	-
Total Runsize (minus external strays & imported BS)	10,954	621	3,915	42,685	5,037	12,716	0	0	0

Figure 7. AHA estimates of NOR early (summer) and late (fall) Chinook escapement, harvest, broodstock, surplus broodstock and total run-size for the long term (assumes no terminal harvest; 64% exploitation rate on the early (summer) component of the summer/fall population).

ISRP Comment No. 10: In the near term, maintaining the current high harvest rate on the integrated population is not compatible with the Fish and Wildlife Program.

The Master Plan should demonstrate, using existing data, how it will achieve a PNI of 0.5 or higher through harvest management, broodstock management, and habitat rehabilitation efforts. Objectives for the target proportion of NOR versus HOR on the spawning grounds should be stated and should be consistent with establishing a self-sustaining population (e.g., see Table 3-6).

Yakama Nation Response No. 10:

We assume that the near term refers to the transition period and respond accordingly.

We agree that high harvest rates are an issue for not only the Yakima summer/fall Chinook program but also for the population above Wells Dam. These fish provide much of the catch in the ocean fishery for both the US and Canada. WDFW is also working to implement selective fisheries in the Columbia River that should reduce impacts to NOR adults. These efforts are on-going and will take substantial time and effort to implement. As noted previously, to increase escapement levels to the basin, the summer component of the population will not be ad-clipped and the terminal fishery will be managed to achieve a minimum spawning escapement.

The purpose of the hatchery program in the transition period is to provide harvest and restore historical run timing, spatial structure and diversity to the summer/fall Chinook population. In short, the transition period builds a locally adapted hatchery population with characteristics similar to the historical summer/fall population. These fish will re-colonize the target habitat as a step towards a long-term sustainable summer/fall Chinook population.

The results of AHA modeling (Figure 8) indicate that program purpose can be achieved even under the high harvest exploitation rate (68 percent) assumed for the early (summer) component of the run. On average, the program results in approximately 1,300 early-arriving summer Chinook and 4,200 late-arriving fall Chinook spawning naturally, for a total average escapement of about 5,500 summer/fall Chinook. Approximately 7,000 summer/fall Chinook are estimated to be harvested in fisheries. Lastly, sufficient adults return to the basin to achieve broodstock needs. Because the program meets it purpose (harvest and re-colonization) for this phase of the program, it is consistent with the Fish and Wildlife Program.

Although some NOR fish will be used for broodstock in the transition phase, an objective to fully integrate the program to meet HSRG guidelines (e.g., PNI > 0.5) does not begin until the long-term phase is initiated. This phase starts when the 5-year running average NOR + HOR escapement exceeds 5,000 adults. At such time, the program will become an integrated harvest augmentation program, where the assumptions presented in Figure 3 will be used to manage the Chinook program. If these assumptions are met, AHA modeling indicates that the PNI objective will also be met. As described below, it is reasonable to expect that these assumptions will be met within a foreseeable future. A PNI of > 0.5 will be achieved in the long term through a combination of actions.

- A new adult collection facility will be constructed at Sunnyside Dam to remove NOR fish for broodstock and to control pHOS levels. It is expected that 50 percent of the HORs passing this point may be collected at this new facility.
- HOR fish will be removed at the Prosser Dam fish ladder/trap. The Prosser Dam fish ladder/trap is capable of removing ~25 percent of the total number of Chinook HOR's passing this point. If a higher removal percentage is required, fish wheels and traps can be used at the entrance or exits of the other two ladders.
- Marion Drain Hatchery Releases- Fish released from Marion Drain have a high homing fidelity due to its groundwater-influenced water source. A fish wheel is operated here to remove adults for use as broodstock. The fish wheel is able to remove the majority of the adults returning to this location when needed.
- Beach Seining- HORs can be removed from areas near the acclimation sites using a simple beach seining system if needed. The ability to remove HORs will depend on fishing effort and riverine conditions.
- The URB component of the program will be released from acclimation facilities (equipped with adult collection capabilities) located near the mouth of the Yakima River (at RM 10). In the past, these fish were released at Prosser (RM 46.8), which resulted in large numbers of hatchery fish entering the middle watershed. Returning adults are expected to home to the new site and be collected/harvested at high rates (> 90 percent).
- Improved habitat- Habitat actions will increase the productivity and abundance of the natural population; larger NOR returns make it easier to achieve PNI and pHOS targets.
- Harvest- Fishery time, location, gear and bag limit harvest regulations will be used to ensure adult escapement targets are achieved each year.

	Early (Summer)			Late (Fall)		
	Transition			Transition		
	Max	Min	Ave	Max	Min	Ave
NOR Escapement	1,602	136	444	9,384	797	2,277
HoS Total Escapement (plus strays)	2,658	461	870	6,148	1,067	2,013
HoS Effective Escapement	1,861	323	609	4,106	936	1,612
Total Natural Escapement (NoS & All HoS)	4,260	634	1,314	15,532	1,948	4,290
Total Harvest	9,259	1,436	2,887	15,994	1,714	4,176
Hatchery Broodstock (includes imported)	237	237	237	191	191	191
Surplus at Hatchery	650	-	76	462	-	50
Total Runsize (minus external strays & imported BS)	14,406	2,271	4,514	30,805	2,394	7,332

Figure 8. AHA estimates of HOR and NOR early (summer) and late (fall) Chinook escapement, harvest, broodstock, surplus broodstock and total run-size for the Transition period (assumes 11% terminal harvest rate; 68% exploitation rate on early (summer) component of the summer/fall population).

ISRP Comment No. 11: For Step 1, the ISRP would also like data on recent program performance and a general timeframe for achieving the transition to the integrated program. This information can then be used in the Master Plan to describe more realistic potential benefits of the project.

Yakama Nation Response No. 11:

Recent program performance for the summer/fall Chinook program is illustrated in Table 7 and Table 8 below[12]. The information in Table 7 was provided in the Master Plan. The data in Table 8 is based on CWT analysis and will be included in the Step 2 submittal. The CWT data were used in AHA modeling to set the expected SAR for the fall Chinook component of the program.

The average number of summer/fall Chinook returning to the Yakima River is 4,915 adults (NOR+ HOR). The average number of adults (HOR + NOR) passing Prosser Dam averaged 4,200 (Table 7). These numbers were achieved with an annual release of 1.6 million out-of-basin-origin hatchery fish each year (Table 8).

The CWT analysis presented in Table 8 indicates that the 1.6 million URB release at Prosser produced an average of about 5,600 adults/jacks. In contrast, the proposed program will release 1.7 million acclimated URB fall Chinook to the lower Yakima River (RM 10), well downstream of Prosser Dam. The AHA analysis assumes that these fish will have a total survival rate similar to the observed data and will therefore produce a similar number of adults. Thus the benefits of this program are highly likely to be achieved. The Master Plan also anticipates that because the 1.7 million URB fish will be released lower in the basin, their survival may be higher than historic rates as they will not migrate through much of the lower river (i.e., below Prosser Dam) which has poor habitat and large predator populations.

In the transition period, the summer/fall program will release 1.0 million summer/fall Chinook to areas upstream of Prosser Dam. According to the AHA analysis (Figure 8), total NOR and HOR adult returns to the spawning grounds will average approximately 5,600 (combined summer and fall component), ranging from about 2,500 to 20,000 fish. The key to achieving these numbers is the productivity of the natural habitat as SARs for hatchery fish are based on observed data for the Yakima and other basins (Upper Columbia River above Wells summer/fall Chinook).

[12] Data is provided for fall Chinook; insufficient CWT data is available on the more recent summer Chinook releases.

If modeling assumptions are correct, the AHA analysis indicates that the 5,000 NOR + HOR trigger (5-year average) that moves the program to the long-term phase should be met within 10-years of program implementation. For this to occur, marine survival rates will need to be similar or better than those observed for the 1998-2008 period.

The ability of the program to meet long-term objectives will depend highly on the timing and effectiveness of habitat actions, especially water actions being considered as part of the Integrated Water Resource Management Plan. This process will likely take 25 years to fully implement if funding is provided on a consistent basis.

Table 7. Estimated fall Chinook return, escapement, and harvest in the Yakima River, 1998-2010.

	Total Return		Escapement (NOR +HOR)[1]				WA Recreational Harvest	
			Above Prosser		Below Prosser			
Run Year	Adult	Jack	Adult	Jack	Adult	Jack	Adult	Jack
1998	1,743	106	1,064	84	645	22	34	0
1999	4,056	43	1,876	20	2,046	23	134	0
2000	4,557	1,138	1,371	922	2,931	194	255	22
2001	5,886	869	3,651	660	1,293	151	942	58
2002	13,369	211	6,146	95	4,923	116	2,300	0
2003	10,092	193	4,796	79	3,874	73	1,422	41
2004	5,825	271	2,862	85	2,231	140	732	46
2005	3,121	45	1,920	22	491	7	710	16
2006	2,299	67	1,499	29	363	10	437	28
2007	1,318	461	892	240	194	26	232	195
2008	3,403	208	2,739	124	137	17	527	67
2009	3,315	772	2,381	591	424	106	510	75
Average	4,915	365	2,600	246	1,629	74	686	46

[1] Because not all HOR fish are marked, it is not possible to estimate NOR proportion of the total run.
Source: WDFW and YN databases.

Table 8. Number of hatchery summer/fall Chinook released, total survival rate, total fish production and number harvested by brood year (1998-2008).

Brood Year	Number Released	Total SAR	Total Adults and Jacks	Estimated No. HOR Harvested
1998	1,700,000	1.45%	24,628	8,736
1999	1,695,037	0.87%	14,750	7,405
2000	1,701,527	0.17%	2,940	1,302
2001	1,698,286	0.42%	7,114	4,294
2002	1,771,129	0.71%	12,575	2,007
2003	1,748,200	0.02%	379	96
2004	1,912,676	0.33%	6,302	1,692
2005	1,883,328	0.02%	356	151
2006	1,700,000	0.13%	2,166	765
2007	789,993	0.30%	2,360	1,831
2008	1,647,275	0.02%	272	83
Average	1,658,859	0.40%	6,686	2,828
Adults				
Adults (no jacks)	1,658,859	0.34%	5,640	~2,400

Yakama Nation Response
to ISRP 2013-8 Response Review
of the
Yakima Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan
May 23, 2018

This submittal provides the response of the Yakama Nation to the comments offered by the Independent Scientific Review Panel (ISRP) in their response review of the Yakima Subbasin Summer and Fall Run Chinook and Coho Salmon Hatchery Master Plan (Project No. 1988-115-25; ISRP 2013-8). These responses address ISRP comments on the Yakima River coho program only. A list of acronyms used is provided at the end of this document.

ISRP 2013 Comments and YN Responses

ISRP 2012 Comment 1*: Habitat capacity standards for coho salmon were developed, but the values need clarification. In the Master Plan (page 90) habitat improvement is identified as having the potential to increase Yakima River coho production by 26 percent. In Appendix E, recent past productivity is given as 34 coho smolts per spawner and capacity of smolts is 72,059. Under Phase 4, smolts per spawner is 93 and capacity is 256,720 smolts. This future performance is substantially more than the 26 percent increase that was estimated on page 90. The Master Plan needs to provide a reasonable likelihood that habitat restoration will lead to this level of improvement or modify the future production values.*

ISRP 2013 Response Comment 1:
The sponsors state that two factors – habitat improvement and fitness gains in coho caused by implementing an integrated hatchery program – will significantly increase the capacity of the Yakima River to produce smolts. Estimates for how habitat improvements in the Yakima River may increase coho smolt abundance were based on data presented in the Yakima River Basin Integrated Water Resource Management Plan. In the Integrated Plan, the potential production of coho in the Yakima River was estimated for three different levels of habitat restoration. In the first instance, it is assumed that the Integrated Plan is not implemented but that ongoing restoration activities are continued. In the second scenario, the habitat restoration actions in the Integrated Plan are implemented but fish passage into the basin's upper reservoirs has not taken place. The final estimate assumes that all seven parts of the Integrated Plan have occurred including passage into upper reservoir habitats. A gain of 36% from a baseline figure of 8,806 adult coho is predicted to occur under option one while gains of 63.5% and 71.1% are expected to occur under options two and three. The Master Plan assumes that option three will occur. This assumption is highly uncertain because implementing the full Integrated Plan is expected to cost $4 billion and depends upon federal funding that has yet to be secured.

The YN also assigned a 50% fitness value to the current coho salmon used in the restoration program and anticipates a 91% fitness value when the integrated program is fully implemented with a PNI of 0.75 and pHOS of 30%.

EDT modeling was used to estimate the productivity and capacity of the habitat to produce coho under each phase of the Integrated Plan. These estimates were used in the All-H Analyzer (AHA model) to predict the effects of various levels of habitat restoration on coho abundance. The reliability of these estimates depends upon the quality of the data inputs used. In Step 2, the analysis should identify whether the inputs into the model were based on empirical data or expert opinion. In either case, the gains in coho abundance presented in the Integrated Plan should be regarded as hypotheses and not certainties. Additionally, restoration actions specifically designed for coho were not included in the Integrated Plan. Instead, estimated benefits to coho abundance were based on the presumed effects of habitat actions in the Yakima steelhead recovery plan.

The Master Plan includes the untested assumption that locally adapted coho from an integrated hatchery program would be twice as fit as coho from out-of-basin populations. Currently, coho returning to the Yakima River originate from parents that came from out-of basin populations or were produced by fish that had returned to the Yakima River and were allowed to spawn naturally or were used as hatchery broodstock. The YN anticipates that an integrated hatchery program will facilitate the incorporation of locally adapted traits into the Yakima River coho population which will bring about an increase in their overall productivity. Based on these assumptions, the YN estimates that the current smolts-per-spawner of 34 fish would increase to 58 fish through habitat improvement and implementation of integrated water management (34 x 1.71). If using an integrated hatchery strategy with a PNI of 0.75 improves relative fitness from 0.50 to 0.91, the anticipated smolts-per-spawner would be 105. The YN should reference literature on wild coho smolts per spawner, including populations of wild coho that meet or exceed the assumed 93 smolts per spawner.

The response to the ISRP provides an adequate explanation for the basis for improved capacity and productivity under Phase 4, assuming the Integrated Plan was fully implemented. However, because the habitat improvements identified in the Integrated Plan may not be fully implemented or may not provide the anticipated benefits to fish, the ISRP concludes that an experimental framework for decision-making and fish production should be employed to establish limits to artificial production consistent with guidelines based on empirical evidence from within the subbasin. Similarly, the guidelines used for fitness improvement under an integrated hatchery strategy were extracted from HSRG assumptions. These assumptions have not been subject to empirical testing or rigorous modeling. There is evidence from the Mid-Columbia coho reintroduction project that selection (re-adaptation) is taking place, but the pace of improvement and level where performance will plateau are unknown. Consequently, at this time, it is unknown what size the natural population might be under restored conditions. Under the Fish and Wildlife Program's artificial production strategies, hatchery releases need to reflect the capacity and productivity of habitat and reintroduction should lead eventually to self-sustaining natural production. Furthermore, under an integrated harvest program with PNI >0.50, the size of the artificial production program is limited by the size of the natural population. The harvest plan should demonstrate how harvest rate will be adjusted to match varying levels of productivity of natural-origin coho. These uncertainties and constraints need to be considered in the Master Plan and decision framework, and described in Step 2.

In Step 2, the sponsors need to clearly indicate how their Monitoring and Evaluation (M&E) plan will be used to test the results of their earlier modeling efforts and assumptions. How much habitat has been restored, and did the habitat restoration activities actually provide expected benefits? Will ISEMP, CHaMP, and/or AEM methods or programs be employed in the basin to help quantify the effects of the habitat restoration activities that have taken place? If not, how will the relationships among habitat restoration efforts and salmonid abundance be examined and assessed? Additionally, the M&E plan should indicate the statistical designs or approaches that will be employed to measure the degree of fitness benefit actually gained by Yakima River coho by using an integrated hatchery program.

For completeness, the Master Plan should describe and provide background information on the data that were used to support the EDT and AHA modeling efforts. For example, as indicated above, a baseline abundance level of 8,806 coho was used for the basin in the Integrated Plan. Where did this value come from? The HGMP for coho shows that the greatest number of adult coho returning to the Yakima based on counts at Prosser Dam was 6,424 fish which occurred in 2010 (Table 3, page 18 in the HGMP; Master Plan Volume 2). Conversely, Table 2.4 (page 15 in Master Plan Volume 1) has different values for total coho returns for years 2008 – 2010. In this Table, almost 10,000 adult coho returned to the Prosser Dam in 2008 and a little more than 8,000 returned in 2010. Which values are correct?

YN Response to ISRP 2013 Response Comment 1:

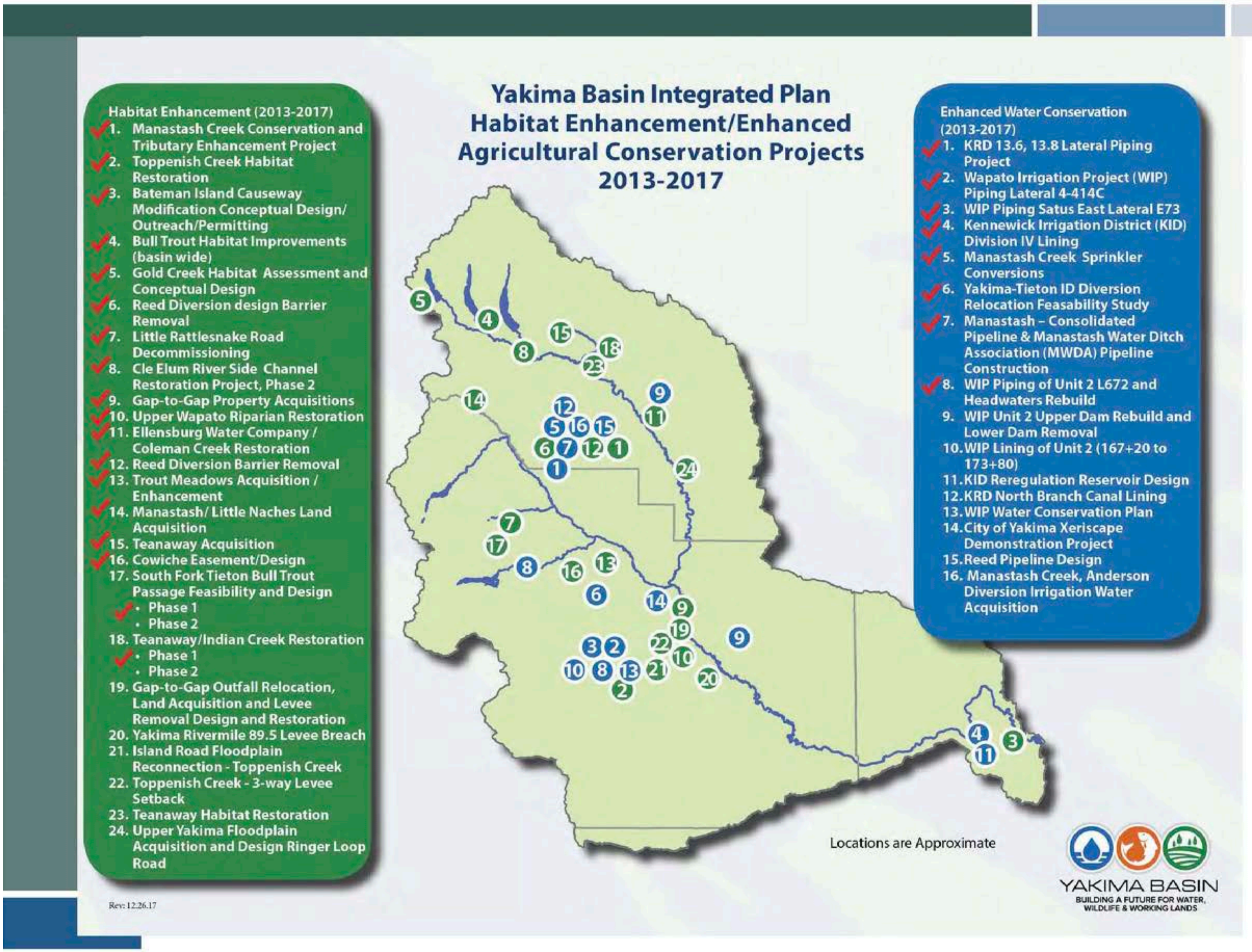
Habitat improvements and the Yakima Basin Integrated Plan
The Yakima River Basin Integrated Water Resource Management Plan (Integrated Plan) was developed by the U.S. Bureau of Reclamation and the Washington State Department of Ecology in conjunction with the Yakama Nation and Yakima River basin stakeholders. The goals of the Integrated Plan are to protect, mitigate, and enhance fish and wildlife habitat; provide increased operational flexibility to manage instream flows to meet ecological objectives, and improve the reliability of the water supply for irrigation, municipal supply and domestic uses. A Final Programmatic Environmental Impact Statement (PEIS) analyzing broad effects of the Integrated Plan on environmental resources was issued in 2012.

Funding for the Integrated Plan comes from a variety of federal sources including:
Reclamation – YRBWEP
BIA – Wapato Irrigation Project improvements

USFWS – Partners for Fish and Wildlife and Yakama Nation Fish Passage Program
BLM – Water Conservation
BPA – Northwest Power and Conservation Council's Fish and Wildlife Program
NMFS – Pacific Coastal Salmon Recovery Fund
NRCS – Regional Conservation Partnership Program
USFS – Land and Water Conservation
USACE – Flood Plain Restoration

An update on the Yakima Basin Integrated Plan provided by the U.S. Forest Service on April 11, 2018 estimated total FY 2017 federal funding for the Plan of approximately $50M (U.S. Forest Service, Portland, OR). A fiscal year 2018 budget brief published by the U.S. Bureau of Reclamation estimates 2016-2018 expenditures for YRBWEP alone to be in excess of $91M. U.S. Senate Report 115-107 estimates increased spending of $65M for YRBWEP during 2018-2022 subject to appropriation.

Clearly the Yakima Basin Integrated Plan has broad support at both the local and federal levels. There has been substantial funding of the Plan since at least 2011 and funds are already being committed well into the future. Figure 1 summarizes habitat and water enhancement projects completed with this funding during the 2013-2017 period. There is broad support in the literature that actions such as these provide benefits to fish, with many of the studies specifically citing benefits to coho (White et al. 2011; Carah et al. 2014; Pierce et al. 2015; Roni et al. 2015; O'Neal et al. 2016; Clark and Roni 2017).



Yakima Basin Integrated Plan
Habitat Enhancement/Enhanced Agricultural Conservation Projects
2013-2017
Habitat Enhancement (2013-2017)
1. Manastash Creek Conservation and Tributary Enhancement Project
2. Toppenish Creek Habitat Restoration
3. Bateman Island Causeway Modification Conceptual Design/ Outreach/Permitting
4. Bull Trout Habitat Improvements (basin wide)
5. Gold Creek Habitat Assessment and Conceptual Design
6. Reed Diversion design Barrier Removal
7. Little Rattlesnake Road Decommissioning
8. Cle Elum River Side Channel Restoration Project, Phase 2
9. Gap-to-Gap Property Acquisitions
10. Upper Wapato Riparian Restoration
11. Ellensburg Water Company / Coleman Creek Restoration
12. Reed Diversion Barrier Removal
13. Trout Meadows Acquisition / Enhancement
14. Manastash/ Little Naches Land Acquisition
15. Teanaway Acquisition
16. Cowiche Easement/Design
17. South Fork Tieton Bull Trout Passage Feasibility and Design
• Phase 1
• Phase 2
18. Teanaway/Indian Creek Restoration
• Phase 1
• Phase 2
19. Gap-to-Gap Outfall Relocation, Land Acquisition and Levee Removal Design and Restoration
20. Yakima Rivermile 89.5 Levee Breach
21. Island Road Floodplain Reconnection - Toppenish Creek
22. Toppenish Creek - 3-way Levee Setback
23. Teanaway Habitat Restoration
24. Upper Yakima Floodplain Acquisition and Design Ringer Loop Road
Enhanced Water Conservation (2013-2017)
1. KRD 13.6, 13.8 Lateral Piping Project
2. Wapato Irrigation Project (WIP) Piping Lateral 4-414C
3. WIP Piping Satus East Lateral E73
4. Kennewick Irrigation District (KID) Division IV Lining
5. Manastash Creek Sprinkler Conversions
6. Yakima-Tieton ID Diversion Relocation Feasability Study
7. Manastash – Consolidated Pipeline & Manastash Water Ditch Association (MWDA) Pipeline Construction
8. WIP Piping of Unit 2 L672 and Headwaters Rebuild
9. WIP Unit 2 Upper Dam Rebuild and Lower Dam Removal
10. WIP Lining of Unit 2 (167+20 to 173+80)
11. KID Reregulation Reservoir Design
12. KRD North Branch Canal Lining
13. WIP Water Conservation Plan
14. City of Yakima Xeriscape Demonstration Project
15. Reed Pipeline Design
16. Manastash Creek, Anderson Diversion Irrigation Water Acquisition
Locations are Approximate
YAKIMA BASIN
BUILDING A FUTURE FOR WATER, WILDLIFE & WORKING LANDS
Rev: 12.26.17

Fitness and productivity expectations for locally adapted coho

We understand the scientific skepticism regarding the ability of out-of-basin stocks to adapt and reach the level of reproductive success and productivity required to achieve our long-term goal of maintaining or increasing natural populations in native habitats. However, recent science supports the idea that this is possible given the implemented and planned habitat actions described above. The Yakama Nation's Coho Salmon work in the mid-Columbia River tributaries, which is very similar to what we are doing in the Yakima River Basin, illustrates that adaptive divergence is occurring in the reintroduced population and that genetic variation and structure of reintroduced populations are likely to reflect source stocks for multiple generations but may shift over time once established in nature (Campbell et al. 2017). Chittenden et al. (2010) failed to observe any genetic differences between wild- and hatchery-born coho salmon in the Chehalis River in British Columbia, and stated that while this may be due to the long-term mixing of these genotypes from hatchery introgression into wild populations, it could also be due to strong selection in nature with fish proving capable of maintaining highly fit genotypes whether or not they experienced part of their life history under cultured conditions. Tymchuk et al. (2006) reported that phenotypic effects of domestication in a Pacific Coho Salmon population can be largely diluted within two generations by backcrossing with wild salmon, indicating that local adaptation can occur relatively quickly even in farmed salmon with many generations in culture. The work of Liermann et al. (2017) in the Elwha River demonstrates that transplanting hatchery-dominated Coho Salmon adults into newly available habitat can result in immediate freshwater production that is comparable to other systems. A study in the Umpqua River, Oregon reported by Thériault et al. (2011) found no significant difference in reproductive success in the wild between hatchery-origin Coho Salmon with two hatchery-origin parents and those with two natural-origin parents indicating that environmental rather than genetic effects played a larger role in this study. Ford et al. (2006) reported reduced natural smolt production in a naturally spawning Puget Sound tributary Coho Salmon population after 60 years of intensive hatchery supplementation. However, subsequent studies (Spromberg et al. 2015; Feist et al. 2017; McIntyre et al. 2018), some specific to Puget Sound, report significant mortality threats to Coho Salmon from urbanization effects indicating that observed differences in Ford et al. (2006) could also be due to environmental and not genetic effects.

While the YN accepts and acknowledges that there are risks involved with any particular restoration action, it is also important for critics of production actions to acknowledge benefits as well. Indigenous people have long understood and taught the importance of the "interconnection" of all things. This philosophy and approach, more commonly referred to as "ecosystem restoration" in the "western science" context, is a fundamental part of the NPCC's Fish and Wildlife Program, the ESA, and conservation literature. The National Research Council (1996) concluded that, "… a goal of management should be to increase the size and maintain the diversity of spawning populations and to re-establish ecosystem processes." In addition, the return of the wolf to Yellowstone (McNamee 1997; National Park Trips Media 2011), Schindler et al. (2010), and Ripple et al. (2014) all provide evidence for how species-rich communities can produce more temporally stable ecosystem services because of the complementary or independent dynamics among species. Adult coho carcasses returning to the Upper Yakima Basin watersheds will restore marine derived nutrients which will benefit all species (Bilby et al. 1996). Thus, it is likely that YN coho reintroduction efforts will increase the stability and function of ecosystems in the Yakima and upper Columbia Basins consistent with the ISAB's revised principles, the NPCC 2014 Fish and Wildlife Program's overall vision and ecosystem function strategy, and the ESA's primary purpose "to protect and recover imperiled species and the ecosystems upon which they depend".

Evaluating benefits from the integrated hatchery program and habitat actions

Habitat action effectiveness monitoring is beyond the scope of the MRS Coho master plan. However, as the ISRP is aware, this has been an increasing topic of interest and progress over the past five years. We intend to continue monitoring results from ongoing habitat action evaluation programs throughout the region as well as the literature for relevance to our work here in the Yakima Basin. For example, Clark and Roni (2017) specifically included some of the habitat restoration actions in the Upper Yakima watersheds in their study demonstrating positive results from such actions.

As described in our response to Comment 3 below and in Appendix A we intend to assess benefits from habitat restoration actions and the MRS integrated Coho program largely through monitoring and evaluation of trends in natural-origin Coho smolt and adult return abundance. The Upper Columbia program, which is very similar to that in the Yakima Basin, is already doing genetic evaluation (empirically testing gains in fitness) in cooperation with a CRITFC basin-wide supplementation evaluation project (see Campbell et al. 2017). Results from the parental-based tagging we intend to incorporate into the MRS program (described in Comment 3 and Appendix A) may be used to supplement the information being gained from the CRITFC/YN Upper Columbia Coho program in the future.

As habitat actions and the MRS Coho program progress and additional information is gained, adaptive management will be used to modify program parameters as necessary.

ISRP 2012 Comment 2. *Additionally, the assumed SAR of 5% for natural coho production during Phase 3 (Table 3-2) is considerably higher than the observed SAR (avg. 3.6%) during 2000-2010. This assumption likely leads to an overestimation of project benefits.*

ISRP 2013 Response Comment 2:
The sponsors clarified that the 5% SAR is pre-harvest, whereas the currently observed 3.6% SAR for coho includes a harvest rate of ~40% (20% below Bonneville and in ocean fisheries and 20% above Bonneville). Consistent use of terminology is needed in the Master Plan and in the response to comments (e.g., Fig. 2). For example, in the Columbia Basin smolt to adult survival (SAS) is typically used to describe survival prior to harvests, whereas SAR is typically reserved for survival after most harvest and dam passage.

YN Response to ISRP 2013 Response Comment 2:

We apologize for inconsistent use of terminology and will do our best to correct documents in the future as they are updated. Table 1 presents current Prosser Dam smolt to Prosser dam returning adult survival indices for juvenile migration years 2000 to 2015.

Table 1. Preliminary estimates of smolt-to-adult return (SAR) indices for adult returns from hatchery- and natural-origin coho for the Yakima reintroduction program, juvenile migration years 2000-2015.

Juvenile	Hatchery-origin			Natural-origin		
Migration Year	Chandler Smolts[a]	Prosser Adults[b]	SAR Index	Chandler Smolts[a]	Prosser Adults[b]	SAR Index
2000	331,503	3,546	1.1%	37,359	1,432	3.8%
2001	134,574	166	0.1%	40,605	309	0.8%
2002	155,814	669	0.4%	19,859	1,523	7.7%
2003	139,135	505	0.4%	9,092	1,820	20.0%
2004	148,810	2,405	1.6%	18,787	472	2.5%
2005	204,728	2,646	1.3%	31,631	1,562	4.9%
2006	204,602	2,203	1.1%	8,298	1,049	12.6%
2007	260,455	4,132	1.6%	20,131	459	2.3%[c]
2008	416,708	8,835	2.1%	43,046	982	2.3%[c]
2009	496,594	5,153	1.0%	25,108	573	2.3%[c]
2010	341,145	7,216	2.1%	35,158	802	2.3%[c]
2011	333,891	4,948	1.5%	24,108	550	2.3%[c]
2012	244,503	1,865	0.8%	17,667	424	2.4%
2013	483,122	19,913	4.1%	56,947	1,082	1.9%
2014	337,988	2,943	0.9%	159,642	362	0.2%
2015	134,084	1,590	1.2%	20,757	103	0.5%
Mean	272,979	4,296	1.3%	35,512	844	3.7% [d]

[a] Yakama Nation estimates of coho smolt passage at Chandler.
[b] Yakama Nation estimates of age-2 and age-3 coho returns to Prosser Dam for this juvenile migration cohort.
[c] Average estimate derived from PIT-tag detections of Taneum Creek natural coho for juvenile migration years 2009-2011.
[d] Excludes migration year 2003.

ISRP 2012 Comment 3*. The objective of >5,000 coho spawners during Phase 3 should identify the proportion of NOR and HOR spawners that is consistent with the transition to an integrated program.*

ISRP 2013 Response Comment 3:
The response to the ISRP identifies that under Phase 3, on average, 2,541 natural-origin and 4,881 hatchery-origin adults will return to spawn in the Yakima River (from Figure 2. Key assumptions and outcomes for the Yakima River integrated and segregated coho programs (based on AHA analysis)). The ISRP is unable to reconcile Figure 2 in the response with Table 3-1 on page 24 of the Master Plan, as described below. Further, the ISRP finds the biological objective(s) vague with regard to a definition of “coho spawners,” and finds inconsistencies in objectives in various places in the Master Plan and response.

Specifically, the reference to >5000 (NOR+HOR) spawners does not indicate whether this is spawning escapement, spawning escapement plus hatchery broodstock, or some other composite of natural spawning fish, hatchery broodstock, and terminal harvest. This confusion stems from inconsistent numbers. Figure 2 shows a terminal run of hatchery-origin adults of 6779, with 4881 allowed to spawn naturally, 655 hatchery broodstock, and 904 hatchery surplus. But, this does not sum: 6779-4881-655 = 1243, not 904. Further, the Expected Catch All Fisheries value of 13,896 in Fig. 2 is very different from the value 203 in the Master Plan Appendix E, without explanation for the change.

The Master Plan and response do not provide a clear path from a Phase 3 program releasing 700,000 smolts with a PNI of 0.32 to a Phase 4 program releasing 300,000 smolts with a PNI of 0.75. The Master Plan indicates the transition will begin when 5000 NOR adults are returning to the watershed, but there is no justification for this number. It is assumed that during Phase 3, 7422 coho will be spawning naturally, whereas during Phase 4, only 5347 coho will be spawning naturally. How were these target numbers for Phase 3 and 4 determined, and are they consistent with the capacity of the habitat? The plan to have more spawners during Phase 3, when habitat is not yet restored, in comparison to Phase 4, requires explanation. The initial production assumptions used in the Master Plan indicate that spawning abundance is near optimal at somewhat over 2000 adults.

It would be very helpful in Step 2 to elaborate further on the “stepping stone program” that will be used to provide broodstock to each of these programs. For example, it is indicated that a pNOB of 30% would be targeted during Phase 3. Does this mean that NORs would be incorporated into the segregated program when it was initially established, and if so for how many years would this occur? The PNI for Phase 3 is expected to be 0.32 while in Phase 4 a 0.75 PNI goal has been established. How will this transition take place; in other words how will pNOB and pHOS be adjusted over time? Additionally, HORs originating from the integrated and segregated programs will apparently be used as broodstock in the segregated program. Step 2 should indicate what proportion of the broodstock in the segregated program will originate from each of these sources and whether that proportion will change over time. Some discussion about why the proportions of integrated and segregated broodstock were chosen would also be helpful. Providing the above information would help clarify how the coho program will transition from Phase 3, which is primarily a harvest augmentation effort, to Phase 4 which is a harvest and conservation endeavor.

The YN response states that approximately 2500 NOR and 4900 HOR coho will spawn naturally each year (7400 total), on average, during Phase 3. These spawners are expected to produce 72,059 smolts (Fig. 2), which yields only 9.7 smolts per spawner, a productivity estimate that is much lower than the assumed Phase 3 estimate of 34 smolts per spawner. Even with a 0.5 fitness factor this value does not make sense. Fig. 2 in the response is confusing because the 5% SAR for natural production is the SAS value (prior to fisheries), whereas the 1.27% SAR for hatchery fish must be a value after removing harvested fish (700,031*1.27%=8,890), which is much lower than the reported harvest in all fisheries: 13,896 coho). Complete and consistent reporting of the statistics for natural and hatchery coho is needed so that the entire life cycle can be easily tracked and evaluated to make sure the values are consistent, reasonable, and comparable with values determined during monitoring and evaluation.

YN Response to ISRP 2013 Response Comment 3:

We agree with the ISRP on the need to clarify Phases 3 and 4 of the coho program(s). Portions of the Master Plan presentation were confusing and our thinking with respect to these programs has evolved some over the past 5-6 years. We combine our responses to ISRP comments scattered throughout their review regarding the need for additional description about Phases 3 and 4 of the coho program(s) as well as for additional clarity on data, key metrics and how the program will transition from Phase 3 to Phase 4 under this comment response. As described in the Master Plan there are actually two coho programs, a lower Yakima segregated program with a primary objective of contributing fish to harvest, and an upper Yakima integrated program with dual objectives of contributing to harvest as well as to natural stock restoration in the upper watersheds.

<u>Segregated Coho program</u>

The segregated Coho program will continue to reside at Prosser Hatchery and have an on-station smolt release goal of 500,000 fish (Table 2). Broodstock will consist of approximately 1,200 fish collected from adults returning to the Prosser Hatchery denil trap, the Prosser Dam denil trap, or from fish stranded in the Chandler irrigation canal. Smolts will be 100% adipose fin-clipped prior to release to allow maximum retention in selective fisheries. Based on analysis of PIT tag data, we estimate juvenile survival from Prosser to McNary dams to be approximately 60% and a smolt-to-adult return rate to McNary Dam of about 1.7% for the most recent five to ten years. Available PIT-tag data suggests an exploitation rate of about 40% on returning fish from this program between Bonneville and Prosser dams. We estimate a terminal harvest rate of 5% growing to 10% and 20% in Phases 3 and 4 of the program (Table 3-3 in the Master Plan). Of the escaping fish, we estimate that about 1,200 fish (25-29% of the escapement) would be collected for broodstock use and that we may be able to incorporate some natural-origin fish (~10%) into the broodstock in Phase 4 of the program. Of the remaining fish, we intend to use up to 1,000 adults from the segregated program for adult outplants to the integrated program during Phase 3 for the first year or two until integrated program adults begin returning from the MRS program (see Table 3 below). Finally, any remaining captured fish from the segregated program would be processed and used for tribal ceremonial and subsistence use. Fish escaping above capture points at and near Prosser Dam and Hatchery may spawn in the wild. However, we expect the majority of these fish to remain in reaches of the Yakima below its confluence with the Naches River in Yakima, WA. PIT-detection data indicate that these fish do not ascend Roza Dam.

Table 2. Key metrics, current (recent 5-year average) estimates, Phase 3, and Phase 4 goals for use of hatchery-origin fish in the segregated Coho Master Plan program.

	Hatchery-Origin		
Metric	Current	Phase3	Phase4
Local brood	1,200	1,200	1,200
Smolts released	500,000	500,000	500,000
Smolts to McNary	300,000	300,000	300,000
Smolt-to-Adult Surv. Est.	1.7%	1.7%	1.7%
Prop. NOR in Brood	0	0	10.0%
Total Return to Yak. R.	5,136	5,136	5,136
Terminal Harvest	257	514	1,027
Escapement	4,879	4,622	4,109

Integrated Coho program

The integrated Coho program will reside at the new Melvin R. Sampson (MRS) Hatchery near the town of Thorpe, WA. Phases 3 and 4 of this program will consist of the following release goals: 200,000 smolts, 500,000 parr, and 1,000 adults (Table 3). All fish will be outplanted or acclimated and released in targeted tributaries in the upper Yakima and Naches watersheds. As soon as they are available (one year after releases commence from the MRS facility), adult outplants will consist of MRS integrated program hatchery-origin adults returning from smolt releases (distinguished by marks detectable from a live sample) returning to the Prosser Denil or Roza Adult Monitoring (RAMF) Facilities.

The main objectives in Phase 3 of the program are to increase the number of coho spawning naturally in upper watershed tributaries and to increase the proportion of natural-origin returns used for broodstock. We expect Phase 3 to last about six years (two generations) which will allow substantial colonization of tributaries and increase natural-origin returns. We expect hatchery-origin fish to demonstrate increased localization and naturalization as well. During Phase 3, broodstock will consist of up to 800 fish collected from hatchery- (2/3) and natural-origin (1/3) adults (distinguished by marks detectable from a live sample) returning to the Prosser Denil or RAMF. Beginning in Phase 4, all escaping fish will be allowed to return to the spawning grounds as a major objective of this program is natural stock restoration, and all returning fish will either be the progeny of fish that spawned in the wild, or crosses of natural-origin fish at the MRS Hatchery. This strategy is consistent with that of the Levi George spring Chinook Hatchery program which has maintained an average PNI of 0.66 (Fast et al. 2015; Bosch 2017). Phase 4 of the program will use 100% natural-origin fish in the brood stock while hatchery-origin spawners (most of which will be from localized parr releases) should demonstrate increasing local adaptation.

Like the CESRF spring Chinook program, collection protocols will allow only taking at most one of every two natural-origin fish passing upstream at the Prosser Denil or Roza Dam brood collection facilities. After 2025 (Phase 4), if fewer than 800 natural-origin fish are available for brood stock in any given year due to reduced natural-origin returns then release programs would revert to Phase 3 protocols to meet program release goals. All adults used for broodstock in the integrated program will be DNA-sampled for parentage-based-tagging (PBT). In addition, all integrated program hatchery-origin progeny will receive a coded-wire (CWT). Different locations will be used for CWT placement to allow distinction between parr (snout) and smolt (post-dorsal) release programs. Based on analysis of data collected during juvenile sampling at the Chandler (Prosser) juvenile sampling facility, we estimate that geomean natural coho smolt production in the Yakima River Basin is approximately 38,000 fish annually. The changes in life-stage release strategies planned for Phases 3 and 4 of the program, as well as ongoing habitat enhancements and actions, are hypothesized to result in increased natural smolt production over time. Based on analysis of PIT tag data over the most recent five to ten years, we estimate smolt-to-adult and parr-to-adult return rates (McNary to McNary Dam estimates) of about 1.3% and 3.0%, respectively. Applying these return rates to the planned and estimated parr and smolt production, we estimate that natural-origin adult returns will average 9,000 and 10,400, respectively, for Phases 3 and 4 of the program (Table 3). Because integrated program hatchery-origin fish will not be adipose fin-clipped, we expect them to be harvested at rates similar to natural-origin coho in all fisheries.

Table 3. Key metrics, current (recent 5-year geomean) estimates, Phase 3, and Phase 4 goals for use of hatchery- and natural-origin fish in the integrated Coho Master Plan program.

	Hatchery-Origin			Natural-Origin		
Metric	Current	Phase3	Phase4	Current	Phase3	Phase4
Local brood	800	550	0		250	600
Adults released	30-300	1,000	1,000			
Smolts released	930,900	200,000	200,000			
Smolts to Prosser	282,127			38,108	114,325	152,434
Parr Released	30,000	500,000	500,000			
Parr To Prosser	10,000	166,667	200,000			
Smolt-to-Adult Surv. Est.	1.7%			1.3%	1.3%	1.3%
Parr-to-Adult Surv. Est.	3.0%			3.0%	3.0%	3.0%
Total Return to Prosser	3,863			504	8,960	10,441
Escapement	3,863			504	8,960	10,441
Prop. NOR in Brood				5.0%	31.3%	100.0%
Prop. HOR in Esc.[a]				96%	84%	82.0%
PNI estimate				5%	27%	55%

[a] Approximately 2/3 of hatchery-origin returns will be from parr releases that spend very little time in the hatchery environment.

Evaluation of returning adults

At Prosser, all adiposed fin-clipped Coho will be enumerated using visual identification in video counting and denil trap sampling. All non-adipose-clipped Coho passing through the Prosser denil facility will be mark-sampled for CWT tags. Results from mark sampling should allow enumeration of total natural-origin passage at Prosser Dam with high confidence as Coho passage through the Prosser denil ladder averaged over 40% of the entire estimated return from 2001-2017. Loss of CWT tags is expected to be less than 5% (Knudsen et al. 2009), and we will be able to confirm this error rate using PBT analysis and RAMF sampling results.

At the RAMF, all adiposed fin-clipped Coho (presumed strays from the segregated program) will be enumerated using visual identification and removed from the spawning population (not allowed to pass upstream). All other Coho will be enumerated and mark- and DNA-sampled. Techniques for PBT analysis are now well-refined, high-powered, and can be done for relatively low cost per sample (Steele et al. 2013). Results from PBT analysis should allow enumeration of total natural-origin passage at Roza Dam with high confidence. Returns to the Naches system should then be able to be estimated with reasonable confidence by subtracting Roza natural- and integrated hatchery-origin passage estimates from the Prosser estimates.

Finally, we welcome a regional scientific dialogue about proportionate natural influence (PNI) estimation as clearly not all hatchery-origin spawners have the same level of hatchery-influence and potential genetic differences (from the target natural population) and therefore should not be treated the same in a PNI calculation. For example, integrated program adult returns from MRS parr (5 months in the hatchery environment) and smolt (1.5 years in the hatchery environment) releases would have varying levels of hatchery-influence and potential genetic differences from Upper Yakima Basin natural-origin Coho. However, our understanding of PNI estimation from the literature does not allow these fish to be treated differently; they are all considered as identical hatchery-origin fish for estimating the proportion of hatchery-origin spawners (pHOS) even though their potential contribution to any fitness loss in the natural population could be very different. This issue may be further exacerbated in other Columbia River tributaries that do not have adult traps as efficient as the RAMF, and where out-of-basin and segregated hatchery-origin returns might also mix with integrated hatchery- and natural-origin fish on the spawning grounds. How should pHOS be calculated in such a case?

ISRP 2012 Comment 4. *A response is also requested for a succinct and complete summary table showing recent program performance for coho and Chinook salmon along with a table that provides proposed program metrics. The summary table should include metrics such as numbers of broodstock required, anticipated fecundity and eggs required, numbers of progeny produced and released, required post release life-stage survival. These data requirements, or "report card" metrics, were recently summarized by the ISRP in its review of the Lower Snake River Compensation Plan's spring Chinook program (ISRP 2011-14). An example of the information needed by the ISRP are Tables 8, 9, and 10 on pages 33, 34, 37, and 38 in the Revised Master Plan for the Hood River Production Program (see Tables below). Some, but not all, of this information is distributed throughout the Master Plan. One of the ISRP's responsibilities in conducting a Step Review for a hatchery master plan is to confirm that the values (numbers) provided for abundance, SARs, and harvest fractions are computationally accurate across life stages. This confirmation is not possible when the necessary information is presented across different sections of the plan. For example, it is not possible for the ISRP to establish a conclusion for initiation of phase 3 of the Lower Yakima Segregated Coho Program using Tables 3-1, 3-3, 2-4, and the discussion of the coho program in section 5.2.2. Additionally, when reporting status and trends of the program such as in Table 3- 10, a comparison of observations with the program objectives should be provided so that program progress can be readily monitored. Finally, the Master Plan claims that the proposed programs will not lead to increased hatchery production, but this is not clearly shown in the Master Plan because there is* *no table directly comparing recent with proposed production of hatchery Chinook and coho salmon.*

ISRP 2013 Response Comment 4:
Coho Tables, such as in the Hood River program, are needed by the ISRP, and we believe they would serve the sponsor in future program evaluation and adaptive management.
Some of the requested data and project goals were reported for coho. For example, adult escapement of NORs and HORs to Prosser Dam from 2000 through 2010 was shown in Table 3, but no estimates of the number reaching the spawning grounds in the Yakima basin were provided. Goals for broodstock collection by phase are provided, but specific numbers used in the past and the ratio of out-of-basin fish (or eggs) to in-basin fish are not provided. No information on harvest numbers is given although expected harvest rates in various parts of the Columbia, starting at the mouth and working up to terminal areas are given for each phase of the project. No data are given for pre-spawning mortality, but 5% was assumed for Phases 3 and 4. Smolt production for both NORs and HORs from 2000 to 2010 is presented along with index SAR values. No specific data on hatchery egg-to-smolt survival was provided for either NOR or HOR parents although 70% is assumed for Phases 3 and 4. An average fecundity value is provided and a range of egg numbers used in the past along with goals for Phases 3 and 4 are shown. In Step 2, the sponsors should combine the information they provided into one or two tables per the examples given and include, whenever possible, the additional information requested.

A critical issue is the need for, first, a clear statement of whether the program is currently able to go to Phase 3 using only adults returning to the Yakima River for broodstock while maintaining a PNI of 0.32 with pHOB of 20%; and second, a decision framework for the size of the program based on NOR and HOR abundances. How the program will transition from PNI = 0.32 to PNI = 0.75 has not been explained. A plan with a scientifically justified rationale is required for various levels of hatchery and natural origin coho abundance and the anticipated harvests of those fish.

It is not clear from Table 1 and Fig. 2 how a broodstock of 655 coho (equal male/female ratio according to Master Plan) with fecundity of 3,000 and pre-spawn mortality of 5% yields 1.1 million eggs. Assuming an equal sex ratio, the reported values only produce 0.93 million eggs, on average. The assumed values for this project need to make sense across all life stages.

YN Response to ISRP 2013 Response Comment 4:
Please see our combined response to these ISRP comments under YN Response to ISRP 2013 Response Comment 3 above.

ISRP 2012 Comment 5*. How will the program keep hatchery salmon straying to less than 5%, and what is the disposition of returning hatchery adults that are not used for broodstock in the hatchery?*

ISRP 2013 Response Comment 5:
The response identifies that the YN will use release locations, weirs, and harvest policies to reduce straying. The final bullet point states that a reduction in production will be considered if

pHOS is not kept within limits. Production levels, and how that might be used to limit pHOS in critical Yakima River and tributary habitats, need to be included in a Step 2 decision framework. The ISRP recognizes that contemplating reduced production is undesirable, so the time to do it is before the hatchery and production levels are approved and implemented.

The response indicates that a unique water source will facilitate homing, HOR fish can be culled at Roza Dam and downstream locations, and hatchery fish (segregated stock) may be selectively harvested using the adipose fin clip. Surplus hatchery fish may be used for subsistence or for stream nutrients. Will YN fishers use selective gears in which hatchery fish (coho marked with adipose clip) are retained and unmarked fish are released when there is a need to maintain escapement of unmarked salmon? Selective fishing in the terminal area is implied in the response, but it is not clearly stated.

All the coho produced from the segregated program will be adipose clipped and some will receive CWTs. As the program progresses, CWTs will not be applied. We suggest that some level of tagging continue to help document possible straying of these fish into other portions of the Columbia basin. Additionally, the YN may wish to collect DNA from all the parental fish used in their coho programs. This material could be archived and used in future Parent Based Tagging programs to further document the straying rates of project fish. Coho from the integrated hatchery program will not be adipose clipped. However, 100% of these fish will receive CWTs linked to their release location. Acclimation sites will be used in the integrated program to help reduce straying. Second, fish trapping facilities exist at Prosser Dam, at the Prosser Hatchery Denil ladder and trap, and at the Sunnyside and Roza dams. At Roza 100% of the fish are examined before they are allowed over the dam making it possible to remove unwanted hatchery origin coho. Third, the sponsors state that they will work with WDFW to develop harvest strategies in the Yakima that target hatchery origin coho. And finally, if necessary, the number of smolts released can be reduced to decrease the occurrence of strays. An important monitoring goal should be to monitor straying rates both inside and outside of the Yakima basin. In Step 2, a monitoring plan for hatchery strays and a decision framework should be described.

YN Response to ISRP 2013 Response Comment 5:
We believe that YN responses to other comments in this document as well as the monitoring and evaluation strategies described in Appendix A of this response address the ISRP's concerns. The marking programs we intend to employ (see YN Response to Comment 3 above) and the efficiency of the Roza adult trap will allow us to preclude any segregated-program Coho that do return to Roza Dam from passing upstream of the dam. Thus, the only hatchery-origin spawners above Roza will be returns from the MRS integrated program.

We queried the PTAGIS information system in March of 2014 and analyzed adult detection data for all PIT-tagged coho released in the Yakima River Basin since 1997. Based on this analysis we estimate there were a total of 2,045 unique detections of Yakima River-released coho migrating upstream at Bonneville Dam as adults since 1998 (adult coho generally return at age-3, one year after their release). We could find only 19 Yakima River-released coho that were detected at locations outside of the Yakima River Basin and not subsequently detected within the

Yakima River Basin. These 19 fish represent 0.93% of the PIT-tagged adult Yakima River-released coho that were detected at Bonneville Dam over this period. We could find no detections of Yakima River-released coho as adult migrants downstream of Hood River (the area designated as critical habitat for ESA-listed lower Columbia River coho; other than upstream migrating coho detected at Bonneville Dam). We conclude that homing behavior for this reintroduction program has thus far been well within scientific guidelines (McElhany et al. 2000).

ISRP 2012 Comment 6*. What is the current level of mini-jack production, how do they affect existing population metrics, and what efforts are being used to reduce mini-jacks?*

ISRP 2013 Response Comment 6:
We agree that the occurrence of precociously maturing coho in hatchery programs is extremely rare and infrequently or never monitored. [The remainder of the comment referred to the summer/fall Chinook program(s).]

YN Response to ISRP 2013 Response Comment 6:
The ISRP comment implies no response is required or requested for coho.

ISRP 2012 Comment 7*. How will harvest rates be controlled in order to rebuild the natural populations in the upriver basin? What is the planned harvest rate in relation to run size and how will this objective be achieved? Is there a plan to allocate harvests in the Yakima River to non-tribal sport anglers as well as Tribal anglers?*

ISRP 2013 Response Comment 7:
The YN response indicates that annual harvest rates will be set with WDFW each year, including allocations to non-tribal fishers. Coho harvest rates will be set to ensure 5,000 NOR + HOR spawners in Phase 3 and 3,500 NOR spawners in Phase 4 are achieved whenever possible. In Step 2, scientific justification for these spawning targets and detailed harvest rate and harvest allocation decision rules for varying levels of hatchery and natural origin salmon abundance should be described.

The ISRP agrees that a good approach will be to establish a minimum spawning escapement goal for both coho and Chinook such that harvests in the lower river will be greatly reduced if the returns to the upper Yakima River appear to be at or below the escapement target. However, it is not clear how the fishery will harvest the segregated stocks co-mingling with upriver stocks if non-selective fishing methods are used. This should be described in Step 2.

YN Response to ISRP 2013 Response Comment 7:
Harvest management decisions are made by tribal and state fishery managers outside the scope of this Master Plan; however, we describe harvest monitoring efforts in Appendix A. Fish from the Prosser segregated program will be adipose fin-clipped and subject to harvest in all mark-selective fisheries. Fish from the MRS integrated program will not be adipose fin-clipped and will presumably be subject to mortality rates observed for natural-origin Coho. As described in our Comment 3 response and Appendix A, we will make enumeration and evaluation of adult

returns by origin a very high priority. We expect very few, if any, Coho from the Prosser segregated program to return to areas upstream of the “gap to gap” reach in the downtown Yakima area, and our monitoring is designed to confirm this expectation. We will allow integrated program fish that are the progeny of natural-origin parents to spawn in the wild as our major objective in this Coho restoration effort is to restore these fish to their native habitats in the upper watersheds.

Comments by ISRP that were not addressed in the YN response:
The YN did not respond to several ISRP comments. These comments are restated here so that they can be revisited during Step 2.

During Step 2, the ISRP anticipates a comprehensive monitoring and evaluation plan that can document progress against the goals and objectives of the program and will provide information necessary for adaptively managing the program. In particular, the ISRP expects that the sponsors will describe how they will assess possible competition and predation interactions between project coho and summer Chinook on spring Chinook, steelhead, and other juvenile fishes in the basin, including predation by warm-water fishes and birds in the lower Yakima River. Water reuse at Marion Drain and Holmes Ranch along with salmon incubation at those same sites may increase the risk of disease; therefore, a plan should include monitoring of fish health at these sites. Step 2 should also address the status of the surface water supply at Prosser and describe the final location for the Upriver Bright (UBR) fall Chinook rearing and acclimation site in the lower River. Results of such work should be incorporated into the Yakama Nation adaptive management plan framework.

The ISRP noted that sockeye may bring IHN into the watershed. However, the YN did not provide a response to this issue, such as the steps needed to protect project fish from this virus and the protocols that will be followed if it is found on fish being reared by the project’s facilities.

Proposed new and remodeled infrastructure was described and justified to some extent. However, the ISRP did identify some issues that needed additional information. For example, the Master Plan states that 31 concrete raceways (10’ wide x 100’ long x 3.5’ deep) will be built at Prosser for supporting 500,000 coho salmon. Rationale for 31 raceways should be described, including what the rearing density goal is and why this goal was chosen. Additionally, the YN proposed to add another well at Marion Drain where the current ground water capacity is 800+ gallons per minute. However, the reported maximum use of well water is only 500+ gallons. Additional justification for the new well is needed.

Management plans for spring Chinook, sockeye, and resident fish are not in the Master Plan. The Master Plan should describe the effects of the enhanced in-river salmon fishery on the resident trout population and other salmonids that might co-occur in the fishery.

YN Response to ISRP 2013 Comments not addressed in YN 2012 Response:
A comprehensive monitoring and evaluation program for all anadromous species in the Yakima River Basin, funded by the Bonneville Power Administration, has been in place for many years

now. We refer the ISRP to annual reports for projects 1995-063-25 and 1995-064-25 for the latest results from these efforts. Appendix A of this response contains additional detail about Yakima Basin monitoring and evaluation strategies. There is also additional information provided in our response to Comment 3 above.

With respect to species interactions and predation, we intend to continue existing monitoring efforts described in the annual reports referenced above. As further background, the YN designed a risk containment monitoring framework into the project from its inception (Pearsons and Hopley 1999); has spent a considerable amount of effort evaluating risks, planning and designing its coho reintroduction efforts in the mid-Columbia and Yakima River systems (Dunnigan and Hubble 1998; Dunnigan 1999; Murdoch and Dunnigan 2001; Murdoch and LaRue 2002; YN 2002; Murdoch et al. 2004 and 2005); and the YN is managing its coho reintroduction activities according to this monitoring and planning framework (Temple and Pearsons 2012). We deliberately chose the strategy of using adult plants in upper Yakima Basin tributaries (Table 3) to minimize interactions with listed steelhead (*O. mykiss*) and bull trout (*S. confluentus*) populations that we know reside in some of these areas. As described on page 94 of the Master Plan (YN 2012), we have been studying coho spawning success and effects on resident trout (*O. mykiss*) in Taneum Creek since we began adult plants there in 2007. Initial results indicate that coho spawned successfully and produced large numbers of offspring. The total biomass of all salmonids in the stream increased and there were no negative impacts to resident trout (Pearsons and Temple 2007 and 2010; Temple et al. 2012). Rainbow trout abundance, average size, condition, and growth were not reduced in experimental reaches relative to control locations following the reintroduction of coho salmon; a result predicted from ecological risk assessment (Temple et al. 2017). Since adult salmon generally do not eat as they return and prepare to spawn, there is no risk of predation by these adult coho plants. The progeny of these naturally spawning coho will emerge from the gravel as native fingerlings in habitats that were historically shared with *O. mykiss* and bull trout; therefore, we expect sympatric interactions among these species to be similar to those observed historically (Quinn 2005). Our findings to date on this project support the view that stream-dwelling salmonids in North America, which have evolved in sympatry, have developed mechanisms to promote coexistence and partition the available habitat (Hartman 1965; Allee 1981; Bisson et al. 1988). Scientists studying the potential effects of reintroducing bull trout in the Clackamas River, Oregon reached similar conclusions (Shively et al. 2007; Marcot et al. 2012).

Regarding virus protection protocols, the YN has worked very closely with USFWS pathologists since the inception of the CESRF spring Chinook program. These pathologists have analyzed our sockeye and coho reintroduction programs in the Upper Yakima and worked with us to develop methodologies and protocols for monitoring, evaluation, and risk containment (R. Brunson-retired and S. Lutz, USFWS, unpublished reports to YN).

The ISRP comments regarding the water supply and concrete raceways at Prosser Hatchery are out of date. The 2012 Master Plan will be updated over the next year at which time proposed Prosser Hatchery upgrades will be subject to further step review.

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List of Acronyms

BIA – U.S. Bureau of Indian Affairs
BLM – U.S. Bureau of Land Management
BPA – Bonneville Power Administration
CESRF – Cle Elum Supplementation and Research Facility (spring Chinook)
ESA – Endangered Species Act of 1973 (16 U.S.C. § 1531 et seq.)
ISAB – Independent Scientific Advisory Board
NMFS – National Marine Fisheries Service
NPCC - Northwest Power and Conservation Council
NRCS – National Resource Conservation Service
USACE – U.S. Army Corps of Engineers
USFS – U.S. Forest Service
USFWS – U.S. Fish and Wildlife Service
YRBWEP – Yakima River Basin Water Enhancement Project (Public law 103-434)

APPENDIX A. YAKIMA BASIN COHO MONITORING AND EVALUATION

The proposed monitoring and evaluation program deals with hatchery, harvest, and species interactions components of the Master Plan. Habitat action effectiveness monitoring is being conducted on an opportunistic basis such as during species interactions and through cooperative work with other scientists as part BPA's Columbia Basin-wide Action Effectiveness Monitoring Program (e.g., see Clark and Roni 2017).

The results of M&E activities under the Master Plan will be presented in annual reports (e.g., https://www.cbfish.org/Document.mvc/Viewer/P156803). A science conference is held annually to present study findings to other agencies and interested members of the public. Study results and conference materials will be stored on the web at http://www.ykfp.org/par.html. Data will also continue to be presented in peer-reviewed scientific publications.

YKFP's M&E data collection and reporting protocols will be consistent with the Columbia River Basin regional strategies including Monitoring, Evaluation, Research, and Reporting (MERR); Anadromous Salmonid Monitoring Strategy (ASMS); Coordinated Assessments (CA), and Pacific Northwest Aquatic Monitoring Partnership (PNAMP).

The Columbia River Basin Research Plan (NPCC 2017), which was developed with input from the Independent Scientific Advisory Board (ISAB), ISRP, and PNAMP, identified a number of critical uncertainties regarding hatchery management that are relevant to this proposed program:

> Question 1. Are current propagation efforts successfully meeting harvest and conservation objectives while managing risks to natural populations?
>
> 1.2. Can hatchery production programs meet adult production and harvest goals (integrated and segregated) while protecting naturally spawning populations?
>
> 1.3. What are the interactions, by life stage, between hatchery-origin and natural-origin populations with respect to competition, predation (direct and indirect), and disease including harvest in fisheries targeting hatchery-origin adults; and from hatchery effluent?
>
> 1.4. What is the magnitude of any demographic benefit or detriment to the production of natural-origin juveniles and adults from natural spawning of hatchery-origin supplementation adults?
>
> 1.5. What are the range, magnitude and rates of change of natural spawning fitness of integrated (supplemented) populations, and how are these related to management rules including the proportion of hatchery fish permitted on the spawning grounds, and the proportion of natural origin adults in the hatchery broodstock?

The M&E plan for the proposed project is intended to address all of the uncertainties at least to some extent. The M&E activities described below focus on determining the success of the hatchery program, the effects on native stocks, and the critical uncertainties.

A.1 Hatchery Monitoring and Evaluation

Objective A.1.1. Operate adult trap(s) at Prosser Denil ladder and Roza adult fish monitoring facility to collect brood stock and/or to sample returning fish for stock composition. Hold and spawn fish maintaining established fish health standards.

<u>*Approach:*</u> YN biologists and technical staff will operate adult fish traps at the Prosser Hatchery swim-in denil ladder, and the right bank river denil ladder above Prosser Dam and Roza ladder for broodstock development. Other possibilities for capturing and/ or monitoring adult coho returns are at Wapatox Dam or Cowiche Dam on the Naches River. YN staff have operated the Prosser right bank denil facility to collect data from returning fish in the fall as well as collect coho brood stock. Factors such as weir/trap impedance/avoidance, run timing, spawn timing, population demographics, phenotypic and genetic characteristics, and return rates are part of the necessary evaluation that will be conducted to facilitate future adaptive management of this program. Additionally, the Prosser Hatchery swim-in denil has been operating since 2006 and has been instrumental in further developing our in-basin broodstock. The structure was built to guarantee the capture of in-basin broodstock that were reared and released from the hatchery. Evaluation staff is responsible for daily record keeping of all species captured, passed, or hauled for broodstock, along with any biological samples collected. These adult traps are also used for estimating adult returns (see A.3). Feasibility studies for broodstock collection at Wapatox or Cowiche dams will be conducted in the future if YN staff determines that Naches basin coho depict different physiological or phenotypic traits.

Task A.1.1.1. Operate adult trap(s) at the Prosser denil ladder and Roza Adult Monitoring Facility (RAMF).

Task A.1.1.2. Collect scale samples on all fish processed both sites. Scales from each fish will be used to document age-structure.

Task A.1.1.3. Collect and transport broodstock for the Prosser and Melvin R. Sampson (MRS) Coho salmon hatcheries.

Task A.1.1.4. Hold broodstock and document mortalities during holding.

Task A.1.1.5. Compile all data from trapping and spawning, and calculate return rates (using CWT, PIT tag, and mark-recapture analysis) for program evaluation.

Task A.1.1.6. Utilize USFWS fish health professionals during spawning to collect and analyze appropriate fish health samples. Cull fish as necessary per established USFWS and YKFP fish health protocols (See A.7 Disease monitoring).

Objective A.1.2. Determine the origin and stock of coho salmon used as broodstock. Monitor and evaluate changes in the phenotypic and genotypic characteristics of coho used at the Prosser and MRS Hatchery facilities.

Approach: YN, WDFW co-managers and NMFS desire to maintain the integrity of salmon stocks in the Yakima Basin and to minimize the potential negative effects of hatchery operations on ESA listed populations. In addition, the project has goals of protecting the health of natural populations while also providing fish for harvest mitigation production.

Broodstock Management

To monitor the phenotypic and genotypic integrity of populations cultured for the program, YN staff strives to collect and mate adults for broodstock to monitor stock demographics (e.g. run/spawn timing, age structure, sex ratios and size of fish) for gametes retained for production. Ideally this would be accomplished by selecting broodstock from throughout the run/spawning season.

YN will use PIT tags, CWTs, fin clips, scale readings, and DNA sampling to identify natural-origin fish for broodstock for the MRS integrated coho program. The Prosser segregated program may use returning hatchery-origin fish from either the integrated or segregated program for broodstock.

Since all natural-origin coho will be unmarked/untagged, any external or internal marks will be used to identify hatchery-origin coho so that fish can be properly managed according to the appropriate integrated or segregated program protocols.

Task A.1.2.1. Examine all coho for marks and tags, and determine sex. Recover and decode all tags from all spawned hatchery-origin carcasses.

Task A.1.2.2. Select natural-origin coho (no more than one of every two returning NOR coho) for use as MRS integrated program brood stock.

Task A.1.2.3. Calculate the rate at which natural origin salmon are included in broodstock.

Task A.1.2.4. Estimate stock composition (e.g., integrated or segregated hatchery- and natural-origin) of fish retained for broodstock.

Task A.1.2.5. Examine salmon for marks, wire (CWT), sex, and collect scales to determine age composition after spawning.

Task A.1.2.6. Collect length and weight samples from hatchery and natural origin spawned females. Estimate fecundity for each and create relationships with body size information to track for long-term changes.

Task A.1.2.7. Enumerate jacks retained in broodstock each week to assist with reporting and to assure jacks are incorporated in broodstock within the spawning protocol guideline.

Task A.1.2.8. Document brood year specific phenotypic characteristics for coho used at the Prosser and MRS Hatchery facilities (natural-origin, segregated, or integrated), and compare and report changes that have occurred over time. Methods will be similar to those described in Knudsen et al. (2006) and Knudsen et al. (2008).

Objective A.1.3. Monitor and evaluate the survival of hatchery salmon produced and reared at the Prosser and MRS Hatchery facilities.

Approach: YN staff will collect data on growth and survival of salmon produced and reared at the Prosser and MRS Hatchery facilities by life stage, from egg to release as pre-smolts.

Task A.1.3.1. Using gravimetric methods, estimate the number of eggs spawned.

Task A.1.3.2. Enumerate live eggs at "shock" time using an egg counter.

Task A.1.3.3. Document fry mortalities during incubation.

Task A.1.3.4. Estimate the number of fish ponded as the live egg count less documented fry mortalities.

Task A.1.3.5. Document mortalities during rearing by pond and month.

Task A.1.3.6. Document size of fish (length and weight) using sub-sample by rearing pond and month.

Task A.1.3.7. Document feed type and food conversion (weight gained divided by pounds of food fed) by rearing pond and month.

Task A.1.3.8. Estimate the number of fish released (e.g., if 100% of the fish are marked, this is the number of fish marked (see A.1.4) less documented mortalities from ponding to release).

Objective A.1.4. Comply with HSRG guidelines and program goals for natural stock restoration and local, natural-origin brood stock development.

Approach: Establish and maintain program marking protocols that allow returning fish to be distinguished by origin and stock. Marking strategies (Table A-1) are preliminary and may change pending further review of available budgets and logistical feasibility. Fish in programs targeted for harvest will be 100% adipose fin-clipped to facilitate harvest in all fisheries. Sufficient staff is available to mark-sample all fish that are handled at the Prosser denil and Roza adult trap facilities. Fisheries will strive to achieve a 20% mark-sample rate for at least adipose presence or absence. These mark and adult return sample rates are equivalent to or exceed those used in most other Columbia Basin programs with similar purposes. Therefore, we believe they will be sufficient to provide reasonable confidence in the parameters (e.g., fishery contribution, survival to Yakima river mouth, pHOS, pNOB, etc.) we are attempting to evaluate. We expect to detect and correct any insufficiencies through our annual review process.

Task A.1.4.1. Mark hatchery-origin coho produced at the Prosser and MRS Hatchery facilities as documented in Table A-1.

Task A.1.4.2. Estimate the total number of fish on hand at marking.

Task A.1.4.3. Observe marks on returning fish and use these data to manage proportion of natural fish in brood stock (PNoB – Objective A.1.2) and proportion of hatchery fish on the spawning grounds (PHoS – Objective A.3.1) per guidelines established by the YKFP Policy Group (as recommended by technical implementation teams).

Table A-1: Hatchery release numbers, number marked, and mark type by species and hatchery component

Facility	Component	# Released	# Marked	Tag or Mark
Prosser	Segregated smolts	500,000	100%	100% AD-Clip of which 100% CWT 5% PIT
MRS	Integrated smolts	200,000	100%	0% AD-Clip 100% CWT post-dorsal 10% PIT
MRS	Integrated parr	500,000	100%	0% AD-Clip 100% CWT snout 10% PIT

Objective A.1.5. Monitor and evaluate the quality and release of salmon produced at the Prosser and MRS Hatchery facilities.

Approach: Evaluation staff will analyze marking data and releases of juvenile salmon to determine survival rates between life stages and examine potential variables that may influence observed survivals. To document PIT tag loss that occurs between tagging and release of coho, we will install and maintain PIT tag arrays in the outlet channels at all release sites.

Task A.1.5.1. Evaluate mark quality and tag retention before release.

Task A.1.5.2. Evaluate fish health of a sub-sample of fish at release. Document and report release size and general condition of juvenile salmonids prior to release.

Task A.1.5.3. Summarize hatchery records for each brood year to document and report green egg-to-fry, fry-to-smolt, and green egg-to-smolt survival rates for each release strategy where appropriate (e.g. – parr or presmolt).

Task A.1.5.4. Based on above monitoring, recommend changes in rearing, marking, and/or tagging protocols to hatchery and YKFP management.

Task A.1.5.5. Install and maintain PIT tag antenna array in the outlets of all final rearing and release locations.

Task A.1.5.6. Document the number of PIT tagged fish in the release and calculate the number of PIT tags shed between tagging and release.

Task A.1.5.7. Document the number of CWT tagged fish in the release and calculate the number of CWT tags shed between tagging and release.

Task A.1.5.8. Report tagged release data to regional PTAGIS and RMIS data bases.

Objective A.1.6: Evaluate coho release strategies, release sites, and smolt out-migration timing and survival from the Prosser and MRS Hatchery facility releases to downstream detection sites.

Approach: Acclimation facilities are located throughout the Yakima River basin to promote homing of coho to their historical spawning grounds. In addition, PIT arrays have been installed and are operated throughout the Yakima Basin on a year-round or seasonal basis as access and flows allow. Out-migration timing can be derived from PIT tag detections at smolt monitoring facilities at Prosser and in the Columbia basin. Our primary evaluations will be performed on parr fish released from tributary streams in the upper Yakima and Naches basins. Smolt releases will primarily occur in mobile acclimation sites located throughout the Yakima Basin. PIT tags will be used to document arrival, duration, and travel times between dams. These data along with size at release data, projected flow data, and projected spill data will be used to determine the optimal release date. Pit tags will be used for adult return calculations and for spawning procedures. Calculated SARs for the releases will be used to compare and contrast performance, and will be the primary metric for determining relative success of subyearling and yearling releases. Marking strategies were given above in Table A-1.

A subsample of outmigrating smolts is also evaluated at both Roza and Prosser/Chandler during annual juvenile sampling operations. Environmental and trap data is recorded along with biological data on a subsample of each salmonid species represented. The excess and non-salmonid fish are tallied by species. Biodata consists of fork lengths, weights and smoltification stage. Environmental and trap data recorded includes weather conditions, and water temperature and clarity.

Task A.1.6.1. Maintain services of a qualified biometrician with experience in estimating smolt trap efficiency rates as well as smolt-to-smolt and smolt-to-adult survival rates for Yakima Basin fish.

Task A.1.6.2. PIT tag juvenile fish in canal or trap operations for use in entrainment, survival and smolt-to-adult survival rate estimation.

Task A.1.6.3. Collect fork lengths, weights, smoltification state, genetic samples, and scale samples from hatchery- and natural-origin juvenile coho obtained in juvenile sampling operations.

Task A.1.6.4. PIT tag groups of coho smolts released from acclimation sites, mobile acclimation or on station coho facilities. Total PIT tag groups may vary from year to year depending on size and timing of releases.

Task A.1.6.5. PIT tag groups of summer coho parr to represent survival in individual tributaries planted with larger numbers deemed necessary for recovery. Total number of tributaries may vary from year to year.

Task A.1.6.6. Document migration timing and survival for yearling and subyearling coho on a daily, seasonal and annual basis using PIT tag detections at Columbia River dams.

Task A.1.6.7. Track enzyme levels of hatchery juveniles released from hatchery facilities and acclimation sites to determine their migratory status. Compare with enzyme levels of natural-origin fish. Use this information to refine hatchery rearing practices and the hatchery release schedule.

Task A.1.6.8. Maintain a database of all biological data for yearling and subyearling releases from the Prosser and MRS hatchery facilities and for natural-origin fish.

Objective A.1.7. Assist in the planning, spawning, record keeping, and summarizing data for spawned salmon at the Prosser and MRS Hatchery Facilities.

Approach: YN biologists will annually assist in the spawning operations of salmon and steelhead at the Prosser and MRS Hatchery facilities. The role of the evaluation staff has been and will be to collect the biological data (date of spawning, sex, length, scales, marks/tags, extraction of CWTs, DNA and scale sampling, fecundity estimation, etc.) from all fish retained/spawned for broodstock. This collaborative role will be critical for optimizing production strategies. In addition, evaluation staff will work closely with the hatchery staff to provide weekly /monthly /yearly summaries of the data for hatchery reports and permit compliance as necessary.

Task A.1.7.1. Develop or update spawning protocols as needed for review and approval by YKFP technical teams and Fish Management staffs prior to the onset of spawning for all species.

Task A.1.7.2. Assist in the spawning of coho at the Prosser and MRS Hatchery facilities.

Task A.1.7.3. Collect biological data from all (or representative sample) spawned fish (sex, length, scales, DNA, marks/tags, CWT extraction and verification, PIT tag detection, fecundity estimation).

Task A.1.7.4. Where applicable, assist or provide hatchery staff with the necessary data summaries for completion of hatchery records from spawning activities.

A.2 Harvest Monitoring and Evaluation

Harvest monitoring of Yakima River-origin salmonids will be performed by WDFW and the Yakama Nation. The WDFW is responsible for monitoring non-tribal sport and commercial fisheries in the Columbia River, Yakima River, and ocean. The fisheries monitoring methodologies used by WDFW and other state and federal agencies are outside the scope of this document.

The Tribal harvest monitoring program is designed to achieve project goals through:

- sampling subsistence fisheries below Bonneville Dam and at Cascade Locks, The Dalles Dam, John Day Dam, and McNary Dam on the mainstem Columbia River

- sampling all Tribal fisheries in the Yakima River

Objective A.2.1. Monitor Tribal Subsistence Fisheries in the Columbia River

Approach: YN biologists and technicians annually monitor tribal ceremonial and subsistence fisheries in the Columbia River from the newly established tribal fishing area below Bonneville Dam upstream to McNary Dam. Fishing areas are observed to record total effort in a monitored time frame, with a subsample of effort monitored for observed catch. Biologists expand recorded data for each fishing area and time frame to estimate total catch.

Task A.2.1.1. Monitor Tribal fisheries below Bonneville Dam and at Cascade Locks, The Dalles, John Day, and McNary dams daily whenever fisheries are conducted.

Task A.2.1.2. Each fishing day will be divided into three 8-hour periods. A different observer will be used to monitor each 8-hour period.

Task A.2.1.3. Every 2 hours, the observer will record the number of active gear, the number of fish captured per gear type, and the length of the observation period.

Task A.2.1.4. Catch estimates will be calculated by expanding the counts for both time and gear.

Task A.2.1.5. Caught fish will be randomly sub-sampled for marks. Fish species and (if possible) sex will be identified for each fish and each fish will be examined for marks. Length measurements will be taken for each fish caught. Scale samples will be collected on each fish for aging. DNA samples will also be collected on a sub-sample of fish if required as part of genetic studies being undertaken by YN or other research groups.

Task A.2.1.6. Recovered CWTs will be sent to WDFW for processing. WDFW will report tag recoveries and information to the appropriate regional databases.

Task A.2.1.7. YN will be responsible for reporting PIT-tag recoveries to PITAGIS (the PIT-Tag Information System) and other regional databases.

Task A.2.1.8. YN reports estimated harvest in these fisheries through the *U.S. v Oregon* Technical Advisory Committee (TAC). Annual harvest in these fisheries is maintained as part of the TAC record.

Task A.2.1.9. YN biologists will analyze available data and estimate the number of Yakima released salmon and steelhead by origin caught in these fisheries.

Objective A.2.2. Monitor Fisheries in the Yakima River Basin

Approach: The majority of Tribal fishing activities in the Yakima River occur mainly at the Wapato, Sunnyside, Prosser, and Horn Rapids irrigation diversion dams. These fisheries will be monitored in a manner similar to that described in Objective A.2.1. Non-tribal recreational fisheries also occur in the Yakima River and are monitored by WDFW using standard creel methods.

Task A.2.2.1. YN staff will monitor tribal subsistence fisheries in the Yakima Basin using methods described in Objective A.2.1.

Task A.2.2.2. YN staff will conduct interviews with Tribal fishers. Their catch may be subsampled as described in Objective A.2.1 above.

Task A.2.2.3. WDFW will monitor recreational fisheries in the Yakima River using standard creel methods.

Objective A.2.3. Estimate harvest of Yakima Basin coho in Marine Fisheries.

Approach: The Regional Mark Information System (RMIS) will be queried regularly for any CWT recoveries of Prosser or MRS hatchery complex coho releases in ocean or Columbia River mainstem fisheries. The results of these queries will be analyzed to estimate the number of fish harvested in marine and lower Columbia River non-tribal fisheries.

Task A.2.3.1. YN staff will maintain a database of CWT codes released from the Prosser and MRS hatchery facility programs.

Task A.2.3.2. YN staff will run annual queries of the regional RMIS database, searching for recoveries of Prosser and MRS hatchery facility coho CWT codes.

Task A.2.3.3. YN staff will estimate harvest of Prosser and MRS hatchery facility coho in marine and lower Columbia River fisheries and report these estimates in annual reports.

A.3 Escapement Monitoring and Evaluation

Objective A.3.1. Estimate escapement of coho to the mouth of the Yakima River by origin.

Approach: YN staff utilize video cameras at all ladders at Prosser Dam and maintain a database of counts of fish by date, ladder, and species. In addition, YN biologists and technical staff will operate adult fish traps at the Prosser denil ladder and Roza for broodstock development and biological sampling (Objective A.1.1). As discussed earlier, Wapatox or Cowiche dams may be brought online in the future. YN staff has been operating both facilities for years to sample returning fish and to collect broodstock. Adult trap data and Prosser/Roza PIT and CWT detection data will also be used for estimating adult return composition (stock and origin).

Task A.3.1.1. Enumerate returning fish using ladder count data, other databases, and present methods.

Task A.3.1.2. Operate Prosser denil and Roza trapping operations and conduct fish sampling per established protocols.

Task A.3.1.3. Evaluate trapping operation and tag detection databases to estimate composition of returning fish by stock and origin.

Task A.3.1.4. Evaluate harvest estimates for Yakima Basin fisheries and spawning survey data to estimate escapement.

Task A.3.1.5. Summarize and report above data.

Objective A.3.2: Estimate adult returns, collect life history characteristics, and document distribution of adults to spawning areas.

Approach: Measuring adult returns to the point of release and to other intermediate areas is necessary to determine program success. YN monitors the returns of salmon and steelhead throughout the Yakima Basin via video counts and adult trap operations at Prosser and Roza dams and hatchery swim-in ladders, spawning ground surveys, mark-recapture estimation (as warranted using PITs or CWTs for substock determination), and harvest monitoring. Trapped and/or spawned broodstock fish and carcasses provide data concerning origin, stray rates, sex ratios, and composition of each year's run. Spawning surveys provide numbers of redds, spawn timing, and distribution of fish in each of the surveyed reaches and tributaries. These are primary actions to track program performance and progress toward meeting goals.

Task A.3.2.1. Conduct spawning ground surveys to count redds, determine distribution of spawners, and sample carcasses (sex, length, scales for age composition, and tissue for genetic typing) to document life history characteristics of coho in the Yakima Basin.

Task A.3.2.2. Process scales and CWTs for age composition.

Task A.3.2.3. Estimate stray rates from the PTAGIS and RMIS regional databases and DNA sampling.

A.4 Productivity Monitoring and Evaluation

Objective A.4.1. Estimate juvenile smolt production of coho by stock and origin.

Approach: YN staff will maintain and operate the Roza and Prosser/Chandler juvenile sampling facilities, and instream PIT arrays, and potentially, rotary screw traps in the Yakima Subbasin. A number of coho juvenile migrants will be sub-sampled annually. Staff will maintain a database containing length, weight, marks, DNA, etc. information collected from these samples. These and available PIT data will be analyzed to estimate smolt outmigration past Prosser Dam and smolt-to-adult productivity (return) rates.

Task A.4.1.1. Operate Chandler juvenile monitoring facility and collect phenotypic and genotypic data from a subsample of migrating juveniles.

Task A.4.1.2. Maintain a database of these sample data.

Task A.4.1.3. Use PIT or acoustic tags and technologies to evaluate flow and entrainment relationships to estimate annual smolt outmigration at Prosser by origin.

Task A.4.1.4. Evaluate available PIT data to estimate smolt-to-smolt and smolt-to-adult survival indices (see objective A.1.6), using analysis techniques such as those in Buchanan and Skalski (2007) or similar.

Objective A.4.2. Estimate adult-to-adult productivity of coho in the Yakima Basin.

Approach: YN staff will compile and maintain annual run reconstruction tables using the data collected from the objectives and tasks described above. Available age-at-return data will be used to develop brood/cohort return tables and adult return per spawner productivity.

Task A.4.2.1. Compile available escapement, harvest, and age-at-return data. Update and maintain these data annually in appropriate databases and spreadsheets.

Task A.4.2.2. Report these data in annual reports and other appropriate technical fora.

A.5 Ecological Interactions Monitoring and Evaluation

Objective A.5.1. Monitor inter- and intra-specific interactions and evaluate potential negative influence on the abundance and productivity of natural populations.

Approach: WDFW staff will continue non-target taxa of concern monitoring conducted under the YKFP M&E umbrella project, 199506325 (see https://www.cbfish.org/Document.mvc/Viewer/P155169 for latest annual report). YN staff will use information from the literature as well as in-basin demographic and migratory data collected from other tasks identified in this appendix as indicators of potential survival or productivity bottlenecks for natural populations.

Task A.5.1.1. Establish criteria for demographic or migratory parameters that would indicate potential bottlenecks. Criteria development may include risk assessment of competition and other ecological interactions as described in Pearsons and Hopley (1999), Ham and Pearsons (2001), and Kostow (2009).

Task A.5.1.2. Using PIT or acoustic tagging of hatchery juveniles prior to release, generate travel time and smolt-to-smolt survival estimates to the mouth of the Yakima River (from objective A.1.5 and A.4.1, using PIT tag detections at the Yakima juvenile sampling operations, and Bonneville Dam, or alternatively using acoustic tagging and monitoring). Evaluate data on hatchery juvenile distribution and duration of presence in the subbasin from this effort as well as from Tasks A.1.5.8 and A.4.1.4, and from expanded fish presence/absence sampling in the mainstem and tributaries.

Task A.5.1.3 Investigate feasible alternative methods for monitoring certain ecological interactions (such as competition) relative to conditions in the Yakima subbasin (i.e. direct observations of competition via snorkeling is impractical due to glacially-induced visibility limitations, extensive electrofishing in certain river reaches introduces risk to adult salmonids).

Task A.5.1.4. Annually review results from Yakima Subbasin Monitoring and Evaluation activities. Evaluate results relative to established criteria. Work with YKFP policy and technical teams to design and implement changes to Yakima production programs when criteria are exceeded.

Task A.5.1.5. Periodically review results from other ongoing Columbia Basin interactions studies for recommendations. Implement recommendations deemed practical and relevant to Yakima production programs.

A.6 Predation

Objective A.6.1. Estimate juvenile smolt mortalities of coho and identify mortality "hot spots" in the Yakima system during outmigration. Utilize collected data to develop and make *recommendations to policy makers that will improve juvenile survival through the Yakima system migration corridor.*

<u>Approach:</u> YN staff will continue avian and northern pikeminnow predation studies conducted under the YKFP M&E umbrella project, 199506325.

Task A.6.1.1. Monitor, evaluate, and index the impact of avian predation on annual salmon and steelhead smolt production in the Yakima Subbasin. The index consists of two main components: 1) an index of bird abundance along sample reaches of the Yakima River and 2) an index of consumption along both sample reaches and at key dam and bypass locations (called hotspots).

Task A.6.1.2. Examine roosting and nesting sites for the presence of salmon PIT tags. Link tag detections to sources of release and correlate with river flows. Analyze and utilize these data to recommend changes in present water and irrigation facility management practices to policy makers that will improve juvenile survival through the Yakima River system migration corridor.

Task A.6.1.3. Monitor, evaluate, and index impact of piscivorous fish on annual smolt production of Yakima Subbasin salmon and steelhead.

Task A.6.1.4. Develop methods to remove some salmonid predators from the Yakima system.

A.7 Disease Monitoring and Evaluation

Objective A.7.1. Maintain Prosser and MRS hatchery operation protocols that minimize potential disease transmission within and outside of the hatchery, assuring that fish reared at the coho facilities have high survival rates with little chance of pathogen transmission to naturally-rearing fishes and aquatic organisms.

<u>Approach:</u> YN staff will work with USFWS fish health specialists to implement disease management protocols and monitor hatchery operations for specific fish pathogens in accordance with the Washington Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines.

Task A.7.1.1. On at least a monthly basis, both healthy and clinically diseased fish from each fish lot will be given a health exam. The samples will include a minimum of 10 fish per lot.

Task A.7.1.2. At spawning, a minimum of 150 ovarian fluids and 60 kidney/spleens will be examined for viral pathogens from on-station broodstock. The enzyme linked immunosorbent assay (ELISA) sampling will be performed on all spawned spring Chinook females to reduce potential vertical transmission of *Renibacterium salmoninarum* (causative agent of bacterial kidney disease) to the progeny. Additional fish health samples will be collected to assess the incidence of other bacterial and parasitic pathogens.

Task A.7.1.3. Prior to transfer or release, fish will be given a health exam. This exam may be in conjunction with the routine monthly visit. This sample will consist of a minimum of 60 fish per lot.

Task A.7.1.4. Whenever abnormal behavior or mortality is observed, the fish health specialist will examine the affected fish, make a diagnosis and recommend the appropriate remedial or preventative measures, such as optimal fish-rearing densities.

Task A.7.1.5. Movements of fish and eggs will be conducted in accordance with the Co-Managers Salmonid Disease Control Policy and the USFWS Fish Health Policy and Implementation Guidelines. As needed, fish transferred from other facilities to the Yakima Basin will be given a health inspection.

Task A.7.1.6. At spawning, eggs will be water-hardened in iodophor as a disinfectant. All eggs transferred to the facility will be surface-disinfected with iodophor as per the USFWS Fish Health Policy.

Task A.7.1.7. Juvenile fish will be administered antibiotics orally when needed for the control of bacterial infections.

Task A.7.1.8. Formalin (37% formaldehyde) will be dispensed into water for the control of fungus on eggs and the control of parasites on juveniles and adult salmon. Treatment dosage and time of exposure may vary with species, life-stage and condition being treated.

Task A.7.1.9. All equipment (nets, tanks, rain gear) will be disinfected with iodophor between different fish/egg lots.

Task A.7.1.10. Different fish/egg lots will be kept in separate ponds or incubation units.

Task A.7.1.11. Tank trucks or tagging trailers will be disinfected when brought onto the station. Foot baths containing iodophor will be strategically located on the hatchery grounds (i.e., entrance to hatchery building) to prevent spread of pathogens.

Task A.7.1.12. Therapeutants approved by the U.S. Food and Drug Administration or those under Investigative New Animal Drug permits will be used for treatments. Under special circumstances, extra-label usage of other animal drugs may be prescribed by a veterinarian to control resistant disease organisms.

A.8 Genetic Monitoring and Evaluation

Objective A.8.1. Gain a thorough understanding of the genetic make-up of target stocks in order to maintain long term genetic variability and minimize the impacts of domestication on supplemented stocks.

Approach: YN staff will collect genetic samples from adult and juvenile coho. Analysis of genetic markers will be used to evaluate the relationship of salmon populations in the Yakima River relative to others in the Columbia River Basin and estimate origin of coho returning to the Yakima River. Subpopulation structure within the Yakima subbasin will also be evaluated for changes over time.

Task A.8.1.1. Collect genetic samples from adult coho at the Prosser and Roza adult sampling facilities, and from fish used for broodstock.

Task A.8.1.2. Collect genetic samples from juvenile coho at juvenile sampling facilities.

Task A.8.1.3. Send samples for analysis by CRITFC geneticists or other similarly qualified lab with information added to existing databases.

Task A.8.1.4. Evaluate results with particular interest to the following questions:

1. How is the genetic composition of natural-origin coho in the Yakima Basin changing over time (e.g., see Williamson et al. 2010 and Hess et al. 2011)?
2. Are there differences in genetic composition between segregated and integrated hatchery-origin and natural-origin coho? How is genetic composition of these various components changing over time?

Task A.8.1.5. Incorporate information into future reports and management actions through review with YKFP policy and technical teams.

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