FY 2008-2009 F&W Program Accords (MOA) Proposal Review

Narrative

Table 1. Proposal Metadata

Project Number	2009-001-00
Proposer	Yakama Nation Fisheries Resource Management
Short Description	Expanded Multi-Species Acclimation Wenatchee/Methow
Province(s)	Columbia Cascade
Subbasin(s)	Wenatchee, Methow
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Information transfer:

A. Abstract

This project proposes to develop and implement an expanded acclimation program for existing spring Chinook and steelhead hatchery mitigation programs in the Wenatchee and Methow basins. The expanded acclimation program will emphasize acclimation and release strategies similar to what has been uniquely successful in the Mid-Columbia Coho Restoration Project (BPA Project #19-96-04000). Direct stream releases and large single point hatchery releases will be redirected to appropriate habitat throughout the basins by adding additional acclimation sites within the Wenatchee and Methow. Acclimation sites which target releases in appropriate habitat areas may help achieve the recovery goals for these two listed stocks. Small acclimation/release sites scattered throughout appropriate spawning habitat will disperse returning adults to correct locations and should produce higher smolt to adult survival rates than direct scatter plants or large single point releases. This proposal represents a conceptual plan for "targeted acclimation". Specific site location options and details will be identified during program development.

B. Problem statement: technical and/or scientific background

Since 1991, several species and anadromous salmonid populations inhabiting the Columbia Basin have been listed as “threatened” or “endangered” under the Endangered Species Act. Upper Columbia Steelhead and Upper Columbia Spring Chinook populations are listed as “endangered” and considered by the Interior Columbia Basin Technical Recovery Team (ICTRT) to have a moderate to high risk of extinction when considering the biological factors that contribute to VSP (viable salmonid population) parameters: diversity, abundance, spatial structure and productivity.

B.1 Upper Columbia Steelhead

Upper Columbia River tributaries were once productive wild summer steelhead systems, but the populations have declined significantly since the early 1900s. The intensive commercial fisheries in the late 1800s and industrial development of the Columbia River were largely responsible for the decline of the wild steelhead run (Mullan et al. 1992; Chapman et al. 1994). Unlike chinook and sockeye salmon catches, steelhead harvest remained fairly constant from the early 1900s through 1940 at about 300,000 fish. Between 1938 and 1942, lower river commercial fisheries, including tribal fisheries within Zone 6, took about 70% of the run. Curtailing the commercial fisheries resulted in a resurgence of wild steelhead productivity in the upper Columbia River region, where the run size tripled (5,000 fish to 15,000 fish) between 1941-1954 (Mullan et al. 1992). Sale of steelhead by non-Indians was prohibited beginning in 1975. Subsequent to the dramatic increase, escapement has fluctuated widely. When the wild productivity declined again with completion of the Columbia River hydropower system, hatchery steelhead had replaced natural production in the run counts, masking the gravity of the change in wild fish production. Wild fish were subjected to, and suffered as a result of, mixed stock fisheries in the lower Columbia River directed at their abundant hatchery cohort. And while the hatchery steelhead could sustain the relatively high harvest rates, their wild counterparts could not.

Artificial production programs using locally adapted summer steelhead were fully implemented by the late 1960s. External marking of all hatchery steelhead was implemented in 1987 allowing non-tribal fisheries to increase harvest rates on the component of the run that could sustain it, while providing more protection to the wild component. Current artificial production programs focus releases into the Wenatchee, Methow and Okanogan systems, although the Entiat River received a portion of the hatchery steelhead up through 1998.

Hatchery fish made up an increasing fraction of the steelhead run after the 1960s, as wild runs became depleted (Chapman et al. 1994). Mullan et al. (1992) spawner-recruit analysis calculated the maximum sustainable yield (MSY) run size and escapement for steelhead at Rock Island and Rocky Reach dams to be 16,000-19,000 and 4,000–7,000, respectively. When hatchery produced steelhead are combined with the naturally produced steelhead, no long-term declining trend is evident. However, wild steelhead returning to the upper Columbia River region sustain themselves only at a threshold population size today. The high hatchery return rate, genetic homogeneity of hatchery and wild steelhead (Chapman et al. 1994b) and maintenance of near MSY levels in most years suggest a truly wild fish does not exist. Rather, hatchery production sustains these populations and has become a dominant component of the stocks that currently exist today.

For Upper Columbia Steelhead, which is a focal species in all upper Columbia Sub-basins, the ICTRT determined through run reconstruction and data analysis that the 12 year geometric mean of return per spawner was between .01 to 1.2 with the assumption that hatchery fish are as effective spawning as naturally produced steelhead. Of all listed salmonid populations in the Columbia River, the upper Columbia steelhead have the largest recovery “gap” measured as the difference between current population status and status needed for recovery (ICTRT 2007a).

Several artificial production programs related to hydroelectric mitigation in the region produce steelhead. The majority of these outplants are associated with integrated, supplementation programs to help in the recovery of the Upper Columbia Steelhead ESU. Those supplementation programs are listed in Table B-1.

Table B-1. Steelhead artificial production programs in the Upper Columbia region.

Funding Agency	Hatchery/Release Location	# of Smolts	Release Type
Chelan PUD	Eastbank H./Chiwawa River	350,000	Single site, acclimated release. Begin 2010-- Chiwawa Acc. Facility
Chelan PUD	Eastbank/Blackbird Pond (Wen. River)	50,000	Acclimated
Douglas & Grant PUDs	Wells H./ Methow Basin	350,000	Unacclimated, scatter planted
Bureau of Reclam.	Winthrop NFH/Methow Basin	100,000	On-station, concrete to concrete management

Most UC steelhead releases are direct stream plants or are acclimated and released from a large, single acclimation site (Table B-1). At this time, the Mid-Columbia PUDs and the Bureau of Reclamation do not intend to fund construction of additional acclimation sites leaving two acclimation sites in the Wenatchee basin and none in the Methow basin. The current acclimation/release strategy does not maximize imprinting and survival to specific steelhead habitat areas in the Wenatchee and Methow basins.

B.2 Upper Columbia River Spring Chinook

Natural occurrences influenced by detrimental human activities (e.g., drought, floods, landslides, fires, and debris flows) have impacted the abundance, productivity, spatial structure, and diversity of Upper Columbia spring Chinook salmon. Environmental conditions (ex. annual precipitation and ocean cycles) have also influenced these four Viable Salmonid Population (VSP) attributes which are important for long term population viability. Some populations of spring Chinook have been lost from the region. Lasting effects from some of these early activities may still act to limit fish production in the Upper Columbia Basin. Threats from some current activities are also present in the Upper Columbia Basin. Populations of spring Chinook within the Upper Columbia River Basin were first affected by the intensive commercial fisheries in the lower Columbia River. These fisheries began in the latter half of the 1800s and continued into the 1900s and nearly eliminated many salmon and steelhead stocks. With time, the construction of dams and diversions, some without passage, blocked migrations and killed upstream and downstream migrating fish. Early hatcheries constructed to mitigate for fish loss at dams and loss of spawning and rearing habitat were operated without a clear understanding of population diversity, where fish were transferred without consideration of their actual origin. Although hatcheries were increasing the abundance of spring Chinook stocks, they may have been decreasing the productivity of populations they intended to supplement (Berejikian and Ford 2004).

Concurrent with these historic activities, human population growth within the basin was increasing and land uses, in many cases encouraged and supported by governmental policy, were impacting spawning and rearing habitat. These activities acting in concert with natural disturbances decreased the abundance, productivity, spatial structure, and diversity of spring Chinook salmon in the Upper Columbia Basin (Upper Columbia Salmon Recovery Board, 2007)

Presently, harvest has been greatly reduced from historic levels, dams are being changed and operated to increase passage and reservoir survival, and some hatcheries are being managed to address spatial structure and diversity issues, and habitat degradation is being reduced by implementation of recovery projects, voluntary efforts of private landowners, irrigators, and local governments, and improved land management practices on public and private lands. Nevertheless, additional actions are needed within all sectors (Harvest, Hatchery, Hydro, and Habitat) in order for listed spring Chinook stocks in the Upper Columbia Basin to recover.

Upper Columbia spring Chinook, like steelhead, is a focal species in all upper Columbia sub-basins. The ICTRT determined that adult returns have been reduced dramatically from historical levels as a result of habitat degradation, high harvest levels and hydroelectric development (e.g. Mullan et. al 1992). A series of years of poor ocean productivity in the 1990s significantly reduced the abundance of spring Chinook in this ESU. The Wenatchee and Methow spring Chinook salmon populations currently have extremely low productivity and wild fish abundance (ICTRT 2007a). The long term viability of this ESU is unlikely unless these populations are recovered to a viable status (ICTRT 2007b).

Several artificial production programs associated with hydroelectric mitigation in the region produce spring Chinook that are outplanted in the Wenatchee and Methow basins. The majority of these outplants, listed in Table B-2, are associated with integrated supplementation programs to help in the recovery of the Upper Columbia spring Chinook ESU.

Table B-2. Upper Columbia spring Chinook artificial production program in the Upper Columbia region.

Funding Agency	Hatchery/Release Location	# of Smolts	Release Type
Chelan PUD	Eastbank H./Chiwawa River	672,000	Single site, acclimated release-- Chiwawa Acc. Facility
Grant PUD	Hatchery Unknown/Nason Creek	250,000	Single site, acclimated release by 2011
Grant PUD	Little White NFH/White River	150,000	Single site (McComas), acclimated
Douglas & Grant PUDs	Methow Sp. Ch. Hatchery/ Methow Basin	550,000	Acclimated at 3 locations
Bureau of Reclam.	Winthrop NFH/	600,000	On-station, concrete to concrete management

Compared to UC steelhead, more hatchery reared spring Chinook are released from acclimation facilities. However, several of the releases are at a single location with a high number liberated annually. As with steelhead, the PUDs are not obligated to fund and expand their acclimation infrastructure as part of their mitigation. These PUD entities are not responsible for recovery of salmon populations that they mitigate for from their project impacts but rather their hatchery compensation measures must not impede or negatively impact salmon recovery. Their current mitigation and hatchery infrastructure meets the stipulations in their FERC license. The stipulations in the Grand Coulee mitigation funded by the Bureau of Reclamation do not require any additional production facilities other than the three USFWS hatcheries located in the Wenatchee, Entiat and Methow basins.

B.3 Benefits of acclimation and project justification

Published research shows that acclimation is a critical component of salmonid recovery strategies. Research conducted to date forms the basis for the assumptions made below:

Assumptions

1. Acclimation of smolts prior to release minimizes adult straying between watersheds. The reduction of stray rates of acclimated versus truck planted smolts has been directly demonstrated for Atlantic salmon (Isaksson et al., 1978) and coho salmon (Johnson et al., 1990). Other studies done on other species give less direct evidence by comparing straying rates for hatchery released and truck planted smolts (Labelle, 1992, Slaney, 1993, and Vander Haegen and Doty, 1995). These studies show that rearing for an undefined period of time at release locations reduces the straying of returning adults to other basins.

2. Multiple acclimation/release sites near spawning habitat encourages more rapid restoration by dispersing adults into large areas in the correct habitat. This assumption suggests that more,

smaller sites are more desirable than fewer, larger sites. Multiple sites also spread the catastrophic loss risk. Practical operational considerations and cost place a limit on the degree to which site numbers can be increased.

3. Releasing multiple species at single acclimation sites will not cause negative impacts. The number of acclimation sites can be decreased by releasing more than one species at new and existing locations. Disease considerations and species interactions will need to be considered. Mixing species in single release ponds has program benefits and may be utilized after testing.

4. Low density, quality, natural rearing conditions during acclimation, improve smolt quality. Artificial production strategies which have been proposed (Flagg et al., 1999) for conservation hatcheries can also be applied, where practical, to acclimation sites. The use of surface water, natural rearing units with "enriched" environments, low rearing densities, and volitional releases are design criteria that can be applied to acclimation site location and design. Some work has been published on "natural" acclimation. The effects on adult survival of acclimation using natural river water in conventional rearing units has been tested for coho (Hopley et al, 1978) and spring Chinook (Appleby, 1998). Acclimation for 6 weeks significantly improved coho but not spring Chinook survival. In another study (Olson, 1997), adult survival rates of spring Chinook acclimated through the winter in low density ponds was "substantially" higher than raceway reared fish. Low density rearing also has other benefits. Larger water volumes improve site security by increasing oxygen reserves in case of water supply failures. Also, volitional smolt releases may not be as influenced by the artificial migratory impetus caused by crowding. The effect of this assumption on acclimation site identification is to emphasize site locations where large rearing units with natural bottoms and surface water supplies can be built or used.

5. "Full term" acclimation, defined as from late November to release, reduces the stresses due to hauling smolts, improves adult homing, provides a more natural water temperature regime, allows time for cultured smolts to adapt to the more natural environment of the acclimation site, and further reduces hatchery capacity requirements. "Short term" acclimation begins when icing, snow and other conditions allow site operations..

6. Acclimation improves survival to adulthood. Comparisons have shown acclimated smolts survive at higher rates than truck planted smolts for Atlantic salmon (Isaksson et al., 1978) and for coho salmon (Johnson et al., 1990 and YIN, 1999). Studies of other species have not been published.

7. Acclimation sites high in the water sheds improve adult dispersal. Work with steelhead (Slaney, 1993) and fall Chinook (Pascual, 1994) has shown that adults disperse to areas at much higher rates below than above release hatcheries. If this behavior occurs at acclimation sites, releases at the upper ends of watershed spawning areas are desirable. Site development and access in these upper areas are important limitations.

8. Adult dispersal inside watersheds is increased by the absence of acclimation site return water during adult return periods. Straying of adults outside watersheds is a disadvantage, but straying within a watershed to appropriate spawning areas maybe a program benefit. If attraction water from specific locations does not exist as adults return, the assumption is that they will not concentrate spawning activity at that location. Fall Chinook (Pascual, 1994), for example, showed "extremely" high rates of straying when released from the heterogeneous environment of

estuaries. Truck scatter plants also show high rates of straying, as discussed above, which likely also means high rates of dispersal.

B.3.1 Project Justification

For both UC steelhead and UC spring Chinook, expansion of existing hatchery programs by adding additional semi-natural acclimation releases for these integrated recovery programs should result in better distribution of adult returns to known habitat areas, while minimizing adult straying to other watersheds, reducing residualism of released fish (especially steelhead), yielding returning adults that will be capable of producing naturally spawned progeny and potentially increasing smolt to adult survival rates for cultured fish.

C. Rationale and significance to regional programs

C.1 Columbia River Basin Accords

The Columbia River Basin Accords recognize that hatchery actions can provide important benefits to ESA-listed species and to the Tribes in support of their treaty fishing rights. The Three Treaty Tribes – Action Agency Agreement identifies expanded, multi species acclimation as a new artificial production action.   The proposed expansion of acclimation will be closely coordinated with on-going mitigation programs under the jurisdiction of US v. Oregon, Mid C HCPs and Settlement Agreements.

C.2 Subbasin Plans

C.2.1 Wenatchee Subbasin Plan

We believe this acclimation program contributes to the goals of the Wenatchee Subbasin plan. Specifically, Goals 1 and 3 of the Plan.

Goal 1. *Maintain existing high quality habitat and the native fish and wildlife populations inhabiting these areas*

Goal 3. Restore maintain, or enhance fish and wildlife populations to sustainable and harvestable levels, while protecting biological integrity and the genetic diversity of the species.

- *Maintain or increase abundance of native fish and wildlife species to a level where populations can be harvested and can be sustained through natural reproduction and productivity*
- *Maintain or rebuild distribution of native fish and wildlife populations to perpetuate spatial structure, life history diversity, and genetic diversity*

C.2.2 Methow Subbasin Plan

This project encompasses the "vision" for this subbasin which "includes viable, self-sustaining, harvestable, and diverse populations of fish and wildlife and their habitats, along with recognition of the need to support the economies, customs, cultures, subsistence and recreational opportunities within the subbasin." Under the subbasin Plan's **Foundation and Supporting Principle – Long Term Sustainability,** this project supports the Plan's premise that "most native fish and wildlife populations are linked across large areas and do not consider political borders; therefore, the possibilities for extinctions or extirpations is reduced. An important component for recovery of depressed populations is to work within this framework and maintain or recreate large-scale spatial diversity. Populations with the least amount of change from their historical spatial diversity are the easiest to protect and restore and will have the best response to restoration actions."

C.3 Goals and Objectives of the 2000 Fish and Wildlife Program

We believe that the proposed acclimation expansion for upper Columbia spring Chinook and steelhead is consistent with the objectives and principles of the 2000 Fish and Wildlife Program. This project will help enhance life history diversity for these 2 listed species in the upper Columbia which is congruent with the over arching objectives to sustain an abundant, productive and diverse community of fish and wildlife and to recover fish affected by the development and operation of the hydro system that are listed under the Endangered Species Act.

Also, the Program acknowledges Treaty Rights. "The Council recognizes that the Indian tribes in the Columbia River Basin have vital interests directly affected by activities covered in this program. These Indian tribes are sovereigns with governmental rights over their lands and people, and with rights over natural resources which are reserved by or protected in treaties, executive orders, and federal statutes. The United States has a trust obligation toward Indian tribes to preserve and protect these rights and authorities. Nothing in this program is intended to affect or modify any trust or treaty right of an Indian tribe. The Council also recognizes that implementation of this program will require significant interaction and cooperation with the tribes, and commits to working with the tribes in a relationship that recognizes the tribes' interests in co-management of affected fish and wildlife resources, and respects the sovereignty of tribal governments."

"The fish and wildlife program is implemented principally at the subbasin level. It is at this subbasin level that the more general guidance provided by the basin and province level visions, principles, objectives, and strategies is refined in light of local scientific knowledge, policies, and priorities." Therefore, this expanded acclimation project supports the goals and principles of the Fish and Wildlife Program given this implementation strategy and the proposal's consistency with the Wenatchee and Methow Subbasin Plans.

C.4 Upper Columbia River Salmon Recovery Plan

The specific, overall goal for the recovery of upper Columbia spring Chinook and steelhead in the Plan is: "To secure long-term persistence of viable populations of naturally produced spring Chinook and steelhead distributed across their native range." Our project supports this goal.

The Upper Columbia River Salmon Recovery Plan lists several objectives for hatchery programs within the upper Columbia region. The short term objective listed in the hatchery section of the recovery plan is "use artificial production to seed unused, accessible habitats." This is one of the main objectives of our proposed project.

D. Relationships to other projects

Table D-1. Relationship to existing projects

Funding Source	Project #	Project Title	Relationship (brief)
BPA	199604000	Mid-Columbia Coho Restoration	Coho acclimation sites may be incorporated into the multi species concept. In other words, if a site is biologically sound and appropriate for acclimating and releasing coho, than this species may also be programmed for release there as well.
Chelan, Grant and Douglas PUDs	N/A	Hatchery Compensation Programs for Methow and Wenatchee spring Chinook and Steelhead.	As described in this Narrative, existing production from established hatchery mitigation programs will be used in this project to expand the geographic area of release for better spatial distribution of listed steelhead and spring Chinook.
BPA	200501700	Integrated Status and Effectiveness Monitoring Program (ISEMP)	ISEMP is expanding remote PIT tag monitoring sites in the Wenatchee Basin. The data collected from these sites will contribute to evaluations of adult return distribution, timing, and habitat use as a result of this proposal.

E. Project history (for ongoing projects)

N/A

F. Proposal biological/physical objectives, work elements, methods, and metrics.

F.1 Project Objectives

The project objectives are to:

1. Develop an expanded acclimation program for UC spring Chinook and UC steelhead in the Wenatchee and Methow subbasins using existing PUD/federal mitigation production in the region.

2. Acclimate upper Columbia steelhead and spring Chinook in natural or semi-natural acclimation sites located near spawning habitat in the Wenatchee and Methow Subbasin.

This proposed project would develop new semi-natural ponds similar to systems that have been uniquely successful for the Mid-Columbia Coho Restoration Project (BPA Project #19-96-04000). Semi-natural coho acclimation sites currently in operation include existing beaver ponds, wetland complexes and constructed earthen ponds. All of these sites have common features such as gravity flow surface water supplies, ability to provide a supplemental food source of aquatic invertebrates, earthen bottoms, and natural vegetation cover (see Figures F-1, F-2, and F-3). The newly developed ponds would be used to acclimate fish produced under existing PUD/federal hatchery programs that are currently practicing either direct stream plants or single point, large releases. The acclimation sites would be located within known habitat reaches within the Wenatchee and Methow watersheds.

F.2 Development of an expanded acclimation program
Work elements associated with the first objective can be found in Table F-1.

Table F-1. Work elements associated with developing and expanded acclimation plan and site construction.

Work Element Title	**Work Element Description**
Produce Plan	Develop the expanded acclimation plan which would identify specific potential acclimation sites, biological data to include water quality, water quantity, number of fish which could be acclimated at the specific sites, construction needs, and which hatchery program would benefit from the use of each site.
Watershed Coordination	The expanded acclimation plan will be closely coordinated through the Chelan and Douglas HCP hatchery committees (CPUD, DCPUD, USFWS, Colville Tribes, WDFW, Yakama Nation, NMFS), PRCC Hatchery Committee (Grant PUD Settlement Agreement) as well as landowners within the Wenatchee and Methow sub-basins.
Manage and Administer Project	Manage all aspects of design, development and implementation of the expanded acclimation project.
Collect/Generate/Validate Field or Laboratory Data	Collect data from potential acclimation sites to evaluate suitability and capacity.
Produce Environmental Compliance Documentation	Determine what documentation/assistance is needed from BPA’s environmental compliance lead and meet the necessary environmental compliance requirements prior to site development and acclimation activities.

To achieve the first objective, a plan will be developed that will identify potential acclimation sites, the number of sites per basin and which species can be acclimated at each site. The plan will be further refined through landowner and agency coordination, and data collection to identify the capacity limits at each potential site. Seasonal flow rate, pond dimensions to determine maximum volume, and potential ground water availability data will be collected by YN staff and consultants. Flow and volume density criteria will be site specific and determine potential capacities for species involved.

The types of sites that will be included in the plan are described in Table F-2. Site locations will be prioritized based upon their location relative to appropriate habitat. This approach can be defined as "targeted acclimation". To allow for the maximum number of release locations, development costs per site will be kept low. Locations that do not require major new construction would be emphasized.

Table F-2. Preferred acclimation alternatives.

Acclimation Alternatives	Description
Small ponds constructed on small streams	Ponds constructed in many locations near appropriate adult spawning habitat, supplied by small streams that may be dry in late summer and fall. The ponds may be constructed to capture the entire creek using gravity flow, depending on the evaluation of the creek for present and potential spring-time fish habitat value. If feasible, three ponds would be constructed at each site to allow separate multiple species releases. The Rohlfing Coho Acclimation Pond on upper Nason Creek is an example of this type of site. See figure F-1.
Existing side channels and ponds	Side channels used with net barriers installed at the exits and/or entrances. To be functional, the side channels must have flow rates large enough to support rearing and low enough to prevent nets from being blown out. Existing ponds can be used wherever possible, for example, beaver ponds exist in many upstream areas near habitat. An example of such a site is the Butcher Creek Coho site on lower Nason Creek. The beaver pond on Butcher Creek is beautiful holding habitat – riparian vegetation and dead wood provide shade, structure, refuge from avian predation. See figure F-2.
Small ponds constructed at irrigation diversions	Existing diversions may provide a stable, gravity flow or pumped water supply to acclimation ponds. The Winthrop NFH back channel coho acclimation pond on the Methow is an example of this type of site. See figure F-3.
In-river acclimation	Net barriers placed in quiet areas of river channels would create low-impact, short-term acclimation sites. River nets are subject to impacts from high debris loads and high flows during spring acclimation periods. The nets would be designed to fail through release of the fish during such conditions. An example of such a site is the planned McComas White River spring Chinook site.
Existing acclimation facilities	Several single species acclimation sites exist in the upper watersheds. These include Chiwawa in the Wenatchee basin and Twisp and Chewuch in the Methow basin. These sites could be adapted to multi-species acclimation, increasing their effectiveness.

Figure F-1. The Rohlfing coho acclimation pond on Nason Creek is an example of a small pond constructed on a small seasonal stream.

Figure F-2. Butcher Creek coho acclimation pond; an example of an existing pond.

Figure F-3. The Winthrop NFH back channel coho acclimation pond; and example of an acclimation site on a diversion.

The constructed pond on the small stream alternative (Table F-2; Figure F-1) would be used in locations where existing components do not exist, generally in the upstream areas. This strategy will allow the development of an acclimation system that should produce high quality smolts and disperse returning adults throughout appropriate spawning habitat. The existing side channel/pond, ponds on irrigation diversions, and in-river alternatives could be used, depending on watershed characteristics.

Expanded use of existing acclimation facilities for multiple species may also be possible. Capacity would be available if specific single species site numbers are reduced by spreading releases throughout the watersheds.

A feature of this proposal is to expand the use of present and proposed acclimation sites for the release of multiple species from each site. This concept maximizes the number of sites available in the watersheds. However, mixed-species acclimation plans must consider the compatibility of species based on species-specific traits such as differences in spawning distribution and juvenile run timing and the large size, aggressive nature and hardiness of steelhead smolts. Disproportionate use of sites by each species will result from the consideration of these species differences. Multiple species releases at single acclimation sites will ideally occur from separate rearing units. Where this is not feasible, mixing species in individual units would be considered. WDFW (Andy Appleby, personal communication) has successfully mixed species in release ponds in the past.

During low water (or very cold) years, some small stream sites developed for acclimation may not be functional. These events will require reliance on alternative release strategies, including scatter plants and additional releases from sites in the watersheds with mainstem water supplies.

Another program feature is the emphasis on releasing smolts into "appropriate" spawning habitat. Spawning distributions for spring Chinook and steelhead in the mid-Columbia are summarized in Mullan et al. (1992) and Chapman et al. (1994, 1995). This information has been used in determining the general location for potential acclimation sites.

The effect of acclimation programs on PUD and federal hatchery operations could be significant. Removing fish from the hatcheries in winter or early spring will greatly reduce water requirements during periods when water availability may limit hatchery production. This increase in water availability may allow hatcheries to reduce rearing densities or increase production.

An important part of designing an acclimation program is determining the number of sites per watershed. There is very limited information on how far adults disperse from acclimation sites, especially sites of the various types proposed for use here. Given this limitation, some decision needs to be made about the distance between sites to obtain adequate adult dispersal. An initial guess of a 3 mile separation is proposed, which will require the development of up to 5 sites on most watersheds. Further refinement of this spatial assumption will be based on local geographic features, land ownership, and species proposed for acclimation once locations are chosen.

Releases high in the watersheds have been assumed to be important (see Section B.3, #7), but they represent unique challenges. These sites are generally on US Forest Service land and require the construction of ponds. Obtaining USFS permission and the necessary construction and water rights permits will be required. At higher elevations, snow conditions will limit seasonal access. The value of these sites to the program may dictate that snow removal equipment be purchased or leased during the acclimation period and the use of smolt hauling trucks designed for winter conditions.

F.1.2 Acclimate upper Columbia steelhead and spring Chinook in natural or semi-natural acclimation sites located near spawning habitat in the Wenatchee and Methow Subbasin.

Work Elements associated with the Objective 2 can be found in Table F-2.

Table F-2. Work elements associated with developing and expanded acclimation plan and site construction.

Work Element Title	Work Element Description
Develop Plan	Initial scoping between YN, subcontractors, co-managers, and HCP and PRCC committee members and plan development to include

	rearing strategies, site locations, water availability, etc.
Acclimate Juvenile Fish	Upper Columbia spring Chinook and steelhead pre-smolts from existing PUD/Federal supplementation programs will be acclimated in semi-natural and natural ponds located near spawning and rearing habitat. Number of fish acclimated will be dependent upon the capacities of the acclimations sites identified and developed under the first objective.
Mark or Tag animals	A sample (3000-8500) juveniles per acclimation site will be PIT tagged to allow collection of metrics described in the M&E plan.
Manage and Administer Project	Manage all aspects of design, development and implementation of the expanded acclimation project.
Collect/Generate/Validate Field or Laboratory Data	Collect data as described in Section G: Monitoring and Evaluation
Produce Environmental Compliance Documentation	Determine what documentation/assistance is needed from BPA's environmental compliance lead and meet the necessary environmental compliance requirements prior to site development and acclimation activities.

The number and location of acclimation sites will be determined during plan development. We expect that many of the expanded acclimation sites will not be suitable for overwinter acclimation. In this case, spring Chinook and steelhead smolts will be transported from rearing facilities to acclimation sites in early spring, as soon as the ponds are ice free. Acclimation duration will range from 4-10 weeks depending upon location and weather conditions. Overwinter acclimation will involve transport of fish to acclimation sites in the late fall/early winter period. Acclimation would occur for up to 6 months at sites that are capable of winter operation.

Each acclimation pond will be staffed during daylight hours. Staff at the acclimations sites will be responsible for implementing the daily feeding schedule, predator hazing, and daily site data collection. Daily site data collection will include water temperature, dissolved oxygen levels, observance of predators, kilograms of feed consumed, and documentation and removal of any mortalities. On a weekly basis fish will be sampled to obtain growth and condition factor data as well a visual measure of smoltification.

Smolts will be volitionally released from the acclimation ponds. Where appropriate, PIT tag detection systems will be used to monitor the volitional releases (see section '**G. Monitoring and Evaluation**' for more detail)

G. Monitoring and evaluation

This proposal works in concert with existing hatchery programs with previously established and documented M&E plans. The current M&E plans for the Chelan and Douglas HCP Hatchery Compensation programs (DCPUD 2005; Murdoch and Peven 2005) will be applied to the fish released from the proposed acclimation ponds and will help to assess the contribution of these hatchery programs to the natural spawning population. In addition to M&E plans implemented through the Chelan and Douglas County HCP hatchery compensation programs, we propose additional metrics specifically to evaluate the efficacy of the expanded sites.

G.1. Chelan and Douglas County HCP Hatchery Compensation Monitoring and Evaluation Plans

The existing M&E program is designed to determine whether the hatchery programs are supporting the recovery of ESA listed species by increasing the abundance of the natural adult population while ensuring appropriate spatial distribution, genetic stock integrity, and adult spawner productivity. The M&E Plans and the associated Analytical Framework (Hays et al. 2007) have 10 objectives listed below:

1. Determine if supplementation programs have increased the number of naturally spawning and naturally produced adults of the target population relative to a non-supplemented population (i.e. reference stream) and the changes in the natural replacement rate (NRR) of the supplemented population is similar to that of the non-supplemented population.

2. Determine if run timing, spawn timing, and spawning distribution of both the natural and hatchery components of the target population are similar.

3. Determine if genetic diversity, population structure, and effective population size have changed in natural spawning population as a result of the hatchery program. Additionally, determine if hatchery programs have caused changes in phenotypic characteristics of natural populations.

4. Determine if the hatchery adult-to-adult survival (i.e. hatchery replacement rate) is greater than the natural adult-to-adult survival (i.e, natural replacement rate) and equal to or greater than the program specific HRR expected value based on survival rates listed in the BAMP (1998).

5. Determine if the stray rate of hatchery fish is below the acceptable levels to maintain genetic variation between stocks.

6. Determine if hatchery fish were released at the programmed size and number.

7. Determine if the proportion of hatchery fish on the spawning ground affects the freshwater productivity (i.e., number of smolts per redd) of supplemented streams when compared to non-supplemented streams.

8. Determine if harvest opportunities have been provided using hatchery returning adults where appropriate.

Regional Objectives

9. Determine whether BKD management actions lower the prevalence of disease in hatchery fish and subsequently in the naturally spawning population. In addition, when feasible, assess the transfer of Rs infection at various life stages from hatchery fish to naturally produced fish.

10. Determine if ecological interactions attributed to hatchery fish reduce the abundance, size or distribution of non-target taxa (NTT).

In addition to this existing M & E plan (Appendix A and B), new, natural acclimation sites will require more project performance indicators to evaluate survival and condition of fish acclimated in the ponds compared to fish released without acclimation. Monitoring of these additional project performance indicators will allow for adaptive management of hatchery practices to improve benefits achieved. M&E results will be reviewed and revised every 5-years on the same schedule as program M&E objectives described in Appendix A and B.

G.2 Additional Proposed Metrics Specific to Expanded Acclimation Sites.

G. 2. 1. In-Pond Survival

Objective: To estimate in-pond (transport-to-release) survival of UC spring Chinook and steelhead in expanded acclimation sites.

Metric: In-pond survival estimate will be based on PIT tag detection (Neeley 2007) and /or predator and mortality observations (Murdoch et al. 2007).

Rationale: In-pond survival estimates will increase the accuracy of smolt-to-adult survival estimates. In-pond survival estimates will be used to evaluate the success of acclimation ponds and predator control strategies, allowing researches to maximize survival through adaptive management.

Method: Groups of approximately 3,500 to 8,000 juvenile spring Chinook or steelhead will be PIT tagged 3-6 months prior to release. All PIT tagging will follow protocols described in the PIT tag Marking Procedures Manual (CBFWA 1999). Where possible, PIT tag detection antenna arrays will be installed to detect fish volitionally emigrating from the expanded acclimation sites. In-pond survival will be calculated following methods described in Neeley (2007). In the event that PIT tag detection cannot be installed at the pond outlet, in-pond survival rates will be estimated based on moribund fish, numbers of predators observed, and predator consumption rates (Murdoch et al., 2007).

G.2.2. Pre-Release Fish Condition

Objective: To provide a comparative measure of fish condition and stage of smoltification prior to release.

Metric: Stage of smoltification will be measured as the proportion of fish which upon visual examination, appear to be smolts, transitional (in the process of becoming a smolt), or parr (Kamphaus and Murdoch 2004). Fish condition will be assessed based on size and the amount of growth in the pond, and on a pre-release examination of external features such as fins and eyes; of internal organs including kidney and liver; and of mesenteric fat levels and blood components (% volume of red and white blood cells, plasma protein levels).

Rationale: Pre-release fish condition examinations are intended to assess the normality or overall health of the population. These examinations will allow researchers to compare fish condition among ponds and across years as a measure that may affect survival.

Methods: A random sample of 100 fish from each acclimation pond will be used to measure stage of smoltification and mean fish size on a weekly basis until release. The pre-release fish condition assessment will be done once within 72 hours of release. Detailed methods describing how stage of smoltification is determined and how pre-release fish condition examinations are conducted can be found in Kamphaus and Murdoch (2004).

G.2. 3 Smolt-to-Adult Survival (SAR)

Objective: To measure and compare smolt-to-adult survival for each acclimation site, and to compare smolt-to-adult survival rates between ponds and release strategies.

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Metric: Smolt-to-adult survival will be calculated as follows:

$$S_{\text{smolt-adult}} = \text{Adults and Jacks}_{\textbf{broodyear X}} / \text{Smolts}_{\textbf{broodyear X}}$$

Where $S_{\text{smolt-adult}}$ is the estimated smolt-to-adult survival rates; Adults and Jacks $_{\textbf{broodyear}\ X}$ is the number of adults to return from broodyear *X* ; Smolts $_{\textbf{broodyear}\ X}$ is the population of emigrating smolts.

Rationale: For hatchery fish, smolt-to-adult survival will be used to ensure that each natural acclimation site is contributing to adult returns. A comparison in survivals between each natural acclimation pond and traditional release strategies (current program of single, non-natural acclimation site or truck planting) will be examined. Knowledge of how smolt-to-adult survival indices correlate with rearing and environmental conditions will allow researchers to adaptively manage the acclimation effort to maximize survival. Evaluations will include facility comparison, comparison of growth rates, smolt size and acclimation length.

Methods: SARs will be calculated for fish released from the expanded acclimation sites as well as the traditional release methods. Unique Coded Wire Tags (CWTs) will be required for each acclimation site. CWTs will be used to calculate SARs from each release group and location. Pre-release CWT retentions will be used to estimate the number of fish with CWTs released.

H. Facilities and equipment

As discussed in section ‘B. technical and/or scientific background’, the hatcheries producing juvenile steelhead and spring Chinook for recovery in the upper Columbia are Eastbank Fish Hatchery, Wells Fish Hatchery, Winthrop NFH, Methow Fish Hatchery and a YTD Grant PUD facility. Production from these facilities will be outplanted to acclimation sites which will be identified as the program is developed. The acclimation sites will be selected in locations that provide for better spawning distribution within available habitat.

Acclimation sites will be semi-natural with a minimal constructed footprint. Examples of the types of acclimations facilities that will be developed include existing or modestly constructed earthen ponds, side channels or irrigation canals.

Equipment needed include two vehicles, two office computers, PIT tag detection arrays, and miscellaneous field and hatchery equipment.

I. References

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Aren't these allozyme (and possibly mtDNA studies? More recent microsatellite work is more useful for stock discrimination)

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Neeley, D. 2007. Smolt-to-Smolt survival to McNary Dam of 2003 through 2007 releases into the Wenatchee and Methow basins. *Prepared for:* Yakama Nation Fisheries Resource Management. Toppenish, Wa.

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J. Key personnel

Mr. Tom Scribner will have the prime responsibility for ensuring that the project remains on schedule and within budget and will be directly accountable to the BPA. Ms. Keely Murdoch and/or Mr. Cory Kamphaus will be responsible and provide oversight for all program deliverables. Staff biologists will be responsible for successful execution of all field components of the proposal. These two individuals will ensure that data acquisition remains on schedule and of the highest possible quality. We will also contract with USFWS for fish health monitoring but incidental work performed by USFWS hatchery personnel at the ENFH.

J.1 Curriculum Vitae for Key Personnel

J.1.1 Tom Scribner – Yakama Nation Policy /Project Manager

<u>Project Responsibility</u>: Provides overall Tribal oversight and management of the BPA funded Coho Restoration contract. Directs, plans and manages activities and tasks in accordance with established policies, regulations, ordinances, and resolutions to achieve the YN Tribal goals of coho salmon restoration in the Mid-Columbia region.

<u>Education</u>

1975-77 University of Washington
Master of Science Degree, 1977
Major: Fisheries

1967-71 Middlebury College
Bachelor of Arts Degree
Major: Biology (Dean's List)

<u>Experience</u>

7/82 - present **Yakama Nation - Title: Mid-Columbia Policy Advisor**

Present: Oversee all salmon production in the Mid-Columbia for the Tribe including all fish propagation/outplantings done by the Yakama Nation or any other fisheries agency.

Tribal representative on the Rock Island, Rocky Reach and Wells Dam HCP Hatchery Committee. This interagency committee is responsible for implementing hatchery compensation measures and associated monitoring/evaluation plans to fulfill Chelan/Douglas PUDs No Net Impact obligations.

Tribal representative on the Priest Rapids Hatchery Committee. Similar to the HCP Hatchery Committee, this interagency committee is responsible for implementing hatchery compensation measures and associated monitoring/evaluation plans to fulfill Grant PUD's No Net Impact obligations.

Tribal representative on the Production Advisory Committee established to exchange information and to review and analyze present and future artificial and natural production programs pursuant to the *U.S. v. Oregon* Columbia River Fish Management Plan. Committee Chairman, 1993; re-elected for 1994.

92-94 Tribal representative on the Integrated Hatchery Operations Team. The team's purpose was to both develop and coordinate regional hatchery policies concerning fish health, genetics and ecological conditions and to provide hatchery performance standards. The team also developed a hatchery audit procedure and policy implementation plans.

85–90 Tribal representative on Northwest Power Planning Conservation Council's Artificial Production Review Team. This group comprised of resource managers and environmental organizations submits recommendations to the Council's review of hatchery operations and production.

<u>Publications</u>

M.S. Thesis, 1977. <u>Relationship Between Growth and Population Density in Sockeye Salmon Fry</u>, 111 pgs.

"Recommendation for Proposal and Evaluation of Salmonid Facilities", 84 pgs. (Publication for Congressional Act; Salmon and Steelhead Enhancement Act, 1980).
"Evaluation of Potential Species Interaction Effects in the Planning and Selection of Salmonid Projects", 72 pgs. (same publication conditions as above).
Scribner, T.B. 1993. "Spring Chinook Spawning Ground Surveys of the Methow River Basin." Report to Public Utility District No. 1 of Douglas County. Yakima Indian Nation, Fisheries Resource Management Program. Toppenish, WA.

J.1.2 Keely G. Murdoch, Fisheries Biologist

Project Responsibility: Provide oversight for M&E project deliverables

Education: **M.S. Biology, August 1996**
Central Washington University, Ellensburg, Washington
Coursework included Fisheries Management, advanced statistical analysis, research and study design.

B.S. Biology, June 1994
Western Washington University, Bellingham, Washington

Professional Experience:

Feb 2000- Present **Fisheries Biologist**
Yakama Nation, Fisheries Resource Management
Peshastin, Washington
Responsible for implementing the mid-Columbia coho reintroduction feasibility study monitoring and evaluation plan. Design and implement biological studies to assess ecological interactions between coho salmon, spring chinook, summer steelhead, and sockeye salmon. Studies include use of radio-telemetry to identify stray and drop-out rates of reintroduced coho salmon, redd surveys, hydro-acoustic surveys, direct predation evaluations, and micro-habitat use and competition evaluations. Techniques used include smolt-trap operation, underwater observation, electro-fishing, and tow-netting. Coordinate research activities with the USFWS, USFS, WDFW, CCPUD, DCPUD, GCPUD, private landowners and consultants. Contribute to the design, construction and implementation of coho acclimation sites in the Wenatchee River Basin. Designed and implemented adult coho trapping program. Responsible for spawning up to 1400 coho salmon and early egg incubation. Participate in technical work group meetings. Prepare annual reports and presentations. Supervise five biologists and up to nine fisheries technicians.

Mar 1997- Dec 1999 **Fisheries Biologist,** *Chelan County Public Utility District, Wenatchee WA*
Jan 1999 - Dec 1999 **Instructor - Statistical Analysis,** *Wenatchee Valley College, Wenatchee WA*
June 1996- Mar 1997 **Fisheries Biologist,** *U.S. Fish and Wildlife Service, Leavenworth WA.*
April 1995- Aug 1995 **Hydroacoustic Research Technician,** *Hydroacoustic Technology, Inc., Seattle, Washington*

Publications

Murdoch, K.G., C.M. Kamphaus, and S. A. Prevatte. 2005. Feasibility and Risks of coho reintroduction in mid-Columbia tributaries: 2003 Annual Monitoring and Evaluation Report. *Prepared for* Bonneville Power Administration, Portland OR.
Murdoch, K.G. and C.M. Kamphaus. 2004. Mid-Columbia coho reintroduction feasibility project: 2001 annual broodstock development report. *Prepared for:* Bonneville Power Administration, Portland OR. Project Number 1996-040-000.
Mosey, T. R., and K.G. Murdoch. 2000. Spring and summer chinook spawning ground surveys on the Wenatchee River Basin, 1999. Chelan County Public Utility District, Wenatchee Washington.
Titus, K. 1997. Stream Survey Report, Chumstick Creek, Washington. U.S. Fish and Wildlife Service, Mid-Columbia River Fisheries Resource Office, Leavenworth WA.

J.1.3 Corydon M. Kamphaus

Project Responsibility: **Provide project oversight for operations and deliverables**

Education: B.S. Zoology, December 1997
Washington State University, Pullman, Washington

Professional Experience:

Feb 2002- Present Fisheries Biologist
Yakama Nation, Fisheries Resource Management

Responsible for O&M activities for the mid-Columbia coho reintroduction feasibility program including**:**

1. Oversee acclimation for Wenatchee Basin coho releases
2. Determine in-pond survival at various acclimation sites by modeling predator consumption compared to PIT tag survival
3. Analyze multiple rearing strategies such as long versus short term juvenile rearing and semi-natural versus conventional acclimation
4. Design and implement adult collection protocols to maximize upstream collection facilities
5. Maintain broodstock integrity through run-at-large collection
6. Coordinate and facilitate broodstock collection with Chelan County PUD, USFWS, and WDFW.
7. Implement new propagation and incubation techniques to increase survival
8. Participate in technical work group meetings and prepare annual reports and presentations

Apr 1998- Feb 2002 Fisheries Technician
WDFW-Hatchery Evaluation

Responsible for monitoring and evaluating Chelan County PUD supplementation programs in the Wenatchee and Methow Rivers. Conduct hatchery evaluations on juvenile steelhead, spring chinook, summer chinook, and sockeye. Lead supervisor of the Methow/Okanogan summer chinook broodstock collection facilitated at Wells Dam. Conduct spawning ground surveys for Wenatchee River Basin sockeye, spring and summer chinook, and steelhead as well as the Okanogan summer chinook. Assist in the preparation of annual reports.

Publications

Murdoch, K.G., C.M. Kamphaus, and S. A. Prevatte. 2005. Feasibility and Risks of coho reintroduction in mid-Columbia tributaries: 2003 Annual Monitoring and Evaluation Report. *Prepared for* Bonneville Power Administration, Portland OR.

Kamphaus, C.K. and K.G. Murdoch. 2005. Mid-Columbia coho reintroduction feasibility project: 2003 annual broodstock development report. *Prepared for:* Bonneville Power Administration, Portland OR. Project Number 1996-040-000.

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RESUME

EDUCATION

1971 - Bachelor of Science, Engineering, University of Washington
1973 - Master of Science, Engineering, University of Washington

WORK EXPERIENCE

1972-1974, University of Washington.
- Teaching and research assistant.

1974-1977, Weyerhaeuser Company, aquaculture engineer.
- Research on salt water salmon rearing systems.
- Facilities design and citing for a major commercial salmon hatchery.

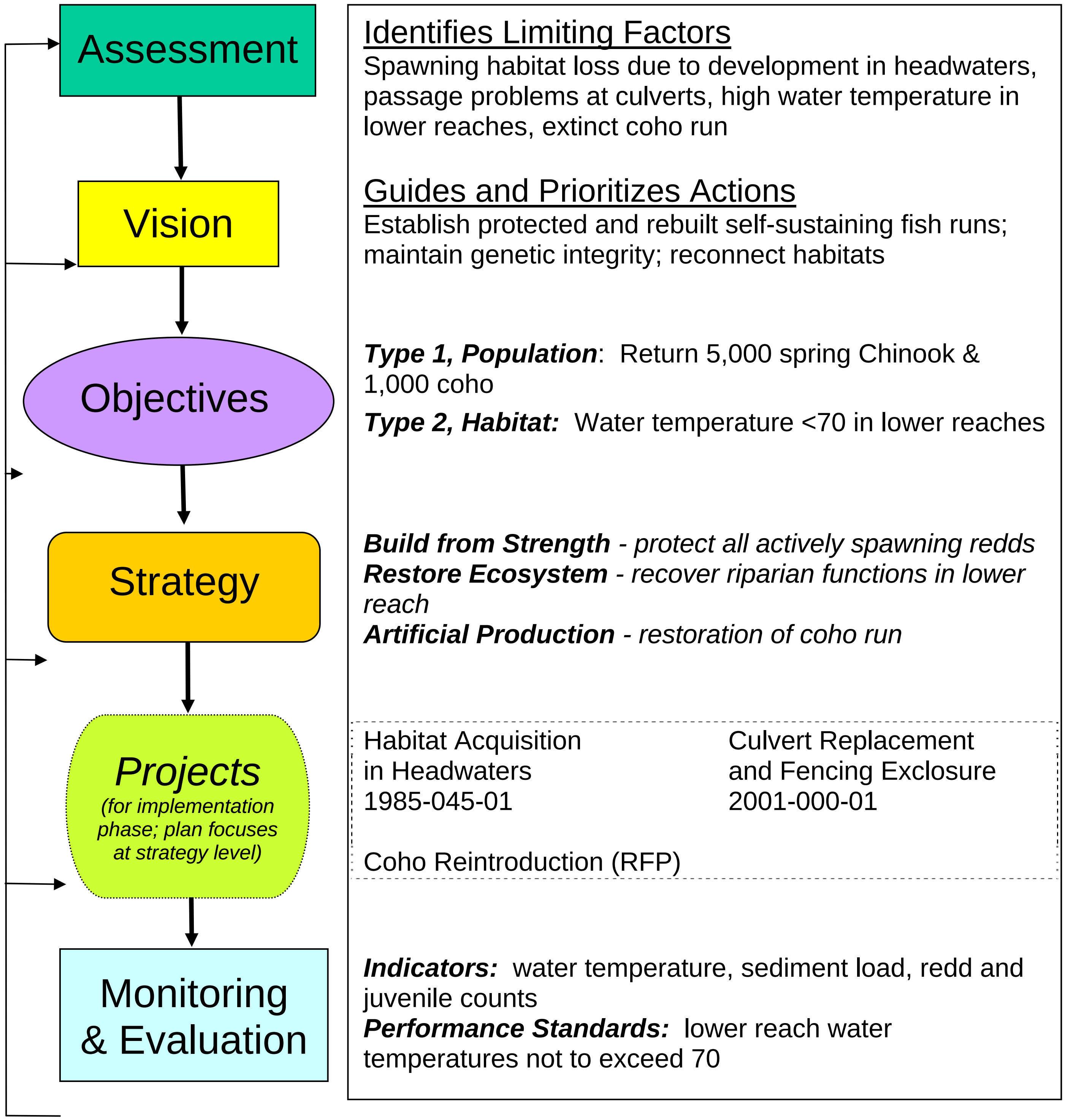
1977- Present, Sea Springs Co., president.
- Design, construction, operation of three private salmon hatcheries.
- Fisheries facilities design and construction consulting.

1981 - Present, TSKA, Inc., vice-president.
- Design, manufacture, and sale of oceanographic instrumentation.

PROFESSIONAL AFFILIATIONS

American Salmon Growers Association, past-president.
Washington Fish Growers Association.
Marine Technology Society.

Attachment: ISRP Flowchart: Subbasin Plan Logic Path



Note: the numbers given above are hypothetical and, for habitat projects, the ISRP and ISAB have recommended that performance standards may be more usefully articulated by coupling the potential range of parameter conditions (i.e., median, range, and variance) with a predicted rate of change from the current to the desired state. See the ISAB's report: A Review of Strategies to Recover Tributary Habitat (ISAB 2003-2) www.nwcouncil.org/library/isab/isab2003-2.htm.

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