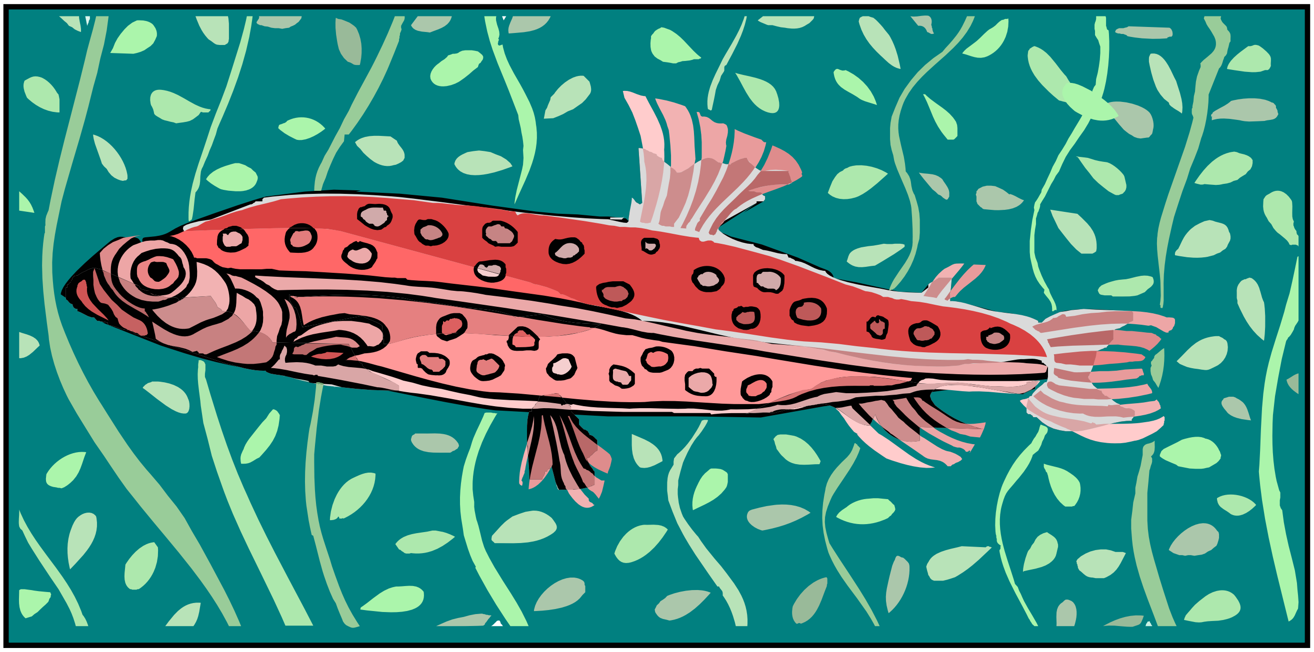
SALMON HABITAT PROTECTION AND RESTORATION STRATEGY



WRIA-10
Puyallup Watershed

WRIA-12
Chambers/Clover Creek Watershed

Pierce County
Lead Entity

March, 2008

Salmon Habitat Protection and Restoration Strategy

March 2008

"Chambers/Puyallup Partners for Salmon Recovery"

Puyallup (WRIA 10)

and

Chambers/Clover Creek (WRIA 12)

Watersheds

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EXECUTIVE SUMMARY

Salmon Habitat Protection and Restoration Strategy

March 2008

"Chambers/Puyallup Partners for Salmon Recovery"

Puyallup/White (WRIA 10) and Chambers/Clover Creek (WRIA 12) Watersheds

The 1999 Washington Legislature created and authorized the Salmon Recovery Funding Board (SRFB) to guide spending of funds targeted for salmon recovery activities and projects. The legislation also included a ranking process that provides an opportunity for local organizations to prioritize projects from their watersheds before they are submitted to the SRFB.

Pierce County serves as the "Lead Entity" for the Puyallup/White and Chambers/Clover watersheds ranking process. Projects from both watersheds are ranked together and only one list is submitted to the SRFB for consideration.

Project ranking is performed by a "Citizens' Advisory Committee" (CAC) of stakeholders from both watersheds.

The CAC is guided in their ranking by a "Technical Advisory Group" (TAG). The TAG provides a technical project ranking which is based on a scientific assessment of each project's benefit to salmon, certainty of success, and fit to this lead entity strategy.

This strategy document describes the criteria that both the CAC and TAG consider when evaluating, scoring and ranking salmon recovery projects.

MISSION

The mission of the CAC is to support the recovery of self-sustaining, harvestable salmon populations in Puget Sound by restoring and protecting the habitat in WRIAs 10 and 12.

GOAL

The goal of the Salmon Habitat Protection and Recovery Strategy is to provide guidance to the CAC and TAG, the SRF Board and Project Sponsors to identify and prioritize salmon habitat recovery projects in WRIAs 10 and 12.

We now know that the most important actions for salmon recovery in the Puyallup/White Watershed is to reconnect the mainstem rivers with their floodplains, so that relatively frequent floods occupy the floodplain and natural riverine processes are restored. These projects will be expensive and a challenge to implement and will not occur rapidly, however, efforts are underway to increase capacity and support for these actions.

We (the CAC, TAG, and the Lead Entity) can accomplish other important actions in the near-term with moderate to high benefits and certainty. These actions are described in Chapter 7. Briefly, in WRIA 10 these near-term high-priority actions include protection and/or restoration on presently functional salmon streams, including:

- South Prairie Creek and its tributaries
- Boise Creek
- Greenwater River
- Huckleberry Creek
- Clearwater River

In WRIA 12 near-term high-priority actions include:

- Passage restoration at two specific barriers;
- Restoration of flow in seasonally dry sections of Clover Creek;
- Projects to restore in-stream habitat diversity (LWD) may be high priorities if they are cost effective and properly sequenced relative to other restoration needs; and
- Restoration within Chambers Bay and along the WRIA 12 nearshore.

Much of the information used to prioritize actions to address specific habitat factors in specific geographic areas is based on the results of Ecosystem Diagnosis and Treatment (EDT) modeling of Chinook and coho in WRIA 10 and 12. The modeling effort was completed in two phases. The first phase identified degraded environmental factors within different stream reaches, and prioritized specific geographic areas for protection and restoration. The second phase updated the model input data and created restoration and protection scenarios to examine the effectiveness of proposed actions to recover salmon populations.

The following paragraphs describe the organization of the document:

Chapter 1 - Identify and Prioritize Stocks: The Lead Entity, CAC and TAG will pursue the recovery of White River spring Chinook[1], and Puyallup River fall Chinook in WRIA 10; steelhead in WRIAs 10 (Puyallup, White and Carbon river stocks) and 12; and Chambers Creek coho in WRIA 12.

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[1] Recent evidence suggests the presence of a fall Chinook stock in the White River in addition to the spring Chinook stock. The fall stock includes a Puget Sound hatchery origin Chinook, as demonstrated by mark and tag recoveries at the Corps of Engineers and White River Hatchery traps. For the present we will not differentiate between the White River Chinook stocks in prioritizing projects.

Chapter 2 - Priority Stocks' Status: We can improve stocks by increasing the abundance, productivity, life history diversity, and spatial distribution for White River spring Chinook, Puyallup River fall Chinook, Puyallup, White and Carbon River, and Chambers Creek steelhead, and Chambers Creek coho.

Chapter 3 - Determine Limiting Habitat Features and Watershed Processes: Limiting habitat features within WRIAs 10 and 12 include: loss of off-channel habitat, the disconnection of floodplain habitat, alteration of natural flow regimes, loss of riparian function, and habitat complexity and connectivity.

Chapter 4 – High-Priority Areas for Restoration and Protection: The high-priority areas for restoration in WRIA 10 are the lower and middle Puyallup River, the lower White River, the lower Carbon River, and the Puyallup estuary. The high-priority areas for restoration in WRIA 12 are within Chambers Bay, along the WRIA 12 nearshore, and the mainstem Clover Creek above Steilacoom Lake. High priority areas for protection in WRIA 10 include middle and upper Puyallup, Upper White and its tributaries, and South Prairie Creek.

Chapter 5 - Identify and Prioritize Actions: Priority actions in WRIA 10 include: Levee setbacks[2], estuarine habitat creation, increased flows in the hydroelectric diversion reach, remove artificial barriers, restore habitat diversity[3] and riparian conditions in tributary streams.

Priority actions in WRIA 12 include: restoration of nearshore habitat, widespread addition of Large Woody Debris (LWD) to restore habitat diversity and complexity, and correction of certain barriers, restoring summer flows, and riparian restoration.

Chapter 6 - Socio-Economic Objective (CAC): Salmon recovery cannot be divorced from the context of the surrounding community. With this in mind the CAC has created the following four categories or actions as a tool or threshold to measure socio-economic values of each project.

Action: A Prioritized List of Outreach and Public Support Building Needs

Action: Encourage Cooperative Watershed Partnerships

Action: Economic and Social Benefits

Chapter 7 – Near-term Actions: Over the long-term, projects to construct levee setbacks, restore floodplain connectivity, restore estuarine habitat, or to screen the Electron diversion will be high priorities in WRIA 10. In the Near-term Actions, we will support projects that protect and/or improve habitat in presently productive streams or that correct barriers to high quality habitat.

In WRIA 12, projects to restore nearshore habitats, correct significant barriers, place LWD, and restore riparian conditions may be high priorities if they are cost effective.

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[2] Levee setbacks can result in re-connecting large areas of floodplain to the main river. They allow natural processes to create side-channel and off-channel habitat areas. Oxbow and off-channel habitat reconnections can provide similar benefits by providing water and fish access to existing habitat.
[3] Habitat diversity includes pool/riffles, LWD, etc.

Chapter 8 - Project Ranking Criteria: The TAG will create a ranked list based on scientific criteria that include benefit to salmon, certainty of success, and fit to strategy.

The CAC will score projects based on the social and economic criteria listed in Chapter 8.

ACKNOWLEDGMENTS

Citizens' Advisory Committee (CAC)

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INTRODUCTION AND BACKGROUND

The 1999 Washington Legislature created and authorized the **Salmon Recovery Funding Board (SRFB)** to guide spending of funds targeted for recovery activities and projects. In addition to creating the SRFB, the legislature provided guidance on the ranking process for funding projects. That ranking process includes an opportunity for local organizations to prioritize projects from their watersheds before submission to the SRFB. The process is sometimes referred to as "2496" based on the House bill number that created it. RCW, Chapter 77.85 codifies this legislation.

Pierce County applied to be the "Lead Entity" for the Puyallup/White and Chambers/Clover watersheds ranking process in 1999. The County continues to serve in that capacity.

Project ranking is performed by a "Citizens' Advisory Committee" (CAC) of stakeholders from both watersheds. The Pierce County Executive, with recommendations from the Puyallup River Watershed Council (PRWC) and the Chambers-Clover Creek Watershed Council (CCWC), appointed members of the CAC reflecting stakeholder representation required by state statute. The committee ranks projects from both watersheds and submits a single list to the SRFB for consideration.

The CAC is guided in their ranking by a "Technical Advisory Group" (TAG). The TAG provides a technical project ranking based on a scientific assessment of each project's benefit to salmon, certainty of success, and fit to the lead entity strategy.

This strategy document describes the criteria that both the CAC and TAG consider when evaluating the desirability of salmon recovery projects.

MISSION

Our mission is to support the recovery of self-sustaining, harvestable salmon populations in Puget Sound by restoring and protecting the habitat in WRIAs 10 and 12.

GOAL

The goal of the Salmon Habitat Protection and Restoration Strategy is to provide guidance to the CAC and TAG, the SRF Board and Project Sponsors to identify and prioritize salmon habitat recovery projects in WRIAs 10 and 12.

Chapter 1

"IDENTIFY AND PRIORITIZE STOCKS"

The Pierce County Lead Entity will pursue the recovery of White River spring Chinook[1] and Puyallup River fall Chinook in WRIA 10; Puyallup, White, and Carbon River, and Chambers Creek steelhead in WRIAs 10 and 12; and Chambers Creek coho in WRIA 12.

The precipitous decline of steelhead in WRIAs 10 and 12 is of particular concern to the Lead Entity. We recommend further analysis to determine the needs of steelhead in the Watershed.

The WRIA 10 Chinook stocks are priorities because of their ESA threatened status and because they are priorities in the SRFB funding process. The steelhead stocks in WRIAs 10 and 12 are also a priority because of their ESA threatened status as of 2007. It is important to note that due to their extended freshwater residence (1-7 years), steelhead are more dependent on stream habitat than other salmon.

Coho are a priority in WRIA 12 because the Watershed was historically highly suited to coho salmon, and because Chinook do not presently use the freshwater habitat in WRIA 12[2]. It appears that a population of coho is still present in WRIA 12, though at relatively low numbers[3]. Recent analyses (Mobrand, 2001) indicate coho would make an excellent indicator species for formulating watershed action plans to address salmonid conservation and recovery needs in WRIA 12.

Chinook salmon do not use the freshwater habitat of Chambers Creek because returning adults are intercepted at Chambers Bay either by the terminal fishery or are trapped at the upper end of the bay for hatchery production. Since the ESA listing of Chinook, it has been WDFW policy to not pass any Chinook upstream. The WRIA 10/12 lead entity recommends that WDFW revisit this policy due to the quality of habitat in the lower four miles of Chambers Creek that is suitable for Chinook spawning and rearing. Recent studies have documented that juvenile Chinook salmon make extensive use of nearshore habitat throughout Puget Sound.

WRIA 12 nearshore habitat protection and/or restoration are also a priority because both Nisqually and Puyallup River Chinook[4] and other stocks use this nearshore habitat. While there

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[1] Recent evidence suggests the presence of a fall Chinook stock in the White River in addition to the spring Chinook stock. The fall stock includes a Puget Sound hatchery origin Chinook, as demonstrated by mark and tag recoveries at the Corps of Engineers and White River Hatchery traps. For the present, we will not differentiate between the White River Chinook stocks in prioritizing projects.

[2] The "Ecosystem Diagnosis and Treatment" (EDT) analysis indicated that Chambers Creek historic Chinook abundance may have been 2100 spawners and could be 350 under restored conditions. However, the study also concluded that it might be unlikely that such a small watershed could sustain an independent population. The Washington State Department of Fish and Wildlife considers Chinook in small watersheds like Chambers to be "sink" populations that do not meet the definition of viable self-sustaining populations.

[3] As of Oct 22, 2003, 455 coho had passed through the trap at the head of Chambers Bay. 2005 numbers were 1044, passed upstream; and about 1000 harvested in the Bay. These are improvements over recent years.

[4] Nisqually Tribe coded wire tag data, Sayre Hodgson, personal communication, 2004.

is some uncertainty about the relative benefits of nearshore habitat to Chinook performance, there is general agreement that it is important.

The Pierce County Lead Entity organization considers steelhead stocks to be of high significance. Steelhead stocks status in the Watershed are depressed, and may be critical in the view of the TAG. Steelhead were once abundant in the Puyallup and habitat protection and restoration are very important.

We assume that our strategy to protect and restore Chinook habitat will benefit steelhead. Important project priorities for steelhead are listed in Chapters 4 and 5 of this 2008 version of the strategy.

United States Fish & Wildlife Service (USFWS) has listed bull trout threatened under the ESA. For this interim strategy, we have not prioritized bull trout, but have concluded that forest protection activities in the Watershed as well as our strategy to protect and restore Chinook habitat will benefit bull trout. We may direct actions towards protection and/or restoration of bull trout habitat as we learn more from ongoing studies.

Bull trout spawning and rearing areas are in the higher altitude, forested portions of the Watershed, and habitat should improve as the riparian forest matures due to implementation of the Forest Plan on federal lands and improved forest management practices on private timber lands subject to state regulations. The *Interim Guidance for Protecting and Restoring Bull Trout Habitat* (draft November 27, 2002) concluded that efforts aimed at near-term protection and recovery actions for Chinook salmon and steelhead will generally address the needs of bull trout throughout their migratory and foraging corridors but may not address bull trout use in higher elevation portions of the basin. Also, by protecting and restoring watershed processes that provide for a wide diversity of salmon species, watershed productivity and available forage (predominately juvenile salmonids) should increase to levels that help ensure self-sustaining populations of bull trout.

We are not prioritizing additional stocks at this time, but expect that many of the proposed actions would benefit more than just the target stocks.

The lead entity relies on various status and trend documents for the salmonid stocks present in WRIAs 10 and 12. These reports prepared by the Puyallup Tribe[5] and WDFW[6] each evaluate stock performance. Additional stock status and trends resources are listed in the References section.

Planning Targets for Recovery

WDFW and the Treaty Tribes have developed recovery planning ranges and targets (interim recovery goals) for abundance and productivity of the 22 independent populations that National Marine Fisheries Service (now NOAA Fisheries) Puget Sound Technical Recovery Team (TRT) identified (*Table 1*). Puyallup fall Chinook targets and ranges were included, but the White River spring Chinook ranges and targets have not been published. The Muckleshoot Tribe of Indians has used the SHIRAZ model to develop an estimate of White River spring Chinook recovery targets and ranges that may be available in the future.

[5] Puyallup Tribal Fisheries, 2003-2004. Annual Salmon, Steelhead and Char Report: WRIA 10: Puyallup/White River Watershed.
[6] WDFW, 1993 SASSI:, WDFW, 1998 SaSI)

The planning ranges provide a broad estimate of the abundance needed for a population to be viable. The planning target provides a more specific measure within the range that is helpful for evaluating recovery actions in habitat, harvest and hatcheries. The target predicts the abundance and productivity of a salmon population based on a fully functioning estuary, improved freshwater conditions, restored access to blocked habitats, and poor ocean conditions.

We expect that the TRT and the co-managers will provide additional guidance on criteria for the other Viable Salmonid Population (VSP)[7] parameters, e.g. spatial structure and diversity in addition to abundance and productivity.

Ultimately, the outcomes of combined habitat, hatchery and harvest conditions on VSP will need to be evaluated for each population.

Puyallup River Chinook

The TRT planning targets for Puyallup Chinook range from 5,300 (at productivity of 2.3) to 18,000 (productivity of 1.0). The Pierce County Ecosystem Diagnosis and Treatment (EDT) Phase 2 analysis estimates potential abundance at 6,170 spawners after implementing a series of actions (see additional discussion in Chapter 5).

White River Chinook

The TRT has not yet provided recovery targets for White River Chinook. However, we are aware of two recovery targets or estimates that may be useful for planning purposes. An interim recovery goal from the *Recovery Plan for White River Spring Chinook Salmon* (1996) was 1000 or more unmarked spawners per year in three of four consecutive years, with the normal level of incidental sport, commercial and tribal harvest. The long-term recovery goal was to meet an escapement goal that reflects watershed carrying capacity subject to a full complement of directed and incidental harvest in sport, commercial and tribal fisheries. The Recovery Plan did not suggest a target number associated with long term recovery.

The EDT Phase 2 analysis for the White River estimated 2280 naturally spawning Chinook in the upper and lower White River combined, with continued operation of the White River hydroelectric facility. Without the hydroelectric facility in operation, the number of spawners was estimated as 3225.

Chambers/Clover Creek Coho

The Pierce County EDT Phase 2 analysis suggests that restoration actions in WRIA 12 could increase coho abundance by almost 300% from current average abundance of 700 spawners to 2660 spawners.

The Pierce County Lead Entity goal is to improve the performance of target stocks by increasing abundance, productivity, spatial structure and diversity. We will evaluate changes in performance based on the interim recovery targets where they have been identified.

[7] Chapter 2 discusses VSP parameters in more detail. Also, refer to McElhany et al., (2000).

Table 1

"Chinook Spawner Abundance Planning Targets & Ranges for Puget Sound Region"

(The table presents numbers for the populations with a completed analysis. State and tribal biologists are still developing the numbers for the populations that are blank.)

Population	Mean Spawner Abundance for 1996-2000	Low Productivity[1]		High Productivity[2]
		Planning Range for Abundance	Planning Targets for Abundance (productivity in parentheses)	
NF Nooksack	120______	16,000-26,000 (1.0)	16,000 (1.0)	3,800 (3.4)
SF Nooksack	200______	9,100-13,000 (1.0)	9,100 (1.0)	2,000 (3.6)
Lower Skagit	2,300______	16,000-22,000 (1.0)	16,000 (1.0)	3,900 (3.0)
Upper Skagit	8,920______	17,000-35,000 (1.0)	26,000 (1.0)	5,380 (3.8)
Upper Cascade	330______	1,200-1,700 (1.0)	1,200(1.0)	290 (3.0)
Lower Sauk	660______	5,600-7,800 (1.0)	5,600 (1.0)	1,400 3.0)
Upper Sauk	370______	3,000-4,200 (1.0)	3,030 (1.0)	750 (1.0)
Suiattle	420______	600-800 (1.0)	610 (1.0)	160 (2.8)
NF Stillaguamish	660______	18,000-24,000 (1.0)	18,000 9(1.0)	4,000 (3.4)
SF Stillaguamish	240______	15,000-20,000 (1.0)	15,000 (1.0)	3,600 (3.3)
Skykomish	1,700______	17,000-51,000 (1.0)	39,000 (1.0)	8,700 (3.4)
Snoqualmie	1,200______	17,000-33,000 (1.0)	25,000 (1.0)	5,500 (3.6)
NL Washington	194*_____			
Cedar	398*_____			
Green	7,191*_____			
White	329*_____			
Puyallup	2,400______	17,000-33,000 (1.0)	18,000 (1.0)	5,300 (2.3)
Nisqually	890______	13,000-17,000 (1.0)	13,000 (1.0)	3,400 (3.0)
Skokomish	1,500*_____			
Dosewallips	26______	3,000-4,700 (1.0)		
Dungeness	123*_____	4700-8100 (1.0)		
Elwha	1,319*_____			

* Represents spawner escapement 1987-2001.

1. The low productivity number in both the range and the target represents one adult fish return per spawner, also called the equilibrium point of 1:1 (recruits per spawner).

2. The high productivity number represents the number of spawners at the point where the population provides the highest sustainable yield for every spawner. The productivity ratio is in parentheses for each population and represents the relationship of recruits per spawner (e.g., 3.8:1 for Upper Skagit).

Chapter 2

"PRIORITY STOCKS' STATUS"

We can improve stocks by increasing the abundance, productivity, life history diversity and spatial distribution for White River spring Chinook, Puyallup River fall Chinook, WRIA 10 and 12 steelhead, and Chambers Creek coho.

Population performance can be thought of in terms of the four parameters (abundance, productivity, spatial structure, and diversity[1]) which National Marine Fisheries Service (McElhany et al., 2000) used to define a "Viable Salmonid Population (VSP)". Under contract to Pierce County, Mobrand Biometrics, Inc. used EDT modeling to evaluate the abundance, productivity and life history diversity of Chinook and coho in WRIAs 10 and 12. *Table 2* presents the EDT Phase 2 baseline conditions (historic and current equilibrium conditions).

As shown in *Table 2,* Chinook baseline results for current conditions in WRIA 10 indicate greatly reduced abundances and exceptionally low productivity[2] (spawner values <2)[3] compared to estimated historic values. Total current abundance is about 2000 spawners, compared to an estimated more than 64,000 fish. Estimated historical productivity was 7-10 returns per spawner. Productivity correlates strongly with habitat quality and the decrease in productivity in the Puyallup-White system (including its estuary and bay[4]) is the result of severely degraded habitat. The reduced abundances are the expected result of chronically poor productivity.

The EDT Phase 2 report emphasized the conclusion that the overall performance of naturally produced Chinook in the White-Puyallup system appears to be exceptionally poor. The estimated productivities for Chinook produced in the Puyallup, upper White, and lower White rivers are 1.5 or less (see *Table 2*). These values are aggregate values of population components that have different productivities, for example, South Prairie Creek Chinook would have a productivity that exceeds 2.0. The recent evidence of high straying rates by Voights Creek hatchery fish and the natural production from those strays gives the impression of better Chinook performance than is actually occurring for wild fish. Genetic studies by the co-managers are ongoing to assess the actual degree of hybridization that may be occurring.

[1] Abundance is the number of individuals in a population at a given life stage or time; productivity or growth rate is the actual or expected ratio of abundance in the next generation to current abundance; spatial structure refers to how the abundance at any life stage is distributed among available or potentially available habitats; and diversity is the variety of life histories, sizes, and other characteristics expressed by individuals within a population.
[2] Productivity represents the density-independent reproductive rate (or success) of a life history pattern over an entire life cycle. It is probably the most critical measure of the resilience of a life history pattern. It determines the rate of loss that can be sustained.
[3] Values less than one are by definition not sustainable; as population productivity approaches 1 (e.g. values less than 2) the population is clearly at risk.
[4] For the EDT Phase 2 analysis we considered Commencement Bay actions and the Puyallup River estuary (mouth of the river to extent of tidal influence) actions separately. Both of these areas are part of the nearshore, as defined by the Puget Sound Nearshore Ecosystem Restoration Project (PSNERP).

<u>**Table 2**</u>

"EDT baseline performance estimates for Chinook and coho salmon in Lower White, Upper White, Puyallup, Hylebos and Chambers-Clover basins[5]"

CHINOOK

Watershed	Average abundance		Productivity		Life history diversity	
	Historic	Current	Historic	Current	Historic	Current
Lower White	15,600	200	7.4	1.3	100%	40%
Upper White	6,700	500	9.7	1.5	100%	40%
Puyallup	42,000	1,300	9.6	1.3	100%	30%
Hylebos	500	40	15.6	2.6	100%	50%
Chambers-Clover	2,100	0[6]	22.0	0	100%	0%

COHO

Watershed	Average abundance		Productivity		Life history diversity	
	Historic	Current	Historic	Current	Historic	Current
Lower White	10,500	1,100	18.4	3.6	100%	40%
Upper White	13,500	1,200	17.4	2.0	80%	30%
Puyallup	56,700	5,200	19.6	5.9	90%	30%
Hylebos	1,800	200	25.0	6.5	100%	70%
Chambers-Clover	12,200	700	35.9	7.8	100%	40%

[5] The values in the table represent EDTPhase 2 modeled estimates. In this analysis, fisheries are turned off so that only the effect of environmental condition is being assessed. This serves to standardize the analysis between watersheds and to focus attention on the effect of changing environmental conditions through the actions being considered. Escapement estimates over the last ten years from the Puyallup Tribe indicate a higher current Chinook abundance. Through adaptive management the EDT input data will be periodically updated and the out put calibrated to observed current abundance.

[6] The baseline estimate for average abundance of Chinook in Chambers Creek is zero, because WDFW currently operates the fish ladder and trap at the head of tidewater to allow no Chinook to pass upstream and spawn naturally. However, the reported observations of Chinook passing over the dam during extreme high tides may indicate some Chinook utilization of the system.

One might conclude that the use of habitat measures alone in WRIA 10, even conducted on a very extensive scale is unlikely to achieve the fish production targets in this Basin (Mobrand Biometrics, Inc., 2004). On the other hand, it is clear that implementing the actions will result in significant improvements in abundance, productivity and life history diversity. While abundance is the most visible sign of improved performance, increases in abundance will necessarily be dependent upon greater life history diversity and increased productivity.

The high benefit of habitat restoration actions, that we are prioritizing, support these elements of improved performance. We also recognize that protection of existing high quality habitat is important. Acquisition for conserving that habitat may be an important tool that we intend to evaluate in future updates of this strategy.

Table 2 also shows a reduction in life history diversity from historic conditions. Life history variants allow a species to use the available habitat more effectively, and these variants will not necessarily experience the same impact on overall productivity due to changes in habitat conditions affecting a specific life history stage. The losses of habitat areas historically used by these variant life history patterns have resulted in an overall loss of life history diversity. In Chapter 5, we describe the expected changes in performance (abundance, productivity and life history diversity) due to implementing various types of actions.

WRIA 12 coho show a sharp reduction in performance measures between historic and current conditions (*Table 2*). The average estimated spawning population size was approximately 700 fish under existing conditions, with a productivity of approximately six returning adults per parent spawner. The model estimated historic average abundance to be approximately 12,200 fish, suggesting that this basin was once highly suited to coho. Estimates of historic productivity are more than 36 returning adults per parent spawner.

Areas of WRIA 12 that would provide the most benefit for coho are located upstream of Steilacoom Lake and include all of the Clover mainstem, North Fork Clover Creek, and Spanaway Creek. The principal attribute classes or factors that rank highest for coho restoration benefit are generally sediment load, substrate stability, habitat types (e.g. pool frequency, back water pools), water quality characteristics and obstructions to fish passage.

Restoration of flow to the lower sections of Clover Creek, from Steilacoom Lake upstream to above the north fork confluence is necessary to achieve the benefits of habitat restoration. A recent retrospective analysis based on interviews of long-time residents and other sources provides evidence that until about 1940 Clover Creek sustained perennial flow.[1]

Pierce County plans to conduct pilot projects beginning in 2004 to identify effective ways to seal the streambed and thereby retain existing flows in the stream channel[2].

H-Integration in WRIA 10

Piece County, the Puyallup Tribe of Indians, the Muckleshoot Indian Tribe, and Washington Department of Fish and Wildlife have been working together to develop integrated goals for the management of hatchery, harvest, and habitat restoration programs. The H-Integration effort involves the identification of current conditions, agreement on near-term and long-term goals for salmon management, and the identification of actions that will achieve the goals. A summary of the current status of H-Integration in WRIA 10 is provided in Appendix A.

[1] Fred L. Tobiason, 2003. Historic Flows, Flow Problems and Fish Presence in Clover Creek – 1924-1942: Interviews with Early Residents.
[2] Pierce County Water Programs, 2003. Clover Creek Basin Plan.

Chapter 3

"DETERMINE LIMITING HABITAT FEATURES AND WATERSHED PROCESSES"

The loss of off-channel habitat in the lower river and estuary, and the disconnection of floodplain habitat in the Puyallup River are the primary causes of poor VSP parameters for Puyallup River Chinook.

Alteration of natural flow regimes in the White River and loss of off-channel habitat are the primary causes of poor VSP parameters for White River Chinook.

Alteration in natural flow regime, the loss of riparian function, and habitat complexity and connectivity are the primary causes of poor VSP parameters for WRIA 12 coho.

WRIA 10

Puyallup River

The performance of Puyallup River Chinook is poor. The most significant habitat factors causing this and the associated life stage functions are as follows:

- Extensive loss of mainstem lowland floodplain off-channel habitat for fry colonization and juvenile rearing,
- Extensive loss of estuarine habitat and habitat diversity for salinity adaptation and juvenile rearing[1],
- Poor screening on the Electron diversion causes large losses of downstream migrant Chinook[2]

White River

The performance of White River Chinook is also poor. Alteration of natural flow regimes and the loss of off-channel habitat are the primary causes of poor VSP parameters for Chinook. Scenario modeling in the EDT phase 2 analysis indicated that the most significant habitat factors were the flow modifications produced by the PSE flow diversion to Lake Tapps and by operation of the Mud Mountain Dam flood control facility.

For Chinook produced in the lower White, the next most significant habitat factor was the loss of large woody debris, largely resulting from snagging operations at the Mud Mountain Dam facility.

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[1] There is uncertainty regarding the benefits of restoration in Commencement Bay. Newly created intertidal habitat in the Bay may become increasingly important as life history trajectories make use of the new areas.
[2] It has been estimated that upper Puyallup Chinook production is not sustainable unless the large loss of downstream migrant Chinook juveniles into the canal is corrected.

After the flow modification actions, seven of the top ten ranked actions for fish produced in the upper White River involved actions in the upper drainage. The top ranked action of these seven is Greenwater River LWD placement. A high sediment load was also identified as a significant habitat factor in the Greenwater River and Huckleberry Creek. Improved road management would help address the currently high sediment load.

In addition to the Greenwater River and Huckleberry Creek, the Clearwater River was identified in the EDT Phase 2 analysis as a high priority for protection and restoration for Chinook and Coho. The primary degraded environmental factors in the Clearwater include reduced habitat diversity, reduced key habitat quantity, and increased sediment load. An increase in the amount of large woody debris, improvement in riparian condition, and improved road management would likely address the degraded habitat conditions. Overall, the results indicate that the greatest benefits to upper river salmonids will tend to be achieved by actions conducted upstream of Mud Mountain Dam.

Common Elements to White and Puyallup

For both the Puyallup and lower[3] White River Chinook, except as noted, the principal attribute classes or factors that rank highest for Chinook restoration benefit are generally channel (or substrate) stability and habitat diversity in the freshwater areas of highest importance to restoration. This reflects the benefit that would occur if side channels and backwaters were reopened and restored for use, primarily for fry colonization and juvenile rearing. These types of actions seem to be more beneficial for Puyallup Chinook than for White River Chinook, perhaps because of the dominant effect of hydro-modifications on White River fish.

WRIA 12

Chambers/Clover Creek

The performance of coho in WRIA 12 is poor because of the many alterations that have occurred in the basin over the past 150 years. Development activities have led to higher peak flows, excessive sediment load and gravel scouring. Removal of LWD and channelization has led to losses of habitat diversity, including pools and backwaters. Numerous obstructions to fish passage are blocking access to high quality habitat in some cases. Loss of flow in the central section of mainstem and North Fork Clover Creek creates a passage barrier as well as a loss of habitat area. Poor water quality has led to fish kills in the past – typically the result of first flush events on holding coho.

Coho utilize other streams within WRIA 12, but these streams are a lower priority.

EDT Analysis

The EDT Phase 1 and 2 analyses build on the results of the Limiting Factors Analysis (LFA) for WRIAs 10 and 12 (Washington Conservation Commission (WCC) 1999, 2003 respectively) and also uses information supplied by various assessments (culvert barrier inventories, etc.) to identify needed habitat improvements. The EDT analysis uses this background information and the knowledge of local experts in a conceptual model to estimate changes in population

[3] This document will refer to Chinook produced below Mud Mountain Dam as lower river fish, and to Chinook produced above Mud Mountain Dam as upper river fish.

performance that should result from implementing identified habitat improvements. Pierce County is providing a staff person to periodically update the EDT input data and use the model to evaluate operational hypotheses regarding system performance. In addition, the WRIA 10 and 12 EDT model is available on line at http://www.mobrand.com/edt/ so that others will be able to evaluate actions.

The WRIA 10 Limiting Factors Analysis Executive Summary (WCC 1999) succinctly summarized the salmon habitat conditions in the Puyallup River Basin as follows:

> "Commencement Bay, once a highly productive estuarine environment, has lost in excess of 98% of its historical intertidal and subtidal habitat. The remaining habitat is separated and in places contaminated with chemicals that further reduce its value to organisms and their biological processes. The Puyallup, White and Carbon Rivers are all contained within a revetment and levee system for their lower 26, 8 and 5 miles respectively. These channel containment structures have removed the natural sinuosity of the rivers and the spawning and rearing habitats that were once present. The two hydroelectric dams, and later a flood control project on the White River, have blocked salmon from their historical habitat and reduced their geographical distribution. Numerous other impassable barriers exist on smaller tributary streams that further reduce available spawning and rearing habitats. Land use practices have eliminated the opportunities for large and small woody debris recruitment and heavily impacted riparian buffers."

In WRIA 12, the LFA (Runge et al., 2003) notes that "The principal impacts to habitat have been caused by dredging and rerouting of stream channels, ditching or burying of the stream, elimination of wetlands and estuarine habitat, riparian forest removal, non-point water quality pollution, industrial discharges, fish passage barriers, and removal of large wood from channels."

The EDT Phase 1 analysis for WRIA 10 concluded that in the lower gradient mainstem rivers where restoration was most beneficial, the principal attribute classes or factors that rank the highest for Chinook restoration benefit are channel (or substrate) stability and habitat diversity. This reflects the benefit that would occur from reopening and restoring side channels and backwaters primarily for fry colonization and juvenile rearing. In the estuary, habitat diversity, and habitat types, especially inter-tidal and nearshore habitat should be principal targets.

The EDT Phase 2 analysis for WRIA 10 provided estimates of improved Chinook performance (abundance, productivity, and diversity index) expected by implementing identified restoration actions in those areas. By providing an estimate of the relative benefits from actions, the EDT analysis reflects the relative importance of different limiting factors. That is, actions which are estimated to provide a larger increase in abundance (or productivity, etc.) are necessarily addressing the more significant limiting factors; presuming that the list of actions is comprehensive and/or that synergistic groupings of actions are not overlooked. The program analyzed one hundred eleven individual actions, as well as logical groupings of actions (scenarios). Chapter 5 provides more information about prioritized actions. The EDT Phase 2 report describes all actions in detail.

In the Puyallup River Watershed the type of actions as a group that produced the greatest increases in abundance and productivity for Chinook were levee setbacks, because these projects create side-channel, backwater, and off-channel habitat essential for juvenile colonization and rearing and protection from flood events. The same group produced the greatest increase in abundance for coho. In contrast, combined actions in South Prairie Creek, notably because of the actions opening access to off-channel ponds produced the largest increase in productivity for coho. This type of action tends to increase productivity more than abundance, though both are increased. These findings are consistent with the life history needs of the two species. Estuarine actions as a group produced the second highest increase in abundance for Chinook. (Note: for purposes of this study, the estuary extends from the river mouth upstream to the extent of tidal influence. Commencement Bay was considered separately.)

Based on assumptions of relatively short juvenile residence time within the Bay, the current results of EDT Phase 2 modeling show a relatively low benefit of restoration and protection actions in Commencement Bay. One exception is the proposed "Outer Hylebos" project located between the mouth of Hylebos Waterway and Browns Point. The proposed action describes the placement of clean dredged material over an area of approximately 40 acres of DNR bedlands to convert subtidal habitat to intertidal and shallow subtidal habitat. The "Outer Hylebos" project ranked among the top ten most effective actions for recovering Puyallup Chinook, Lower White Chinook, and Upper White Chinook.

Although the low effectiveness of other Commencement Bay actions seems to run counter to studies in other systems that show a great importance of nearshore habitat to juvenile Chinook, the results are based on assumptions consistent with juvenile migration patterns described in reports of Chinook life histories in Commencement Bay (e.g., Pacific International Engineering 1999, 2000, and 2000b; Port of Tacoma and Puyallup Tribe of Indians 1999). It should be noted, however, that assumptions of longer residence time and greater survival yield modeling results that show an increased benefit of restoration in Commencement Bay.

Furthermore, it is possible that current residence times and migration patterns may not hold as shoreline habitat is restored. As more and more habitat is restored, juveniles may have a greater tendency to reside longer in these habitats, experiencing greater survival and growth than would occur with the movement pattern currently seen. If this is the case, we would expect that habitat restoration would tend to increase life history diversity, as well. Recent monitoring results from the Northwest Fisheries Science Center (Rice, et al., 2002) support this hypothesis. Their monitoring report states that juvenile Chinook lengths over the year show evidence of multiple life history types migrating through, and possibly rearing in, Commencement Bay.

Given the uncertainty in our understanding of how juvenile Chinook use Commencement Bay, it is unclear how beneficial restoration in Commencement Bay will be in the long-term. Nevertheless, significant restoration activities are occurring in the Bay associated with Superfund projects, mitigation activities, WDNR lands management, and other funding sources. In recent years there have been approximately 200 acres of intertidal habitat restoration in the Bay (Leslie-Ann Rose, Citizens for a Healthy Bay, personal communication, 2004). Such actions will likely improve salmonid habitat in the Bay.

Based on the tremendous benefits that floodplain reconnection projects will have for Chinook in WRIA 10, we think that our focus on freshwater habitat and the lower Puyallup , lower Carbon and lower White Rivers is an appropriate strategy. We also recognize the importance of nearshore habitat for WRIA 10 and 12 salmonids, and support efforts by others to protect and restore intertidal and shallow subtidal habitat throughout Commencement Bay, similar to the "Outer Hylebos" project.

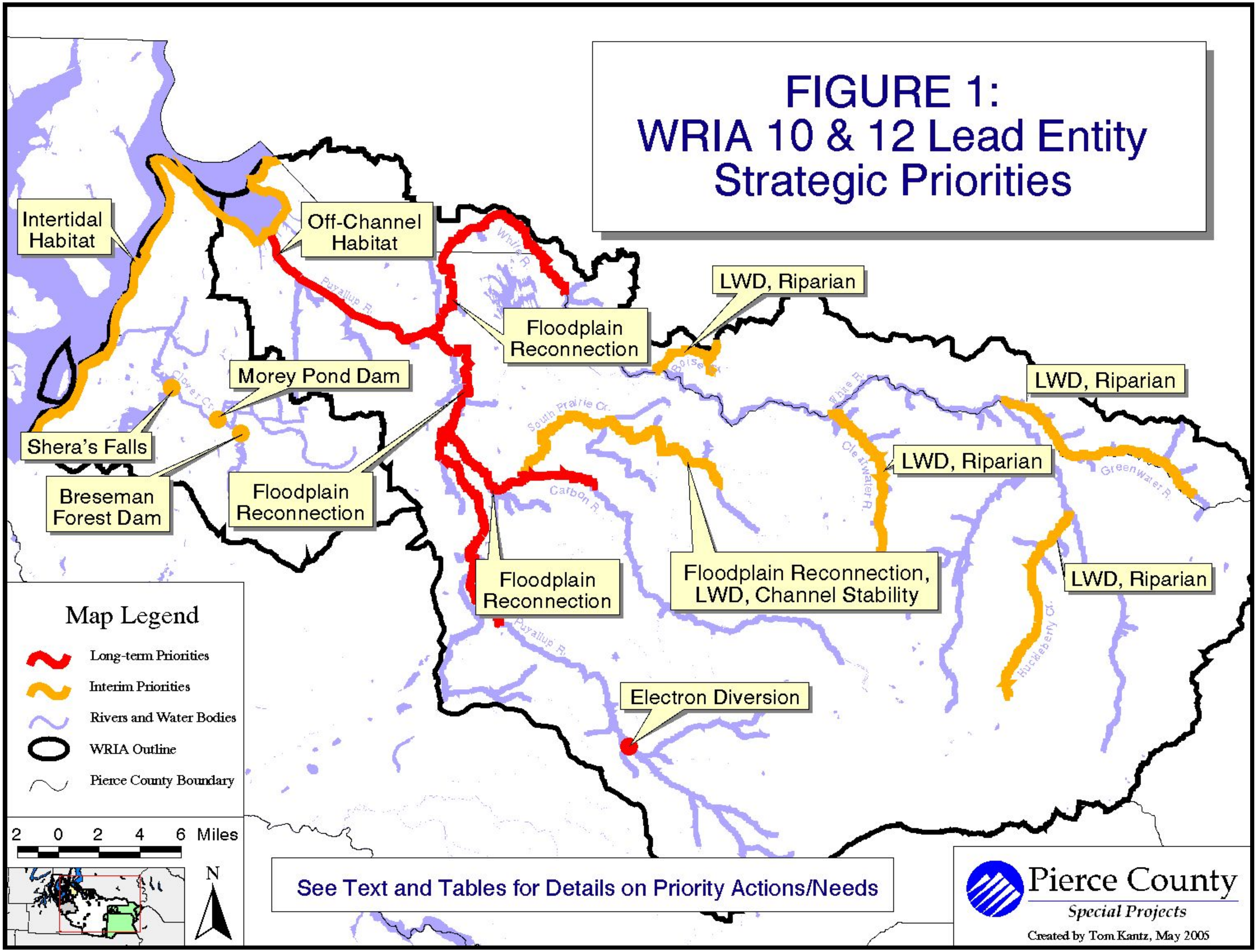

FIGURE 1:
WRIA 10 & 12 Lead Entity
Strategic Priorities
Intertidal Habitat
Off-Channel Habitat
Floodplain Reconnection
LWD, Riparian
Morey Pond Dam
LWD, Riparian
Shera's Falls
LWD, Riparian
Breseman Forest Dam
Floodplain Reconnection
Floodplain Reconnection
Floodplain Reconnection, LWD, Channel Stability
LWD, Riparian
Electron Diversion
White R.
Puyallup R.
Clover Cr.
South Prairie Cr.
Carbon R.
Clearwater R.
Greenwater R.
Huckleberry Cr.
Map Legend
Long-term Priorities
Interim Priorities
Rivers and Water Bodies
WRIA Outline
Pierce County Boundary
2 0 2 4 6 Miles
N
See Text and Tables for Details on Priority Actions/Needs
Pierce County
Special Projects
Created by Tom Kantz, May 2005

Chapter 4

"HIGH-PRIORITY AREAS FOR RESTORATION AND PROTECTION"

The high-priority areas for restoration in WRIA 10 are the lower and middle Puyallup River, the lower White River, the lower Carbon River and the Puyallup estuary to address the low VSP parameters caused by river channelization and filling in the estuary.

The high-priority area for restoration in WRIA 12 is the mainstem Clover Creek above Steilacoom Lake. Clover Creek needs restoration on the mainstem to restore flow regimes and habitat connectivity, habitat complexity (LWD), and to remove barriers.

Figure 1 shows the high-priority areas, as well as near-term priority areas and projects for WRIAs 10 and 12 respectively.

WRIA 10

The loss of floodplain habitat that is limiting the performance of Puyallup and White River Chinook is due to the channelization and confinement of the river within an extensive system of revetments and levees (flood works) in the mainstems of the Puyallup, White and Lower Carbon Rivers. Preferred projects in the mainstem areas would protect and restore floodplain habitat such as side channels and backwaters. In general, the restoration benefit increases as projects are located further downstream, however, the upper watersheds are the most important to protect due to their relatively intact habitats. The principal targets for estuary projects are those that increase juvenile salmonid habitat area, restore habitat diversity and habitat types.

Restoration opportunities exist in both the upper and lower watershed of the Puyallup/White Rivers. Due to the differences in the types of adverse impacts occurring in the upper and lower watershed, we have divided these opportunities appropriately.

Lower Watershed

Opening floodplain habitat in the lower mainstem rivers and increasing habitat diversity and types in the estuary provides the greatest restoration benefit to Puyallup/White River Chinook abundance. These areas are described as follows, and are shown on *Figure 1.*

- Puyallup River Estuary, mouth to extent of tidal influence at about RM 6.0, near Clarks Creek.
- Puyallup mainstem, RM 6.0 to 24.5; from approximately Clarks Creek to the upstream extent of the levee system[1].
- Lower Carbon River mainstem, from its mouth at RM 17.3 on the Puyallup River to the canyon reach (RM 10).
- Lower White mainstem, from its mouth at RM 10.4 on the Puyallup River to RM 11.

[1] Significant actions have already occurred above RM 21.5. A right-bank setback levee was constructed from RM 23.2 to 24.8 in 1997-98. A left-bank setback levee from RM 21.5 to 22.2 is scheduled for construction in 2004. The levee system from RM 24.8 to 28.4 was severely damaged in 1996-97 and is no longer maintained.

Aside from the benefits of normal flow restoration, actions to open floodplain habitat and restore riparian function on the lower 9-10 miles of the White River mainstem would provide the greatest restoration benefits for lower White River Chinook.

Flow modifications that have resulted from the Mud Mountain Dam flood control reservoir and from the Puget Sound Energy flow diversion for the White River hydroelectric facility at Lake Tapps strongly limit White River spring Chinook performance[2]. Restoration of more normative flows in the diversion reach and more normative flows from the flood control reservoir were projected to produce the greatest benefits to all White River salmonids by a substantial margin over other actions, including Chinook produced in the upper and lower river.

Upper Watershed (upstream of the river miles given in previous section)
The reliance upon the upper watershed in both the Puyallup and White Rivers to produce salmon has increased over the last 20 years. The riparian functions and riverine geomorphic processes are generally more intact in the upper watersheds than the lower watersheds due to the disparity in urbanization and subsequently are likely to form favorable habitat conditions that are better producers of salmon. Because of these favorable habitat conditions, salmon enhancement efforts rely upon these upper watershed habitats for spawning, rearing, and outmigration of both natural origin and hatchery enhancement program salmon. It is of high importance to (1) protect and maintain the natural geomorphic processes and riparian functions of the river systems where they currently exist, and (2) restore these processes where they are currently compromised, degraded, or severed.

<u>White River</u>
The tributaries to the upper White offer the primary habitats for all freshwater life-stages of all major salmonid species, including federally listed species of bull trout and steelhead. The mainstem of the upper White River also offers productive habitats, where Spring Chinook have been observed spawning (Ladley, pers. comm.). Road construction, levee work and forest practices are the main sources of resource impact in these reaches. The White River tributaries Boise Creek, Clearwater River, Greenwater River, and Huckleberry Creek, suffer from low quantities of LWD, poor riparian function, and high sediment load. Candidate areas concerning these objectives are bulleted below.

- White River mainstem from RM 41 to 64.
- Greenwater River
- Clearwater River
- Boise Creek
- Huckleberry Creek
- West Fork White River

<u>Puyallup River</u>
High priority areas include South Prairie Creek, a tributary to the Carbon River,that suffers from low quantities of LWD, poor channel stability, and disconnection of the floodplain. The loss of estuarine habitat that is limiting the performance of both Chinook stocks is due to channelization

[2] Throughout this document we refer to the effect of reduced flows in the bypass reach of the White River because of the Lake Tapps diversion. We evaluated the benefits to salmon that would occur by restoring flow, but acknowledge the interests of Lake Tapps homeowners in continuation of flows to the Lake. The analysis assumed normal flows in the diversion reach, i.e. that the PSE diversion would not be operational. It seems likely that any increase in flows in the diversion reach would be beneficial, although not to the same degree as full flow restoration.

and confinement of the river by the flood works from the mouth upstream to the extent of tidal influence near Clarks Creek (RM 6.0).

The following restoration recommendations are based on steelhead biology and behavior. Important project types include: (1) those that focus on restoring mainstem and large fluvial processes (channel meandering/side channel formation) such as levee setbacks; (2) efficient upstream and downstream passage at Mud Mountain dam, Buckley diversion dam, and Electron dam; (3) addition of LWD; and (4) protection of RM 41-63 of the mainstem White River to help maintain natural fluvial-geomorphic processes.

Important areas to emphasize for protection include: (1) Puyallup River, upstream of Electron dam; (2) South Prairie Creek; and (3) the Upper White River, especially Greenwater and Clearwater Rivers, and Huckleberry Creek.

WRIA 12

The top two actions modeled were LWD enhancement and nutrient enhancement. These ranked highest because the action presented to the model applied over large areas of the Watershed. Enhancement actions with a more limited scope are probably more realistically implemented, but with benefits roughly proportional to the area enhanced.

The areas of LWD and nutrient enhancement modeling included essentially all of Clover Creek above Steilacoom Lake, including the North Fork and Spanaway Creek. Coho abundance was increased about 28% and 35% by the LWD and nutrient actions respectively. The next six ranked actions each resulted in 15-22% increases in abundance. Three of these were barrier correction actions. The results for groups of actions show very significant increases in performance as actions were combined, with 200% increased coho abundance for all actions combined, excluding the flow restoration and channel reconstruction actions.

The model indicated high priorities for protection of Upper Clover Creek from Spanaway Creek confluence to source springs near Canyon Road. The area near the headwaters has relatively good habitat quality and perennial flow, which should be protected and enhanced[3].

Coho utilize other streams within WRIA 12 but these streams are a lower priority.

The EDT Phase 2 report includes descriptions of all the actions used in the modeling.

Natural Chinook and steelhead production should be targeted and habitat enhanced on the lower four mile reach of Chambers Creek (from Lake Steilacoom to the WDFW weir.

Preliminary results from the WRIA 11/12 Nearshore Assessment identify the following priorities for restoration in the WRIA 12 shoreline: (1) primary estuarine systems (Chambers Bay, Sequalitchew Creek); (2) barrier lagoon systems (Titlow Lagoon); (3) secondary-tributary estuarine systems (Solo Point); (4) riparian treatments (Chambers to Sunset Stretch, Seqaualitchew Creek to Solo Point); and (5) beach enhancement (Seqaualitchew Creek to Solo Point). These priorities will be updated upon completion of the assessment in December 2008.

[3] Recent acquisitions of open-space in this area by Pierce County and the Cascade Land Conservancy include about 3000 feet of stream channel and over 25 acres of riparian area and associated wetlands.

Chapter 5

"IDENTIFY AND PRIORITIZE ACTIONS"

Levee setbacks[1] and estuarine habitat creation are the most beneficial types of actions needed for recovery of Chinook in WRIA 10. Increased flows in the hydroelectric diversion reach of the White River would also be very beneficial[2]. Removal of artificial barriers and restoration of habitat diversity[3] and riparian conditions in tributary streams with already good production is also beneficial.

In WRIA 12, the widespread addition of LWD to restore habitat diversity and complexity would be highly beneficial for coho performance. In Clover Creek and Morey Creek, the correction of fish passage barriers, restoring summer flows, riparian restoration and addition of LWD to create habitat diversity and complexity would be the most beneficial actions.

In the EDT Phase 2 modeling effort (Mobrand, 2004), Mobrand Biometrics, Inc., with the assistance of the TAG, evaluated a total of 111 different actions in WRIAs 10 and 12 for Pierce County. Scientific professionals serving as members of the advisory group, familiar with the watershed or portions of the watershed (the estuary), submitted the actions. There were 59 actions in the Puyallup/White upstream of the estuary and 25 in the Puyallup/White and Hylebos estuaries and Commencement Bay. There were 14 actions in Hylebos Creek[4], and 13 in WRIA 12. We used the EDT model to evaluate each individual action, and to evaluate logical groupings of actions (scenarios) to estimate increases in abundance, productivity and life history diversity. *Figure 2* through *Figure 5* show the predicted changes in performance.

As noted previously, the EDT Phase 2 report describes each of the actions. Puyallup River actions (type and number) that were considered included:

- Electron Diversion screen modification (1)
- Levee setbacks (14)
- Oxbow or off-channel habitat reconnection
- Riparian corridor restoration
- LWD placement
- Fish passage barrier removal (37 barriers)

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[1] Levee setbacks can result in re-connecting large areas of floodplain to the main river. They allow natural processes to create side-channel and off-channel habitat areas. Oxbow and off-channel habitat reconnections can provide similar benefits by providing water and fish access to existing habitat.
[2] Flow has increased in the diversion reach because the hydroelectric operation has ceased. Negotiations on flow diversions to maintain the lake and provide a water supply continue. Our strategy does not address this issue, but does consider the benefits to salmon that would result from flow increases.
[3] Habitat diversity includes pool/riffles, LWD, etc.
[4] Actions in the Hylebos are not further detailed here because they did not significantly benefit Chinook.

Puyallup River

Chinook

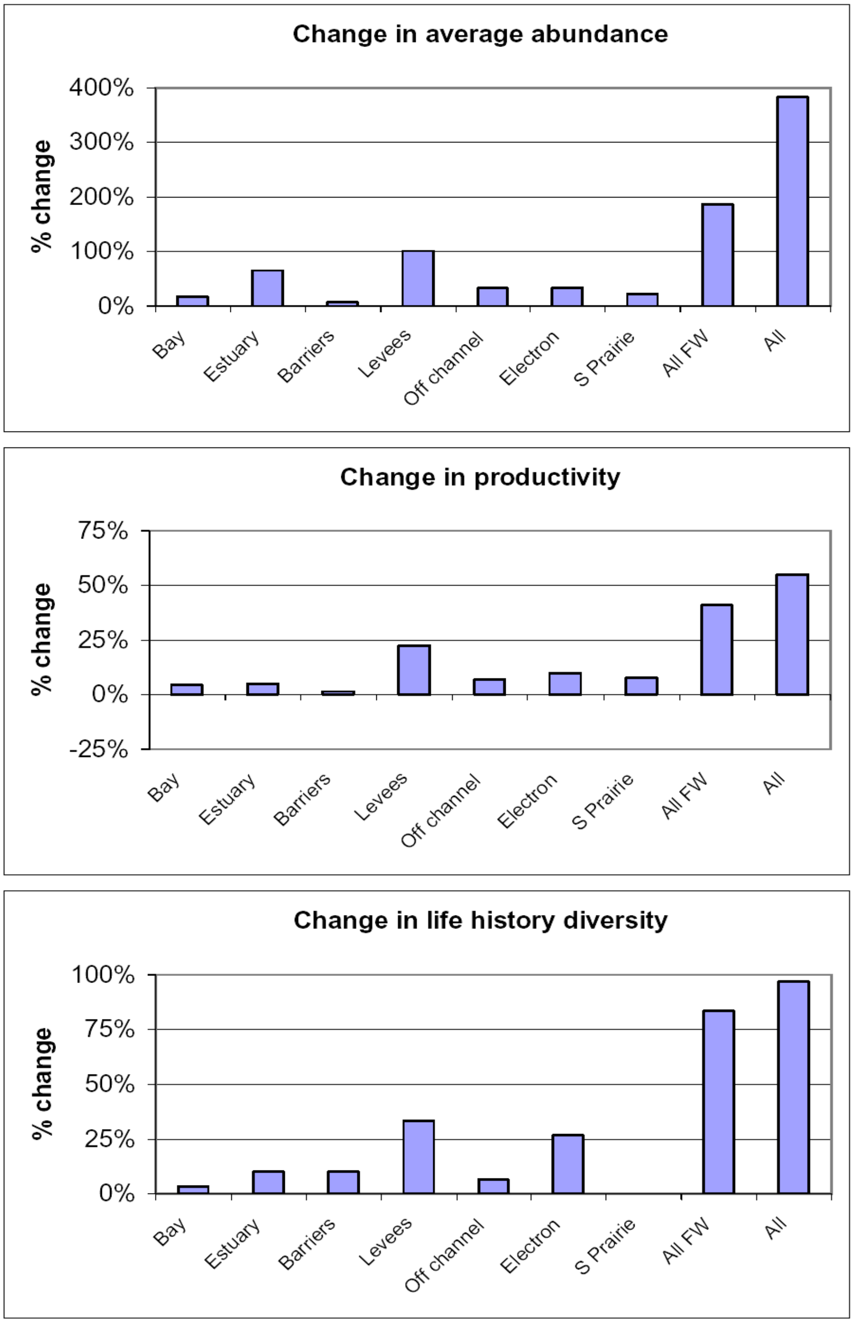

Figure 2*.* Change in performance of Chinook by action groups for populations in the Puyallup River. Groups: **Bay** – all actions in Commencement Bay; **Estuary** – all actions in the estuary; **Levees** – all levee setback actions; **Off-Channel** – all actions adding off-channel habitat; **Electron** – Electron diversion screens; **S. Prairie** – all South Prairie Creek actions; **All FW** – all freshwater actions; **All** – all actions.

Upper White River Populations

Chinook

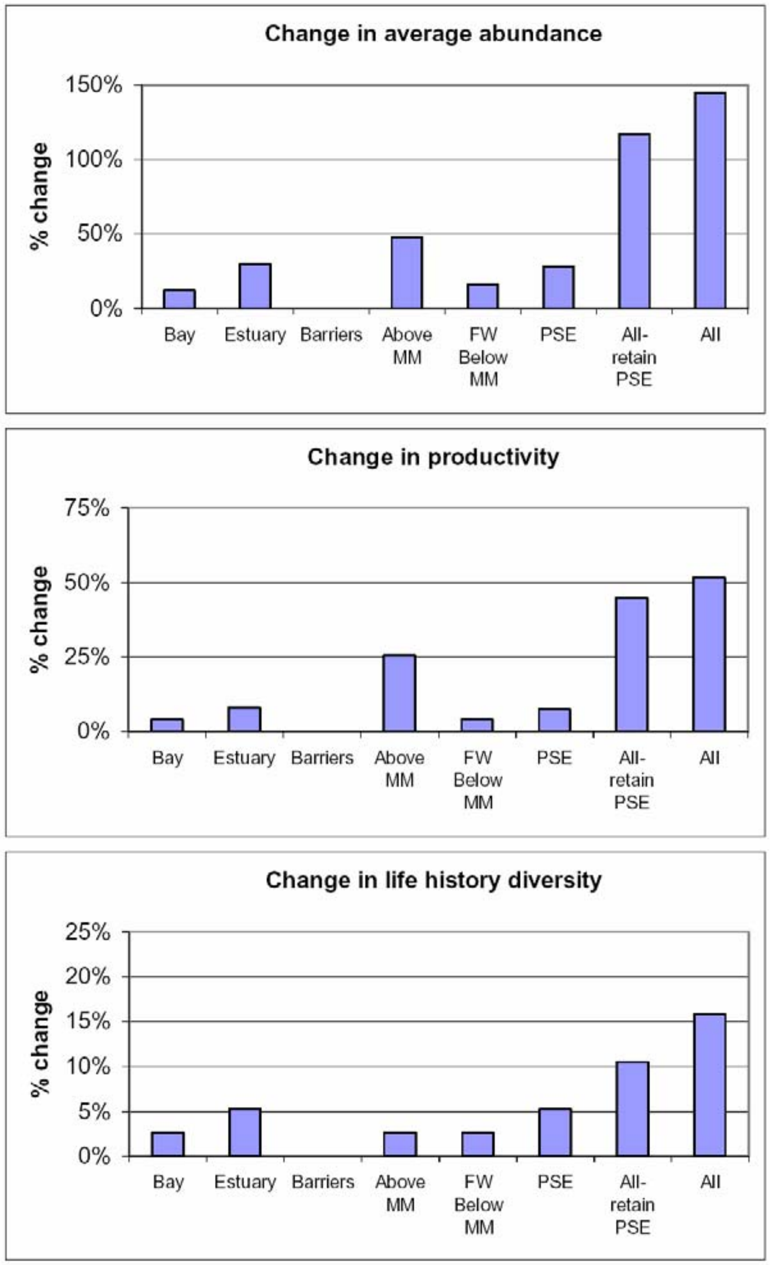

Figure 3. Change in performance of Chinook by actions groups for the populations produced in the upper White River Watershed. Groups: **Bay** – all actions in Commencement Bay; **Estuary** – all actions in the estuary; **Barriers** – all passage barrier actions (except removal of PSE trap, PSE Dam, and Mud Mountain Dam); **Above MM** – all actions upstream of Mud Mountain Dam; **FW Below MM** – all actions below Mud Mountain Dam and upstream of the estuary; **PSE** – elimination of the PSE flow diversion; **All-retain PSE** – all actions except elimination of PSE Diversion and modification of flows released by Mud Mountain Dam; **All** – all actions except modification of flows released by Mud Mountain Dam.

Lower White River Populations

Chinook

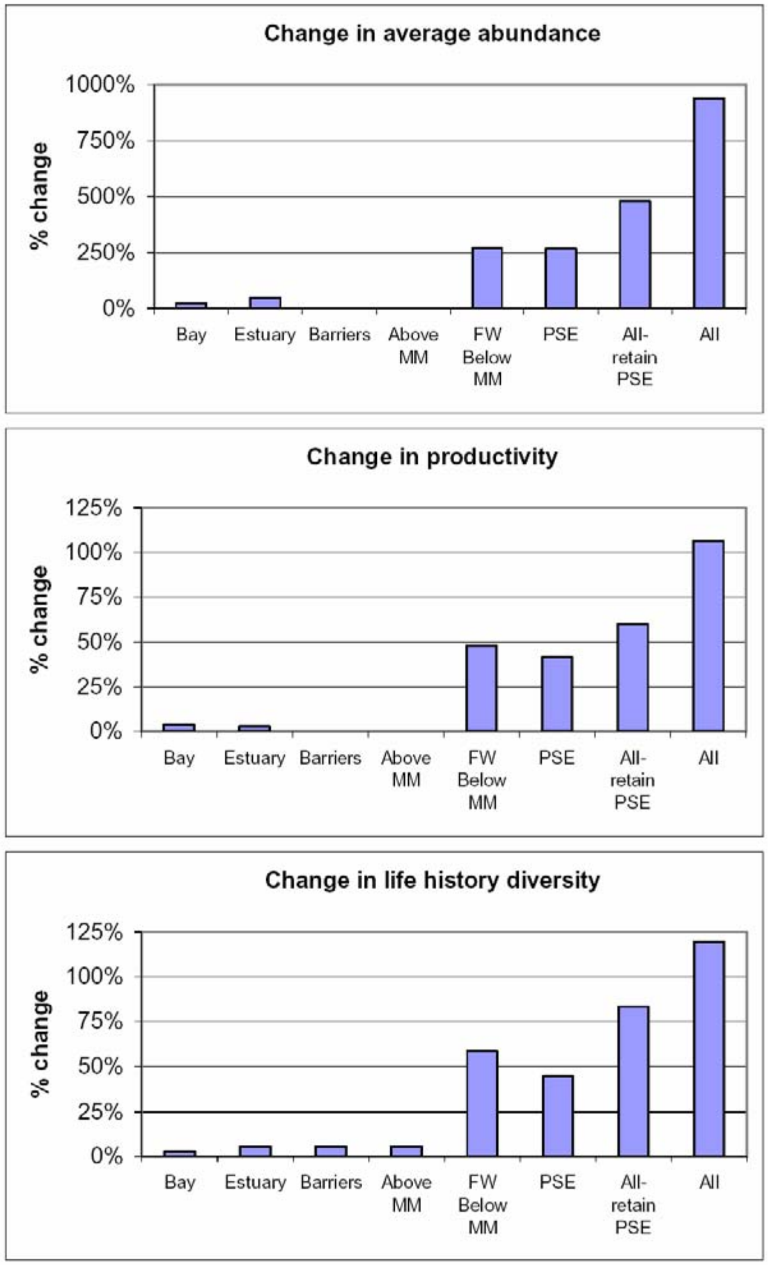

Figure 4. Change in performance of Chinook by actions groups for the populations produced in the lower White River Watershed. Groups: **Bay** – all actions in Commencement Bay; **Estuary** – all actions in the estuary; **Barriers** – all passage barrier actions (except removal of PSE trap, PSE Dam, and Mud Mountain Dam); **Above MM** – all actions upstream of Mud Mountain Dam; **FW Below MM** – all actions below Mud Mountain Dam and upstream of the estuary; **PSE** – elimination of the PSE flow diversion; **All-retain PSE** – all actions except elimination of PSE Diversion and modification of flows released by Mud Mountain Dam; **All** – all actions except modification of flows released by Mud Mountain Dam.

Chambers-Clover Creek

Coho

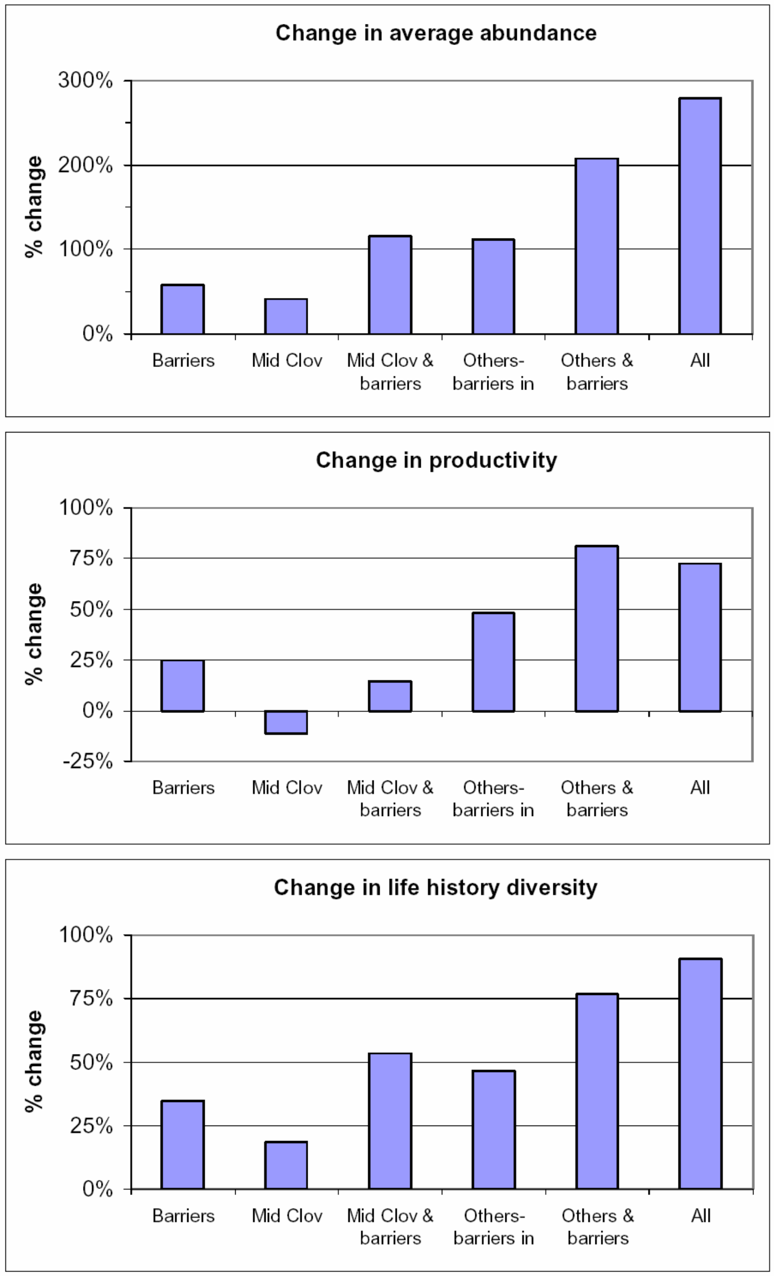

Figure 5. Change in performance of coho by actions groups in Chambers-Clover Creek. Groups: **Barriers** – all relevant barriers corrected; **Mid Clov** – channel reconstructed and flow restored in area of PLU (no barriers corrected); **Mid Clov & barriers** – channel reconstructed and flow restored in area of PLU with barriers corrected; **Others-barriers in** – all other actions (no barriers corrected); **Others & barriers** – all other actions with barriers corrected; **All** – all actions.

In the White River the types of actions included were:

- Levee setbacks (3)
- Restoration of flow to the PSE bypass reach (1)
- Riparian corridor restoration
- Channel reconstruction
- LWD placement
- Semi-normative flow restoration at Mud Mtn Dam (1)
- Forest road removal
- Bridge replacement
- Fish passage barrier removal (20 barriers)

There were 12 actions in the Puyallup estuary, 12 in Commencement Bay and 1 in the Hylebos estuary. The following types of actions were included:

- Creation of salt marsh/blind channels
- Creation of distributary channels
- Beach replenishment

The 13 actions considered in Chambers/Clover Creek included:

- Flow restoration in dewatered reaches
- LWD placement
- Beneficial nutrient resupply (e.g. salmon carcasses)
- Stream corridor acquisition and associated restoration
- Channel reconstruction
- Fish passage barrier removal (4 barriers addressed)
- Storm water detention facilities

The actions included in this analysis are conceptual in development. For instance, potential setback levee locations may have been identified based on evidence that the river had historically occupied that location and because the site is not now significantly developed. Certainly there are locations which were not included but which might be suitable sites. Significant further analysis is necessary to determine actual locations, extent and feasibility for levee setback projects.

Puyallup River

Among individual actions, the top ranked action for Puyallup Chinook is the Electron diversion screen improvement. This action produces the largest projected increase in abundance (34%), productivity (10%) and life history diversity (27%) for any single action. This action was the clear winner for Chinook in the Watershed.

Puyallup River Scenarios

Bay	All actions in Commencement Bay (12 projects)
Estuary	All actions in the Puyallup Estuary (12 projects)
Barriers	Physical barriers to fish passage corrected except those associated with the Electron Dam (37 barriers corrected)
Levees	All setback levee projects (14 projects)
Off Channel	All actions that primarily add off-channel habitat or access to off-channel habitat.
Electron	Modification to the Electron Diversion screens to remedy mortality issues
S. Prairie	All actions on South Prairie Creek (including barrier corrections and access to off-channel habitat
All FW	All actions affecting freshwater habitat
All	All actions combined (49 projects – some consist of multiple measures)

For the Puyallup, the scenario that produced the greatest increases in abundance and productivity for Chinook was levee setbacks. The same scenario produced the greatest increase in abundance for coho. Potential locations for levee setbacks in the Puyallup watershed were recently identified in the Levee Setback Feasibility Study between RM 2.6 and 23.3 on the Puyallup River. A total of 20 potential levee setback sites were identified.

Estuarine actions produced the second highest (as a group) increase in abundance for Puyallup fall Chinook. Note that estuarine in this case refers to the Puyallup River, from the mouth to the extent of tidal influence near the mouth of Clarks Creek. Potential locations in this reach to increase off-channel intertidal habitat include the Union Pacific setback (RM 2.6-3.7) and the Wetland Oxbow reconnection (RM 4.6-5.7), identified in the Levee Setback Feasibility Study.

Both the EDT Phase 1 and Phase 2 reports identified the South Prairie Creek mainstem as a high-priority for protection, meaning that further degradation would have a large negative effect on Chinook performance in that system. Restoration was a lower net benefit than some other areas because performance was already relatively good. Though it still contains relatively high quality habitat, indicators may not accurately reflect Chinook performance in South Prairie Creek according to new information on the magnitude of inadvertent supplementation by hatchery fish[5]. Maintaining flow, substrate, stream bank and riparian characteristics in the system should receive high-priority. Interestingly, the highest ranking project for coho in WRIA 10 was an off-channel habitat re-connection project on South Prairie Creek – largely due to increased coho productivity from more off-channel rearing and over-wintering habitat.

[5] Baranski, as cited in Mobrand, 2003 (EDT Phase II report).

White River

For fish produced in the upper and lower White River, the top ranked individual actions were Mud Mountain Dam flow modifications and the restoration of normal flow in the PSE diversion reach[6]. These actions produced the greatest projected benefits to salmonids by a substantial margin over other individual actions, giving some insight into how severely these hydrologic modifications have impacted the performance of salmonids in the White River. We included these actions in the analysis because of the potential for increased flows in the diversion reach. Chapter 4 also discusses this issue.

White River Scenarios

Bay	All actions in Commencement Bay (12 projects)
Estuary	All actions in the Puyallup Estuary (12 projects)
Barriers	All physical barriers to fish passage corrected except those associated with the PSE Diversion and Mud Mountain Dam (addresses issues on 20 barriers)
Above MM	All actions upstream of Mud Mountain Dam (16 projects – some consist of multiple measures)
FW below MM	All actions downstream of Mud Mountain Dam (excluding those in the estuary/bay and those associated with the PSE Diversion or Mud Mountain (17 projects –some consist of multiple measures)
PSE	The action that remedies issues associated with the PSE Diversion (excludes flow modifications at Mud Mountain Dam)
All – retain PSE	All actions except those associated with the PSE Diversion or Mud Mountain Dam flow modifications (58 projects – some consist of multiple measures)
All	All actions except those involving flow modifications at Mud Mountain Dam (59 projects – some consist of multiple measures

For lower White River fish, the second ranked group of actions included all freshwater actions downstream of Mud Mountain and upstream of the Puyallup confluence (17 actions). This group of actions produced approximately equivalent benefits to Chinook as the action that eliminated the PSE bypass effects. This group of actions included several setback levees, floodplain reconnections, riparian restoration projects, redistribution of LWD from Mud Mountain reservoir, and significant restoration of Boise Creek. Potential locations for levee setbacks in the White River were recently identified in the Levee Setback Feasibility Study between RM 2.6 and 7.3. A total of six potential levee setback sites were identified. The combination of all actions in this area produced the greatest benefits to Chinook compared to the groups that

[6] The action of implementing Mud Mountain flow modifications was modeled to include both changes in flow at the PSE bypass as well as a more normalized flow released from Mud Mountain Dam. We assumed that it would make little sense to attempt to model normalized flow realized from the dam while still maintaining the PSE bypass with current operations. For this action, Mud Mountain flows would be modified to achieve more of a more normative pattern, except we assumed that only the most extreme flood peaks would be reduced by temporary storage.

consisted of all actions in the other watersheds analyzed (producing nearly a 900% increase in Chinook abundance in the lower White River). Boise Creek LWD enhancement and re-vegetation ranked among the top ten projects for lower White River fish.

The relative benefits of actions differed significantly for Chinook produced in the upper and lower White River drainages (e.g. above and below Mud Mountain Dam). This is in part an artifact of the more severely depressed performance of the lower White River fish. For instance, the current abundance estimate of Chinook produced in the lower White River is about 1% of the historic abundance, while the upper White River Chinook abundance estimate is about 7% of historic abundance – thus any increase in the abundance of lower river fish is larger relative to the existing abundance. The estimated increases in abundance from all modeled actions are 1800 more Chinook (spawners) in the lower river (from 200 currently estimated) and 725 more in the upper river (from 500 currently estimated).

For upper river fish, after the benefits of flow normalization, the results estimate that the greater benefits to upper river Chinook will tend to be achieved by actions conducted upstream of Mud Mountain Dam. Riparian restoration and LWD placement in the Greenwater River and Huckleberry Creek were high benefit actions. The top ranked action in the upper river was Greenwater River LWD placement, which by itself is estimated to produce a nearly 40% increase in abundance for Chinook and coho originating in the upper drainage. Improved road management in the Greenwater River and Huckleberry Creek would likely address the increased sediment load in these tributaries. In the Clearwater River, high benefit actions would be riparian restoration, LWD placement, improved road management, and other actions that increase habitat diversity, increase key habitat quantity, and decrease sediment load. The remaining two projects in the top ten for the upper White River were estuarine restoration actions.

Chambers/Clover Creek

Chambers/Clover Creek Scenarios

Barriers	Physical barriers to fish passage corrected (4 barriers)
Mid Clover	Clover Cr. channel reconstructed and low flow problem remedied
Mid Clover and barriers	Barriers corrected; with channel reconstructed and low flow problem remedied
Others – barriers in	All actions except those that address channel reconstruction and low flow correction, and barriers to fish passage
Others and barriers	All actions except those that address channel reconstruction and low flow correction
All	All actions combined (12 projects)

The top two actions for both coho and Chinook in Chambers-Clover Creek were LWD enhancement and nutrient enhancement, applied extensively over many reaches in the system. This assumed coverage by these actions over many reaches is likely the reason the actions ranked over all others, which were more limited in scope. Coho abundance was increased about 28% and 35% by the LWD and nutrient actions respectively. The results indicate that increasing food organism abundance and quantity of LWD over extensive areas of the Watershed would produce the highest increases in performance. We point out that we are unaware of any instances of significant attempts to increase beneficial nutrients in urbanized streams such as Chambers-Clover Creek. Research in British Columbia suggests that nutrient enhancement using briquettes composed of marine derived nutrients could produce significant increases in fish food organisms.

The next six ranked actions each resulted in 15-22% increases in coho abundance. Three of these were barrier correction actions, which are relatively easy to implement.

The results for combinations or groups of actions show very significant increases in coho performance. Projected increases for Chinook are much smaller because of the more limited potential range of the species in the drainage. All actions combined except those involving re-channeling and flow restoration in Clover Creek between Spanaway Creek and North Fork Clover Creek, which would be the most difficult to implement, produced more than a 200% increase in coho abundance.

Regional Projects

In the 2007 SRFB funding round the Nisqually National Wildlife Refuge approached the WRIA 10/12 Lead Entity for assistance in funding the Nisqually Estuary Restoration Project. The Nisqually NWR proposed a project to completely remove several dikes and restore 700 acres of tidal estuary habitat in the Nisqually Delta. Once completed, this project will increase the amount of tidal estuarine habitat in South Puget Sound by 46 percent providing substantial benefit to all estuarine dependent fish and wildlife in the South Puget Sound. In addition, recent fish monitoring studies clearly demonstrate that the estuary restoration project will be of value to multiple salmon populations throughout the Central and South Puget Sound region.

Because of the clear regional benefit of the Nisqually estuary restoration project, the WRIA 10/12 Lead Entity honored the request of the Nisqually NWR and allocated $200,000 toward the project. In addition, the Lead Entities from WRIAs 11, 13, 14, and 15 also allocated funding toward the project, resulting in nearly $1,000,000 in regional Lead Entity funds allocated toward the Nisqually estuary project. The willingness of the South Puget Sound Lead Entities to work together in this way is unique in the state, and was praised by the members of the Salmon Recovery Funding Board.

As we move into future rounds of SRFB funding it is necessary for us to continue looking beyond the freshwater WRIA boundaries, and toward the shared marine and nearshore habitats of the Puget Sound. By continuing the effort at developing a regional approach to salmon habitat restoration and protection we will address the habitat needs of our own salmon stocks throughout their entire life history, and we will be able to better leverage limiting funding for important regional projects.

The WRIA 10/12 Lead Entity will consider funding or partially funding projects that provide significant benefit to salmon populations in Puget Sound, so long as there is consensus among the members of the Technical Advisory Group and the Citizens' Advisory Committee to do so.

Chapter 6

“SOCIO-ECONOMIC OBJECTIVES”

The Citizens Advisory Committee (CAC) places fundamental value on the best available science (as recommended by the TAG) when considering the merits of each project. However, salmon recovery cannot be divorced from the context of the surrounding community. Strong public support for salmon recovery is essential to the success of individual recovery projects, regional recovery and long-term taxpayer support to provide ongoing funding for salmon recovery projects. Conversely, a strategy that focuses solely on best available science while failing to build public support or worse yet alienating the public and potential local sponsors, may unwittingly contribute to the failure of salmon recovery. With this in mind, the CAC has created the following four categories as a tool or threshold to measure socio-economic values of each project.

Action: A PRIORITIZED LIST OF OUTREACH AND PUBLIC SUPPORT BUILDING NEEDS

There needs to be a better understanding of:

- The life cycle of salmon,
- The overall decrease in the number of returning salmon,
- The degraded state of natural stocks,
- The impacts of increasing development and economic growth on water quality and quantity in and around the Sound, and how that impacts the health of salmon stocks,
- The importance of distinguishing between hatchery, farmed and wild salmon,
- The famous “5 Hs”; habitat, hydro, hatchery, harvest, and history in reference to salmon recovery,
- The natural watershed processes in WRIAs 10 and 12.
- The monetary benefit or value each returning salmon has on our regional or local economy.

Strategies to Address these Needs

The CAC and Lead Entity will continue to write news articles for local distribution, continue to present Power Point programs, and hold local workshops in both the Puyallup/White River and the Chambers Clover Creek Watersheds. The Watershed Councils will be used as the primary contact for outreach.

The content of workshops will include all aspects of the issues outlined above, in addition to explaining the basic principals of salmon habitat recovery.

A) Do no harm to existing habitat
B) Conserve and preserve areas of best existing habitat
C) Restoration of appropriate sites

Guest speakers will be invited and audience interaction encouraged. An emphasis on public and private roles in salmon habitat conservation and restoration will be explored and options and activities developed. These will inform the community about areas where they can get involved and make a difference.

Examples might include:

Water conservation;
Choosing less toxic cleaning products;
Adopting salmon-friendly gardening practices;
Actions of private owners of shoreline property;
Landscaping property;
Managing stormwater;
Treating waste;
Removing invasive species;
Planting native vegetation; and
Gathering monitoring data at the stream level and on a watershed scale to track key indicators of ecosystem health.

Participation on Puyallup River and the Chambers Clover Creek watershed councils;
Assist in the implementation of both the Upper and Lower Puyallup River and the Chambers Clover Creek Watershed Action (non-point) Plans.

A clear connection must be established between the factors of decline affecting salmon habitat and the policies, actions and choices that governments, the public and businesses make daily.

Candidate Project List Presented to the Community

Once complete applications for projects are submitted to the Lead Entity Coordinator, presentations of the projects will be held before both the Puyallup River and the Chambers Clover Creek Watershed Councils to explain the proposals and gain public understanding and support. Once the CAC has scored and ranked all projects, this list will be presented to both watershed councils.

Projects with Volunteer and Public Education Components

Salmon recovery projects that include substantive volunteer and or public education components are essential to build public support for salmon recovery and cultivate a stewardship ethic in the surrounding community. Consideration will be given to projects that:

- Include public education components relative to watershed health and salmon recovery
- Increase the amount of preserved open space and habitat
- Incorporate volunteer labor in implementation

- Involve local schools in implementation
- Can be used as a showcase to educate the community about the need for similar projects

Action: ENCOURAGE COOPERATIVE WATERSHED PARTNERSHIPS

To be successful, salmon recovery projects often require several different organizations working together in both funding and implementation. Because watersheds, and even sub-watersheds (or basins), typically cross jurisdictional and community boundaries, cooperative partnerships are also essential to comprehensive salmon recovery planning. Involvement of private landowners and businesses strengthens a strategic element of the community support. Consideration will be given to projects that:

- Involve partnerships between multiple jurisdictions or agencies
- Involve partnerships between public and private entities
- Include matching funds from multiple partners

Action: ECONOMIC AND SOCIAL BENEFITS

Salmon recovery is inextricably linked to a sustainable economy. It is only when people are comfortable with their economic situation that they will be willing to give salmon the resources (water, habitat, etc.) that they need to survive. Therefore, projects that take economic concerns into account are more likely to help salmon recovery as a whole. Consideration will be given to projects that:

- Encourage businesses or industries to participate in restoring or preserving salmon habitat
- Support economic development opportunities in the vicinity, downstream areas, or region
- Have cultural or social value
- Promote a sustainable approach to salmon recovery
- Have a greater than the minimum of matching funds

Chapter 7

“NEAR and LONG-TERM ACTIONS”

Among our priorities there will be both near-term and long-term actions (Tables 3 and 4).

Long-term high-priority projects in WRIA 10 include construction of levee setbacks, restoration of estuarine habitat, and screening the Electron diversion. However, sponsorship capacity to implement those projects is limited and requires a longer timeframe for their successful implementation. We do not expect many of these types of complex proposals in the near-term (five to 10 years)

In the near-term, we will support other important projects that protect and/or improve habitat in presently productive streams or that correct barriers to high quality habitat.

Studies to identify the most effective levee setback and/or estuarine projects, assess their feasibility and prepare preliminary designs are high priorities for near-term actions.

In WRIA 12, projects to correct significant barriers on Clover Creek and its tributaries will be high-priorities. LWD and riparian restoration projects may be high-priorities if they are cost effective. Assessment(s) of the nearshore area that lead to restoration actions would be of high-priority.

We now know that the most important actions for salmon recovery in the lower reaches of WRIA-10 are large-scale floodplain reconnections to the mainstem rivers. These will be expensive and difficult to implement and may not occur soon. However, efforts are underway to increase the collaboration of project partners and so provide the funding capacity to support these actions.

We can accomplish other important actions in the near-term that have moderate to high benefits and certainty. This chapter presents those near-term priorities.

A number of potential levee setback and floodplain re-connection projects have been identified on the Puyallup, White and Carbon Rivers. Generally, these projects are conceptual, and the list of projects is not comprehensive. The list of potential projects in the bay and estuary is similarly conceptual, although sponsors and funding (from other sources) may be more available.

With SRFB funding from Round 5, Pierce County, with the assistance of a technical advisory group has begun to identify potential setback levee projects and to evaluate their feasibility based on geomorphic, engineering, land use, and cost factors. Then projects can be prioritized and project sponsors and funding can be sought. .

A project to place an effective screen on the Electron hydroelectric diversion canal is a high-priority. Estimates that half the downstream migrant juveniles enter the diversion canal and trapping returns at best, only 20% of those to the river. This loss accounts for 40% of all downstream migrant fish, and may make populations in the Upper Puyallup River unsustainable.

We support projects to create intertidal and shallow subtidal habitat throughout Commencement Bay, and especially between the mouth of Hylebos Waterway and Browns Point, similar to the “Outer Hylebos” project proposed in the EDT Phase 2 report. Because projects in the estuary and

Commencement Bay tend to be relatively expensive, large-scale restoration actions there would likely not be as cost effective as similar scale restoration actions in the middle and upper watershed. Therefore, we would expect competitive estuary and bay project proposals to be highly partnered and have relatively high rates of in-kind match,

Projects to protect and/or restore presently functional salmon streams are near-term high-priorities. In WRIA 10, this includes South Prairie Creek and its tributaries; and the White River tributaries Boise Creek, the Greenwater River, the Clearwater River, and Huckleberry Creek.

In WRIA 12, projects to restore passage at the Morey Creek Dam and at Shera's Falls on Clover Creek, and restoration with Chambers Bay and along the WRIA 12 nearshore are high priorities. Projects to restore habitat diversity (LWD) throughout the watershed may be high priorities if they are cost effective and properly sequenced relative to other restoration needs. A project to restore flow in the seasonally dry sections of Clover Creek is a high-priority. Pierce County is conducting pilot studies/projects along Clover Creek to determine an effective means to this restoration; and later will be implementing a flow restoration project.

Priority Data Gaps

The Technical Advisory Group (TAG) has identified several data gaps that are limiting our ability to make informed decisions about key aspects of salmon recovery and habitat priorities. The highest priority data gap is information on migration timing and production of smolts in the various river and stream systems. In addition, productivity is a key issue for both the Puyallup fall and White River spring Chinook populations. Smolt trapping to help understand migration timing and production is recommended and prioritized in the following order: (1) White River, (2) South Prairie Creek, and (3) Chambers Creek.

Other priority data gaps include EDT modeling for steelhead, including possible habitat survey needs to support steelhead modeling, and salmon productivity upstream of the Electron dam. This should be evaluated through biological sampling (e.g., smolt trapping, mark and recapture, e-fish, etc.)

Table 3

"Long-term Priorities (High Benefit)"

Reach	Species	Habitat type	Recommended Action	Actions/Needs	Rationale	Comments
Puyallup Estuary (RM 0 – 6.0)	Chinook, coho, steelhead, bull trout cutthroat	Rearing, refuge	Acquisition, restoration	Create off-channel estuarine habitat	high benefit for Chinook fry rearing, osmoregulation	As a group, 2nd highest benefit type of project
Puyallup River (RM 6.0 to 22)	Chinook, coho, steelhead, bull trout cutthroat	rearing	Acquisition and restoration	Setback levees, floodplain reconnection	High benefit for Chinook fry colonization and rearing	As a group, highest benefit type project
White River (RM 0 to 10)	Chinook, coho, steelhead, bull trout cutthroat	rearing	Acquisition and restoration, normalized flows	Setback levees, floodplain reconnection	High benefit for Chinook fry colonization and rearing	As a group, highest benefit type project
Carbon River (RM 0 to 10)	Chinook, coho, steelhead, bull trout cutthroat	rearing	Acquisition and restoration	Setback levees, floodplain reconnection	High benefit for Chinook fry colonization and rearing	As a group, highest benefit type project
Puyallup River at Electron Dam (RM 31.2)	Chinook, coho, steelhead, bull trout	Out-migration	screening	Need adequate screening on Electron diversion canal	80% loss of canal migrants	Highest ranked individual project

Table 4

"Near-term Priorities (Moderate – High Benefit)"

Reach	Species	Habitat type	Recommended Action	Actions/Needs	Rationale	Comments
S. Prairie Creek	coho, steelhead	Rearing	Restoration	Restore floodplain/wetland connectivity to the river	Benefits coho abundance and productivity	% increase in abundance and productivity
S. Prairie Creek	Chinook, coho, pink, steelhead	Spawning, rearing	Protection Restoration	LWD, channel structure, sinuosity	Active spawning area	Habitat diversity limiting
Boise Creek	Chinook, coho, steelhead	Spawning, rearing	Restoration	LWD, riparian	Benefits Chinook abundance and productivity	2 of 10 top ranked projects for lower river fish
Clover Creek	coho	migration	Restoration	Barrier removal	15 – 22% increase in abundance from each project	Shera's Falls Morey Pond Dam
WRIA 12 Nearshore	Chinook, chum, bull trout, coho	Juvenile rearing	Restoration	Barrier removal, intertidal habitat	Some uncertainty	Need assessment
Greenwater River	Chinook, bull trout, coho	Spawning, rearing	Restoration	LWD, riparian, road management	Ranked 3 &4 for upper river fish	
Huckleberry Creek	Chinook, bull trout, coho	Spawning rearing	Restoration	LWD, riparian, road management	Ranked 6th & 8th for upper river fish	
Clearwater River	Chinook, bull trout, coho	Spawning, rearing	Restoration, Protection	LWD, riparian, Road Management	High priority geographic area in EDT Phase 2	
Commence ment Bay	Chinook, bull trout, coho	juvenile rearing	Restoration	protect, restore or create intertidal and shallow subtidal habitat	The Outer Hylebos project was ranked 5th, 9th, and 10th for Lower White, Upper White, and Puyallup Chinook, respectively	The Outer Hylebos project is listed in the Recovery Plan as a project to initiate within ten years

Chapter 8

"PROJECT RANKING CRITERIA"

Ranking Procedure

Initial Project Review: All project proposals submitted to the Lead Entity process will be reviewed by the TAG. The TAG will review proposals, develop a prioritized list of projects, and submit the list to the CAC for their review and approval. Proposed projects will need to be at least of medium benefit and certainty to be recommended for SRFB funding by the TAG. The TAG will meet with each project sponsor to discuss the merits of the project, including how well the project fits the WRIAs 10 and 12 Strategy and the SRFB selection criteria. The TAG may ask for additional information or provide suggestions on how to improve the fit, benefit and certainty of the project.

Project Ranking: The TAG will rank projects based on the following criteria and the strategy. Each member of the TAG will individually score and rank projects. The TAG will discuss the results, and members may be asked to provide their rationale for scoring individual criteria. Members may adjust their scoring and rank during the discussion. When finalized, the rank order provided by each member of the TAG will be used to calculate the mean rank order for each project. The TAG will provide information for each project on the criteria that resulted in the high, medium, or low benefit to salmon rating (e.g., watershed processes and habitat features, areas and actions, scientific, species, life history, costs) and certainty of success rating (e.g., appropriate, approach, sequence, threat, stewardship, implementation). Mean rank order will determine the final rank order. The TAG will provide a memorandum describing its deliberations, with the ranked list of projects. Low benefit and/or low certainty projects will be forwarded to the CAC with a recommendation that they not be forwarded to SRFB for funding support.

Table XX. TAG Scoring Sheet and Ranking Criteria:

Benefit to Salmon (SRFB definitions, 2008 Draft)	
• High benefit	8-10
• Medium benefit	5-7
• Low Benefit	0
Certainty of Success (SRFB definitions, 2008 Draft)	
• High certainty	4-6
• Medium certainty	1-3
• Low certainty	0
Fit to Strategy	
• Project addresses issue specifically identified as a long-term high-priority	8-10
• Project addresses issue specifically identified as a near-term high-priority	8-10
• Project is consistent with a long-term high-priority	5-7
• Project is consistent with a near-term high-priority	5-7

- Project is not consistent with a priority area or action but would be a high/medium benefit and certainty action 1-4
- Other actions 0

The CAC shall review the TAG's memorandum and ranking of the project proposals. The CAC will then score projects based on the 13 social and economic criteria as shown in Table XX. Each member of the committee will rank each project proposal by assigning a value from 0 to 10 points to each criteria element. This will provide a possible 130 Socio/Economic (S/E) points for each proposal.

The TAG and CAC scores will be scaled to reflect a contribution to the final score of 30% from the CAC and 70% from the TAG. The total score will determine the projects ranking with the exception that the application of the S/E scores will affect the project's ranking only within the benefit category (high, medium, low) generated by the TAG ranking, and cannot move a project ahead of another project with a higher benefit rating.

CITIZENS COMMITTEE SOCIO/ECONOMIC SCORING SHEET

Does the project promote public visibility and participation?	Maximum Points	Points
Does the project include a public education component relative to watershed health and salmon recovery?	**5**	
Does the project increase the amount of preserved open space and habitat?	**5**	
Does the project incorporate volunteer labor in implementation?	**5**	
Does the project involve local schools in implementation?	**5**	
Will the project be used as a showcase to educate the community about the need for similar projects?	**5**	

Does the project encourage cooperative watershed partnerships?

Does the project involve partnerships between multiple jurisdictions or agencies?	**5**	
Does the project involve partnerships between public and private entities?	**5**	
Does the project include matching funds from multiple partners?	**5**	

Does the project have other economic and social benefits?

Does the project encourage businesses or industries to participate?	**5**	
Does the project support economic development opportunities in the vicinity, downstream areas, or region?	**5**	
Does the project have cultural or social value?	**5**	
Does the project promote a sustainable approach to salmon recovery?	**5**	
Does the project have a greater than the minimum amount of matching funds?	**5**	

Does the project have landowner willingness?

Is there a willing landowner for the proposed project?	**5**	

TOTAL (max 70) | |

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Appendix A

H-INTEGRATION in WRIA 10

An important element of Chinook recovery in the Puget Sound is the alignment and integration of recovery goals and actions in the management of hatchery, harvest, and habitat restoration programs. To better integrate the H's in the Puyallup/White watershed we have chosen to use the All H Analyzer (AHA) model, which allows managers to explore the implications of alternative ways of balancing the "H's" so that informed decisions can be made. The AHA model input data includes fish productivity, habitat capacity, harvest rate, hatchery brood stock information, and hatchery release numbers. By changing various parameters in different ways, managers are able to create scenarios that examine the interactive effects of hatchery, harvest, and habitat practices on salmon populations.

Puyallup River Fall Chinook: Participants in the H-Integration efforts include the Puyallup Tribe of Indians, WDFW, and Pierce County. So far, we have examined multiple H-integration scenarios using the AHA model. In addition, we have identified potential near-term goals and actions. Future work will include reaching agreements on both near-term and long-term goals and actions, and assigning responsible parties for the actions. We will also document our assumptions, AHA model results, goals, actions, and presumed outcomes.

A brief description of the AHA modeling results for Puyallup River Fall Chinook is provided below:

- *Current Conditions:*
  - Habitat:
    - Productivity = 1.39
    - Capacity = 4,075
  - Harvest:
    - 50% harvest rate on Hatchery Origin Recruits (HORs)
    - 50% harvest rate on Natural Origin Recruits (NORs)
  - Hatchery:
    - 1110 adult local brood stock
    - 70% of HORs return to hatchery and 30% return to spawning grounds
    - Hatchery brood stock is approximately 4% NORs
    - Hatchery origin spawners is approximately 87%
- *Near-term goals:*
  - Habitat:
    - Productivity = 2.6
    - Capacity = 10,000
  - Harvest:
    - 35% harvest rate on NORs
    - 70% harvest rate on HORs
  - Hatchery:
    - 1470 adult local brood stock
    - 70% of HORs return to hatchery and 30% return to spawning grounds
    - Hatchery brood stock is approximately 20% NORs
    - Hatchery origin spawners is approximately 55%
- *Near-term actions:*

- Habitat:
  - Conduct habitat improvements to achieve a habitat productivity of 2.6 and capacity of 10,000. Habitat improvements include levee setback projects on the middle and lower Puyallup River, estuary restoration, and protection and restoration of South Prairie Creek and the upper Puyallup River. In addition, fish passage improvements at the Electron Dam would be especially beneficial.
- Harvest:
  - Implement a selective harvest in the Puyallup River and Commencement Bay to achieve a harvest rate of 35% on NORs and 75% on HORs.
- Hatchery:
  - Construct fish racks on Voights Creek and South Prairie Creek to allow sorting and separating of HORs and NORs in those tributaries.
  - Limit the number of HORs above the Voights Creek Hatchery and South Prairie Creek to achieve the 55% hatchery origin spawners.
  - Use adipose-present fish (presumptive NORs) at the Voights Creek Hatchery to achieve the goal of 20% natural-origin brood stock.

As different scenarios were analyzed, it became clear that the currently low natural productivity of the Puyallup system limited near-term recovery options. It was not until productivity was above about 3.0 that the number of NORs increased to the point that the Proportion of Natural Influence (PNI) was above 0.5. The PNI is a function of the proportion of natural spawners that are of hatchery origin (pHOS); as pHOS decreases, PNI increases. Presumably, when the PNI is above 0.5, then natural selection has a greater effect on the population than does domestication of the hatchery environment.

White River Spring Chinook: The H-integration effort for White River Spring Chinook is still in a preliminary stage. Participants have included the Puyallup Tribe of Indians, the Muckleshoot Indian Tribe, WDFW, and Pierce County. Early AHA scenario modeling has shown that, similar to the Puyallup system, the currently low natural productivity of the White River has drastically reduced the number of NORs, and limited near-term recovery options. It is likely that additional scenario modeling will show that actions to increase habitat productivity are critical to achieving a population with a PNI above 0.5. As yet, no near-term or long-term goals or actions have been identified. Future work will include reaching agreements on both near-term and long-term goals and actions, documenting our assumptions and results, and assigning responsible parties for completing identified actions.

A brief description of the AHA modeling results for White River Spring Chinook is provided below:

- *Current Conditions:*
  - Habitat:
    - Productivity = 1.4
    - Capacity = 2600
  - Harvest:
    - 20% harvest rate on Hatchery Origin Recruits (HORs)
    - 20% harvest rate on Natural Origin Recruits (NORs)
  - Hatchery:
    - About 300 adult local brood stock and 500 imported brood stock, (adjusted to achieve a release of about 1,200,000 smolts). Hatchery brood stock is approximately 2% NORs

    - 65% of HORs return to hatchery and 35% return to spawning grounds.
    - Hatchery origin spawners is approximately 62%
- Population Composition
    - NOR Escapement of about 561, Hatchery origin Spawners (HoS) of about 1137, and a Total Escapement of about 1698.
    - A total harvest of about 582.
    - Hatchery broodstock of about 817, and a hatchery surplus of 331.
    - An average total runsize of about 2912.
    - The Proportion of Natural Influence (PNI) is 0.03, indicating that selection in the hatchery is greater than selection in the natural environment.

The productivity and capacity estimates used in the "Current Conditions" scenario are derived from EDT modeling that does not include the increased flow conditions that currently occur in the bypass reach between Buckley and Sumner. The improved flow conditions have likely increased the actual productivity and capacity. As better estimates of current conditions are developed they will be included in the AHA scenario development.

Appendix B

"POLICY RECOMMENDATIONS"

WRIA 10

We recommend continuation of a hatchery production role in the Puyallup-White basin, but a reform of hatchery practices consistent with the Hatchery Scientific Review Group Recommendations (2003) that more directly addresses effective supplementation of natural production by hatchery fish.

WRIA 12

We prefer that unmarked (e.g. non-hatchery) Chinook be passed upstream to spawn naturally. Chambers Creek habitat could be important for Chinook by providing spawning and rearing habitats for use during periods of low habitat quality or reduced access to primary areas and by providing 'bridging points' that affect the likelihood of dispersal and re-colonization.

Appendix C

WATERSHED PROCESS BACKGROUND INFORMATION

Chapter #3 presents the analysis of watershed processes and limiting habitat features in WRIAs 10 and 12. Below is a general definition and description of these terms. We provide this for background purposes.

Watershed Processes

"In physical terms, a watershed is an area from which water drains to a common point. This trait results in a set of physical and biological interactions and processes that causes the watershed to function as an ecological unit. Watersheds can be considered at a range of nested scales, beginning with the area contributing to a small first-order stream (i.e., a stream with no tributaries) and culminating with the world's great river basins (such as the Amazon, Nile, Congo, Mississippi, Columbia, etc.). Ultimately, stream processes that create habitat integrate the physical and biological processes occurring across the contributing watershed."

Watershed Components

"Across landscapes, two controlling factors – climate and geology – create three basic ecosytem components: soil, vegetation, and water (Note: the effects of animals on soil and vegetation will be ignored for the sake of simplicity). These components are overlaid on, and influenced by, *topography* that is also shaped by climate and geology. Within watersheds, the interactions of these components result in yields of stream flow and sediment with patterns of timing, quantity, and quality characteristic of each watershed. These yields of water and sediment, in turn interacting with riparian vegetation (and, in steep, forested watersheds, large wood delivered from upland sources), form the stream channel and associated aquatic habitat.*"

* From: Saldi-Caromile, K., K. Bates, P. Skidmore, J. Barenti, D. Pineo. 2004 Stream Habitat Restoration Guidelines: Final Draft. Co-published by the Washington Departments of Fish and Wildlife and ecology and the U.S. Fish and Wildlife Service. Olympia, Washington.

Limiting Habitat Features

"The quantity and quality of aquatic habitat may present in any stream, river, lake, or estuary is a reflection of the existing physical habitat characteristics (e.g., depth, structure, gradient, etc.) as well as the water quality (e.g., temperature and suspended sediment load). There are a number of processes that create and maintain these features of aquatic habitat. In general, the key processes regulating the condition of aquatic habitats are the delivery and routing of water (and its associated constituents such as nutrients), sediment and large woody debris (LWD). These processes operate over the terrestrial and aquatic landscape…. In addition, ecological processes operate at various spatial and temporal scales and have components that are lateral (e.g., floodplain), longitudinal (e.g., landslides in upstream areas) and vertical (e.g., riparian forest)."

"The effect of each process on habitat characteristics is a function of variations in local geomorphology, climatic gradients, spatial and temporal scales of natural disturbance, and terrestrial and aquatic vegetation. For example, wood is more of a critical component of stream habitat than in lakes, where it is primarily an element of littoral habitats. In stream systems, the routing of water is primarily via the stream channel and subsurface routes, whereas in lakes, water is routed by circulation patterns resulting from inflow, outflow, and climatic conditions."

"Human activities degrade and eliminate aquatic habitats by altering the key natural processes described above. This can occur by disrupting the lateral, longitudinal, and vertical connections of system components as well as altering spatial and temporal variability of the components. In addition, humans have further altered habitats by creating new processes such as the actions of exotic species. The following sections identify and describe the major alterations of aquatic habitat that have occurred and why they have occurred.***"**

* From: Runge, J., Marcantonio, M., and Mahan, M. June 2003. Washington Conservation Commission. Salmonid Habitat Limiting Factors Analysis, Chambers-Clover Creek Watershed.