

Watershed Profile:

Puyallup/ White Basin

The People and the Place

Shaped by a series of mudflows running down Mount Rainier starting about 5,600 years ago, the Puyallup/White River basin is geologically the youngest watershed in Puget Sound. The Puyallup and its two major tributaries, the White River and the Carbon River, are glacially-born on the flanks of Mount Rainier. The Puyallup flows from Klapatche Ridge on the southwestern slopes of Mount Rainier to empty into Commencement Bay at the Port of Tacoma, the third largest port in the western U.S. The White River flows about 68 miles from its headwaters on the northeast face of Mount Rainier before joining the Puyallup River at Sumner. The Carbon River flows from the Carbon glacier to its confluence with the Puyallup River near Orting.

South Prairie Creek, a major tributary of the Carbon River, is considered one of the most productive reaches used by Chinook for spawning habitat that is available for natural salmonid production in the basin. Most of the watershed lies within Pierce County. It includes more than a dozen cities and towns, including the state's third largest city, Tacoma. In total, the Basin drains an area of approximately 1,065 square miles, and has over 728 miles of rivers and streams which flow over 1,287 linear miles.



Photo by Dan Kowalski

Annual average rainfall in the basin ranges from 40 inches at the city of Puyallup to 70 inches at the Electron Dam. Eighty percent of this precipitation occurs in the fall and winter months. Sixty percent of the basin lies at an elevation of 1,000 to 4,000 feet, an area where neither rain nor snow predominates. This topographical feature often leads to moisture

conditions that are capable of generating tremendous amounts of runoff. Flood events normally occur in the winter months and are followed by less severe spring runoffs generated by snowmelt.

There are three hydroelectric facilities in the watershed. The Electron Dam, operated by Puget Sound Energy, is on the Upper Puyallup River. Mud Mountain Dam, about five miles upstream from Buckley on the White River, is used to regulate flows to protect Sumner, Auburn, Puyallup and other lowland areas by holding back water from heavy rains and snow melt in the reservoir, then releasing it slowly back into the river. When returning adult salmon are trapped at the diversion dam at Buckley they are trucked upstream of the Mud Mountain Dam where they are released into the Upper White River. Fry pass through the dam's tunnels as they head downstream for Puget Sound.

Downstream of the dam, between Enumclaw and Buckley, Puget Sound Energy operates a diversion dam—the White River Hydroelectric Facility (completed in 1911). This dam redirects up to 2000 cubic feet per second of the water from the White River through a canal and flume system into Lake Tapps.

The Puyallup River Basin was one of the earliest areas to be settled by Euro-Americans in the Puget Sound region. They prized the basin for its deep-water embayment, large tracts of pristine old growth forests, fertile river valley soils and abundant runs of salmon. Homesteads and settlements began appearing in the early 1850s. The Puyallup River basin was also one of the first watersheds in Puget Sound to experience the full impacts of industrial, urban and agricultural development. Extensive urban growth, heavy industry, a large modern marine port, hydropower, an extensive revetment and levee system, and agriculture have combined to significantly alter the natural landscape. These activities and land uses have led to negative impacts on the salmon populations that had thrived in the basin. Nonetheless, functioning, productive habitats still exist for salmon to spawn

and rear, especially in the middle and upper White, Puyallup, and Carbon watersheds and in the South Prairie Creek watershed.

Pierce County, the Port of Tacoma, the Puyallup Tribe, WDFW, US Forest Service, and other stakeholders collaborated in the development of an Ecosystem Diagnosis and Treatment (EDT) modeling exercise to help guide decisions on restoration and protection efforts. Salmon recovery efforts are focused on addressing the loss of floodplain habitat. Dikes and levees have been used extensively to contain the White, Puyallup and Carbon Rivers' natural inclinations to meander.

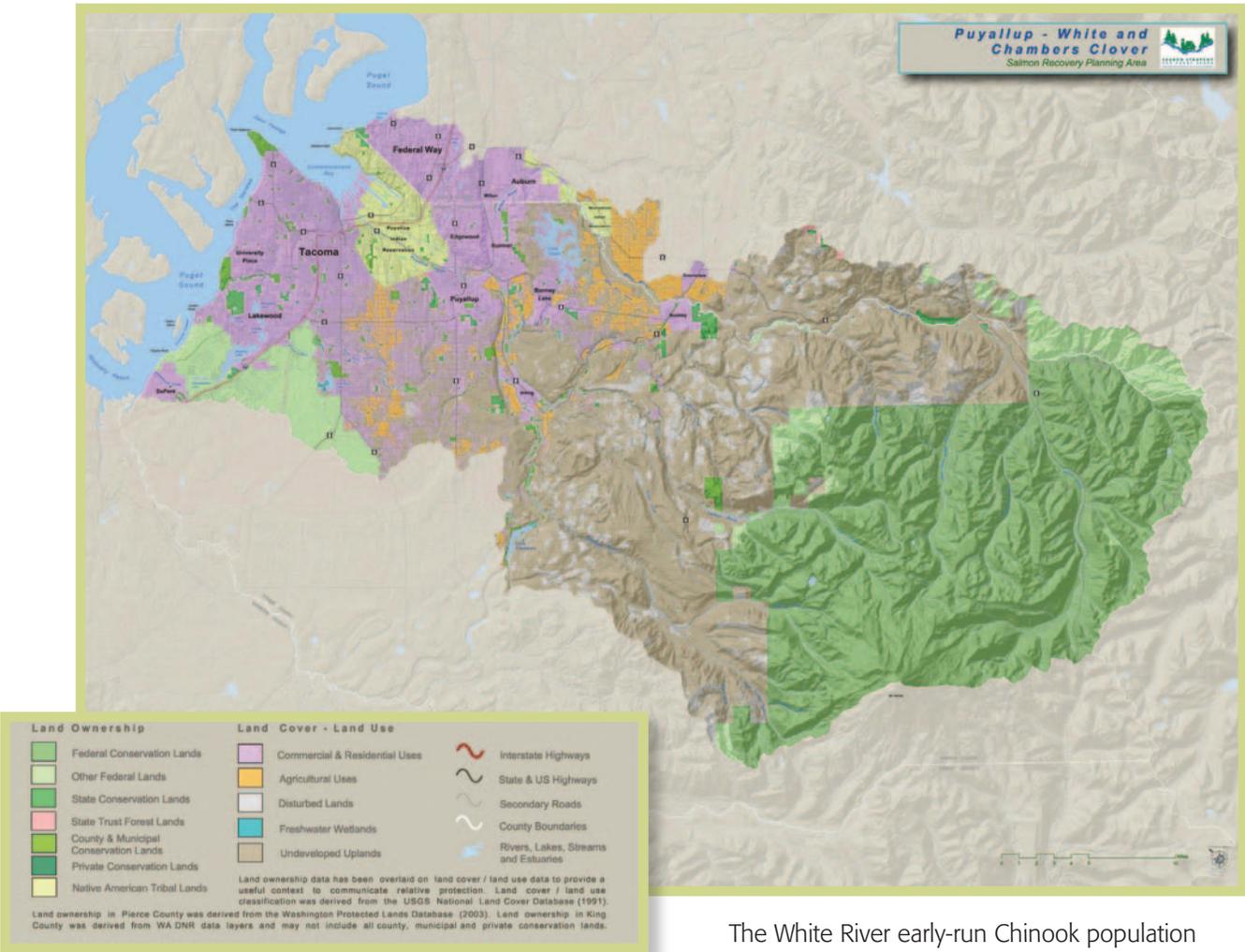
Pierce County, the Puyallup Tribe, the Muckleshoot Indian Tribe and the Washington Department of Fish and Wildlife (WDFW), have each been active in developing and coordinating recovery efforts in the Puyallup basin. The two tribes, along with other natural resource trustees, are engaged in identifying estuarine areas for clean-up of contaminated sediments.

Major restoration projects completed and/or slated for action include levee setbacks and oxbow restoration while simultaneously continuing to provide for flood control. Limiting the impact of new development is also critical in any highly-urbanized watershed. Pierce County recently worked with a developer and engineering firm to introduce low impact development technologies in the Fife Heights (Meadow on the Hylebos) area and is promoting the approaches with other developers.

The County, Puyallup Tribe, agencies, and other stakeholders and residents of the watershed will build on these recent efforts to continue to work towards protecting and restoring their watershed into the future.

Puyallup/White Salmon and bull trout

The basin is home to early and late run Chinook, three native chum stocks, pink salmon, and steelhead. There are three native populations of bull trout, and the basin is considered a core area for



bull trout recovery. The US Fish and Wildlife Service has identified five local bull trout populations within the Puyallup core area – Carbon River, Greenwater River, Upper Puyallup and Mowich Rivers, Upper White River and West Fork White River. There is one potential bull trout population in the Clearwater River.

Chinook

The Puyallup River basin supports two populations of Chinook salmon -- the early returning White River Chinook, which spawn in the upper and lower White River, and the late returning Chinook population that spawns in the Carbon River, Puyallup River, and associated tributaries. There are also some late returning Chinook that spawn in the lower White River that will need to be assigned to one of the populations.

The White River early-run Chinook population is genetically the most distinctive stock in central and south Puget Sound. It is the last existing early returning “spring” Chinook population in southern Puget Sound. Most natural spawning occurs in the mainstem White River upstream of Mud Mountain Dam, and in major tributaries such as the Clearwater River, Greenwater River, Huckleberry Creek, Boise Creek and potentially the West Fork White River. The early Chinook also spawn in the White River downstream of the water diversion at RM 24, where some late returning Chinook also spawn.

Most Puyallup Chinook natural spawning occurs in South Prairie Creek up to RM 15, the Puyallup mainstem up to the Electron Dam, the lower Carbon River, Voights’s Creek and Kapowsin Creek. Some spawning is believed to occur in the upper Puyallup now also since passage has recently been established at the Electron diversion dam.

Recovery Goals

Ecosystem Diagnosis and Treatment (EDT) analyses conducted by Pierce County in collaboration with the Puyallup Tribe, WDFW, the U.S. Forest Service, Port of Tacoma, and other stakeholders was used to estimate reasonable recovery goals based upon a relatively comprehensive list of restoration actions.

Puyallup River Chinook: The Technical Recovery Team planning range for abundance is 17,000 to 33,000 (productivity of 1.0). The planning target for abundance is 5,300 (productivity of 2.3) to 18,000 (productivity of 1.0). The EDT analysis estimates that the basin can potentially support abundance at 6,170 spawners after implementing a series of actions.

Measurable recovery goals are under study by the co-managers and will be developed as H-Integration is achieved. The current escapement goal (number of fish allowed to “escape” harvest to spawn) for the Puyallup River Chinook is 1,200. Currently, for South Prairie Creek, co-managers want to see at least 500 adult spawners return to the Creek. The long term goal stated in the Puyallup Fall Chinook Baseline Report (2000) is “to ensure that Puyallup River natural fall Chinook are allowed to continue to respond and adapt to their local environments and that the stock be maintained at or, if necessary, restored to a healthy, productive status.”

White River Chinook: The EDT analysis estimates 3,225 Chinook in the upper and lower White River combined assuming discontinuation of the White River hydroelectric facility flow diversion.

Measurable goals for the White River population are under study and will be developed as H Integration is achieved. Currently, the co-managers short term goal is for 1,000 or more adult natural origin spawners returning to the Buckley Dam. The long term goal stated in the White River Recovery Plan (1996) is “to restore the native population of White River spring Chinook stock in the White River watershed to a healthy, productive condition...”

The escapement goal should reflect the watershed carrying capacity and should be met with a full compliment of directed and incidental harvest in sport, commercial, and tribal fisheries.”

Bull trout: The US Fish and Wildlife Service recovered Puyallup core area adult abundance target for bull trout is 1,000.

What is the current status of the threatened fish?

EDT analysis suggests that the average historic abundance of the Lower White River Chinook was 15,000; currently, it is estimated at 200. The average historic abundance of Upper White River Chinook according to EDT analyses was 6,700, with 500 as the current abundance estimate (Key Peninsula, Gig Harbor, and Islands Watershed Near-shore Habitat Assessment Report, Vol. 11, 2003.) White River Chinook escapement fell to below 100 through the 1980s, and in two of those years, was below 10. The hatchery supplementation program has raised escapement to levels ranging from 300 to 600 between 1992 and 1998. (Comprehensive Chinook Salmon Management Plan, 2002).

EDT modeling results estimate that the Puyallup River supported 42,000 Chinook historically; the estimate of current abundance is 1,300 (Key Peninsula, Gig Harbor, and Islands Watershed Nearshore Habitat Assessment Report, Vol. 11, 2003.)

Over the last ten years, natural spawning escapement of Puyallup Chinook ranged from 1,500 to 5,000, with averages over the last 8 years of 2,500. The median natural escapement to the South Prairie spawning grounds was as low as 25 in the 1970s and 1980s.

What are the key factors affecting the current salmon populations?

Supporting factors

Nearshore and estuarine habitats provide food and refuge for juvenile salmon as they prepare for their journey to the ocean; but, flood control



Photo by Dan Kowalski

projects, Port of Tacoma activities and urbanization have resulted in severely degraded conditions and significantly reduced the amount of functioning habitat. Since the 1990s, EPA and the natural resource trustees, including the Puyallup Tribe and the Muckleshoot Indian Tribe, have been working with the Port of Tacoma and Port tenants on sediment remediation and habitat restoration projects in Commencement Bay and the Hylebos. The estuary factors and restoration strategies identified through the Puyallup watershed EDT assessment build upon the work of the trustees, particularly the Commencement Bay Aquatic Ecosystem Assessment (Simenstad, 2000).

South Prairie Creek, a tributary to the Carbon River, has been characterized as “the backbone of natural salmonid production” in the Lower Carbon River sub-basin and Puyallup watershed. While the area currently has the highest productivity for Chinook, it was recently placed on the 303(d) water quality list for high temperatures. Pierce County developed and is implementing a plan to address high temperatures. The County Water Program actively participates with Cascade Land Conservancy and Pierce Conservation District to acquire properties for protection and restoration purposes. The County has provided and expects to continue to provide matches for at least three acquisitions

funded by SRFB and other sources in the next ten years.

Most of the Upper Puyallup River watershed is managed under the Forests and Fish agreement and Habitat Conservation Plans. Forest Service ownership on the east headwaters is contiguous with Mount Rainier National Park. The upper watershed offers an opportunity to increase spawning and rearing habitat for Chinook through road decommissioning and other restoration actions. The Puyallup Tribe entered into a Resource

Enhancement Agreement with Puget Sound Energy (PSE) in 1997. Among the actions that benefit Chinook are provisions for minimum instream flows based on the needs of Chinook and completion of a fish ladder to get fish above the Electron Dam to about 26 miles of stream habitat.

County management has made a commitment to support and participate in the development of good environmental science through such processes as the EDT modeling effort, nearshore habitat assessments, the Biodiversity Analysis (GAP analysis), and PSNERP. Directions, Pierce County’s critical areas protection package, was updated in 2004 using Best Available Science (BAS). BAS is used for sub-basin planning, Comprehensive Plan amendments, GMA and other regulatory updates, including the Shoreline Management Plan update scheduled to begin in 2006 and conclude in 2011.

The County conducts regulatory program gap analyses prior to proposing regulatory program updates, as was done with the “Directions” package in 2000. The county analyzes population growth projects and buildable lands when preparing for GMA updates.

The County uses regulatory updates, community planning and sub-basin planning and similar programmatic measures as vehicles to educate

members of the public concerning habitat actions that will benefit salmon.. These activities include discussions of Biodiversity Management Areas, Sub-basin Plans, support for Low Impact Development, workshops for marine shore zone owners, and information on the Public Benefit Rating System.

Significant habitat factors limiting Chinook

Fish Access: Fish access to spawning and rearing habitat is limited by hydroelectric power projects as well as numerous flood control diversions, dikes, and stream channelization projects through the Puyallup, White and Carbon River systems and many of the tributaries. The Mud Mountain Dam and White River Hydroelectric Project eliminated 9.6 miles of mainstem spawning and rearing habitat. Returning adult salmon are trapped at the diversion dam and trucked upstream of the Mud Mountain Dam impoundment where they are released back into the White River at RM 33.9. About 70% of the known culverts within the Puyallup river watershed

in 1999 acted as partial barriers to salmon migration upstream and downstream; about 40% were determined to be complete barriers. EDT modeling is being used to analyze effects of removing some of the culverts.

Sediment transport: Mud Mountain Dam disrupts the natural delivery of sediments by impounding fine sediments during high flow and/or high load periods and discharging them for prolonged periods during lower flow periods. This causes increased localized deposition and results in the reduction of spawning area and destruction of redds. Sediment deposition in Dumas Bay, a 253 acre intertidal sandflat habitat integral to the nearshore ecosystem slightly north of Federal Way, is occurring at an accelerated rate due to increases in peak flows of Lakota and Joes Creeks, shoreline armoring, clearing of vegetation on slopes, and wastewater treatment plant discharges.

Lack of estuarine and nearshore habitat: Out of more than 5,900 acres of estuary habitats that historically existed at the head of Commencement Bay, only about 200 acres remain due to dredging, filling and activities associated with development. The substantial loss of estuary habitat support for the Chinook populations has reduced capacity, productivity, and diversity. Contaminated sediments which have further limited the nearshore/estuarine habitat have resulted in additional reductions in Chinook productivity.

Flows: Diversion of flows from the 24 mile bypass reach of the lower White River has reduced spawning and rearing habitat and has disrupted the use of the river as a migratory corridor. Diversion of flows from the ten mile reach of the Puyallup River between the Electron Powerhouse and the dam has also reduced spawning and rearing habitat and disrupted the migration corridor. Periodic manipulations of flows associated with operations of both facilities are believed to result in recurrent fish strandings and kills. Numerous kills have been



Photo by Dan Kowalski

documented in the White River bypass reach during these flow manipulations. A lack of adequate screening in the diversion dams also impacts salmon. Screens were installed in the White River Diversion and appear to have largely corrected this issue—the effectiveness of the guidance system at Electron is being studied.

Water Quality: Point and non-point source pollution due to industrial and commercial activities, residential development and agriculture adversely impacts water quality. Water quality parameters are exceeded in the vicinity of the White River due to sanitary sewage effluent from the cities of Buckley and Enumclaw. Many of the streams in the basins suffer from combinations of high fecal coliform levels, low dissolved oxygen levels, and other water quality impacts.

Impaired riparian functions and condition: The lack of large woody debris in the upper Puyallup due to logging and associated road construction and other activities reduces pool quantity and quality, elevates water temperatures, and increases the vulnerability of the stream channels to instability. Habitat in the lower reaches of the mainstem Puyallup River is fragmented and disconnected. Only about 5% of the riparian habitat is rated as high quality. Large woody debris from Mount Rainier is typically broken into smaller pieces by the high energy stream and boulder resulting in inadequate in-stream structures that provide resting and feeding areas.

Floodplain processes and off-channel habitat: The loss of floodplain processes and off-channel habitat along the Puyallup, White and Carbon Rivers limits spawning and rearing habitat in the Puyallup. Levees along the Carbon River and Puyallup mainstems have been constructed to protect residential, agricultural and industrial lands from flooding. Downstream of the confluence with the White River, the Puyallup has been described not as a river, but as “a single purpose conveyance system”.

Future Threats

Flows will remain a key threat in the future unless flows to the White River Puget Sound Energy bypass reach and more normal flows from Mud Mountain Dam are restored. Attempts to achieve positive changes in flow management from Mud Mountain Dam and the PSE bypass have not been successful to date. While progress seems to have been made recently on the White River, further work appears to be needed on protocols to protect fish during flow manipulations associated with operations and maintenance at both diversions. Fish stranding and mortalities need to be minimized to the greatest extent practicable, consistent with recovery goals.

Lack of consistent collaboration on many aspects of recovery planning among Pierce County, the co-managers, municipalities and other stakeholders inhibits and prevents developing much needed strategies to integrate habitat, hydro, harvest, and hatchery objectives and management actions that are consistent with recovery (H-Integration).

Straying of Voights Creek Hatchery fish into various areas of the Puyallup/White system has been identified as a threat to the recovery of the White River Chinook. In 2002, about 20% of the fish that were captured and passed upstream of Mud Mountain, and about 30% to 50% of the adult spawners in South Prairie creek, are believed to have been Voights Creek Hatchery strays.

Setback opportunities from critical areas and floodways are lost as new developments proceed in Orting, Sumner, Puyallup, and other areas. It is critical to protect remaining habitat and preserve options for restoration, especially in areas pressured by growth and development in the lower river, floodplain and estuary.

Actions needed to remove or ameliorate migration barriers particularly at the Electron Dam diversion have not been implemented.

Overall Approach to Habitat Recovery

Pierce County has developed a habitat recovery plan using EDT modeling. The Puyallup Tribe and WDFW participated in analyses and developed management actions to support salmon recovery. The co-managers are currently revising the White River Chinook Recovery Plan published in 1996, and have submitted a recovery plan for Puyallup River Chinook. Co-managers and the County are just beginning to work together to determine the compatibility of their respective plans within an all-H context.



Photo by Dan Kowalski

Key Strategies and Actions Supporting the Overall Approach to Recovery

Habitat

The multi-jurisdictional team that participated in EDT modeling and analysis developed strategic protection and restoration priorities for specific geographic areas. The strategic priorities provide the backdrop to Pierce County's recovery activities. These priorities are also used by the WRIAs 10 and 12 Lead Entity processes.

According to EDT analyses, long-term and near-term management actions that will be most effective in improving conditions necessary to support increased fish populations are as follows:

- Restoration of estuary habitat and floodplain connectivity in the lower Puyallup, lower White and lower Carbon Rivers.
- Increased protection and restoration of tributaries which currently have relatively high productivity, including South Prairie Creek, Boise Creek, Greenwater River, Huckleberry Creek, and the Clearwater River.

- Major management actions noted in the plan as necessary but beyond the purview of Pierce County are changes in flow management for Mud Mountain Dam and PSE bypass, removal and amelioration of migration barriers associated with the Electron Dam.

Habitat Restoration and Protection Strategic Priorities and Actions

Puyallup River Chinook

Key environmental factors needing to be addressed include habitat diversity, channel stability and sediment load, as well as barriers to fish migration for both adults and juveniles. Areas of highest priority for restoration projects include Puyallup mainstem downstream of Orting (to estuary), the estuary, and the diversion screens associated with the Electron Dam. Areas of highest priority for protection include the South Prairie Creek mainstem and estuary.

Actions:

- Pierce County is initiating a Levee Setback Feasibility Study in 2005 which will be completed in two years. The study will consider the entire levee system on the Lower White, Lower and Mid Puyallup and Lower Carbon. Results will be used to identify and prioritize potential

setback projects. Pierce County commits to pursuing funding for 2-3 projects that will be brought to a 30% design level. Additionally, Pierce County commits to pursuing funding for property acquisitions for projects where acquisition is indicated. In addition to using its own funds, Pierce County intends to pursue other potential sources.

- Old Soldiers Home levee set back — Construction will begin at the end of 2005 or in 2006.

White River Spring Chinook

Key environmental factors needing to be addressed include habitat diversity, channel stability, sediment loading, habitat quantity, and flow conditions. Areas of highest priority for restoration projects include portions of the lower mainstem river and the estuary. Areas of highest priority for actions that consider both protection and restoration include the estuary and portions of the mainstem.

Actions:

- Large woody debris, riparian restoration projects in the Upper White: The U.S. Forest Service is the lead for projects in the Upper White, including the Greenwater River and Huckleberry Creek restoration projects. Pierce County provides an in-kind match.
- At least two large woody debris and riparian restoration projects are scheduled for Boise Creek, and funding is being sought for additional projects on the near-term list of projects.
- The County is committed to supporting a TMDL Implementation Plan that was developed in the first quarter of 2005.

Hylebos Chinook

Key environmental factors needing to be addressed include habitat diversity and flow conditions. Areas of highest priority for restoration projects include lower mainstem below the forks and lower reaches of the West Fork. Areas of highest priority for protection include the upper West Fork, followed by the lower West Fork.

Chambers-Clover Chinook

Key environmental factor needing to be addressed is habitat diversity. Areas of highest priorities for restoration projects include mainstem Chambers Creek; Chambers Bay is highest ranked area when reach lengths are normalized. Highest priorities for protecting against further degradation include mainstem Chambers Creek and, when normalizing for reach length, Chambers Bay.

In-stream Flows:

The County is pursuing projects to understand the low flow issues in WRIA 12 and is currently participating in studies that are expected to identify actions that can be taken to repair the natural stream seal.

Pierce County staff members are reviewing the Puget Sound Low Flow Survey (review draft 2004). The survey identified reaches with flow problems for fish and other studies, and the county will develop and propose implementation of 3-5 projects that will address flow problems.

All H-Integration:

Habitat and harvest management actions and decisions are the purview of the state and tribal co-managers. The co-managers have expressed their intent to work with Pierce County to achieve H-Integration.

In the Habitat Plan, Pierce County offers the following observations:

EDT results demonstrate that the habitat measures alone, even conducted on a very extensive scale, are unlikely to achieve desired fish production levels in the Puyallup/White basin in the near term. For the foreseeable future hatchery production should continue to be given a role in the Puyallup-White basin; the White River hatchery supplementation program is recognized as vitally important in the White River system. For the Puyallup River, it appears that hatchery production will also be important to help maintain natural production until more progress is made in habitat restoration. How-

ever, there is a need to determine how hatchery management tools and approaches can be used more effectively to supplement natural production.

Hatchery strategy

The White River Spring Chinook Hatchery program is located on the White River at the water diversion dam near Buckley. The White River hatchery is managed to help sustain and rebuild the White River early-run Chinook. The long term restoration goal for White River Chinook is to restore the population to a healthy, productive condition. Chinook are reared and released from the White River Hatchery and acclimation ponds in the upper White River watershed above the Mud mountain Dam. The remote hatchery program at Hupp Springs/ Minter Creek hatcheries is ongoing until White River watershed recovery goals are achieved.

The Voight's Creek hatchery and Puyallup Tribal satellite hatchery at Diru Creek operate as the main Chinook facility for the Puyallup and Carbon River systems. Program operations for Puyallup Chinook are designed to provide fish for harvest while minimizing adverse genetic, demographic or ecological effects on listed fish. For example, juvenile Chinook are released as smolts to minimize emigration time to saltwater thereby minimizing potential competition with and predation on natural-origin listed fish.

Harvest strategy

In the short term, harvest management actions are intended to allow a portion of the Puyallup Chinook returning adults to spawn naturally in order to rebuild self-sustaining populations. Currently, insofar as is possible as the natural population increases, fishing efforts are directed to the harvest of hatchery rather than naturally spawning Chinook. Harvest opportunities are provided for the Puget Sound recreational fishery and tribal net fisheries in Carr Inlet, and harvest on the Muckleshoot reservation for ceremonial purposes. The long term goal is to achieve self-sustaining populations to provide for commercial, ceremonial and subsistence harvesting.

White River Chinook are harvested in the mixed stock Chinook fisheries and a current management objective, given the need to protect the viability of the stock, is to limit incidental impacts from coho, sockeye and other fisheries. As recovery occurs, directed fisheries on the White River Chinook may begin at low levels, increasing only in concert with population recovery. Tribal fisheries in the Puyallup watershed and estuary are timed to avoid capture of White River early Chinook.

Adaptive management and monitoring

Pierce County will track progress toward recovery goals by determining how many of the near-term and long-term strategic priorities identified in the lead entity (Salmon Recovery Funding Board) strategy are accomplished and will assess the results. County staff will also use EDT online to update environmental information as needed and to develop and analyze new restoration scenarios.

Monitoring results from sponsors of projects within the watershed will be requested for the EDT updates (e.g. monitoring data developed by the U.S. Forest Service for actions on the Upper White). Pierce County will take the lead on monitoring habitat preservation and restoration projects in which the county is the sole sponsor or a principal partner.

Part of Pierce County's adaptive management plan is to incorporate any changes made to the EDT modeling tool. Pierce County anticipates sponsoring a large modeling effort within the next ten years that will include new actions and reexamine actions that were originally proposed.

Adaptive Management activities would include an annual review of monitoring results of all projects undertaken in the watershed under NRDA, the lead entity strategy and other programs. Technical and policy leads of Pierce Co, Port of Tacoma, and co-managers (WDFW, Puyallup tribe, and Muckleshoot Indian Tribe), the Lead Entity coordinator and committee chairs will review results and compare them with projections and EDT analyses and recommend adjustments in the ten-year plan as appropriate.

Results

The watershed plans for the Puyallup/White were reviewed by the Puget Sound Technical Recovery Team (TRT: a group of seven scientists) and an interagency committee facilitated by the Shared Strategy staff. The TRT reviewed the plan to determine the degree of certainty that the plan can achieve recovery goals. The conclusions of this analysis are below. For the most part, the issues identified below by the analysis are discussed in the watershed plan to some extent, but the reviewers felt they merited particular attention or additional effort to increase the certainty of achieving plan outcomes. Where the analysis identified key uncertainties, proposals are included for consideration. If implemented along with the watershed plan's other actions, these proposals would increase the certainty of results and achieve the requirements for a recovery plan under the Endangered Species Act.

The habitat protection and restoration plan submitted by Pierce County and the state and tribal co-manager salmon recovery plan together show a good understanding of the actions needed to achieve low risk status for the two Chinook populations in the basin.

The White River Chinook is the only remaining early-run population in the south/central region of the Puget Sound evolutionarily significant unit (ESU), and as such it needs to achieve low risk status over time to meet ESU recovery criteria. At this time, the certainty of achieving this status is low. The Puyallup River population needs to at least improve from current conditions to meet the ESU criteria. For this reason it is important to protect this population from further decline and preserve options for its recovery.

The certainty of achieving this plan's outcomes and the resulting contribution to overall ESU recovery will increase if the following issues receive focused attention as described below.

In the immediate near-term, it is critical that the co-managers and the County agree on and adopt a common set of recovery goals for both populations in the watershed. Developing and implementing strategies to integrate harvest, hatchery and habitat management actions are key to increasing the certainty of being able to meet recovery criteria.

Harvest objectives need to be linked to the four Viable Salmonid Population (VSP) parameters and recovery goals.

The implicit hypothesis in this watershed is that the hatchery programs, which in this basin are intended to provide harvest, will not interfere with recovery. However, the plan lacked recovery goals that could be tied to an explicit recovery hypothesis. A particular concern is the Voight's Creek hatchery fish straying into the White River and impacting wild Chinook. New straying data reported in South Prairie Creek show that natural spawners have 30-50% hatchery-origin fish. The reviewers strongly encourage the movement toward hatchery reforms to be more consistent with recovery goals.

Significant water flow issues due to water diversions (from the Cascade Water Alliance Agreement for Lake Tapps and the Mudd Bay and Electron dam diversions) are also a significant concern in this watershed. Currently there is no evaluation of the effects of flows on fish populations. It will be important to establish a time table and set of actions to understand the impact of flows for salmon populations and achieve flows necessary for salmon survival.

The effects of disrupted sediment processes on the ability of the two Chinook populations to recover have not been addressed in the plan. Including consideration of sediments being trapped behind dams and their effects on riverine processes in the recovery strategy would increase its certainty of success.

A key strategy for salmon recovery in this basin is floodplain management. There is an active program in the Puyallup/White River system that is beginning to be funded. However, there is a significant

amount of development underway in the lower river system that is putting major stress on the lower river floodplain and estuarine areas. Consequently, opportunities for large scale restoration in this part of the watershed are dwindling. It is critical for achieving plan outcomes to preserve options for protection and restoration in these areas. It is also important to coordinate estuary improvement efforts with the Port of Tacoma and the Commencement Bay effort.

The review process also identified a number of issues and uncertainties that are common to many Puget Sound watersheds. Strategies to address these issues that are contained in this local watershed chapter are a good approach, based on the current state of scientific understanding. Nevertheless, because (1) these issues are very important to the success of watershed approaches to recovery and (2) the effects of some of these strategies on salmon populations at watershed scales are relatively untested, these issues deserve particular attention. Reducing the uncertainties in the issues below could come through local and/or regional inclusion in adaptive management and monitoring programs, regional or local pilot studies to explicitly test their effects, or through additional implementation actions. The complexities associated with these issues are discussed in the regional strategy section of this document or in the regional adaptive management and monitoring program. The “cross-watershed” issues identified are:

- The importance of habitat protection strategies and the need to assess the results for fish from the combination of protection tools available,
- The need to develop H-Integration strategies or, where they are included, to move them further along the integration continuum over time,
- The need to reconcile local nearshore strategies and actions with the regional nearshore chapter,
- The need to address water resources, both water quality and water quantity,

- The need to better link the effects of land use to habitat-forming processes and to habitat conditions. In turn, the effects of these changes in habitat, processes and landscapes on salmon populations need to be estimated,
- The need to develop or complete a robust adaptive management and monitoring program.

If the above uncertainties are addressed, the Puyallup/White watershed has the opportunity to contribute significantly to overall ESU recovery.