### Watershed Profile:

# Snohomish

#### The Place and the People

The Snohomish River Basin in east central Puget Sound lies in two counties-Snohomish and King-and covers an area of 1,856 square miles with over 1,700 identified rivers and tributaries. It is the second largest watershed in the Puget Sound. The basin's varied topography ranges from low, rolling terrain near Puget Sound to the steep Cascade mountains along the eastern border.

This watershed has long been known for its enviable quality of life. The quality of life is characterized by attractive job opportunities, fertile agricultural lands and extensive timber resources, diverse outdoor recreational opportunities, vast areas of public land, and abundant natural resources extending from Puget Sound to the Cascade crest.

Streams and creeks in the upper reaches of the Snohomish basin flow through forestlands including the popular Alpine Lakes Wilderness. The Snohomish basin currently retains significant ecological assets that contribute to salmon recovery. Overall, 75% of the basin remains in forest lands or wilderness which contributes to greater hydrologic and riparian function and better sediment conditions than are found in other basins across



Photo courtesy the Washington State Salmon Recovery Funding Board

Puget Sound.

The Skykomish River drains the northern Snohomish Basin. Streams originate in the ragged peaks of the Cascade Mountains, and the north and south forks of the river converge in the shadow of Mount Index. The upper Skykomish mainstem is steep. It transports sediment quickly through its narrow, confined channel that is characterized by boulders and numerous rapids. Downstream, toward the cities of Gold Bar and Sultan, the river flattens and the gravel and cobble settle out, forming multiple braided channels and excellent spawning riffles and rearing areas for salmon. From Sultan to Monroe the sediment supply and deposition begins to balance, and the channel becomes more stable. This stretch of river still provides some spawning and rearing habitat for Chinook. Here the river bank is significantly armored. This armoring protects adjacent land uses from erosion, but it also isolates the main river from off-channel habitats that are important for rearing. Rural communities retain their small town charm.

The Snoqualmie River and its tributaries drain the southern Snohomish Basin. Like the Skykomish, the Snoqualmie begins in the Cascade Mountains, although it is not glacier fed. Snoqualmie Falls, one of the best-loved scenic treasures in Washington State, divides the steep upper reaches from the low-gradient river that eventually joins the Snohom-

#### Key facts:

Forest lands and wilderness cover about 75% of the basin; 5% is agricultural. Urbanization is concentrated near the estuary.

Located in King and Snohomish counties, towns and cities in the watershed include Carnation, Duvall, Everett, Granite Falls, Gold Bar, Index, Lake Stevens, Marysville, Mukilteo, Monroe, North Bend, Skykomish, Snohomish, Snoqualmie, and Sultan.

The Tulalip Reservation is located north of the Snohomish estuary.

The Snohomish Basin is one of the fastest grow-

ing areas in Puget Sound with projected population growth of 59 percent from 2000 to 2030.

The planning area for the watershed under the state Watershed Management Act is Watershed Resource Inventory Area (WRIA) 7 ish River. The Tolt and Raging Rivers are both major tributaries to the Snoqualmie. The Tolt is critical for contributing gravel that is important for Chinook spawning habitat, and the best spawning habitat in the Snoqualmie is found at the mouths of both of these rivers. Gliding past the communities of Carnation and Duvall, the Snoqualmie winds through productive farms and rural residences, where river banks have been hardened and the river straightened.

Formed by the confluence of the Skykomish and Snoqualmie Rivers, the mainstem Snohomish River flows through a broad valley and multi-threaded delta for 21 miles on its journey toward the Sound. Some of the best farmlands remaining in Western Washington flank the Snohomish and the lower portions of its two major tributaries, the Skykomish and Snoqualmie Rivers. Portions of the Snohomish have been straightened and the banks have been armored, particularly in the lower river. The upper end of the Snohomish River provides important spawning habitat for the Skykomish Chinook and holding and rearing habitat for both the Skykomish and Snoqualmie Chinook populations and many other species of salmon.

As with many large rivers in the Puget Sound, urbanization has caused a loss of off-channel habitat such as oxbows. This is important salmon rearing habitat and provides fish shelter from major flood events. Reconnecting access to those channels for fish in the lower river is part of a suite of mainstem actions that include restoring bank edges and riparian forests, opening access to side channels and creating logjams in strategic locations. Recovery planners can build on successful restoration efforts to date by continuing to work effectively with farmers and other private landowners.

Before reaching the sound, the Snohomish River flows through the estuary. In addition to providing habitat for rearing and returning salmon, the estuary is also home to at least 350 different kinds of birds and countless varieties of mammals and plants, including blue heron, eagles, osprey, seals and



otter. As the tide rises and falls, saltwater extends about 15 miles upstream of the actual river mouth. Estuaries benefit people by acting as a natural filter that cleans water before it passes into the Sound, and also like a giant sponge, absorbing and slowing floodwaters. The Snohomish estuary is also a place where people from throughout the Puget Sound can watch birds and appreciate the scenic beauty of our region. The Snohomish River empties into Puget Sound north of Everett, the region's third largest city and a major industrial and commercial center that includes the Port of Everett.

The Snohomish Basin Salmon Recovery Forum (Forum) uses an inclusive process, with representation from many sectors including local governments, tribes, farmers, businesses, non-governmental organizations and citizens. The Forum has a broad base of support, and using the Forum's guidance, members and other partners have demonstrated success in completing restoration and protection projects. One of the Snohomish basin's strongest salmon recovery assets is participation from the Tulalip Tribes and the Washington Department of Fish and Wildlife, who work together to co-manage salmon harvest and hatchery production, and to protect and restore habitat. Developing actions that best mix the immediate benefits from changes in harvest and hatchery practices with longer term improvements to altered habitat conditions will move the Snohomish salmon more quickly toward a healthy state.

Achieving their goal of healthy salmon runs will require sensitivity to the needs of both the people and fish that live in the Snohomish basin. The people of the Snohomish basin are committed to meeting the challenge, and have already begun. Since 1998, governments and organizations including Snohomish County, King County, the Tulalip Tribes, City of Everett, Cascade Land Conservancy, Stilly-Snohomish Fisheries Enhancement Task Force, Washington Trout and others have completed approximately 100 projects. The people and organizations care about the place they've inherited, and believe that with innovative solutions both human needs and salmon can be supported. They know that their river basin is a valuable resource that contains a thriving urban center that supports a diverse community, forestry and farming activities that help preserve the rural way of life, and wilderness areas that preserve ecological functions and provide recreation opportunities. This combination of urban, rural and wild is perhaps the Snohomish basin's greatest strength: there is a large enough urban center to provide significant scientific and planning support, while the basin retains the ecological assets and opportunities for restoration upon which the Forum can build its recovery effort.



#### **The Snohomish Salmon**

The Snohomish watershed is home to threatened Chinook and bull trout, as well as declining coho salmon runs. Populations of chum, pink, sockeye salmon, and steelhead, rainbow, cutthroat trout, and mountain whitefish also inhabit the Snohomish system.

Chinook rely primarily on the Snohomish and the lower Skykomish and Snoqualmie Rivers for spawning and rearing. The Snoqualmie and Skykomish Rivers are each home to one spawning population of threatened Chinook salmon and the Snohomish River provides essential habitat for both as they migrate up and down the river. These populations, along with those in the Skagit and Stillaguamish rivers, form the backbone of Chinook populations in Puget Sound.

The Skykomish Chinook population spawns in the Skykomish and Snohomish Rivers and their larger tributaries. The Snoqualmie Chinook population spawns in the Snoqualmie and its larger tributaries. The highest concentrations of spawning Chinook in the Snohomish system are currently located in the Skykomish.

Coho, on the other hand, spend much of their freshwater lifecycle in the smaller tributaries of major rivers. Coho are relatively abundant compared to the Chinook in the Snohomish watershed, which offers hundreds of miles of high-quality habitat in its middle and upper reaches. In fact, the Snohomish is home to the largest population of wild coho of any watershed in the Sound, though recent impacts to these areas have resulted in declines in the populations.

There are four bull trout populations in the Snohomish Basin: North Fork Skykomish, South Fork Skykomish, Salmon Creek, and Troublesome Creek. They can be found throughout the Snohomish River basin, generally downstream of barriers that block the passage of fish swimming up river. Unlike other salmon species, bull trout can migrate between fresh and saltwater several times in their lifetime, making migratory corridors between upland and lowland areas critical.



Photo courtesy the Snohomish Basin Salmon Recovery Forum.

Three of the four populations of bull trout migrate to the estuary and nearshore for the spring and summer, and immature fish use the lower reaches of the Snohomish River from Ebey Slough to Thomas' Eddy during the winter months. Mature adult fish migrate all the way upriver to spawn primarily in the Upper North Fork Skykomish River and its tributaries, as well as in the Foss River above Sunset Falls, which is accessible only by a trap and haul system. Recent surveys by the US Fish & Wildlife Service indicate that the number of bull trout redds (nests in the gravel where they lay their eggs) are increasing.

#### **Recovery Goals**

The Forum has set a long-term vision for the future and has identified the need for a significant level of habitat improvement in the next 10 years. They believe that this is the time to be bold because there is a window of opportunity to maximize habitat recovery efforts while funding is available, ocean conditions appear to be favorable, and because harvest and hatchery management actions have improved. The Forum created a thoughtful, cost-effective plan that focuses on the areas where measurable progress toward the fish population goals stated below can be achieved. By supporting both people and fish through innovative solutions, the Forum has affirmed the importance of maintaining and sustaining agriculture and forestry in the basin, protecting the health and safety of those who live there, working cooperatively and respectfully with landowners, and enhancing the conservation ethic that supports both salmon recovery and healthy ecosystems in general.

#### **Fish Population Goals**

Scientists on the Puget Sound Technical Recovery Team have established four parameters for healthy salmon populations: abundance, or the number of fish in a population at any given time; productivity, or that population's ability to replace itself or grow

Population	Average Number of natural origin spawners (1996-2000)	Planning Targets	
		Low Productivity	High Productivity
Skykomish	1,700	39,000 (1.0)	8,700 (3.4)
Snoqualmie	1,200	25,000 (1.0)	5,500 (3.6)

with the next generation; spatial structure, or the amount and variety of habitat salmon occupy in a river; and genetic diversity, which makes the populations better able to survive and adapt to disease and other challenges. As salmon recovery actions are taken over time, these parameters provide a means to measure their success.

The Forum has adopted the following planning targets set by the tribes and state of Washington for abundance and productivity. These are approximately 50 year goals. Low productivity represents one fish returning from the ocean for every adult that spawns; high productivity represents an average of three and a half fish for each adult spawner. **Bull Trout** 

For the three bull trout populations that migrate down rivers and may move into the marine environment seasonally, the US Fish & Wildlife Service set the following recovery goals as best estimates for what is required to reduce their risk of extinction: Each migratory population needs to have greater than 100 adults, and the total number of adult bull trout in the Snohomish system should equal 500. The remaining bull trout population is considered resident, meaning those fish do not migrate from the place where they hatch; this population does not have recovery targets.

#### What is the current status of the Threatened Salmon populations?

#### Chinook

Since the late 1970s, the Skykomish population has experienced a steep decline in total number of fish. Between 1999 and 2003, the Skykomish population has averaged about 1,755 naturalorigin fish that return to the river to spawn, and the Snoqualmie has averaged approximately 1,776. Together this means that the populations are at approximately 3.4% and 5.7% of their historic numbers respectively. These numbers do not include hatchery fish that return to the natural spawning ground; when hatchery fish are included, the number rises to 4,099 for Skykomish

and 2,245 for the Snoqualmie. The Skykomish run has the highest recovery target for abundance of those set for Puget Sound Chinook populations; the Snoqualmie run has the third highest target.

#### **Bull Trout**

The total number of bull trout in the Snohomish Basin is unknown, though it is believed that only one migratory population has greater than 100 individuals.

#### What are the key factors contributing to the current status of the populations?

The Snohomish basin has been altered significantly since Europeans began moving into the area. Early settlers recognized that the expansive floodplains, rich with sediment and organic material, would make for excellent farmland. They cleared the land of lowland forests, and created dikes along the river to prevent floodwaters from sweeping over the new fields. At the same time, they cleared the large log jams out of rivers to make transportation by boat easier. Over time, the basic ecological processes that form habitat that salmon depend on were altered. This means that there is less habitat for salmon to use and the quality of some of the remaining habitat is reduced. This is because many of the processes that create those habitats no longer exist or are greatly diminished. In spite of these changes, the ecological integrity in the Snohomish basin is still relatively intact and scientists and the community see a path to restoring these watershed processes and salmon habitats.

Several factors are significant to address in the Snohomish Basin. Juvenile salmon, particularly

Chinook, rear in mainstem margins, and need high quality habitat. The loss of rearing habitat quantity and quality is the primary factor affecting population performance and so processes and habitats that support this life stage are key restoration priorities. The following list represents factors that have been degraded across the basin. The impact these losses have on salmon recovery vary within the basin and are addressed through the Plan's geographically focused recovery strategies. Losses include:

- Loss of estuarine and marine habitats due to residential and industrial development and urbanization. The mouths of rivers were convenient places to locate cities and factories when the primary source of transportation revolved around moving people and cargo on ships;
- 2. Poor quality riparian forests and decreased forest cover as a result of clearing land for timber, farming, road building, and residential and urban development;
- 3. Lack of habitat complexity that provides pools and back-eddies, providing homes for insects and small fish, and therefore food and refuge for salmon. For example, logjams create important in-stream habitat. In the past, thick forests grew along the banks of river systems, providing a source of large woody debris. Before the river was restrained and confined to one

channel, natural bends and sand banks would create hang-ups for these logs and branches as they swept downstream.

- 4. The loss of hydrologic function. Flood flows now scour nests of eggs and sweep young salmon downstream before they're ready, because the river can no longer overflow its banks and spill out across its historic floodplain.
- 5. Loss of floodplain function. This includes a loss of wetlands and off-channel habitats These

changes have occurred through diking and draining activities, bank hardening, urbanization and residential development.

- 6. Disruption of sediment processes that create and sustain high quality habitat over the longterm.
- 7. Access to habitat is critical for salmon and is often blocked by poorly designed culverts and other human-made structures.

Other concerns that are not yet considered high restoration priorities across the basin are low flows and water quality.

While degradation in the above areas has already occurred, much habitat remains forming the foundation for restoration and enhancement actions.

#### **Future Threats**

The Snohomish River Basin is among the most rapidly growing regions of the Puget Sound at 59 percent projected population growth from 2000 to 2030. Areas along the mainstem rivers in some locations and along some lowland tributaries are most likely to be affected by growth and development pressures.

As people continue to move to the area, how and where development takes place across the basin will have a tremendous impact on the ability of Chinook and bull trout to recover. Once wild



Photo courtesy the Snohomish Basin Salmon Recovery Forum.



Photo by Dan Kowalski

or working lands are converted to residential and urban areas, forest cover and ecosystem processes are altered or lost. The change is almost always permanent. New buildings, roads, and infrastructure bring with them impermeable surfaces like rooftops, parking lots, and asphalt. This makes rainwater less able to soak into the ground, and as it runs off, contaminants like oil and pesticides can be carried into streams. However, growth can occur in a manner such that it minimizes impacts to salmon habitats. The Forum recognizes that growth will occur and provided information in the plan that shows where growth overlaps with salmon recovery needs. This information provides a tool that helps decision-makers and those planning in the basin to think strategically and realistically about salmon recovery.

The threat of growth potentially affects planning in all geographic sub-basins. The following are known areas of overlap.

**Nearshore:** Possible residential development north of Priest Point, and development of the Maulsby mudflat, marinas and piers (both new and modified) are potential actions that could degrade existing nearshore habitat.

Estuary: Further loss of habitat could result from

development within the urban growth boundary, which extends into portions of the estuary downstream of I-5. Further expansion of the I-5 corridor to include a carpool lane in both directions is scheduled to begin in 2008.

Snohomish, Skykomish, and Snoqualmie mainstems: Urban zoning comprises approximately 8% of the land area, and will absorb future growth in the Snohomish basin. The cities of Monroe, Sultan, Gold Bar, Duvall and Carnation are located near high quality spawning grounds. If current trends continue, in 25 years forest cover could drop by 10% and impervious surface area could increase by 4%.

Modeling suggests that the rate, timing, quantity and quality of water will continue to change as a result of population growth and climate change. While not listed in the top tier of current limiting factors described above, flows are a current factor negatively impacting salmon and bull trout in some years and locations. Known locations of flow issues, suspected causes and timing of problem are documented in the current Snohomish Basin recovery plan. Forty-four streams are listed as having low flow problems, where at times there isn't enough water to support healthy fish. There is also concern about whether flows will be adequate for salmon because the population served by the Snohomish system is expected to grow from 965,000 to 1,390,000 by 2020 resulting in an increased water demand by 53 million gallons per day.

#### **Overall Approach to Recovery**

The Snohomish Basin Salmon Recovery Forum's approach to salmon recovery is to structure goals, strategies and actions around specific groups of geographic areas in the basin, rather than broader limiting factors. The Forum has divided the basin into five major groups of sub-regions, described as the nearshore, estuary, mainstems, lowland tributaries (including urban areas), and headwaters.

The Forum chose this approach for several reasons. Salmon and bull trout populations are not distributed uniformly across the landscape, so identifying areas of high and potential salmon use helps to direct scarce resources where they will have the greatest effect. In addition, sub-basins within these broader geographical groups play similar roles in supporting salmon, have similar physical features, and share similar land use issues. In this way, goals, strategies and actions can be tailored to different life stages of Chinook and bull trout according to the unique challenges and potential partnerships present capital projects focus on improving the amount and quality of habitat in nearshore, estuary, and mainstem portions of the rivers. Improvements in these areas will allow for rapid gains in the Chinook populations and provide visible results that can be seen by the community. The Forum's recommended strategy is to focus restoration in areas that have local support, have a high potential for restoration of habitats and the processes that naturally create and maintain them, and can provide significant gains for abundance, productivity, spatial structure and diversity.

Actions in these areas alone will not produce viable Snohomish populations in the long-term. Protecting and enhancing spawning areas and improving egg survival within large tributary sub-basins will also be necessary. Thus, the Forum's approach also includes actions to minimize habitat losses and make habitat gains through restoration throughout the rest of the Snohomish basin. This includes focusing actions on areas that improve habitat complexity and connectivity near and downstream from Chinook spawning grounds. The Forum chose this overall approach because it targets actions in areas where they will make the most difference for Chinook, spreads actions across the basin, involves many people, and is designed to help improve habitat for other salmon such as coho.

in each place. This geographically specific approach helps people and governments clearly understand their roles and responsibilities in salmon recovery. It also provides tools for planners, decision-makers and those with regulatory authorities to use when weighing priorities, updating growth management and shoreline regulations, and developing best management practices.

The Forum recommends that most of the resources for



hoto courtesy the Snohomish Conservation District.

Recovery will be implemented through three major areas: capital projects, regulatory and policy actions, and programs and technical assistance. The existing salmon recovery planning structures of the Snohomish Basin Salmon Recovery Forum (the Forum itself, Policy Development Committee and the Snohomish Basin Salmonid Recovery Technical Committee), will be used to track implementation and effectiveness of actions and will refine the plan's hypotheses, strategies and actions as necessary to improve overall effectiveness.

#### Key Strategies and Actions Supporting the Overall Approach to Recovery

The following describes each of the key geographic areas selected in the overall approach, linking salmon use of the area, specific factors limiting recovery and the strategies and proposed actions for addressing the factors. The Forum set overall habitat milestones for the estuary, nearshore, mainstems, and lowland tributaries for the year 2015. These measure the cumulative result of protection and restoration actions. Restoration goals are based on the assumption that protection efforts will prevent further habitat loss.

**Nearshore:** The nearshore is defined as the strip of shoreline that extends from the top of the bank or bluff into the water to a depth of about 30 meters. The nearshore zone is important to salmon for many reasons: it provides a place for juvenile salmon to hide, feed, and grow in preparation for their journey in to the Pacific Ocean, it serves as an important migratory corridor for salmon as they leave for and return from the ocean, and it provides habitat that supports the food that salmon eat, like marine insects and forage fish.

The nearshore in the Snohomish basin is considered moderately degraded. About 40% has been hardened by rocks and cement bulkheads. Development and modification of the shoreline have caused plant and animal species that salmon depend on to decline. A significant portion of this is due to the presence of the Burlington Northern/ Santa Fe railroad which runs along four miles of the beach. Bulkheads that protect the tracks and other property from erosion, docks and piers along the industrial waterfront, and dredging have affected the natural erosion processes that feed and form beaches, impacted the quality of riparian conditions, and degraded inter-tidal conditions. Low quality riparian conditions alter large woody debris recruitment, shading, and contributions of leaf litter and insects to nearshore salmon and forage fish habitat. Forage fish like sand lance and surf smelt lay their eggs in the gravel along the upper beach; in areas that lack a shady riparian zone, eggs can have a harder time surviving.

Modifications to the shoreline have also reduced low gradient beaches from Preston Point to Mukilteo and from Priest Point to Kayak Point. The shallow water edge environment is especially important as feeding and refuge areas for juvenile salmon, as well as migration pathways.

The most important focus for the nearshore is to increase survival of juvenile Chinook. The Snohomish Basin Salmon Recovery Forum recommends that the best way to do this is by focusing on protecting and restoring shoreline conditions, restoring the natural sediment transport processes, and protecting habitats like eelgrass and kelp beds, as well as the freshwater and saltwater processes that create and support them. Existing WDNR regulations protect known eelgrass habitat and kelp beds, and the beach forming processes that create and support them will be improved where possible. This will be accomplished by removing shoreline armoring, using more ecological designs to protect property instead of riprap and traditional bulkheads, and restoring beaches with sediment harvested during dredging activities. By re-connecting naturally eroding feeder bluffs to the marine environment, beaches will be nourished with a natural source of sediment, and by removing barriers like bulkheads, structures, and piers, wave action will again transport sediment to form beaches. Where possible, native plants should be planted between

the railroad tracks and the Sound and on private property. The Forum recommends that protection efforts focus on undeveloped areas predominately located north of Priest Point, in particular forage fish spawning beaches and bluffs that provide beach-forming sediment.

Specific proposed ten year actions include gaining at least 1 mile of shoreline that provides both juvenile rearing habitats and the landscape processes that create and support them. The Forum recognizes that it may be difficult to achieve the longer term goals for the nearshore. While additional res-

toration in the estuary may help offset the lack of opportunities in the nearshore, the habitat functions provided by the estuary will be different from those in the nearshore.

Estuary: The Snohomish estuary is among the most productive in the region, even though its health and productivity have been greatly diminished. Agricultural and urban development have significantly changed naturally functioning estuarine habitat. The estuary is considered to be degraded, with a loss of 85% of the historic tidal marsh area. two-thirds of the channel edge along the mainstem and distributary channels hardened, and only 11% of the channel containing intact riparian areas. As a result, there are many significant losses for salmon. Off-channel habitats that provide places for juvenile fish to feed and grow have been greatly diminished; areas of tidal exchange where they transition from freshwater to saltwater have been lost; healthy shoreline conditions, including riparian cover for shelter, shade, and a source of large woody debris have decreased. The Interstate-5 corridor runs through the upper portion of the Snohomish estuary, creating a significant constraint to the processes that form habitats and for restoration.

With directed effort, the Forum believes gains



Photo courtesy the Snohomish Basin Salmon Recovery Forum.

can be made in the estuary that support all of the parameters that contribute to strong and healthy salmon and bull trout populations. The Forum's recommended strategy is to restore habitat and habitat forming processes through actions that reconnect estuarine tidal marsh, protect remaining functioning habitats or maintain restoration opportunities in the lower estuary where development pressure is high. Approximately 50% of the estuary (over 2,700 acres) is publicly owned by Snohomish County, The Tulalip Tribes, City of Everett, City of Marysville, Port of Everett, and Washington State Department of Fish and Wildlife who are all active Forum participants.

Opportunities exist for large and complex projects in the estuary. Proposed actions include protecting existing critical estuarine habitat, and gaining 1,237 acres of tidal marsh habitat through restoration and acquisition. This can be done by reconnecting large blind tidal channels and sloughs isolated behind dikes, and improving connectivity between channels, sloughs, and marshes that provide rearing habitat for juvenile salmon, filter water, and absorb flood level flows. The Forum recommends that actions be directed at restoring the habitat on existing public lands first, where habitat gains will be highest and where existing projects can be expanded. Another strategy for improving the estuary is to pool restoration and mitigation funds to create larger and more effective projects at lower cost. For example, the Interstate-5 expansion could be coordinated with proposed restoration projects resulting in substantial cost savings and habitat improvements.

Mainstems of the Snohomish, Skykomish, and **Snoqualmie Rivers:** The mainstems of all three rivers are considered to range between moderately degraded and degraded, although the Snohomish and Snoqualmie watersheds are more impacted than the Skykomish. Dikes, bank armoring, roads, railroads, and bridges confine these mainstem rivers, disconnect off-channel habitat, reduce edge habitat complexity, and increase peak flows downstream. Combined, 82% of the off-channel sloughs and ponds have been disconnected from the rivers, and are no longer available for salmon. Forty-four miles of dikes isolate the river from the floodplain, and subsequently Chinook smolt production has decreased. Several thousand acres of marshy wetland, particularly in the lower Skykomish and Snoqualmie Rivers, have been disconnected, and channels lack pools and side channels, partly

because there are low levels of large woody debris and logjams. Riparian forest cover has been substantially degraded as people have cleared the land for other uses.

Excessive erosion of stream banks, culverts that block fish passage on small streams, and degraded water quality (including high temperatures, low dissolved oxygen, high fecal coliform counts, and high levels of toxic metals,) all diminish the ability of salmon to thrive in the Snohomish basin, though the extent of these impacts is currently unknown.

Major improvement of habitat conditions within the mainstem rivers are necessary to ultimately reach the salmon recovery goals. Mainstem rivers need to have more room to move, overflow their banks, recruit large woody debris from healthy riparian forest, and form pools. If improvements are achieved, both abundance and productivity for Chinook are expected to improve.

The long-term strategy is to reduce further degradation of the mainstem rivers by protecting existing healthy habitat, and restoring the connection of rivers and floodplains This will improve improve wood recruitment from riparian areas, and enhance channel complexity within and upstream of spawn-



hoto courtesy the Snohomish Basin Salmon Recovery Forun

ing reaches. This can be done, in part, by increasing enforcement of existing regulations to protect those processes. Dike setback and innovative armoring will allow river channels to shift from side to side, increasing the amount of off-channel habitat available for iuvenile fish while still protecting farms, homes and businesses from flood events. Planting trees and native vegetation along the channel margins will provide better habitat along the river edge, contribute large

woody debris, provide shade, and buffer the river from adjacent land uses. The Forum recommends that significant improvement be made in all three river systems. The Forum believes that this can be accomplished by building on the existing cooperative effort between local landowners, community organizations and governments to implement proposed projects and regulatory and incentive programs.

The ten year proposed mainstem actions are to gain 10.4 miles of restored river edge habitat, 256 acres of riparian habitat, 41 logjams and 167 acres of off-channel habitat. The plan also includes recommended gains for riparian forest cover and off-channel habitat in slightly lower priority mainstem areas.

#### Lowland Tributaries and Headwaters

Similar challenges face the lowland tributary streams and rivers. Urban streams are highly degraded for Chinook and bull trout functions, facing even higher surface and stormwater run-off, and increased water quality problems. High in the headwaters, road densities of 3.4 to 1 miles per square mile change the way that the upland forests drain, and feed sediment into salmon bearing rivers. Poorly constructed culverts block fish access and stream forming processes. In the rural and urban tributaries, as well as the headwaters, recommended actions focus on protecting existing healthy habitat and habitat forming processes, and restoration activities will be directed towards improving riparian forest cover and improving watershed processes. The plan includes habitat milestones for riparian forest and off-channel habitat in lowland tributaries.

## Additional key strategies covering the entire basin include:

#### **Protect existing habitat**

Preservation of habitats and habitat forming processes are needed across the entire salmon migratory journey. The Forum recommends that existing habitat and watershed processes be protected through a variety of tools and creative solutions. These include regulatory programs, acquisitions, voluntary and incentive stewardship programs, and public education. Habitat goals were established for 2015. These goals can be reached through a combination of protecting of current habitat and restoration. Restoration milestones were set assuming the protection of current habitat.

Snohomish County is currently updating their development regulations. Information from the Snohomish Basin Salmon Conservation plan was used to help develop science-based policy recommendations. King County recently updated their regulations and improvements to protection are expected from these changes.

The goals of the Growth Management Act's Critical Areas Regulation (CAR), Shorelines Management Programs, and a variety of incentive and voluntary programs overlap with those planning for salmon recovery. Thus the opportunity exists over the long-term to increasingly coordinate updates to regulations and other programmatic tools with salmon recovery planning efforts. The Forum has provided salmon-habitat focused guidance that local governments can consider during their updates. Commitments have been included in the plan that show many Forum members have considered or are considering these recommendations in their update processes.

#### **High and Low Flows**

Current information about flows is included in the plan and preliminary analyses have identified lowand peak-flow problem areas. The Forum has identified steps that would need to be taken to more completely address this in the future. The group has discussed working cooperatively to address water quantity as it relates to salmon recovery.

#### Harvest management strategy

There has been a significant change in how harvest is managed. Historically, harvest rates on the Skykomish and Snoqualmie were nearly 80% and probably exceeded the harvestable surplus of Chinook, contributing to the observed decline in numbers of fish returning to the spawning grounds. There is currently no fishery (tribal, commercial or recreational) that targets wild Skykomish or Snogualmie Chinook. Harvest rates on Chinook from the Snohomish basin have been reduced to 20-30% which represents fish caught incidentally during fisheries that target other species, hatchery Chinook, and mixed stocks. This has resulted in increased numbers of fish that return to spawn. The goal of harvest management is to maintain fishing rates low enough (24%) so that wild Chinook can take advantage of the habitat that has been or is being protected. Over time, this will allow the populations to expand. In addition, controls on the timing and location of fisheries targeted toward hatchery fish will help minimize the incidental harvest of wild fish.

#### Hatchery management strategy

Hatcheries are now being managed to minimize impacts on wild fish. Changes made to the two Snohomish programs include using only in-basin broodstock, limiting the location and timing where broodstock can be collected, and establishing a numeric range of local broodstock that will contribute to the hatchery program. Hatchery fish provide opportunities for commercial and sport fishing, as well as ceremonial and subsistence harvest while wild Chinook are rebuilding toward harvestable levels.

#### **Keep working lands in business**

Farming is a major land use along mainstem rivers and tributaries and forestry comprises a significant portion of the basin. The Forum recognizes that well-managed farms and forests offer more and better quality salmon habitat than urban areas and fragmented rural residential development. It is important to the Forum that these land uses remain viable and sustainable in the Snohomish basin.

Setting back dikes and removing armoring, re-connecting the river to side-channel habitats, replanting riparian forests, and implementing agricultural best management practices will provide the greatest returns in population performance of any restoration actions in the freshwater environment. The Forum recommends working with willing landowners on habitat protection and restoration by providing technical assistance, creating incentives, sharing costs, and recognizing their efforts.

Similarly, loss of forest cover is one of the greatest risks in the Snohomish River basin due to pressures on private lands to convert to non-forest uses such as rural residential development. Maintaining viable and sustainable forestry will help retain forest cover and retain watershed processes that will, among other things, protect flows. Recent improvements to forestry practices are anticipated to improve the 75% of the basin that is in federal, state or private ownership. The Forum recommends sharing information with forest managers such as the US Forest Service, the Washington Department of Natural Resources, and private landowners to help ensure that the priorities in the plan are being addressed. The Forum recommends that rural residential development occur in ways that maintain existing forest cover, and that forest cover be restored in urban areas where possible.



oto courtesy the Snohomish Basin Salmon Recovery Forum

#### Results

The watershed plan for the Snohomish was 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, but the reviewers felt they merited particular attention 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 two Chinook populations in the Snohomish River basin belong to a group of ten populations in the Whidbey basin. The Skagit River is home to six Chinook populations, and the Stillaguamish is home to two. Together, these ten salmon runs form a key sub-region in the Puget Sound Evolutionarily Significant Unit. The potential for early success in moving populations out of high risk in the Whidbey Basin is an important component to minimizing the risk to the overall ESU because salmon runs elsewhere in the Puget Sound face greater constraints. The TRT and interagency committee believe, based on the Snohomish Recovery plan and substantial letters of commitment and endorsement, that the Snohomish River has the potential to support robust populations of salmon once again and plays a key role in Puget Sound recovery.

The Snohomish Basin Salmon Recovery Forum has created a comprehensive plan that will start these populations on a strong trajectory toward recovery over the next ten years. The Forum has a solid understanding of the conditions needed for recovery, and has made a good connection between underlying habitat forming processes, the habitat function that results, and the response of salmon population to the improvements. The plan is particularly strong in terms of protecting and restoring the estuary and historic floodplain, where juvenile salmon feed and grow.

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.

While the first ten-year action plan starts this watershed down an improvement trajectory, it will be necessary, through their adaptive management and monitoring program, for the Snohomish Forum to identify over the long-term what comes after the completion of the first ten years of this plan.

Given the relative importance of these Chinook runs to the ESU, and given the human population pressure that the Snohomish basin will receive in the coming years, the reviewers feel that there is uncertainty this plan will provide sufficient protection for existing healthy habitat and habitat forming processes. If salmon recovery is to succeed, the people of the Snohomish basin will need to "hold the line" regarding loss of habitat and process function to development and urbanization. This is especially true in the lower river where development pressure will be greatest, in the tributaries where the potential loss of forest cover is high, and in the headwaters where there is a reliance on maintaining hydrologic and sediment function. The results of existing protection regulations are uncertain throughout the Puget Sound and an approach to increasing certainty is provided in the Protection section of this plan.

Reviewers cited the importance of developing a program to address the impacts and limitations from low flows in this watershed. They understand that the Forum has identified the steps needed in order to address low flows in the next several years. In the meantime, it will be important to determine if the current instream flows are protected and to describe how the restoration strategy will accommodate full hydrology concerns.

It will be important to continue research on hatchery and wild fish interaction in the lower river and nearshore marine habitats.

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 "crosswatershed" 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.

The TRT and interagency committee believe, based on the Snohomish Recovery plan and substantial letters of commitment and endorsement, that the Snohomish River has the potential to support robust populations of salmon once again and plays a key role in Puget Sound recovery. If the carefully crafted actions in the Snohomish Basin Salmon Recovery Forum's plan are implemented, and the above uncertainties are addressed, this watershed and its two Chinook populations provide a critical foundation for the recovery of the Puget Sound Chinook ESU.