

July 2016



**SNOQUALMIE WATERSHED FORUM TEN-YEAR STATUS REPORT**

2005-2015

Real Progress, Real Challenges:  
Working Toward Salmon Recovery and Watershed Health





*The Snoqualmie Watershed Forum is a partnership of elected officials, citizens and representatives from conservation organizations supporting salmon recovery and ecological health in the Snoqualmie and South Fork Skykomish Watersheds. Member governments include King County, the Snoqualmie Tribe, Tulalip Tribes, the cities of Duvall, Carnation, North Bend and Snoqualmie, and the Town of Skykomish. Since 1998, the Forum and its many partner organizations have worked to protect and restore salmon habitat and improve overall watershed health through collaborative action. From 1998-2005, the Forum played a key role in developing the Snohomish River Basin Salmon Conservation Plan, and since that time has led its implementation in the King County portion of the basin. The Forum's work is funded by contributions from its member governments, as well as grants from the King County Flood Control District. In 2015, Forum member governments signed an interlocal agreement that renews this partnership through 2025.*

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“ The encouraging gains made through restoration are still being outpaced by habitat loss and degradation throughout Puget Sound. ”

**INTRODUCTION**

Ten years have passed since the completion of the Snohomish River Basin Salmon Conservation Plan (Salmon Plan) in 2005. This Status Report summarizes progress along the 10-year recovery road map, with an emphasis on 2011-2015, and a focus on the King County portion of the broader Snohomish River Basin. We also highlight some of the lessons learned and the emerging issues that will shape our efforts in the next decade of salmon recovery work.

The Salmon Plan's geographic scope is Water Resource Inventory Area (WRIA) 7, which extends from the headwaters of the Snoqualmie and Skykomish watersheds to the Snohomish River estuary and associated Puget Sound nearshore environment. The Salmon Plan laid out a roadmap for the first decade of a projected 50-year effort to rebuild populations of Chinook and other salmonids that have sustained the people and ecosystems of the Snohomish, Skykomish and Snoqualmie rivers for millennia.

These first ten years have provided many moments of celebration, such as the breaching of the levee at the Tulalip Tribes' Qwuloolt restoration site in 2015 that allowed salmon access to 375 acres

of tidal estuary habitat for the first time in decades; witnessing juvenile salmon finding refuge from fast river flows right on the footprint of the former levee at the Lower Tolt River Floodplain Reconnection project; or watching tribal and non-tribal volunteers work side by side to restore the riparian corridor along the Snoqualmie River at Fall City Park, a former tribal village site.

During the past ten years, Snoqualmie Watershed partners have leveraged more than \$32 million into over 100 habitat protection and restoration projects, adopted more stringent environmental regulations, investigated water quality problems, engaged thousands of volunteers in hands-on restoration activities, and delivered education programs and other outreach activities to schools, community groups and landowners throughout the watershed. Moreover, scores of individual landowners have undertaken voluntary restoration efforts on their residential properties and farms, demonstrating the depth of community commitment to protecting and restoring our environment for the benefit of fish, wildlife and people.



**South Fork Skykomish & Snoqualmie Watersheds**



But despite many successes, salmon populations in the basin remain in a dire condition. A recent analysis by the Tulalip Tribes found that spawning populations of Chinook salmon in the Skykomish and Snoqualmie Rivers are failing to replace themselves from one generation to the next, so that fewer than one adult Chinook salmon returns for each spawner of its parent generation. As the Treaty Tribes of Western Washington concluded in their 2011 paper “Treaty Rights at Risk,” the encouraging gains made through restoration are still being outpaced by habitat loss and degradation throughout Puget Sound.

In the Snoqualmie and South Fork Skykomish watersheds, the overall human population density is quite low compared to the rest of King County, with only 2% of the land area located within cities or their designated Urban Growth Areas. Nevertheless, the combined urban population across our cities has grown by 14% in the past five years, and additional growth is expected as the area’s economy continues to improve, and a growing regional population looks for housing farther from major cities.

We are also learning that our watersheds and fish populations are no longer as resilient to environmental extremes. A record drought year in 2015, higher peak flows and lower low flows due to climate change, and a recent warm

water ‘blob’ in our coastal ocean that caused the salmon food supply to plummet have further exacerbated the situation for salmon in recent years. When salmon encounter poor or significantly impaired habitat conditions during all phases of their lifecycle—in freshwater, estuary and marine areas—the ability of their populations to ride out periods of extreme conditions is severely compromised.

If we lose the salmon in our watersheds, we will have lost a major part of our region’s identity, and a cherished and valuable renewable food supply. Salmon are remarkably adaptable creatures, but we must redouble our efforts to give them a chance to bounce back. By learning from our past actions and adapting our strategies in the work we do, we believe that our goals for salmon and people are still within reach.

### HOW ARE SALMON DOING IN OUR WATERSHEDS?

There are two distinct Chinook salmon populations in the Snohomish Basin. The Skykomish River population uses the Skykomish and its contributing tributaries and is an “integrated” population, including both hatchery and natural spawners. The Snoqualmie population spawns naturally and uses core spawning areas in the Tolt River, Raging River and in the Snoqualmie River itself.

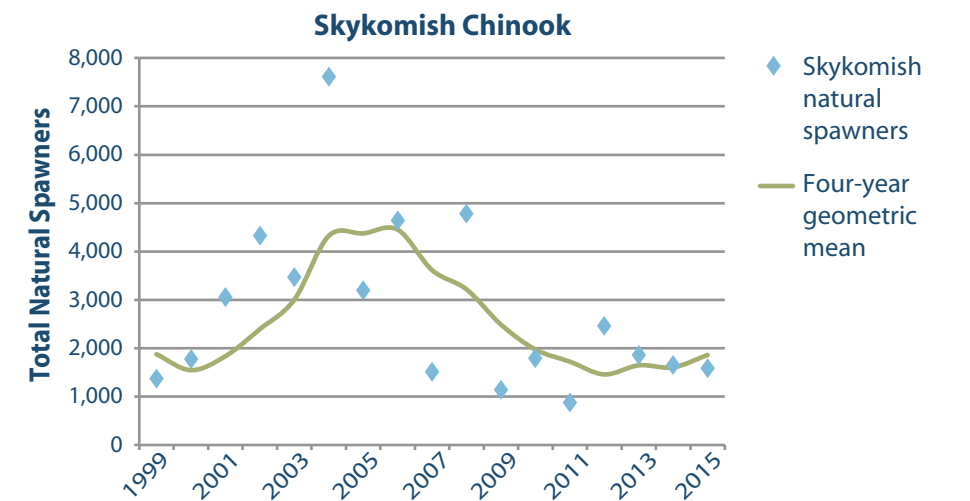
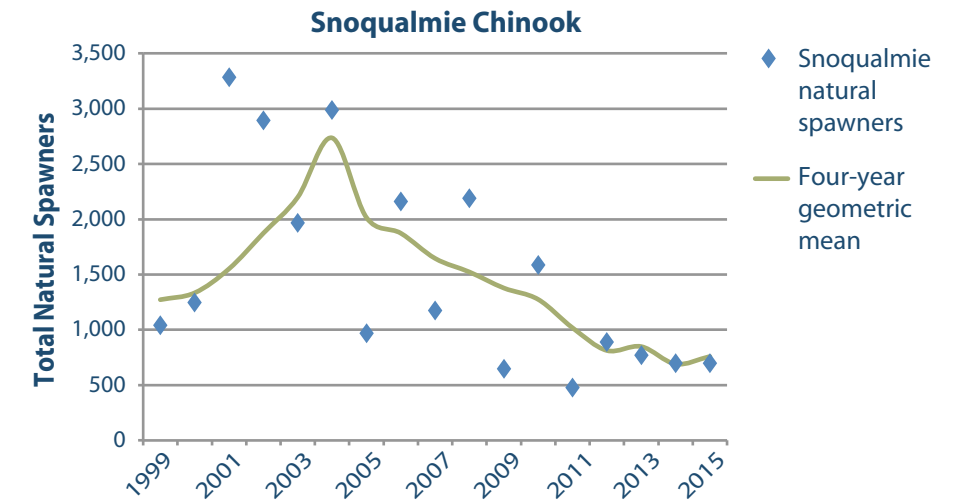
A key measure of fish health is “escapement,” the number of adult salmon in a population that “escape” all other sources of mortality to return and spawn in their home stream. In the Snohomish system, escapement varies substantially year to year due to fluctuating conditions during salmonids’ freshwater and ocean life stages as well as changing harvest levels.

It has been 15 years since Chinook were listed as threatened under the Endangered Species Act (ESA) and populations have fluctuated each year. While some years have had encouraging Chinook returns, the overall trend is static at best and declining at worst.

Current Chinook abundance is well below estimated average historical levels and significantly below the 50-year recovery goal established in the Salmon Plan. In the Snoqualmie, the average escapement levels between 1999 and 2015 were 4.8% of the historical abundance and 6% of the 50-year target (Figure 3). This is a decrease from 6% of historical abundance in 2009 as reported in the *Snoqualmie Watershed Forum Salmon Plan Five-year Status Report*.



In light of these declining numbers, federal, tribal and state managers have severely restricted Chinook harvest. Chinook harvest numbers have declined over the years from a high of more than 70% in the mid-1980s to rates closer to 20% since the early 2000s. While there is no current harvest effort directed at the natural origin Snohomish Chinook stock in Puget Sound, these fish are vulnerable to harvest directed at other area stocks. Even with harvest rates at record lows, current research indicates that the population continues to decline. Research suggests that for Snohomish Basin Chinook, each generation of spawning salmon is smaller in number than its parent generation. The 2005 Salmon Plan attributed decreasing productivity to poor conditions during the juvenile life stages that include incubation and rearing in river, estuary and nearshore environments.



Figures 1 and 2. Snohomish Basin Chinook escapement (1999-2015)

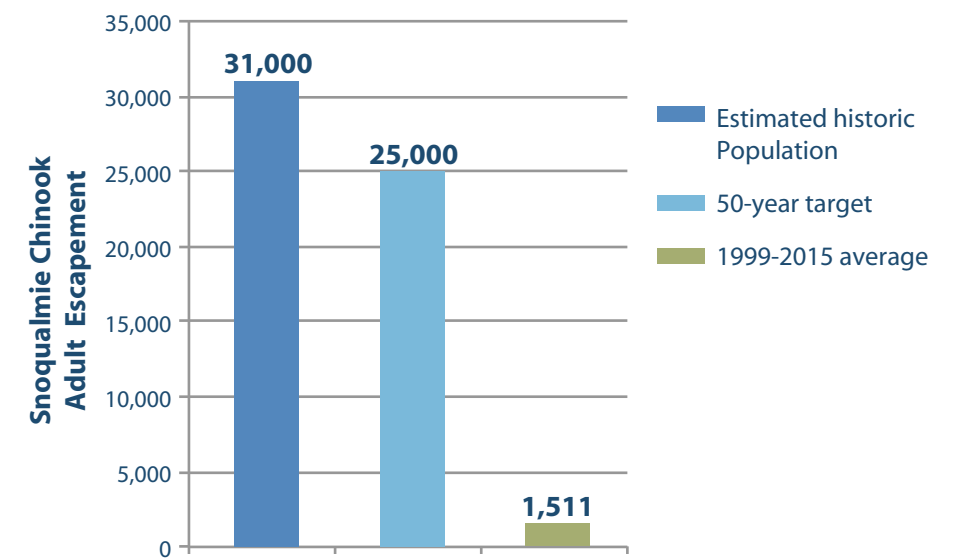


Figure 3. Snoqualmie Chinook escapement and recovery benchmarks

## Coho and steelhead at risk

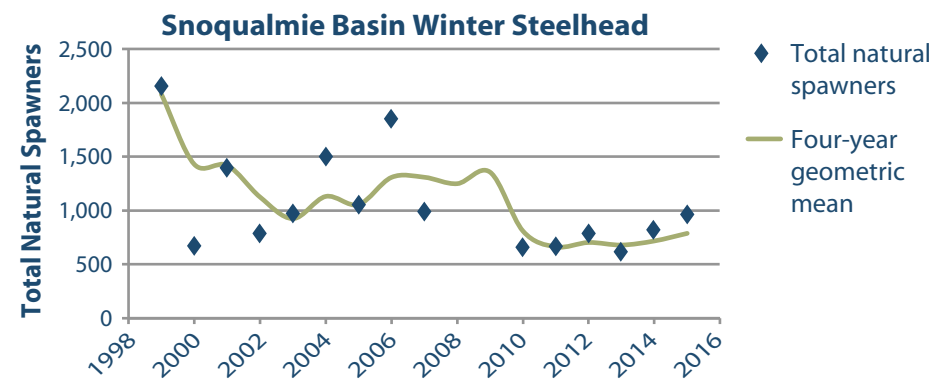
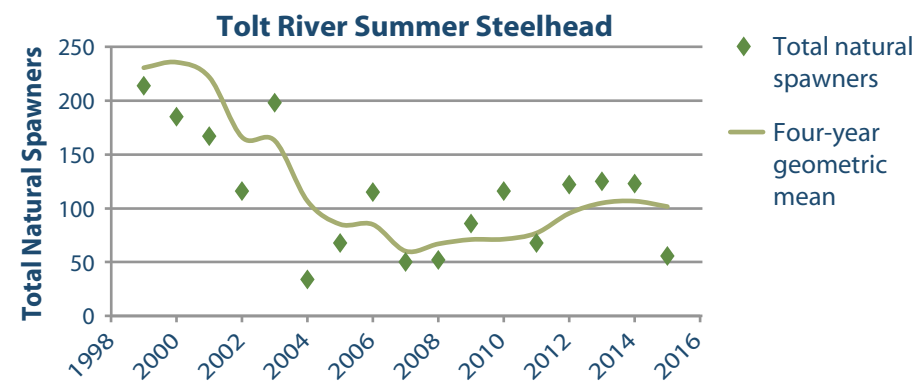
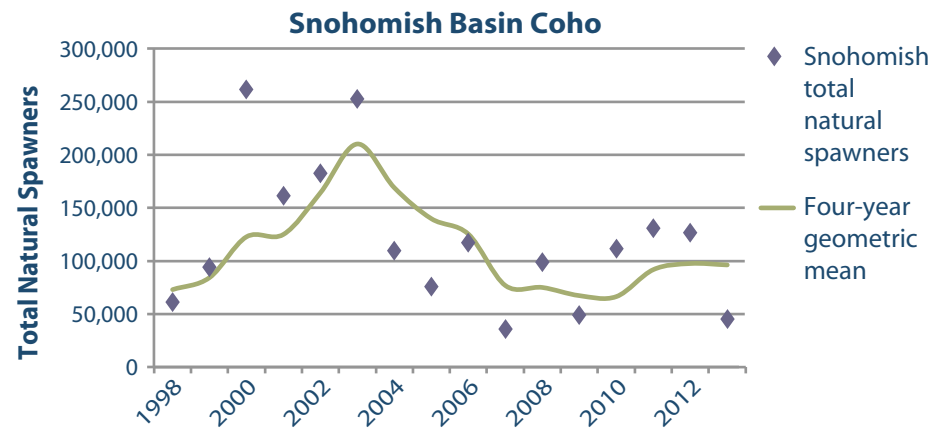
While the Salmon Plan is focused on Chinook recovery, we also consider other salmonid species in our restoration and monitoring efforts.

Steelhead, the anadromous version of rainbow trout, are also listed as threatened under the ESA. The Snoqualmie is home to the small Tolt River summer run, which spawns only in the Tolt and its two forks, and the larger Snoqualmie River winter run, which spawns primarily in the mainstem Snoqualmie, Tolt and Raging Rivers.

Coho salmon are currently listed as a Species of Concern under the ESA and the Snohomish Basin is a top coho-producing watershed in the Puget Sound region. Coho are more abundant than Chinook, as they use the mainstem and many smaller tributaries for spawning and rearing.

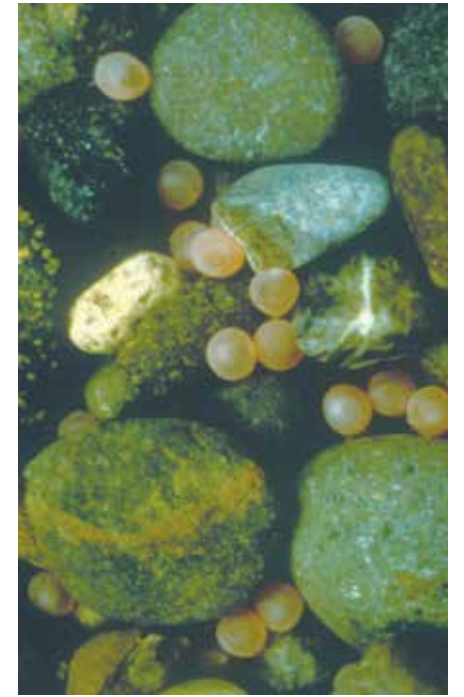
Unfortunately, coho and steelhead population numbers tell a similar story to Chinook salmon. While the number of spawners varies year to year, the overall trend seems to be static or declining.

While coho numbers are much higher than either Chinook or steelhead, the population does not appear to be growing and may be declining. Only an estimated 13,000 coho adult spawners returned to the Snohomish River in 2015 (the lowest number in 50 years), and, given the challenging ocean conditions for outmigrating fish last year, 2016 returns are expected to be very low as well.



Figures 4, 5 and 6. Snohomish Basin coho and Tolt/Snoqualmie steelhead escapement (1998-2016)

“ This suggests that if river conditions are unfavorable for salmon, their ability to survive poor ocean conditions decreases even further.”



Steelhead populations also appear to be declining. Steelhead can spend up to three years in rivers and their tributaries; with their diverse habitat needs, they are especially vulnerable to habitat loss and damage. Federal, tribal and state managers and biologists continue to work on developing guidance for steelhead recovery in both the Snohomish Basin and the Puget Sound.

Many things can affect salmon survival: their time in freshwater, predation, water quality, floods and especially ocean conditions. Interestingly, pink salmon have been posting record population numbers while other salmonid populations have suffered. Pinks don't spend much time in fresh water relative to Chinook, steelhead and coho. We know that poor ocean conditions greatly affect salmon survival, but salmonid species that spend more time in freshwater seem to be struggling more. This suggests that

if river conditions are unfavorable for salmon, their ability to survive poor ocean conditions decreases even further.

### More work is needed to sustain salmon populations

Ten years have passed since the adoption of the Salmon Plan. Large habitat restoration projects have been completed, but it is not yet clear whether they have sufficiently improved conditions for salmon. While there are multiple factors at work in salmon survival year to year, the data show downward trends across all Snoqualmie salmon populations.

Snoqualmie Watershed Forum partners can best help salmon populations by continuing to implement and advocate for large-scale freshwater habitat restoration projects that restore a diversity of habitat types. Salmon will likely need refuge from changing climate conditions: they need slower backwater and off-channel areas to endure high winter flows and areas that provide cooler water and reliable flows during summer. Only by restoring habitat strategically and quickly can we hope to improve salmon survival in our basin.

## HABITAT RESTORATION: PROGRESS AND CHALLENGES

Since the Salmon Plan was completed in 2005, Snoqualmie Watershed Forum members and partner organizations have been working diligently to implement its recommendations. Because the Plan emphasizes restoring juvenile rearing habitat, projects have focused on the Puget Sound nearshore, the Snohomish estuary and mainstem river habitat areas used by young Chinook salmon.

Several large and ambitious restoration projects were completed between 2005 and 2015, including the Stillwater Levee Removal, Lower Tolt River Floodplain Reconnection, Chinook Bend Levee Removal, Upper Carlson Floodplain Restoration, and Camp Gilead Off-Channel Reconnection projects. In addition, a number of riparian planting projects have been completed on public and private land (especially on local farms). While work is complete on these projects, it takes years for natural processes to fully restore habitat, as the river re-engages the floodplain and trees grow to maturity. The Lower Tolt River Floodplain Reconnection Project removed a barrier to channel migration, but the process of erosion and full restoration of floodplain function could take several decades (see below).



Tolt River and access road before 2009 levee removal



Tolt River after levee removal in 2015

The Upper Carlson project, finished in 2014, provides a glimpse into the future of restoration, allowing river processes to restore habitat while providing multiple benefits. By removing approximately 1,600 feet of levee and revetment on public land and constructing a new setback revetment to protect Neal Road and adjacent farms, King County's project reconnected 50 acres of floodplain to the Snoqualmie River and soon doubled the river's width in this reach following a series of high-flow events. This migration will continue over time, improving habitat conditions (see Figure 7). King County project staff worked closely with neighboring landowners on this project, meeting several times before, during and after construction. The project also provided material to construct farm pads on neighboring farms, keeping animals and equipment safe from floods. The multi-objective nature of this project and its acceptance from the community was critical to the project's success and is vital for salmon recovery efforts in the years ahead.

Conservation organizations are working on other priorities throughout the watershed as well: restoring riparian forests, controlling invasive plants, eliminating fish passage barriers, decommissioning abandoned logging roads, constructing log jams in river channels<sup>1</sup>, and more.

<sup>1</sup>In the Salmon Plan, large wood placement is considered a short-term measure to fill the void until restored riparian forests mature and provide natural wood.

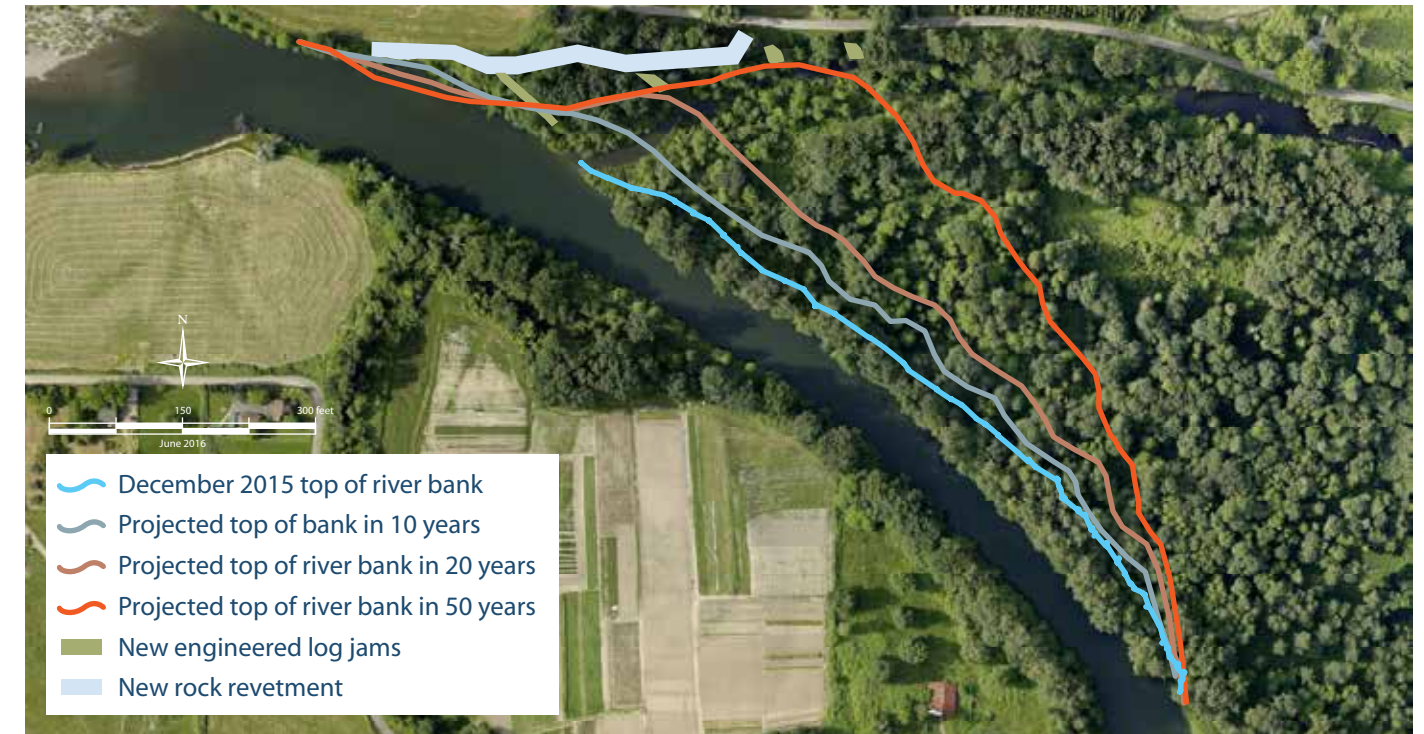


Figure 7. Snoqualmie River channel migration after Upper Carlson construction

### Progress toward 10-year Salmon Plan goals is mixed

The Salmon Plan established quantitative ten-year goals for restoration actions in specific areas (Table 1). These 10-year goals represent 20% of the overall effort required under the 50-year recovery plan. For this report, these numbers were further split to reflect goals for the King County portion of the Snohomish Basin.

SUB-BASIN STRATEGY GROUP: RESTORED HABITAT	10 YEAR GOALS	2005-2015 PROGRESS
Nearshore Beaches and Shoreline <sup>1</sup>	At least 1 mile	.57 mile (57%)
Estuary: Tidal Marsh <sup>1</sup>	1,237 acres	836 acres (68%)
Mainstem: Edge <sup>2</sup>	5.2 miles	1.9 miles (37%)
Mainstem: Off-Channel <sup>2</sup>	84 acres	6.6 acres (8%)
Mainstem: Floodplain Reconnected <sup>3</sup>	No target defined	337 acres
Mainstem: Riparian <sup>2</sup>	128 acres	164 acres (128%)
Mainstem: Large Wood Jams <sup>2</sup> (engaged in river)	20 new jams	18 jams (90%)
Mainstem: Floodplain Large Wood Jams <sup>2</sup>	No target defined	13 jams

### When evaluating progress toward these goals, remember:

- The goals refer to net gains in each category. A complete evaluation must include an assessment of losses due to new development or other factors, as well as gains from restoration.
- Many restoration actions are initial investments in long-term processes. When a section of levee is removed, it may take years for natural processes to restore habitat conditions. Off-channel habitat forms over years as rivers engage floodplains. Similarly, trees planted at sites may take decades to grow and mature.

<sup>1</sup> Sub-basin not located in King County

<sup>2</sup> Goal is for the King County portion of Salmon Plan area in Mainstem Primary Restoration Sub-basins

<sup>3</sup> Potential for future off-channel habitat formation

Not meeting 10-year goal

Achieved 10-year goal

Table 1. Restoration progress toward Salmon Plan 10-year goals in highest priority habitat areas



*Pile-supported structures built at the Upper Carlson site provide flood protection as the river migrates.*

Of the major goals highlighted in Table 1, only mainstem restored riparian habitat and large wood jams are on track to meet 10-year goals, while the others lag behind. Progress toward edge habitat goals slowed 50% between 2010 and 2015 compared to the previous five years. Because mainstem edge and off-channel habitat is so important to juvenile salmon, there is significant concern that falling short of these goals may impact salmon recovery. Though nearshore and estuary goals were not met by 2015, they will likely be met in 2016 given projects planned for construction.

The Salmon Plan also developed goals for riparian restoration and off-channel habitat gains in tributary streams (such as Cherry, Harris, Patterson and Ames creeks), in second-tier mainstem areas (such as the South Fork Tolt River and the lower mainstem Snoqualmie River upstream of the Raging River) and headwaters areas (Table 2). Except for Cherry Creek riparian restoration, little

SUB-BASIN STRATEGY GROUP: RESTORED HABITAT	10 YEAR GOALS	2005-2015 PROGRESS
Mainstem Secondary: Riparian <sup>1</sup>	3 acres	0 acres
Mainstem Secondary: Off-channel <sup>1</sup>	3 acres	0 acres
Cherry Creek: Riparian <sup>1</sup>	7 acres	13 acres (185%)
Cherry Creek: Off-channel <sup>1</sup>	5 acres	1.5 acres (30%)
Rural Secondary: Off-channel <sup>1</sup>	21 acres	0 acres
Rural Secondary: Riparian <sup>1</sup>	No target defined	20.3 acres
Headwaters: Riparian <sup>1</sup>	No target defined	58.5 acres

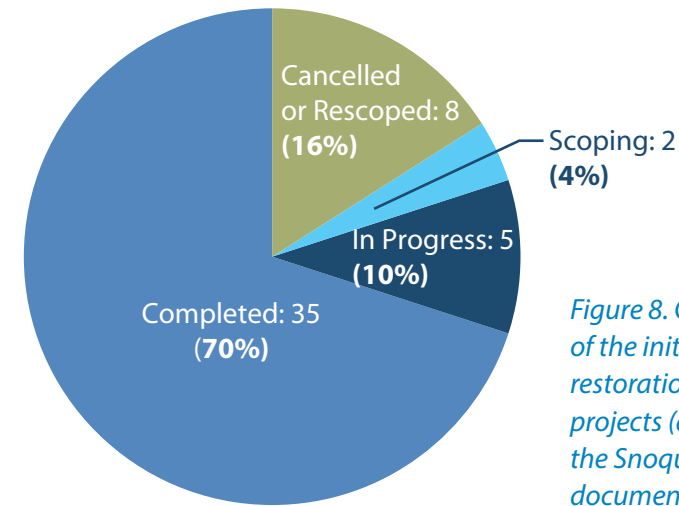
<sup>1</sup> Goal is for the King County portion of Salmon Plan area

■ Not meeting 10-year goal    ■ Achieved 10-year goal

*Table 2. Progress toward Salmon Plan 10-year habitat restoration goals in second tier sub-basins*

progress has been made toward these goals to date. However, additional projects are currently planned in Cherry and Patterson Creeks and on the Snoqualmie River upstream of the Raging River.

The Forum developed a 10-year project list in 2005 to guide implementation efforts that included a variety of large-scale and small-scale restoration actions in the Watershed. While new project ideas and opportunities were regularly added to the list and others were changed or deemed infeasible, steady progress was made through the actions of numerous basin partners (Figure 8). While we have made strong progress on our initial 10-year list of projects, some critical projects were not completed, leading to under-performance on mainstem and tributary habitat goals. Over the next 10 years, we must continue to implement similar types of restoration projects but accelerate our implementation rate and focus on those areas where progress has lagged since 2005.



*Figure 8. Current status of the initial list of 50 restoration and acquisition projects (data from the Snoqualmie 2015 document)*



### Other restoration and protection achievements

The Salmon Plan does not provide quantitative goals for all types of restoration actions, but partners have made progress on a number of projects that benefit water quality, riparian conditions and other habitat features.

- Since 2005, King County Noxious Weeds Program has controlled 21 different invasive weeds on 168 acres of private and public lands throughout our Watersheds.
- In addition, King County surveyed 52 miles of rivers and streams for invasive knotweed and controlled 145 acres of knotweed, primarily in the Upper Snoqualmie and South Fork Skykomish. Natural seed sources will likely bring native species back to most of these sites.
- Stewardship Partners has worked with 27 local farmers in the Snoqualmie Valley to implement best management practices that benefit water quality, fish and wildlife.
- The Forest Service has decommissioned 26.5 miles of abandoned logging roads, improving fish passage, habitat conditions, and sediment and hydrologic processes.
- King County and the City of Seattle have worked together to acquire 95 parcels along the lower six miles of the Tolt River. As of 2015, 52% of the Tolt River floodplain (RM 0-6) is in public ownership, protecting critical salmon habitat and providing land for future restoration.

### Restoration funding increases but organizational capacity lags behind

For large capital projects, like the Upper Carlson project, many years of design, fundraising, permitting, land acquisition and public outreach are needed before any work takes place on the ground. Each of these project phases requires funding and staff to keep pace with the Salmon Plan's habitat goals.

In recent years we have seen a robust increase in salmon recovery funding opportunities. The Puget Sound Acquisition and Restoration (PSAR) and Floodplains by Design grant programs now fund large multi-million dollar capital projects throughout the state. Since 2013, the Floodplains by Design program has helped bring in over \$4 million for multi-objective projects that benefit salmon habitat in the Snoqualmie Watershed. This increase in funding opportunities is great news, but local organizational capacity to implement projects has not kept pace.

For example, project partners in the Snoqualmie Watershed have not applied for PSAR grants in the large capital category even though it was created to move projects forward more quickly. To implement large projects effectively, organizations need project managers, technical experts, outreach professionals and financial staff. Many local partners do not have this level of staffing. This lack of capacity has limited their ability to take full advantage

of this funding increase, and is one reason we are falling behind in reaching our mainstem habitat goals.

Though state and federal funding sources such as Salmon Recovery Funding Board (SRFB), PSAR and Floodplains by Design have increased in recent years, they are still subject to fluctuations. All have competitive processes as well, so funding for local projects is not guaranteed. King County's Surface Water Management (SWM) fee is a source of funds for County-led projects, but these are allocated across three major watersheds, so amounts vary year to year.

King Conservation District (KCD) grant funding was replaced by the King County Flood Control District Cooperative Watershed Management (CWM) grant program in 2012, and has continued to be our most stable funding source, increasing from \$330,000 in 2005 to over \$800,000 in 2015. The Forum is directly involved in the allocation of these funds, evaluating project proposals from basin partners through an annual grant process and forwarding its recommendations to the Flood Control District Board of Supervisors for approval.

Figure 9 shows the funds received for restoration in the watershed from 2005 to 2015. The annual need to ensure robust progress toward Snoqualmie Watershed restoration goals is estimated to be \$10 million. Though we almost reached that level of funding in 2013 with a one-time infusion

of SRFB and Floodplains by Design monies, the average annual funding secured was \$2.1 million between 2005 and 2015, less than a quarter of our goal.

### Partners have made significant progress; challenges lie ahead

Habitat restoration is a cornerstone of salmon recovery. Restoration projects attempt to remedy the effects of past actions and must also address new challenges posed by our region's population growth and climate change.

Working together, Snoqualmie Watershed Forum partners and other groups have made substantial progress during the first 10 years of Salmon Plan implementation. Several large capital projects have been completed or are underway, and dozens of smaller projects have been implemented in mainstem and tributary areas.

Despite the efforts of local governments and numerous other basin partners, though, we are well behind the pace the Salmon Plan requires in most restoration categories. We must move to implement the next 10-year slate of projects as quickly as possible (see map).

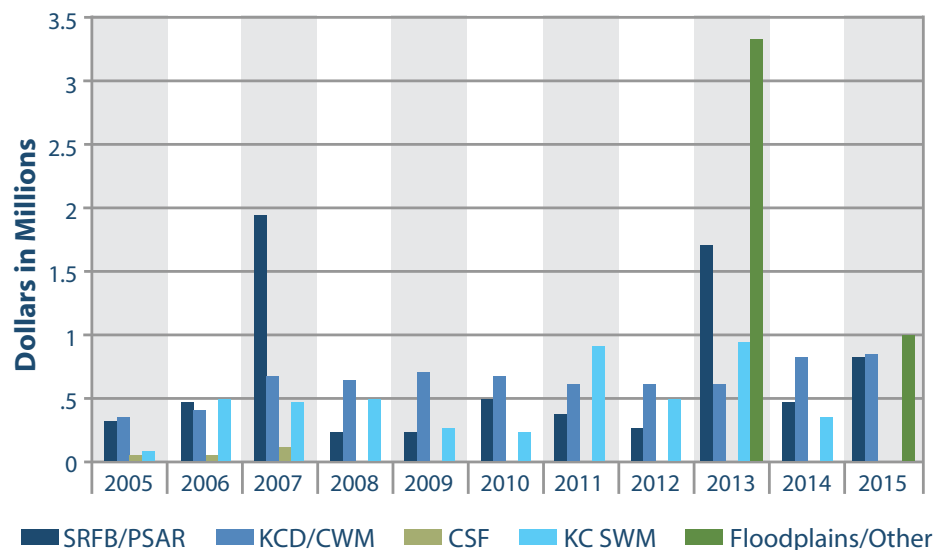


Figure 9. Snoqualmie restoration funding by source, 2005-2015<sup>2</sup> (does not include funding for acquisitions).

<sup>2</sup>SRFB: Salmon Recovery Funding Board, PSAR: Puget Sound Acquisition and Restoration, KCD: King Conservation District, CSF: Community Salmon Fund, KC SWM: King County Surface Water Management.

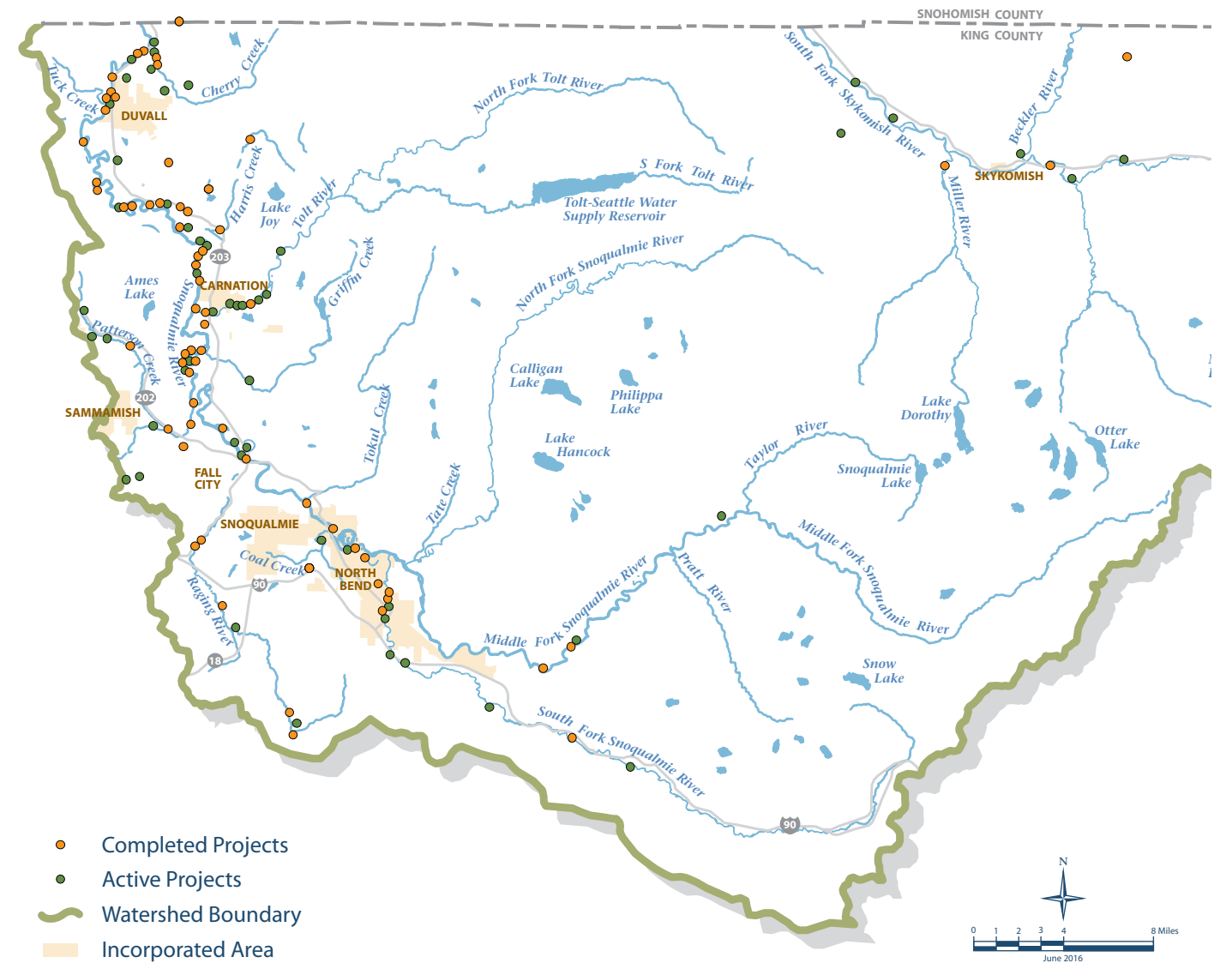


Figure 10. Snoqualmie and South Fork Skykomish Completed and Active Project Map

### Floodplains by Design projects meet multiple watershed goals

In 2013, the Department of Ecology and its partners, the Puget Sound Partnership and The Nature Conservancy, worked together to secure legislative funding for a Floodplains by Design grant program, which supports a multi-objective approach to watershed projects. Since then, the Washington State Legislature has provided nearly \$80 million to support 29 innovative Floodplains by Design projects across the state. The projects, which include the Upper Carlson Floodplain Restoration and the City of Snoqualmie Riverwalk projects, benefit ecosystem restoration and reduce flood hazards while addressing other priorities like agriculture and recreation.

The City of Snoqualmie's Riverwalk Project is a great example of a multi-objective project. For many years the City of Snoqualmie has been buying up flood-prone homes along the Snoqualmie River. More recently, the City has begun restoring these parcels and building a trail system, helping residents see the river as an amenity rather than just a flood hazard. To date, the City of Snoqualmie has acquired approximately 34 riverfront parcels that cover about 1.2 miles of shoreline and 46 acres. Future acquisitions may include 20 more riverfront homes and over 1.5 miles of shoreline. This progressive vision for Snoqualmie's riverfront will benefit people and watershed health.

## PROTECTING EXISTING HABITAT IS ALSO CRITICAL FOR FISH

Building restoration projects is only part of what is needed for salmon recovery. Protecting existing habitat and water resources is also fundamental.

When the National Marine Fisheries Service (NMFS) adopted the 2005 Snohomish River Basin Salmon Conservation Plan in 2007, they found that it complied with the ESA, but noted gaps in key areas, including adaptive management, monitoring, and habitat protection. At the same time, the Puget Sound Tribes and other stakeholders were increasingly concerned about the slow implementation and uncertain efficacy of habitat protection measures included in the Puget Sound Salmon Recovery Plan. In 2009, Snohomish County, King County, and the Tulalip Tribes set out to address the habitat protection gap by creating a Snohomish Basin Protection Plan (SBPP) with funding provided to Snohomish County by the U.S. Environmental Protection Agency (EPA).

The SBPP focused on basin hydrology -- for two reasons. First, the Snohomish Basin contains some of the most rapidly developing areas in the Puget Sound region. Development impacts (e.g., increased stormwater runoff from impervious surfaces) can cause or exacerbate poor water quality, loss of wetlands and riparian forests, altered hydrologic processes, and degraded shorelines. Second, scientists predict that climate change will reduce snowpack by 40 to 60 percent over the next 50 years, increase the magnitude of peak flows, reduce spawning flows, lengthen the duration of persistent low flows, and raise stream temperatures. These changes to hydrology will severely tax water resources, threatened salmon populations, and working farms and forests.

Consequently, the SBPP focuses on protecting the Basin's existing water resources and the watershed processes that support them. The Plan identifies geographic areas key to protecting hydrology and incorporates information on land use, expected climate change impacts, ecosystem services provided by hydrology, salmon use and existing protection measures. The Plan spells out possible improvements to policies, programs, and projects and lays out near and longer-term strategies to protect hydrologic processes that support salmonid habitat, farms and forests.



### Without protection for Snohomish Basin hydrology, we are likely to see:

- Loss of habitat for salmon and other aquatic species
- Continued degradation of water quality
- Decreased ability to mitigate drought conditions
- Negative impacts on in-stream flows
- Risk of loss of life and infrastructure during flood events
- Lost opportunity to protect ecosystem function
- High future costs of restoration

## Duvall completes watershed planning effort to guide future growth while protecting key natural resources

*In 2015, the City of Duvall completed its work with local and regional environmental experts and stakeholders to create a science-based Watershed Plan specifically designed for the city. The Plan is the first of its kind for a city in the Puget Sound area and provides a watershed-based framework to inform the city's 2015 Comprehensive Plan Update, focus future development based on a comprehensive understanding of watershed processes, maintain and improve forest cover and open space, enhance the City's approach to stormwater management and salmon recovery, and strengthen sensitive area regulations to provide enhanced protection for important resources.*

*The goal was to help Duvall attract new residents and businesses while maintaining its cherished small town identity and natural beauty. This effort shed light on the shortcomings of some existing regulations and allowed staff to review natural resource conditions while making decisions about growth and zoning.*



## MONITORING EFFORTS TELL US ABOUT THE WATERSHED AND OUR RECOVERY WORK

Habitat restoration and protection are key priorities for the Snoqualmie Watershed Forum and basin partners. Once a restoration project is “done,” though, monitoring our projects is how we learn whether we are doing the best we can for the watershed. Monitoring can tell us:

- Are these projects working to improve conditions for fish? How?
- Should we do things differently next time to maximize project benefits?
- Are we making the most cost-effective choices?

Several types of monitoring help us better understand the effectiveness of our salmon recovery efforts in the watershed: ongoing annual monitoring, one-time monitoring to investigate a particular question, and basin-wide efforts to monitor changes at a landscape level.

### Ongoing monitoring

Ongoing monitoring efforts in the basin include King County’s restoration project monitoring and water quality assessments, Tulalip Tribes’ smolt trap, and Washington State Department of Fish and Wildlife (WDFW) and the Tulalip Tribes’ adult salmon spawner surveys.

King County staff evaluate restoration projects like the Chinook Bend Levee Removal, the Upper Carlson Floodplain Restoration and the Lower Tolt Floodplain Reconnection to understand project performance at a reach scale, improve cost-effectiveness and inform adaptive management. This work helps project sponsors and funders learn how to plan future projects and modify existing ones to maximize gains for salmon. King County has been monitoring large capital projects in the basin for many years, and while plenty of work remains, some trends have emerged. Restoration projects have increased rearing capacity for salmonids and provided more refuge habitat. Fish are now more able to find areas where they can escape fast, high flood flows as well as backwaters and side channels with pools that provide respite from summer low flows and warm water.

In 2011, King County’s Science Section began tracking baseline water quality conditions in the Snoqualmie Basin to help inform stormwater management, salmon recovery and land use regulation, among other things. Twelve permanent sampling locations were established in the Snoqualmie River, its tributaries and the South Fork Skykomish. Monthly sampling allows staff to track dissolved oxygen, temperature, pH, specific conductivity, nutrients, and fecal coliform. Results from 2011-2013 suggest that water quality conditions are of low concern (with the exception of temperature), but as sampling continues, longer-term data will help guide natural resource management decisions facing Snoqualmie jurisdictions and residents.



“ Restoration projects have increased rearing capacity for salmonids and provided more refuge habitat. ”



A temporary dam protects water quality during construction of the Chinook Bend project.



The Snoqualmie Watershed Forum helps support a third critical monitoring effort, the rotary screw trap on the Snoqualmie River near Duvall operated by the Tulalip Tribes since 2001. The trap captures migrating juvenile fish of various species during the spring months. Fish are identified, counted, measured and released back into the river. The resulting data are used to estimate population abundance, better understand migration timing, provide crucial sample data for salmon monitoring and research and, over time, determine whether restoration efforts are bringing hoped-for changes in fish populations

Complementing the screw trap data are spawner surveys done by WDFW and the Tulalip Tribes. These surveys count redds (salmon “nests”) and extrapolate from that the number of adults in the system. From this data and screw trap information, we can track the salmon population trends and escapement numbers we report on earlier in this document.

### One-time monitoring programs

There are also individual monitoring projects being done throughout the basin to fill in known data gaps or answer specific questions (like the 2015 temperature study discussed below). These projects include things like understanding blockages to fish passage, investigating the ecological benefits of habitat complexity, tracking populations of other ESA-listed fish like steelhead, water

typing small streams, and targeted water quality studies, such as those conducted by the Snoqualmie Tribe in the Kimball Creek area. All of these projects advance our understanding of how salmon use the Snoqualmie Basin and how we can improve and protect their habitat.

### Basin-wide assessments

Additionally, larger scale monitoring is periodically needed to analyze basin-wide trends such as riparian conditions, land use, land protection and habitat conditions—all of which can help tell us where we are on the path to salmon recovery. These larger scale assessments typically take place every five to ten years and allow us to communicate bigger picture trends to the state, local jurisdictions and other salmon recovery partners.

Despite the importance of tracking the performance of our restoration efforts and the status of salmon populations, many of the grant dollars available in Washington State for salmon recovery are restricted to project design and construction and exclude monitoring efforts. Given this funding gap, the Snoqualmie Forum plays a large role in providing grant dollars for monitoring projects. Every year, the Forum dedicates an estimated 10% of the Cooperative Watershed Management grant funds to monitoring. Without this critical investment, we are less likely to learn from our past efforts and may miss vital environmental cues that can and should inform our path toward long-term salmon recovery.



## SUMMER 2015 TEMPERATURE STUDY MAY HOLD LESSONS FOR THE FUTURE

The summer of 2015 was one of the warmest on record, with periods of the lowest water flows ever recorded in the Snoqualmie Valley. To document this extreme event, the Snoqualmie Watershed Forum, in partnership with King County, deployed 27 thermistors collecting continuous water temperature across the Snoqualmie River and its primary tributaries from June 30 to September 30. The study goal was to document a record weather event to better understand the conditions salmon face during such years. For the full report, see <http://www.govlink.org/watersheds/7>.

Many factors threaten salmon habitat in the Snoqualmie River, but warm water temperatures pose a serious challenge to salmonid health, development, migration, and survival. A single daily peak temperature of 23-25°C can kill salmonids in a few seconds or hours. Even if water temperatures do not reach lethal levels, warmer temperatures (16 to 23°C) can cause significant sub-lethal effects that reduce survival by increasing susceptibility to disease and metabolic stress, and impeding migration (since salmon may elect not to swim through extremely warm waters). Warm temperatures also affect spawning, development and rearing, and hinder juvenile salmonid health and growth, reducing their chances of survival.

According to the scientific literature and the Washington Department of Ecology (DOE)'s water quality standards, Snoqualmie basin salmonids were subjected to both lethal and sub-lethal water temperatures in the mainstem of the Snoqualmie River during the summer of 2015. Temperatures surpassed the 7-DADMAX standard (i.e., the moving average of the daily maximum water temperature over a seven-day period) for most of the summer (Figure 11). The State sets the standard at 16°C in

core summer habitat and 17.5°C in spawning, rearing, and migration areas. The 7-DADMAX did not drop below the temperature standard until late summer storms arrived at the end of August, and then only for a short period.

The beginning of the summer (i.e., June and July) was significantly warmer than the late summer. During those months, mainstem Snoqualmie temperatures intermittently rose above the 1-DMAX, a one-day maximum temperature threshold that can produce both lethal effects (23°C) and migration barriers (22°C).

Like the mainstem, many Snoqualmie tributaries experienced exceptionally high water temperatures for core summer habitat. In some of the larger tributaries (Cherry Creek, Tolt River, and Raging River), patterns were fairly similar to the mainstem, including frequent excursions above the one-day lethal threshold, particularly in July. In the Raging River, not only were

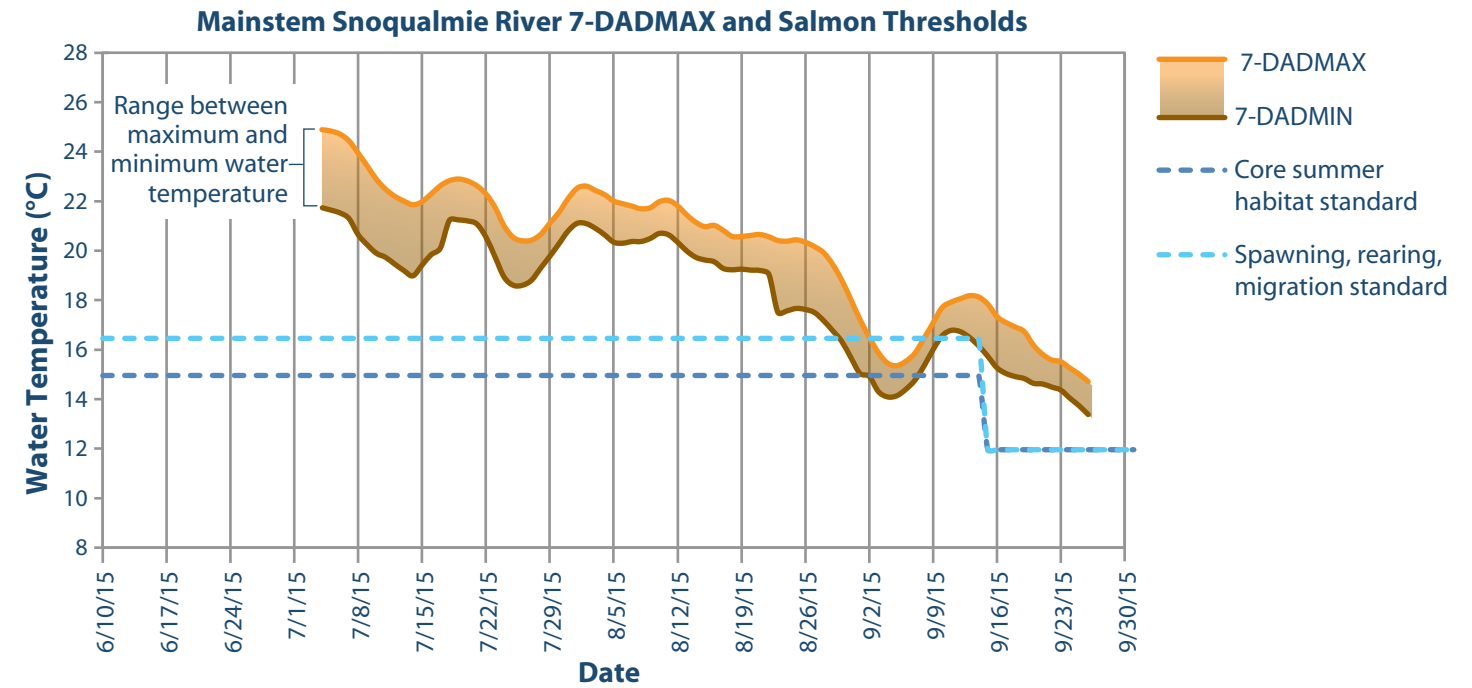


Figure 11. Mainstem Snoqualmie 7-DADMAX range and DOE standards for designated uses. State standards after September 15 specific for spawning and egg incubation.

temperatures well above the 23°C lethal standard, flows were so low that the river flowed sub-surface near the confluence with the Snoqualmie, barring fish access to potential refuge from the highest temperatures.

The smaller tributaries were generally cooler. Most still exceeded the applicable 7-DADMAX standards, but most remained at or below the threshold for lethal effects. These cooler tributaries as well as groundwater exchange areas create refuges of cooler water that may support salmonids' physiological and ecological needs during extreme periods.

This study illuminates the potential impacts of water temperatures on salmonids during a particularly hot, low-flow season and highlights the potential significance of cold-water refuge areas across tributaries and areas of groundwater exchange. The warm temperatures likely affected juvenile coho, steelhead and Chinook rearing in the river over the summer as well as early-arriving adults holding in the river for later fall spawning. While warm water conditions were pervasive throughout the Snoqualmie, the extent to which these conditions influenced juvenile and adult salmonids will not be fully known until we can evaluate the survival and productivity of these fish when they return as adults.

The conditions observed in 2015 provide useful insight into the potential impacts of climate change on the Snoqualmie River Watershed. The ability of the Snoqualmie River and its tributaries to continue supporting salmonid populations will depend on their resilience to climate change impacts. Building resiliency may require more emphasis on protecting and enhancing cold-water refuge areas such as tributary confluences and groundwater recharge zones, as well as continued support for repairing riparian condition, extent, and connectivity. Protecting and restoring floodplain processes, natural watershed storage, and instream flows will also be essential. These efforts must take place at a scale commensurate with the urgency of the temperature threat.



BankSide Farm

## WORKING ON PRIORITIES FOR FISH, FARMS AND FLOODS

While the Forum works to support healthy fish populations in the Valley, there are other key values and resources to consider at the same time. In our previous Status Report, we highlighted the critical importance of resolving tensions between agriculture and salmon recovery if we are to succeed in our collective efforts:

*“The resolution of the restoration vs. agriculture issue must be given high priority with an emphasis on solutions that ensure the long-term viability of both. Without it, salmon recovery is not likely to succeed in the Snoqualmie Watershed.”* - Snoqualmie Watershed Forum Salmon Plan Five-year Status Report, 2005-2010

Add to these issues a third, critical policy objective—reducing flood risk—and the picture becomes even more complex, particularly in the lower Snoqualmie Valley, where flooding is frequent and pervasive.

Each of these priorities is shaped by legal mandates, policies, plans and programs that enjoy significant public support, and some of the needed actions conflict with each other when applied on the ground. For example, some key salmon habitat restoration actions in floodplain areas, such as removing and setting back levees, may permanently remove existing farmland from production. On the one hand, such actions are called for in



plans adopted by King County and the federal resource agencies, as well as numerous local partners, to support the recovery of salmon. On the other hand, the state Growth Management Act and county policies require the designation and protection of resource lands, such as farm and forest lands. And, growing recognition of the importance of a strong local food economy has led to a number of recent efforts in King County to strengthen local agriculture, such as the Local Food Initiative. Finally, there is a very strong policy basis in local, state and federal law to minimize development and fill in floodplains to protect life, property and infrastructure.

In autumn 2013, pursuant to County Comprehensive Plan Policy R-650, King County convened the

“ The ability of the Snoqualmie River and its tributaries to continue supporting salmonid populations will depend on their resilience to climate change impacts. ”

Snoqualmie Fish, Farm & Flood Advisory Committee to inform the County on what is most important for each of these sectors to thrive in the Snoqualmie Valley, and how balance might be attained among these interests. As part of its work, the Committee is charged with identifying short- and long-term recommendations that collectively improve conditions for fish, farms and flood risk reduction (aka the “three F’s”). The Snoqualmie Watershed Forum has participated actively in this effort since its inception.

The 14-member committee comprises four local farmers (including one member of the Agriculture Commission), and representatives of two tribes, the Snoqualmie Watershed Forum, the Snohomish Basin Salmon Recovery Forum, Futurewise, Washington Department of Ecology, City of Duvall, Wild Fish Conservancy, the King Conservation District and the King County Flood Control District. Following 25 committee meetings over two and a half years, several field trips and extensive outreach to the farming community, the Committee reached an “agreement in principle” on May 11, 2016 that includes a suite of recommended near-term actions as well as follow up “task force” efforts to delve more deeply into specific issues. The

Committee’s recommendations cover a broad range of topics, such as improving the safety of farms during floods; addressing regulatory hurdles for farming, especially those related to drainage maintenance; accelerating progress toward salmon recovery through capital actions; exploring ways to enhance summer low flows while also addressing irrigation needs; assessing the vulnerability of the Valley’s road network to flooding; and strengthening expectations for community outreach around restoration and flood risk reduction capital projects.

While much work remains to be done to formalize the agreement, the Committee reached an important milestone that points to the possibility of a much more collaborative culture of engagement between stakeholders in the Snoqualmie Valley. Implementing these recommendations will require a significant commitment of resources by King County and basin partners, including the members of the Forum, as well as a willingness to adjust strategies over time. But, perhaps most importantly, the Committee’s joint effort has built trust and common understanding among diverse stakeholders that will help resolve future challenges as they arise.

## Watershed Improvement District forms to address Valley water needs

*Farmers, residents and businesses in the Snoqualmie Valley have long recognized that there is often too much water – and, at times, not enough. But, unlike some other agricultural valleys in Puget Sound, the Snoqualmie has not had a functioning irrigation or drainage district for several decades, with the exception of Drainage District #7, which is limited to Cherry Valley. Following several years of planning and community outreach led by the Snoqualmie Valley Preservation Alliance, the Snoqualmie Valley Watershed Improvement District (WID) was officially formed on December 7, 2015 after receiving a 94% approval by district voters. The district boundaries include roughly the entire Snoqualmie Agricultural Production District (APD), which measures more than 14,000 acres, as well as an assortment of parcels near the APD. The purpose of the WID is to address water needs on a system-wide basis, protect water rights, increase access to irrigation, and address drainage issues. The Forum looks forward to exploring opportunities to work with the WID on collaborative projects and programs that help both farms and fish.*

## SUCCESSSES AND FUTURE CHALLENGES

As we reflect on the first ten years of implementing the Salmon Plan and embark on the next ten, we note that some promising avenues for progress have developed recently, especially around regional funding for multi-objective projects, and growing trust between the farming and salmon recovery communities. But on other fronts we have seen less movement and must continue to push for the financial investments and political will needed to make meaningful strides forward.

### Leverage project funding by thinking “multi-objective”

An important and encouraging regional trend is the recognition that wherever land meets water, projects that address multiple objectives can be the most effective way to make meaningful progress for all stakeholders. This is reflected in the emergence of the Floodplains by Design funding program as a new approach that couples floodplain restoration activities with flood risk reduction, as well as actions to strengthen other floodplain land uses, such as agriculture and recreation. Organizational and decision-making structures need to adapt to take advantage of this new paradigm, but the ability to conduct multi-objective planning and to form broad support for integrated actions may well be the secret to success.

### Build on the early agreements of the Fish, Farm, Flood effort

The prospect of an enduring agreement between fish and farm interests is a tantalizing one, and much work remains to get to that point. But as restoration efforts are increasingly dependent on access to private lands, resolving these issues is more important than ever. Similar conflicts are playing out in different ways across the Puget Sound and the broader Northwest, but the agreement in principle reached by the Snoqualmie Fish, Farm, Flood Initiative in 2016 gives significant hope for a collaborative future. The Forum will support the spirit and letter of the agreement, and work in good faith to build new partnerships with the agricultural community in the Snoqualmie Valley.

### Advocate for acquisition and restoration funding at local, state and federal levels

While there have been some encouraging developments in the funding environment for capital projects in recent years, the average annual level of funding available to further salmon recovery is still woefully below the actual need. More acquisition funding is especially needed to stave off habitat losses and secure lands critical to restoration. The Forum and its many regional partners must continue to push for increased funding from federal and state sources in particular.

### Increase project implementation capacity

Increased capital project funding is not enough if project implementers don't have the capacity to secure the funds and design and execute

the projects. Few non-local funding sources will support operating costs, preferring instead to fund capital projects “on the ground.” But it takes planners, basin stewards, acquisition experts, outreach specialists, engineers, biologists, ecologists, GIS personnel, attorneys, administrative professionals and many others to move projects from ideas to reality. Currently, this cost falls primarily on local budgets, and can be difficult to sustain. This lack of capacity has greatly curtailed our ability to get work done. As a region, we must come up with a better way to fund these critical functions.

### Increase research and monitoring to track progress

Monitoring and research studies are critical if we want to understand whether our investments are having their expected benefits. Unfortunately, monitoring has been woefully underfunded. Without it we cannot understand key trends, like recent severe declines in the coho population and alarmingly low Chinook productivity. To truly understand if we are improving conditions for salmon, we must find ways to support research and monitoring in the basin and greater Puget Sound region.

### Strengthen measures to protect watershed hydrology

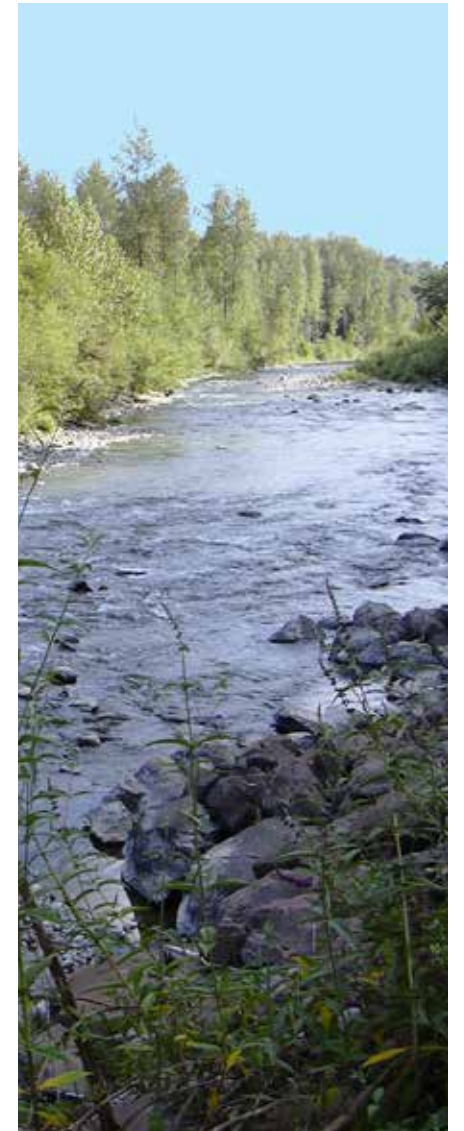
The Snohomish Basin Protection Plan identifies critical implementation priorities to protect the functioning ecosystem in the basin. It is infinitely easier and cheaper to protect intact habitat and hydrology now than try to restore it later. Implementing the plan and protecting hydrologically vital areas to halt further degradation is critical at both basin and local scales. The Duvall Watershed Plan is a prime example of how to implement the intent of the SBPP on a local level. Similar planning efforts are essential if we are to achieve the desired outcomes the SBPP identifies.

### Communicate our successes and watershed issues

Frequently, watershed residents don't have the right information to understand the complex nature of issues like salmon life history, flooding, gravel movement, groundwater exchange, and how these are affected by human activity. The Forum and our partners must work to convey clear messages about these watershed processes. Long term stewardship of our natural resources is inextricably linked to understanding the rich ecosystem of the Snoqualmie Valley.

### Plan for climate change and increase watershed resiliency

As we look ahead, there is a growing awareness of the way changing climate conditions will affect our watershed through increasing peak flows, decreasing snowpack, and significant sea level rise. Though climate change is complex, watershed partners are beginning to develop plans to make the basin more resilient to the expected changes. More work is needed to determine how flooding patterns will change, how we design projects to accommodate higher peak flows and sea level rise, and how we mitigate the effects of increased stream temperatures on salmon. With help from national and regional partners, we have a chance to continue salmon recovery despite the challenge of a changing climate.



**Real Progress, Real Challenges: Working Toward Salmon Recovery and Watershed Health**

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A PDF of this report is available at the above website.

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