SNOHOMISH BASIN PROTECTION PLAN

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Prepared by

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EXECUTIVE SUMMARY

The primary goal of this 2015 *Snohomish Basin Protection Plan* (SBPP) is to identify protection strategies that prevent the degradation of hydrologic processes that support salmon or salmon habitat. In 2005, the Snohomish Basin Salmon Recovery Forum members approved the Snohomish Basin Salmon Conservation Plan and laid out a 50-year road map for multi-species recovery. The 2005 Plan was based on historical records, the best available science, and social and economic conditions. The Plan recognized that it was critical to use adaptive management to increase the chance of success by incorporating new data, information about successes and failures, and new opportunities provided by changing context in the Snohomish River Basin.

Since 2005, there have been many site-scale successes on restoration projects in the mainstems, estuaries and tributaries. However, many environmental indicators continue to decline, according to local data and the 2009 State of the Sound report (Puget Sound Partnership 2010). The continued decline is likely due to little-understood cumulative effects that need to be addressed through protection at the landscape-scale.

Snohomish Basin Hydrology—Supporting People, Wildlife, and Fish

The Snohomish River Basin contains diverse aquatic resources, a variety of fish and wildlife populations of local and regional significance, and a diverse portfolio of land uses. The Basin and its many natural resources and human communities are inextricably linked to how water moves through space and time, from the smallest headwater streams to mainstem rivers and the groundwater beneath the surface.

Photo credit: Greg Dunlap

Hydrology in the Snohomish, Snoqualmie, and Skykomish rivers and associated tributaries is changing. Historical flow patterns and volumes are shifting as a result of changing land uses and climate change. Human activities—such as impervious surface installation, tree cover removal, traditional stormwater conveyance systems, and water withdrawals—are contributing to altered watershed processes, degraded water quality, loss of wetlands and riparian forests, and degraded shoreline conditions.

Investigating Protection of Snohomish Basin Hydrology

The continued degradation of hydrology in the Basin, rapid urbanization, and threats from climate change motivated a new effort focused on the protection of the water resources in the Basin and the watershed processes that support them. This SBPP identifies areas that are important to the goal of protecting hydrology, and examines new and existing tools to help support that goal. Through the protection of hydrology, the SBPP aims to ultimately protect habitat quality, quantity, and heterogeneity for fish and wildlife. The protection of hydrology will also support a continued high quality of life for those who live and work in the Basin, help ameliorate flood risks, and ensure the availability of water for multiple uses into the future.

To best characterize the different challenges, hydrological importance, and opportunities in each area, an approach was developed that incorporates information on land use, expected climate change impacts, services provided by hydrology, salmon use, existing protection measures, and possible improvements to policies, programs, and projects. The Puget Sound Watershed Characterization model was used to understand the importance of different components of hydrology at various scales and to describe the level of hydrological degradation. Assessment of the components of hydrology resulted in the development of

basic protection strategies and aided in the assessment of tools to achieve protective actions.

The Snohomish Basin Protection Plan

The intent of the SBPP is to set a framework for a more complete implementation and accounting of protection efforts by all Basin partners. Section 1 of the SBPP provides the Basin protection context and more details on the intended purposes of this document. Section 2 describes the technical assessment approach and Section 3 summarizes the results of the technical assessment (with additional details provided in Appendix A).

Section 4 of the SBPP provides an overview of protection tools that can be a starting point for planners and others to consider in combination with local hydrology concerns, land use types, fish use, and implementation opportunities. The tools include a range of existing programs in their current form, existing programs with suggestions for improvements, and entirely new tools. Section 5 presents an assessment of current and potential future funding strategies to support SBPP objectives.

Section 6 presents a summary example of how the SBPP can guide the development of protection strategies towards a specific program goal—in this case, salmon recovery—and provides updates on information developed since the 2005 Snohomish Basin Salmon Conservation Plan. Appendix B provides more detailed recommendations for updated salmon recovery protection strategies relative to specific land uses in the Basin. In December 2015, the Snohomish Basin Salmon Recovery Forum adopted Appendix B as the first formal adaptive management action for the 2005 Plan. This protection update does not change existing restoration recommendations and habitat goals from the 2005 Plan.

The consequences of not implementing protective measures for hydrology in the Snohomish Basin include the following:

- *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*

Although a lot of good work is being done through existing policy and programs, water quality has continued to degrade and with the challenges of drought and extreme flow events, the Basin's natural hydrologic regime has been significantly altered. It is more cost effective to protect hydrology now than to pay later for restoration actions and projects.

Photo credit: flickr user brewbooks

It has been 10 years since the 2005 Plan was adopted by the Forum, with broad support of jurisdictions operating in the Basin. Much has been accomplished in the realm of habitat restoration, yet landscape-scale indicators—such as total forest cover and water temperature—continue to show degradation. The intent of this SBPP is to provide an update to the 2005 Plan, and to serve as planning guidance to achieve greater protection of hydrology and, in turn, salmon habitat. This SBPP was developed at a time when there is recognition for the need to create watershed and ecosystem resilience in the face of growing populations and changing climatic conditions. Just as restoration relies on partnerships and collaboration, protection of hydrology and habitat cannot be undertaken in isolation, or by one entity, group, or agency. As stated by the original chairs of the Forum, "we know that to recover salmon in Puget Sound, we must succeed in the Snohomish Basin."

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BMP	best management practice
CAR	critical areas regulation
CFT	Conservation Futures tax
CREP	Conservation Reserve Enhancement Program
CUT	Current Use Taxation
CWA	Clean Water Act
DNR	Washington State Department of Natural Resources
EASC	Ecological Analysis for Salmonid Conservation
Ecology	Washington State Department of Ecology
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
Forum	Snohomish Basin Salmon Recovery Forum
FPP	Farmland Preservation Program
GMA	Growth Management Act
HCP	Habitat Conservation Plan
HPA	Hydraulic Project Approval
HRCD	High Resolution Change Detection
ILP	Integrated Licensing Process
IRPP	Instream Resource Protection Program
LID	Low Impact Development
LiDAR	Light Distance and Ranging
MS4	municipal separate storm sewer system
NMFS	National Marine Fisheries Service
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWFP	Northwest Forest Plan
NWPA	Northwest Power Act
PBRS	Public Benefit Rating System

PDR	Purchase of Development Rights
PSWC	Puget Sound Watershed Characterization
RCW	Revised Code of Washington
SBPP	*Snohomish Basin Protection Plan*
SFLO	small forest landowner
TDR	Transfer of Development Rights
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
WAC	Washington Administrative Code
WDFW	Washington Department of Fish and Wildlife
WRIA	Water Resource Inventory Area
WSU	Washington State University

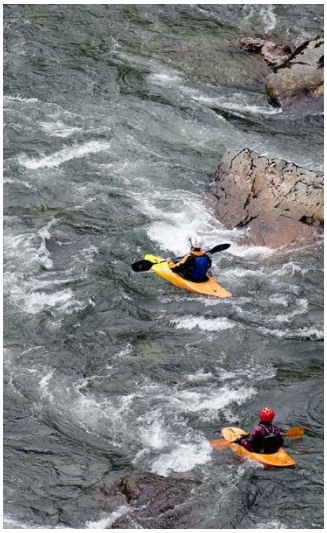
Section 1

INTRODUCTION AND BASIN PROTECTION CONTEXT

The Snohomish River Basin (see Figure 1), the second largest drainage in the Puget Sound, contains diverse aquatic resources. It is home to Endangered Species Act (ESA)-listed Chinook salmon, steelhead trout, and bull trout char populations as well as other fish and wildlife populations of local and regional significance. Among Puget Sound watersheds, it is the largest producer of coho salmon and the second largest producer of Chinook salmon, supporting two spawning populations—the Skykomish and the Snoqualmie.

The Basin contains a diverse portfolio of land uses including agriculture, forestry, and urban and rural residential areas. From 2000 to 2010, Snohomish County was the fastest growing county in the Puget Sound region, by percent growth (Earth Economics 2010). The Basin is famous for recreational opportunities for kayaking, fishing, boating, bird watching, and swimming.

The Snohomish River Basin is an 1,856 square mile watershed that drains from the Cascade Mountains to Puget Sound. The second largest watershed that drains into Puget Sound, it includes the Skykomish, Snoqualmie, and Snohomish rivers, along with numerous tributaries.



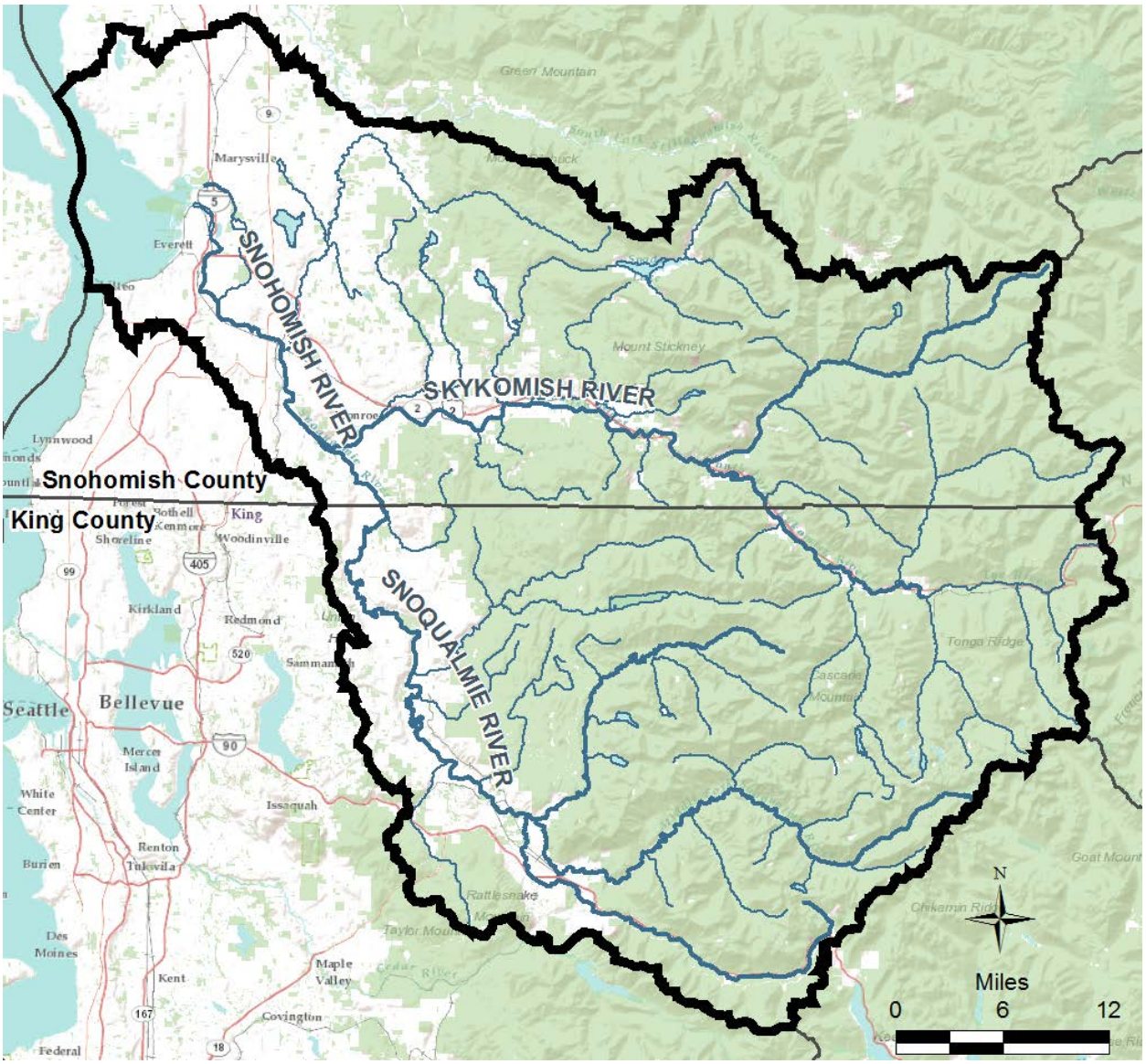


Figure 1: Snohomish River Basin

1.1 The Importance of Hydrology in the Basin

The Basin and its many natural resources and human communities are inextricably linked to how water moves through space and time, from the smallest headwater streams to mainstem rivers and the groundwater beneath the surface. Intact hydrology supports people, wildlife, and fish in the Basin. Salmon are dependent on adequate cool, low flows in the summer, the timing of outmigrant peak flows in the spring, and periodic winter flooding to create new habitat. Farmers depend on water for irrigation in summer and can suffer production losses during floods. Communities require drinking water supplies and safe areas to build. Recreational river users depend on clean rivers for swimming and fishing, and flow levels to support boating.

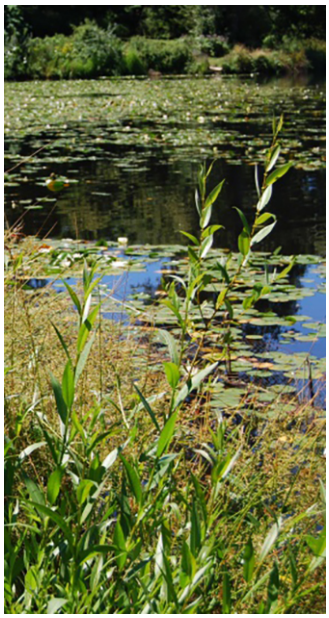
Ecosystem services are benefits that humans derive from the environment, which can include flood control and water quality, water supply, nutrient cycling, and recreation.

By acknowledging the multiple benefits that intact watershed processes provide, there is opportunity to expand non-traditional partnerships and funding, and improve willingness to protect and improve implementation.

In December 2006 alone, Snohomish County Emergency Management Department estimated $5.3 million dollars damage from floods to farms along the Skykomish and Snohomish Rivers (HeraldNet 2011). In addition, the City of Snoqualmie is one of the most flood-prone cities in Washington and has produced the highest number of flood claims of any city in the state (City of Snoqualmie 2014).

In 2002, Snohomish County farms sold more than $126 million in agriculture products, and King County had comparable sales (USDA 2009). Many of these products depend on the availability of existing water rights. The Washington State Department of Ecology (Ecology) is currently not issuing new irrigation rights in the majority of the Basin's agricultural areas.

The City of Everett depends on the upper Sultan watershed forests to provide natural water purification for their Spada Lake water supply. This source provides clean, safe water for more than 570,000 people and 80% of the businesses and residents of



Wetlands are areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. (40 CFR 230.3)

The riparian zone is the vegetated area bordering a waterbody. Riparian areas help protect aquatic ecosystems and salmon habitat in many ways, including controlling erosion, filtering pollutants, contributing large woody debris, protecting microclimate, and providing shade to moderate stream temperature.

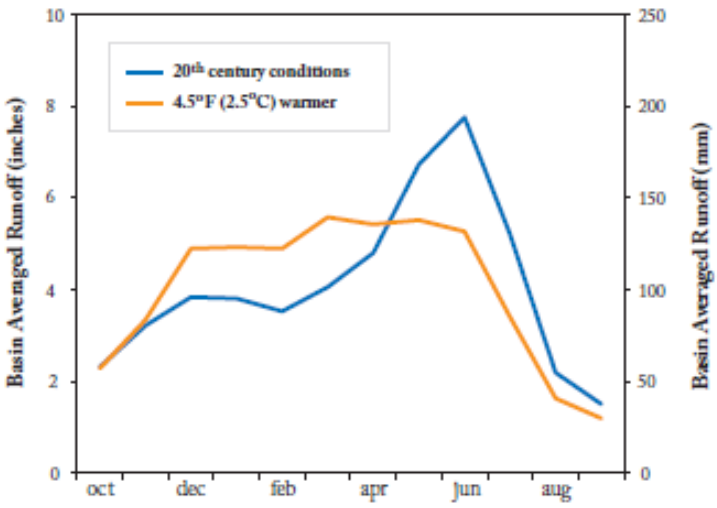
Snohomish County through a network of local water providers (https://everettwa.gov/444/Water-System). Snohomish County residents receive water captured and largely filtered by natural systems. When the City's filter system was compromised, the U.S. Environmental Protection Agency (USEPA) allowed the City to continue providing drinking water because the forest-filtered water met clarity parameters and there was no threat to public safety (Earth Economics 2010). The City of Seattle maintains a similar system in the Cedar River Watershed and estimates that management of their forests has avoided construction of a water filtration plant and the estimated cost of $200 million (Earth Economics 2010).

Recreation provides a boost to the entire Puget Sound economy. Nearly 80% of the state's revenue from tourism occurs in Puget Sound, with Snohomish and King Counties within the top four counties (OFM 2007). According to the recreation surveys and public records used in a recent Earth Economics study, there were a total of about 446 million participant days per year spent on outdoor recreation in Washington, resulting in $21.6 billion dollars in annual expenditures. Expenditures were highest for recreation associated with public waters (Briceno and Shundeler 2015).

According to the Washington State Office of Financial Management, King and Snohomish counties are two of the three counties in Washington with the greatest growth (OFM 2015). Between 2010 and 2014, Snohomish County grew by more than 6.5% and King County grew by more than 7.7%. By 2035, Snohomish County is projected to grow to a population greater than 955,000 (an increase of approximately 15% from 2000) and by 2030 King County is projected to exceed 2.1 million (an increase of 18% from 2000).

Hydrology in the Snohomish, Snoqualmie, and Skykomish rivers and associated tributaries is changing. Historical flow patterns and volumes are shifting as a result of changing land uses and climate change. Human activities—such as impervious surface installation, tree cover removal, traditional stormwater conveyance systems, and water withdrawals—are contributing to altered watershed processes, degraded water quality, loss of wetlands and riparian forests, and degraded shoreline conditions.

Climate change in the Basin has been modeled extensively by the University of Washington Climate Impact Group and Battelle (CIG and NWFSC 2005; PNNL 2015). Predicted effects include increases in the magnitude of peak flows, changes in the timing of seasonal flow peaks, prolonged and persistent low flows, reductions in summer flows, and increased stream temperatures. These effects would place even greater strain on water quality, threatened salmon populations, drinking water supplies, flood-prone areas, and working farms and forests.



Climate change models show that river discharge is predicted to change with more flow in the winter, less in the summer, and the loss of the spring peak floods.

Source: Snover et al. 2005

In order to prioritize actions in the Basin, we need to understand how different hydrologic functions are distributed throughout the watershed and its many sub-basins. Ecology recently developed the Puget Sound Watershed Characterization (PSWC) model (Hume et al. 2015). This model

The protection of hydrology will improve the overall resiliency of the ecosystem in the Basin. Resiliency is the ability of the ecological system to withstand perturbations and other stressors while still maintaining its structure and function. When resiliency is improved, a system is more likely to tolerate disturbances, such as population growth and climate change, without collapsing.

A watershed is the geographic area that drains into a particular river system or other body of water.

Watershed processes refers to the natural physical, chemical, and biological interactions that form the ecosystem of a watershed.

describes the importance of different components of hydrology at the sub-basin scale, regardless of current land use, and also provides information on the level of hydrological degradation. The information derived from the PSWC model is an important new tool to be considered in the face of development and climate change impacts.

The continued degradation of hydrology in the Basin, rapid urbanization, and threats from climate change have motivated a new effort focused on the protection of the water resources in the Basin and the watershed processes that support them.

1.2 Snohomish Basin Protection Plan Purpose

This *Snohomish Basin Protection Plan* (SBPP) identifies areas that are important to the goal of protecting hydrology, and examines new and existing tools to help support that goal. Through the protection of hydrology, the SBPP aims to ultimately protect habitat quality, quantity, and heterogeneity for fish and wildlife. The protection of hydrology will also support a continued high quality of life for those who live and work in the Basin, help ameliorate flood risks, and ensure the availability of water for multiple uses into the future.

This document is intended to be used by cities, counties, state and federal agencies, tribes, non-profit organizations, and other planning entities working in the Basin. The primary audience is land use planners, who will make recommendations to decision-makers about how to direct land use changes in the Basin, and resource managers and program staff who make decisions on how and where to apply programs and projects on the ground. The overview of protection tools in Section 4 can provide a starting point for planners and others to consider in combination with local hydrology concerns, land use types, fish

use, and implementation opportunities. Tools can be packaged to develop protection strategies appropriate to particular geographic areas to achieve the entities' goals.

Though protection and restoration are both essential to improving hydrologic process, this SBPP is focused on actions that do not directly involve restoration. The Basin has a focused and strategic approach for restoration needed to recover salmon populations and there was no attempt in this plan to change or update the restoration targets or emphasis areas. Although there is overlap between protection and restoration actions and they are often done in tandem, for the SBPP, protection tools were defined as those that do not "use a shovel or move dirt."

The tools for habitat protection are implemented by a broad spectrum of public and private entities within the Basin and there are many efforts underway that fall under the category of protection. Protection efforts range from regulations at the local government scale to acquisitions by land conservancies to incentive programs offered for specific resource industries.

The SBPP outlines many of the protection tools that have been used but that have not typically been implemented or tracked at a Basin-wide scale. The SBPP builds on information recognized at the time of the *Snohomish River Basin Conservation Plan* (Forum 2005; referred to as the 2005 Plan in this document) and integrates new tools, political context, and lessons learned from 10 years of implementation. The tools include a range of existing programs in their current form, existing programs with suggestions for improvements, and entirely new tools. The intent of this document is to set a framework for a more complete implementation and accounting of protection efforts by all Basin partners.

The definition of protection for the purpose of this document is inclusive of all areas in the Basin, regardless of their current levels of degradation. This definition was created to recognize that even degraded areas in the Basin have hydrological value and should be protected against further damage.

Habitat protection definitions traditionally only focus on pristine habitat areas. The definition of protection in the SBPP shifts attention from strictly intact opportunistic areas to a more comprehensive approach that takes into account the function and services each area in the watershed provides.

Basin partners include area state, local, and tribal governments, as well as non profit organizations

Additionally, the SBPP goals, if implemented, would further portions of the *2014/2015 Action Agenda for Puget Sound* (Puget Sound Partnership 2014). Implementing tools in this plan will directly lead to improvements in several Puget Sound Partnership vital signs (Figure 2) including, but not limited to, summer stream flows, water quality, shoreline armoring, Chinook salmon, floodplains, and land development and cover. Improving hydrologic function in the basin makes a positive contribution to the six goals outlined in the Action Agenda: healthy human population, vibrant quality of life, thriving species and food web, protected and restored habitat, abundant water quantity, and healthy water quality.

Figure 2: Puget Sound Vital Signs

From Puget Sound Partnership

Vital signs of Puget Sound's health were identified in 2011 by the Puget Sound Partnership as indicators to track progress. Current information is provided at: http://www.psp.wa.gov/vitalsigns/

1.3 Snohomish Basin Protection Plan Organization

Section 2 of this document describes the technical assessment approach and Section 3 summarizes the results of the technical assessment (with additional details provided in Appendix A). Section 4 examines new and existing tools to support the goal of protecting hydrology. Section 5 presents current and potential future funding strategies to support SBPP objectives. Section 6 summarizes protection strategies that specifically benefit ESA-listed Chinook salmon, with additional details provided in Appendix B.

The SBPP process was motivated by an understanding by recovery partners that protection can and must be done better to protect hydrology for enhancement of both salmon habitat and human uses. Information on the progress of recovery—restoration gains and protection losses—is also included in this document.

Section 2

TECHNICAL ASSESSMENT APPROACH

The SBPP process was driven by the understanding that hydrology is changing in the face of increasing pressures in the Basin. To best characterize the different challenges, hydrological importance, and opportunities in each area, an approach was developed that incorporates information on land use, expected climate change impacts, services provided by hydrology, salmon use, existing protection measures, and possible improvements to policies, programs, and projects. This will allow land managers and decision-makers to best align their particular physical and political context with the available protection tools.

2.1 Geographic Scales of Analysis

The SBPP technical approach sought to balance many different considerations throughout the basin, including land use and associated jurisdictions, salmon habitat, local opportunities, and important areas for hydrological protection based on existing geologies and precipitation regimes. All of the information considered has different meanings at basin-wide and local scales. The watershed characterization provided the ability to zoom in and out of areas, highlighting different relative importance values, which led the project team to analyze information in a similar manner. Three different scales were selected that gave a continuum of landscape-scale to practitioner-scale with different resolutions of information (Figure 3):

- **Scale 1 – Snohomish Basin Scale:** This broadest scale allowed a general understanding of hydrologic importance in the entire Snohomish River Basin. It also allowed the consideration of tools that can be applied to general land use

An example of how the SBPP approach and protection tools can be used at a locally relevant scale is provided by the City of Duvall 2014 comprehensive watershed planning process. Duvall was among the first communities in the Basin to incorporate a watershed planning effort into a Comprehensive Plan Update.

Duvall coupled the PSWC model with their exising information, such as zoning and critical area regulations, to identify opportunities to allow growth while ensuring protection and restoration of critical hydrologic areas.

The goal of the effort was to develop tools for the city to continue to grow and develop while trying to protect important resources. The process of examining the tools shed light on shortcomings of existing protection and allowed review of resources in the face of decisions related to growth and zoning. Although some of the solutions are long-term for development and adoption, there were also tools identified that can be implemented on a much shorter time line.

Duvall serves as a model for how the information in the SBPP can be used to inform real changes.

categories, rather than considering the nuances of each jurisdiction.

- **Scale 2 – Mainstem Scale:** The decision to look at each of the mainstem basins was driven by the fact that the Skykomish, Snoqualmie, and Snohomish rivers are very different from each other physically, especially in the lowlands. Additionally, the Skykomish and Snoqualmie rivers have unique Chinook salmon populations that are dependent on the watershed-scale hydrology of the mainstems and major tributaries. Finally, there is a fairly clear geographic division between King County (Snoqualmie) and Snohomish County (Snohomish and Skykomish), with the exception of the South Fork Skykomish. The physical differences between the basins and the jurisdictional uniqueness drives how certain salmon plan goals are allocated.
- **Scale 3 – Planning Unit Scale:** This smallest scale highlights fine-scale conditions such as hydrology, habitat, and ownership. It was organized around combined sub-watershed drainages (hereafter referred to as planning units) and smaller watersheds were grouped by similarity of location, fish use, and land use. At this local scale, jurisdictions are ultimately the major drivers of tools, though watershed characterization still aids understand of the relative hydrologic importance. Scale 3 was also advantageous for identifying unique opportunities for protection strategy implementation.

Maps of the three scales are provided in Figure 3. The white planning units shown at Scale 3 are mainstem floodplains that are better described in Scale 2.

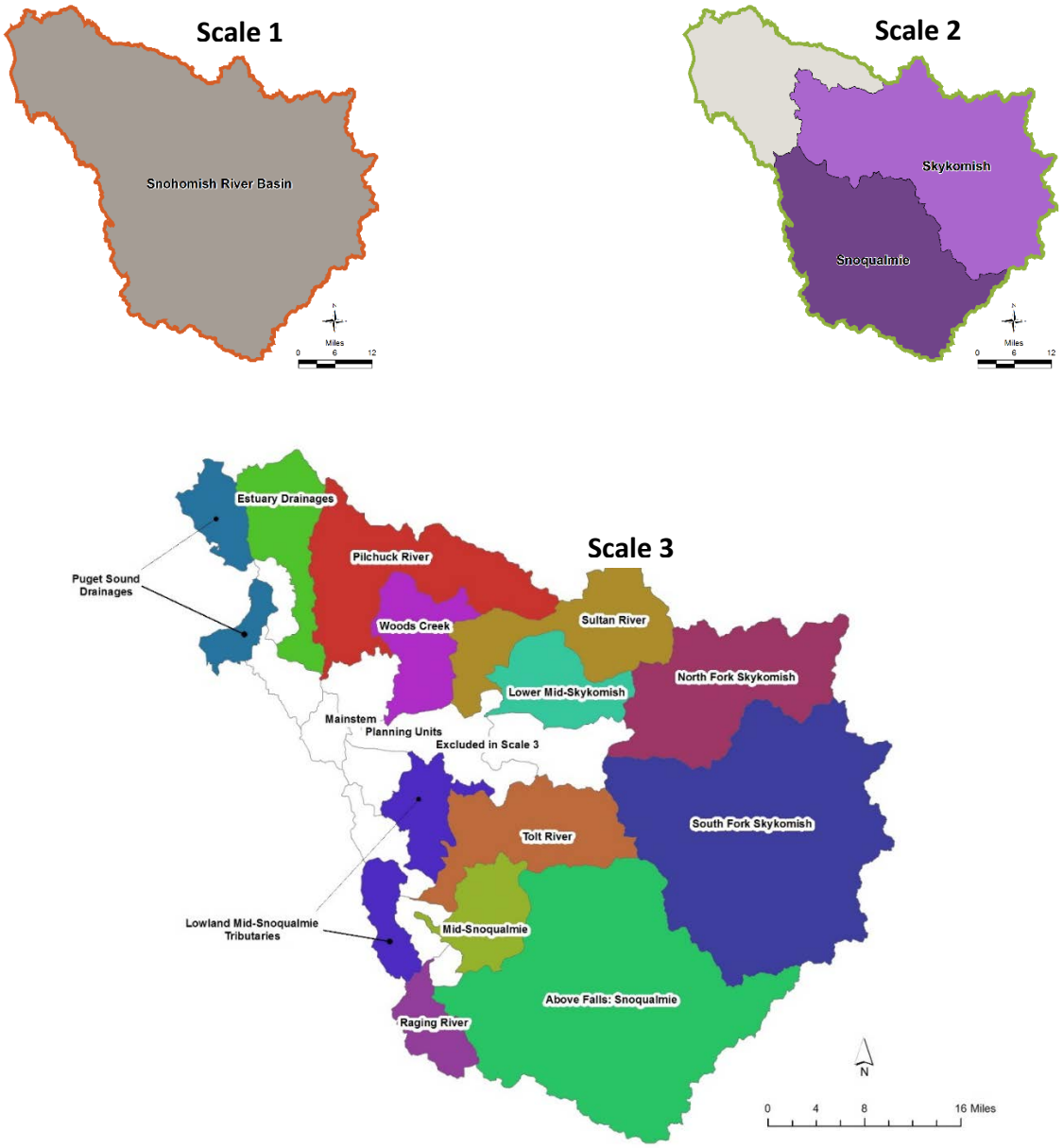


Figure 3: Scales Examined in the SBPP Technical Assessment

Note the white planning units shown at Scale 3 are mainstem floodplains that are better described in Scale 2.

The Scale 3 planning units were determined based on the following criteria: 1) contributing basins, which flow into critical/priority Chinook salmon areas and focal reaches; 2) sub-watersheds with relatively similar hydrology; and 3) sub-watersheds with potentially similar protection strategies due to comparable land uses.

Assessment at all three scales focused on the overlap of hydrology, anadromous salmon use, and landscape pressures. Resulting protection strategies relevant to Scales 1 and 2 focused on land use type. Protection strategies relevant to Scale 3 are geographically specific and account for the results of the hydrologic importance model. Scale 3 strategies were identified where possible and presented in Appendix A. These designations were chosen to best align the suites of strategies with the appropriate scales for implementation.

2.2 Building a Layered Technical Approach

Various layers of information, or lenses, were available for the planning units (Figure 4).

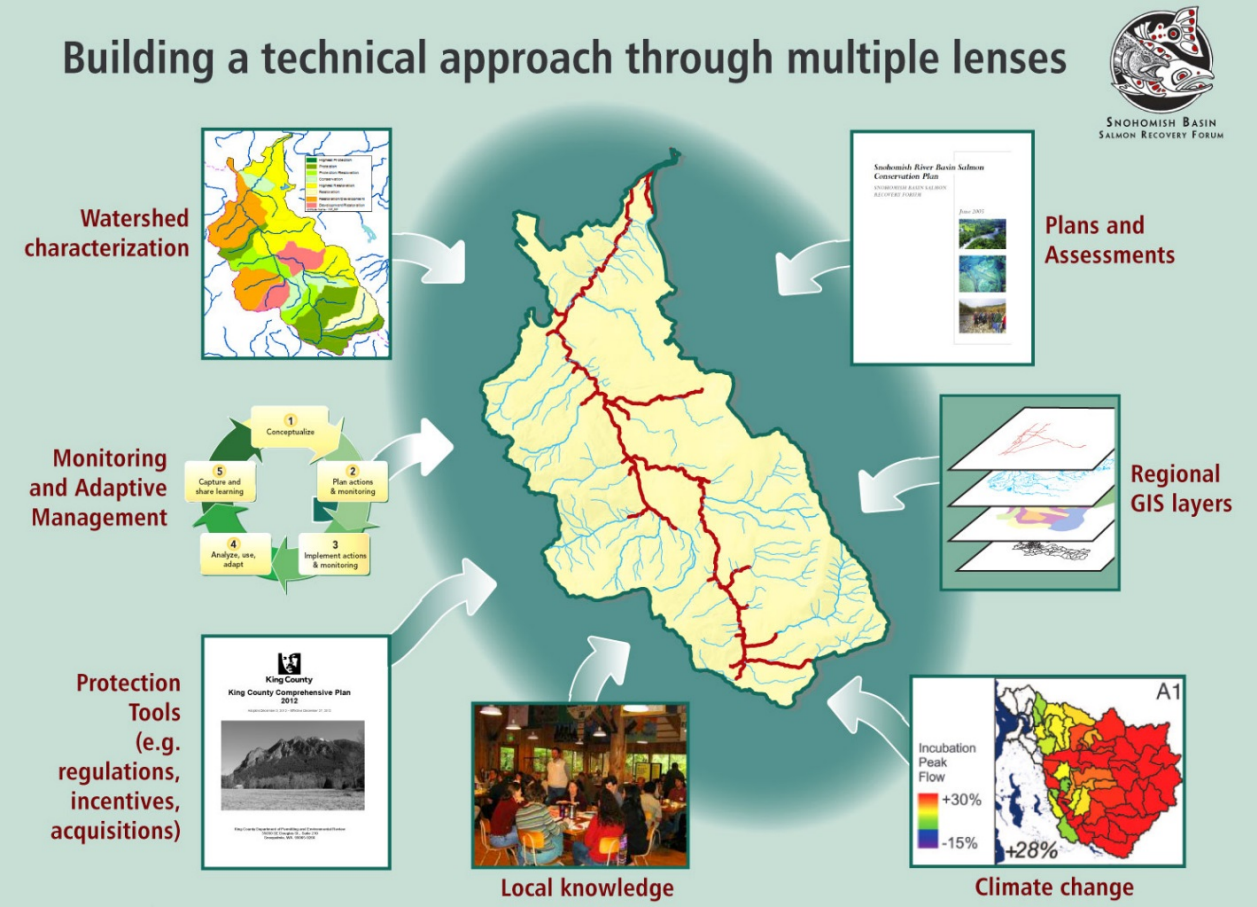


Figure 4: Building a Technical Approach through Multiple Lenses

Assessment at Scales 1 through 3 relied heavily on the PSWC models to provide hydrologic context and an evaluation of key hydrologic components (see Section 2.5). However, because Scale 3 provides analysis at the planning unit scale, watershed characterization was one of several lenses used to determine areas for protection and strategy development; this scale included a supplemental multi-facetted technical approach focused on integrating additional information sources to better assess the overlap of hydrology, anadromous salmon use, and landscape pressures. This included primary anadromous fish use, information on habitat changes, precipitation regime, primary land use and activities, modeled hydrologic and habitat conditions, limiting factors related to hydrology, ecosystem services, potential climate change impacts, and current and future pressures. This technical approach helped to determine the overlap of hydrologic importance, threats of continued degradation, and opportunities for protection. The Scale 3 technical approach primarily focused on evaluating previously available information and data sets with the exception of an updated hydrologic and habitat conditions assessment.

Anadromous species hatch in freshwater, mature in saltwater, and return to freshwater to reproduce.

2.3 Identifying Land Uses

Land use information can change quickly in urban-rural fringe areas, and land use maps can only provide information relative to a particular snapshot in time. Current aerial images can be used to determine more current land uses in an area, but land use maps can give context for development and open space patterns and help shape opportunities for protection.

Figure 5 shows the land use designations for the Basin, based on the Comprehensive Plans of Snohomish and King Counties. While this does not show the current on-the-ground land use, it maps the potential growth and conservation areas. When

coupled with a current aerial image, the map can be used to identify the potential land use of the area, show opportunity, and help refine the appropriate suite of tools.

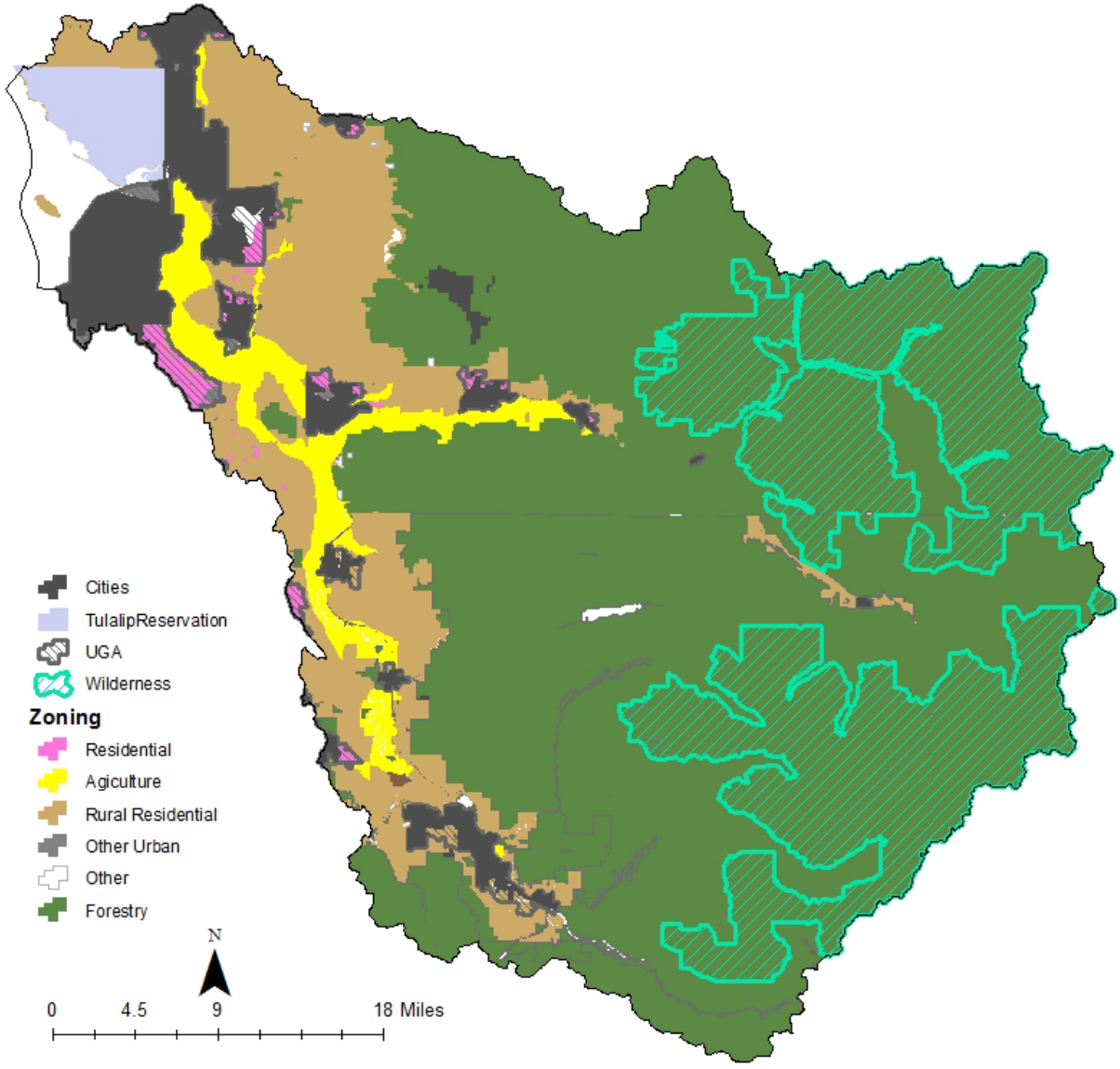


Figure 5: Land Use Designations for WRIA 7

2.4 Identifying Current and Existing Protection

In addition to the land use identification, it is important to explore the existing protection methods that are already applied in the area of interest (Figure 6). Protection maps were used to help identify tools that could complement work being done in the area and show where existing protection tools could be expanded or strengthened.

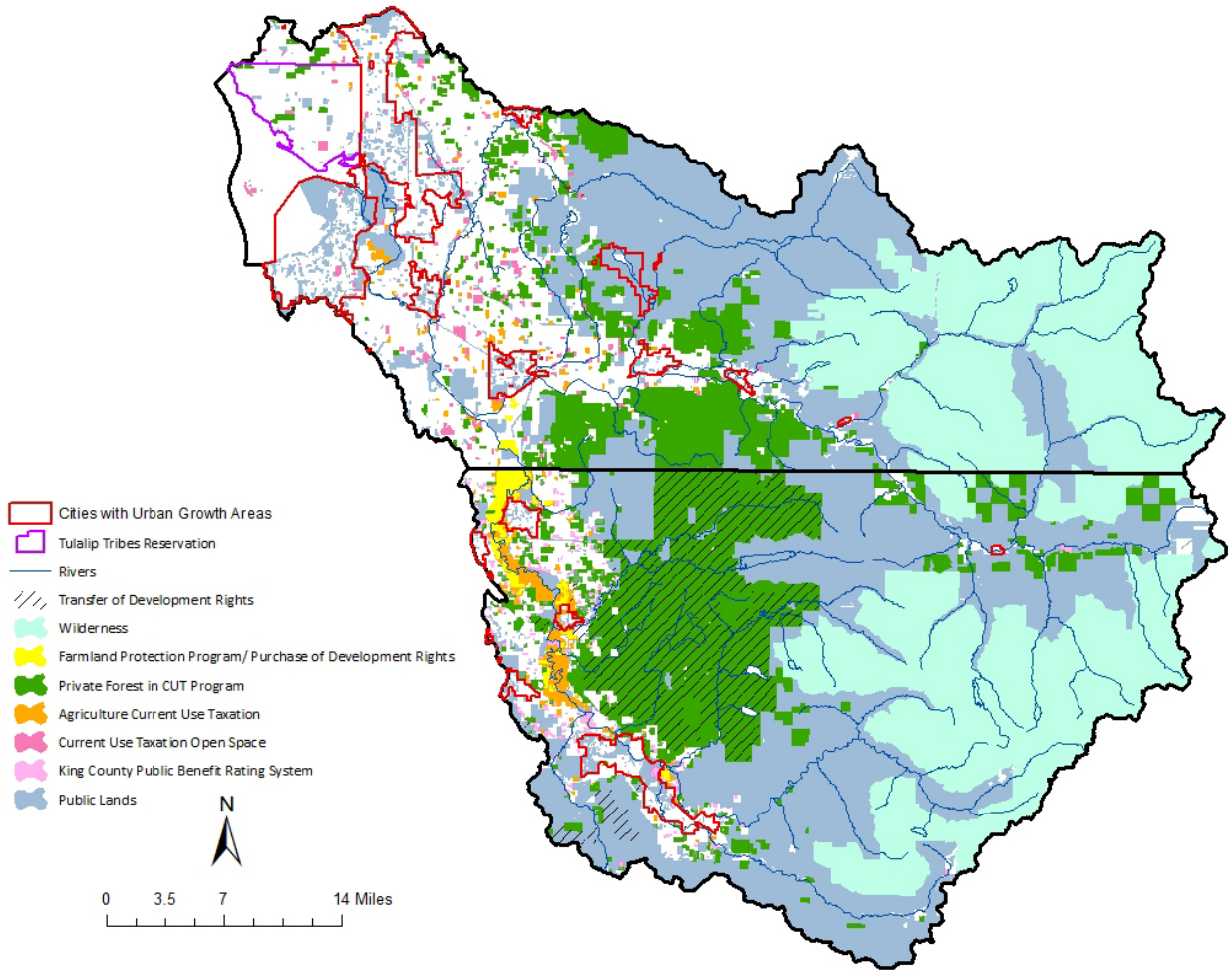


Figure 6: Current Protection Tools in WRIA 7

2.5 Puget Sound Watershed Characterization Models

Across all spatial scales, the project team evaluated hydrology using Ecology's PSWC models (Stanley et al. 2012; Wilhere et al. 2013). PSWC examined the four key components of hydrology—delivery, surface storage, recharge, and discharge (see Section 3)—as well as overall hydrologic importance.

Since the SBPP is focused on assessing areas of hydrologic importance, regardless of condition (i.e., degradation), the technical approach focused on evaluating results from the hydrologic flow importance sub-model. The flow importance sub-model evaluated hydrology based on physical attributes of topography, soils, geology, and hydrology. This sub-model evaluated water-flow processes in an "unaltered" state, without consideration of land-use changes or human modifications, providing a detailed spatial assessment of hydrologic importance across the Basin.

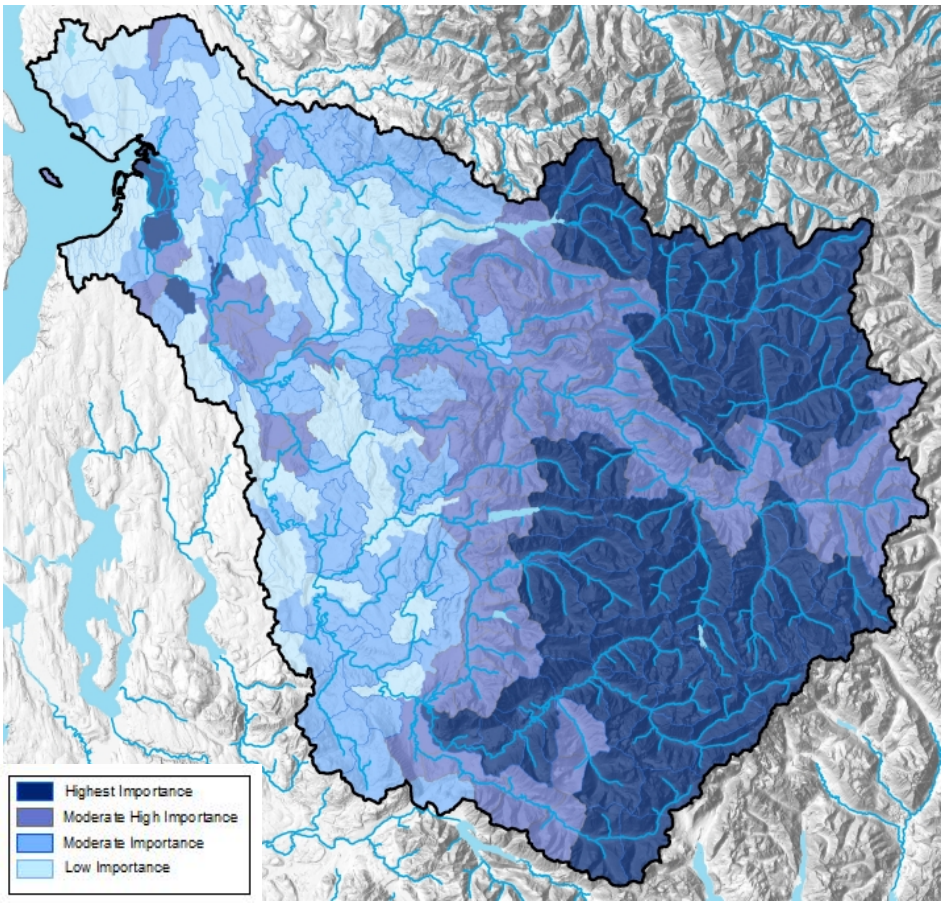
The four water-flow processes used in this sub-model included delivery, surface storage, and movement (separated into recharge and discharge). The following attributes determined the level of importance assigned to each component:

- *Delivery: precipitation regime*
- *Surface storage: depressional wetlands, lakes, and stream floodplains*
- *Recharge and discharge: precipitation, soil composition, slope wetlands, alluvial floodplains*

The model highlighted the areas that were important for all four hydrologic components as well as areas important for each of the individual hydrologic components. The model provides a relative comparison between watersheds in an unaltered state. These results inform decisions about the most important opportunities to protect specific components of hydrology at each scale.

The hydrological importance of the area of interest was identified using watershed characterization maps (Figure 7). These maps establish hydrologic areas of interests and important areas within the Basin (or sub-basin or planning unit). Note the importance rating changes relative to scale, but the prioritization can be used at any scale. An example of a detailed map at a smaller scale is provided in Figure 8. Additional detailed maps at smaller scales are provided in Appendix A.

Figure 7:
Ecology Watershed Characterization Model for Hydrologic Importance in WRIA 7



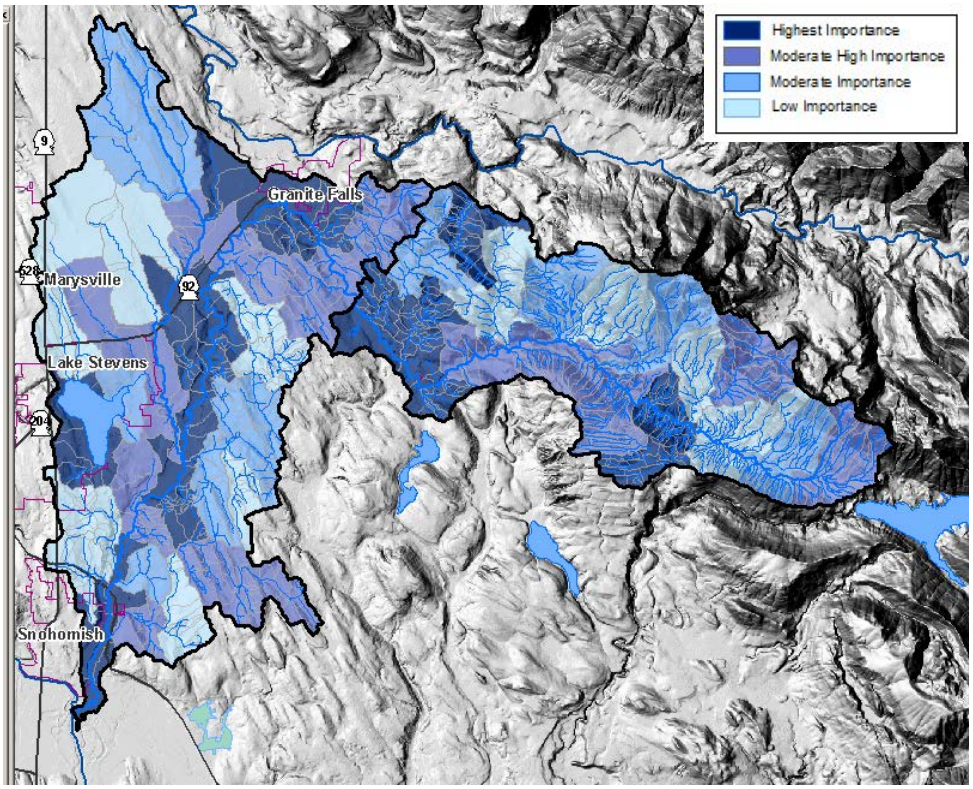


Figure 8: Example of a Smaller-Scale Watershed Characterization Model for Hydrologic Importance

Section 3

TECHNICAL ASSESSMENT RESULTS

Assessment of the four key components of hydrology—delivery, surface storage, recharge, and discharge—using the PSWC models resulted in basic protection strategies, detailed in Section 3.1. Section 3.2 summarizes the overall watershed characterization hydrologic importance assessment results at Scales 1 through 3, and provides information regarding locations in the Basin where the particular components are most important.

Section 4 provides recommendations related to tools to achieve these protective actions.

3.1 Watershed Characterization Hydrology Components and Protection Strategies

Each of the four key components of hydrology has basic protection strategies, detailed in Sections 3.1.1 through 3.1.4.

3.1.1 Delivery

Delivery is a mechanism of water flow processes that has to do with the quantity and timing of water available for surface waters and groundwater.

The PSWC model (Hume et al. 2015) indicates that delivery is most important in the forested areas. These areas are typically dominated by forest cover, and characteristic of rain-on-snow and snow-dominated precipitation zones. Delivery is critical to maintain water in rivers and streams. Protection of delivery functions is imperative to ensure water is available throughout the year, particularly in low flow conditions. Spatial orientation of delivery across the three scales is shown in Table 1. Delivery functions are degraded through loss of forest cover and increases in impervious surface. In order to protect areas important to

delivery, strategies will have to focus on protecting forest cover, especially in rain-on-snow and snow-dominated zones.
The following are examples of strategies to protect delivery:

- Preserving tree cover (conifers in particular) to allow for infiltration and prolonged delivery of water to the Basin
- Protecting snow-dominant and rain-on-snow areas to maintain appropriate delivery
- Ensuring zoning is in line with long term protection of resources
- Increasing the size of protected areas around streams and wetlands

3.1.2 Storage

Storage is a mechanism of water flow processes where surface runoff accumulates during storm events, desynchronizing flows to downstream areas.

The storage of water is a key process in lowland and transition zones between mountainous areas and the lowlands. Areas that are important to storage generally have a high proportion of wetlands, lakes, and floodplains. Spatial orientation of storage across the three scales is shown in Table 1. The storage process is degraded through the loss of wetlands, increased channelization, and disconnection of streams from floodplains.

The following are examples of strategies to protect storage:

- Limiting stream and wetland crossings by roads
- Maintaining beaver ponds to increase surface storage
- Limiting road building in forested areas
- Reducing the density of artificial channels (interception of shallow groundwater in channels and road ditches)
- Reducing channelization and, where appropriate, finding ways to combine drainage systems for better hydrologic benefit
- Reducing opportunities for development in the floodplain, encouraging abandonment of floodplain development, and purchasing floodplain development rights

- Ensuring zoning, critical areas regulations, shoreline regulations, and other pertinent regulations are consistent with protection of wetlands, lakes, and floodplains
- Increasing the size of protected areas around streams and wetlands

3.1.3 Recharge

Recharge is a key hydrologic process in areas with permeable outwash and alluvial deposits, particularly in glacial terraces and floodplains because these areas allow for higher infiltration. The importance of groundwater and interactions with recharge and water flow are clearly important; however, groundwater dynamics are not addressed in the SBPP. Spatial orientation of recharge across the three scales is shown in Table 1. Areas with high infiltration that also experience high precipitation rates are critical for recharge, which is degraded by impervious surface.

Recharge is a mechanism of water flow processes where water moves downward from surface water to groundwater and is dependent on the infiltration rate associated with soils and underlying geology.

The following are examples of strategies to protect recharge:

- Reducing groundwater withdrawals
- Capturing runoff in a manner that allows for greater infiltration, such as rain gardens or use of pervious pavement, especially in developed areas
- Limiting development and logging in areas with permeable soils, in particular, when soils are in high-precipitation areas
- Retaining large parcels in recharge areas and limiting certain extraction activities in recharge areas
- Increasing the size of protected areas around streams and wetlands
- Ensuring zoning is consistent with protection of resources
- Reducing the density of artificial channels (interception of shallow groundwater in channels and road ditches)

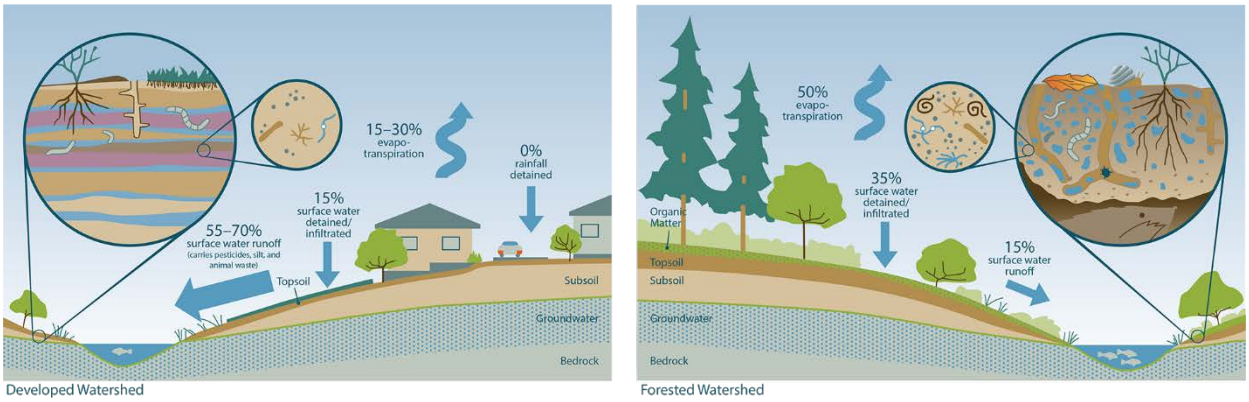
3.1.4 Discharge

Discharge is a mechanism of water flow processes where groundwater seeps out to surface water features as springs or shallow groundwater seeps.

Areas important to discharge processes are concentrated in large floodplain areas where the floodplain intersects permeable soils, and slope wetlands adjacent to rivers. These areas are critical in maintaining low flows. Spatial orientation of discharge across the three scales is shown in Table 1. Discharge is affected by development adjacent to slope wetlands, high density of roads, ditches, and groundwater withdrawals.

The following are examples of strategies to protect discharge:

- Reducing interception of shallow groundwater in channels and road and agricultural ditches
- Protecting wetlands
- Developing regulations that are protective of slope wetlands
- Increasing the size of protected areas around streams and wetlands
- Reducing groundwater withdrawals



Adapted from King County

Figure 9: Movement of Precipitation in Developed and Forested Watersheds

3.2 Scales 1 through 3 Results Summary

Results from the watershed characterization importance model for the different components of hydrology at Scale 1 (across the entire basin) show patterns that should allow managers to plan targeted protection of different kinds of hydrology in appropriate locations. Figure 10 shows the importance maps for each of the four key components of hydrology at Scale 1.

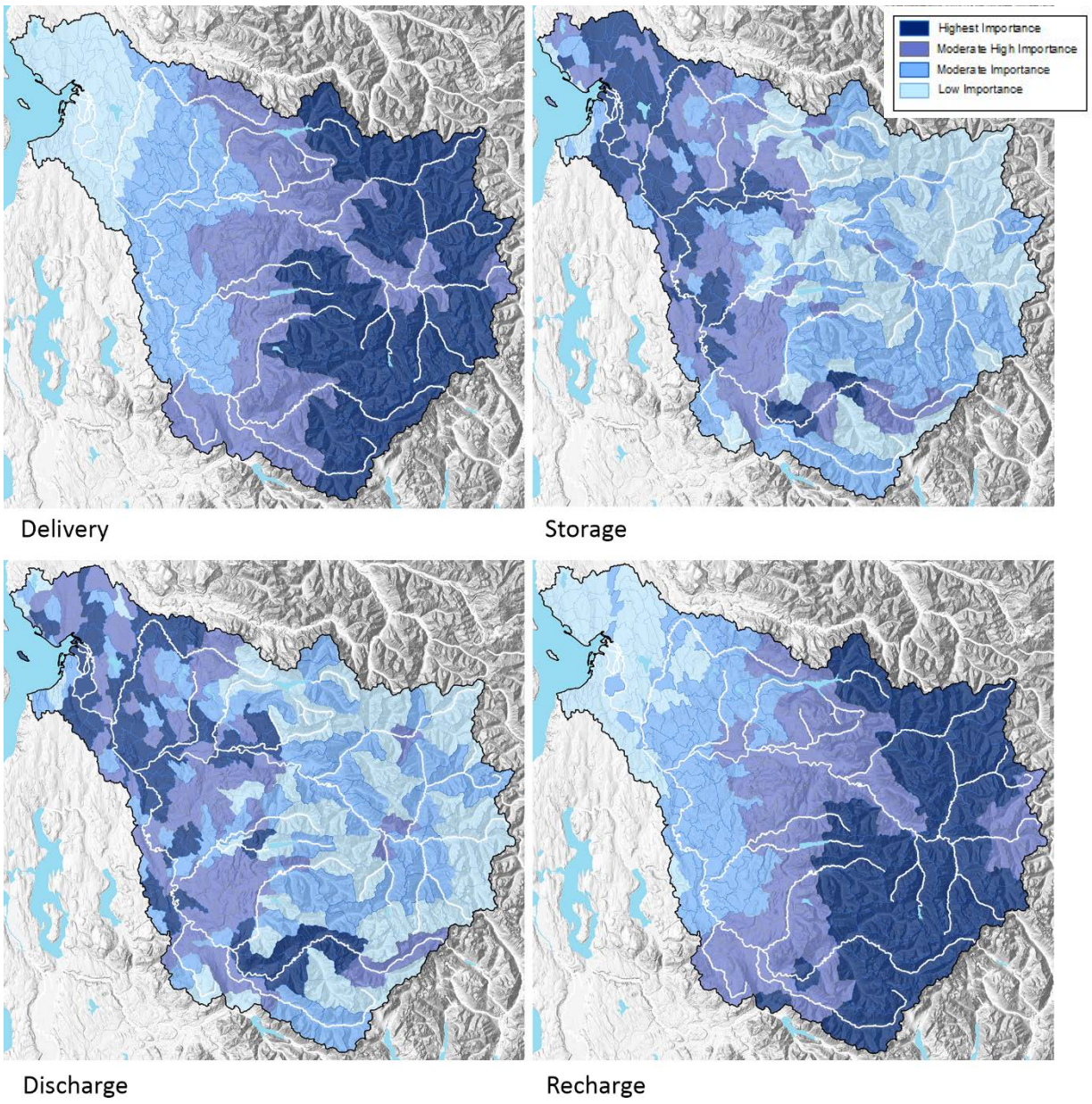


Figure 10: Scale 1 Hydrologic Components Importance Maps

Interpretation of the results patterns reveal that in the upper watershed, forested headwaters with high precipitation are critical in maintaining delivery. Where these areas lose forest cover, delivery will be impacted. Many of the same areas with appropriate geology also maintain recharge for the movement of water through the slope down-watershed. These areas would be affected by compaction and impervious surface.

In the lower watershed, discharge is related to valley-bottom coarse sediment floodplains. These areas could be affected by anything that intercepted the movement of water throughout the floodplains and into channels such as wells or revetments. Storage in the lowlands is identified as important where there are depressional features. Regrading or filling these surfaces could result in a loss of function.

In Tables 1 through 3, results are color-coded to indicate applicable Puget Sound Watershed Characterization scales:

Scale 1

Scale 2

Scale 3

The patterns across the landscape remain consistent as the analysis zooms in from Scale 1 to more the more refined Scale 3. In order to facilitate quick reference of results, Table 1 shows a summary of the importance of the watershed characterization hydrology components at the three scales and information regarding locations in the Basin where the particular components are most important. Table 2 presents the results of the habitat model and assessment of protection considerations at a planning unit scale (Scale 3). Table 3 presents a summary of the information gathered in the technical assessment for each Scale 3 planning unit. More detailed technical assessment results—including lenses such as expected hydrological change due to climate change, current fish use, and local opportunities—are provided by planning unit in Appendix A.

Table 1: Highest Importance Watershed Characterization Model Outputs for Scales 1 through 3

Geographic Extent (Scale)	Overall Flow Importance Model	Delivery Importance Model	Surface Storage Importance Model	Recharge Importance Model	Discharge Importance Model
Scale 1					
Snohomish River Basin	• Upper watersheds of Snoqualmie and Skykomish basins • In particular, Upper Snoqualmie, Upper South Fork Skykomish, and Upper North Fork Skykomish planning units contain significant proportions of AUs ranked highest or moderate-high for importance to overall water flow processes	• North Fork Skykomish, Upper South Fork Skykomish, and Upper Snoqualmie • To a lesser extent, Sultan, Tolt, and Upper Pilchuck rivers	• Lower Snohomish mainstem near estuary and lower portions of Pilchuck River • Areas of the lower portion of Skykomish mainstem, Woods Creek, and Sultan River • Snoqualmie mainstem, Cherry Creek, and Upper Snoqualmie are of moderate importance	• Snoqualmie River basin • Skykomish River basin	• Snohomish and Snoqualmie rivers • Lower Pilchuck and estuary drainages • To a lesser degree, Upper Snoqualmie, Skykomish mainstem, and lower middle Skykomish
Scale 2					
Snohomish Mainstem	• Pilchuck and Snohomish rivers mainstem planning units • Estuary drainage also contain some moderate-high to high ranked AUs	• Upper Pilchuck • Eastern drainage of Snohomish mainstem	• Snohomish mainstem • Snohomish estuary • Lower Pilchuck (at a moderate-high degree)	• Upper Pilchuck • Eastern portion of Snohomish mainstem • Quilceda Creek	• Pilchuck mainstem • Allen Creek • Snohomish mainstem
Snoqualmie Mainstem	• Upper Snoqualmie planning unit, though some areas of highest and moderate-high-ranked AUs can be found in North and South Forks Tolt River, as well as lower Snoqualmie mainstem • Generally, Upper Snoqualmie ranks highest for overall importance, followed by Tolt and Raging rivers planning units	• Upper Snoqualmie (all three forks) • North and South Forks Tolt River	• Snoqualmie mainstem • Patterson and Cherry creeks • Middle Fork Upper Snoqualmie	• Upper Snoqualmie • Tolt • To a lesser degree, Raging River and Snoqualmie mainstem	• Snoqualmie mainstem • Cherry and Patterson Creek • Middle Fork Upper Snoqualmie
Skykomish Mainstem	• Upper reaches of South Fork Skykomish, Upper North Fork Skykomish, and Sultan River planning units • Skykomish mainstem • Upper North Fork Skykomish and Upper South Fork Skykomish rank highest in Skykomish basin for overall importance to water flow process	• Upper portions of North and South Forks are the most important to delivery • Sultan River is of moderate importance	• Woods Creek • Skykomish mainstem • Lower Sultan • Lower middle Skykomish	• North and South Forks Skykomish River • Upper Sultan River	• Skykomish mainstem • Woods Creek • Lower Sultan River • Olney Creek
Scale 3					
Above the Snoqualmie Falls	• Entire Middle Fork Snoqualmie • Taylor River • Tate Creek	• Headwaters • Eastern extents of Upper North Fork • Middle Fork Snoqualmie	• Lower-mid Middle Fork Snoqualmie • Coal Creek • Tate Creek (around North Bend and Snoqualmie)	• Taylor River • Eastern headwaters • Upper portions of North and Middle Forks	• Middle Fork Snoqualmie • Tate Creek • Coal Creek • Northern tributaries of North Fork Snoqualmie

Geographic Extent (Scale)	Overall Flow Importance Model	Delivery Importance Model	Surface Storage Importance Model	Recharge Importance Model	Discharge Importance Model
Snohomish Estuary Drainages	• East Fork Quilceda Creek • Allen Creek drainage	• Upper portion of Quilceda Creek (specifically, East Fork south of Arlington)	• Areas near confluence of West and East Forks Quilceda • Allen Creek drainage	• Primarily, East and West Forks Quilceda Creek (excluding headwaters of East Fork)	• Lower East Fork Quilceda • Allen Creek drainage
Lower Mid Skykomish	• Lower middle Skykomish	• Upper Wallace River • May Creek • Lower reaches of Olney Creek	• Headwaters in Upper Wallace Creek • Upper Olney Creek • Upper May Creek	• Mid-lower Olney Creek • Upper Bear Creek • Lower May Creek (around Gold Bar) • Confluence of Wallace River with May and Olney creeks	• Upper Olney Creek • Upper Wallace River • Upper May Creek • Lower May Creek
Lowland Snoqualmie Tributaries	• Mid-lower Patterson Creek • Eastern headwaters of Cherry Creek • Lower Cherry Creek near confluence with Snoqualmie River (near Duvall) • Mid-upper portion of Harris Creek	• Headwaters of Patterson Creek • Eastern headwaters of Cherry Creek	• Northern headwaters of Patterson Creek • Lower Patterson near confluence with Snoqualmie River • Harris Creek • Lower Cherry Creek near confluence with Snoqualmie (near Duvall)	• Mid-lower Patterson Creek • Cherry Creek	• Mid-lower Patterson Creek • Mid-lower Harris Creek • Lower Cherry Creek
Mid Snoqualmie Tributaries	• Headwaters of Tokul Creek (Canyon Creek, Beaver Creek, and Ten Creek drainages) • Western portions of Griffin Creek drainage	• Eastern portion of Tokul Creek drainage (including Beaver Creek and Ten Creek drainages)	• Western drainage of Griffin Creek • Southern drainage of Tokul Creek	• Eastern portion of Tokul Creek drainage (including Beaver Creek and Ten Creek drainages)	• Griffin Creek drainage • Beaver and Ten Creek drainages
North Fork Skykomish	• Lower North Fork Skykomish (around Index and up to Bitter Creek) • Mid North Fork (from Silver Creek to Goblin Creek)	• Upper North Fork Skykomish • West Cady Creek	• North Fork Skykomish from Bear Creek down to confluence with South Fork Skykomish (around Index)	• Upper North Fork Skykomish including west Cady Creek, Goblin Creek, and Troublesome Creek drainages	• Lower-mid North Fork Skykomish
Pilchuck	• Upper headwaters of Pilchuck • Portions of middle Pilchuck between Granite Falls and Lake Stevens • Mouth of Pilchuck near Snohomish	• Headwaters in Upper Pilchuck down to Granite Falls	• Areas around Lake Stevens • Catherine Creek • Little Pilchuck • Portions of middle Pilchuck • Mouth of Pilchuck near Snohomish	• Headwaters of Upper Pilchuck • Tributaries near Granite Falls • Mouth of Pilchuck near Snohomish	• Areas around Granite Falls down to confluence of Dubuque and Little Pilchuck • Worthy Creek • Upper Panther Creek • Lower Pilchuck near confluence of Snohomish
Puget Sound Drainages	• Tulalip Creek and Mission Creek drainages (on Tulalip reservation)	• Drainages around Port Gardner • Japanese Gulch Creek • Merrill Creek • Ring Creek • Pigeon Creek drainage	• Tulalip Creek • Mission Creek drainage	• Tulalip Creek • Mission Creek • Japanese Gulch • Merrill Creek • Ring Creek	• Tulalip Creek • Mission Creek
Raging River	• Headwaters rank moderately high in importance to basin hydrology	• Headwaters (near Tiger Mountain)	• Mouth of Raging River near Preston and Fall City	• Headwaters (near Tiger Mountain) • Middle portion of basin	• Mouth of Raging River near Preston and Fall City

Geographic Extent (Scale)	Overall Flow Importance Model	Delivery Importance Model	Surface Storage Importance Model	Recharge Importance Model	Discharge Importance Model
South Fork Skykomish	• Lower South Fork Skykomish drainage from confluence with North Fork up to confluence with Miller River (excluding Index Creek, Barclay Creek, and Money Creek drainages) • East Fork Miller River drainage • West Fork Foss drainage • Lower Tye River drainage	• Rapid River • Miller River • Foss River • Deception Creek drainage	• South Fork Skykomish mainstem • Upper Miller River • West Fork Foss River • Alpine Creek drainage	• Miller River • Foss River • Rapid River • Johnson Creek drainage	• South Fork Skykomish mainstem from confluence with North Fork up to confluences with Beckler/Rapid, Tye, Foss, and Miller rivers
Sultan	• Upper Sultan River (upstream of Spada Lake) • Lower Sultan (up to Woods Creek)	• Headwaters and upper portions of Sultan River	• Lower Sultan • Spada Lake	• Upper Sultan (upstream of Spada Lake)	• Lower Sultan (near Sultan and up to Woods Creek)
Tolt	• Lower Tolt River (near Carnation) • Upper South Fork Tolt	• Upper portions of North and South Forks Tolt	• South Fork Tolt (below South Fork reservoir) • Drainage below confluence of North and South Forks Tolt	• Eastern headwaters of North and South Forks Tolt • Areas directly below South Fork reservoir	• North Fork Creek drainage • Areas directly below South Fork reservoir • Lower Tolt near Carnation
Woods	• Primarily, East Fork from confluence with Rosinger Creek down to confluence with West Fork • Richardson Creek drainage	• East Fork Woods Creek	• Lower East Fork • Richardson Creek • Below confluence of East and West Forks	• East Fork from confluence with Rosinger Creek down to confluence with West Fork • Richardson Creek	• East Fork from confluence with Rosinger Creek down to confluence with West Fork • Richardson Creek

Notes:
AUs = Assessment Unit (a smaller basins broken out within a planning unit that allowed the Watershed Characterization Model to be run at a more refined scale)

Table 2: Habitat Model Outputs and Assessment of Protection Considerations for Scale 3 (Planning Units)

Planning Unit	Habitat Model	Protection Consideration
Scale 3		
Above the Snoqualmie Falls	• Generally, North and Middle Forks Snoqualmie have higher watershed habitat indices than South Fork Snoqualmie and western drainages • Upper portions of North and Middle Forks, in addition to Taylor River, displayed the highest watershed habitat values • While habitat potential is good, Snoqualmie Falls is a natural barrier that prevents anadromous fish from being able to access this habitat	• North Fork: protection of delivery and recharge; restoration of delivery and recharge processes in mid reaches • Middle Fork: restoration of storage and protection of delivery and recharge • South Fork: protection of delivery and recharge processes
Snohomish Estuary Drainages	• West Fork Quilceda Creek • Allen Creek drainage • Majority of eastern drainages into Ebey Slough	• Restoration of surface storage • Protection of recharge and delivery
Lower Mid Skykomish	• Mid-lower Olney Creek • Mid-lower May Creek	• Wallace River • Lower Olney Creek • Lower May Creek (around Gold Bar)
Lowland Snoqualmie Tributaries	• Generally, Cherry and Harris creeks have higher watershed habitat values than Patterson and Ames creeks • Within Cherry-Harris Creek area, mid-lower Cherry Creek near Duvall and northern tributaries of middle Cherry Creek have high watershed habitat values	• Cherry Creek: restoration of discharge and surfaces storage processes • Patterson Creek: restoration of discharge and surface storage processes
Mid Snoqualmie Tributaries	• Griffin Creek • Tokul Creek	• Protection and restoration of surface storage and discharge
North Fork Skykomish	• Lower North Fork Skykomish (near Index) • Areas around Bear and San Juan creeks	• Protection of delivery • Protection and restoration of recharge
Pilchuck	• Specifically, from confluence of Little Pilchuck and middle Pilchuck up to Purdy Creek • Upper portion of Dubuque Creek • Upper portion of Little Pilchuck Creek	• Highest protection in upper watershed • Protection of recharge and delivery in upper watershed • Restoration of discharge and surface storage in lower watershed
Puget Sound Drainages	• Lower Tulalip Creek and lower Mission Creek drainages have the highest watershed index values • Among those, lower Mission Creek drainage has the highest watershed habitat indices	• Northern drainages around Tulalip Creek: protection of surface storage and recharge and discharge • Restoration of discharge, delivery, and recharge in southern drainages
Raging River	• Best habitat is in lower portions of Raging River • Upper reaches of Raging are considered moderate quality or importance	• Protect delivery and recharge in upper watershed
South Fork Skykomish	• Lower portions of South Fork Skykomish mainstem drainages (downstream of Index Creek confluence), areas around confluence of Miller River, and areas around confluence of Foss with Tye rivers have the highest watershed index values • Deception Creek drainage in Tye River drainage was also characterized as having high watershed habitat indices	• Northern tributaries: restore recharge and protect and restore delivery • Southern tributaries: protect recharge and delivery • South Fork mainstem: restore surface storage
Sultan	• Much of Sultan has high watershed habitat value; however, lower portions near Sultan, areas below Spada Lake, and Elk Creek drainage have the highest habitat values because above Spada Lake reservoir there is no passage for anadromous fish at the Jackson Dam	• Upper watershed: protection of surface storage and recharge • Lower watershed: restoration of discharge and surface storage
Tolt	• All of drainages below confluence of North and South Forks Tolt have high watershed habitat values. Specifically, the areas directly below South Fork reservoir and lower Tolt near Carnation have the highest habitat values. • Only spawning reach for summer steelhead in South Fork Tolt is below dam, which is highlighted as a unique population in the distinct population segment	• North Fork: restoration of delivery and protection of recharge • South Fork: protection and restoration of delivery and recharge • Mainstem: protection and restoration of surface storage
Woods	• Much of Woods Creek has high watershed habitat value, with the Richardson Creek drainage, Upper West and East Forks drainages (area at top of the East Fork is not accessible to anadromy), and areas near the confluence of the West and East Forks having the highest habitat values	• Restoration of surface storage and discharge

Table 3: Information Sources included in Scale 3 (Planning Units) for the SBPP Technical Approach

Planning Unit	Salmonid Use[1, 2]	Precipitation Regime	Primary Land Uses	Life Cycle Limiting Factors	Current and Future Pressures	Ecosystem Services	Climate Change Impacts	Existing Protection Strategies in Unit	Opportunities
Scale 3									
Above the Snoqualmie Falls	No anadromous fish use (assumed bull trout presence)	• Highland (30%) • Snow Dominant (26%) • Rain on Snow (21%) • Rain Dominant (18%)	• Forestry (91%) • Rural Residential (6%) • Cities (3%)	NA; anadromous fish not present in this planning unit	• City growth and rural residential development • Forestry practices • Water withdrawals • High water temperatures • Revetments/levees disconnect river from floodplain • Limited large wood recruitment from logging and development	• Flood regulation • Water quality regulation • Drinking water provisioning • Recreation • Energy production • Spawning • Water storage • Disturbance prevention	• Minimal increase for pre-spawning temperature (Battin et al. 2007) • Shift to earlier runoff timing and increases in magnitude of extreme precipitation and discharge events (King County 2010)	• PBRS 0.3% • Forestland 16.1% • Agriculture 0.1% • FPP 0.1% • Public 77.2% (12.6% of basin in TDR and 30.8% of basin in wilderness protection)	• Decrease private inholdings surrounded by public land • Study impacts of groundwater withdrawals on instream flows and groundwater • Acquire TDRs in key areas of hydrologic importance • Ensure timber harvest methods are protective of hydrology
Estuary Drainages	• Chinook salmon/bull trout use = low • Bull trout = presumed presence • Coho salmon use = low to moderate • Steelhead = present	• Lowland (100%)	• Rural Residential (34.7%) • City (45%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • Estuarine rearing • River outmigration	• Continued expansion of UGAs • Industrial development along mainstem	• Recreation • Irrigation	No data for spawning and incubation	• Public Lands (11.3%) • Agriculture (0.9%) • Timber (2.0%) • Open Space (1.0%)	• Implement LID for future development • Protect lands in floodplains for future levee setbacks • Protect urban trees • Protect open space and agriculture in estuary areas under the Comprehensive Plan
Lower Middle Skykomish	• Wallace River = Chinook = moderate; coho/bull trout = low use; steelhead = present • Olney Creek = no Chinook salmon use; bull trout/coho presumed use; steelhead = present • Bear Creek = no Chinook salmon use; bull trout/coho = low; steelhead = modeled presence • May Creek = moderate Chinook use; bull trout/coho = low use; steelhead = present	• Rain Dominant (39.1%) • Rain on Snow (22.9%) • Snow Dominant (20.4%) • Highland (10.7%) • Lowland (7%)	• Forestry (88.6%) • Rural Residential (7.7%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • River outmigration	• Most important areas for hydrology are in and near cities; future development will have impacts on hydrology • Conversion of forest land to rural residential • Dredge mining in upper areas of lower middle Skykomish • Areas of agriculture that correspond to key areas of surface storage will need to be maintained	• Flood regulation • Water quality regulation • Recreation • Hatchery water supply • Storage • Water quantity regulation	• Small to significant increase in incubation peak flow • Minimal to moderate decrease (Upper Wallace) in minimum spawning flow • Minimal change to moderate increase (Olney) in pre-spawning temperature • Change in average number of adult Chinook spawners: slight decrease in one of six scenarios in May Creek • No change or slight increase in others	• Public Lands (65.7%) • Timberlands (22.4%) • Open Space (0.2%)	• Protect forestlands from conversion • Ensure protective timber harvest methods and allow for adaptive management in the face of climate change • Work on acquiring TDRs in key areas of hydrologic importance • Decrease private inholdings surrounded by public lands • Protect floodplain areas between Highway 2 and Snohomish River, upstream of Start Up levee; area is important for surface storage and discharge • Use LID in cities and UGA • Use inventive programs in residential areas

Planning Unit	Salmonid Use[1, 2]	Precipitation Regime	Primary Land Uses	Life Cycle Limiting Factors	Current and Future Pressures	Ecosystem Services	Climate Change Impacts	Existing Protection Strategies in Unit	Opportunities
Lowland Snoqualmie Tributaries	• Cherry Creek: - Chinook salmon/ bull trout use = low - Coho = high - Steelhead = present • Harris Creek: - Chinook salmon/ bull trout use = low - Coho = moderate - Steelhead = present • Ames Creek: - Chinook salmon = none - Coho/bull trout = low - Steelhead = presumed presence • Patterson Creek: - Chinook salmon/ bull trout use = low - Coho = moderate - Steelhead = present	• Lowland (74%) • Rain Dominant (25%) • Rain on Snow (1%)	• Rural Residential (60.2%) • Forestry (27.9%) • Agriculture (8%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • River outmigration	• Conversion of forestry lands to rural residential development • Growth of cities and UGAs • Increase of water withdrawals in rural residential areas (Cherry)	• Flood regulation • Water quality regulation • Recreation • Irrigation • Storage • Water quantity regulation	• Moderate increase in incubation peak flow • Minimal decrease in minimum spawning flow • No change to minimal increase in pre-spawning temperature • Change in average number of adult Chinook spawners: - Cherry/Harris creeks: increase in all scenarios - Patterson/Ames: assumed decrease in all scenarios (Battin et al. 2007)	• Public Lands (21%) • Forestlands (13%) • Agriculture Lands (8%) • PBRS (7%)	• Implement stormwater regulations as cities grow • Ensure that timber harvest methods are protective of hydrology and can adaptively manage with climate change • Acquire TDRs in key areas of hydrologic importance • Continue to enhance open spaces—limit conversions • Enroll rural residential properties into appropriate CUT • Decrease number of private inholdings surrounded by public lands • Study groundwater withdrawals to understand impacts on instream flows and groundwater recharge
Mid Snoqualmie Tributaries	• Chinook salmon = low use • Coho = high use (Griffin) and low use (Tokul) • Bull trout = presumed presence) • Steelhead = present	• Rain Dominant (89%) • Rain on Snow (2%) • Lowland (9%)	• Forestry (96.1%) • Rural Residential (2.8%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • River outmigration	• Biological resource use—in particular, timber harvest • Natural system modification • Human intrusions and disturbance • Development • Invasive and problematic species	• Flood regulation • Water quality regulation • Recreation • Irrigation • Storage • Water quantity regulation	• Moderate increase in incubation peak flow • Minimal decrease in minimum spawning flow • Moderate increase in pre-spawning temperature • Moderate decrease in average number of adult Chinook spawners in four of six scenarios (Battin et al. 2007)	• Forestland (95%) • PBRS 0.3% • Agriculture CUT 1% • Public Lands 1% • 0.3% of Agriculture Land is in FPP • 92% of forestlands in TDR	• Place non-protected parcels into appropriate CUT programs, particularly in hydrologically important areas • Ensure timber harvest methods are protective of hydrology

Planning Unit	Salmonid Use[1, 2]	Precipitation Regime	Primary Land Uses	Life Cycle Limiting Factors	Current and Future Pressures	Ecosystem Services	Climate Change Impacts	Existing Protection Strategies in Unit	Opportunities
North Fork Skykomish	• Chinook Salmon = low • Bull trout = known presence to high • Coho = high use (known use in upper reaches) • Steelhead = present	• Highlands (46.4%) • Snow Dominant (27.4%) • Rain on Snow (18.8%) • Rain Dominant (7.4%)	• Forestry (99.9%) • City (0.1%)	None identified	• New roads • Bank hardening for road protection • Geothermal/hydropower exploration	• Recreation	• Incubation peak flow: moderate to major increase • Minimum spawning flow: moderate to major decrease • Pre-spawning temperature: minimal to moderate increase • Change in average number of adult Chinook spawners: moderate decrease	• Public Lands (84.1%) • Timberlands (0.5%) • Open Space (0.1%)	• Educate the population in this basin and recreational users about the importance of leaving wood in the river system and not harvesting it for firewood • Use LID techniques in and around the Town of Skykomish • Protect hydrology as exploration of geothermal and hydropower increase in the area • Encourage acquisition of private inholdings in and around public lands
Pilchuck	• Chinook salmon = low • Bull trout = presumed presence • Coho = known presence to moderate • Steelhead = present	• Rain on Snow (33.1%) • Lowland (56.7%)	• Rural Residential (51.1%) • Forestry (37.9%)	• Upriver migration • Spawning • Egg development • Freshwater rearing • River outmigration	• Conversion of forest land and farmland to rural residential • Additional bank armoring • Loss of critical areas • Increased flooding and diking with climate change • Loss of wood in river due to firewood	• Flood regulation • Water quality regulation • Drinking water provisioning • Recreation • Water quantity regulation	• Incubation peak flow: moderate increase • Minimal decrease in pre-spawning minimum spawning flow • No change to minimal increase in temperature	• Public Lands (35.2%) • Timberlands (6.7%) • Agriculture (2.3%) • Open Space (1.8%)	• Protect forestry and agricultural lands from conversion • Use PDR/TDR to purchase development rights in agricultural land • Buy development rights in areas currently forested that are zoned rural residential • Study impacts of exempt wells on basin hydrology and find ways to minimize those impacts
Puget Sound Drainages	• Tulalip/Battle Creek: - Chinook salmon = none - Bull trout = none - Coho = none - Steelhead = present • Everett Coastal: - Chinook salmon = none - Bull trout = low - Coho= low - Steelhead = present	• Lowland (100%)	• Cities (39.4%) • Rural Residential (32.1%) • Tribal Land (27.1%)	Freshwater rearing	• Transportation infrastructure	• Recreation • Water storage (artificial)	None listed	• Public Lands (9.7%) • Timberlands (2.2%) • Open Space (1.2%)	• Use acquisitions to acquire key areas such as wetlands • Cities should use best management practices when it comes to LID • Snohomish County could adopt a PBRS (very similar to Open Space CUT program) that could potentially allow more urban property owners to take advantage of a CUT program

Planning Unit	Salmonid Use[1, 2]	Precipitation Regime	Primary Land Uses	Life Cycle Limiting Factors	Current and Future Pressures	Ecosystem Services	Climate Change Impacts	Existing Protection Strategies in Unit	Opportunities
Raging River	• Chinook salmon = high use • Coho = moderate • Bull trout = presumed presence • Steelhead = present	• Rain Dominant (63.1%) • Rain on Snow (27.9%) • Lowland (4.5%) • Snow Dominant (4.4%)	• Forestry (72.6%) • Rural Residential (24.6%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • River outmigration	• Biological resource use—in particular, timber harvest • Natural system modification • Human intrusions and disturbance • Development • Invasive and problematic species	• Flood regulation • Water quality regulation • Recreation • Storage • Water quantity regulation	• Slight decrease in incubation peak flow • Minimal decrease in minimum spawning flow • Moderate increase in pre-spawning temperature • Decrease in average number of adult Chinook spawners in five of six scenarios (Battin et al. 2007)	• Public Lands (79.2%) • TDR (20%) • Forestlands (3.6%) • PBRS (2.2%) • Agriculture (0.3%)	• Try to capture any DNR Public Trust lands to avoid being put into private ownership • Ensure timber methods are protective of hydrology • Enroll private properties into CUT programs • Decrease private inholdings surrounded by public land
South Fork Skykomish	• Chinook = high use (Upper South Fork) and low use (South Fork) • Coho = known presence • Bull trout = known presence) • Steelhead = present	• Highland (47.9%) • Snow Dominant (24.1%) • Rain on Snow (19.1%) • Rain Dominant (8.9%)	• Forestry (98.1%) • Rural Residential (1.8%) • Cities (0.1%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • River outmigration	• Timber harvest • Removal of large woody debris • Natural system modification • Human intrusions and disturbance • Development • Geothermal energy, oil, gas, and mineral • Hydropower	• Flood regulation • Water quality regulation • Recreation • Storage • Water quantity regulation • Disturbance prevention	• Moderate increase in incubation peak flow • Moderate decrease in minimum spawning flow • Minimal increase in pre-spawning temperature • Decrease in average number of adult Chinook spawners	• Public Lands (94.2%) • Forestlands (5.76%)	• Acquire key parcels to protect hydrology in the face of development • Explore beaver reintroduction to improve hydrologic conditions • Continue to use current minimum road strategy implemented by USFS • Improve and relocate bridges, roads, and railways to improve hydrologic conditions • Engage in planning processes for hydropower development, geothermal energy development, and oil, gas, and mineral resource development proposals to ensure hydrology is not further degraded • Decrease number of private inholdings in public areas • Ensure timber harvest methods are protective of hydrology

Planning Unit	Salmonid Use[1, 2]	Precipitation Regime	Primary Land Uses	Life Cycle Limiting Factors	Current and Future Pressures	Ecosystem Services	Climate Change Impacts	Existing Protection Strategies in Unit	Opportunities
Sultan	• Chinook = high use (in the river downstream of the City of Everett Diversion Dam) • Coho = known presence • Bull trout = presumed presence • Steelhead = present	• Rain Dominant (27.9%) • Rain on Snow (25.9%) • Snow Dominant (22.7%) • Highland (15.7%) • Lowland (7.2%)	• Forestry (90.4%) • City (5.6%)	• Freshwater rearing (currently debatable)	• Timber harvest • Natural system modification (bank hardening) in lower watershed • Development in lower watershed • Invasive species	• Flood regulation • Water quality regulation • Drinking water provisioning • Recreation • Energy production • Storage • Water quantity regulation	Hydrology largely regulated by Culmback Dam for next 45 years	• Public Lands (89.6%) • Timberlands (3.2%)	• Enroll lands into CUT programs • Reduce number of private inholdings in public lands through targeted acquisitions • Ensure that forestry practices are using best available management practices for harvesting • Use LID practices • Focus education programs on importance of stream buffers
Tolt	• Chinook salmon = high use below forks and low use above forks • Coho = high use below forks and low use above forks • Bull trout = presumed presence • Steelhead = present	• Rain Dominant (35.4%) • Rain on Snow (24.2%) • Snow Dominant (21.8%) • Lowland (10.1%)	• Forestry (92.7%) • Rural Residential (3.83%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • River outmigration	• Floodplain disconnection • Lack of natural cover leading to a lack of habitat in Lower Tolt • Sediment impacts from historic gravel removal • Residential development • Invasive and problematic species	• Flood regulation • Water quality regulation • Drinking water provisioning • Recreation • Energy production • Storage • Water quantity regulation	• Significant increase in incubation peak flow • Minimal decrease in minimum spawning flow • Moderate increase in pre-spawning temperature • Decrease in average number of adult Chinook spawners in five of six scenarios • Hydrology will be largely regulated by South Fork Tolt dam (Battin et al. 2007) • Some models predicting decreased low flows, higher frequency of high flow events, and increased annual peak flow (King County 2010)	• Forestlands (72.9%) • TDR (65.2%) • Public Lands (40.1%) • PBRS (0.6%) • Agriculture (0.3%) • FPP (0.2%)	• Continue acquisitions and levee setbacks • Decrease private inholdings surrounded by public lands • Ensure timber harvest methods are protective of hydrology • Support and improve small forestry owner-harvest methods • Participate in South Fork project relicensing to ensure protection of hydrology

Planning Unit	Salmonid Use[1, 2]	Precipitation Regime	Primary Land Uses	Life Cycle Limiting Factors	Current and Future Pressures	Ecosystem Services	Climate Change Impacts	Existing Protection Strategies in Unit	Opportunities
Woods	• Chinook = low use • Bull trout = presumed presence • Coho = moderate use • Steelhead = present	• Rain Dominant (51.5%) • Lowland (48.5%)	• Rural Residential (51.3%) • Forestry (42.1%)	• Upriver migration • Spawning • Egg deposition • Egg development • Freshwater rearing • Hydrology: frequency	• Conversion of open space to residential development • UGA expansion – City of Monroe • Loss of critical areas • Loss of beaver ponds/wetlands	• Flood regulation • Water quality regulation • Drinking water provisioning (exempt wells) • Recreation • Energy production • Irrigation • Hatchery water supply	• No increase to moderate increase in incubation peak flow • Minimal decrease in minimum spawning flow • Minimal increase in pre-spawning temperature • Decrease or little change in average number of adult Chinook spawners in four of six scenarios	• Public Lands (43.9%) • Timberlands (10.8%) • Agriculture (0.8%) • Open Space (1.6%)	• Decrease number of private inholdings surrounded by public lands • Work on acquiring TDRs in key areas of hydrologic importance • Enroll properties in CUT Program • Implement LID in cities and rural residential areas • Increase education with homeowners on importance of stream buffers

Notes:
1 Chinook salmon, bull trout, and coho salmon data from the Ecological Analysis for Salmonid Conservation
2 Steelhead data from Washington Department of Fish and Wildlife Salmonscape
CUT = Current Use Taxation
DNR = Washington State Department of Natural Resources
FPP = Farmland Preservation Program
LID = Low Impact Development
NA = not applicable
PBRS = Public Benefit Rating System
PDR = Purchase of Development Rights
TDR = Transfer of Development Rights
UGA = Urban Growth Area
USFS = U.S. Forest Service

Section 4

PROTECTION TOOLS

This section provides descriptions of a wide range of protection tools—both those in existence and potential tools—and presents assessments of the tools in relation to Basin hydrology. Readers should consider the relative hydrological importance in their areas of interest, the current and potential land uses, and other pertinent information (such as expected hydrological change or fish considerations) to determine which protection tool opportunities are available in their area of interest and what they have the ability to govern (e.g., via regulation) or implement through other programs, such as voluntary measures.

*For purposes of the SBPP, a **protection tool** is any action that prevents the degradation of hydrologic processes that support salmon or salmon habitat, regardless of how degraded those processes currently are. In this context, protection tools are different from **restoration** or **mitigation approaches**, which refer to actions resulting in physical alterations that improve hydrologic processes.*

4.1 Overview

4.1.1 Purpose

Basin partners have made significant investments to develop strategies and tools within the Basin that meet the definition of protection tools in the SBPP. Some of the tools were specifically developed to protect hydrologic function, while others were developed to achieve different objectives. For this chapter of the SBPP, the project team identified, categorized, and conducted assessments of these existing tools, as well as new and emerging tools. The purpose of these assessments is to inform planning and decision-making as relates to protecting hydrologic function in the Basin.

4.1.2 Approach

The protection tools included in Sections 4.2 through 4.6 range from those that are in use across the Basin, to those that have been implemented in certain jurisdictions, to conceptual tools that have not yet been tested. These tools were assessed at a high level, with the objective of helping decision-makers

understand the range of tools available to them as they develop viable near-term actions to help implement the SBPP. To accomplish this objective, the project team assessed each protection tool based on the following criteria:

- *Geographical scale* – Is the tool implemented Basin-wide, by jurisdiction, or at the individual project/property scale?
- *Existence and feasibility* – Is the tool in use? Is the tool technically feasible?
- *Effectiveness* – From a general qualitative standpoint, does the tool achieve protection?
- *Hydrological benefits* – How does the tool affect the hydrology of the Basin? To what degree does use of the tool result in desired hydrological outcomes?
- *Affordability* – Is the tool economically feasible? Are there any public costs, and are they reasonable?
- *Actionable* – Can the tool be used now or in the near future?

Figure 11 illustrates how these six criteria informed the assessment and recommendations of the project team.

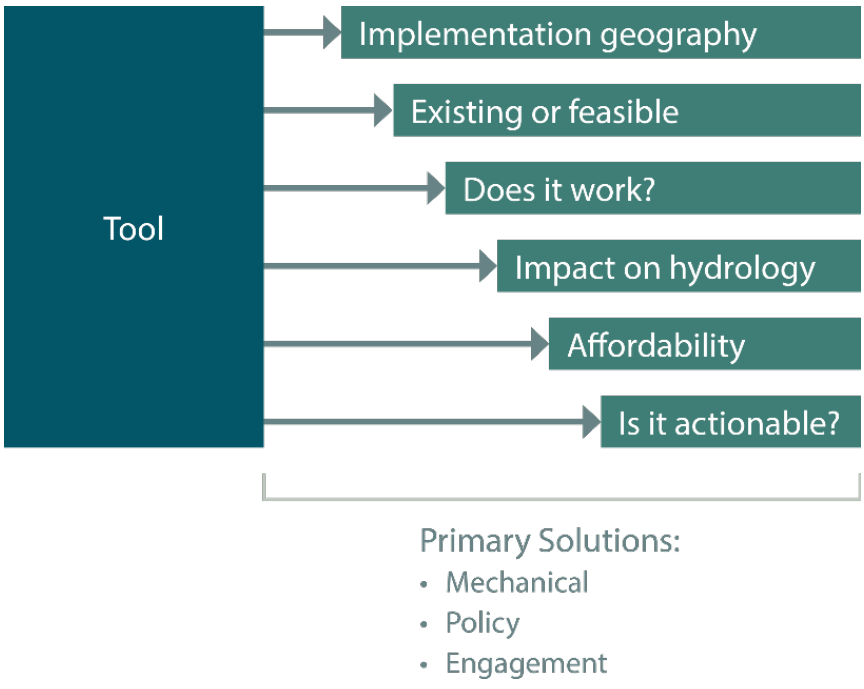


Figure 11: Protection Tools Assessment Flow Chart

The assessments presented in Sections 4.2 through 4.6 suggest where existing tools could be improved, introduce appropriate tools that are being implemented elsewhere in the region, and identify new and innovative tools that would be appropriate for the Basin.

4.1.3 Considerations

In its assessments of protection tools, the project team considered the geographic scales at which the tools are primarily applied. For the purposes of this section, protection tools are considered to be implemented at the following levels:

- *Basin-wide* – available uniformly throughout the Basin regardless of jurisdiction
- *Jurisdictional level (city or county)* – may be used by all of the jurisdictions within the Basin, although the way in which it is implemented likely varies across jurisdictions
- *Individual properties or projects* – may be implemented without the involvement of a jurisdiction

For those tools not available Basin-wide, opportunities for alignment between jurisdictions and between agencies within a jurisdiction were considered in the assessments. It is important to recognize the role of the Tulalip Tribes in the Basin, as their involvement in advancing and implementing protection efforts spans all levels listed above. The Tulalip Tribes manage protection strategies within the extent of their reservation and participate in a wide range of projects, fora, initiatives, and partnerships that use many of the land protection tools described in this chapter. Protection efforts in which the Tulalip Tribes participate largely overlap with existing Basin-wide tools, strategies, and assessments.

4.1.4 Recommendations

Following the assessment of each protection tool in Sections 4.2 through 4.6 are recommendations that focus on areas of opportunity to best implement the tool. These recommendations are grouped into three categories:

The expansion of engagement efforts is applicable to all protection tools and is a universal opportunity for improving the effectiveness of tools included in the SBPP.

For some tools, engagement is one of the most promising opportunities, and is specifically noted in the recommendations where applicable.

- *Engagement* – characterized by education, outreach, recruitment, or other approaches to interacting with a target group (to improve protection outcomes through increased participation in a program, for example)
- *Mechanical* – characterized by specific actions to enable or improve functioning of a protection tool (creation of a market for an incentive, for example)
- *Policy* – characterized by a legislative action to create direction and regulatory framework that would enable or improve a protection tool (adoption of state legislation allowing value capture financing, for example)

Recognizing that there is a range of improvements possible for each tool, the recommendations presented in these sections emphasize actions that would have the most meaningful impact on achieving land protection and, by extension, hydrologic processes in the Basin.

4.1.5 Organization

The protection tools identified and assessed by the project team are organized in Sections 4.2 through 4.6 in the following five categories:

For a summary of the protection tools, refer to Table 8 in Section 4.7.

1. *Regulatory mechanisms* – protection tools or processes that are required by law
2. *Incentives* – measures that give individuals financial benefits for voluntarily protecting private property
3. *Acquisitions* – permanent protection tools that involve the purchase of all or a portion of an individual's property rights

4. *New models and assessments* – models or assessments that have been developed or changed since 2005 that could help focus or improve protection efforts
5. *Other tools/strategies* – protection tools or processes that do not clearly fit into the other categories

4.2 Category 1: Regulatory Mechanisms

A key component in the protection of natural resources is regulation of human activity on the landscape. In Washington State, land use regulations focus on local control rather than centralized planning and decision-making at the state level. The primary source for local regulatory authority is the Growth Management Act (GMA), under which 29 counties must prepare comprehensive plans and implement them through land use regulations. Other sources of local regulatory authority include the Shoreline Management Act, which requires local jurisdictions to regulate development on shorelines of the state, and the Planning Enabling Act, which allows cities, counties, or public regional planning organizations to regulate development through mechanisms such as zoning.

While many local regulations provide some degree of protection for hydrologic processes (either directly or indirectly), they do not align well across jurisdictions. It has therefore been difficult to achieve efficient implementation and enforcement at the Basin scale. One major challenge is that the current overarching regulatory structure is characterized by conflicting priorities (e.g., the recovery of endangered salmon versus the goals of the agricultural community). Some of these conflicts are addressed specifically in Sections 4.2.1 through 4.2.11; however, a few broad suggestions for improving regulatory alignment are also included in the recommendations for this section.

Recommendations across all Regulatory Mechanism Tools

- Pursue opportunities at the policy level for achieving greater alignment across jurisdictions, advisory and planning entities, and management regimes.
- Work to align the language and definitions used in regulations and policies.
- Use the federal definition of wetlands in local regulations, as it affords the most protection.
- Ensure that funding is provided to appropriately implement and enforce regulations.
- Increase coordination between local governments and groups pursuing Basin-wide land protection to identify opportunities for sharing information and collaborating on regulatory updates.

4.2.1 Growth Management Act

In 1990 the Washington State Legislature adopted the GMA (Revised Code of Washington [RCW] 36.70A) based on its finding that unplanned, uncoordinated growth poses a threat to sustainable economic development, quality of life, and the environment. The GMA, which has been amended annually since its adoption, requires the state's most rapidly growing counties and the cities within them to adopt comprehensive plans and development regulations that address future population growth and its impacts. These plans and regulations must be consistent with GMA goals for the following:

- Sprawl reduction
- Urban growth
- Open space and recreation
- Natural resource industries
- Environmental protection
- Shoreline management
- Public facilities and services
- Affordable housing
- Economic development
- Transportation
- Historic lands and buildings
- Permit processing
- Public participation and coordination
- Private property rights

Counties planning under the GMA must designate and direct growth to Urban Growth Areas, where public facilities and services can be provided most efficiently. In addition, all counties and cities, including those not planning under the GMA, are required to periodically review and, if necessary, revise their designations and development regulations for natural resource lands and critical areas.

An Urban Growth Area is the area of a county, as designated in a County Comprehensive Plan, where most future urban growth and development is designated to occur.

GMA

Implementation

The GMA is implemented at the Basin scale. King and Snohomish Counties, as well as all cities contained therein, are required to engage in comprehensive planning under the GMA.

Assessment

The GMA provides local jurisdictions with a framework to plan for future population growth and requires them to adopt development regulations for natural resource lands and critical areas. The GMA has additional significance in that it serves as the legal foundation for some of the other protection tools. The GMA does not have direct public costs like those associated with some protection tools; however, it does have indirect costs associated with compliance. Costs related to implementing specific elements of the GMA are discussed below. Political sensitivities around implementation of the GMA vary; however, proposed changes to the act have historically been controversial.

The GMA has had a substantial impact on land use and development patterns in the Basin, but incremental growth in rural areas continues to exert conversion pressures on the resource land base and, by extension, hydrologic processes.

Recommendations

Policy

- Strengthen protection policies and regulations to reduce the fragmentation and loss of resource lands.
- Encourage the Washington State Department of Natural Resources (DNR) to retain ownership of properties that provide hydrologic benefits, especially within Urban Growth Areas.
- Protect the boundaries between Urban Growth Areas and rural areas by focusing more effort on the retention of forest cover.

Mechanical

- Limit the exceptions, exemptions, and variances that can result in decreased function of hydrologically sensitive areas such as shorelines, wetlands, forest cover, and riparian zones.
- Increase flexibility in local permitting processes to facilitate actions that protect hydrology to a greater degree than required under regulations.

4.2.1.1 Comprehensive Plans

The first and most important step in local planning under the GMA is the development of comprehensive plans. These plans, which must be updated periodically, outline policies, goals, and implementation strategies for managing population growth and its impacts over the next 20 years. Comprehensive plans must include, at a minimum, the following elements: land use, housing, capital facilities, utilities, transportation, economic development, and parks and recreation. County plans must also include a rural element. Comprehensive plans provide key guidance to cities and counties as they consider how to best accommodate different land uses and meet multiple goals for growth and natural resource protection. The plans also play an essential role in shaping local development regulations, since the GMA requires consistency between comprehensive plans and implementing regulations.

Comprehensive Plans

Implementation

The comprehensive planning process is implemented at the city and county level, in alignment with the regional growth strategy set by the Puget Sound Regional Council. Cities and counties planning under the GMA must periodically conduct an extensive review of their comprehensive plans and development regulations and update them based on land use changes, projected population growth, and any relevant amendments to the GMA. This "periodic update" is required at least once every 8 years for most cities and counties; however, certain small, slow-growing communities are given an additional 2 years to complete their updates. In addition to conducting major updates of their comprehensive plans, many cities and counties choose to adopt minor amendments to their plans annually and regularly adopt changes to development regulations that implement the plans, including zoning regulations.

Assessment

The GMA establishes the comprehensive plan as the primary instrument for local planning. Under these plans, cities and counties designate lands for specific uses such as agriculture, timber harvesting, and rural residential development. While not strictly a regulatory mechanism, comprehensive plans articulate policy direction, objectives, and priorities for natural resource protection, and as such, are influential tools for guiding land use patterns and protecting hydrology in the Basin.

Comprehensive planning is both affordable and actionable insofar as it is a locally funded state mandate within the Basin. Political sensitivity surrounding comprehensive plan updates varies. In cases where

minor or routine revisions are made to the plans, political sensitivity is typically low. In cases involving policy shifts or substantial revisions, however, political sensitivity can be high.

Recommendations

Policy

- Fund watershed planning as part of comprehensive plan updates.
- Manage to maximize multiple objectives through the Counties' comprehensive planning processes.
- Support the development of watershed characterization information (see Section 4.5.6) at a scale relevant to every local jurisdiction in the Basin and encourage its use in comprehensive planning.

4.2.1.2 Critical Areas Regulations

The GMA requires every city and county in Washington State to adopt and regularly update critical areas regulations (CARs) to protect the functions and values of wetlands, aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas (RCW 36.70A.030(5)). During CAR updates, local jurisdictions must use the best available science to review and revise their policies and regulations for critical areas, in accordance with Chapter 365-195 Washington Administrative Code (WAC). They must also "give special consideration to conservation and protection measures necessary to preserve or enhance anadromous fisheries" (RCW 36.70A.172(1)).

CARs

Implementation

CARs are implemented at the city and county level. King County adopted major updates to its CAR in 2004; Snohomish County did so in 2015. Due to controversy surrounding the application of CAR updates to agricultural activities, the state legislature enacted a moratorium that prevented local jurisdictions from implementing new CAR provisions on agricultural lands between 2007 and 2011. (King and Snohomish Counties adopted new provisions for agricultural areas after the moratorium was lifted.) Since 2007, King and Snohomish Counties have conducted assessments on the environmental effectiveness of CAR permitting and enforcement. Both counties issued CAR monitoring reports in 2014.

Assessment

CARs are affordable and actionable, as they are required by law. These regulations play a key role in the protection of hydrology by restricting development in and around ecologically sensitive areas. For

example, they require buffers, setbacks, or other mitigation measures for development activities near wetlands and streams. CARs can be politically sensitive, as they are often viewed by landowners as placing unreasonable restrictions on their property rights or land use options.

Recommendations

Policy

- Manage for multiple benefits and include consideration of watershed characterizations in regulatory updates.

Mechanical

- Provide the latest updates regarding best available science to planners to inform regulatory updates (near-term opportunity).
- Ensure that funding is provided to appropriately enforce and implement these rules and regulations.

4.2.1.3 Zoning Regulations

The Planning Enabling Act (RCW 36.70) authorizes cities, counties, and certain regional planning commissions to regulate development through mechanisms such as zoning. Zoning regulations specify the type and density of residential, commercial, or industrial development that is allowable for a given category of land as well as what uses are permitted in different geographical areas. These regulations are updated, as needed, through the comprehensive planning process.

Zoning Regulations

Implementation

Zoning regulations are implemented at the city and county level.

Assessment

Zoning regulations are generally considered to be effective protection tools because they provide clear guidelines, standards, and permitting requirements for development and land use activities. However, any protection they provide can be described as impermanent, because they can be revised by legislative action. Nevertheless, these regulations do confer numerous benefits to hydrology, including limiting impacts on the landscape, limiting runoff potential, and limiting development in floodplains. They are affordable and actionable, as they are required by law. Political sensitivities around zoning regulations vary. Routine or technical changes may not draw attention; however, substantial changes may be controversial.

Recommendations

Policy

- Manage for multiple benefits and include consideration of protections (such as expanding use of Transfer of Development Rights [TDR] programs, using watershed characterizations to inform land use decisions) during rezoning processes.
- Create a new Snohomish County TDR receiving area as part of the County's area-wide rezone of Multifamily Residential (near-term opportunity).
- Explore opportunities for jurisdictions that are planning rezones to include incentive zoning tools (such as TDR or in-lieu fees) to support Basin-wide protection outcomes while advancing growth, economic development, and infill objectives. Such consideration could include a market-based understanding of demand for growth to best align rezones with economic opportunities.
- Allow for exploration of opportunities to reduce the potential for future build-out, particularly in areas of hydrological importance.

4.2.1.4 Minimized Impact Rural Development

The GMA recognizes rural character and establishes guidelines for growth in rural areas based on density of development. An approach to reducing the impact of rural growth on the landscape and hydrology of the Basin is to change the focus from rural density to impervious surface or impact on hydrology. This would result in more compact land uses tied to the permanent conservation of surrounding open space. Some options for achieving this exist on a limited basis (e.g., rural cluster plat) and on the state level (e.g., Master Planned Resorts). Other options that could achieve protection on a broader scale would require state legislation.

Minimized Impact Rural Development

Implementation

Minimized impact rural development strategies are primarily implemented on the county level.

Assessment

Within the potential range of approaches to minimizing rural development impacts, some exist while others are conceptual. Clustering and rural-to-rural development right transfers are available on a limited basis in Snohomish County; neither Snohomish County nor King County have provisions for more coordinated approaches.

The effectiveness of this group of strategies is largely untested in the Basin. Snohomish County recognizes the public benefit of retaining open space in rural cluster developments; however, the utilization of these provisions has been limited. Larger-scale options do not yet exist in the Basin and are untested. Hydrologic benefits of these approaches in general result from reduced impervious surfaces in the rural landscape relative to traditional development patterns.

These approaches have a low public cost, as they are generally regulatory in nature. Some variations are actionable (although only in Snohomish County) while others are not yet available in the Basin. Political issues surrounding these approaches are contentious, as they may be perceived as encouraging residential growth in rural areas.

Recommendations

Policy

- Encourage state legislation to permit the use of large-scale, compact development.
- Consider expanded rural applications of TDR for King County.

4.2.2 Shoreline Management Act

The Shoreline Management Act (RCW 90.58) requires local jurisdictions to develop and update programs to regulate uses of the shorelines of the state (Chapter 173-26 WAC Part III). These programs must be based on guidelines and standards issued and updated by Ecology. A central goal of the Shoreline Management Act is to prevent uncoordinated development on Puget Sound shorelines, rivers, large lakes, and associated wetlands.

Shoreline Management Act Implementation

The Shoreline Management Act is implemented at the city and county level. King County adopted a Shoreline Master Program in 1975 and most recently updated the program in 2013. Similarly, Snohomish County adopted a Shoreline Management Master Program in 1974 and completed a comprehensive update in 2012. The purpose of these updates was to ensure that the county programs are consistent with state Shoreline Master Program Guidelines, county comprehensive plans and implementing zoning, CARs, and other county development regulations.

Assessment

The Shoreline Management Act protects hydrology by requiring local jurisdictions to regulate structures and uses along state-designated waterbodies and to address the cumulative impacts of shoreline development.

Shoreline Master Programs can be politically sensitive, as they may be viewed by landowners as placing unreasonable restrictions on their property rights or land use options.

Recommendations

Policy

- Manage for multiple objectives and use watershed characterization to inform program updates.

Mechanical

- Convene planners from jurisdictions across the Basin to identify, discuss, and coordinate hydrologic and land protection priorities in the next round of plan updates (near-term opportunity).
- Ensure that funding is provided to appropriately enforce and implement these rules and regulations.

4.2.3 Forest Regulations

In Washington State a substantial framework of state and federal laws and land management plans has been developed to help limit the environmental impacts of forest practices on private and public forestlands. The framework has two main relevant components administered by DNR: the Forest Practices Rules, and other federally approved Habitat Conservation Plans (HCPs). The U.S. Forest Service (USFS) manages the Northwest Forest Plan (NWFP) on federally owned forestlands. One overarching objective of these regulatory components is to protect the hydrologic processes that support salmon or salmon habitat, as well as other species.

4.2.3.1 Forest Practices Rules

In 1974, the Washington State Legislature adopted the Forest Practices Act (RCW 76.09) to regulate forestry activities on all private, state, and local government lands. The Forest Practices Act broadly defines forest practices as "any activity conducted on or directly pertaining to forest land and relating to growing, harvesting or processing timber…"

The act is implemented through the Forest Practices Rules (WAC 222), which divide forest practices into four classes based on their potential impacts to public resources. Classes I through III are administered by DNR and have limited concerns that there may be damage to public resources, though in some cases additional permits may be required.

Class IV permits are split into two categories: Class IV-Special and Class IV-General. Class IV-Special forest practices have the potential to cause a substantial impact on the environment. They include certain aerial applications of pesticides, forestry activities on lands designated as critical habitat for threatened or endangered species, or certain harvest activities within geologically unstable areas. Class IV-Special permits are processed and approved by DNR.

Class IV-General forest practices are forest practices on lands that have been or are being converted to another use incompatible with forestry or on lands that are likely to be converted to urban development in the future. Class IV-General permits are managed through the relevant local jurisdictions (e.g., county or city).

In 1999, a group of public and private sector stakeholders published the *Forests and Fish Report*, which presented a comprehensive set of recommendations for improving the regulation of forest practices (USFWS et al. 1999). Two years later, the Forest Practices Rules were amended to include more stringent environmental standards and guidelines for riparian buffers and forest roads maintenance, and are referred to as the Forests and Fish Rules.

Forest Practices Rules Implementation

The Forest Practices Rules are implemented across Washington State broadly and are applied individually to each HCP or Forest Practices Application. Until recently, DNR regulated all forest practices on non-federal lands. Snohomish and King Counties, as well as several cities, now administer and enforce Class IV-General permits in unincorporated county areas (on lands that have been or are being converted to another use or on lands that are likely to be converted to urban development in the future).

Assessment

The Forest Practices Rules establish standards for forest practices such as timber harvest, pre-commercial thinning, road construction, fertilization, and forest chemical application (Title 222 WAC). They give direction on how to implement the Forest Practices Act (RCW 76.09) and Stewardship of Non-industrial Forests and Woodlands (chapter 76.13 RCW). The rules are designed to protect public resources such as water quality and fish habitat while maintaining a viable timber industry. They are under constant review through the adaptive management program, otherwise known as CMER (Cooperative Monitoring, Evaluation, and Research). Rule changes and updates, if needed are promulgated by the Forest Practices Board.

Recommendations

Policy

- Maintain funding for the adaptive management process.
- Work closely with the Counties' and Cities' strategies for implementing rules associated with Class IV-General.
- Update best available science to incorporate the current landscape regulatory framework (e.g., water quality, sediment from roads, riparian protection).

4.2.3.2 Other Federally Approved Habitat Conservation Plans

Section 10 of the ESA authorizes landowners to negotiate conservation plans with the federal government in order to minimize and mitigate impacts to threatened and endangered species while carrying out lawful activities. In 1997, DNR State Lands signed an agreement with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service (NMFS) for the implementation of a long-term, multiple-species HCP on state-owned and regulated forestlands within the range of the northern spotted owl. In addition to the State Lands HCP, several large private timber companies have negotiated HCPs on their properties. With the approval of a HCP, the federal

agencies issued an incidental take permit to the landowner for a period of 70 years. Under the provisions of this permit, the landowner may carry out timber harvesting and other forest management activities as long as the agency complies with the HCP implementation agreement.

The State Trust Lands HCP alone covers approximately 1.6 million acres of state-managed forestlands, including those within the Basin. The plan includes a riparian conservation strategy for DNR planning units in western Washington. This strategy is the primary mechanism by which the HCP minimizes forestry impacts on salmon habitat, as it limits timber harvesting and road building on unstable slopes or in riparian zones, rain-on-snow zones, and wetlands. All HCPs also include a requirement for annual implementation, effectiveness, and validation monitoring and periodic comprehensive reviews. The results of these monitoring and review processes feed into DNR's adaptive management cycle.

Other Federally-Approved HCPs

Implementation

In the Snohomish Basin, there is a HCP that applies to all state lands but is implemented at the site scale with site-specific prescriptions. Additional federally approved HCPs in the Snohomish Basin may be pursued by landowners at any time in the future.

Assessment

HCPs include four detailed conservation strategies: marbled murrelets; northern spotted owls; riparian areas, wetlands, and salmon; and other species of concern and uncommon habitats. Through these conservation strategies, protection is provided for the following:

- Habitat for northern spotted owls, marbled murrelets, and riparian-dependent species such as salmon
- Habitat for other animal and plant species that are federally listed as threatened or endangered
- Habitat for state-listed threatened or endangered species
- Uncommon habitats and habitat elements (e.g., talus fields, caves, cliffs, oak woodlands, large snags, balds, mineral springs, and large, structurally unique trees), that support the various species that depend on them
- Old-growth forests in the five Westside HCP planning units
- Unstable slopes

- Habitat for unlisted plant or animal species that might be declining in numbers or that could be listed in the future

Recommendations

Engagement

- Maintain funding for the adaptive management process.
- Update best available science to incorporate the current landscape regulatory framework (e.g., water quality, sediment from roads, riparian protection).

Mechanical

- Ensure that adequate funding is provided to monitor and adaptively manage implementation of the HCPs.

4.2.3.3 Northwest Forest Plan

In 1994, the USFS and the Bureau of Land Management jointly adopted the NWFP. This plan amended existing USFS and Bureau of Land Management land and resource management plans throughout the range of the northern spotted owl, including western Washington. The NWFP established standards and guidelines for implementing a science-based ecosystem management strategy on federal forestlands. It also created a network of old-growth and riparian reserves, as well as adaptive management areas. The goals of the NWFP are to protect and restore critical forest habitat, watershed health and function, and a sustainable supply of forest products to help support local and regional economies.

A central component of the NWFP is the Aquatic Conservation Strategy, which provides guidance for the management of aquatic and riparian habitats on federal lands covered by the plan. Objectives of the Aquatic Conservation Strategy focus on the protection of habitat-forming processes, water quality, instream flows, and the physical integrity of aquatic systems. Under the NWFP, land managers must evaluate proposed projects and management activities for consistency with these objectives. In doing so, they must employ tools such as

watershed analysis, which provides baseline information on geomorphic and ecological processes in specific watersheds and guides monitoring and restoration efforts.

NWFP

Implementation

The NWFP amended a total of 26 land and resource management plans, and was implemented on federal lands stretching from northern California to western Washington. Federal lands falling under the purview of the NWFP are predominantly national forests; however, Bureau of Land Management lands, national parks, national wildlife refuges, and military bases are also covered by the plan. In 2015, the USFS initiated a public outreach process to gather input on how to revise management plans for forestlands that are currently managed under the NWFP.

Assessment

The NWFP was envisioned to protect late-successional and old-growth forests, but it also provides protection for younger forests. The NWFP significantly reduced harvest levels in old-growth areas and aimed to create sustainable harvest cycles. Since the adoption of the NWFP, a regional interagency effectiveness monitoring framework has been implemented to track the status and trends of watershed condition, late-successional and old-growth forests, population and habitat for marbled murrelets and northern spotted owls, and socioeconomic conditions.

In 2008, a federal NWFP status review, called the 15-year Report, was completed (Grinspoon and Phillips 2008). That report stated that late-successional and old-growth forest acreage had remained relatively constant in areas covered by the NWFP. A small amount of old-growth loss occurred, but this was attributed mainly to natural disturbance regimes such as forest fires. The 15-year Report also stated that the majority of watersheds (69%) had a positive change in condition scores. Most of the larger positive changes were driven by improvements in road (decommissioning) and vegetation (natural growth) scores. Overall, the report indicated that the NWFP had resulted in the successful protection of forest cover on federal lands, and the associated protection or improvement of hydrologic processes.

Recommendations

Mechanical

- Increase monitoring funding so that local Basin information can be gathered and analyzed to address forest management issues locally.
- Encourage and fund ongoing USFS forest management planning to manage forests for hydrologic benefits to salmon and other species.
- Increase funding for acquisitions within the USFS district boundaries to secure inholdings and ecologically sensitive areas.
- Provide input to USFS as it initiates the process to update management plans for forestlands that are currently managed under the NWFP.

4.2.4 Federal Land Designations

4.2.4.1 Wilderness Act Designation

Federal lands can be designated as "Wilderness Areas" by an act of Congress. Wilderness Areas are defined as "...lands designated for preservation and protection in their natural condition" (1964 Wilderness Act Section 2(a)). A Wilderness designation generally prohibits motorized use, mechanical transport, timber harvest, and new mining claims. Most types of outdoor recreation are allowed in Wilderness Areas, including hunting and fishing, except those needing mechanical transport or motorized equipment, such as motorboats, cars, trucks, off-road vehicles, bicycles, and snowmobiles. The Wilderness Act of 1964 is one of the most successful environmental laws in the United States, standing for almost 50 years without a substantial amendment.

Wilderness Act Designation

Implementation

There are currently three designated wilderness areas that are either completely within or partially within the Basin: The Wild Sky Wilderness (2008), The Henry M. Jackson Wilderness (1984), and the Alpine Lakes Wilderness (1976). The Wild Sky Wilderness is the most recently designated wilderness area and includes more than 106,000 acres in the North Fork Skykomish and Beckler River basins. There are additional areas of roadless forests managed by the Mt. Baker Snoqualmie National Forest in the Skykomish and Snoqualmie River basins that may merit designation as Wilderness. For example, legislation in 2014 added 22,000 acres to the Alpine Lakes Wilderness near Snoqualmie Pass.

Assessment

The Wilderness Act provides the highest level of federal protection and is considered one of America's greatest conservation achievements. However, the local support necessary and the congressional approval required often necessitate 3 to 10 years to achieve a designation. Many groups whose members enjoy recreating are hesitant to support new Wilderness designation because it will limit activities they are currently able to do in the area (e.g., bike, snowmobile, use off-road vehicles). Additionally, though tribes are offered consultation and review during the process, there are concerns that treaty right activities are not given due consideration. Current Wilderness Areas do not allow for active management, such as burning for berry production, that is important to maintaining tribal resources. The areas considered for Wilderness designation are chosen as a result of ecological value, suitability, and political considerations.

Recommendations

Engagement

- USFS and tribes work to identify how to design Wilderness Area boundaries to support the highest degree of tribal use.

Policy

- Review potential wilderness areas for hydrologic value to ensure inclusion.

4.2.4.2 National Wild and Scenic River Designation

Reaches of free-flowing rivers or streams can be designated as Wild and Scenic Rivers under the Wild and Scenic River Act of 1968. The designation, which generally requires an act of Congress, preserves certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations (Wild & Scenic Rivers Council 2015). A designation prohibits federal support for actions such as the construction of dams or other instream activities that would harm the river's free-flowing condition, water quality, or outstanding resource values. The designation creates a federal reserved water right to protect flow-dependent values but does not affect existing water rights or the existing jurisdiction of states and the federal government over waters as determined by established principles of law.

National Wild and Scenic River Designation Implementation

In 1990, USFS, as a part of its land management planning, evaluated all rivers and streams originating on National Forest Lands within the Mt. Baker-Snoqualmie National Forest to determine their eligibility and suitability for designation under the federal Wild and Scenic Rivers Act (USFS 1990). Many rivers in the Basin (see recommendations below) have been found eligible for Wild and Scenic designation, and some have been found suitable for recommendation to Congress. In December 2014, the Middle Fork Snoqualmie and Pratt Rivers were designated as Wild and Scenic.

The Skykomish River is part of the separate Washington State Scenic River system, the legislative purpose of which is to "protect and preserve the natural character of such rivers and fulfill other conservation purposes." Rivers in the system "shall be preserved in as natural a condition as practical" and "overuse of such rivers, which tends to downgrade their natural condition, shall be discouraged."

Assessment

Identifying rivers that are eligible or suitable for Wild and Scenic designation is important because they are then afforded administrative protection. The USFS, for example, states in their management manual that "rivers found to be eligible and suitable must be protected as far as possible to the same extent as a designated study river" (Forest Service Manual 2354.62). These eligible rivers must therefore be managed "to protect existing characteristics" and "resource management activities may be carried out provided they do not cause a negative or reduced classification recommendation" (Forest Service Manual 2354.21). While the administrative protections for eligible rivers are not as strong as Congressional (Wild and Scenic) designation, they do provide important protection. Proponents of non-motorized river recreation are often effective in making the case for eligibility determinations during agency planning efforts.

Recommendations

Future priorities for Wild and Scenic designation in the Basin include the following: North Fork and South Fork Skykomish, Troublesome Creek, West Cady Creek, Tye River, Miller River, West Fork and East Fork Miller, Foss River, West Fork and East Fork Foss, Beckler River, Rapid River, South Fork Tolt, North Fork Snoqualmie, Lennox Creek, and Taylor River.

4.2.5 Water Rights and Instream Flow Protection

The state of Washington regulates groundwater and surface water withdrawals through a system of water allocations, or "water rights." Ecology is the regulatory agency that tracks, administers, and issues water rights in Washington State. There are several different types of water rights—surface water rights focused on withdrawals typically from lakes, streams, and rivers; groundwater rights, which withdraw from subsurface water such as aquifers; and water storage rights, which allow for the impoundment of water on a property.

Washington water rights are steeped in legal history and are based on a doctrine of prior appropriation, meaning "first in time, first in right" (i.e., priority water rights are given to those who had them first). While it is true that the majority of permits are assigned to a specific piece of property, one very important water right was issued for the Basin in 1979 that established instream flows for the Basin.

4.2.5.1 Instream Flow Rule Making

The Instream Resource Protection Program (IRPP) for the Snohomish River Basin (Chapter 173-507 WAC) was enacted in 1979. The intent was to retain base flows in perennial streams, rivers, and lakes at levels necessary to protect a wide range of benefits including wildlife, fish, scenic, aesthetic, recreational, environmental, and navigational values. The IRPP established instream flow rules at ten control points on the Snohomish, Skykomish, Snoqualmie, Sultan, Tolt, and Pilchuck rivers within the Basin. The IRPP also identified 30 streams and lakes subject to conditional and unconditional closure when flows drop below specified levels. Ecology can initiate a review of the IRPP whenever new information, changing conditions, or statutory modifications make it necessary to consider revisions.

The IRPP states that from the date of establishment forward, all consumptive water rights shall be subject to the instream flow rules and no surface water right granted afterward shall be in conflict with the rules or with closures. Because instream flows do not meet the required levels at all times in the Basin, new water rights cannot be obtained without performing mitigation. In the Basin, several creeks have been determined to be flow-limited and are closed to new water rights. However, even in these sub-basins new groundwater withdrawals exempt from permitting are allowed. These withdrawals—from what are termed "permit exempt wells"—are subject to the following limits:

- Withdrawal for domestic use is limited to 5,000 gallons of water per day.
- Water use for lawns or non-commercial gardens is limited to "reasonable use" on an outdoor area up to 0.5 acre in size with no quantity restriction.

- Withdrawal for industrial use, which includes agricultural irrigation, has no acreage restriction but is limited to 5,000 gallons of water per day.
- Stock watering is allowed and has no daily quantity limit or acreage restriction.

The IRPP is aimed at protecting current instream flows, not restoring pre-development flows. Although the IRPP also states that any future groundwater permitting actions must consider the interrelationship of surface and groundwater to ensure compliance with the IRPP, permit exempt wells continue to be allowed throughout the Basin, mostly in rural areas not served by utilities. Newer instream flow rules utilize a "reservation" system for further water withdrawals, including limits on the number of exempt wells allowed in a basin or sub-basin. These rules are being legally challenged at the state level.

4.2.5.2 Water Rights Market Tools

Ecology has three major tools that protect instream flows by allowing the acquisition and redistribution of water rights. These tools—Trust Water Rights, Water Banking, and Water Acquisition programs—are designed to help water right holders use their permits efficiently. Descriptions of the three tools are as follows:

- Trust Water Rights: The Trust for Water Rights Program is the legal process for holding water rights for future uses. By allowing water right owners to put their water right into the program, they avoid the "use it or lose it" scenario. Water right owners can bank these rights temporarily or permanently. The benefit of this tool is that even temporary rights in the trust can be used to protect instream water flows.
- Water Banking: This particular program works at a regional/watershed level. A water bank is an institutional

mechanism used to facilitate the legal transfer and market exchange of various types of surface, groundwater, and storage rights. The exchange purchases water from willing sellers and then holds, transfers, and exchanges water rights on behalf of willing buyers. The seller can be anyone who holds a water right and the buyer can be anyone who needs to mitigate for a new water use or restore instream flows.

- Water Acquisition: Water Acquisition programs buy existing water rights for stream flow enhancement. Acquired water rights can be temporarily leased or permanently purchased. Water rights use the Trust Water Rights Program to legally protect the water rights and make sure no one else uses the water. The Washington State legislature has allotted money to Ecology to purchase water rights. Also, private money can be used to purchase water rights. There are two non-profit stream flow organizations that actively use Water Acquisitions as a restoration tool; these purchases are prioritized to be used in 16 basins in the state that have vulnerable salmon or trout populations, due to critically low flows. However, purchases can be made anywhere in the state. The Pilchuck sub-basin within the Snohomish River Basin is one of these 16 rivers.

Water Rights and Instream Flow Implementation

Water rights are implemented at a Basin-wide scale, although maintenance of instream flows via the IRPP is implemented at the sub-basin scale. Water uses in the upper Basin will affect downstream flows.

Assessment

Water marketing tools are intended to allow for water right flexibility in a changing landscape.

The instream flow standards established for the Pilchuck, Skykomish, Snohomish, Snoqualmie, Sultan, and Tolt rivers will affect any newer water rights that could be interrupted if the instream flows are not met. Obtaining a new, year-round water right is very difficult and applicants will have to mitigate if they need a year-round water supply.

In addition to meeting the instream flows, there are several sub-basins that are currently closed year-

round to any new water withdrawals unless they are mitigated. These sub-basins include: Griffin Creek, Harris Creek, Little Pilchuck Creek, May Creek, Patterson Creek, Quilceda Creek, Raging River, and Bodell Creek.

All of these sub-basins require some form of mitigation and using a water bank or the Trust for Water Rights Program could help manage water rights better within any of these sub-basins.

Recommendations

Mechanical

- Conduct a survey of the validity of water rights in order to understand rights holders, quantity, and types of water use relative to water rights permit information.
- Conduct a water supply/demand study for Water Resource Inventory Area (WRIA) 7 and determine if it is necessary to initiate new rules or revise the instream flow rule in the Basin. For basins in WRIA 7 that are determined to have a water supply issue and a demand for new water rights, establish a water bank.
- Work with public entities and non-profits that are engaged in land acquisition and restoration to survey their properties for water rights (previous 5 years). If water rights are still active, work to get water rights banked and/or notify Ecology of the desire to relinquish rights if they have not been used in 5 or more years.
- Continue long-term streamflow monitoring at existing gages and consider more monitoring of low flows.
- Initiate more detailed hydrologic (streamflow) analysis in areas specifically affected by low flows and habitats critical to fish.
- Consider conducting studies of hydraulic conductivity in areas where development relies on groundwater.
- Explore closing sub-basins for groundwater withdrawals as well as surface water withdrawals.

Engagement

- Develop an education program encouraging landowners on exempt wells to conserve water.
- Launch education campaigns to educate water right holders how they could use Trust Water Rights and Water Banking to help manage their water rights and protect instream flows.
- Work with irrigation districts to upgrade their irrigation efficiency and bank the saved rights into the Trust for Water Rights Program.
- Encourage Public Utility Districts, cities, and private water purveyors that deal with exempt wells and water rights to launch water conservation education campaigns.

Policy

- Set a limit (number of gallons per day) for domestic outdoor water use.
- Set a limit (number of gallons per day) for stock watering use.
- Close critical basins to all water withdrawals, even exempt domestic wells, based on analysis determining flow impairment.
- Find ways to store more water in valley aquifers to provide flows for the environment.
- Encourage Ecology to eliminate illegal surface water diversions and expire water rights if they are not used in 5 years. Protect existing wetlands in the landscape and aquifer recharge areas.

4.2.5.3 Reclaimed Water

Reclaimed water is a newer technology that is gaining interest in water conservation. The approach uses treated waters from wastewater treatment plants for industrial uses, irrigation, wetland and stream flow enhancement, and other non-potable water uses.

Reclaimed Water

Implementation

Reclaimed water is implemented at a jurisdictional level.

Assessment

Reclaimed water is a new approach to managing water resources and the technologies required for water reuse and recycling are not currently being widely used. It provides some interesting opportunities for a different source of water so some new water rights applications may be postponed or eliminated; this is of particular importance in closed basins. The approach would also leave water in the systems to support instream flow requirements and reduce energy demand in the wastewater treatment process. Care should be given to concerns that reclamation may reduce the amount of water in the system and impact current water rights holders.

Recommendations

Mechanical

- Explore tertiary treatment at wastewater treatment plants to improve any impairment (nutrients) in the discharge water.
- Explore new wastewater facility technologies that discharge drinking water standard flow into reaches with low flow issues, at times when old infrastructure has to be replaced.

Engagement

- Educate people on the benefits and uses of reclaimed water and encourage it as an option for water needs where the focus is on matching quality to use.

Policy

- Secure funding to explore options for using reclaimed water.
- Allow for flexibility in the use of reclaimed water.
- Examine the ability to produce and use reclaimed water as wastewater facility permits come up for renewal.
- Align with public health policies and ensure compliance with plumbing codes or address existing codes and revise to ensure cross connections are not an implementation issue.

4.2.6 Beaver Management

4.2.6.1 Living with Beavers

Beavers are native to the Basin and were once ubiquitous around the region. Populations plummeted when trapping of beavers for pelts was prevalent. In the last century, beaver populations have rebounded and now beaver are seen even in the Basin's most urbanized aquatic settings. Beavers are one of the key animals that can affect the quantity and quality of water in an aquatic system. In unpopulated places, their manipulation of the landscape is appropriate and welcomed but in populated and agricultural areas, that manipulation can create challenges. However, the beavers' ability to create water storage helps protect hydrology.

Living with Beavers

Implementation

The trapping and movement of beavers is regulated through the Washington Department of Fish and Wildlife (WDFW). Removing or altering beaver dams in any way requires an HPA, also within the purview of WDFW. Currently, King and Snohomish Counties, conservation districts, WDFW, and a number of non-profit organizations offer site visits and limited technical support to landowners with concerns about beavers and related flooding.

Assessment

Beavers benefit hydrology by building ponds that store runoff water and allow water to slowly enter neighboring streams and other waterbodies. These ponds can help regulate flood flows by storing and gradually releasing flood waters during storm events while also increasing flows during the dry season. Beavers also benefit hydrology by creating wetlands that can purify water and recharge groundwater.

Recommendations

Engagement

- Increase outreach to landowners to address questions and concerns about beaver management.
- Distribute information about water level management devices to landowners prior to dam removal.

Policy

- Increase access to beaver management resources through public agencies, special purpose districts, and non-profit organizations.
- Streamline HPA permits for pond levelers and beaver deceivers.
- Encourage local jurisdictions to incentivize living with beavers by amending CAR buffer requirements for beaver-formed wetlands , shoreline and other land use requirements

similar to the way the existing statutes, WACs and local government regulation that exempt enhancement and restoration projects.

4.2.6.2 Beaver Relocation

The Tulalip Tribes are working to improve water storage in the headwaters of the Basin in order to ameliorate the hydrologic shifts caused by climate change. This effort involves trapping beavers and releasing them in appropriate areas on USFS land. Once released, the beavers will create a complex series of dams that will store runoff and/or snow melt in the upper watershed and moderate flows during high-flow and flood events.

Beaver Relocation

Implementation

The Tulalip Tribes, in partnership with the University of Washington, are relocating nuisance beavers from the lowlands to headwater systems on federal lands as part of a pilot program.

Assessment

The goal of the pilot beaver relocation program is to introduce viable populations of beavers into the federal forestlands of the Basin. Based on studies conducted by Tulalip Tribes and the University of Washington, there is moderate amount of suitable habitat on USFS lands for beavers, which could result in beaver pond complexes.

Recommendations

Mechanical

- Identify and study land suitable for beaver relocation in USFS areas across the Basin.
- Model impacts from beavers on the hydrology of the Basin.
- Evaluate how to preserve beaver habitat and encourage the acceptance of beaver presence while protecting development and landowners from property damage.

Policy

- Work with WDFW to allow the relocation of beavers between watersheds on the west side of the Cascade Mountains.

4.2.7 Hydroelectric Facility Licensing

The Federal Energy Regulatory Commission (FERC) licenses hydroelectric facilities under the Federal Power Act. In 2005,

FERC implemented the Integrated Licensing Process (ILP) with the goal of streamlining the licensing and relicensing processes while ensuring adequate resource protections. The ILP requires an applicant to provide detailed information on the proposed hydroelectric project at the beginning of the licensing process, or during relicensing, and to submit study plans for assessing the impacts of the project on environmental, cultural, and socioeconomic resources. The ILP also requires an applicant to consult with tribes, agencies, nongovernmental organizations, and public stakeholders early in the process so that the parties can identify key issues and resolve disputes over project design, studies, and alternatives. Dispute resolution may include the development of a settlement agreement under which the applicant agrees to implement resource protection, mitigation, and enhancement measures before or after FERC issues a license; FERC is not obligated to grant a license to projects or to relicense existing projects.

The Northwest Power Act of 1980 (NWPA) authorized Washington, Idaho, and Oregon to create a regional power plan and prioritize protections for fish and wildlife habitats from hydroelectric development. The Northwest Power and Conservation Council studied and identified areas of critical importance to the region where mitigation techniques could not ensure all adverse impacts of hydroelectric development to fisheries and wildlife could be reversed. The council designated river reaches throughout the Northwest as protected areas where "unacceptable risks of loss to fish and wildlife species of concern, their productive capacity or their habitat" would occur under hydroelectric development. Under the NWPA and the Federal Power Act, federal entities must consider Protected Area status and restrictions when making decisions regarding hydroelectric facility permits and access to electricity from those facilities. Inclusion in a Protected Area does not prohibit

Locations of Protected Areas can be found through the StreamNet Protected Areas Mapper, available from: http://psmfc.maps.arcgis.com/apps/webappviewer/index.html?id=f4a9bf13f2014b259d63c8eb03e1f7af.

hydroelectric development at a site; however, the council calls on FERC to not license a new hydroelectric development in a Protected Area, and Bonneville Power Administration to not acquire the power from such a project should one be licensed by FERC (nor to allow access to the power grid in a way that would undermine the protected areas policy).

Most of the 44,000 miles of stream designated as Protected Areas are located within the Columbia Basin, although protected areas are located throughout the Bonneville Power Administration service territory, including several reaches within the Snohomish Basin. Two proposed projects within designated Protected Areas are currently moving through the ILP in the Snohomish Basin: the Sunset Falls project on the mainstem Skykomish River, and the Black Canyon project on the North Fork Snoqualmie River.

Hydroelectric Facility Licensing

Implementation

The licensing and relicensing of hydroelectric facilities can be viewed as being implemented at the Basin scale.

Within the Basin, there are several existing licensed hydroelectric facilities with varying license periods. Salmon recovery interests, jurisdictions, and other interested parties have engaged to varying levels in licensing processes, depending on project location, potential impacts, and capacity to participate. Tables 4 through 7 provide information on existing projects, pending licenses, and preliminary permits.

Assessment

License articles in the FERC-issued licenses for hydroelectric projects may contain immediate and future operational and management actions to attempt to mitigate for aquatic and wildlife impacts identified in the ILP. License articles are prescriptive and therefore do not allow for adaptive management in the implementation phase. Adaptive management is not typically addressed in license articles. Settlement agreements contain provisions for addressing issues important to stakeholders and co-managers (Washington State and Treaty Tribes) in the ILP, yet action was not considered necessary by FERC for licensing. Settlement agreements can include a monetary fund to help address unforeseen issues, studies, and land acquisition. Depending on the language in the settlement agreement, the funds may be used for adaptive management.

The designations under the NWPA of Protected Areas of fish and wildlife habitat from future

hydroelectric development are intended to provide hydrologic protections by ensuring that streamflow is not appropriated for out-of-stream uses and adjacent wildlife habitat is not altered by a project area or project operations. The amendment process allows for petitioning to remove the Protected Area designation provided by the NWPA. Any party may recommend an amendment to change the designation of a river reach as protected or unprotected. The amendment process requires notification of state and federal fish and wildlife agencies and Indian tribes. There is a process to petition for an exception of the Protected Area designation for proposed projects that will provide exceptional benefits to fish and wildlife. Black Canyon Hydro filed a petition in 2013 to try to remove a reach of the North Fork Snoqualmie from the list of Protected Areas. To date, that petition has not been successful, but the company's efforts to secure a FERC license in the reach continue. The Sunset Falls Fish Passage and Energy Project is a likely candidate for an exception from the list of Protected Areas for providing exceptional benefits to fish and wildlife by funding the reconstruction and operation of the salmon trap-and-haul operation at Sunset Falls.

Recommendations

Through participation in an ILP, parties should advocate for maintaining hydrographs in project reaches that closely follow the natural, pre-project condition.

Participation in ILP processes by multiple levels of government, fish and wildlife agencies, tribes, nongovernmental organizations, and other stakeholders is recommended. The accelerated rate of the process makes it difficult to track the process and ensure appropriate studies are designed. Groups participating in the ILP process could petition for an adaptive management component within the license articles, which may help to ensure the correct actions are taken to protect hydrology over the course of the license.

While much of the Basin has Protected Area status, new hydropower facilities continue to be proposed in such areas and it may be necessary to monitor the petitioning process in order to ensure key areas remain protected.

Table 4: Existing Licensed Projects

Project No.	Project Name	Expiration Date	Issue Date	Authorized (MW)	Licensee	Waterway
02959	Tolt River – South Fork	07/19/29	03/29/84	16.7	Seattle, City of (WA)	South Fork Tolt River
07563	Weeks Falls	03/31/35	04/25/85	4.8	South Fork II Associates (WA	South Fork Snoqualmie River
04885	Twin Falls	04/30/35	05/06/85	24	Twin Falls Hydro Associates LP (CT)	South Fork Snoqualmie River
06221	Black Creek	06/30/38	07/29/88	3.7	Black Creek Hydro Inc. (WA)	Black Creek
10359	Youngs Creek	04/30/42	05/05/92	7.5	PUD No 1 of Snohomish County (WA)	Youngs Creek
02493	Snoqualmie Falls	05/31/44	06/29/04	54.4	Puget Sound Energy, Inc. (WA)	Snoqualmie River
02157	Henry M Jackson (Sultan)	08/31/56	09/02/11	111.8	PUD No 1 of Snohomish County (WA)	Sultan River

Table 5: Existing Exempt-from-License Projects

Project No.	Project Name	Issue Date	Authorized (MW)	Licensee	Waterway	Description
3602	Woods Creek	02/03/82	.65	PUD No 1 of Snohomish County (WA)	Woods Creek	Exemption – Non Conduit

Table 6: Licensed but Not Yet Constructed Projects

Project No.	Project Name	Expiration Date	Issue Date	Authorized (MW)	Licensee	Application Type
13948	Calligan Creek	05/31/65	06/23/15	6	Snohomish County PUD No. 1	Original License
13994	Hancock Creek	05/31/65	06/19/15	6	Snohomish County PUD No. 1	Original License

Table 7: Issued Preliminary Permits (Working Toward Application)

Project No.	Project Name	Expiration Date	Issue Date	Authorized (MW)	Licensee	Waterway	Description
14110	Black Canyon	09/30/16	10/14/11	25	Black Canyon Hydro, LLC	North Fork Snoqualmie River	Conventional Permit
14295	Sunset Falls	02/28/17	03/02/12	30	PUD No 1 of Snohomish County (WA)	South Fork Skykomish River	Conventional Permit

4.2.8 WDFW Hydraulic Project Approval

WDFW is responsible for preserving, protecting, and perpetuating fish and shellfish resources of the state. In 1943, the state Legislature passed the Hydraulic Code (Chapter 77.55 RCW) that requires any person, organization, or government agency wishing to conduct any construction activity that will use, divert, obstruct, or change the natural flow or bed of state waters to do so under the terms of a permit (the HPA) issued by WDFW. The law's purpose is to ensure that work does not damage the state's fish and shellfish, and their habitats.

Activities in freshwater that require an HPA include, but are not limited to: stream bank protection; construction or repair of bridges, piers, and docks; pile driving; channel change or realignment; conduit (pipeline) crossing; culvert installation; dredging; gravel removal; pond construction; placement of outfall structures; log, log jam, or debris removal; installation or maintenance of water diversions; and mineral prospecting. Activities in saltwater that require an HPA include, but are not limited to: construction of bulkheads, fills, boat launches, piers, dry docks, artificial reefs, dock floats, and marinas; placement of utility lines; pile driving; and dredging.

WDFW HPA Implementation

The RCW directs WDFW to "preserve, protect, perpetuate, and manage" the fish and wildlife species of the state as its paramount responsibility (RCW 77.55.021). To help achieve that goal, the state Legislature passed the Hydraulic Code (chapter 77.55 RCW) in 1943. This law was designed to protect public fish resources by requiring a Hydraulic Project Approval before conducting activities in fresh and salt waters of the state. Specifically, WDFW, who administers the Hydraulic Code, regulates work that "uses, obstructs, diverts or changes the natural flow or bed of state waters for the protection of fish life."

WDFW reviews and issues approximately 5,000 HPA permits per year covering a wide range of activities. All HPA permits are issued with provisions to protect public resources. These provisions are consistent with best available science as informed by comprehensive literature reviews and by experience gained by WDFW employees during the course of providing technical assistance, particularly in the area of culvert

design. In 2013, WDFW published the Water Crossing Design Guidelines to help applicants better design and install culverts and bridges for fish passage. Goals of the Habitat Program include improving fish passage as well sediment distribution, flow, and large woody debris movement in streams. Hydrology can be improved by addressing undersized barriers.

Effective July 2015, the Hydraulic Code Rules, Chapter 220-660 was re-written to update construction specifications for all freshwater and marine projects.

Assessment

To help ensure that work permitted under the terms of HPAs sufficiently preserves, protects, and perpetuates the fish and shellfish resources of the state, WDFW conducts research to address specific areas where the effectiveness of HPAs is uncertain. WDFW results suggest that it is possible to make immediate improvements to the HPA program by ensuring that all pertinent provisions are included on each permit. This has been accomplished through the July 2015 WAC revision. Assessing levels of success in achieving "no net loss" is complex. Notwithstanding issues of different baseline conditions or subjectivity in effectiveness ratings, it appears that projects can and do meet a high standard of resource protection.

Recommendations

Mechanical

- Ensure all pertinent provisions are included on each permit.
- Secure funding to increase enforcement of proper HPA implementation. Work with Habitat and Enforcement Programs to improve coordination and communication on hydraulic violations or unpermitted activities.
- Continue monitoring and mitigation of culvert replacement projects to ensure compliance.

Policy

- Secure funding to redevelop the HPA application process to be more streamlined.

4.2.9 Gold Mining and Fish Hydraulic Project Approval

Prospecting and mining by individuals are currently allowed in the freshwater basins of Washington State. In WRIA 7, these activities primarily occur in the North Fork of Skykomish, but also in smaller tributaries such as the Raging River and Olney Creek. Individuals are allowed to mine/prospect in the area by obtaining the 2015 Gold and Fish Pamphlet. This pamphlet describes when prospecting or mining are allowed and specifies the equipment that is allowed. The main elements of this

pamphlet HPA are the "fish window," a list of dates by river section that determines when actions in the water will not detrimentally affect fish and the tools that can be used at particular times. Most often, the HPA dictates when mechanized mining equipment, such as suction dredges, can be used in any particular stream. If individuals follow the fish window and equipment requirements, WDFW (the enforcing agency) generally is not alerted to where the mining is occurring. The only HPAs that require permission from WDFW are for prospectors who are looking to use mechanical equipment or timing extensions beyond the allowed fish window. Fish window or in-water work dates are available on the WDFW website.

Gold Mining and Fish HPA

Implementation

This permit is applied at a Basin-wide scale.

Assessment

As increasing numbers of people are interested in mining and prospecting in Basin streams, it is difficult to assess the impacts, given that the pamphlet allows for a variety of actions, including power and suction dredging. There is also limited information on the number of individuals mining and whether they are following the rules from the pamphlet. However, it is known that using mechanical mining equipment in the streams and rivers of WRIA 7 can have hydrologic impacts including changing hydraulic patterns, possibly dewatering areas. It is also possible that excavation of flood terraces and riverbanks could increase their instability and enhance the likelihood of increased flood scouring.

One of the major issues in the small mining operations in WRIA 7 is the practice of "high banking," which deposits sediment in piles along the channel edges, creating new flow patterns or increases in sedimentation. Curtailing the use of mechanical equipment, in particular those that allow high banking, through legislative action would offer hydrologic protection.

Current hydraulic law is criminal, creating an environment with a high burden of proof for WDFW officers. This is expensive and time consuming for staff, and difficult to prosecute. By changing the enforcement to be civil penalties, it is more likely that violations will be caught, protecting the critical hydrology in these basin streams. A change in low would allow WDFW to charge violators with infractions and require violators to fix the damage; if they do not, WDFW could conduct repairs and charge the violator for the cost plus a penalty.

Recommendations

Policy

- Limit use of mechanical tools allowed in small-scale mining based on impacts to stream or fish life.
- Prohibit the practice of high banking in streams with unstable banks or endangered fish use.
- Improve WDFW's ability to enforce the Gold and Fish Pamphlet by changing enforcement to a civil penalty.

4.2.10 National Pollutant Discharge Elimination System

The National Pollutant Discharge Elimination System (NPDES) Program was established by Congress in 1972 and incorporated into the federal Clean Water Act (CWA) in 1977. Under this program, any facility that discharges pollutants from a point source into waters of the United States is required to obtain an NPDES permit. The NPDES permit system regulates wastewater discharges from industries and municipal wastewater systems as well as stormwater discharges from industries, construction sites, and municipal separate storm sewer systems (MS4s).

With the exception of the municipal stormwater permit, NPDES permits are issued to a specific discharge and location, set forth numeric effluent limits for specific parameters, and in some cases set forth required actions to prevent or minimize pollution. Many urban areas that collect stormwater runoff in MS4s are required to have an NPDES municipal stormwater permit. USEPA established two phases under which states issue these permits: Phase I for medium and large MS4s, and Phase II for smaller MS4s. As of 2015, municipal stormwater permits do not contain numeric effluent limits. Rather, they require implementation of a set of programs or actions associated with Total Maximum Daily Load requirements affecting municipal operations such as storm sewer operation and maintenance,

water pollution investigations, municipal property management, and standards for construction and land development affecting both private and public construction. Municipalities covered by an NPDES municipal stormwater permit in western Washington are also required to participate in watershed-scale stormwater planning. This effort involves the development of a stormwater management strategy that is intended to result in hydraulic and water quality conditions that fully support existing and designated uses.

The NPDES municipal stormwater permit was issued in 1995 to six Phase I jurisdictions, and when reissued in 2007, more than 100 additional cities and counties within Washington were issued Phase II permits. These permits contain requirements for construction and land development affecting both private and public construction. Permitees are required to adopt land development regulations that contain the equivalent of those directly set forth in the NPDES permit plus those incorporated by reference in the appropriate Ecology Stormwater Management Manual (either Eastern Washington or Western Washington).

NPDES

Implementation

The CWA allows USEPA to delegate NPDES permitting authority to individual states. In Washington State, the NPDES permit system is administered by Ecology, with the exception of permits required for federal agencies and tribes, in which cases the permits are administered directly by USEPA. All of the NPDES permit types cited above are in effect within the Basin, including Phase I and II municipal stormwater permits. Those who may need to obtain coverage under one or more NPDES permits includes individual citizens, corporations, special districts, cities and counties, the state of Washington, federal agencies, and tribes.

Assessment

NPDES permits regulate discharges of pollutants in stormwater or wastewater discharges, within the scope of the CWA. This scope is fairly broad, and within that scope, the permits allow extensive ability to regulate. However, the scope of the CWA has limits. For example, the CWA overall is aimed at

achievement of water quality standards as established by USEPA. This is a different goal than, for example, recovery of species listed as endangered under the ESA. One can determine or infer connections between levels of specific pollutants in water and the potential to endanger a species, but the CWA does not directly protect endangered species or directly regulate "harm" to them as "harm" is defined in the ESA. Further, the scope of each type of NPDES permit is limited. For example, the municipal stormwater permit specifically regulates discharges to and from municipal storm sewers. That permit does not regulate discharges of polluted stormwater that never enter a municipal storm sewer. Thus, there are many polluted stormwater discharges that are outside the scope of the NPDES municipal stormwater permit, and in fact are outside the scope of the entire NPDES permit system.

The NPDES permit system is, in itself, quite robust and effective, within the context of its underlying statutory basis. Many of the perceived "problems" with it are, in fact, a perceptual problem stemming from an imperfect understanding of the permit system and its underlying statutory basis, in the larger context of other regulations underlain by the CWA (such as the Total Maximum Daily Load program related to Section 303 of the CWA), and other federal laws such as the ESA and the Safe Drinking Water Act. In short, because the NPDES system is one of the most robust regulatory systems in effect, the last 2 decades have seen numerous attempts to contort various NPDES permits into doing things for which there is no statutory basis, or for which the permit system is an inefficient or ineffective tool.

Recommendations

- Regionalize NPDES-driven program requirements where it makes sense.
- Consider alternative management models based on drainage basins rather than jurisdictions.
- Provide better collaboration between regulatory programs such as Total Maximum Daily Load, the Model Toxics Control Act, NPDES, etc. and the relevant regulatory agencies.
- Collaborate with other efforts such as salmon recovery, floodplain reconnectivity, and habitat restoration.
- Provide additional funding sources from the regional, state, and national levels.

4.2.11 Low Impact Development

Low Impact Development (LID) is an approach to land use and stormwater management that aims to preserve or mimic natural, pre-disturbance hydrologic processes. Key tenets of LID include minimizing site disturbance, conserving native vegetation, reducing impervious surface, and controlling stormwater at or near its source through the use of best management practices (BMPs). Stormwater BMPs, which are commonly referred to as green stormwater infrastructure, are small, distributed facilities that manage water through infiltration, filtration, storage,

Best management practices (BMPs) are structural and procedural measures applied to control the adverse impacts of development and redevelopment.

evaporation, and transpiration. Specific BMPs include rain gardens, permeable pavement, and vegetated roofs and will be primarily located on private properties and maintained by homeowners and businesses.

In western Washington, jurisdictions covered by a Phase I or II NPDES municipal stormwater permit must adopt development regulations that require LID BMPs to be used whenever feasible at development sites. In addition, between 2015 and 2018, these jurisdictions must incorporate specific LID requirements into local codes, ordinances, and standards. They must also evaluate their development codes, using a process established in the NPDES permit, to determine whether barriers to LID exist and revise the codes to remove or reduce identified barriers and make LID the preferred and commonly used approach to site development.

LID

Implementation

In Washington State, the NPDES permit system is administered in most cases by Ecology. Between 2015 and 2018, Ecology will require all western Washington jurisdictions covered by an NPDES municipal stormwater permit to integrate LID requirements into their stormwater and development codes. To facilitate compliance with this requirement, Ecology has established a Stormwater Retrofit and LID grant program to assist Phase I and II municipal stormwater permittees with funding for the design and construction of stormwater capital retrofit projects, with an emphasis on LID facilities. The Puget Sound Region has yet to fully understand how to implement and maintain LID features in the most effective way.

Assessment

LID has been implemented throughout the Puget Sound region. In some cases, LID has been shown to reduce the costs of storm sewer construction and maintenance and/or to provide environmental benefits, such as reduced stormwater runoff. However, in other cases, LID features have produced little or no measurable benefit, have resulted in unforeseen problems, or have increased long-term operation and maintenance costs for storm sewers. The most recent NPDES Phase I and II municipal stormwater permits include revised LID facility design and construction standards aimed at maximizing the benefits of the LID, as well as infeasibility criteria intended to prevent construction of LID facilities that would have no benefit or cause unanticipated issues.

Recommendations

- Provide programmatic support for LID implementation in stormwater planning and projects.
- Perform further study of LID facility function and assess the effectiveness of new NPDES infeasibility criteria, especially in the urbanized environment.
- Provide training for design, construction, operation, and maintenance. Develop and implement inspection and maintenance protocols. Develop methods for transfer of responsibilities when properties with LID change ownership.
- Use catchment scale assessments to identify areas in which LID facilities could yield desired environmental benefits.
- Apply total life cycle cost-benefit research on LID facilities to improve understanding of the situations in which such facilities are the best approach for achieving desired environmental benefits.

4.3 Category 2: Incentives

Incentive programs are intended to encourage voluntary protection. These tools reward positive actions through tax and fee reductions, streamlined permitting, recognition, and financial compensation. The success of these tools is often dependent on market conditions.

4.3.1 Property Tax Reduction

4.3.1.1 Current Use Taxation Program

In 1970, the Washington State Legislature enacted the Open Space Taxation Act (RCW 84.34) for the purpose of preserving adequate open space lands for the production of food, fiber, and forest products as well as for recreational use and scenic beauty. The act established the Current Use Taxation (CUT) Program, a voluntary program under which property owners can reduce the amount they pay in property taxes by having their open space or natural resource lands valued at their current use, rather than at their highest and best use.

A property owner who wishes to participate in the CUT Program submits an application to the local granting authority requesting one of four land classifications: farm and agricultural land, open space land (which includes farm and agricultural conservation land), timber land, or designated forest land. If the application is approved, the county assessor must calculate annual taxes based on the current use value of the property. In addition, the landowner must maintain the property as presented for classification for as long as the property remains in the program.

Once a property is classified under the CUT Program, the property remains in that classification until a request for removal is made by the owner, land use changes disqualify the property, or the property is sold or transferred to a new owner who doesn't continue enrollment in the program (or who causes the land to be tax-exempt). Additional tax, interest, and penalties—based on the difference between the current use value and the market value of the property—may become payable upon disqualification or removal from classification.

CUT Program Implementation

The CUT Program is mostly implemented at the county level. Both King and Snohomish Counties have implemented programs that offer property tax reductions for properties successfully enrolled in the CUT program. In Snohomish County, CUT applications are processed through two programs: the Open Space Program or the Designated Forest Land Program. In King County, applications are processed through four programs—one for each of the CUT land classifications established by the Open Space Taxation Act. These programs are Timber Land, Forestland, Farm and Agricultural Land, and Open Space, which is also referred to as the Public Benefit Rating System (PBRS). (See Section 4.3.1.2 for additional information on PBRS.) If a property owner submits a CUT application for land located in an unincorporated area, the county legislative authority is the granting authority on the application. If, however, a property owner submits an application for land located within an incorporated area, the county and city legislative authorities act jointly on the application.

Assessment

The CUT Program is enabled by state law and is implemented by local jurisdictions across the Basin. The main hydrologic benefit of this tool involves the protection of pervious land surfaces in the Basin. This protection can be viewed as temporary in nature, however, because landowners can opt out of the program whenever they wish, as long as they pay any required fees or penalties.

The CUT Program is actionable, as it has been successfully used for decades and enjoys broad support. The program is also affordable. In implementing the CUT program, counties do not lose tax revenue. Instead, they shift the overall public tax burden by reducing the amount of property tax they collect from property owners participating in the program while slightly increasing the amount of tax they collect from non-participants.

Recommendations

As a general recommendation, one approach that would increase value to landowners (and potentially increase participation) is the "stacking" of incentives whereby individuals enroll in multiple conservation incentive programs simultaneously. For example, a landowner could achieve greater compensation by selling development rights and participating in Conservation Reserve Enhancement Program (CREP; see Section 4.3.3) and pursuing added-value products.

Mechanical

- Target outreach of CUT programs to areas of hydrologic importance.

Engagement

- Expand engagement efforts; although the CUT program is already widely used, the primary opportunity for expanding use of this tool is increased participation.

4.3.1.2 Public Benefit Ratings System

Under the Open Space Taxation Act, counties may choose to adopt a PBRS (RCW 84.34.055) to establish more specific criteria used to evaluate or rate open space resource value on properties. PBRS offers property owners an incentive (a property tax reduction) to protect or restore open space resources on their land. A PBRS program identifies open space resources and assigns a rating or score to determine the level of property tax savings participating properties are eligible for. Properties with the highest scores, and therefore the greatest conservation values, are eligible for the greatest tax reduction.

PBRS

Implementation

PBRS enrollment is based on a point system. Points are awarded for each PBRS resource category a property qualifies for (such as protecting stream and wetland buffers, preserving significant wildlife habitat, and conserving native forestland). In King County, the total points awarded for a property's PBRS resources translate into a 50% to 90% reduction in the taxable land value for the portion of the property enrolled. Over the past 15 years, King County has enrolled an average of 60 to 80 properties and 500 to 600 acres annually.

Snohomish County has considered the merits of a PBRS several times in recent years, as the adoption of a rating system has the potential to make implementation of the 'open space' current use assessment (CUT) classification more effective and equitable. However, the county has been reluctant to develop and adopt a PBRS due to staff capacity issues and budget constraints. For now, Snohomish County evaluates open space applications based on 19 designation criteria, including criteria that qualify properties based on the presence of wetlands, undeveloped natural areas, sensitive wildlife habitat, or unstable slopes. The county assessor hopes to get a PBRS program in place for a subset of open space properties (farm and agricultural conservation land) sometime in 2016.

Assessment

King County has protected a significant amount of open space using a PBRS (more than 11,000 acres); however, as mentioned previously, enrollment in a CUT program may confer only temporary protection. One potential benefit of adopting a PBRS program is that it can be used to complement more permanent protection tools, such as TDR or Purchase of Development Rights (PDR) programs, which are described in Sections 4.4.3 and 4.4.4. Landowners who may be eligible to participate in PDR or TDR programs but may not be willing to accept permanent conservation easements on their properties could protect natural resources on their properties by enrolling in the CUT Program.

Recommendations

Policy

- Pursue the creation of a PBRS program in Snohomish County with an award structure informed by watershed characterization, comprehensive planning policies, and conservation priorities as identified in existing incentive programs.

Mechanical

- Improve the local benefits of PBRS within King County that are informed by watershed characterization (near-term opportunity).

4.3.2 In-Lieu Fee

Also known as a density fee, an in-lieu fee is an alternative to other density incentives (e.g., affordable housing bonuses) whereby developers pay a fee to a public entity instead of providing a specified public benefit. The public entity then uses

the fee revenue to achieve the public benefit (in this context, protection).

In-Lieu Fee

Implementation

An in-lieu fee would be implemented at the county or city level.

Assessment

The in-lieu fee has been used by local jurisdictions around the Puget Sound region but it has not been tested in King or Snohomish Counties. As with other incentives, the main hydrologic benefit of this tool involves the protection of pervious surfaces (non-developed land) in the Basin.

Like TDR programs with which it is often associated, the success of the in-lieu fee depends on market conditions. When there is demand for growth, developers will use the fee to achieve higher densities. By creating an in-lieu fee option now (or in the near term), jurisdictions will be prepared to make use of the tool when the market for growth reaches a level at which this tool becomes attractive.

Public costs are relatively low because fees are paid into a fund by private developers. Local jurisdictions are responsible for administering the fund and using its proceeds for acquisitions. An in-lieu fee is not currently actionable in the Basin but could become actionable in the near term if Snohomish County creates the mechanism pursuant to policy updates adopted as part of its 2015 Comprehensive Plan. Potential political sensitivities include prioritizing how fee revenue is spent and the view that this fee adds to the cost of growth. Other considerations include how a fee structure should be priced and how to integrate it with other incentive programs.

Recommendations

Policy

- Explore the potential of having cities in the Basin adopt an in-lieu fee program individually or in partnership with other jurisdictions.

Mechanical

- Pursue the modification of the existing County TDR programs to create a fee option that developers can pay to the county as an alternative to purchasing TDR credits on the private market. The Counties could manage revenues from this fee (or delegate the role to an external partner with experience in conservation land transactions) and use proceeds to acquire development rights from lands whose protection would be important to hydrologic processes in the Basin.
- Pursue this option for cities within the Basin, either by creating a new fee program or by updating existing TDR programs to include an in-lieu fee.

4.3.3 Conservation Reserve Enhancement Program

CREP is a voluntary program in which a local organization, typically a conservation district, uses federal funds to pay landowners for maintaining or installing and improving natural riparian buffers on farmland. The goal is to provide financial compensation to landowners for the reduction in productive land and to pay for enhancement of buffers.

CREP

Implementation

CREP is available on agricultural land Basin-wide, though the application varies by county.

Assessment

CREP, while arguably a restoration tool, is included in this category because it has a conservation component and offers financial compensation to participating landowners. The program is available and in use. The program achieves land protection on a small scale and participation is limited by multiple factors. The hydrologic benefits of the tool in the Basin derive from improved riparian buffers on agricultural land.

The public cost of this program is relatively low. In the context of local governments implementing the SBPP, CREP is cost-effective because funding is federal and local conservation districts conduct projects. CREP is actionable and fully functional. A political consideration of the program is the reduction in area of land available for agricultural production, which may be a concern to proponents of "no net loss" of farmland.

A consideration for CREP is the value of the financial incentive. For some landowners, the compensation the program provides is insufficient to motivate participation. Surveys of landowners suggest that participation could potentially increase if the program offered greater compensation.

CREP contracts have a specific time period for lease payments. Funding would be required to secure permanent easements. CREP buffer easements that have reached their maturity may be cut down, depending on the application of local regulations.

Recommendations

Mechanical

- Identify local funding opportunities that augment the value offered by the federal program.
- Secure funding for permanent riparian buffer easements.

4.3.4 Forestry Riparian Easement Program

DNR compensates small forestry landowners in exchange for a 50-year easement on "qualifying timber." Qualifying timber includes areas that have trees that would have resulted in economic gain if harvested and are adjacent to streams, wetlands, seeps, unstable slopes, or channel migration zones. The small landowner cannot cut or remove the qualifying timber during the easement period. The voluntary program reimburses landowners for a minimum of 50% of the value of the trees that they are required to leave by regulation.

Forestry Riparian Easement Program

Implementation

Forestry riparian easements are implemented Basin-wide.

Assessment

This approach, which involves applying the same easement concepts and mechanics to forested properties as those that are applied to agricultural lands, exists in the Basin. The hydrologic benefits of the tool derive from improved riparian, channel migration zone, and unstable slope buffers on forested land that has already been harvested.

Recommendations

Mechanical

- Continue funding for the program.
- Ensure proper funding for enforcement of easements.

Engagement

- Target outreach to small forested landowners in high-priority areas for hydrologic protection.

4.3.5 Four-to-One Program

This program allows developers to cluster and achieve a development bonus on land along urban growth boundaries, provided that for each acre developed, four are retained as open space. The program is administered through the comprehensive plan amendment process.

4:1 Program

Implementation

The 4:1 program is implemented at the county level.

Assessment

The 4:1 program exists in the Basin but it is currently actionable only in King County. The program has been used successfully in the past and its hydrologic benefits include reduction of impervious areas associated with residential development projects near the urban-rural fringe.

The 4:1 program has a low public cost, as the responsibility for implementation rests with private developers who propose projects under the program. The program is actionable and functional; however, program applications are complex and King County only considers them as part of the annual comprehensive planning cycle. Considerations for 4:1 include program extent. Use of the program is constrained by geography, raising the question of whether the program is scalable in a meaningful way.

Recommendations

Policy

- Consider a similar program in Snohomish County.
- Reduce the minimum property size requirement for the King County program to create more opportunities for participation.
- Review which uses are allowed and restricted within the retained open space in the King County program to more closely support protection goals.

4.3.6 Added Value Products

This approach involves landowners capturing additional value from their property by selling products or by-products as raw material for other industries. In the Basin, this concept is often referred to as "working buffers." An example of how this could improve hydrologic function is raising woody crops for biofuels on lands otherwise used for traditional farming that have no riparian forests. The potential hydrologic gain comes from creating temporary riparian zones or tree cover where there is none.

Added Value Products

Implementation

Projects and programs focused on developing added value products on existing resource land would be

implemented at the Basin level.

Assessment

This approach does not yet exist at scale as a protection tool. Recent feasibility studies conducted by the Snohomish Conservation District have shown that it is feasible although untested in the Basin. Changes in regulatory structure are untested and identified funding sources have not been used. The approach of using existing resource land more efficiently to expand production for new markets has been successful in the past in Europe and the eastern United States.

The affordability of this protection strategy is unknown. Given the market-based nature of the mechanism, the public costs would likely be relatively low. This strategy is not yet actionable at scale in the Basin. Likewise, political issues are also unknown. Additional effects of planting new species should be considered.

Recommendations

Mechanical

- Create or identify markets for the added value products.
- Identify and partner with landowners and potential customers for added value products to explore the feasibility of a pilot program that could be scalable (near-term opportunity).

4.3.7 Cost Share Programs

Both King and Snohomish Conservation Districts offer cost share opportunities for landowners that can reduce project costs from 50% to 100%. This incentive helps landowners be able to implement BMPs that are recommended through farm plans or site visits.

To be eligible for cost share funds, the landowner must complete a cost share application and arrange a site visit. Qualifying BMPs include projects such as buffer fencing, heavy use area protection, stream crossing improvement, and gutter and downspout piping. The availability of cost-share, however, is limited based on how the projects ranks and the availability of funding. Once landowners have received approval, they have a limited window to implement the BMPs and submit receipts for reimbursement.

Cost Share Products

Implementation

In areas served by King and Snohomish Conservation Districts, cost share funding is fully allocated every year.

Assessment

The funding for cost share programs comes from a variety of federal, state, and local sources, including the Natural Resource Conservation Service, the Washington State Conservation Commission, and Conservation Districts' assessment fees. However, the application process is limited by the capacity of staff to review cost share applications and the availability of cost-share funding and landowner match. As a result, there is a backlog of applications, resulting in a loss of interest from landowners.

Recommendations

Mechanical

- Increase funding and capacity to process cost share applications.

4.4 Category 3: Acquisitions

Acquisition provides permanent protection tools that involve the purchase of existing property rights. Land acquisition is typically prioritized by habitat value, threats, and opportunities to protect functioning habitat and key hydrologic areas, but is always conducted with willing landowners.

4.4.1 Outright Purchase

Public or private entities may protect land by purchasing it outright (also referred to as "in fee"). This is an appropriate mechanism for when a landowner has no further interest in a property that may otherwise face conversion pressure or if conservation of a property creates a compelling public benefit. An example of this could be purchase of land for a public park. Depending on the ultimate use of land protected through outright purchase, monitoring and stewardship may be part of the long-term management plan and will require funding.

Outright Purchase

Implementation

The ability to purchase properties outright is implemented at the jurisdictional and individual project levels.

Assessment

Outright purchase as a protection strategy is available for use in both King and Snohomish Counties. This strategy has been successfully used in a variety of applications and is a proven, permanent protection mechanism. Hydrologic benefits include maintaining pervious areas in a multitude of locations across the Basin.

The cost of outright purchase varies; it can be high if public, and is lower if private. Prices are limited to fair market value as determined by appraisal. Outright purchases are an actionable protection strategy. Political sensitivities include issues such as cost and value to the public, as well as changes in use (farm to recreation). Outright purchase is often the most expensive means by which to protect land, as the costs include not only the acquisition but also stewardship and other aspects of management. Another consideration is ownership – whether it makes sense for a county, city, or private partners to hold and manage protected property.

Recommendations

Policy

- Prioritize and select properties for purchase based on hydrological importance.

Engagement

- Encourage collaboration among stakeholder groups and public entities, prioritizing purchases based on watershed characterization and other criteria.

4.4.2 Conservation Easement

A conservation easement allows a qualified private land conservation organization or government to constrain land uses on private or public properties to achieve certain conservation or preservation purposes. Landowners can sell conservation easements or donate them for tax benefits. They are typically permanent, though the landowner may still own the land. Some involve restoration of portions of the protected property and all involve monitoring to enforce easement terms.

Conservation Easement

Implementation

Conservation easement acquisition is implemented at the county and individual project levels.

Assessment

Conservation easement acquisition is available for use in both King and Snohomish Counties. This strategy has been successfully used in a variety of applications and is a proven, permanent protection mechanism. Hydrologic benefits include maintaining pervious areas in a multitude of locations across the Basin. The public cost of acquisitions can be high, although this depends on funding sources: some are available through federal and state programs, others can be private. Transactions are required to be at or below fair market value as determined by appraisal. Acquisitions are an actionable protection strategy. Political sensitivity is generally low; landowners participate on a voluntary basis, properties are determined to be of high conservation value, and a transparent process determines compensation. Other considerations include limited availability of funding, complexity of the acquisition process, and responsibility for stewardship and monitoring of conservation easements. Counties and nonprofit organizations may accept donations of easements from landowners seeking to permanently protect their properties. While the donation incurs no acquisition costs, the county or land trust bears the long-term cost of monitoring and enforcing easements.

Recommendations

Policy

- Increase existing funding sources or create new ones.
- Examine the conversion of trust lands to natural lands.
- Prioritize and select properties for conservation easements based on hydrological importance.

Mechanical

- Work with private entities (potentially tribes as well) to prioritize acquisitions.
- Find ways to get easements on DNR trust lands so they are not converted.

4.4.3 Transfer of Development Rights

TDR is a voluntary, market-based real estate tool that gives landowners the option to sell development potential in the form of credits, to buyers who may in turn use the credits to build to higher intensities in designated "receiving areas" than zoning otherwise allows. Land protection at "sending areas" resulting from the TDR credits is permanent and enforced through a conservation easement, which entails monitoring and enforcement. Both King and Snohomish Counties have county-wide programs and several cities in each county have programs with inter-jurisdictional transfer agreements (such as the

Landscape Conservation and Local Infrastructure Program). A regional program also allows for transfers across county boundaries and provides financial benefits for certain cities to participate.

TDR

Implementation

For the purposes of the SBPP, TDR is implemented at the county level.

Assessment

Both counties have used TDR to varying degrees as a means to permanently protect rural residential and resource lands. As a market-based program, TDR use is driven by development and the extent to which it is used varies according to real estate market trends. The hydrologic benefits of lands protected via TDR involve maintaining existing levels of pervious surfaces in perpetuity at TDR sending sites, which can be in rural-zoned land (including forest and agricultural zones) from the urban-rural fringe to the headwaters.

Administrative costs of the program vary between King and Snohomish Counties, as have the respective returns on public investment in TDR credit acquisitions. TDR is fully actionable: owners of designated resource lands across the Basin are eligible to participate, as are some owners of rural residential lands. Political issues around the use of TDR vary. While the voluntary and market-based aspects of the program respect property rights and thus are broadly consistent with landowner interests, expanded use of TDR at the regional scale has introduced political sensitivities. In cities, TDR may compete with other incentives like affordable housing. More broadly, use of the tool is perceived as an additional cost imposed on growth. Considerations influencing more extensive use of TDR in the Basin include greater incentives for jurisdictions to use TDR, the dependency of local programs on market conditions, and the breadth of program adoption and credit absorption. As more cities participate in the regional program, they will absorb more credits and, by extension, permanently conserve more land.

Recommendations

Policy

Snohomish County near-term opportunities:

- Ensure that upcoming area-wide rezones in urban areas become TDR receiving areas in accordance with comprehensive plan policies.
- Partner with eligible cities to implement the regional TDR tool, the Landscape Conservation and Local Infrastructure Program.
- Market the TDR credits that the county currently holds (at prevailing market rates) and revolve the initial public investment made in the TDR pilot program into more conservation (i.e., purchases of additional TDRs).

King County near-term opportunities:

- Support the work of additional cities to implement the regional TDR tool, the Landscape Conservation and Local Infrastructure Program.
- Support adoption of TDR agreements between cities and counties to ensure continued demand for TDRs; update existing programs periodically to reflect changing conditions in local real estate markets.

- Support adoption of TDR agreements between cities and counties to ensure continued demand for TDRs; update existing programs periodically to reflect changing conditions in local real estate markets.

4.4.4 Purchase of Development Rights

PDR is a voluntary market-based tool in which landowners may sell or donate the development potential from their natural resource lands, typically by encumbering those lands with a conservation easement. The chief distinctions from TDR are that PDR is publicly funded, development potential is permanently extinguished (rather than transferred), and easements are typically more restrictive. As with TDR, conservation easements acquired through PDR require regular monitoring and enforcement. PDR can operate as a standalone program or can be modified to work in conjunction with TDR.

PDR

Implementation

For the purposes of the SBPP, PDR is implemented at the county level.

King County initiated its PDR program, called the Farmland Preservation Program (FPP), in 1979 after county voters approved an initiative that authorized the county to protect increasingly scarce farmland by purchasing the rights to develop it. Landowners who sell their development rights to the county under the FPP allow restrictive covenants to be placed on their properties, which greatly limit non-agricultural uses and development. Since 1979, King County has used the FPP to acquire the development rights on 13,200 acres of high-quality agricultural land within its boundaries.

Snohomish County carried out its first acquisition of development rights in 2005 and formally established its PDR program via ordinance in 2006. Under this program, the county preserves valuable farmland by purchasing development rights from landowners and placing conservation easements on their properties that prohibit most non-agricultural uses. Between 2005 and 2012, Snohomish County protected nearly 500 acres of agricultural land in a pilot area in the southern portion of the county. The program has been on hold in recent years.

Assessment

PDR is actionable, as both King and Snohomish Counties have adopted PDR programs and used them to

permanently protect agricultural lands. However, PDR can be a relatively expensive protection tool. PDR acquisitions within the Basin have been funded by a combination of local Conservation Futures tax (CFT) funds and state/federal matching funds; the long-term availability of these matching funds is uncertain.

PDR is also limited in terms of the amount of protection it can provide. The main hydrologic benefit of PDR is the protection of pervious land surfaces in the Basin. The conservation easements used in local PDR programs prohibit most non-agricultural activities, thereby limiting opportunities for ecological restoration. In King County, new FPP easements now allow for greater restoration opportunities (older FPP easements still allow only minimal restoration).

Recommendations

Policy

- Expand the PDR program area in Snohomish County to include all designated resource lands and integrate the program with TDR, allowing the county to sell publicly acquired credits and revolve funding.
- Adapt the funding structure for PDR to increase local flexibility in program implementation.

4.4.5 Reverse Purchase of Development Rights Auction

A reverse PDR auction is a conservation mechanism based on a transaction model used in agricultural commodity markets. A public entity raises funds, announces a PDR, and accepts bids from landowners who declare the price at which they are willing to sell. The public entity reviews the bids, prioritizes them, and purchases development rights from interested parties until funds are expended or all properties have been protected. Participating landowners accept conservation easements on their properties. The purchased rights may either be extinguished or re-sold through a TDR program. This process can be repeated according to the availability of resources and the level of interest.

Reverse PDR Auction Implementation

A reverse PDR auction would be implemented at the county level.

Assessment

A reverse PDR auction does not exist in either King or Snohomish Counties. The effectiveness of this approach to watershed protection is untested, although the mechanism is established in agricultural commodity markets. The benefits for hydrology are the same as existing PDR programs.

This protection strategy would involve public funding to pay for acquisitions; however, the design of the auction incentivizes conservation that is more flexible than the existing PDR program, as there would be no appraisal requirements. Potential political issues surrounding this approach could include participant uncertainty and the public's need for assurance that it is not paying above fair market value for development rights.

Recommendations

Mechanical

- Create the mechanism for conducting a reverse auction in King and Snohomish Counties and generate funding to invest in purchases.
- Explore fundraising targets, bond issuance, and assessment of protection goals in King and Snohomish Counties.

4.4.6 Public Corporation/Authority

Washington authorizes the creation of public corporations by local jurisdictions (RCW 35.21.730 through 35.21.755). If chartered accordingly, public corporations can buy, sell, and own property. They can issue revenue-backed debt to finance acquisitions, making them an option for the purchase and ownership of resource lands, such as managed timbered property.

Public Corporation/Authority Implementation

The establishment of a public authority would be implemented at the county level.

Assessment

Public authorities focused on activities that protect hydrologic functions do not yet exist but could be feasible within the Basin. Effectiveness as a protection strategy is untested. Hydrologic benefits include maintaining pervious areas in the Basin uplands.

A public authority would be chartered for a specific purpose and would be self-sustaining; however, for the model to be viable, it may require authority-issued revenue-backed bonds, guaranteed by the full faith and credit of the hosting county. Authorities are available but not yet actionable given that their

establishment would require additional research into viability. Political issues include a requirement for enabling legislation. Additional considerations are the cost structure of the business model—whether it can deliver a return on investment—and backing the program with the full faith and credit of the public.

Recommendations

Policy

- Evaluate the feasibility of this tool, identify possible funding sources, and explore additional steps toward legislation.

4.5 Category 4: New Models and Assessments

Additional modeling and assessment tools have been developed (or have significantly changed) since the 2005 Plan that could help focus or improve protection efforts in the Basin. These tools allow for better alignment of policies and regulations to protect hydrology and ensure that areas for protection are accurately identified. Some of these tools are focused on informing and prioritizing protection strategies.

4.5.1 Water Typing

Water typing is a process that identifies and classifies streams, lakes, and wetlands into types based on physical, biological, and human-use characteristics. The goal of water typing is to identify waterbodies that are sensitive and important both ecologically and for human use so they can be protected. The original intent of water typing was to regulate forest practices by providing the basis for forestry regulations; to date, forestry practices are still dictated by water typing maps. However, it is also recognized that many local entities use the water typing maps to help identify critical areas in their jurisdictions.

Water Typing

Implementation

Water-typing primarily supports forestry regulations through the Forests and Fish regulations but can also be used in other land use decisions. This tool is implemented at a Basin wide scale.

Assessment

Although water type maps are a protective tool in theory, it is commonly understood that these maps are inaccurate, compromising the effectiveness of planning decisions and regulations intended to protect sensitive, hydrologically important areas. This is true in the higher-elevation forest lands of the Basin, where many forest practice regulations are applied, as well as in the low-elevation forests where water type determines regulatory buffers through local ordinances.

The use of inaccurate maps sets the stage for inappropriate logging and development in potentially sensitive areas. Streams and wetlands that are unmapped or inaccurately mapped may be areas critical to preserving the hydrology of the Basin. In order to ensure the state and local regulations and policies (Forest Practice Rules, HPAs, Critical Areas Ordinances, and Shoreline Master Programs) are appropriately enforced, water typing needs to occur across the Basin, in order to produce a better baseline. Educating partners about the importance of water typing in the Basin will help further the cause and then training those partners in water typing will help cover the Basin.

Recommendations

Mechanical

- Implement water typing efforts in critical basins based on hydrologic importance.
- Establish better enforcement, with meaningful penalties.
- Evaluate compliance, with adaptive management.
- Require better documentation of data collected during field surveys in a standardized format. This would include details on bankfull widths and gradient measurements, e-fishing effort, flow conditions during survey and precipitation preceding survey, and documentation that no constructed barriers (full or partial) exist downstream from the reach in question if fish absence is presented to justify type N.

Engagement

- Increase professional water typing expertise by jurisdictions in the Basin.

Policy

- Develop on-call contracts to provide ground-truthing of water types; make this service available to cities and small forest landowners.
- Establish a certification of water type surveyors, a process that includes mandatory training in water typing to attain professional accountability of consultants who perform the work. Follow state protocols (WAC 222-16-031).
- Re-write WAC 222-16-030 and WAC 222-16-031 to ensure proper classification of stream reaches.

4.5.2 High Resolution Change Detection

The High Resolution Change Detection (HRCD) data set is a land use decision assistance tool developed by WDFW that uses 1-meter National Agricultural Imagery Program ortho-photography to quantify land cover change between different time periods. Each area that is statistically likely to have changed, based on an automated process that evaluates pixel

change, is visually inspected and confirmed by a technician and assigned attributes of initial land class, change percentage, and the change agent. The ability to quantify a variety of land cover change metrics, such as canopy loss and impervious surface increase, can have profound effects on effectiveness assessment of land use decisions like CARs.

HRCD

Implementation

The HRCD dataset currently covers the entire Puget Sound watershed and compares land cover change between 2006, 2009, and 2011. The HRCD pilot study is engaging several localities, including Snohomish County, Pierce County, Whatcom County, Kitsap County, the City of Tacoma, and the Northwest Indian Fisheries Commission.

Assessment

The HRCD dataset is unique in its scale. Covering the entire Puget Sound watershed, the HRCD data currently compare land cover change between 2006, 2009, and 2011, with more iterations set to be developed in the coming years. In order to assess the utility of the HRCD data set, in 2014 WDFW began recruiting local partners to engage in a pilot study to work out a project that addresses a land use issue within a brief (approximately 6-month) time frame. Projects so far include, but are not limited to, canopy loss in riparian areas, evaluation of Shoreline Master Program effectiveness, and (in the case of Snohomish County) evaluation of the permit-based land cover change detection system. Each project will be documented as a case study and compiled to function as both a standardization of use protocol for other localities in the region and to demonstrate support for future iterations of the data. The ultimate goal of the pilot study is to garner support in developing the HRCD project into a self-sustaining land use decision assistance tool that is incorporated into regular operational functions of localities, tribes, and the state.

Recommendations

Policy

- Potentially use HRCD for effectiveness monitoring of Critical Areas Ordinances by quantifying canopy loss and impervious surface increase over time.

Engagement

- Provide technical support/classes to interested parties on how to use the tool.
- Provide a case study on how the tool is used for protection strategies.

Mechanical

- Secure funding to make HRCD a web-based application to be used by nongovernmental organizations, jurisdictions, and agencies in Puget Sound.
- Secure funding to ensure the program is updated on a regular basis.

4.5.3 LiDAR

Light Distance and Ranging (LiDAR) is an airborne laser swath mapping technology that uses a high-frequency pulsed laser (up to 150,000 pulses/sec) typically mounted on a helicopter or fixed-wing aircraft to produce very accurate topographic surveys. Surveys can show tops of structures (like buildings, trees, and stumps) or can be digitally manipulated to show the ground surface in great detail, as though the vegetation has been completely removed.

LiDAR is used to create bare earth models, which can detect geologic faults, unmapped streams, unknown or abandoned roads under a dense forest canopy, unstable slopes features (e.g., inner gorges, deep-seated landslides, steep convergent terrain), wetland features, mapping geomorphic features, flood modeling and forecasting, and other features. Additionally, LiDAR assessments can include tree mapping and species identification, vegetation canopy height, and forest characterization.

LiDAR

Implementation

LiDAR was flown in all of King County, but across several different efforts between 2003 and 2006. In the upper watershed in King County, the quality of the LiDAR was quite low. New Puget Sound protocols have since been developed that will help ensure high quality products.

In Snohomish County, LiDAR has been flown for most of the County with the exception of the USFS ownership on the east side of the County.

Assessment

There are many ways LiDAR information can be used to assist land managers or land use decision-makers in identifying areas of concern or where to focus efforts for more intense scrutiny. Natural resource managers typically use these data to focus on-the-ground evaluation of sensitive resource concerns. For example, unmapped streams, channel migration/erosion zones, unstable slopes, orphaned roads, and fish habitat streams are just a few of the landscape features that were identified for protection for during forest practices review. Many timber and development proposals have been reexamined and resource protection risk reduced over the years due to the ability to use this information, where available. This information is also valuable when designing and scoping restoration projects.

The need for repeating LiDAR flights largely depends on what questions the information is trying to answer. For large swaths of the landscape, the bare earth model does not change much over time. However, in dynamic areas, such as floodplains, managers may want new LiDAR information following large flow events or large restoration projects. For managers in timberlands, where LiDAR can help describe vegetation conditions, LiDAR should be flown more regularly.

Recommendations

Policy

- Work with the USFS to acquire new LiDAR information that will help develop stand management, road, and sensitive feature management approaches that will best protect intact hydrology.

4.5.4 Drainage Classification

King County has an Agriculture Drainage Assistance Program that classifies agricultural waterways according to salmon presence, seasonal stream flow, watershed size, temperature data, and geomorphic characterizations that indicate presence of stream characteristics. The classification is updated periodically when new information is learned about a specific waterway. This classification helps guide decisions on allocation of BMPs for fish protection and restoration of fish habitat and water quality during agricultural waterway maintenance dredging. The County used the classification system as a basis for a streamlined drainage maintenance permitting with WDFW and King County's Department of Permitting and Environmental Review.

Drainage Classification

Implementation

This tool is King County-specific and implemented through the Agriculture Drainage Assistance Program.

Assessment

This classification system has been applied to all waterways (approximately 400 miles) in King County's Agricultural Production Districts, including the Snoqualmie Agricultural Production District, but no similar system has been applied to the Snohomish County portion of the Basin.

Recommendations

Mechanical

- Use method to help determine areas where drainage ditches can be combined to potentially provide greater benefit to hydrology.

Policy

- Consider establishing an agriculture drainage assistance program in Snohomish County and developing a similar stream classification system.
- Use the system to identify which "low" salmonid use streams would have greater juvenile salmon use potential if the fish passage barrier was addressed.
- Use the classification to help pilot installation and evaluation of "controlled drainage" or "drainage water management" systems that can provide greater protection of hydrology than typical drainage systems.

4.5.5 Stream Gauges

A stream gauge, stream gage, or gauging station is a location used by hydrologists or environmental scientists to monitor and test surface water. Hydrometric measurements of water level surface elevation (stage) and/or volumetric discharge (flow) are generally taken and observations of biota and water quality may also be made.

Stream Gauges

Implementation

Stream gauges have been put in place throughout the Basin by federal, state, and county agencies.

Assessment

Stream gauges provide critical information regarding stream flow to environmental scientists, fishery biologists, and planners. This information can help plan for flooding projects, irrigation withdrawals, hydroelectric power production, recreation, infrastructure designs, and habitat conditions. Long-term stability of stream gauging provides consistent, systematically collected information that can be used to track climate and land use changes; improve flood forecasting models; observe flows across jurisdictional and tribal borders; and monitor flows into major river basins that serve heavily populated areas or that sustain vital aquatic communities. Stream flows can inform numerous efforts but, often, long-term stream gauges are lost due to budget cuts.

Recommendations

Policy

- Establish funding source for long-term operation of key stream gauges.

Mechanical

- Determine critical stream gauge stations that will track hydrologic integrity of the Basin and ensure those remain funded.

4.5.6 Watershed Characterization

Ecology was a major partner in the SBPP project by providing technical assistance in running and interpreting the PSWC model. It was a very large undertaking and resulted in the *Watershed Characterization for WRIA 7: Assessment and Recommendations for Protection of Water Flow Processes* (Hume et al. 2016). The following text is from that report.

Watershed processes are defined as the dynamic physical and chemical interactions that form and maintain the landscape and ecosystems on a geographic scale of watershed to basins. This includes the movement of water, sediment, nutrients, pathogens, chemicals and wood. As described by Stanley et al. (2012), the PSWC is built on the basic relationships between ecosystem processes, structure, and function.

Watershed process are controlled and influenced by natural attributes and human actions. Natural controls on watershed processes include physical attributes of the ecosystem such as geomorphology, geology, and soils. Many human actions influence watershed processes. For example, timber harvest may reduce the amount of wood entering streams. Shoreline armoring can reduce sediment input from bluffs and alter the erosion, movement, and deposition of sediments along beaches. Urban development can increase the amount and amplitude of stormwater runoff. PSWC attempts to model these watershed

"Shoreline armoring" refers to the artificial application of materials to protect streambanks from erosion.

processes such that areas of the landscape can be identified that are relatively more important (presence of natural controls) or degraded (due to human impacts).

Watershed Characterization Implementation

Watershed characterization consists of a series models and indices that evaluate hydrology, water quality, and habitat in watersheds across Puget Sound. The models are run and maintained by Ecology and WDFW. The models are appropriate for comparing the relative value and degradation of processes and habitats in watersheds across Puget Sound. In many cases, with technical assistance from Ecology, the models can be adapted and applied to different watersheds and tailored to inform unique planning scenarios.

Due to the ability to scale the model, watershed characterization results can be applied at all levels (from an individual jurisdiction to Puget Sound-wide).

Assessment

In 2009, Ecology released the first watershed characterization model. This model combines information for assessments from land uses and landforms to present information on the relative importance and degradation of four different components of hydrology: storage, delivery, recharge, and discharge. The model is intended to guide land use planners in identifying areas that are important for restoration and protection. The Project team saw the potential of using the tool to take a landscape-scale approach to new hydrology-focused protection strategies with geographic specificity.

More recently, the completion of PSWC Volume 1 (Stanley et al. 2012) and Volume 2 (Wilhere et al. 2013) provided additional models and assessments of water quality processes (sediment, metals, pathogens, nitrogen, and phosphorus) and fish and wildlife habitats (terrestrial, freshwater, and marine shorelines) for use in planning. Hume et al. 2015 (in review) integrates assessments of water flow processes with those of sediment process degradation and salmonid habitats to help prioritize watersheds of the Basin for protection of hydrologic process, and identify additional benefits for salmonid habitat and potential limiting factors to management actions targeted in those watersheds.

The PSWC project generally prioritizes protection actions in watersheds that are highly important and are relatively less degraded for watershed processes, when resources to enhance or restore these areas are limited. This does not mean that there are not important areas or necessary restoration actions in assessment units that are not highly important and highly degraded. Rather, given limited resources, these might be the first place a planner would want to focus on to increase the likelihood of improving watershed processes in key areas.

Recommendations

Policy

- Incorporate PSWC as a key part in the Comprehensive Plan Updates for local jurisdictions.
- Consider PSWC models and indices, or other similar approaches to a comprehensive assessment of watershed processes, as best available science for local planning when relevant.

Engagement

- Make PSWC training available for planners in the Basin to learn how to best utilize the tool in their jobs.
- Highlight local uses of PSWC assessments—for planning projects or Comprehensive Plan updates—in workshops and planning forums to illustrate their utility, increase understanding and acceptance, and continue to refine methods for effective application.

4.6 Category 5: Other Tools/Strategies

This section details other protection tools or processes that do not clearly fit into the other categories.

4.6.1 Snohomish-Stillaguamish Local Integrating Organization

This tool is part of a regional process to assist in local implementation of the *2014/2015 Action Agenda for Puget Sound* (Puget Sound Partnership 2014). A regional group called the Snohomish-Stillaguamish Local Integrating Organization was formed in 2012 to "enable communities to guide the implementation of Action Agenda priorities at an ecosystem scale, and to prioritize local actions for investment" (Puget Sound Partnership 2015).

Snohomish-Stillaguamish Local Integrating Organization

Implementation

Protection actions would be promoted by inclusion as near term actions in the local profile of the Action Agenda.

Assessment

Unlike Lead Entities, the Local Integrating Organizations do not directly control any portion of Puget Sound investment funding.

Recommendations

Engagement

- Seek endorsement from the Local Integrating Organization for proposed protection actions.

4.6.2 Value Capture Financing

This tool, requiring state legislation to create, would create new funding through voluntary property taxes for built and natural infrastructure within a given a watershed. Such infrastructure could include utilities, sidewalks, or other built improvements to support growing urban populations, as well as parks, greenways, or other natural areas that provide hydrologic benefits. A projected outcome of its implementation would be new sources of funding for a variety of incentive and acquisition protection tools that will be eligible for use across the entire Basin.

Value Capture Financing

Implementation

Value capture financing investment in green infrastructure would be implemented at the Basin-wide level.

Assessment

This approach does not yet exist as a protection strategy. In concept, it is feasible although untested. Hydrologic benefits in the Basin derive from permanent protection of pervious areas.

The costs of implementing this strategy are unknown and it is not yet actionable. Political issues include the requirement of state legislation to effect implementation.

Recommendations

Policy

- Adopt legislation to make this tool possible.

4.6.3 Department of Natural Resources Programs

Each of these state-administered programs is implemented on a Basin-wide scale and targets protection of forest lands. Hydrologic benefits are similar to other acquisition tools and mainly involve the retention of pervious land in the Basin. These programs are grouped for analysis because they all operate under the auspices of DNR.

4.6.3.1 Forest Legacy Program

The Forest Legacy Program protects environmentally important forestlands threatened by conversion to development by acquiring conservation easements. Eligible properties must be managed for forest products and to provide public benefits such as healthy riparian areas and scenic, cultural, and recreation resources. Projects are prioritized that demonstrate national significance regarding the impact of forestland on the local or regional economy and on hydrology through water quality and habitat.

Forest Legacy Program

Implementation

The Forest Legacy Program is federally funded, implemented by DNR, and available to be applied statewide. As of 2014, more than 37,000 acres had been entered into the program in seven counties.

Assessment

Appropriations come from the Land and Water Conservation Fund, made up of revenue from offshore drilling for oil and gas. Annual appropriations are usually $50 million, which funds 15 to 20 projects. The grant process is often lengthy; it can be 2 to 3 years from project submittal to receipt of funding.

Recommendations

Mechanical

- Expedite the process for participants to make it more attractive.
- Use watershed characterization results to target outreach to landowners who may be interested in the program.

4.6.3.2 Community Forest Trust

In 2011, the Washington State Legislature worked with DNR to create a new tool for local community partners to participate in protecting working forestlands. This category of working forest will be held by the state, actively and sustainably managed by DNR, and used by the local community. Local communities nominate forest candidates, which are selected by DNR and funded jointly by the community and the legislature. Once acquired, a management plan will be developed for each Community Forest to specify financial, conservation, and recreation objectives. The Community Forests must be financially supported through revenue-generating activities.

Community Forest Trust

Implementation

The establishment of a community forest trust would be implemented at the Basin-wide level.

Assessment

Since adoption of enabling legislation, the program has been used to create the Teanaway Community Forest in Kittitas County. Costs are shared between the state and other parties; the legislature appropriated nearly $100 million for the Teanaway Community Forest. Political sensitivities vary and can include resistance to government acquisition of private land.

Recommendations

Mechanical

- Explore the interest and feasibility of creating a community forest within the Basin.

4.6.3.3 Trust Land Transfer Program

DNR manages more than 3 million acres of state trust forest, agricultural, range, and commercial properties. Income from these trust lands funds public education and other state institutions to provide local services. The Trust Land Transfer Program allows identified trust lands with high ecological value to remain in public ownership while maintaining and improving economic return to trust beneficiaries. Designated

properties are appraised for current market value. DNR uses the land value of the property to acquire replacement property better suited to generating revenue for education. These timbered properties are transferred to another public agency that will manage and protect it for public use and enjoyment. Properties with lower timber-to-land value ratios are often not suitable for this program.

Trust Land Transfer Program

Implementation

The Trust Land Transfer Program is available to public agencies across Washington. The land that DNR acquires to offset the trust land transfer program is often private.

Assessment

The Trust Land Transfer Program is funded by the state legislature.

Recommendations

Mechanical

- Use watershed characterization results to identify public agency property that may be particularly important for maintaining intact hydrological function.
- Use watershed characterization results to target outreach to landowners who may be interested in exchanging land to support the program.

4.6.4 WSU North Puget Sound Extension Forestry and Agriculture Programs

The Washington State University (WSU) Forestry and Agriculture Extension programs provide education and information about forest and agricultural management to private forest landowners and farmers as well as the general public. Local WSU Extension forestry programs include a forest stewardship university; field tours; expert consultations; seminars on topics such as wetlands, ponds, and amphibians; and evaluation of different harvesting techniques to promote woodland health. Local WSU agriculture programs focus on small farm sustainability and entrepreneurship.

WSU North Puget Sound Extension Forestry and Agriculture Programs

Implementation

The WSU North Puget Sound Extension program delivers research-based information and resources to farmers and foresters in King, Snohomish, Island, Skagit, Whatcom, and San Juan Counties.

Assessment

This is a popular, expanding education and outreach program with typical participants being small-scale woodland owners. The overall focus is to provide landowners with the knowledge, tools, connections, and motivation to restore degraded areas of their properties and protect existing intact and functioning systems.

Recommendations

Seek participants—such as professionals, educators, and policymakers—with the goal to reduce the economic pressure on forest owners to convert their forestland to non-forest use.

4.7 Summary of Tools

Table 8 provides a synthesis of the tools discussed in Section 4, including a brief description of the protection tool, the applicable geography and land use type, the affected hydrological component, and details of how the tool can be used to affect hydrology.

Table 8: Synthesis of Tools

Tool	Tool Description	Geography	Implementer	Land Use Type	Hydrology Component	Method of Protecting Hydrology	Notes
Category 1: Regulatory Mechanisms							
Growth Management Act	Plans for growth and land use on a 20-year timeline. State law that lays out 13 broad goals to guide local governments in the planning process including conservation of natural resources and protection and enhancement of the environment.	Basin-wide	State	All land use types	Delivery, storage, recharge, and discharge	Sets aside resource lands and requires the protection of all critical areas. Can help protect sensitive areas by directing development and growth.	
Comprehensive Plans	Goals and policies describing a community's (jurisdiction's) vision and priorities for development and how it plans to achieve them.	Cities and Counties	Cities and Counties	All land use types	Delivery, storage, recharge, and discharge	Through goals and policies for development patterns that emphasize the importance of water and hydrologic processes to the environment and human health.	
Critical Areas Regulations	A code with policies and standards intended to protect critical areas.	Cities and Counties	Cities and Counties	All land use types	Delivery, storage, recharge, and discharge	Requires compliance with policies and standards and protects water resources and hydrologic processes.	
Zoning Regulations	Implements land use designations described in the comprehensive plan (e.g., directs development in certain areas).	Cities and Counties	Cities and Counties	All land use types	Delivery, storage, recharge, and discharge	Policies and standards associated with each zone can protect hydrology	
Minimized Impact Rural Development	Look at rural development from impervious surface or impacts to hydrology lenses vs. density.	Basin-wide	County	Rural	Delivery, storage, recharge, and discharge	Allows development in a manner that is sensitive to hydrology and ecological conditions.	
Shoreline Management Act	Establishes goals and policies for land use and the protection of shorelines and shoreline processes within 200 feet of shorelines of the state.	Cities and Counties	Cities and Counties	Aquatic and upland areas 200 feet from the ordinary high water mark	Delivery, storage, recharge, and discharge	Requires no net loss of ecological function and compliance with policies and standards to protect aquatic habitat and water quality.	
Forest Practices Rules	Regulates logging to protect fish and aquatic resources.	Basin-wide (state, local, and private lands)	State	Forestry	Delivery	Implements forestry practices, which can greatly affect hydrology.	
Other Federally Approved Habitat Conservation Plan	Allows DNR to carry out timber harvesting and other forest management activities on state forestlands	Basin-wide (state, local, and private lands)	State (DNR)	Forestry	Delivery	Provides habitat protection through four detailed conservation strategies.	
Northwest Forest Plan	Regulates logging to protect spotted owl habitat and watershed conditions.	Basin-wide (federal lands)	Federal USFS	Forestry	Delivery, storage, recharge, and discharge	Implements forestry practices, which can greatly affect hydrology.	
Wilderness Act Designation	Sets aside large tracks of forestry land to protect it from development and excessive use.	Basin-wide	Federal USFS	Forestry	Delivery, storage, recharge, and discharge	Protect large tracts of forested lands from manipulation and development.	
National Wild and Scenic Rivers Designation	A designation of rivers that results in banning the licensing of hydropower and creates a federal reserved water right to protect flow-dependent values.	Basin-wide	Federal Government	All land use types	Delivery, storage, recharge, and discharge	Allow rivers to flow unencumbered.	
Instream Flow Rule Making	Regulations for using surface and groundwater for irrigation, livestock, and domestic use.	Basin-wide	State	Rural/Urban	Delivery and storage	Policies protect water in the system and can protect fragile, flow-limited systems.	

Tool	Tool Description	Geography	Implementer	Land Use Type	Hydrology Component	Method of Protecting Hydrology	Notes
Water Rights Market Tools	Trust Water Rights, Water Banking, and Water Acquisition programs designed to help water right holders use their permits efficiently.	Basin-wide	State	Agriculture, Rural, Urban	Delivery and storage	Keeps water in the system for instream uses.	
Reclaimed Water	The use of treated wastewater for non-potable uses.	Local jurisdiction	Cities and Counties	Rural/Urban	Delivery	Keeps water in the system.	
Living with Beavers	Make it easier for land owners to live with beavers on their property.	Local jurisdiction/ Planning Unit	Cities, Counties, and Non-profits	All land use types	Storage and delivery	Improves water storage; moderates delivery by minimizing peak flows.	
Beaver Relocation	Move beavers to forested lands to create wetland complexes.	Basin-wide	Federal Government	Forestry	Storage	Stores runoff in forest lands and creates storage for water delivery.	
Dam Licensing	FERC relicensing can dictate new hydrologic requirements.	Basin-wide/ Planning Unit	Federal Government, State, and Counties	Public lands	Delivery and discharge	Dams can impact delivery and storage. Relicensing can refine how those components are affected.	
WDFW Hydraulic Project Approval	Allows for conducting projects within an aquatic area.	Basin-wide	State	All land use types	Delivery, storage, recharge, and discharge	Can help protect aquatic areas by determining what is allowed and how it is done.	
Gold Mining and Fish Hydraulic Project Approval	Hydraulic Project Approval allows for gold mining in streams and rivers.	Basin-wide/ Planning Unit	State	Streams/rivers on public property	Primarily delivery, and discharge	Ensuring mining HPA works keeps delivery of water and does not create artificial berms.	
National Pollutant Discharge Elimination System	Permit that dictates how selected cities and counties manage stormwater.	Basin-wide	State, Counties, and Cities	Rural/Urban	Delivery, storage, recharge, and discharge	Runoff flow rates from land development projects must meet standards set forth by Ecology, with a focus on infiltrating as much runoff as feasible on site.	
Low Impact Development	Approach to land use and stormwater management that aims to preserve or mimic natural, pre-disturbance hydrologic processes.	Basin-wide	State	Rural/Urban	Delivery, storage, recharge, and discharge	Increases tree cover, infiltration, and storage features through mimicking natural conditions in built landscapes.	
Category 2: Incentives							
Current Use Taxation Program	Tax breaks for people enrolled in programs that protect resources.	Local jurisdiction	Counties and Cities	Agriculture/forestry	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas.	Not in existence.
Public Benefit Rating System	Tax breaks for people enrolled in programs that protect resources.	Local jurisdiction	Counties and Cities	Mostly Rural Residential	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas.	Currently only available in King County.
In-lieu Fee	Developers pay a fee to a public entity and the public entity then uses revenues to achieve the public benefit (in this context, protection) with the fee revenue.	Local jurisdiction	Counties and Cities	Urban/Rural Residential	Delivery, storage, recharge, and discharge	Local jurisdictions could use money to protect key areas of hydraulic importance.	
Conservation Reserve Enhancement Program	Leases land from a farmer to plant a buffer.	Basin-wide	Counties and Cities	Agriculture	Delivery and storage	Maintains riparian buffers, even if only temporarily.	

Tool	Tool Description	Geography	Implementer	Land Use Type	Hydrology Component	Method of Protecting Hydrology	Notes
Forestry Riparian Easement Program	Compensating forest landowners for retaining and improving riparian buffers for a specified period of time.	Basin-wide	Department of Natural Resources	Forested uplands	Delivery, storage, recharge, and discharge	Could protect critical hydrologic zones in forestlands.	
Four-to-One Program	Allows developers to cluster development and for each 1 acre developed, 4 acres must remain undeveloped.	Local jurisdiction	Counties and Cities	Rural Residential interface	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas.	
Added Value Products	Captures additional value by allowing landowners to sell products/byproducts to other industries	Basin-wide	Counties, Cities, and Non-profits	Agriculture and Forestry	Delivery and storage	Establishes riparian buffers.	Not in existence.
Category 3: Acquisitions							
Conservation Easement	Land is permanently kept in a particular land use type.	Local jurisdiction/ Planning Unit	Counties, Cities, and Non-profits	All land use types	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas by maintaining pervious surface.	
Transfer of Development Rights	Landowners sell development rights in the form of credits and developers can buy them to gain development flexibility.	Local jurisdiction	Counties and Cities	Mostly resource lands – agriculture, forestry	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas.	
Purchase of Development Rights	The purchase of development rights extinguishes development rights and restricts easements.	Local jurisdiction	Counties and Cities	Mostly resource lands – agriculture, forestry	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas.	Uses public money and is known as the Farmland Preservation Program in King County.
Reverse Purchase of Development Rights Auction	Public entity purchases development rights based on landowner's set price.	Local jurisdiction	Counties and Cities	Agriculture	Delivery, storage, recharge, and discharge	Could purchase lands critical to maintain hydrologic conditions.	Not in existence.
Outright Purchase	Purchase of land	Local jurisdiction/ Planning Unit	Counties, Cities, and Non-profits	All land use types	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas.	
Public Corporation/ Authority	Public corporations can buy, sell, and own property.	Local jurisdiction	Counties and Cities	All land use types	Delivery, storage, recharge, and discharge	This is a funding approach that could protect key hydrologic areas by maintaining pervious surface.	Not in existence.
Category 4: New Models and Assessments							
Water Typing	Tool that allows better implementation of land use regulations.	Basin-wide/ Planning Unit	State, Counties, Cities, and Non-profits	Mostly forestry but could be applied more broadly.	Delivery	Ensures streams are typed appropriately, to better apply critical areas regulations and other regulations.	
High Resolution Change Detection	High-resolution aerial photography that tracks changes over time.	Basin-wide	State	All land use types	Delivery, storage, recharge, and discharge	Tracks land use over time and can help align policies and regulations to protect hydrology.	
LiDAR	Remote sensing technology that makes very high-resolution maps and is the basis for many models.	Basin-wide	Federal, State, and Counties	All land use types	Delivery, storage, recharge, and discharge	Allows for highly detailed ground truthing of an area and existing features on the landscape.	

Tool	Tool Description	Geography	Implementer	Land Use Type	Hydrology Component	Method of Protecting Hydrology	Notes
Drainage Classification	Classification system to help determine best methods for performing drainage actions.	Basin-wide	Counties	All land use types (mostly agriculture)	Storage, recharge, and discharge	Ensures that areas prime for hydrological storage, recharge, and discharge are protected.	
Stream Gauges	Monitor water flow and water level in streams.	Basin-wide	Federal, State, and Counties	All land use types	Delivery	Helps inform changes in water quantity and timing of water delivery.	
Watershed Characterization	Combines information for assessments from land uses and landforms to present information on the relative importance and degradation of four different components of hydrology: storage, delivery, recharge and discharge.	Basin-wide	State, County, and Local Jurisdictions	All land use types	Delivery, storage, recharge, and discharge	Helps show important hydrologic areas scaled to specific geographic boundaries.	
Category 5: Other Tools/Strategies							
Snohomish-Stillaguamish Local Integrating Organization	Local/regional planning group is part of the Puget Sound Partnership's Action Agenda program.	Basin-wide	State, Counties, Local Jurisdictions, Tribes, and Non-profits	All land use types	Delivery, storage, recharge, and discharge	Could prioritize and fund key actions to protect hydrology.	
Value Capture Financing	New funding through voluntary property taxes for built/natural infrastructure within a specific watershed.	Basin-wide/ Local jurisdiction	State, Counties, and Cities	All land use types	Delivery, storage, recharge, and discharge	Could protect key hydrologic areas depending on priority.	Not in existence, but strengthens incentive to use TDR.
Forest Legacy Program	Protects environmentally important forestlands threatened by conversion to development by acquiring conservation easements.	State	State	Forestland	Delivery, storage, and recharge	Maintains forestlands.	
Community Forest Trust	A community forest will have a management plan developed by DNR and the local community, specifying financial, conservation, and recreation objectives.	State/ Local jurisdiction	State, Counties, and Cities	Forestland	Delivery and storage	Maintains forestlands.	Not in existence.
Trust Land Transfer Program	Allows identified trust lands to remain in public ownership while maintaining and improving economic return to trust beneficiaries.	Basin-wide	State	Forestland	Delivery, storage, recharge, and discharge	Could protect critical hydrologic zones in forestlands.	
WSU North Puget Sound Extension Forestry and Agriculture Programs	Education on forestry including silviculture and managing woodlands for private forest landowners.	Basin-wide	State	Forestland	Delivery, storage, and recharge	Maintains forestlands and promotes stewardship to maintain hydrologic functions.	

Section 5

FUNDING STRATEGIES

As discussed in the strategy assessments, many of the tools available to protect land and hydrologic function across the Basin face funding challenges. This section presents a range of funding opportunities that are available, or that may become available, to support SBPP objectives relating to Basin-wide strategies and early actions.

In the past, public sources have constituted a central component of funding for protection purposes. The long-term certainty of these sources is unclear; state and federal appropriations for funding programs may change and competition for these funds may grow. While many of these programs will continue to play an important role in protection efforts in the Basin, other opportunities may diversify the range of funding. These include expanded use of market-based tools that draw on private sources to achieve protection and emerging forms of incentives that encourage their use. Local funding sources can provide flexibility in achieving protection but may be challenging to expand given competing needs.

Table 9 lists the sources of funding identified to support the objectives of the SBPP. Descriptions of each source are in Sections 5.1 through 5.5, noting the availability, purpose, and applicability to the protection tools that were assessed in Section 4.

Table 9: Summary of Funding Sources

Name of Source	Type of Protection Tool Funded	Availability
Washington Wildlife and Recreation Program	Incentives/acquisitions	Current, state program
Salmon Recovery Funding Board	Acquisitions/assessments	Current, state/federal program
Puget Sound Acquisition and Restoration Fund	Acquisitions	Current, state program
Floodplains by Design	Acquisitions	Current, state program
Estuary and Salmon Restoration Program	Acquisitions	Current, state program
Forest Legacy Program	Acquisitions	Current, state program
Trust Land Transfer Program	Acquisitions	Current, state program
Community Forest Trust	Acquisitions	Current, state program
National Estuary Program	Incentives/regulatory	Current, state/federal program
Land and Water Conservation Fund	Acquisitions	Current, federal program
Cooperative Endangered Species Conservation Fund "Section 6"	Acquisitions	Current, federal program
Natural Resource Conservation Service Farm and Ranch Lands Protection Program	Incentives/acquisitions	Current, federal program
Conservation Futures	Incentives/acquisitions	Current, county programs
Non-levy Revenue	Incentives/acquisitions	Future, county/city option
Bonds	Acquisitions	Future, county option
Impact Fees	Incentives/acquisitions	Future, county/city option
King County Flood District's Cooperative Watershed Management Grants	Incentives/acquisitions/ assessment	Current, King County portion of the Basin
King County Parks Expansion Levy	Acquisition	Current, King County portion of the Basin
King Conservation District Member Jurisdiction Grant Program	Incentives/acquisitions	Current, King County portion of the Basin
Transfer of Development Rights Credit Sales	Incentives	Variable
Property Taxes	Incentives	Current, county/city program
Value Capture Financing	Incentives	Future, county/city option
Density/In-lieu Fees	Incentives	Variable
Tribes	Acquisitions	Current, tribal efforts
Donations	Acquisitions	Current, multiple opportunities

5.1 State Programs and Funding Sources

5.1.1 Washington Wildlife and Recreation Program

The Washington Wildlife and Recreation Program is a state grant program that provides funding to protect habitat, preserve working farms, and create new local and state parks (RCW 79A.15; WWRC 2014). Administered by the State's Recreation and Conservation Office, the program involves a competitive process from which projects are selected for funding. The amount of funding and project approval are decided by the governor and state legislature. Of the project categories that the Washington Wildlife and Recreation Program funds, several are germane to the protection goals of the SBPP.

Applicability

This funding source is available and supports acquisition and incentive protections. Specific funding areas that pertain to the Basin include critical habitat, farmland preservation, natural areas, and riparian protection.

5.1.2 Salmon Recovery Funding Board

Administered through the State's Recreation and Conservation Office, the Salmon Recovery Funding Board is a combined state and federal grant program that awards funding to protect or restore salmon habitat and assist with related activities (RCW 77.85). Local groups develop projects that are evaluated by scientific panels and forwarded to the board for consideration. The emphasis is on encouraging locally-generated project ideas.

Applicability

This funding source is available. A portion of Salmon Recovery Funding Board funding supports acquisition (primarily habitat) and planning projects. Some projects involve a combination of acquisition, restoration, or planning activities.

5.1.3 Puget Sound Acquisition and Restoration Fund

Administered through the State's Recreation and Conservation Office and the Puget Sound Partnership, the Puget Sound Acquisition and Restoration Fund is a biennial state funding source, authorized through the legislature, that awards funding to protect or restore salmon habitat. Local groups develop projects that are evaluated by scientific panels and forwarded to the board for consideration. The fund has a regional large capital component and a local watershed component. The local component follows the same approval process as the Salmon Recovery Funding Board grants.

Applicability

This funding source is available. A portion of Puget Sound Acquisition and Restoration funding supports acquisition (primarily habitat). Some projects involve a combination of acquisition, restoration, or design activities.

5.1.4 Floodplains by Design

This is a public-private partnership that seeks to integrate flood hazard reduction with habitat restoration and protection. It is administered by Ecology with the involvement of the Puget Sound Partnership, The Nature Conservancy, and numerous partners representing tribes, state and federal agencies, and private groups. A project focusing on restoration and infrastructure assessment along the lower Snohomish River has already won funding.

Applicability

This funding source is available and emphasizes coordination in approaches to protection. The Sustainable Lands Strategy continues to be a project proponent, as it is inclusive of many groups and interests. Awards may include funding for acquisitions.

5.1.5 Estuary and Salmon Restoration Program

The Estuary and Salmon Restoration Program provides state funding and technical assistance for nearshore restoration and protection efforts in Puget Sound. Developed as a tactical element by the Puget Sound Nearshore Ecosystem Restoration Project, the Estuary and Salmon Restoration Program is focused on moving from opportunistic grant funding towards strategic ecosystem restoration.

This strong link to science and an ecosystem-scale approach ensure that the Estuary and Salmon Restoration Program's investment decisions are strategic and that the efforts will translate into estuaries, bays, and shorelines that are intact, functioning, and resilient to climate change.

The estuary is the region where fresh water from the Basin mixes with the salt water of Puget Sound. The estuary is a highly productive and diverse environment and provides unique and critical habitat for salmon for rearing, migration, and transitioning between fresh and saltwater.

The nearshore is the area extending from the shoreline into the water. Nearshore areas provide habitat for 80% of the fish species in the United States (USEPA 2012).

Applicability

This funding source is available to funding estuary and nearshore acquisition of intact estuary lands. Projects are large-scale efforts that may involve restoration and assessments.

5.1.6 Forest Legacy Program

The Forest Legacy Program protects environmentally important forestlands threatened by conversion to development. The program operates by paying for conservation easements. To be eligible for the program, properties must be managed to produce forest products and provide non-commodity values such as healthy riparian areas and scenic, cultural, and recreation resources. Projects are prioritized that demonstrate national significance regarding the impact of forestland on the local or regional economy and on environmental values such as water quality and habitat.

Applicability

Although a federal program, Washington State's participation is administered by DNR. The state convenes a panel to determine which projects should move to federal consideration. Each state can submit up to three projects (may not exceed $10 million). The grant process is often lengthy; it can be 2 to 3 years from project submittal to receipt of funding.

5.1.7 Trust Land Transfer Program

DNR manages more than 3 million acres of state trust forest, agricultural, range, and commercial properties. Income from these trust lands goes toward public education and other state institutions to help fund local county services. Some trust lands provide habitat for fish and wildlife and recreation and education opportunities for the public, but do not generate revenue. The Trust Land Transfer Program allows identified trust lands to remain in public ownership while maintaining and improving economic return to trust beneficiaries.

Applicability

The Trust Land Transfer Program is funded by the state legislature. Designated properties are appraised and transferred at market value.

The value of the timber is deposited into the Common School Construction Account to provide revenue for K-12 schools. The value of the land is used to acquire replacement property that is better suited to generate future revenue for schools. The timbered property is transferred to another public agency to be managed and protected for public use and enjoyment.

5.1.8 Community Forest Trust

In 2011, the Washington State Legislature worked with DNR to create a new tool for local community partners to participate in protecting working forestlands. This category of working forest will be held by the state, actively and sustainably managed by DNR, and used by the local community.

Applicability

Community forest candidates are nominated by local communities, selected by DNR, and funded jointly by the community and the legislature. Once acquired, a working forest management plan will be developed for each Community Forest. The plan will specify financial, conservation, and recreation objectives. The Community Forests must be able to support themselves financially through revenue-generating activities.

5.1.9 National Estuary Program Grants

Administered by Ecology and the Washington State Department of Commerce, the National Estuary Program grants are funded through USEPA. The National Estuary Program is a multi-year program awarding annual grants to projects proposed by local jurisdictions, tribes, non-profit organizations, and partnerships. Awards support both restoration activities and planning activities that inform regulatory updates to improve land use decisions and reduce hydrologic impacts by encouraging development within existing urban areas. The program supports projects that advance Puget Sound Partnership Action Agenda (Puget Sound Partnership 2014) items.

Applicability

Cities in the Basin, including Everett and Snohomish, have won awards to fund planning work that improves land use decisions. Planning supported by this program can result in policies and regulations that lead to reduced hydrologic impacts at the Basin level.

5.2 Federal Programs and Funding Sources

5.2.1 Land and Water Conservation Fund

The focus of this federal program is to conserve irreplaceable lands and improve outdoor recreation opportunities nationwide. The program works in partnership with state and local efforts to acquire and protect inholdings and expansions in national parks, wildlife refuges, forests, trails, and Bureau of Land Management areas (LWCF 2014). The program is funded by offshore oil and gas royalties.

Applicability

Funding for this program has been highly variable. Given the estimated value of deferred federal acquisitions and unpredictable revenue streams, opportunities to use this program for protection in the Basin are currently limited.

5.2.2 Cooperative Endangered Species Conservation Fund "Section 6"

This program provides federal grant funding to acquire, enhance, and protect land in perpetuity to benefit threatened and endangered species in support of state and federally recognized HCPs. Grant funds are available to protect lands in perpetuity for habitat conservation through the Recovery Land Acquisition grant or a HCP Land Acquisition grant. Funds are also available to plan and develop an HCP through the Habitat Conservation Planning Assistance grant.

Applicability

DNR works in partnership with WDFW and U.S. Fish and Wildlife Service to administer and implement the national competitive grants. Individuals or groups are eligible to seek federal funding under this grant by working with DNR or WDFW.

5.2.3 Natural Resource Conservation Service Farm and Ranch Lands Protection Program

The Natural Resource Conservation Service (NRCS) offers a grant program available to local jurisdictions that provides matching funds for easement acquisition to keep agricultural land in production. One factor influencing the amount of funding available to state offices of the NRCS is the presence of other programs that also fund farmland protection. NRCS is more likely to allocate higher dollar amounts to program areas with a strong local commitment to protecting agricultural land.

Applicability

NRCS funding is available and has an annual application cycle. Snohomish County has successfully leveraged this funding with CFT funds to acquire easements on farmland in the Tualco Valley through its PDR program. Limitations of this program include a requirement to extinguish development potential (development rights may not be re-sold) and the restriction of all non-agricultural activity.

5.3 Local Programs and Funding Sources

5.3.1 Conservation Futures

At present, Snohomish and King Counties fund a range of programs with revenue from the CFT. Examples of past expenditures include parks funding, grants to cities, TDR purchases, and grants to private entities for conservation projects. Projects receiving CFT funds are recommended by an advisory board.

Applicability

CFT funding is available in both counties. Snohomish County is currently using a portion of this revenue source to service debt on a bond that expires in 2017. Once this bond is paid off, more money might become available to fund protection projects.

5.3.2 Non-levy Revenue

Snohomish County collects non-levy revenues that could potentially be allocated to fund protection tools. These include investment interest, lease-holding tax, timber revenues, and miscellaneous funds. These funds provide a predictable income stream to the County; however, their value is not very large. In 2009, the combined revenue collected from these sources totaled about $250,000.

Applicability

These funding sources are not currently appropriated for protection purposes. Non-levy revenues could supplement other sources of local funding to provide matches for state and federal grant programs.

5.3.3 Bonds

Bonds may be issued by County Council decision (councilmanic) or by popular vote (general obligation). For the purposes of funding acquisitions or incentive programs (such as PDR or a reverse PDR auction), the local governments might explore public opinion around a general obligation bond. The debt service on this type of bond would not come at the expense of other County programs and public support for a general obligation bond would substantiate the value of conserving important natural areas that advance the objectives of the SBPP.

Applicability

The authority already exists for bonding; however, Snohomish County is repaying an existing bond (with CFT revenues) that will end in 2017. Issuing new debt is risky and in the case of general obligation bonds, it must be approved by a majority of voters. It is difficult to predict what public opinion will be on this subject but the County can attempt to measure it through a survey.

5.3.4 Impact Fees

Counties and cities may collect fees on developments to pay for impacts to traffic, infrastructure, and other public benefits. Local jurisdictions set these fees and may choose to absorb a portion of the costs of infrastructure improvements to encourage growth. A portion of these fees may be set aside to fund implementation of protection tools. In one innovative example, the City of Kirkland explored using TDR as an offset for impact fees to more effectively leverage revenue through the Landscape Conservation and Local Infrastructure Program.

Applicability

Local jurisdictions have the authority to charge impact fees. Raising existing fees or creating new ones to fund protection may be a sensitive decision.

5.3.5 King County Flood District's Cooperative Watershed Management Grants

In 2012, the King County Flood Control District agreed to provide funding to support watershed salmon recovery projects and activities in King County watersheds through a Cooperative Watershed Management Grant Program. Eligible applicants include local governments, tribes, and non-profit organizations. Among the highest funding priorities will be those projects or programs that promote recovery of ESA-listed species. In addition, actions that benefit steelhead trout and other salmonids are important. Awards primarily support restoration activities but also support acquisitions, monitoring projects, and watershed planning.

Applicability

Work done by this funding program must be done in King County. All local jurisdictions in the Snoqualmie Basin are eligible for this funding, as well as tribes and non-profit organizations working in the area. Funding for the program is allocated annually by the King County Flood Control district.

5.3.6 King County Parks Expansion Levy

King County Parks secured voter-approved capital funding through a Parks Expansion Levee in 2014. The funding can be matched to CFT funding to purchase intact habitat or purchase conservation easements on forestlands. King County agencies are eligible to apply for funding but the funds can be used within cities as well. The funding is an important match source to CFT due to CFT's 50% match requirement, which can be difficult to obtain in rural areas of King County.

Applicability

King County runs an annual project selection process beginning in January that is approved by the King County Council in November.

5.3.7 King Conservation District Member Jurisdiction Grant Program

Since 1998, jurisdictions in King County have been eligible to apply for project funding though the King Conservation District Member Jurisdiction Grant Program. The program funds habitat restoration, acquisition, outreach, incentives, and monitoring.

Applicability

This funding source is an important match for larger grants, especially for smaller cities that do not have internal funding for acquisitions. Jurisdictions have a set grant allocation each year but must apply to the King Conservation District and secure approval from the King Conservation District Board.

5.4 Market-Based Programs and Funding Sources

5.4.1 TDR Credit Sales

Both King and Snohomish Counties own TDR credits purchased with public funds. Snohomish County's 49 credits stem from a single acquisition under a pilot project; King County holds an inventory of more than 1,000 credits in a TDR bank. Snohomish County has made efforts in the past to sell its credits but has not found adequate demand. King County has made multiple sales of TDR credits from its bank, including recent sales to projects in Seattle through the Landscape Conservation and Local Infrastructure Program (RCW 39.108). King County reinvests proceeds from credit sales in additional acquisitions.

Applicability

The level of market activity in Seattle suggests that there will be further opportunity for King County to sell banked TDR credits, which could support protection efforts in the Basin, particularly of agricultural land. Opportunities for credit sales in Snohomish County are currently limited, but may change as a TDR market expands.

5.4.2 Property Taxes

Enacted in 2011, the Landscape Conservation and Local Infrastructure Program (RCW 39.108) creates incentives for cities to invest in public improvements to support growth while conserving resource lands through TDR. Eligible cities can access a portion of a county's share of property taxes in exchange for accepting development rights in a regional marketplace. Development rights can either be transferred through private transactions or public acquisitions (which can then be re-sold).

Applicability

Currently 35 cities in Snohomish, King, and Pierce Counties are eligible to participate. Seattle is the first city to do so, and will generate $27 million for infrastructure funding while protecting up to 25,000 acres of resource lands through private TDR transactions. Seattle's conservation focus is on agricultural lands that are in close proximity to the city.

5.4.3 Value Capture Financing

Tax increment financing to pay for public improvements is allowed in Washington State through the Landscape Conservation and Local Infrastructure Program, which combines this tool with TDR on a regional scale. One opportunity for improving the economic benefit to cities (and, by extension, increasing land protection) is to increase the amount of financing that cities can access. Value capture financing would augment existing revenue by authorizing cities to keep more property tax proceeds.

Applicability

While Landscape Conservation and Local Infrastructure Program is available (adopted in Seattle and considered by 12 other cities), value capture financing is not. Realization of this additional funding tool will require state legislation. Should it become available, it will strengthen the incentives for cities to join a regional TDR marketplace.

5.4.4 Density/In-Lieu Fees

In 2010, the Snohomish County Council adopted updates to the County's Urban Centers Code (30.34A Snohomish County Code). This code update included density bonus provisions under which developers may gain density beyond base zoning for projects in Urban Centers by pursuing one or more actions, including paying a density fee. The fee, set at $21 per square foot of bonus floor area, is paid to the County and may be used to fund public purchases of development rights. This is an unpredictable revenue source, has not generated funding since creation, and revenues depend on developers choosing this option when seeking bonus density.

Applicability

This source is available; however, it is unfunded. Demand has not emerged for growth at intensities where developers would use this tool to gain a bonus. Once used, funds will become available to support protection through purchases of development rights.

5.5 Other Programs and Funding Sources

5.5.1 Tribes

Tribes have a vested interest in the natural resources of the Basin and play an important role in the suite of funding for protection projects. In addition to participating in grant programs identified in this section, tribes invest their own revenues to support restoration and protection initiatives. Examples of collaborative endeavors funded in part by tribes include the Tulalip Tribes' participation in the Qualco anaerobic digester in the Tualco Valley—agricultural infrastructure with a range of hydrologic and economic benefits for the watershed.

Applicability

Funding from tribes is available. Natural resource staff identify and prioritize opportunities for projects that support tribal protection objectives; funding decisions are made by the board of directors.

5.5.2 Donations

While not strictly a funding source, donations of easements or property by private landowners represent a cost savings for entities that would otherwise pay for acquisitions of real estate interests. Some landowners will offer donations for altruistic or tax purposes.

Applicability

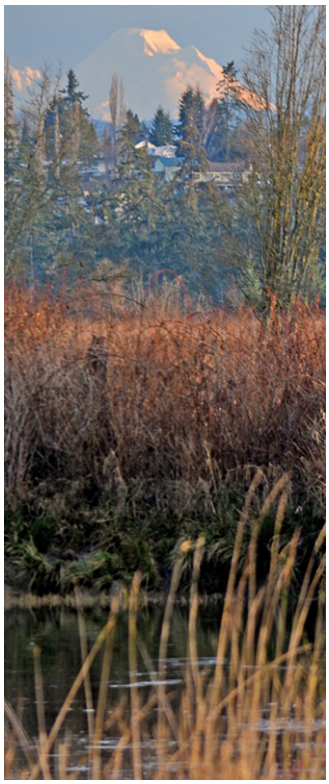
Local jurisdictions and non-governmental conservation organizations often accept donations when opportunities become available. While the cost of acquisition may be free, there are other costs of ownership involving stewardship and monitoring, which need to be covered by other sources such as endowments.

Section 6

PROTECTION APPROACH APPLIED TO SNOHOMISH BASIN SALMON RECOVERY

This section presents a summary example of how the SBPP can guide the development of protection strategies toward a specific program goal—in this case, salmon recovery—and provides updates on information developed since the 2005 Plan. Detailed information on application of the SBPP to salmon recovery is provided in Appendix B. In December 2015, the Snohomish Basin Salmon Recovery Forum (Forum) adopted Appendix B as the first formal adaptive management action for the 2005 Plan. This protection update does not change existing restoration recommendations and habitat goals from the 2005 Plan.

Recommendations for updated salmon recovery protection strategies (packages of specific tools) for specific land uses in the Basin are summarized in Section 6.5 and further detailed in Appendix B.



In 2005, the Shared Strategy Development Committee presented the Recovery Plan to NMFS. NMFS adopted and expanded the Recovery Plan to meet its obligations under ESA. The NMFS Supplement was adopted in January 2007.

Together, the Recovery Plan and NMFS Supplement comprise the Puget Sound Chinook Recovery Plan.

6.1 Protection in the Context of Salmon Recovery

In 1999, Puget Sound Chinook salmon and bull trout were listed as threatened under the federal ESA. The 2005 Plan was adopted by NMFS in January 2007 as a chapter in the regional *Puget Sound Chinook Recovery Plan* (NMFS 2007), referred to as the Recovery Plan in this document. NMFS concluded that the Recovery Plan (including the regional Volume 1 and the watershed-specific chapters in Volume 2) met the requirements of ESA Section 4f, which requires adoption of a species recovery plan for those species listed as "threatened" or "endangered" under ESA. However, NMFS provided additional conditions in the *Final Supplement to the Shared Strategy's Puget Sound Salmon Recovery Plan* (NMFS 2006), referred to as the NMFS

Photo credit: Roger Tabor, U.S. Fish and Wildlife Service

The 2005 Plan discussed the necessity of integrating harvest, hatchery, and habitat actions for successful recovery of salmonid populations. That concept is referred to as H-integration.

Photo credit: USDA

Supplement in this document. The NMFS Supplement outlines concerns about the 2005 Plan in the following three key areas:

- **Habitat protection** – Volumes 1 and 2 of the Recovery Plan were developed on the assumption that current protection tools were sufficient to "hold the line" and prevent further loss. However, there were few specifics of how this would be deployed. The NMFS Supplement includes water quantity and land use as important elements for a habitat protection strategy.
- **Adaptive management and monitoring** – NMFS requested the development of a monitoring plan connected to an adaptive management process.
- **H-integration** – The region subsequently identified a six-step process to address H-integration for salmon recovery, which was developed by an H-integration work group.

The Forum has been working since 2005 to respond to the gaps identified in the NMFS Supplement. The H-integration Plan was provided to the Forum in 2008 (Kaje et al. 2008), and salmon recovery partners have been working on adaptive management and monitoring, with the development of a draft monitoring plan (2011) and a draft adaptive management framework (2014). There was recognition in 2010 that work was progressing on adaptive management and monitoring and H-integration; however, the Basin had yet to address habitat protection in a comprehensive way.

6.2 Summary of 2005 Plan Strategy and Implementation Progress

The 2005 Plan proposed a scientifically based suite of actions intended to recover local salmon populations in the Skykomish and Snoqualmie rivers. The 2005 Plan was written as a multi-species plan and identified actions to recover Chinook

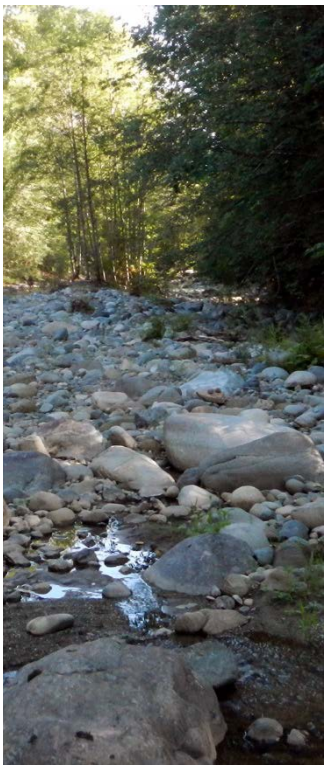
salmon, bull trout, and coho salmon as a proxy for all salmonids in the watershed. Actions were focused on habitat, hatchery, and harvest with a strong emphasis on H-integration. All actions related to habitat restoration and protection called for in the 2005 Plan are voluntary; however, jurisdictions provided letters of commitment to implement the 2005 Plan.

The 2005 Plan presented an ambitious number of capital project types and land-use-based protection strategies that could be implemented to reach scientifically sound habitat gain benchmarks. These actions were predicated on a policy of net gain in the hope was that the watershed partners in the Basin—those who had restoration capacity and land management authority—would adopt this approach. With the partners implementing the 2005 Plan, Basin habitat would be gaining along a trajectory that model outputs said was necessary for recovery.

The majority of the 2005 Plan focused on the habitat restoration strategy. Strong scientific underpinnings for the habitat strategy were developed in the Ecological Analysis for Salmonid Conservation (EASC). Quantitative goals, or "benchmarks," were developed for a variety of habitats types in various locations throughout the Basin. These benchmarks were written to be additive above 2005 condition. The key assumption for habitat protection was net gain in tandem with restoration; any degradation was assumed to be mitigated or replaced with restoration above levels described by the quantitative benchmarks.

Hydrology was considered in the EASC and peak flows were used as a proxy to describe the level of hydrological degradation in the sub-basins. Sub-basins were rated as degraded, moderately degraded, or intact, as a function of 2005 peak flows

The Ecological Analysis for Salmonid Conservation was a compilation and analysis of ecological information about the Basin that provided the scientific foundation for the 2005 Plan.



relative to historical peak flows. Peak flows were modeled as a function of effective impervious area. Though the coarse rating was provided in the EASC, there were no benchmarks developed for either peak flows or impervious areas in any of the sub-basins.

Since 2005, there have been many site-scale successes on restoration projects in the mainstems, estuaries, and tributaries. However, many environmental indicators continue to decline, according to local data and the 2009 and 2013 State of the Sound reports (Puget Sound Partnership 2010). The continued decline calls for greater protection measures watershed-wide, reaching beyond the regulatory framework.

The last 10 years have produced a number of valuable tools and innovative approaches to protection that maximize multiple benefits. In order to provide a full accounting of progress, and protect against future known threats such as climate change, this update presents an array of technical information and protection tools that reflect baseline conditions. Restoration efforts can then build upon this baseline and gain the required lift to both restore conditions for the species that use the Basin and benefit the people who live in it.

6.3 Information Developed Since the 2005 Plan

6.3.1 Protection Progress

There have been varying protective actions taken in the first decade of the 2005 Plan implementation. The following are some examples of protection tools implemented in the Basin:

- The 2005 King County Critical Areas Ordinance and subsequent Critical Areas Ordinance Effectiveness Study show the regulations may be sufficient to protect hydrology (Lucchetti et al. 2014).

- In the 2009 Raging River Headwaters Protection, King County authorized the use of $3.7 million to support a DNR conservation effort to acquire and protect an estimated 4,000 acres of a 7,000-acre purchase in the upper Raging River watershed. This would protect lands from conversion.
- In 2008, the Wild Sky Wilderness was designated, protecting 2.6 million acres of forested headwaters in the North Fork Skykomish Basin.
- The monitoring and regulation update to the Snohomish County CARs provided information on the effectiveness of existing regulations.

However, across the Basin, there has been no effort to uniformly track or report on the amount of land protected, including those areas permanently protected (e.g., designated as federal Wilderness) or temporarily protected (acquired as a conservation easement) across different land use categories. Appendix B includes an effort by the project team to summarize the status of protection efforts. It is possible to report on a handful of efforts, but without system-wide monitoring, there is no way to connect those efforts to current conditions and associated trends in hydrology or salmon habitat. Efforts such as the WDFW High Resolution Change Analysis indicate that there continues to be an overall slow loss of riparian habitat, even when accounting for restoration gains. WDFW found that between 2006 and 2009, 73 acres within 100 meters of fish-bearing streams were lost to permanent development and 163 acres were cleared but not converted to permanent development. This is compared to the 163 acres that were planted as part of restoration efforts.

6.3.2 Climate Change

Climate change was not explicitly addressed in the 2005 Plan, though there was early recognition that effects would likely

include increases in the magnitude of peak flows, prolonged and persistent low flows, reductions in spawning flows, and increased stream temperatures. These conditions would place a greater strain on water resources, threatened salmon populations, and working farms and forests. Information on the predicted effects of climate change has been refined since 2005.

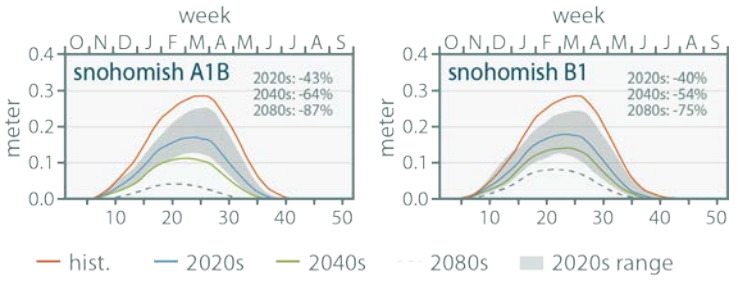


Figure 12: Projected Change in Snohomish Weekly Snow Water Equivalent for the 2020s, 2040s, and 2080s

Adapted from CIG 2009

Several science-based organizations, including the University of Washington Climate Impacts Group and the Pacific Northwest National Laboratories, have released model results (e.g., Figure 12) that provide greater detail on potential changes in water temperature, flow volume, and flow timing.

The 2013 Snow Caps to White Caps report provided information and modeling of water resources in the Basin that are affected by climate change and increased development pressures (PNNL and University of Washington 2013).

The 2005 study of climate change effects on salmon recovery in the Basin by the Climate Impacts Group and the National Oceanic and Atmospheric Administration predicted a 5% to 23% decline in average Chinook salmon abundance even after the 2005 Plan is implemented.

6.3.3 Watershed Characterization

In 2009, Ecology released the Puget Sound Watershed Characterization (PSWC) model. This model combines information for assessments from land uses and landforms to present information on the relative importance and degradation

of four different components of hydrology: storage, delivery, recharge, and discharge. The model is intended for land use planners to guide decisions in areas that are important for restoration and protection. The PSWC tool has been used to take a landscape-scale approach to new hydrology-focused protection strategies with geographic specificity.

6.3.4 Ecosystem Services

In the last decade, there has been an emerging understanding of ecosystem services, and they have come into prominence in considerations of the interaction of people and land. Ecosystem services are benefits that humans derive from the environment. They can include regulating services such as flood control and water quality, provisioning services such as water supply, supporting services such as nutrient cycling, and cultural services such as recreation. The concept of ecosystem services provides the Basin with a new framework and language that allows for a better understanding of how salmon recovery provides multiple benefits.

If treated like an asset with a life span of 100 years, the present value of the Snohomish Basin would be between $13.2 billion and $180.1 billion, using a 2.7% discount rate (Earth Economics 2010).

The 24-acre North Scriber Creek wetland in Lynnwood, Snohomish County, was found by Ecology to have a flood protection value of $8,000 to $12,000/acre/year, and 292 acres of wetland in Renton were found to have a flood protection value of approximately $41,000/acre/year (Leschine et al. 1997).

Traditionally, recovery efforts only considered provisioning services (salmon to support economies) and cultural services (salmon as a spiritual component of tribal culture). Considering ecosystem services helps relate salmon recovery protection efforts to other benefits such as flood control and water quality improvement. By acknowledging the many benefits that are provided by intact watershed processes that support salmon runs, there is opportunity to expand non-traditional partnerships and funding, and improve willingness to protect hydrology and improve implementation.

Given the emerging recognition of the importance of habitat protection in Puget Sound and the Snohomish River Basin, the Forum acknowledged that habitat protection must be more

Terms used in evaluating salmon populations:

Abundance refers to the number of fish at various life stages or at a specific time, generally measured as population size. A population should be large enough to survive normal environmental variation or human-caused impacts.

Productivity is the growth rate, or a population's potential for increasing or maintaining its abundance over time. A population that consistently fails to reproduce itself is at risk of extinction.

Diversity refers to the differences in genetic and behavioral traits, including life histories, sizes, and other characteristics. Diversity helps protect populations from short-term environmental change and provides a basis for survival during long-term environmental change.

Spatial structure is a means of measuring how the abundance at any life stage is geographically distributed among habitats or potential habitats.

specific and measurable. In response, the Tulalip Tribes, King County, and Snohomish County developed the USEPA SBPP grant proposal that was funded in 2010. The presentation of a wide range of protection tools within the context of what we know about the hydrology of the Basin is the first step in revamping salmon recovery protection strategies.

6.4 Connections between Hydrology and Salmon Habitat

The Snohomish Basin is the second largest drainage in the Puget Sound region, and one of the primary producers of anadromous salmon. The Basin contains nine salmonid species including two spawning populations of ESA-listed Chinook salmon and populations of steelhead trout and bull trout. The primary goal of the SBPP is to develop protection strategies that prevent the degradation of hydrologic processes that support salmon or salmon habitat, regardless of the existing state of salmon populations or habitat. Since hydrologic processes were identified as proxies for salmon habitat condition and function for the SBPP, a baseline evaluation of hydrology across the Basin was necessary for strategy development and orientation.

The physical-biological connections between hydrology and salmon life history were fundamental considerations in the development of the SBPP. Through the protection of hydrology, this SBPP aims to protect salmonid habitat quality, quantity, and heterogeneity, helping to promote the overall resilience of salmon populations. The underlying assumption in this approach is that the protection of hydrologic function and processes would inherently influence salmon ecology, biology, and behavior. Protecting these mechanistic and inferential linkages is predicted to result in support for salmon population performance, productivity, and abundance. This approach is similar to the habitat hypotheses emphasized in the 2005 Plan

and employed across regional salmon conservation and restoration efforts.

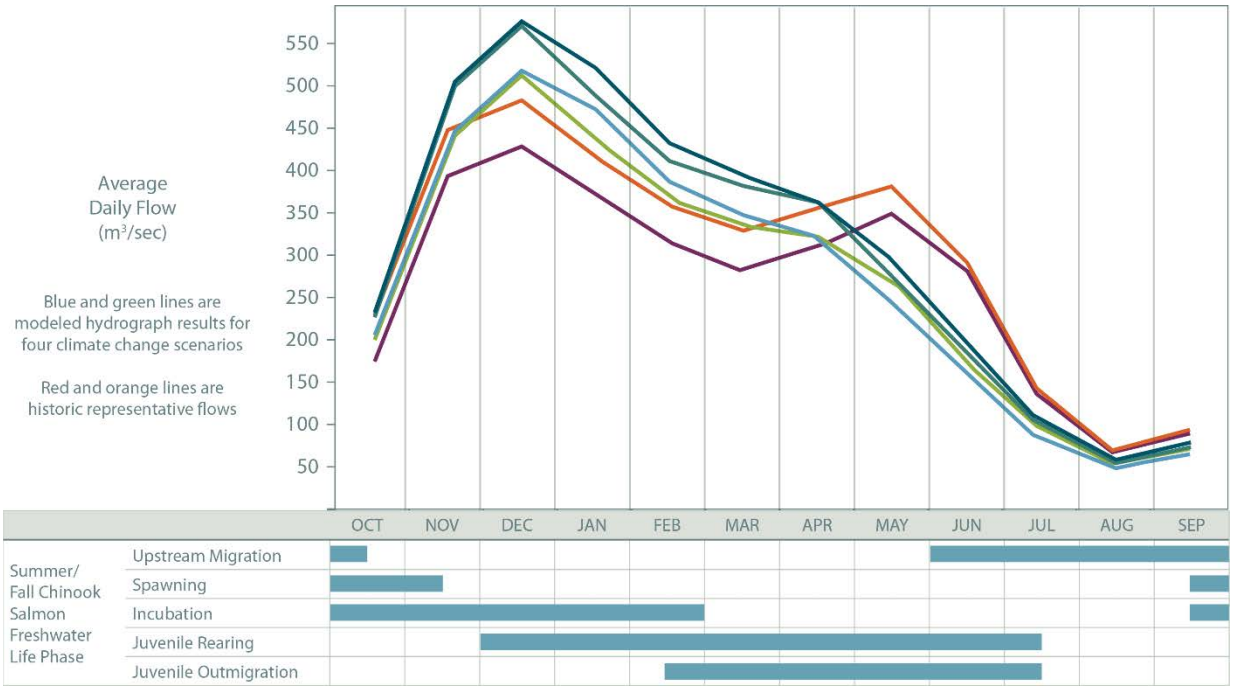
The clear connections between hydrology and salmon life history (see "Scientific Basis of the Connections between Hydrology and Salmon Habitat" on the next page) lend support to the theory that alteration of hydrology and its constituent attributes would subsequently affect salmon survival, growth, and population performance. Ecosystem and hydrologic processes can be disrupted or degraded by human activities including, but not limited to, dams/diversion structures, urbanization, draining and filling of wetlands and floodplains, removal of riparian vegetation, levees and channelization, excessive loading of sediments, forest clearing, and groundwater pumping (Poff et al. 1997; Stanley et al. 2012). Additionally, the influence of climate change would likely have a significant impact on the hydrologic regime as well as related salmon life-history dynamics. These climate change impacts would likely result in alterations in flow, temperature, and habitat quality/quantity across salmon life cycles.

Scientific Basis of the Connections between Hydrology and Salmon Habitat

Aquatic ecosystems are influenced by broad physical, chemical, and biological processes including fluxes of water, nutrients, sediment, organic material, and biota. These processes and attributes interact to form structural features that influence habitat occurrence and function (MacIsaac 2010). Specifically, hydrology acts as a major determinant of physical habitat formation processes by building and sustaining landform features and influencing habitat-specific characteristics.

The attributes of hydrologic regimes—including magnitude, frequency, duration, timing, and rate of change—govern the quality and quantity of water and influence energy sources, physical-biotic relationships, and biotic interactions (Poff and Ward 1989; Richter et al. 1996; Walker et al. 1995; Poff et al. 1997). Through these linkages, variation and patterns in hydrology end up characterizing the relative abundance, composition, and diversity of fish assemblages (Meffe and Sheldon 1988; Pusey et al. 1993, 1998, 2000; Bunn and Arthington 2002). Hydrologic flow regimes have a profound role in the life history of fishes, since critical life events such as phenology of reproduction, spawning behavior, larval survival, growth patterns, and recruitment are dependent on specific flow conditions (Welcomme 1995; Junk et al. 1989; Copp 1989, 1990; Sparks 1995; Humphries et al. 1999).

These ecological and physio-biological connections support the theory that variation and trends in salmonid life history (e.g., body length, upstream migration timing, spawning age and timing, and outmigration age and timing) are likely adaptive responses to specific ranges and seasonal patterns of water and flow conditions (Smith 1969; Beacham and Murray 1987; Quinn et al. 2001; MacIsaac 2010).



Since anthropogenic modifications and climate change impacts will influence flow regimes, and subsequent diversity and functional organization of fish communities, it is essential to understand how flow regimes have been altered and are changing, what the apparent stresses and pressures are, and how different aspects of hydrology are characterized across the landscape. Similarly, since natural seasonal variations in streamflow are primarily driven by local climate and precipitation, and moderated by the hydrologic and geomorphic characteristics of the watershed (MacIsaac 2010), it is important to understand the spatial arrangement of hydrologic function and the condition of related attributes across the landscape. Evaluation of these hydrologic attributes, landscape pressures, and the related salmon habitats provides the context needed to evaluate potential hydrologic protection strategies relevant to salmon habitats.

6.5 Salmon Recovery Protection Strategy Recommendations

Using the technical information from Sections 4 and 5, and the technical assessment results in Appendix A, this section includes summary recommendations for a package of tools for each land use type in the Basin. These recommendations are intended to flesh out the protection strategies from the 2005 Plan. The presentation of protection strategy recommendations by land use type is consistent with the 2005 Plan; they are organized in Sections 6.5.1 through 6.5.5 by basin-wide, urban, rural residential, agricultural, and forestry strategy recommendations.

Solid policy, regulatory, and programmatic actions are necessary to protect hydrology and help achieve the 50-year salmon recovery goals. The recommendations in this section are intended to be guidance for local governments to identify alternatives necessary to protect hydrology. As such, they do

not imply a commitment, mandate, or intent on the part of any local governments to adopt these ideas. Local governments have the final decision-making authority to choose and implement policies that work for their jurisdictions within the context of their broader responsibilities. The caveats associated with the original letters of commitment to the 2005 Plan from jurisdictions still stand.

There are many existing programs and regulations intended to protect salmon habitat and watershed processes, including intact hydrologic processes. State and federal regulations are implemented differently by local jurisdictions throughout the Basin. The strategies below are intended to suggest policy and planning within those frameworks to encourage the alignment of existing regulations with the protection of hydrology. The strategies below are also intended to recognize, support, and suggest improvement to existing outreach, technical assistance, and incentive programs that are already in place.

It is important to note that although the recommendations are presented by land use category, there are many strategies that affect more than one land use type. For example, water typing is important for the proper application of regulations in a working forest environment but is also critical in rural residential areas where critical areas ordinances are based on the type of stream and the presence of fish. Likewise, the recommendations stress beaver management in rural residential areas, but landowners in agricultural areas also regularly deal with the effects of beaver dams. Additionally, rural residential landowners with small areas of crops or limited livestock would benefit from much of the technical assistance that is currently recommended for farmers. As entities look to implement recommendations, focus should remain on where there is need for the protection of hydrology. Detailed information—such as

suggested implementers, more detailed context, effectiveness indicators, and theories of change for each strategy—can be found in Appendix B.

6.5.1 Basin-Wide Strategy Recommendations

The Basin-wide potential losses listed in the 2005 Plan were forest cover, riparian habitat, pervious surfaces, and watershed processes. These potential losses directly affect the delivery, discharge, recharge, and surface storage of water moving in, through, and out of the Basin. Across the various land use types, protection tools can be applied that improve the application and effectiveness of regulations, improve the conservation ethic, support forestry and agriculture to limit new infrastructure, and permanently protect the most valuable hydrologic areas and reaches. The following recommendations span jurisdictions and land use categories:

- **Develop information on hydrologic importance in local jurisdictions**
  - Action 1: Support the development of watershed characterization information by Ecology and continue to update local data and information for every local jurisdiction in the Basin.
  - Action 2: Align regulations to limit the variances and exceptions available in hydrologically sensitive areas that result in loss of function.
  - Action 3: Direct incentive programs, open space acquisitions, and other resource conservation efforts to areas with important hydrological features using watershed characterization analysis.
- **Transfer and purchase of development rights (TDR/PDR)**
  - Action 1: Encourage and expand TDR policies in additional jurisdictions.
  - Action 2: Encourage and expand PDR usage.

- Action 3: Encourage the use of TDR and PDR with a focus on aligning the two efforts.

- **Protect instream flows**

- Action 1: Improve guidelines for what constitutes an "adequate water supply" for new development.
- Action 2: Improve residential water conservation measures.

- **Acquire lands with high hydrologic value**

- Action: Acquire conservation easements or properties with high hydrological importance through outright purchase.

6.5.2 Urban Strategy Recommendations

In the Snohomish Basin, there are 15 cities with Urban Growth Areas. Under the GMA, these areas are intended to assume the majority of the future development. Most of these cities are either in or adjacent to mainstem river floodplains. Due to levels of impervious surfaces, stormwater infrastructure and decreased forest cover, most urban areas have a higher level of hydrological degradation. However, urban areas are still able to contribute to the protection of hydrology through the suggested approaches below. Managing water resources in a changing climate with shifting hydrologic regimes requires that approaches be adopted to build systems that may be regarded as redundancies in stormwater management systems today, but which would promote hydrologic resiliency in the watershed over time.

Jurisdictions within the Snohomish Basin under NPDES permit are either Phase I or II permittees and therefore have different requirements. For example, King and Snohomish Counties are Phase I permittees, and the cities of Everett, Marysville, Mukilteo, Snohomish, Snoqualmie, Lake Stevens, Monroe, and Duvall are Phase II permittees. Some smaller towns are not regulated under the NPDES permit. For smaller cities and

towns, or those with limited staff and capacity, access to technical assistance is particularly significant to the success of implementing LID, and in some cases, the requirements of the NPDES permit. Stormwater management practices are evolving to address the requirements of the permit. In addition, LID and alternatives to traditional "pipe and convey" approaches would become necessary in order to match the present and projected challenges of managing water resources, including mitigating for extreme events such as drought or flood. Urban strategy recommendations are as follows:

- **Augment practices to meet NPDES requirements with LID green infrastructure**
  - Action 1: Identify public and private property with legacy stormwater issues that could be improved with LID and other green infrastructure stormwater management techniques.
  - Action 2: Promote LID and other green infrastructure in development and redevelopment projects appropriate to the lot size in question.
- **Improve tree ordinances and other relevant codes that require planting in urban areas**
  - Action: Encourage jurisdictions to strengthen tree retention and landscaping ordinances and codes.

6.5.3 Rural Residential Strategy Recommendations

The rural residential areas in the Basin are located outside of the Urban Growth Areas, Agricultural Production Districts, areas zoned for forestry, and areas zoned for commercial and industrial use. Land use within rural residential areas varies from multiple housing densities, to small hobby farms, to small forestry production. Much of the rural residential area is located in the Basin lowlands, proximate to tributaries and mainstem rivers.

As rural residential development occurs, forest cover typically decreases and impervious surfaces increase. These changes occur as houses are built and infrastructure to support residents, such as roads and utilities, is expanded. The 2005 Plan stated that the amount of forest cover in rural residential areas was expected to fall below levels needed to recover salmon. The primary goal in the rural residential areas to support intact hydrology is to maintain forest cover, pervious areas, and water detention. This would, in turn, capture and slow water, thereby maintaining functioning delivery and storage.

Currently, rural residential area development is regulated through Snohomish and King Counties' land use regulations as well as the DNR Forest Practices Rules. These regulations control development of shorelines and development within riparian buffers and wetlands. The regulations also control the amount of land that can be cleared of trees and the percentage of impervious surfaces.

Though the current regulations are protective, other regulatory and non-regulatory protection tools can be layered upon them to maximize the potential for intact hydrology on each landowner's property. The following recommendations are a mix of incentives and direct technical assistance, both of which

seek to target areas with the most important hydrology and provide residents with additional resources to best protect landscape features, which support intact hydrologic function:

- **Improve outreach and technical assistance to rural residential landowners**
  - Action 1: Align free native tree resources with existing programs that serve rural residential property owners.
  - Action 2: Continue and expand technical support and education for landowners to maintain beavers on their property.
- **Explore PBRS in Snohomish County and target outreach of PBRS in King County**
  - Action 1: Snohomish County institutes a PBRS program.
  - Action 2: King County targets specific areas for PBRS that are identified as important for hydrology.

6.5.4 Agriculture Strategy Recommendations

Farming is a critical cultural and economic land use in the Snohomish Basin that defines many of the rural lowlands and provides food and products for local and regional markets. Most agricultural areas are located in mainstem floodplains, adjacent to many of the focus reaches targeted for capital habitat restoration projects, and also in rural areas.

In the 2005 Plan, one of the primary recommendations was to work cooperatively with the farming community and individual landowners to identify and implement solutions for salmon recovery. While many agricultural landowners have supported restoration projects on their lands, the tension has increased since 2005, with increasing resistance by the broader agricultural community to the restoration of historically or currently farmed land into aquatic or riparian habitat. In an effort to address these tensions and to forge a collaborative path

forward, there are two efforts underway—one in each county, detailed in the paragraphs below—to balance the needs of fish and farmers and to recognize the pressures that affect each.

In Snohomish County, stakeholders representing the agricultural community, the tribes, and environmental interests formed the Sustainable Lands Strategy with facilitation support from Snohomish County Surface Water Management staff. The goals of the Sustainable Lands Strategy include creating actions on-the-ground that result in "net gain" for both salmon recovery and agriculture viability. Additionally, the Sustainable Lands Strategy seeks to reduce process friction, streamline permitting, develop multi-benefit funding solutions, and create broad-based support for recovery actions.

In King County, county staff from the Water and Land Resources Division convened the Snoqualmie Fish, Farm, Flood Project Advisory Committee that includes farmers, tribes, non-governmental organizations, and other partners. The project is using a collaborative process to develop multi-objective strategies for salmon recovery, agriculture viability, and flood risk reduction. The committee will produce specific recommendations, including capital projects, programmatic actions, or changes to policies and regulations, for consideration by the King County Executive and Council.

The following protection recommendations identify additional actions that will benefit hydrology as well as ongoing agricultural practices:

- **Permanently preserve farmland**
  - Action: Permanently extinguish development rights in agricultural areas through TDR and PDR.

- **Provide technical assistance to farmers**

- Action 1: Support development of farm plans and cost-share programs.
- Action 2: Educate and assist farmers in qualifying for easement and tax reduction programs.

- **Support technical innovations that have conservation and economic benefits in agricultural areas**

- Action: Seek funding and support pilot innovation projects.

- **Develop water banks or similar mechanisms to promote conservation and best use of irrigation rights**

- Action: Develop water banks and facilitate conservation discussion within.

6.5.5 Forestry Strategy Recommendations

In 2005, approximately 75% of the Snohomish Basin land base was forestry, with more than half of the acreage in federal ownership. Other players include private small forest landowners, private industrial timber companies, tribes, DNR, counties, and cities. Commercial forestry is an important economic engine in both Snohomish and King Counties. Many of the communities in the upper watershed have a strong cultural connection to logging history and current operations.

Forests play a crucial role in hydrology. Areas high in the Basin have large areas of aquifer recharge zones, wetlands, and are virtually free of impervious surfaces. Tree cover helps support interception and slow water flowing into stream networks. The current regulations have protection for aquifer recharge areas, wetlands, unstable slopes, riparian buffers, and contiguous cover. However, protection provided by these regulations is only as effective as the information that is used to implement them.

In the last 15 years since the 2005 Plan was written, there have been notable changes in Basin forestry. In 2004, King County acquired development rights for more than 90,000 acres in commercial forest in the Basin. The Roads Maintenance and Abandonment Project, led by DNR, tasked forested landowners to map and treat all forest roads subject to Forest Practice Rules by 2016. Many agencies and organizations, including the Counties, DNR, WSU, and others, have worked to assist small forest landowners (SFLOs) with timber stewardship in order to implement BMPs and keep land from being converted.

In King County, the County Council and Executive formed the Rural Forestry Commission. This 13-member commission is tasked with advising King County government on policies and programs that affect rural forestry, ranging from industrial owners to SFLOs. The Commission helps those working in King County to coordinate efforts and address issues facing forestry with broad forestry representation. In Snohomish County, the Executive's Economic Development Office is working to develop a Focus on Forestry forum. This group would support ongoing needs assessment for forestland owners, and explore solutions to help keep forestry economically viable.

Even with ongoing work, forestry is declining in the Basin. Between 2005 and 2012, formal forest practices permit applications showed 2,152 acres were converted from forest lands to other purposes incompatible with continued forestry. With trends in development, there will be additional pressures on forested areas. It is important to note that the conversion documented during the previous period was during a recession, when development slowed considerably. Between 1988 and 2004, more than 100,000 acres of forestland in King and Snohomish Counties were converted to either developed land or agriculture (Earth Economics 2010). A 2009 study by the

University of Washington's School of Forest Resources found that more than 150,000 acres of private forestland in the Snohomish Basin were at high risk of conversion (University of Washington School of Forest Resources 2009).

The following recommendations support the development of better information in forested areas and propose increased support to SFLOs who are often most vulnerable to the rising risk of conversion as the economy improves:

- **Permanently conserve working forestland**
  - Action: Permanently extinguish development rights in forested areas through the TDR, PDR, or acquisition programs such as the USFS Community Forest Programs.
- **Increase coordinated outreach, incentives, and technical assistance to SFLOs**
  - Action 1: Coordinate and target outreach to SFLOs.
  - Action 2: Support development of expanded education, technical training, forest stewardship plans, and cost-share programs.
  - Action 3: Educate and assist SFLOs in qualifying for easement and tax reduction programs.
- **Collect high-resolution LiDAR throughout the entire Basin and coordinate data collection and sharing efforts**
  - Action: Develop high quality LiDAR for the entire Basin and coordinate data collection efforts and data sharing.
- **Expand water typing efforts and resources**
  - Action 1: Expand ground truthing of current water types in areas not regulated by DNR.
  - Action 2: Connect small jurisdictions with robust water typing resources.
  - Action 3: Increase organizational capacity for water typing in the Basin.

Section 7

CONCLUSIONS AND PATH FORWARD

It has been 10 years since the 2005 Plan was adopted by the Forum, with broad support of jurisdictions operating in the Basin. Much has been accomplished in the realm of habitat restoration, yet landscape-scale indicators—such as total forest cover and water temperature—continue to show degradation.

The intent of the SBPP process is to provide an update to the 2005 Plan and to serve as planning guidance to achieve greater protection of hydrology and, in turn, salmon habitat. The SBPP and these 2005 Plan updates were developed with the recognition of the need to create watershed and ecosystem resilience in the face of a growing population and changing climatic conditions. Just as restoration relies on partnerships and collaboration, protection of hydrology and habitat cannot be undertaken in isolation or by one entity, group, or agency. As stated by the original chairs of the Forum, "we know that to recover salmon in Puget Sound, we must succeed in the Snohomish Basin."

Through the SBPP and 2005 Plan update, protection strategies and approaches are offered that can be used to promote the protection or enhancement of hydrology and ecosystem function. The recommendations are consistent with the overall protection approach offered in the 2005 Plan. These recommendations add specific actions and suggested geographic focus in an attempt to make protection more immediately actionable. Many of the protection recommendations and specific actions identified in this document are already utilized in the Basin but could be improved. By tracking protection actions and projects as they are implemented, an assessment can

be made of protection gains or losses so that land use decisions can be better informed. It is the hope of all involved with the creation of the SBPP that the approach and highlighted protection tools will serve as a model for other watersheds and future planning processes.

The urgency of increased protection cannot be overstated. Early action projects funded as part of the SBPP effort show that water typing maps continue to have errors, resulting in less protective regulations being applied. A second project shows that many areas with high conservation values in the Basin have no existing protection, beyond applicable land use regulations, and are likely vulnerable to increasing populations and associated development. These two on-the-ground findings underline the need for action now.

There are several considerations and associated actions that will be needed to ensure the implementation of the SBPP. First is the recognition that the guidance is not considered a mandate and that jurisdictions must consider their broader responsibilities and work plans when considering the recommended approaches. Jurisdictions and recovery partners may adjust the recommendations to best accommodate and complement their existing work. Additionally, all commitments, along with stated caveats, that were made in 2005 continue to hold true in the face of protection updates.

As the Forum and partners move forward with the protection guidance, there are several necessary steps and supporting processes to consider. In the near-term, there are two planning tools to be used to advance strategies. The first, used by the Lead Entity program, is the 4-year work plan. This process lays out the implementation approach, complete with an identified sponsor, goals, and associated costs of large capital restoration

projects. The recommended actions in Section 6 of this Plan were developed at a level of detail appropriate for inclusion in the 4-year work plan. This will allow Lead Entity staff and other partners to track the protection actions, implementing groups, and needed funding in a manner consistent with restoration.

The second process to be considered for implementation is the near-term action list that is developed every two years by the Snohomish-Stillaguamish Local Integrating Organization. These actions are eligible for funding through the National Estuary Program and are expected to be advanced in a 2-year timeframe. The protection update recommendations are particularly well suited to be considered as near-term actions, as they address habitat and stormwater; two of the region's three primary strategic initiatives.

The 4-year work plan and the local integrating organization process provide immediate vehicles for the implementation of protection recommendations. However, a longer-term strategic approach will be necessary to address funding. The effort to create the best protection recommendations once again highlighted the need for a comprehensive funding approach that considers both restoration and protection. Issues such as the matching of non-traditional sources, increased nimbleness of funding sources and grant cycles, and incorporating new information/criteria such as watershed characterization should inform updated thinking on a funding approach.

The protection recommendations suggest a variety of metrics that can be used to evaluate the effectiveness of actions over time. The update does not suggest objectives for these actions related to participation in programs, protection of a certain amount of acreage, or goals for the overall condition of

hydrologic status and trends over time. These objectives and ecosystem goals are related to both protection and restoration and must be revisited with a larger effort that assesses progress toward recovery. Currently, the Snohomish Basin (and all Puget Sound watersheds) are engaged in the Chinook Monitoring and Adaptive Management Project. This effort will result in a framework that monitors actions and environmental outcomes over time. The framework will also identify triggers for revisiting 2005 hypotheses, assumptions, objectives, and goals. Through the Monitoring and Adaptive Management Framework, protection strategies can be specified and associated objectives and hydrologic goals can be set.

The SBPP assumes that planning efforts in the Basin will be better informed and tools and strategies will be adopted by jurisdictions to improve the outcomes for hydrologic and ecosystem function. Improved coordination among stakeholders is key; inter-agency and intra-agency collaboration within the Basin is a good starting point. Funding future planning efforts that promote the integration of watershed management and urban planning would promote the understanding of the land-water connection. In addition, it is important to note that stakeholder engagement and political will are imperative to success. In turn, habitat restoration and salmon recovery efforts will be bolstered by protective actions that stakeholders undertake today and in the future.

Section 8

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GLOSSARY OF TERMS

abundance	The number of fish at various life stages or at a specific time, generally measured as population size; a population should be large enough to survive normal environmental variation or human-caused impacts
adaptive management	A decision-making tool to help measure progress and success, and allow strategies to be adjusted accordingly; new data, information about a project's successes and failures, and flexibility are incorporated into a long-term management program
anadromous	Species that hatch in freshwater, mature in saltwater, and return to freshwater to reproduce
best management practices	Structural and procedural measures applied to control the adverse impacts of development and redevelopment
delivery	How water sources—rain, snow, or groundwater—reach the watershed
discharge	The process by which groundwater moves to the land, surface water, or atmosphere
diversity	The differences in genetic and behavioral traits, including life histories (e.g., run timings), sizes, and other characteristics; diversity helps protect populations from short-term environmental change, and provides a basis for survival during long-term environmental change
Ecological Analysis for Salmonid Conservation	A compilation and analysis of ecological information about the Basin that provided the scientific foundation for the 2005 Plan

ecosystem services	Benefits that humans derive from the environment, which can include regulating services such as flood control and water quality; provisioning services such as water supply; supporting services such as nutrient cycling; and cultural services such as recreation
estuary	The region where fresh water from the Basin mixes with the salt water of Puget Sound; the estuary is a highly productive and diverse environment and provides unique and critical habitat for salmon for rearing, migration, and transitioning between fresh and saltwater
floodplain	The area of land adjacent to a waterbody that can be flooded by the lateral overflow during higher flow periods
Forum	(see Snohomish Basin Salmon Recovery Forum)
H-integration	Successful recovery of salmonid populations depends on integrating harvest, hatchery, and habitat actions
headwaters	The source or upper part of a river
hydrometry	Monitoring of the components of the hydrological cycle including rainfall, groundwater characteristics, and water quality and flow characteristics of surface waters
impervious surfaces	Areas covered by materials that water cannot penetrate such as pavement, parking lots, and rooftops; soils compacted by urban development are also highly impervious
large woody debris	Fallen or placed trees, logs, branches, rootwads, and stumps along the edges of waterbodies that stabilize shorelines and provide habitat for salmon and other animals
mainstem	The main channel of a river
nearshore	The area extending from the shoreline into the water

productivity	The growth rate, or a population's potential for increasing or maintaining its abundance over time; a population that consistently fails to reproduce itself is at risk of extinction
recharge	Process by which water moves from surface water to groundwater
riparian	Vegetated area bordering a waterbody
shoreline armoring	The artificial application of materials to protect streambanks from erosion
Snohomish Basin Salmon Recovery Forum (Forum)	The group charged with developing a local salmon recovery response in coordination with regional efforts and promoting implementation of the 2005 Plan; a 41-member committee that includes high-level decision-making representatives from federal, state, and local governments, the Tulalip Tribes, seven special purpose districts, and 11 special interest groups including four farmers and three citizens
spatial structure	How the abundance at any life stage is geographically distributed among habitats or potential habitats
storage	Water retained in surface areas—such as lakes, reservoirs, and wetlands—and in groundwater
Urban Growth Area	The area of a county, as designated in a County Comprehensive Plan, where most future urban growth and development is designated to occur
Water Resource Inventory Area (WRIA)	A geographic area, defined by hydrologic boundaries on the Basin and sub-basin scale, designated by the state as a way to describe administrative units for resource management; the state comprises 63 WRIAs, each of which typically includes a major river drainage, smaller tributaries, and adjacent nearshore areas

watershed	The geographic area that drains into a particular river system or other body of water
watershed processes	Refers to the natural physical, chemical, and biological interactions that form the ecosystem of a watershed
wetland	Areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, vegetation typically adapted for life in saturated soil conditions (40 CFR 230.3)