PugetSoundPartnership

our sound, our community, our chance

INITIAL DISCUSSION DRAFT

LAND USE/HABITAT PROTECTION AND RESTORATION TOPIC FORUM

APRIL 14, 2008

PugetSoundPartnership
our sound, our community, our chance

Puget Sound Partnership

Introduction to the Topic Forum Discussion Draft

The attached topic forum discussion draft is one of five papers designed to provoke and inspire a long-term, community conversation and critical thinking about the specific problems facing Puget Sound, and the strategies and actions needed to address the threats we face. These papers and your comments will be used to help create the 2020 Action Agenda. Background on the topic forum process and how this information will be used can be found on our website at www.psp.wa.gov in the Action Agenda Center.

These initial draft papers are the first effort in our region to synthesize and document what we know about the problems, solutions that work, our current approach to solving problems, and what approaches we need to continue, add, or change. This is hard work that has not been done before. It means 1) looking at Puget Sound ecosystem from the crest of the Cascades to the Strait of Juan de Fuca, 2) providing sources to back up our statements and conclusions, and 3) establishing links between science and policy.

The discussion papers are DRAFT. They do not yet represent an opinion or position of the Partnership. We very much appreciate your interest and expertise in reviewing this initial work. The Partnership asked a small group of science and policy experts to prepare these draft discussion papers as a starting place for the discussion. As you read this paper and prepare to participate in one of the five upcoming workshops, participate in an online discussion, or submit specific comments, the Partnership requests that reviewers keep this context in mind.

- The Partnership will be identifying priority actions that are based on science. There is currently a wide range of opinion about the problems and literally hundreds of ideas for solutions. Our hope is that if we can agree on the documented threats to Puget Sound in terms of magnitude and impact, we will have a better chance of creating priority and durable solutions.
- The papers mainly focus on the Sound as a whole. We know that there are variations in problems and solutions in different parts of our region. The action area profiles that we are also preparing will highlight local issues.
- The papers are organized to logically step through three initial questions (two are science and one is policy) that build to a rational conclusion (the fourth question) about the strategies and actions that we will need continue, add, or change as a region. The design is intentional so that 1) our policies are based on science and 2) scientists and policy experts talk to one another.
- These initial papers will contribute to a synthesis paper that will describe links between each of the topic areas. Reviewers may want to read more than one paper to begin to see the links across our individual interests and concerns. The papers reach different types of conclusions for where to focus efforts, and in some cases the suggested solutions are far-reaching. Before we get to a synthesis paper (and workshop), we want the initial papers to be as accurate as we can in the time that we have available.
- The intent of papers is to focus on WHAT the problem is and WHAT solutions are needed, rather than HOW to implement specific solutions. For example, we know that we will need to do more to protect

habitat and concentrate growth into urban areas. There are many ways to accomplish this task and different methods will be needed around Puget Sound. We will create the "how" with those who have to implement the solutions.

- The papers intentionally do not focus on the need for more education/outreach, new funding strategies including creative incentives, and a coordinated monitoring and adaptive management program. The Partnership knows that these three aspects are critical to long-term success and is using other processes to address them. That work is linked to the development of the action agenda. By addressing the system-wide needs, we will be able to more effectively focus the education/outreach and funding.
- The Quality of Life "topic", or Partnership goal, is not yet represented in these papers, but will be part of our subsequent work to synthesize across the topics.

You may comment on the draft papers by attending the topic forum workshop, participating in the online discussion at www.psp.wa.gov, or submitting a comment via email or in writing. When reviewing the papers, please consider the following questions:

- Current knowledge: Have we accurately described what we know and don't know about the status of and threats to this topic in the Puget Sound region and the certainty of our knowledge? Have we missed any major documented findings?
- Effectiveness of tools: Have we accurately characterized what is certain and uncertain about the effectiveness of the tools available to address threats to this topic? Have we missed any major documented findings?
- Current strategies: From a topic perspective, have we accurately characterized what we are now doing to address threats? Have we missed any major programs or projects?
- Strategies to continue, add, or change: Given the status of and threats to the topic, effectiveness of the tools available, and current strategies to address threats, have we accurately captured the strategies we should continue, add or change? Have we missed any strategies and actions we should continue, add or change to address the threats (not just good ideas)? What sources have informed your thinking?
- Establishing criteria: Are the proposed criteria for prioritizing topic-specific actions appropriate and sufficient? Are there other criteria to consider?
- Measuring progress: Have we identified appropriate measures to assess progress toward goals for this topic? Have we missed any key measures of progress?

INITIAL DISCUSSION DRAFT PAPER

LAND USE/HABITAT PROTECTION AND RESTORATION IN PUGET SOUND

Science Question 1 (S1): What is the current documented knowledge about threats to ecosystem processes and resulting habitat as a result of land use practices in Puget Sound?

DRAFT

"Habitat" is the biological and physical conditions of an area that support a particular species or species assemblage (Ruckelshaus and McClure 2007). Examples of Puget Sound habitats include high-elevation glaciers, alpine meadows, mid-elevation mixed forests of fir, hemlock, alder and maple, river floodplains, freshwater wetlands, riparian forests, estuarine and tidal marshes, mudflats, eelgrass beds, and sand and gravel beaches (Kruckeberg 1991; Williams et al. 2001; Ruckelshaus and McClure 2007). These habitats are formed and maintained by the interaction of physical, chemical and biological processes (i.e., ecosystem processes) occurring throughout their watersheds (Spence et al. 1996; Dale et al. 2000; NRC 2001; Roni et al. 2002; Stanley 2005; Simenstad et al. 2006). Specific habitats in Puget Sound can be grouped based on the following general ecosystem types: freshwater, estuarine, marine, and terrestrial.

Ecosystem processes deliver, move, and transform water, sediment, nutrients, pathogens, light, and wood and other organic matter. These processes are responsible for creating and maintaining the habitats that we see and for the functions that habitats provide (Figure S1-1; Naiman and Bilby 1998; Hobbie 2000; Benda 2004; Simenstad et al. 2006; King County 2007; see Appendix S1-1 for more information about processes). These processes exist in a dynamic state and constantly respond to controlling factors such as precipitation or to episodic disturbance events like landslides, fires, and flooding (NRC 1996). These processes can operate at different spatial scales (e.g., regional/large-scale, local/landscape-scale, or finite/small-scale) and exert influence at different time intervals (e.g., daily versus once a century) and at different levels of magnitude (e.g., bankfull river flows versus 100-year storm event). Native plant, wildlife, and fish species are adapted to and ultimately benefit from the frequency and magnitude of disturbances in their habitats (Reice et al. 1990).

Ecosystem processes form the basis for evaluating "threats" to habitats from land use practices. It is important to acknowledge that these processes are also at the basis of water quality, biodiversity, water quantity, and human health and well being conditions, although the focus here will be on habitat conditions.

This memorandum is a brief summary of threats and ecosystem conditions in the Puget Sound watershed, based on limited existing information. There are three major studies underway that will be important in improving our picture of the threats and health of Puget Sound habitats:

1. Puget Sound Change Analysis being conducted by the Nearshore Science Team of the Puget Sound Nearshore Partnership (PSNERP). This analysis will look at changes to shoreforms (based on a PSNERP typology), associated wetlands, and human modifications that have occurred between the 1850's-1870's and roughly 2006. The analysis area will cover the Puget Sound marine shoreline and river deltas extending

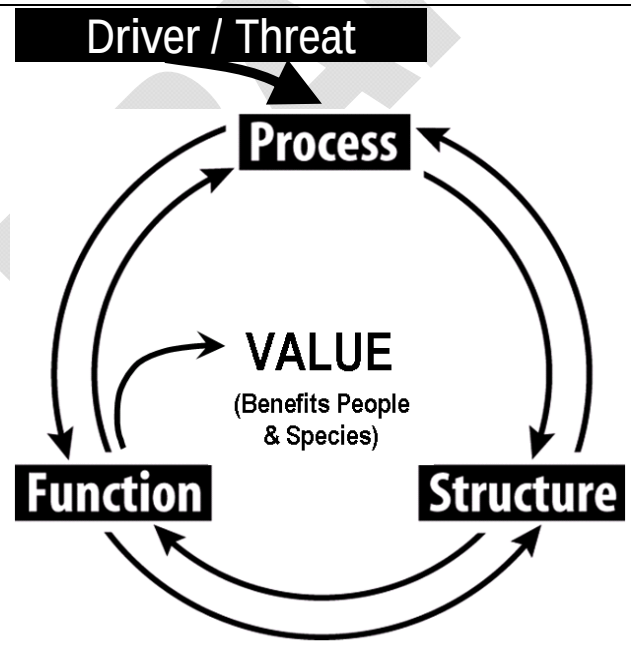
from an average depth of the photic zone offshore up to 200 meters inland, and will include the contributing watershed conditions. The analysis is expected in late 2008.

2. Risk Analysis for the Puget Sound Ecosystem being conducted by NOAA Fisheries. This analysis will estimate the current status of ecosystem components and conduct a vulnerability assessment. This analysis is expected in early 2009.
3. The Puget Sound Future Scenarios project conducted by the University of Washington Urban Ecology Research Lab, in conjunction with PSNP, identified six possible futures for the Puget Sound region in 2050 (UW Urban Ecology Research Lab 2008). Future steps of this project will use the scenarios and modeling to assess nearshore functions and evaluate alternative restoration strategies.

Major Threats to Ecosystem Processes and Habitats

At the base of ecosystem processes are drivers[1]. Human activities can also affect ecosystem processes and threaten the integrity of habitat structures and functions. In this paper, threats[2] are human activities that disturb ecosystems, either through the ability of a process to function (e.g., cutting off beach feeding sediment sources), or through direct damage to habitat (e.g., dredging). Threats include such activities as shoreline armoring, removing vegetation, constructing roads and buildings, and harvesting timber. Threats can affect processes at a local scale or at a larger landscape scale.

Table S1-1 lists major threats to Puget Sound ecosystem processes for freshwater, estuarine, marine, and terrestrial environments and resulting impacts on ecosystem processes. Appendix S1-1 provides more detailed information about ecosystem processes.



[1] "Drivers" are natural phenomena that disturb ecosystems and drive the ecosystem process to create and maintain habitats and the functions they provide (see "A Risk Analysis for Puget Sound")

[2] In this document, "threats" are human activities that disturb ecosystems (see "A Risk Analysis for Puget Sound"). It is synonymous with "stressors", a term that is often used in scientific literature.

Figure S1-1: Ecosystem processes are responsible for creating and maintaining habitat structures and the resulting functions. Drivers are natural phenomena that disturb ecosystems and drive long-term maintenance of habitat structures and their functions. Threats are human-driven disturbances to ecosystems that have cascading effects. Adapted from King County 2007.

DRAFT

Table S1-1: Major threats to habitats in freshwater, estuary, marine, and terrestrial ecosystems and their resulting impacts on ecosystem processes.		
Threat	Ecosystems	Process Impact
In-water		
Overwater structures (docks, piers, buildings, houseboats)	Marine, estuaries, and freshwater (lakes typically)	Light delivery: shades the sea floor Hydrology/Wave energy: redirects/deflects wave energy and currents with influence on sediment and sea floor slopes
Marinas	Marine, estuaries, and freshwater (lakes typically)	Hydrology: redirects/deflects wave energy with influence on sediment and sea floor slopes Light delivery: shades the sea floor Nutrients: adds nutrients and toxics
Dredging, channel straightening	Marine, estuaries, and freshwater (rivers usually)	Sediment dynamics: reduces sediment supply, changes sediment sizes and slope/depth characteristics, reduces river-floodplain dynamics
Jetties, breakwaters, log booms and rafts	Marine, rivers, lakes/reservoirs	Hydrology: redirect and reduce wave energy and current patterns, at river mouths can also tidal prisms and flushing characteristics Sediment dynamics: alters depth and availability of substrates, obstruct littoral drift and longshore sediment transport with resulting bathymetry and beach formation changes
Groins	Marine usually	Sediment dynamics: intercept littoral drift, reduce sediment movement
Boat wakes and prop wash	Marine, estuaries, freshwater (lakes usually)	Hydrology: increases wave energy, focused scouring Sediment dynamics: boat wakes can alter shoreline erosion patterns and change beach profiles, prop wash can scour sediments changing substrate sizes and depths

DRAFT

Table S1-1: Major threats to habitats in freshwater, estuary, marine, and terrestrial ecosystems and their resulting impacts on ecosystem processes.		
Threat	Ecosystems	Process Impact
Culverts	Rivers and streams	Hydrology: reduces stream channel widths, focuses stream flow, increases upstream water levels, can scour stream bed downstream Sediment: can impede sediment upstream Wood: reduces wood movement, can reduce supply as wood is removed for maintenance Light delivery: shades stream
Dams	Rivers and streams	Hydrology: alters timing and magnitude of flows and flooding, creates inundation zone upstream Sediment: traps sediment on upstream side, decreases or eliminates downstream sediment delivery Wood: decreases or eliminates downstream wood delivery, decreases wood recruitment upstream
Aquaculture (e.g., shellfish farming, fish pens, trout ponds)	Marine and estuaries primarily	Depends on type. Issues can include increased nutrient loading and pollution (net pens), changes to physical beach structure, and food web and species assemblage impacts.
At the water's edge		
Armoring (bulkheads, revetments, seawalls)	Marine, estuaries, and freshwater	Hydrology: increases wave energy at shoreline Sediment dynamics: restricts sediment recruitment, increases beach erosion, steepens beach profile, prevents backshore, larger homogeneous substrate Wood: reduces accumulation of wood and detritus
River levees	Rivers	Hydrology: focuses stream flow, increases localized velocities, restricts floodplain access Sediment dynamics: reduces sediment storage and recruitment, alters substrate sizes Wood: reduces wood storage and recruitment
Fill/dikes	Estuaries primarily, marine, freshwater wetlands	Hydrology: reduces water storage, in estuary and marine areas alters tidal prism and inundation patterns, reduce river-floodplain dynamics Sediment dynamics: increases fine sediment delivery downstream Nutrients: reduces biofiltration

DRAFT

Table S1-1: Major threats to habitats in freshwater, estuary, marine, and terrestrial ecosystems and their resulting impacts on ecosystem processes.		
Threat	Ecosystems	Process Impact
Native vegetation removal, ornamental landscaping	Marine, estuaries, freshwater	Hydrology: reduces infiltration and evapotranspiration Light: reduces shading allowing for increased temperatures of water or sediments Sediment dynamics: increased sediment loading if bank left unarmored Wood: Reduces wood recruitment Nutrients: reduces biofiltration, increases toxic loadings
Boat launches and rails	Marine, estuaries, lakes, rivers	Hydrology: increases wave energy at shoreline Sediment dynamics: restricts sediment recruitment Wood: reduces accumulation of wood and detritus
Away from the water		
Timber harvest	Terrestrial	Hydrology: alters timing of snow melt, reduces groundwater recharge, increases in surface runoff and stream peak flows, reduces evapotranspiration Light delivery: increases stream temperatures and reduces dissolved oxygen levels Sediment delivery: increase surface erosion/sediment delivery to streams and wetlands, increased mass wasting Wood: reduces wood and woody debris for aquatic areas Terrestrial species habitat fragmentation and loss
Agriculture/Grazing	Terrestrial	Hydrology: reduces infiltration, alters water patterns and timing with ditching and irrigation Sediment dynamics: increases surface erosion, livestock can increase sediment loading through stream bank trampling Nutrients: increase in nitrogen loading, often toxics as well, can have downstream effects that reach waters of Puget Sound Terrestrial species habitat fragmentation and loss

DRAFT

Table S1-1: Major threats to habitats in freshwater, estuary, marine, and terrestrial ecosystems and their resulting impacts on ecosystem processes.		
Threat	Ecosystems	Process Impact
Depressional wetland fill	Terrestrial	Hydrology: reduced surface storage Nutrients: reduced biofiltration, increase in downstream nitrogen delivery Wetland and terrestrial species habitat loss
Impervious surfaces, urbanization (roads, parking lots, buildings)	Terrestrial	Hydrology: reduced infiltration and water storage from vegetation removal and soil compaction, increased surface runoff and peak flows in streams from impervious areas and constructed drainage systems, reduced groundwater and summer low flows. Sediment dynamics: Increase in fine sediments from ground-disturbing activities, peak flows promote bank erosion and can promote stream channel incision and disconnection from the floodplain. Nutrients: Increase from fertilizers and other sources in addition to an increase in toxic loading Terrestrial species habitat fragmentation and loss.
Sources: Nightengale and Simenstad 2001; Stanley et al. 2005; Spence et al. 1996; Williams and Thom 2001; Bolton and Shellberg 2001.		

DRAFT

Gaps in our Understanding of Habitat Process-Structure-Function and Land Use Impacts

While there is strong scientific evidence documenting how certain types of alterations or threats may result in specific changes to habitat structure and function, there are gaps in our understanding of how human land use activities can affect ecosystems. Some of the most significant needs for better understanding of habitat threats for Puget Sound's ecosystems are listed below:

- Nearshore ecosystem processes and linkages to watershed and marine systems, as well as the effects and implications of human activities on nearshore ecosystem processes (see goals 1 and 2 in Gelfenbaum et al. 2006).
- Deep-water habitat processes in Puget Sound and how those may be affected by future development such as further shoreline modifications, wastewater discharge, and tidal energy generation (see Beechie et al. 2007).
- The cumulative effects of multiple stressors on processes, habitat structure, and function.
- Resulting ecosystem process and habitat impacts from climate-induced changes in sea levels, air and water temperatures, precipitation and surface water movement patterns, Puget Sound circulation and water quality (Mantua et al. 2007).
- Effects of changes in environmental flow parameters (i.e., flood flows, pulses, base flows, and low flows) on riverine habitat, riparian functions, fish communities, and salmon populations.

Current Status of Puget Sound Threats and Habitat Structure

Studies and monitoring of Puget Sound have measured certain aspects of habitat structure (e.g., eelgrass beds), human-induced threats (e.g., impervious surfaces), and ecosystem function (e.g., shorebird colonies). Rarely have ecosystem processes been addressed. Also, information that is Sound-wide tends to be limited in terms of data detail and accuracy, while localized information is often not consistent between different Puget Sound jurisdictions (Anchor Environmental 2007).

Table S1-2 provides brief condition summaries for some habitat structures and threats at the Puget Sound level, based on available information (e.g., Ruckelshaus and McClure 2007; PSAT 2007a; Table 2). Appendix S1-2 provides increased details about land use, watershed and terrestrial habitats, and marine and estuary habitats based on Action Area workshop notes, WRIA plans, and reports and studies within counties and cities.

This section is not based on exhaustive literature searches or analysis of data. It is imperative that future studies provide a more complete picture of ecosystem processes and habitat structures and functions within Puget Sound, and describe how and where processes and habitats deviate from their natural conditions (i.e., Puget Sound Nearshore Partnership Change Analysis and NOAA Risk Assessment).

DRAFT

Table S1-2. Status of select habitat structures and threats at the Puget Sound scale.	
Habitat Structure	
Forest Cover	There were 5.2 million acres of forest cover in Puget Sound in 2001. Between 1991 and 2001, 2.3% of the forest cover was lost. Over the last 50 years, between 66% and 84% of old-growth forest has been lost.
Eelgrass (Zostera marina)	Puget Sound contained between 20,000 and 50,000 acres of eelgrass during 2005 monitoring. This Sound-wide area estimate is consistent with results from previous years (2000-2004). While overall eelgrass area appears stable, localized declines suggest otherwise.
Wetlands	Historically freshwater and saltwater marshes dominated portions of Puget Sound, particularly where larger rivers entered the Sound. It is estimated that about 80% of those wetlands have been lost. Scrub-shrub estuarine wetlands and riverine wetlands have declined over 90% from historic conditions, while estuarine emergent marshes have declines by about 67%.
Threats	
Modified Shoreline	Roughly one-third of the Puget Sound shoreline has been modified with armoring and docks. Numbers are not available for miles of diking, levees, and armoring in freshwater.
Impervious Surfaces	In 2001, impervious surfaces covered 3.3% of the overall watershed, but at elevations less than 1,000 feet, 7.3% of the land was covered. Between 1991 and 2001, impervious surfaces increased by 10.4% (from ~ 3 to 3.3%).
Sources: Collins and Sheikh 2005, Gaeckle et al. 2007, Ruckleshaus and McClure 2007; PSAT 2007a; PSAT 2007b	

DRAFT

How do current conditions compare to a "healthy" Puget Sound?

The Puget Sound Partnership goal for habitat is "A healthy Puget Sound where freshwater, estuary, nearshore, marine, and upland habitats are protected, restored, and sustained." To protect, restore, and sustain habitats, ecosystem processes that create and maintain habitat structure must be able to operate at rates and time scales sufficient to support the desired functions and values (Beechie and Bolton 1999; Goetz et al. 2004). At this stage, however, it is difficult to assess condition of processes. Some areas of Puget Sound have much greater information that can be used to conduct assessments, while others have very little information. The result is that there is only limited understanding of the integrity of various ecosystem processes throughout the Puget Sound watershed.

Assessment of ecosystem process integrity is critical for understanding current conditions and beginning to assess the extent of protection and restoration necessary to maintain a "healthy" Puget Sound. For freshwater areas, catchment-level analyses can be used, such as those conducted for King County's Shoreline Master Program update. This model uses information, such as precipitation patterns, surficial geology, forest cover, and impervious surfaces, and estimates the integrity of the delivery, movement and loss of water, sediment, wood, nutrients, toxics, and pathogens for a given catchment (King County 2007). Other catchment-level analyses include Jefferson County and Birch Bay (Ecology 2007; Stephen Stanley, Washington Department of Ecology, pers. comm.) Similarly, process modeling at the drift cell scale has been conducted for marine shorelines using information on shoreforms, sediment dynamics, and shoreline modifications. Examples include assessments of Jefferson County and Bainbridge Island (Diefenderfer et al. in review; Williams et al. 2004) and WRIA 9 (Anchor Environmental 2006). Such assessments can

help to identify the degree and nature of process impairments and the importance of specific areas for protection and restoration of ecosystem processes.

Moving Ahead on Understanding Ecoystem Processes and Habitat Conditions

Increasing our understanding of ecosystem processes as the basis for assessing condition of habitat structure and ecosystem functions for humans and other species is critical to successful protection and restoration of Puget Sound (Goetz et al. 2004; Simenstad et al. 2006; Beechie et al. 2003). Landscape and site-scale assessment should be conducted to identify process integrity and importance for specific areas, allowing natural resource managers to cater to specific needs in particular areas. Such assessments are an important component of restoration and protection planning, as discussed in the Response to Question S2.

References

Anchor Environmental, LLC. 2006. Prioritization of Marine Shorelines of Water Resource Inventory Area 9 for Juvenile Salmonid Habitat Protection and Restoration. Prepared for the Water Resource Inventory Area 9 Technical Committee.

Anchor Environmental, LLC. 2007. Data Discovery Summary Report: Puget Sound Nearshore Ecosystem Restoration Project. Prepared for U.S. Army Corps of Engineers, Seattle District in support of the Puget Sound Nearshore Partnership. Seattle, Washington. 74 p.

Beechie, T. and S. Bolton. 1999. An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds. Fisheries 24(4):6-15.

Beechie, T.J., E.A. Steel, P.R. Roni, and E. Quimby, editors. 2003. Ecosystem recovery planning for listed salmon: an integrated assessment approach for salmon habitat. NOAA Tech. Memo. NMFS-NWFSC-58, 183 p. Seattle, Washington.

Beechie, T., R. Dinicola, T. Klinger, J. Newton, T. Paulson, and T. Quinn. 2007. The Future of Puget Sound Habitats. In M.H. Ruckelshaus and M.K. McClure (coordinators). Sound Science: Synthesizing ecological and socioeconomic information about the Puget Sound Ecosystem. Prepared in cooperation with the Sound Science collaborative team. U.S. Department of Commerce, National Oceanic & Atmospheric Administration (NMFS), Northwest Fisheries Science Center. Seattle, Washington. 93 p.

Benda, L., N.L. Poff, D. Miller, T. Dunne, G. Reeves, G. Pess, and M. Pollock. 2004. The newwork dynamics hypothesis: how channel networks structure riverine habitats. Bioscience 54: 412-427.

Bolton, S. amd J. Shellberg. 2001. Ecological Issues in Floodplains and Riparian Corridors. Prepared by University of Washington, Center for Streamside Studies. Prepared for Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation. Seattle, WA. 152 p. Available at http://wdfw.wa.gov/hab/ahg/finalrip.pdf.

Collins, B.D and A.J. Sheikh. 2005. Historical reconstruction, classification, and change analysis of Puget Sound tidal marshes. Report to the Washington State Department of Natural Resources, Aquatic Resources Divisions. Available at http://pugetsoundnearshore.org.

Dale, V.H., S. Brown, R.A. Haeuber, N.T. Hobbs, N. Huntly, R.J. Naiman, W.E. Riebsame, M.G Turner, and T.J. Malone. 2000. Ecological principles and guidelines for managaing the use of land. Ecological Applications 10(3): 639-670.

DRAFT

Diefenderfer, H.L., K.L. Sobocinski, R.M. Thom, C.W. May, S.L. Southard, A.B. Borde, J. Vavrinec, and N.K. Sather. In Review. Multi-scale analysis of restoration priorities for marine shoreline planning. Environmental Management. Submitted December 2007.

Gaeckle, J., P. Dowty, B. Reeves, H. Berry, S. Wyllie-Echeverria, and T. Mumford. 2007. Puget Sound Submerged Vegetation Monitoring Project, 2005 Monitoring Report. Department of Natural Resoources, Nearshore Habitat Program. Olympia, Washington. Available at: http://www.dnr.wa.gov/Publications/aqr_nrsh_2005_svmp_report.pdf

Gelfenbaum, G., T. Mumford, J. Brennan, H. Case, M. Dethier, K. Fresh, F. Goetz, M. van Heeswijk, T.M., Leschine, M. Logsdon, D. Myers, J. Newton, H. Shipman, C.A. Simenstad, C. Tanner, and D. Woodson. 2006. Coastal Habitats in Puget Sound: A research plan in support of the Puget Sound Nearshore Partnership. Puget Sound Nearshore Partnership Report No. 2006-1. Published by the U.S. Geological Survey, Seattle, Washington. Available at http://pugetsoundnearshore.org.

Goetz, F., C. Tanner, C.S. Simenstad, K. Fresh, T. Mumford and M. Logsdon, 2004. Guiding restoration principles. Puget Sound Nearshore Partnership Report No. 2004-03. Published by Washington Sea Grant Program, University of Washington, Seattle,Washington. Available at http://pugetsoundnearshore.org.

Hobbie, J.E. (ed). 2000. Estuarine Science: A Synthetic approach to Research and Practice. Island Press, Washington D.C. 539 p.

King County. 2007. King County Shoreline Master Program, Appendix E: Technical Appendix (Shoreline Inventory and Characterization: Methodology and Results). Available at: http://www.metrokc.gov/shorelines/shoreline-master-program-plan.aspx

Mantua, N., S. Moore, R. Palmer, and W. Palsson. 2007. Climate Change and Puget Sound. In M.H. Ruckelshaus and M.K. McClure (coordinators). Sound Science: Synthesizing ecological and socioeconomic information about the Puget Sound Ecosystem. Prepared in cooperation with the Sound Science collaborative team. U.S. Department of Commerce, National Oceanic & Atmospheric Administration(NMFS), Northwest Fisheries Science Center. Seattle, Washington. 93 p.

Naiman, R.J., T.J. Beechie, L.E. Benda, D.R. Berg, P.A. Bisson, L.H. MacDonald, et al. 1992. Fundamental Effects of Ecologically Healthy watersheds in the Pacific Northwest Coastal Ecosregion. R. J. Naiman, ed. Springer-Verlag, New York, New York.

Naiman, Robert J., and Robert E. Bilby, editors. 1998. River ecology and management: lessons from the Pacific coastal ecoregion. Springer-Verlag, New York.

National Research Council (NRC). 1996. Committee on Protection and Management of Pacific Northwest Anadromous Salmonids. Upstream: Salmon and Society in the Pacific Northwest. Washington D.C. National Academy Press. 472 p.

National Research Council (NRC). 2001. Committee on Mitigating Wetland Losses. Compensating for wetland losses under the Clean Water Act. Washington D.C. National Academy Press. 348 p.

Nightingale, B. and C. Simenstad. 2001. Overwater Structures: Marine Issues. Prepared by University of Washington, Wetland Ecosystem Team, School of Aquatic and Fishery Sciences. Prepared for Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation. Olympia, WA. 177 p. Available at http://wdfw.wa.gov/hab/ahg/finalmar.pdf.

DRAFT

Puget Sound Action Team (PSAT). 2007a. State of the Sound 2007. Olympia, Washington. 93 p.

Puget Sound Action Team. 2007b. 2007 Puget Sound Update: Ninth Report of the Puget Sound Assessment and Monitoring Program. Publication Number PSAT 07-02. Olympia, Washington.

Roni, P., T.J Beechie, R.E. Bilby, F.E. Leonetti, M.M. Pollock, and G.R. Pess. 2002. A review of stream restoration techniques and a hierarchial strategy for prioritizing restoration in Pacific Northwest watersheds. North American Journal of Fisheries Management 22: 1-20.

Ruckelshaus, M.H. and M.K. McClure (coordinators). Sound Science: Synthesizing ecological and socioeconomic information about the Puget Sound Ecosystem. Prepared in cooperation with the Sound Science collaborative team. U.S. Department of Commerce, National Oceanic & Atmospheric Administration(NMFS), Northwest Fisheries Science Center. Seattle, Washington. 93 p.

Simenstad, C., M. Logsdon, K. Fresh, H. Shipman, M. Detheir, L. Newton. 2006. Conceptual model for assessing restoration of Puget Sound nearshore ecosystems. Puget Sound Nearshore Partnership Report No. 2006-03. Published by the Washington Sea Grant Program, University of Washington, Seattle, Washington. Available at http://pugetsoundnearshore.org.

Spence, B. C., G. A. Lomnicky, R. M. Hughes, and R. P. Novitzki. 1996. An ecosystem approach to salmonid conservation. Draft report No. TR-4501-96-6057. ManTech Environmental Research Services Corporation, Corvallis, Oregon.

Stanley, S., J. Brown, and S. Grigsby. 2005. Protecting Aquatic Ecosystems: A Guide for Puget Sound Planners to Understand Watershed Processes. Washington State Department of Ecology. Publication #05-06-027. Olympia, WA.

University of Washington (UW) Urban Ecology Research Lab. 2008. Puget Sound Future Scenarios. Draft report, January 2008. Seattle, Washington. 68 p. Available at: http://online.caup.washington.edu/projects/futurewithout/pdfs/scenarios_report.pdf

Washington State Department of Ecology (Ecology). 2007. Draft Watershed Characterization of Jefferson County (version 3, May 16, 2007). Prepared by the Shorelands & Environmental Assistance Program.

Williams, G.D, R.M. Thom, and N.R. Evans. 2004. Bainbridge Island Nearshore Habitat Characterization & Assessment, Management Strategy Prioritization, and Monitoring Recommendations. Prepared by Pacific Northwest Marine Laboratory Batelle Memorial Institute. Prepared for City of Bainbridge Island.

Williams, G.D., and R.M. Thom. 2001. Marine and Estuarine Shoreline Modification Issues. Prepared by Battelle Marine Science Laboratory. Prepared for Washington Department of Fish and Wildlife, Washington Department of Ecology, and Washington Department of Transportation. Sequim, WA. 136 p. Available at http://wdfw.wa.gov/hab/ahg/finalsl.pdf.

DRAFT

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Water Flow Process - Controls, Important areas, Stressors and Environmental Responses						
Component of Process			Major Natural Controls	Important Areas	Stressors	Ecosystem Response
Delivery			Precipitation patterns	Recharge areas with higher amounts of precipitation	Change in Precipitation	Alters timing, duration and frequency of delivery of water to aquatic ecosystems
			Timing of snowmelt	Rain-on-snow zones Snow-dominated zones	Loss of Forest	Increased frequency of rain on snow events. Loss of forest in snow dominated zone reduces late spring to summer groundwater discharge to streams.
Movement	*At the surface*	Surface storage	Topography Surficial geology Soils	Areas of low gradient Floodplains	Draining and filling of wetlands Disconnecting stream from floodplain	Increase in water level fluctuations in downstream wetlands and loss of species richness. Increased peak flows downstream which affects stream structure. Disconnecting the stream from its floodplain through channelization or diking increases stream velocity and erosion, bedload transport and reduces structural complexity in streams.
	Below surface	Shallow subsurface flow	Topography Surficial geology	Areas on geologic deposits with low permeability	Loss of Forest (>35%), Impervious cover (>4%) Roads (density).	Reduces recharge of shallow groundwater which can affect early growing season groundwater discharge to wetlands and streams. Increases overland flow and peak flows downstream.
		Recharge/Storage		Areas on geologic deposits with high permeability	Any loss of Forest and Impervious cover. Roads (density).	Reduces deep recharge of larger aquifers. Increases the 2 year peak flow which in turn affects stream structure
	Return to surface	Discharge	Topography Surficial geology	Slope breaks (steep above, gentle below) intersecting permeable deposits Stratigraphic pinchouts Contact areas between geologic deposits of	Loss of forest on permeable deposits intersecting stream corridors	Reduces recharge and subsequent discharge to hyporheic zones which in turn impacts stream productivity.

DRAFT

Water Flow Process - Controls, Important areas, Stressors and Environmental Responses					
Component of Process		Major Natural Controls	Important Areas	Stressors	Ecosystem Response
			different permeabilities		
Loss	Evaporation/ Transpiration	Vegetation Climate	Entire watershed	Any impervious cover	Alters water budget for watershed

DRAFT

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Sediment Process - Controls, Important Areas, Stressors and Ecosystem Response					
Component of Process		Major Natural Controls	Important Areas	Stressors	Ecosystem Response
Delivery	*Surface erosion*	Topography Soil erodibility Vegetative cover	Steep slopes with erodible soils	Loss of forest on erodible soils (K factor). Roads within 200' of streams (# road crossings) Urbanization	Increases sediment load to streams and wetlands. Increased sediment load raises elevation of wetland and decreases saturation of soils. Water quality, quantity and habitat functions are affected. Increased bedload in streams affects stream structure due to initial steepening of longitudinal profile. Stream adjusts by lowering gradient through bedload transport and deposition which alters stream structure. Increased in-stream erosion can "incise" and disconnect the stream bed from its floodplain and simplify stream structure. Species richness is decreased.
	Mass wasting	Topography Geology	Hazard areas for shallow, rapid landslides	Roads (density), Loss of forest	
	In-channel erosion	Transport capacity Riparian vegetation Vegetative cover	Stream corridors	Channelization of streams Urbanization (increases stream discharge)	
Movement	Sedimentation	Transport capacity	Depressional Wetlands Lakes Floodplains and depositional channels	Draining and filling of depressional wetlands Channelizing streams with floodplains Increased streamflow (urbanization) Dams	Depressional wetlands and floodplains remove fine sediment through filtration by vegetation and sedimentation due to slower water velocities. When wetlands and floodplains are filled or floodplains are separated from the streams by channelization, greater quantities of sediment are transported downstream. This negatively affects the structure and function of these downstream wetlands and floodplains. Dams increase sediment storage but change the habitat structure and complexity downstream and upstream of the dam
Loss		Transport Capacity	Decrease or increase in sediment storage	Same causes as for movement	Same response as above

DRAFT

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Large Woody Debris Process – Controls, Important Areas, Stressors and Ecosystem Response				
Component of process	Major natural controls	Important Areas	Stressor	Ecosystem Response
Streambank erosion	Water energy Riparian vegetation Erodibility of soils	Unconfined channels (low gradient floodplains)	Channelization of streams in unconfined reaches	Channelization and armoring reduces the erosion and the subsequent fall of trees into streams. Large wood is a principal factor in structuring habitat structure of streams. Large wood also plays an important role in providing habitat structure in estuarine and nearshore areas.
			Armoring of streams	
			Removing riparian vegetation	Reduces source of large woody debris for streams. Same effect to habitat structure in aquatic systems as above..
Mass wasting	Topography	Hazard areas for shallow, rapid landslides	Remove forest vegetation on high mass wasting hazard areas	Reduces source of large woody debris for streams. Small streams recruit majority of wood from upslope areas. Similar effect to habitat structure in aquatic systems as above in erosion.
Windthrow	Riparian vegetation Weather patterns	Forest within 100' from aquatic resources	Removal of vegetation adjacent to stream	Windthrow is an important source of wood in steeper small channels. Reduces source of large woody debris for streams. Similar effect to habitat structure in aquatic systems as above in erosion.
Storage	Transport capacity of water	Channels with <4% gradient	Channelization of streams in unconfined reaches	Reduces capacity of stream to store wood which reduces supply of large wood to stream systems. Similar effect to habitat structure in aquatic systems as above in erosion.
			Increased streamflow[3]	
Breakage/ Decomposition	Biotic interactions	None identified	None identified	None identified

DRAFT

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Nitrogen Process – Controls, Important Areas, Stressors and Ecosystem Response					
Component of process		Major natural controls	Important Area	Stressor	Ecosystem Response
Delivery	Nitrogen sources	Weather patterns Biotic composition	Additional sources	Agricultural landuse (livestock, dairies, commercial crops)	Excess nitrogen can increase algal blooms in stream systems reducing dissolved oxygen levels and species richness. In nearshore marine systems, excess nitrogen can create conditions suitable for harmful algal blooms
				Septic systems (rural residential within 200' of streams)	
Movement	Biotic uptake and decomposition	Biotic cover and composition Hydrologic regime	Headwater streams	Channelization of headwater streams (<10m)	Uptake reduced by deeping of stream channel and removal of riparian vegetation. Base of stream food chain affected including photosynthetic and heterotrophic biota (i.e. fungi and bacteria) and invertebrates. As a result, biologic productivity of headwater streams is reduced.
	Nitrification	Hydrologic regime	Depressional wetlands (excluding bogs and fens)	Draining or filling of depressional wetlands	More nitrogen is transported downgradient
	Adsorption	Hydrologic regime	Headwater streams	Channelization of headwater streams	Same effects as above
Loss	Denitrification	Hydrologic regime	Depressional wetlands	Draining or filling of depressional wetlands	More nitrogen is transported downgradient (in both surface water and groundwater)
		Surficial geology Groundwater flow paths Reactive sites	Riparian areas with consistent suppy of shallow groundwater in permeable deposits	Interception of shallow groundwater flow before it discharges in riparian and floodplain areas	Nitrogen is transported downstream to estuaries and nearshore marine environments. See "Delivery" for additional response

DRAFT

Appendix S1-1: Major process tables for water, sediments, large woody debris, nitrogen, toxins and phosphorous. Adapted from Stanley et al. 2005.

Toxins and Phosphorous Processes – Controls, Important Areas, Stressors and Ecosystem Response					
Component of process		Major natural controls	Important Area	Stressor	Ecosystem Response
Delivery	Phosphorus sources	Climate patterns Surficial geology	Additional sources	Agricultural and Urban Land Use (Application of fertilizer, livestock dariries)	Phosphorous is a limiting nutrient in freshwater ecosystems. Additional sources can exceed the capacity of soils to adsorb phosphorous which results in downgradient transport. In aquatic systems, especially lakes, excess phosphorous results in eutrophication and reduction in species richness. Though not a limiting nutrient in marine systems, phosphorous plays a role in promoting harmful algal blooms.
				Application of manure	
	Toxin sources		Additional sources New toxins	Agricultural and Urban Land Use (Application of pesticides, herbicides, and other chemicals)	
	Surface erosion[1]	Soil type Hydrologic regime Soil erodibility	Most soils derived by glacial deposits	Removal of vegetation and grading for new development	Naturally occurring phosphorous, adsorbed to sediment, is transported by overland flow to downgradient aquatic systems.
Movement	Biotic uptake and decomposition	Biotic cover & composition Hydrologic regime	See ecosystem response	See ecosystem response	Because this is an annual process of uptake in the growing season and release in the fall these areas (i.e. emergent & decidous vegetation) are not significant sinks for phosphorous and toxins in urban areas.
	Adsorption (P)	Soil characteristics	Reduced phosphorus adsorption	Draining or filling of depressional wetlands with mineral soils	Depressional wetlands are effective sinks for phosphorous. Draining and filling transports phosphorous downgradient to other aquatic systems.
				Loss of upland areas with clay soils	Increase transport of phosphorous downgradient.
	Adsorption (T)	Soil cation exchange capacity	Reduced toxin adsorption	Draining or filling of wetlands with organic and clay soils	Depressional wetlands are effective sinks for toxins. Draining and filling transports toxins downgradient to other aquatic systems.
	Sedimentation[1]	Water transport capacity (velocity)	Reduced storage of phosphorous & toxins	See Sedimentation Process	See Sedimentation Process

DRAFT

DRAFT

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats[1]
Strait of Juan de Fuca	Headwater areas largely protected in national park (Olympic), except for Hoko and Pysht areas. Outside of protected areas, most mid- to low-elevation areas are in forest and forestry uses. Three moderate-sized UGAs (Port Angeles, Sequim and Port Townsend) are present, located away or mostly away from major river headwaters, corridors and river mouths. Two UGAs (Port Angeles and Port Townsend) have significant development along marine nearhore areas. Otherwise, low elevation areas are dominated by mostly rural residential uses.	Terrestrial – higher elevations contain mixed conifer forests and hemlock and silver fir, lower elevation forests contain hemlock and fir with woodlands and shrubs lands in riparian areas. Freshwater – rivers include the Dungeness, Elwha, Lyre, Pysht, East and West Twin, and Hoko, with many smaller river and stream systems. Lakes Crescent and Sutherland are the largest natural lakes in the area.	Large amounts of rocky reef and kelp habitats (particularly towards western end); sand and gravel beaches and flats, large sand spits at Port Angeles (although affected by lack of sediment from Elwha) and Sequim (Dungeness River mouth), large embayments (Discovery Bay, Sequim Bay), estuaries at mouths of major rivers and many small creeks, moderate human shoreline uses at Neah Bay, Clallam Bay, Port Angeles, and Sequim.	Barriers, especially on the Elwha River, but also on many small stream and in floodplains where old culverts remain, affect fish passage and free flow of materials such as water, sediment and LWD. Forest cover loss and conversion to development is localized (in and near UGAs) and is localized conversion of natural stream systems to artificial ditches, floodplain development. Large woody debris (LWD) and forest type is affected by extensive past logging as well as more localized floodplain and riparian development. Localized riparian and floodplain development also create impacts for floodplains and riparian conditions. Nearshore areas are threatened by increased residential development, fecal coliform and nutrient additions to bays (especially Dungeness Bay), shoreline armoring, fish and shellfish harvest, commercial development along ports.

DRAFT

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats[1]
Hood Canal	Headwater areas largely contained in park (Olympic) and forest service lands.	Terrestrial – higher elevations contain mixed conifer forests and hemlock and silver fir, lower elevation forests contain hemlock and fir with woodlands and shrubs lands in riparian areas. Freshwater – major rivers include the Skokomish, Hamma Hamma, Dosewallips, and Quilcene. Lake Cushman is the largest lake in the Action area.	Dominated by sand and gravel beaches and flats, more sand beaches in Hood Canal than other Action Areas, embayments (Dabob and Quilcene bays), estuaries and wetlands at mouths of major rivers and many small creeks, Heavier human shoreline uses at Port Townsend and Belfair. Moderate uses at other small towns bordering the canal, like Seabeck and Brinnon.	Loss of forest cover, activities that increase impervious surfaces, shoreline modifications, habitat fragmentation; blockage of salmon access to high elevation river habitats

DRAFT

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats[1]
San Juan/ Whatcom	San Juan – rural lands dominate, some forestry, agriculture, conservancy lands, and a few small towns (UGAs). Whatcom portion – In low elevation and marine shoreline areas, several medium to large UGAs, extensive rural residential and agriculture. . Mid to higher elevation areas mostly in forestry and protected status, w/ scattered low density rural residential and agriculture.	San Juan – terrestrial habitats dominated by fir-hemlock-cedar forest, also significant patches of madrone forest, grasslands, scrub-shrub, and rock outcrops. Freshwater habitats are primarily small, intermittent streams and lakes. Whatcom - terrestrial – higher elevations have glaciers, rock outcrops, and hemlock and mixed conifer forests. Hemlock and Douglas fir forests line higher elevation streams, becoming riparian woodlands and shrublands and crop lands along the river in the lowlands. Douglas Fir, hemlock, and red cedar forests dominate upland areas in the Puget Sound lowlands. Freshwater – the Nooksack River is the major riverine system. Major lakes are Samish and Whatcom.	San Juan - Dominated by rock cliffs, rocky reefs and kelp habitats on islands, interspersed gravel beaches, numerous small embayments within the islands, moderate human shoreline uses within major towns on larger islands (San Juan, Orcas, Lopez, Shaw), marinas on many islands. Whatcom - Dominated by sand and gravel beaches and flats, some mudflats and rock cliffs, estuaries and wetlands at mouth of Nooksack River and small creeks, heavy human shoreline uses at Bellingham and Blaine.	Marine shoreline modifications, activities that increase impervious surfaces – transportation infrastructure, land conversion, loss of vegetation, upland/shoreline habitat connectivity

DRAFT

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats[1]
Whidbey Basin	Headwater areas largely protected in park (North Cascade) and wilderness lands. Mid-elevations mostly in forestry, protected uses, scattered small UGAs and rural residential development. In low elevation and along marine shorelines, UGAs ranging from small to large, mostly situated near the mouths of the Snohomish and Skagit rivers. Extensive agriculture in lower and mid-valley floodplains of all major rivers.	Terrestrial – higher elevations have glaciers and hemlock and mixed conifer forests. Hemlock and Douglas fir forests line higher elevation streams, becoming riparian woodlands and shrublands along larger rivers in the lowlands. Douglas Fir, hemlock, and redcedar forests dominate upland areas in the Puget Sound lowlands. Freshwater – major river systems include the Skagit, Stilliguamish, and Snohomish. Largest lakes are reservoirs, include Baker and Ross.	Large freshwater influence from Skagit River, large estuary and wetland areas in Skagit, Padilla, and Everett bays, eelgrass beds in sand and mud flat bays, large areas of sand and gravel beaches and flats, Whidbey and Camano islands provide some shoreline protection, some rocky/sandy cliffs, estuaries at mouths of major rivers and many small creeks, heavy human shoreline uses in Everett, moderate shoreline uses along island shorelines.	Activities that increase impervious surfaces - transportation infrastructure, land conversion, agricultural practices, forest loss predominately along marine shorelines, and in low elevation areas. Mid elevation areas still recovering from extensive historic logging impacts. Dams on the Skagit and Baker Rivers; blockage of salmon access to high elevation river habitats
North Central Puget Sound	Mix of small to medium sized UGAs w/ extensive scattered rural residential development all in low elevation and low topographic relief settings. Scattered small agriculture and forestry.	Terrestrial- Douglas Fir, hemlock, and redcedar forests dominate upland areas. Freshwater – Many small streams and lakes such as Chico Creek and Wildcat Lake.	Dominated by sand and gravel beaches and flats, sometimes backed by feed bluffs. Estuaries at mouths of many small creeks, heavy shoreline uses Bremerton, moderate uses at Poulsbo, Port Orchard, Eagle Harbor, Keyport, Gig Harbor.	Marine (and freshwater?) shoreline modification and vegetation removal, habitat fragmentation

DRAFT

Appendix S1-2: A preliminary overview of Action Area conditions and threats. Table refinements should be made based on input from the Topic Forum on April 28th and from the "Action Area Profiles" currently being developed.				
Action Area	Land Uses	Watershed and Terrestrial Habitats	Dominant Marine and Estuarine Habitats	Action Area-Specific Major Threats[1]
South Central Puget Sound	Major and extensive UGAs in lower elevations and along PS shorelines and estuaries. Medium to small UGAs scattered in surrounding low to mid elevation areas. Extensive rural and development outside UGAs and localized agriculture along undeveloped low elevation floodplains. Mid to high elevation forests in protected or commercial forestry activities.	Terrestrial - Douglas fir, hemlock, and redcedar forests in upland areas, riparian forests and woodlands along rivers and streams. Many forest have high proportion of deciduous trees relative to predevelopment condition Freshwater - major rivers systems are the Duwamish/Green, Puyallup-White, Cedar and Sammamish, large lakes Washington and Sammamish (WA's second and sixth largest lakes, respectively) and many smaller lakes and streams	Dominated by sand and gravel beaches and flats, sometimes backed by feed bluffs. Small, typically developed estuaries at mouths of major rivers (Duwamish, Puyallup), smaller estuaries at many small creeks, significant portions of shoreline armored by railroad, heavy shoreline uses in many areas focused around Seattle, Tacoma, moderate uses throughout eastern side, less intensive shoreline uses on Vashon and Maury islands	Activities that increase impervious surfaces – transportation infrastructure, land conversion; dams on the Cedar, Green and White Rivers; blockage of salmon access to high elevation river habitats
South Puget Sound	Headwaters of most major stream in protected status or forestry w/ scattered rural residential. Fort Lewis surrounds and protects large reach of Nisqually from major development. Scattered medium to small UGAs along marine areas and away from most major streams and stream mouths. Most low to mid elevation areas in scattered rural residential and forestry w/ some agriculture.	Terrestrial – Douglas Fir, hemlock, and red cedar forests dominate upland areas. Riparian woodlands and shrubs along rivers. Contains historic prairie and grasslands. Freshwater – The Nisqually is the major river system in the area. Smaller rivers include the Deschutes, Chambers-Clover system, and Kennedy-Greensborough.	Numerous embayments with little water circulation and subject to high tidal fluctuations, Dominated by sand beaches and flats, mud flats, large estuary at mouth of Nisqually, many small estuaries associated with streams, heavy human shoreline uses at Olympia (Budd Inlet), moderate at Shelton and Steilacoom.	Activities that increase impervious surfaces – transportation infrastructure, land conversion, private ownership of tide lands; water quality form stormwater runoff and septic

1 See Table S1-1 for an overview of threats common within the Puget Sound watershed. Those of particular concern are noted for each Action Area.
Sources: Ruckelshaus and McClure 2007; PSAT 2007a; PSAT 2007b; San Juan County Marine Stewardship Area Plan; County comprehensive plans, Puget Sound Chinook salmon Recovery Plan, Department of Natural Resources Shorezone database.

DRAFT

Science Question 2 (S2): What do we know about the effectiveness and certainty of protection and restoration approaches aimed at addressing threats to habitat?

Human land use activities, such as logging, building roads and homes, and armoring shorelines, impact watershed and coastal ecosystems (NRC 1992; Booth 1991; Richards et al. 1996; Paul and Meyer 2001; Diefenderfer et al. 2007). Many of these activities occurred without adequate measures to protect habitats and the processes that form them, leaving a legacy of historic impacts.

Since about the 1970s, society has implemented considerable programs to manage growth and minimize adverse consequences (see Response to Question P1). These efforts include:

- Protection of lands outright through acquisition and resource-based zoning (e.g., federal, state and local parks, forest resource lands, acquire or use tax incentives and conservation easements for targeted high resource areas).
- Extensive land use and environmental regulations for areas zoned for development (e.g., federal Clean Water Act, state Growth Management Act, local land use codes).
- Stewardship promotion through education and incentive programs (e.g., tax rebates, salmon and beach "watchers").
- Modified construction and operation techniques (e.g., low impact development, best management practices).
- Projects to restore and improve habitat, and mitigate for its loss.

As a whole, habitat continues to degrade from the myriad of human uses of the landscape, and our ecosystems continue to be at risk as future development is planned. Of particular note is that many attempts to restore past impacts and mitigate for ongoing impacts have been unsuccessful at fully replacing the affected habitats or functions (NRC 1992; NRC 2001). Nationally, there has been an estimated 80% net loss of wetlands during the time that the Clean Water Act, Section 404 permitting program was in place to protect wetland functions (NRC 2001). Within Puget Sound, monitoring by the Puget Sound Ambient Monitoring Program indicates that habitats and species using Puget Sound are in decline (PSAMP 2007b). In addition to habitat losses, monitoring to evaluate the effectiveness of protection and restoration actions has been infrequent and often inadequate for understanding ecosystem responses (Roni et al. 2003; Beschta et al. 1994; Reeves et al. 1991).

This memorandum discusses the effectiveness of our approaches to protect and restore[4] habitats and identifies guiding scientific principles for habitat protection and restoration.

Effectiveness of Efforts to Protect and Restore Habitat

Overall, little is known about the effectiveness of efforts to protect and restore habitat from an ecosystem standpoint. In general, monitoring efforts that assess restoration and mitigation projects have been increasing in recent years, while efforts to understand the ecological results from regulations, education, incentives, and other sorts of programs have been sparse.

[4] In restoration science, "restoration" is limited to those areas where the integrity of ecosystem processes can be reinstated. Habitat rehabilitation and substitution are used in instances where processes cannot be fully reinstated. For the purposes of this document, "habitat restoration" will cover all projects intended to improve habitat conditions.

Effectiveness and status and trend monitoring efforts by a number of entities, such as the Washington Salmon Recovery Funding Board, the Pacific Northwest Aquatic Monitoring Partnership, and individual project sponsors, should help to add to our knowledge about what is most and least effective for ecosystems from the standpoint of projects and our accumulating combination of beneficial and damaging activities.

Below is a brief overview of what is known about effectiveness of protection and restoration actions based on a very limited literature review and web search.

Habitat Protection Efforts

Habitat protection efforts can occur through acquisition and creation of reserves, regulations, education and incentive programs, and best management practices. There appears to be little, if any, information about the ecosystem benefits resulting from these efforts. The information available mostly focuses on the intend outputs of the activities (e.g., number of people involved in outreach program, where growth occurs), and not the intended ecological outcome of habitat protection.

For example, there is general consensus that the Washington State Growth Management Act is slowing sprawl and focusing growth in urban areas. Between 1995 and 2007 the amount of growth occurring within urban areas increased from 78% to 88% within King, Pierce, Snohomish, Clark, Kitsap, and Thurston Counties (CTED 2008). A study conducted within Thurston County showed a decreasing trend in the number of permits issued within protected areas between 1990 and 2006 (Reaugh and Toebee 2007). However, how that focused growth has protected or benefited ecosystems has not been studied.

The effectiveness of regulations like the GMA and associated Critical Areas Ordinances and the Shoreline Management Act (SMA) are likely to differ by jurisdiction since local governments have flexibility in the regulations they adopt. For example, single family residences are exempt from the SMA even though 30% of shoreline armoring within Puget Sound is associated with single family residences. Therefore, local jurisdictions are responsible for developing single family shoreline use codes. Similarly, riparian buffers designated in Critical Area Ordinances can vary widely.

Habitat protection through acquisition is commonly thought of as the most effective means to conserve habitats. This approach is considered the most effective for long-term protection of habitat conditions. However, areas can be affected by changes in surrounding lands and conditions can degrade based on changes to the habitat-forming processes that occur outside of the acquired areas. The value of the area also depends on the types of plants and animals that are targeted. Habitat protection is considered the most successful way to protect habitats and the species that use them, but require careful thought (see Principles section below).

Habitat Restoration and Mitigation

Habitat restoration and mitigation project monitoring has been increasing in recent years. There are a number of articles and reviews that assess the effectiveness of particular types of restoration or mitigation projects.

For example, in a review of 345 papers on effectiveness of stream rehabilitation techniques, Roni et al. (in press) found that reconnection of isolated habitats, rehabilitation of floodplains, and placement of instream structures have proven effective for improving habitat and increasing local fish abundance under many circumstances. Techniques that restore the natural processes which create and maintain habitats, such as riparian rehabilitation, sediment reduction methods (road improvements), dam removal, and restoration of floods, are more likely to be effective over long time frames, but little or no long-term monitoring has been conducted on these techniques. Failure of instream projects is most commonly due to the lack of adequate assessment of watershed processes and factors limiting biotic production, or lack of consideration of upstream or watershed-scale factors that influence the outcome of reach or localized rehabilitation projects, and monitoring and evaluation of adequate temporal and spatial scales (Roni et al. in press).

DRAFT

Wetland mitigation reviews have been conducted within Washington State. A Department of Ecology study of wetland mitigation found that of 45 projects, only 13 implemented their projects as planned and met their performance standards (Johnson et al. 2000). Within King County, a survey of wetland and stream mitigation projects found that 75% of projects did not meet performance standards (Mockler et al. 1998). Johnson et al. (2002) found that only 65% of the total acreage of wetlands lost in Washington State were replaced by created or restored wetlands.

Within marine habitats, eelgrass transplants have been assessed (see Williams and Thom 2001). Transplant success has been increasing as measures have accounted for controlling factors such as light and depth. Avoiding and mitigating for eelgrass impacts has also been studied within Puget Sound, particularly in conjunction with Washington State ferry facility projects.

As these examples show, there is project performance monitoring information, both for habitat structure and resulting functions. However, scientific certainty about project results is difficult to attain as projects differ in what they examine, how they collect and data, and the time over which the project is studied. Projects also are undertaken under very different ecosystem conditions and are not considered comparable.

Scientific Principles Underpinning Ecosystem Protection and Restoration

- Restoration efforts must focus on landscape-scale ecosystem processes, such as the delivery and movement of water, sediment, wood, and nutrients, as the basis of complex, high quality habitats and diverse, self-sustaining biological communities (Goetz et al. 2004; Beechie and Bolton 1999). Addressing the factors that impact ecosystem processes is critical for restoring habitats and ecosystem functions.
- Freshwater, estuarine, marine and terrestrial habitats are dependent on natural disturbance regimes. Ecosystem restoration needs to recognize natural variability and the role, rates, magnitudes, and locations of natural disturbances in renewing structure and supporting ecosystem functions (Reeves et al. 1995, Goetz et al. 2004; Hobbs and Norton 1996; Wissmar and Bisson 2003; Hood 2007).
- Restoration of ecosystem processes and functions depends on addressing problems within the appropriate time and spatial scales. Functions of particular areas depend on hydrologic, geologic, and topographic conditions (Goetz et al. 2004; NRC 2001). Restoration goals need to be compatible with these natural characteristics of the landscape (Beechie et al. 2003, Roni et al. 2002).
- The probability of an action working is highly dependent on the landscape and site conditions. For example, if a disturbed site sits within a landscape that is intact, restoring the site will probably be successful because the site will benefit from the healthy landscape processes. Further, the site will be maintained in the long run because the landscape is healthy (Figure S2-1).
- The distribution and array of habitats is a critical factor in determining the viability and health of plant and animal populations. The natural mosaic of habitats in the landscape represents both the culmination of physical and biological processes, and also the structure that animals are adapted to use. The flow of energy, materials, and species among the habitats is critical to resilience of populations, maintenance of biodiversity and of self-maintenance of the ecosystem.
- Protection is the best approach to ensure long-term integrity of ecosystem processes and habitat conditions. Protecting areas with high ecosystem integrity, especially those with documented critical or important ecological functions in the landscape, assures the continued contributions of these areas to the ecosystem. Protection involves minimizing human stressors on existing processes, habitat structures, and ecosystem functions. Restoring habitat conditions is also an important strategy to employ, but is often less certain that protection and is usually more costly. However, in many areas restoration and other habitat improvements will be necessary to achieve desired ecological functions and values.

DRAFT

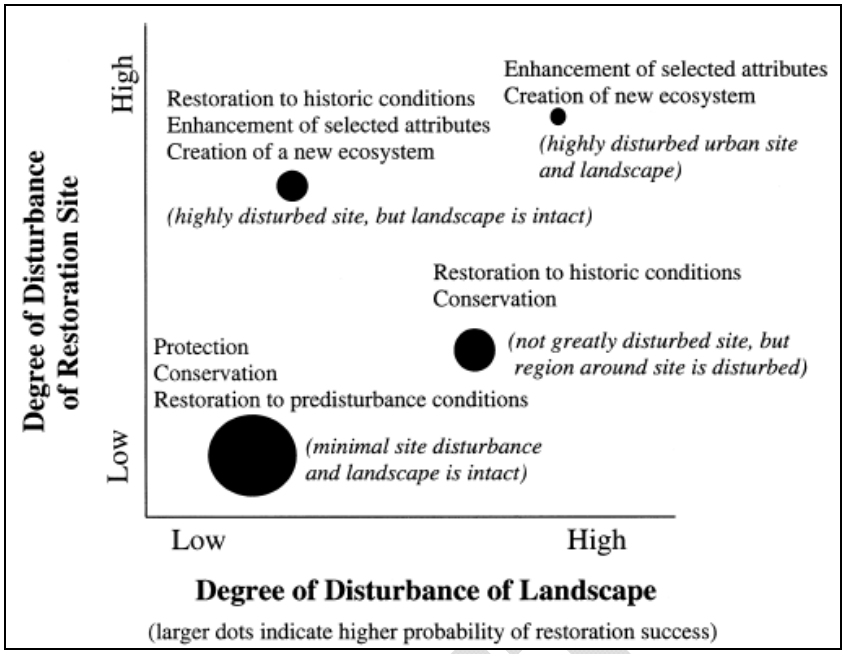


Figure S2-1: Different restoration strategies should be applied depending on the level of disturbance at the landscape and site scales (Thom et al. 2005; Shreffler and Thom 1993).

- Restoration of ecosystem processes should be prioritized for areas key to maintaining downstream aquatic ecosystems. Many lowland areas of Puget Sound have been significantly but not permanently altered (e.g. rural areas). Processes in many of these lowland terraces and valleys support the structure and functions of aquatic habitats (i.e., riverine, estuarine, nearshore). As these areas develop, watershed-based restoration and development (i.e. using smart growth measures) in key areas will be essential to minimizing ecosystem impacts.
- Mitigation should be sited and designed within a watershed context. Most mitigation is developed using an environmental review and assessment process that considers primarily site- and reach-scale conditions. National and state mitigation policies require mitigation sequencing which emphasizes avoidance, redesign or on-site mitigation. This has resulted in the creation of atypical habitats (e.g. wetlands with large areas of open water) with an overall loss of performance of functions. Locating mitigation in areas with a higher priority restoration will result cumulatively in a greater net gain of function.
- Adaptive management and monitoring is critical to achieving ecosystem improvements. Adaptive management, if implemented properly, can reduce cost and increase effectiveness of actions. To date, there is no comprehensive adaptive management program for restoring Puget Sound. However, guidance documents have been prepared by the Puget Sound Nearshore Ecosystem Restoration Partnership (Thom et al. 2007), and for watersheds (e.g., Monitoring and Adaptive Management Plan for Puget Sound Chinook Salmon). Once established, an adaptive management program can provide direct benefit to improving our understanding of how to best and most efficiently restore Puget Sound.

References

Beechie, T. J., G. Pess, E. Beamer, G. Lucchetti, and R. E. Bilby. 2003a. Role of watershed assessments in recovery planning for endangered salmon. Pages 194-225 *in* D. Montgomery, S. Bolton, D. Booth, and L. Wall, editors. Restoration of Puget Sound Rivers. University of Washington Press, Seattle, Washington.

Beechie, T .J., E. A. Steel, P. R. Roni, and E. Quimby, editors. 2003b. Ecosystem recovery planning for listed salmon: an integrated assessment approach for salmon habitat. U.S. Department of Commerce, NOAA Technical Memorandum, NMFS-NWFSC-58, Seattle, Washington

Beechie, T. J., and S. Bolton. 1999. An approach to restoring salmonid habitat-forming processes in Pacific Northwest watersheds. Fisheries 24(4):6-15.

Beechie, T., E. Beamer, and L. Wasserman. 1994. Estimating coho salmon rearing habitat and smolt production losses in a large river basin, and implications for restoration. North American Journal of Fisheries Management 14:797-811.

Bohn, B. A., and J. L. Kershner. 2002. Establishing watershed restoration priorities using a watershed approach. Environmental Management 64:355-363.

Booth, D.B. 1991. Urbanization and the natural drainage system - impacts, solutions, and prognosis. The Northwest Environmental Journal 7:93-118.

Cipollini, K. A., A. L. Maruyama, and C. L. Zimmerman. 2005. Planning for restoration: a decision analysis approach to restoration. Restoration Ecology 13:460-470

CTED (Washington state Department of Community, Trade and Economic Development. 2008. Two year progress report. Olympic, WA. Available at http://www.cted.wa.gov/DesktopModules/CTEDPublications/CTEDPublicationsView.aspx?tabID=0&ItemID=5621&MId=944&wversion=Staging.

Diefenderfer, H.L., K.L. Sobocinski, R.M. Thom, C.W. May, S.L. Southard, A.B. Borde, J. Vavrinec, and N.K. Sather. In Review. Multi-scale analysis of restoration priorities for marine shoreline planning. Environmental Management. Submitted December 2007.

Fresh, K., C. Simenstad, J. Brennan, M. Dethier, G. Gelfenbaum, F. Goetz, M. Logsdon, D. Myers, T. Mumford, J. Newton, H. Shipman, C. Tanner. 2004. Guidance for protection and restoration of the nearshore ecosystems of Puget Sound. Puget Sound Nearshore Partnership Report No. 2004-02. Published by Washington Sea Grant Program, University of Washington, Seattle, Washington. Available at http://pugetsoundnearshore.org.

Frissell, C. A., and D. Bayles. 1996. Ecosystem management and the conservation of aquatic biodiversity and ecological integrity. Water Resources Bulletin 32:229-240.

Greene, C. M., and T. J. Beechie. 2004. Habitat-specific population dynamics of ocean-type chinook salmon (*Onchorynchus tshawytscha*) in Puget Sound. Canadian Journal of Fisheries and Aquatic Sciences 61:590-602.

Hood, W.G. 2007. Landscape allometry and prediction of estuarine ecology: linking landform scaling to ecological patterns and processes. Estuaries and Coasts 30:895-900.

Johnson, P.A., D.L. Mock, E.J. Teachout, and A. McMillian. 2000. Washington State Wetland Mitigation Evaluation Study. Phase 1: Compliance. Washington State Department of Ecology. Olympia, WA.

Johnson, P.A., D.L. Mock, A. McMillian, L. Driscoll, and T. Hruby. 2002. Washington State Wetland Mitigation Evaluation Study. Phase 2: Evaluating Success. Washington State Department of Ecology. Olympia, WA.

Johnson G.E., R.M. Thom, A.H. Whiting, G.B. Sutherland, T. Berquam, B.D. Ebberts, N.M. Ricci, J.A. Southard, and J.D. Wilcox. 2003. An Ecosystem-Based Approach to Habitat Restoration Projects with Emphasis on Salmonids in the Columbia River Estuary. PNNL-14412. Prepared for U.S. Army Corps of Engineers by the Pacific Northwest National Laboratory, Richland, Washington.

DRAFT

Karr, J. R. 1991. Biological integrity: a long-neglected aspect of water resource management. Ecological Applications 1:66-84.

Lewis, C. A., N. P. Lester, A. D. Bradshaw, J. E. Fitzgibbon, K. Fuller, L. Hakanson, and C. Richards. 1996. Considerations of scale in habitat conservation and restoration. Canadian Journal of Fisheries and Aquatic Sciences. 53(Suppl. 1):440-445.

Mockler, A., L. Casey, M. Bowles, N. Gillen, and J. Hansen. 1998. Results of Monitoring King County Wetland and Stream Mitigation. King County Department of Development and Environnmental Services. King County, WA.

National Research Council (NRC). 1992. Restoration of aquatic ecosystems. The National Academies Press, Washington, D.C.

National Research Council (NRC). 2001. Committee on Mitigating Wetland Losses. Compensating for wetland losses under the Clean Water Act. Washington D.C. National Academy Press. 348 p.

Paul, M.J., and J.L. Meyer. 2001. Streams in the urban landscape. Annual Review of Ecological Systems 32:333-365.

Reaugh, D. and T. Toebbe. 2007. An analysis of the effect of Washington's 1990 Growth Management Act. Poster. University of Washington. Seattle, WA. Available at: http://depts.washington.edu/uwtgis/gallery/tgis_312/20071/reaugh_toebbe_tgis312_2007.pdf

Reeves, G. H., J. D. Hall, T. D. Roelofs, T. L. Hickman, and C. O. Baker. 1991. Rehabilitating and modifying stream habitats. Pages 519-557 *in* W. R. Meehan, editor. Influences of forest and rangeland management on salmonid fishes and their habitats. American Fisheries Society, Special Publication 19, Bethesda, Maryland.

Reeves, G. H., L. E. Benda, K. M. Burnett, P. A. Bisson, and J. R. Sedell. 1995. A disturbance-based ecosystem approach to maintaining and restoring freshwater habitats of evolutionarily significant units of anadromous salmonids in the Pacific Northwest. Pages 334-349 *in* J. L. Nielsen, editor. Evolution and the aquatic ecosystem: Defining unique units in population conservation. American Fisheries Society, Symposium 17, Bethesda, Maryland.

Richards, C., Johnson, L., and Host, G. 1996. Landscape-scale influences on stream habitats and biota. Canadian Journal of Fisheries and Aquatic Sciences 53 (Supplement 1).

Roni, P, K. Hansen, and T. Beechie. In press. Global review of the physical and biological effectiveness of stream habitat rehabilitation techniques. North American Journal of Fisheries Management.

Roni, P., T. J. Beechie, R. E., Bilby, F. E. Leonetti, M. M. Pollock, and G. P. Pess. 2002. A review of stream restoration techniques and a hierarchical strategy for prioritizing restoration in Pacific Northwest watersheds. North American Journal of Fisheries Management 22:1-20.

SCSRC (Snake River Salmon Recovery Committee). 2004. 2004 Lead entity habitat protection and restoration strategy: Snake River region. Asotin County Conservation District, Clarkston, Washington. Available: http://www.iac.wa.gov/documents/srfb/lead_entities/Snake/strategy.pdf (December 2006).

Thom, R.M., 2000. Adaptive management of coastal ecosystem restoration projects. PNWD-SA-5738. Ecological Engineering 15(3-4):365-372.

Thom, R.M., G.D. Williams, A.B. Borde, J.A. Southard, S.L. Sargeant, D.L. Woodruff, J.C. Laufle, and S. Glasoe. 2005. Adaptively Addressing Uncertainty in Estuarine and Near Coastal Restoration Projects. Journal of Coastal Research. JCR 40(Special Issue):94-108.

Thom, R.M., G.D. Williams, and H.L. Diefenderfer. 2005. Balancing the Need to Develop Coastal Areas with the Desire for an Ecologically Functioning Coastal Environment: Is Net Ecosystem Improvement Possible? Restoration Ecology 13(1):193-203.

Williams, G.D., and R.M. Thom. 2001. Development of Guidelines for Aquatic Habitat Protection and Restoration: Marine and Estuarine Shoreline Modification Issues. PNWD-3087. Prepared for the Washington State

DRAFT

Department of Transportation, Washington Department of Fish and Wildlife, and the Washington Department of Ecology, by Battelle Marine Sciences Laboratory, Sequim, Washington.

Williams G.D., R.M. Thom, and N.R. Evans. 2004. Bainbridge Island Nearshore Habitat Assessment, Management Strategy Prioritization, and Monitoring Recommendations. PNWD-3391, Battelle Marine Sciences Laboratory, Sequim, Washington.

DRAFT

Policy Question 1 (P1): What policy approaches are being used to address land use management relative to habitat protection and enhancement in the Puget Sound region?

This draft contains a summary of the tools that exist relative to protecting and/or restoring "ecosystems." It omits specific information being covered by other topic forums such as water quantity and quality, biodiversity, toxics, public health, and quality of life.

Introduction

In creating the Puget Sound Partnership, the Legislature determined that the scope of what it would be charged with protecting and restoring wasn't simply *habitat*, but rather the *Puget Sound ecosystem*. (See RCW 90.71.300.) Accordingly, we examine the tools available to protect and restore Puget Sound using an ecosystem approach.

The term "ecosystem" means the sum of ecosystem processes, structures and functions that occur across the landscape, shaped by the geomorphology of an area.[5] (See Response to Question S1 for more details). An "ecosystem approach" recognizes that ecosystem components do not function as independent systems, rather, they exist *only* in association with one another.[6] In Puget Sound, the ecosystem includes terrestrial and aquatic (freshwater and marine) systems, all existing in association with one another.

From this ecosystem perspective, we will first examine the framework of laws and regulations that control the human activities in Puget Sound, in light of the major threats to ecosystem processes and habitats described in this report. Second, we will summarize the various voluntary programs and laws that exist in an attempt to *influence* (rather than mandate), the ways in which humans conduct activities, so that ecosystems are protected, restored or not further degraded. These programs and laws include incentives, education, and stewardship programs. Third, as we discuss these tools, we will identify gaps, where known, where no controls or programs exist to protect the ecosystem or key components of it. Finally, we will discuss the need for one additional tool: a strong monitoring and adaptive management program that continually informs decision-makers about the state of the ecosystem and whether the controls and programs used to protect and restore it are working effectively to achieve and sustain a healthy Puget Sound by 2020.

Controlling Impacts of Human Activities on Puget Sound's Ecosystem

The threats that human activities pose to the health of the Puget Sound ecosystem (marine, terrestrial and freshwater aquatic systems) are documented in the Response to Question S1, as well as other Topic Forum reports. Federal state and local government regulatory programs provide a variety of tools for controlling these impacts, as described below (see also Appendix P1-1).

Protecting the terrestrial and freshwater ecosystem: State and local laws.

In order to understand how we reached the complex web of regulatory and incentive programs that exist today to control human impacts on the natural environment mainly in terrestrial and freshwater areas, we must look briefly at the past. The first set of standardized zoning laws were adopted by the federal government in the 1920s to grapple with the social and environmental stresses afflicting growing cities around the nation. Zoning laws were mainly designed to address and prevent the effects of "nuisance" activities – air and water pollution, noise and industrial

---

[5]Fisher et al., Functional ecomorphology: Feedback between form and function in fluvial landscape ecosystems. Geomorphology 89 (2007) 84-96.

[6] (Bailey 1995a). Omernik and Bailey, *Distinguishing Between Watersheds and Ecoregions,* JAWRA, Vol. 33, No. 5 at 940 (1997).

hazards.[7] There was little understanding about the complex interactions of ecological systems and the impacts of human populations on those systems. Id.

Up until the 1970s, when a national environmental movement spread across the country resulting in the adoption of the federal Clean Water Act and Endangered Species Act, the protection of environmental resources was largely left to local elected officials to deal with on an ad hoc basis. Today, this remains largely the case.[8] There is no comprehensive, national framework that requires the protection and/or restoration of ecosystems. The issue is dealt with mainly by states and local governments. The result is significant. From a policy perspective, it is often very difficult for local leaders to implement significant changes to land use activities using regulatory approaches. It often takes extreme situations (such as the Ohio River fire) to provoke public sentiment to the point where a political movement begins calling for more protection of the environment. After these movements subside, the political pendulum can often swing in the opposite direction over a number of years, as landowners begin to feel the constraints imposed by new protective regulations.

Washington's local experience has been no different from that of the nation. Although general police powers were granted to cities, counties and towns by the State Constitution in 1889,[9] the specific authority to engage in local planning wasn't adopted until 1959 and its provisions were optional.[10] For nearly 100 years, local zoning regulations and building permits were the main tools by which specific activities were either allowed or prohibited across the landscape.

In the early 1970s, consistent with the national environmental movement, Washington adopted three key environmental laws: the State Environmental Policy Act (SEPA), the Shoreline Management Act (SMA) and the Forest Practices Act (FPA). However, further attempts at statewide comprehensive land use planning failed for a variety of reasons.[11] Today, these three laws remain key tools in environmental protection for Puget Sound, although each of them was designed to be applied on a site or permit application scale, rather than an ecosystem scale. The Clean Air Act, implemented by the Puget Sound Clean Air Agency, also protects air quality and limits discharges of certain pollutants within Pierce, King, Snohomish and Kitsap Counties.[12]

With intense population growth throughout the decade of the 1980s, Puget Sound residents began to feel the resulting impacts on their quality of life and rebelled.[13] This resulted in the Legislature's adoption of the Growth Management Act (GMA) in 1990 and 1991.[14] Only a few states have adopted such aggressive limits on the spread of growth across the landscape and most, including Washington, are still working through the policy and management questions that arise when local governments try to balance all of the competing needs of their citizens.

DRAFT

---

[7] *Growing Smart Legislative Guidebook*, 2002 Edition.

[8] It is interesting to note that unlike water quality, there is no overarching federal law relating to water quantity. Water supply laws vary greatly between the east and west coasts. This is a legacy of the way in which the west was settled in the 1800s.

[9] See Wash. Const. Article XI, Section 11.

[10] See Chapter 36.70 RCW- the Planning Enabling Act. See also, Settle, Washington Land Use and Environmental Law and Practice (1983).

[11] At the same time that these three environmental overlays were enacted into law, the Legislature considered adopting a comprehensive state-supervised land use regulatory system (the State Land Planning Act), not only because a respected Model Land Development Code was published by the distinguished members of the American Law Institute, but also because Congress, through the leadership of Senator Henry M. Jackson,[11] was on the verge of enacting large subsidies for states that had such legislation. But, when the ensuing oil embargo diverted national attention away from the issue, along with the funds, our State Legislature lost interest in comprehensive land use reform. See, *Guidance for Growth,* University of Puget Sound Law Review, 16:867 at 870-871; 875-877 (1993).

[12] Chapter 70.94 RCW;

[13] *Guidance for Growth,* University of Puget Sound Law Review, 16:867 at 880-81 (1993).

[14] See Chapter 36.70A RCW)

The GMA is a regulatory tool to manage and direct growth to certain places, while requiring certain infrastructure to accompany it. The Act requires counties to establish urban growth areas as a central component of its "bottom up" or locally controlled growth management strategy, with limited oversight by regional appeal boards. Conceptually, urban growth areas (UGAs) are intended for compact, higher density urban development to enable more cost-effective urban services and infrastructure, while conserving open space, rural, agricultural, and natural resource lands by prohibiting urban development outside of the UGA.[15] The necessary corollary to containing urban growth within the UGA is zoning that restricts urban densities and development on the rural side of the boundary.[16] When used well, the Act is a powerful tool for local governments to concentrating growth, but it is not designed to slow the overall pace of the region's growth as a whole.[17]

The GMA has undergone a number of legislative amendments since its adoption. Most notably for purposes of habitat protection, the Legislature added a requirement in 1995 that the designation and protection of critical areas (which include wetlands, critical aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas) be supported by best available science.

Apart from changes to the Shoreline Management Act (discussed below), few other changes were made to the State's land use regulatory scheme throughout the 1990s, although federal ESA listings and new Clean Water Act requirements have had significant impact on land use activities in Puget Sound. Today, cities and counties spend a great deal of staff time working on growth planning issues and meeting compliance deadlines related to GMA. This work has not been without controversy or litigation.[18] In particular, the requirement to protect critical areas has spawned many lawsuits against several counties and cities, and push back from some citizens concerned about their property rights.

In addition to these major regulatory tools, there are a few other development regulations routinely used by many local governments to protect the environment, as well as public health and safety. They include some "old" tools such as zoning, clearing and grading regulations, as well as newer regulations such as stormwater or drainage regulations, comprehensive flood plans, flood hazard ordinances adopted consistent with FEMA regulations, low impact development standards *Built Green*[19] programs, or other innovative design regulations.

Protecting terrestrial and freshwater aquatic ecosystems from human impacts: Federal regulations.

Most of the federal regulations that protect terrestrial and freshwater aquatic ecosystems (aside from energy-related regulations) have tended to regulate activities that can cause impacts to water quality (Clean Water Act, 404 permits, 401 water quality certifications, etc.), federal forest lands, (e.g., the Northwest Forest Plan), flooding (e.g., FEMA's NFIP standards) and particular species (e.g., ESA and various other species-specific laws). (See Appendix P1-1 for more details). The Northwest Forest Plan was created using an ecosystem approach and remains a strong tool for

---

[15] *K. Dearborn & A. Gygi, Planner's Panacea or Pandora's Box: A Realistic Assessment of the Role of Urban Growth Areas in Achieving Growth Management Goals,* University of Puget Sound Law Review, 975, 976-77 (1993).

[16] *Id.*

[17] It should also be noted that non-traditional management tools exist as well. The Puget Sound Regional Council provides a regional planning framework for King, Snohomish, Pierce and Kitsap counties under GMA. They develop and adopt joint planning policies, such as Vision 2040, which can lead to better coordination and outcomes for growth management among the participants. While not a "management tool" in the sense that the group is not a regulatory agency, the policies do matter. (For example, each participant's transportation plans must be consistent with the latest adopted PSRC planning policies or they will not achieve approval from PSRC, which has consequences).

[18] As noted, the requirement that local jurisdictions adopt critical areas regulations has been a driver of significant litigation, as well as a surge in property rights initiatives led by the farming community, which have been defeated at the polls. As a result, the 2007 Legislature granted a 3-year moratorium on the regulation of agriculture under critical areas protections, in order to provide time for the UW's Ruckelshaus Center to facilitate a stakeholder process to address the needs of agricultural interests.

[19] *Built Green* is a voluntary non-profit program created by the Master Builders Association of King and Snohomish Counties that encourages development using energy efficient, sustainable materials and construction techniques. Some jurisdictions are now adopting those principles into their design and construction standards or allowing their use through innovative design regulations.

the protection of federal forest lands. Two of these federal laws have had particular influence on state and local programs and regulations.

First, in 1995, the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) regulations began applying to counties and cities throughout the Sound. The NPDES municipal stormwater permit protections now apply to all jurisdictions in Puget Sound with 10,000 or more in population, and require them to adopt a multi-faceted program to control nonpoint stormwater discharges. This has included the adoption of new local regulations such as grading, clearing and drainage ordinances, as well as pollution discharge prohibitions, as well as enforcement procedures and reporting requirements. Additional details about this program can be found in the Water Quantity Topic Forum Response to Question P1.

Second, the federal listings of Puget Sound Chinook salmon, Hood Canal summer chum and bull trout under the Endangered Species Act (ESA) in the late 1990s, and recent listings of steelhead salmon and Southern Resident killer whales, have extended the protections of the ESA to human activities that would cause "take" of those species or habitat important for their life stages.[20] Although these ESA listing did not change Washington's land use law per se, concern over the salmon listings has led to several regional efforts to respond proactively through voluntary changes in land use practices, incentive programs, and significant habitat restoration plans.[21] Many jurisdictions also incorporated requirements to protect listed species into GMA critical areas regulations. All of these efforts have been voluntary collaborations convened by leaders across the region who came together to create plans that would respond to the needs of the listed species, while ensuring a vibrant regional economy.

Protecting marine ecosystems: State and local efforts.[22]

At the state and local levels, the list of regulatory programs that protect marine resources is fairly short. The principal tool is the Shoreline Management Act, administered by local governments through local shoreline master programs, which are approved against a set of state regulations by the Department of Ecology. In addition, the State Department of Ecology adds together all of the local shoreline master programs to form the State's Coastal Zone Management Plan, which it prepares in compliance with the Coastal Zone Management Act. The Department of Fish and Wildlife (WDFW) regulates and licenses commercial and sport fishing, aquaculture, and regulates some development activities that potentially alter water flow affecting fish and shellfish through its Hydraulic Project Approval program.[23] In addition, WDFW maintains a list of priority habitats and species (PHS) for which they recommend protection of certain species and habitats.[24] WDFW also administers marine protected areas (MPAs) in Puget Sound within which fishing and harvesting of shellfish and other resources is restricted or prohibited.[25]

At the county level, there is very limited local regulation of marine waters beyond the jurisdiction of the shoreline. San Juan County has adopted limits on the use of jet skis and other personal water craft off of its shores in order to protect local marine life and the public health, safety and welfare. Many Puget Sound counties have created Marine Resource Committees (MRCs) under the guidance of the Northwest Straits Commission. MRCs are citizen-based advisory committees committed to protecting and restoring marine resources. Although their work is advisory in

---

[20] Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884, as amended by Pub. L. No. 97-304, 96 Stat. 1411 (1982), *See*, 16 U.S.C. 1531-1541; ESA Regulations: *See*, 50 C.F.R. Part 17 (USFWS) and 50 C.F.R. Part 222 (NMFS). See Appendix P1-1 for further details.

[21] These include the Timber, Fish and Wildlife negotiations, the Tri-County Model 4(d) Rule Response Proposal – a salmon conservation program; the statewide Agriculture, Fish and Water negotiations, the Northwest Forest Plan, the Shared Strategy for Puget Sound's creation of the Puget Sound Chinook Salmon Recovery Plan, which was adopted by NMFS, and the Hood Canal Coordinating Committee's creation of a Summer Chum Recovery Plan

[22] The regulatory programs discussed in this section are summarized in Appendix P1-1.

[23] The HPA program is authorized under Chapter 77.55 RCW and WAC 220-110.

[24] The list includes fish, shellfish, certain marine mammals (porpoises, gray and killer whales, harbor seals, sea otters, and sea lions), shore birds, and other species.

[25] See, Fish and Wildlife Commission Policy 3013.

nature, their research and policy recommendations for the protection and restoration of marine areas are important resources for local governments to consider in making changes to shoreline master programs and critical areas protections.

Protecting marine resources: Federal efforts.

At the federal level, the picture is more complex. As an estuary connected to the Pacific Ocean, Puget Sound frequently falls under a web of federal regulations. Those laws were analyzed by the Pew Commission during a comprehensive effort to understand the state of our oceans and the effectiveness of the nation's ocean policy. In its final report, the Commission made the following findings about the status of federal ocean governance:

> *Governance is a reflection of the knowledge and values of the society that creates it. Our ocean governance needs updating to reflect substantial changes in our knowledge of the oceans and our values toward them since our major ocean laws, policies, and institutions were established.*
>
> *Not a system at all, U.S. ocean policy is a hodgepodge of individual laws that has grown by accretion over the years, often in response to crisis. More than 140 federal laws pertain to oceans and coasts. Collectively, these statutes involve at least six departments of the federal government and dozens of federal agencies in the day-to-day management of our oceans and coastal resources. Authority over marine resources is fragmented geographically, as well. The Submerged Lands Act of 1953 gave most states authority over submerged lands and overlying waters from the shoreline out three miles. Federal territorial sovereignty extends 12 miles offshore, and consistent with the United Nations Convention on the Law of the Sea, the federal government controls ocean resources out 200 miles or more. The federal/state division of ocean jurisdiction makes it difficult to protect marine ecosystems because it divides their management into a nearshore and an offshore component with insufficient means or mandate to harmonize the two.*
>
> America's Living Oceans, Course for Sea Change: *Summary Report – Recommendations for a New Ocean Policy* at pp. 14-16, Pew Oceans Commission, Arlington, VA, May 2003.

In making its final recommendations, the Pew Commission found three fundamental problems with ocean governance: (1) a focus on exploitation of ocean resources with too little regard for the environmental consequences; (2) the fragmented nature of ocean governance in terms of institutions, laws and geography; and (3) the fact that ocean governance has focused on individual species as opposed to the larger ecosystems that produce and nurture all life in the sea. Id. at pp. 15-16. The Pew Commissions' recommendation for solving these problems is included in Response to Question P2.

In summary, the regulatory tools (federal and state) with the potential to protect or restore portions of the Puget Sound ecosystem are only about 30 years old and our most comprehensive tool from a landscape perspective, GMA, is newer still. GMA is focused on managing growth, not preventing it. This means that although the region will benefit from this regulatory tool, it may not be effective in avoiding impacts to quality of life caused by ever-increasing population growth, and to continuing ecosystem degradation in areas of highly concentrated populations.

While protecting critical areas and shorelines is included among the regulatory mandates of the GMA, planning was not usually accomplished with ecosystem constraints taken into account before uses and zones were adopted. Planning occurs on a jurisdictional basis and occasionally on a multi-jurisdictional level, which merely perpetuates the fragmentation problem.

Most of the environmental protection tools that are available in Washington have an effect at the site scale, rather than at an ecosystem scale, often missing the need to protect key ecosystem-forming processes. All regulatory and voluntary, incentive-based tools contain exceptions and limits that reduce the certainty of results needed to ensure the sustainability of ecosystem processes, structures and function for a healthy Puget Sound.

DRAFT

Part of what explains the current status of our regulatory tools is the fact that this state has a history of favoring local control over land use decisions. On many occasions when the State has stepped forward with increased environmental protections or programs, they are rolled back again or changed as a result of litigation or intense political pressure from those negatively impacted by the regulations. (Examples of this include the legislative history of the Hydraulic Project Approval program, the Puget Sound Water Quality Authority, recent litigation over NPDES permits, Shoreline Management Act regulation litigation, etc.) Finally, our tools are spread across multiple governmental institutions at both the federal, state, tribal and local scales. What exists is a fragmented system of protection and restoration, with conflicting goals and inconsistent outcomes where a comprehensive, consistent approach is what's needed to ensure the recovery of Puget Sound. What it tells us is that the legislative process is alive and well and, more importantly, that regulatory tools have their limits.

Influencing Human Activities: Incentives, Education, Stewardship and Restoration Programs

Washington has a long list of incentives, education and stewardship programs which may influence human activities in a way that results in positive outcomes for the environment. A list of those programs is set forth in Appendix P1-2. With regard to incentive programs, these are activities that provide landowners with benefits that in turn, induce them to protect or restore the ecosystem processes, structures and functions on their land.

Landowner Incentives Programs include: (1) Direct Financial Incentives (grants, subsidized loans, cost-shares, leases); (2) Indirect Financial Incentives (property tax or sales tax relief, such as Public Benefit Rating System programs); (3) Acquisition of Property and/or Conservation Easements; (4) Technical Assistance (referrals, education, training, design assistance programs); and (5) Recognition and certification for products or operations.

Puget Sound has a history of success with landowner incentive programs. For example, many Conservation Districts throughout Puget Sound have been quite successful in working with rural land owners and farmers to create and implement individual farm plans. As a result, land owners and farmers have planted and fenced stream buffers and reduced the introduction of nutrients and pathogens to downstream aquatic ecosystems. Another successful tool is the Public Benefit Rating System program (PBRS), a form of indirect financial incentive. This tool is available today under state law, and has been proven effective in protecting critical habitats in urban and rural areas. For example, King, Clark and Whatcom counties have used the voluntary PBRS program to reduce property taxes in exchange for a landowner granting protective habitat easements and/or restoring habitat on private property.

Conservation Markets encourage the sale of conservation products or credits from private land. Few examples exist for these types of incentives outside of wetland banking, although interest in these programs in growing. (See, e.g., the Ecosystem Services Marketplace program, an innovative water quality trading program designed to reduce stream temperatures in the Willamette Basin; and Green House Gases (GHG) emission cap and trade programs being discussed across the nation).

Stewardship Programs include land sales or exchanges, conservation easements, transfer or purchase of development rights. Acquiring property has the potential to provide long-term protection to habitat resources from a variety of risks. Public agencies, as well as non-governmental organizations such as land trusts and conservancies, often acquire property in one of two ways: acquire the entire property through a fee simple transaction, or, acquire a portion of a property's rights by either stripping the property of its development rights or acquiring a conservation easement with associated long-term deed restrictions and covenants. Successful examples of such stewardship programs include the Cascade Land Conservancy's acquisition efforts through its long-term protection plan known as the Cascade Agenda, and the King County and Snohomish County Transfer of Development Rights/Purchase of Development Rights Programs.

Education Programs include public and private outreach and education programs, which are either passive in nature (where a resident simply receives information in the mail or at an event), or active (where training occurs with the

DRAFT

expectation that a person will volunteer to protect or monitor some portion of the ecosystem or the health of a species). There are many natural resource education programs designed to be taught in K-12 schools (e.g., education programs designed by state agencies such as WDFW or counties under their NPDES permit programs, and private programs such as Salish Sea Expeditions). There are programs for adults, as well, such as beach-watcher and beach seining volunteer organizations for salmon recovery; watershed-keeper education programs and the like. These programs may result in long-term volunteer engagement in efforts to protect and restore local aquatic systems; however their effectiveness has yet to be measured on a comprehensive scale.

Other Voluntary Efforts

Habitat Restoration Projects take place on public and private properties. Restoration project scale is often a function of project objectives, available funding, and property ownership. Effective restoration of aquatic and terrestrial resources results when a restoration project site is identified, through a technical planning process, to be functionally and physically connected to other ecosystem components. A commitment to monitoring and adaptive management strengthens the likelihood of achieving ongoing restoration project objectives. A variety of local, state, federal, and multi-jurisdictional plans provide guidance as to where habitat restoration projects should take place to achieve specific functional habitat outcomes. There are many habitat restoration plans or guidance documents in existence within the Puget Sound region. They include the various recovery plans adopted by NMFS and USFWS for ESA-listed species, Army Corps Ecosystem Restoration Plans; WA Department of Transportation mitigation plans; plans prepared by the Department of Natural Resources and projects funded by the Recreation and Conservation Office (RCO) and Marine Resource Committees. In addition, many local governments have adopted natural resource restoration plans.

Watershed Planning Efforts have mainly resulted from the ESA listings of various salmon species. Planning is authorized under Ch. 39.34 RCW (funding watershed management plans), RCW 76.09.350 (landscape planning), and Ch. 90.82 RCW (watershed planning). Some of these voluntary efforts have led to successful adoption of recovery plans, including: Chinook Salmon Recovery Plan; Hood Canal Summer Chum Recovery Plans. The Washington Biodiversity Conservation Strategy should also be considered.

In summary, there is a broad array of incentive, education, stewardship, and local planning programs that can be used to protect and restore the environment, that have a history of success within Puget Sound. However, the tools have not been widely used, nor has their effectiveness been studies or documented. Due to time constraints for development of the Action Agenda, the Land Use/Habitat Protection and Restoration Topic Forum was unable to study each tool to determine which set of programs may provide the best outcomes in each Action Area across Puget Sound, depending on local circumstances. However, we believe that the potential for these programs may be great and has largely been untapped up until now.

Monitoring and Adaptive Management to Ensure Ecosystem Health over Time

Measuring our progress in restoring the health of Puget Sound with objective data and information from a comprehensive monitoring and adaptive management plan is critical to ensuring that our strategies are effective and ensuring that our actions are increasingly efficient in the context of reaching recovery goals. It is also important to evaluate our results and show our progress in order to sustain long-term political and financial support for implementation of the Action Agenda. One example of an adaptive management approach is shown in Figure P1-1, below. Another example is the Driver-Pressure-State-Impact-Response (DPSIR)[26] approach used by European countries to assess management strategies in marine systems. This approach combines socio-economic analysis with spatial analysis of pollutant transport and impact on the catchment-coastal zone system. Id. (The DPSIR

[26]N. Pirrone et al., *The Driver-Pressure-State-Impact-Response (DPSIR) approach for integrated catchment-coastal zone management; preliminary application to the Po catchment-Adriatic Sea coastal zone system,* Reg. Environ. Change (2005) 5: 111-137. See also, Thom et al., *Adaptively Addressing Uncertainty in Estuarine and Near Coastal Restoration Projects,* Journal of Coastal Research, SI, 40: 94-108 (Winter 2005).

framework permits the identification of the impact of socioeconomic development on the qualitative state of both marine and superficial waters.)

Monitoring and adaptive management programs are sparse in Puget Sound. Although good examples of programs do exist (e.g., new SMA regulations, PSNERP's monitoring program, the former the PSAT water quality monitoring program, and some stormwater monitoring under NPDES permits), there are few regulatory programs that require their use. This is an area where a significant gap exists in management tools in Puget Sound. As discussed in Response to Question S2, little is known about the effectiveness of our habitat/land use management tools (either regulatory or voluntary). Although a few Growth Boards decisions recently held that local regulations to protect critical areas must include a monitoring and adaptive management framework, this requirement is not a statutory requirement and not all jurisdictions include such programs. For those that do intend to include such monitoring and adaptive management programs, the work in many places is just beginning.

The Monitoring Plan must be able to produce information that enables these decision-makers to track the progress of health in Puget Sound at multiple scales (e.g., regional, action area, catchment, drift cell or by jurisdiction) and over relevant time frames. To get there, the monitoring and adaptive management plan must include basic descriptive monitoring:

- Setting goals and tracking implementation of strategies and actions;
- Tracking status and trends of key marine, freshwater and terrestrial species, watershed conditions (or conditions at a catchment or drift cell scale) and the major human threat factors, as well as natural factors (food web, disease, ocean and climate conditions);
- Determining the effectiveness of strategies and actions; and
- Validating hypotheses (which tell us whether the implemented actions caused the resulting ecosystem change and/or biological change in key species).

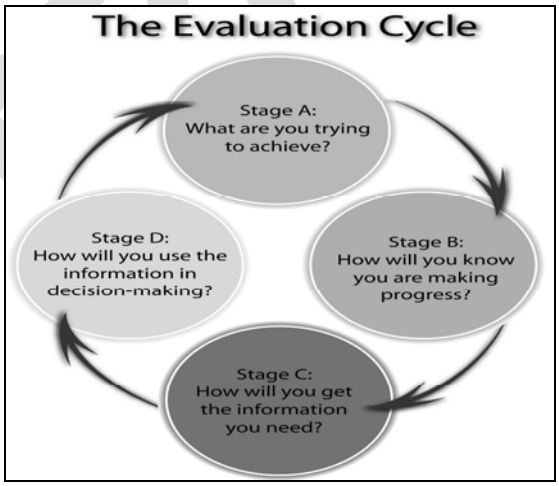


Figure P1-1. A simplified representation of the Evaluation Cycle developed by the University of Michigan Ecosystem Management Initiative.

APPENDIX P1-1 : SUMMARY OF KEY ENVIRONMENTAL REGULATIONS

The following is a non-exhaustive list of key regulations that exist through federal, state or local laws and regulations that have effect in the Puget Sound region. These laws and regulations are highlighted for the reason that they are tools that either directly or indirectly provide protection for some habitat-forming processes, structures or functions or, more generally, the needs of particular species of animals or fish. As noted in the Responses to Questions P1 and P2, there is no single regulation that provides protection from an ecosystem perspective as we have defined it. Instead, the framework of laws and regulations that exist in Puget Sound is largely fragmented, occasionally overlapping and mostly focused on individual parcels (site scale) or individual species.

Federal Laws

The Endangered Species Act. Endangered Species Act of 1973, Pub. L. No. 93-205, 87 Stat. 884, as amended by Pub. L. No. 97-304, 96 Stat. 1411 (1982), *See*, 16 U.S.C. 1531-1541; ESA Regulations: *See*, 50 C.F.R. Part 17 (USFWS) and 50 C.F.R. Part 222 (NMFS). The act protects species listed under the ESA, as well as critical habitats, from hunting, transport, or other harassment. Endangered species are managed by the U. S. Department of the Interior through the U.S. Fish & Wildlife Service (FWS) under the federal Endangered Species Act (ESA). The National Oceanic and Atmospheric Administration (NOAA Fisheries) shares in this administration. Under the ESA, the following strategies are used:

- Directs all federal agencies to use existing authorities to conserve listed species and ensure their actions do not jeopardize the survival of listed species;
- Preparation of Recovery Plans ;
- Prohibits "take" of a listed species (absent certain exceptions) (Section 9);
- Requires Federal agency consultation with FWS and NMFS (Section 7);
- Designation of critical habitat;
- Implements international treaty, the Convention on International Trade in Endangered Species of Wild Fauna and Flora; and
- Preparation of Habitat Conservation Plans that balance development with species conservation (Section 10).

The main protection provided for species listed under the ESA is found in Section 9, known as the "no take" provision. The term "take" is broadly defined to mean *"to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct."* (16 U.S.C. Section 1532(19)). In analyzing the legislative history of this definition, the 9th Circuit Court of Appeals noted that the Senate Report on the Act stated that the term "take" included ". . . every conceivable way in which a person can 'take' or attempt to 'take' any fish or wildlife." Palila v. Hawaii Dept. of Land and Natural Resources, 852 F.2d 1106, 1108 (1988) ("Palila IV"). In 1995, the U.S. Supreme Court upheld the federal rule promulgated by the USFWS interpreting the term "harm" to include *"significant habitat modification or degradation where it actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering."* Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon, 115 S. Ct. 2407 (1995). (*See,* 50 C.F.R. Section 17.3(c) (FWS definition of "harm"). NMFS adopted a similar definition of the term "harm" for the habitat of anadromous fish and marine mammals. (*See,* 63 Fed. Reg. No. 84 at pp. 24148 - 24150, (May 1, 1998)). The key difference in their definition is that it expands the definition of harm to include the terms *breeding, spawning, rearing, migrating, feeding or sheltering.*

A key provision of the Act is its Section 7 consultation requirement. Section 7 requires review of activities to determine whether they are likely to adversely affect the listed species. If so, further consultation and the preparation of a formal biological opinion is required to ensure that the activity will not jeopardize the continued existence of the species. See, 16 U.S.C. Section 1536(a)(2) and 50 C.F.R. Section 402. Section 7 applies to all federal agencies (and the state/local governments or private parties that have a nexus with a federal agency's action. An "action" that can trigger Section 7 review means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies in the United States or on the high seas. The term "action" includes, but is not limited

DRAFT

to: (i) actions intended to conserve listed species or its habitat; (ii) the promulgation of regulations; (iii) the granting of licenses, contracts, leases, easements, rights-of-way, permits, grants-in-aid; or (iv) actions directly or indirectly causing modifications to land water or air. Pacific Rivers Council v. Thomas, 30 F.3d 1050, 1054 (9th Cir. 1994). The agency is required to insure that such actions are not likely to jeopardize the continued existence of the species or result in the destruction or adverse modification of its habitat. *See,* Tennessee Valley Authority v. Hill, 437 U.S. 153, 98 S.Ct. 2279, 57 L.Ed.2d 117 (1978).

Section 10 is a tool often used by large landowners to continue activities (such as commercial forestry), that may have an incidental impact on a listed species. It authorizes habitat conservation plans (HCPs). *See*, 16 U.S.C. 1539(a)(2). The "taking" must be *incidental* to and not the purpose of, the carrying out of an otherwise lawful activity. The applicant must submit a conservation plan based upon the *best scientific and commercial data available* which specifies: (a) the anticipated impacts which will likely result (i.e., the amount, extent and type of anticipated taking) from the proposed activity on the species or stocks; (b) the steps the applicant will take to monitor, minimize and mitigate such impacts; (c) the funding which will be available to implement such measures; (d) the alternative actions to the taking which were considered, and the reasons why they are not being used; and (e) such other measures as the agency may determine are necessary and appropriate for the conservation of the species or stocks. In order to approve an HCP, the Service must determine that the taking will be incidental, that the applicant will, to the maximum extent practicable, monitor, minimize and mitigate the impacts of such taking and, finally, that the taking will not appreciably reduce the likelihood of the survival and recovery of the species in the wild.

Coastal Zone Management Act of 1972. Under the Coastal Zone Management Act, all Federal permitted actions, such as Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbor Act, must be evaluated for consistency with the CZM Program. Federally owned lands or lands held in federal trust are exempt from the state's coastal plan, at least with respect to direct federal activities.

Federal Clean Water Act (CWA). The act prevents or permits discharges of pollutants to waters of the United States;

- NPDES permits are required for direct and indirect (point and nonpoint) source discharges into navigable waters;
- NPDES permits cover many activities including industrial, construction (1 acre or larger), municipal activities (10,000 in population or greater), boatyards, sand and gravel operations, etc.;
- Section 404 of the Act regulates filling but not dredging, draining or clearing of wetlands; and
- The Act is administered by the Environmental Protection Agency (EPA) except in states which have chosen to become the state administrator, such as here in Washington. By law, the Clean Water Act is implemented by the Washington State Department of Ecology.

Marine Mammal Protection Act.

National Estuary Program, under Section 320 of the Clean Water Act.

North American Wetlands Conservation Act.

State Laws

State Environmental Policy Act. SEPA recognizes "that each person has a fundamental and inalienable right to a healthy environment." RCW 43.21.020(3). SEPA creates both procedural and substantive mandates which can be used to require disclosure of significant adverse environmental impacts, mitigation of those impacts and even denial of permits. The requirements of SEPA are carried out at the state and local government level. A similar law is imposed at the federal level, the National Environmental Policy Act (NEPA). See, 42 U.S.C. Section 4331.

Shoreline Management Act. The SMA is quite short and depends on a system of state and primarily local control (including environment designations, development standards and regulations), to be implemented. Its basic premise is that no activity is allowed on the state's shorelines that is inconsistent with the Act or local implementing

DRAFT

regulations and that development result in "no net loss" of shoreline functions. See, Wash. Real Property Deskbook, 3d Ed. Volume VI, Chapter 93. The regulatory reach of the SMA on aquatic systems is fairly broad. It applies to all shorelines of the state, marine waters, certain larger streams, large lakes and water reservoirs. It also includes shorelands extending 200 feet from the ordinary high water mark, and all wetlands and river deltas associated with streams, lakes and tidal waters subject to the Act.[27] However, the SMA is not merely a protective regulation. It balances development and preservation near shorelines, establishes a priority of uses for the shoreline, including an emphasis on water-dependent uses and public access; and the reduction of adverse environmental impacts of development and other activities occurring in the shoreline zone. See, Wash. Real Property Deskbook, 3d Ed. Volume VI, at 93-11.

To implement the act, local governments must prepare Shoreline Master Programs based on standards set forth in the Shoreline Master Program Guidelines (WAC 173-26). Recent revisions to the Shoreline Master Program Guidelines require local governments to use an ecosystem or landscape approach when updating their master programs. Ecosystem wide processes and ecological functions must be characterized and the linkages with shoreline functions described. From this characterization and analysis, measures must be identified to protect and restore healthy and degraded shoreline processes and functions. Additionally, the environment designations, policies, development standards and regulations must be based on the characterization (which includes a comprehensive inventory of shoreline conditions).

Local governments are also required to monitor the implementation of their SMP and demonstrate that there will be "no net loss" of shoreline function. Recognizing that restoration will play a central role in the recovery of Puget Sound ecosystems, the guidelines stipulate the preparation of a restoration plan. The restoration plan is also based on the characterization. The Department of Ecology (statutory authority to review and approve shoreline plans) is presently encouraging local governments to implement the restoration plan using both regulatory and non-regulatory means. Though the preparation of ecosystem based shoreline plans is a welcome advancement in the State, local governments are not required to implement the results of the characterization outside of the narrow 200 foot wide shoreline jurisdiction. This is unfortunate, since most processes that drive shoreline functions are located in watersheds that can extend several miles inland from the shoreline.

Forest Practices Act. All private and non-federally owned "forest lands[28]" fall within the purview of the Forest Practices Act (FPA). The current FPA (Chapter 76.09 RCW) was enacted in 1974. In replacing Ch. 76.08 RCW, a reforestation act dating back to 1945, the FPA created a coordinated, statewide system for regulating forest practices, requiring reforestation, and adding protections for water, fish and wildlife. Forest Practices rules impose standards for road construction, snag retention and for protecting streams, stream corridors and certain types of forested wetlands. The FPA authorizes local governments to enact permit requirements for forest lands which were permanently converting from forestry to other land uses (although few local governments have to date enacted ordinances to regulate such activities). The goal of the FPA is dual: to foster the state's commercial timber industry and to protect the natural environment. The Act is enforced by the State Department of Natural Resources (DNR)

---

[27]The SMA applies to "all shorelines of the state" which include both shorelines and shorelines of state-wide significance, marine waters of the state together with the lands underlying them out to the western boundary of the state in the Pacific Ocean, to streams with a mean flow of 20 cfs. or more, and to lakes larger than 20 acres in area and to water reservoirs. The SMA also applies to associated "shorelands" of all of these shorelines. Shorelands are defined as those lands extending landward for 200 feet in all directions as measured on a horizontal plane from the Ordinary high water mark, floodways and contiguous floodplain areas landward 200 feet from such floodways, and all wetlands and river deltas associated with the streams, lakes and tidal waters which are subject to the Act. Id. See, Ch. 90.58 RCW. (The federally approved Coastal Zone Management Program (CZMP) for Washington contains all of the local shoreline plans, except that the coastal zone plan does not include rivers and wetlands. Id.

[28]Forest lands mean "all land which is capable of supporting a merchantable stand of timber and is not being actively used for a use which is incompatible with timber growing." RCW 76.09.020(6) Merchantable timber means "a stand of trees that will yield logs and/or fiber: suitable in size and quality for production of lumber, plywood, pulp or other forest products, of sufficient value at least to cover all the costs of harvest and transportation to available markets." WAC 222-16-010.

through state regulations promulgated by the Forest Practices Board. Updates to the FPA were added in 1987, as a result of the "Timber, Fish and Wildlife" negotiations conducted by a wide array of stakeholders and state and federal agencies and tribal governments concerned about impacts of forest practices on certain salmon populations listed under the Endangered Species Act. However, some of the provisions have not been implemented due to lack of funding. (See, e.g., RCW 76.09.300 through .320 - hazard reduction program). The update also failed to address issues relating to small forest landowners (mainly those with parcels smaller than 20 acres in size).

The Growth Management Act. The GMA now applies to 29 of 39 counties across the state, as well as to the cities located within them. Local governments subject to GMA must now plan for the growth of their communities by adopting comprehensive plans and planning for the infrastructure needs of their communities using 10- and 20-year increments based on the State's population projections.[29] No longer just a guide, local governments must now adopt development regulations (zoning and development standards) that are consistent with those comprehensive plans. The Act requires planning for urban, rural and natural resource lands. (Natural resource lands include areas for forestry, agriculture and mining). Urban growth boundaries are drawn beyond which dense development is to be prohibited to protect rural and natural resource lands.[30] Finally, the GMA mandates that local governments regulate and protect certain environmental functions and values in "critical areas." These areas include: fish and wildlife habitat conservation areas, wetlands, aquifer recharge areas, and frequently flooded areas. RCW 36.70A.172.[31]

Hydraulic Project Approval (HPA) program (RCW 75.20.100) The statute protects aquatic habitat, including wetlands, within ordinary high water mark of marine waters, lakes, ponds, and streams. It is administered by the Washington Department of Fish and Wildlife through the issuance of Hydraulic Project Approval permits. The HPA program has significant limitations and is an ineffective tool to protect habitat in most cases.

Water Quality: State and federal stormwater and water quality program; Clean Water Act NPDES- Effect of new nonpoint municipal stormwater permit requirements; local non-pollution ordinances; [See other Topic Forum reports]; State Department of Health Water Supply Systems regulations.

Water Quantity: [See other Topic Forum reports] State Groundwater Code

WDFW Species Protection Rules:

> Bald Eagle Protection Rules (WAC 232-12-292) The rules require Washington Department of Fish and Wildlife to identify and protect bald eagle habitat and buffer zones on all non-federal and non-tribal lands in Washington. A process is outlined for protecting habitat via management planning.

DRAFT

---

[29]These plans include future land use maps and land use designations which are consistent with those policies. These policies are required to meet 12 planning goals established by the Legislature. A recent amendment to the Act interposed the goals of the Shoreline Management Act as the 13th goal of the GMA. The Comprehensive Plan must contain plans and policies relating to the following 8 elements: land use; housing; capital facilities plan; utilities; rural element; transportation element; economic development; parks and recreation. Optional elements include conservation, solar energy, recreation, and subarea plans.
[30]There are many other specific requirements of the GMA that are not highlighted here. For additional details, see Chapter 36.70A RCW and the decisions of the three Growth Management Hearings Boards at www.gmhb.wa.gov.
[31]Recent court decisions have interpreted the GMA critical areas requirement to mean that the level of protection required to be met is a "no net loss of existing habitat functions and values" standard. However, the law does not require restoration. As yet, no jurisdictions in Washington apply their critical areas regulations from an ecosystem approach. They are mainly used to protect the functions and values found on specific sites.

APPENDIX P1-2: INCENTIVE PROGRAMS

Appendix P1-2 was informed by two sources: The Washington Biodiversity Project website as well as a Washington Biodiversity Council document entitled, "Washington Incentives Spreadsheet Catalog, Working Paper, 2006".

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Community Salmon Fund	NFWF	Financial Assistance	WA	Ag, Timber, Suburban, Business, etc.	Salmon	http://www.nfwf.org/programs/csf.htm
Conservation Easement Program (CEP)	Farm Services Agency (FSA)	Financial Assistance	National	Ag?	Multiple	
Conservation Reserve Enhancement Program (CREP)	FSA; WSCC (Farm Bill)	Financial Assistance	National	Ag	Salmon	http://www.fsa.usda.gov/dafp/cepd/crp_statistics.htm
Conservation Reserve Program (CRP)	FSA (Farm Bill)	Financial Assistance	National	Ag	Multiple	http://www.fsa.usda.gov/dafp/cepd/crp_statistics.htm
Farm and Ranch Lands Protection Program	NRCS	Financial Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/frpp
Five Star Restoration Challenge Grants	NFWF	Financial Assistance		Various	Multiple	http://www.nfwf.org/programs/5star-rfp.cfm
Forest Legacy Program	USFS (Farm Bill) DNR	Financial Assistance	National (2 WA projects FY 2006)	Timber	Multiple	http://www.dnr.wa.gov/htdocs/amp/forest_legacy/legacyhome.html
Forest Riparian Easement Program	DNR SFLO	Financial Assistance	WA	Timber	Multiple	www.dnr.wa.gov/sflo/frep

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Grasslands Reserve Program	NRCS (Farm Bill)	Financial Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/2005_allocations/
HCP Assistance Grants	WDFW USFWS	Financial Assistance	National	Various	At-risk species	
HCP Land Acquisition	WDFW USFWS	Financial Assistance	National	Various	At-risk species	
Landowner Incentive Program	FWS; WDFW	Financial Assistance	National (W. WA)	Various	At-risk species	http://wdfw.wa.gov/lands/lip/
Migratory Waterfowl Artwork Program	WDFW	Financial Assistance	WA	Various	Waterfowl	
North American Wetlands Conservation Act (NAWCA) Small Grants	USFWS	Financial Assistance	National	Various	Multiple	
Puget Sound Urban Resources Partnership	Multi-Agency	Financial Assistance	WA (W.WA)	Urban	Multiple	
Recovery Land Acquisition	WDFW USFWS	Financial Assistance	National	Various	At-risk species	
Regional Fisheries Enhancement Groups	WDFW	Financial Assistance		Various	Salmon	
Resident and Anadromous Fish and Wildlife Mitigation Program	BPA	Financial Assistance	National	Ag?	Multiple	

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Riparian Open Space Program	WDNR	Financial Assistance	WA	Timber?	Multiple	http://www.dnr.wa.gov/htdocs/amp/riparian/index.html
Rocky Mountain Elk Foundation Grants	RMEF (Private)	Financial Assistance	Regional	Timber?	Elk	
Rural Business Cooperative Service	USDA	Financial Assistance	National	Ag?	Multiple	http://www.rurdev.usda.gov/wa/
Salmon Recovery Funding Board	SRF Board IAC	Financial Assistance	WA	Various	Salmon	http://www.iac.wa.gov/
Soil and Water Conservation Assistance	NRCS	Financial Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/swca
Wildlife Forever Grants	Wildlife Forever (Private)	Financial Assistance		Various	Multiple	
Marsh Program	Ducks Unlimited (Private)	Financial Assistance Technical Assist.	National?	Various	Waterfowl	
Wetland Reserve Program	NRCS (Farm Bill) Ducks Unlimited	Financial Assistance Technical Assistance	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/2005_allocations/
Sustainable Agriculture Research and Education (SARE)	USDA Western Region	Financial Assistance, Research, Education	National	Ag	Multiple	http://wsare.usu.edu

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Chehalis Fisheries Restoration Program	USFWS	Financial Assistance; Technical Assist.	WA (Chehalis River Basin, including Grays Harbor and tributaries)	Various	Salmon	
Conservation Security Program	NRCS	Financial Assistance; Technical Assist.	National	Ag	Multiple	http://www.wa.nrcs.usda.gov/programs/csp
Family Forest Fish Passage Program	DNR, WDFW, IAC	Financial Assistance; Technical Assist.	WA	Timber	Fish	http://www.dnr.wa.gov/sflo//fffpp
National Wetland Refuge Challenge Cost Share	USFWS	Financial Assistance; Technical Assist.	National	Various	Multiple	
Partners for Fish & Wildlife Program	USFWS	Financial Assistance; Technical Assist.	National	Various	Multiple	http://www..fws.gov/partners
Private Stewardship Program	USFWS	Financial Assistance; Technical Assist.	National	Various	At-risk species	http://endangered.fws.gov/grants/private_stewardship.html

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Volunteer Cooperative Fish& Wildlife Enhancement Prog.	WDFW	Financial Assistance; Technical Assist.	WA	Various	Multiple	
WA State Ecosystem Conservation	USFWS	Financial Assistance; Technical Assist.	National?	Various	Multiple	
Wetlands Mitigation Program	WDOT	Financial Assistance; Technical Assist.	WA	Various	Multiple	
Wildlife Habitat Incentive Program	NRCS (Farm Bill)	Financial Assistance; Technical Assist.	National	Ag and Urban	Multiple	http://www.nrcs.usda.gov/programs/2005_allocations/index.html
Forest Land Enhancement (FLEP)	USFS (Farm Bill) DNR	Financial Assistance; Technical Assist.; Educational Assistance	National	Timber	Multiple	

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Environmental Quality Incentives Program	NRCS (Farm Bill)	Financial Assistance; Technical Assist; Educational Assist	National	Ag	Multiple	http://www.nrcs.usda.gov/programs/eqip
Current Use Taxation/Public Benefit Rating System (PBRS)	Local Gov't.	Property Tax Reduction	Counties (Chelan, King, Pierce, Clark Thurston - others?)	Various – Conservation emphasis set at local level.	Multiple	
Development Rights (Transfer or Purchase)	Local Gov't.	Legal/ Statutory	Local option (King, Snohomish, Thurston, Whatcom -others?)	Various	Multiple	
Habitat Conservation Plan (HCP)	USFWS	Legal/Statutory	National	Various	At-risk species	
American Tree Farm System	NGO	Market Incentives	National	Various	Multiple	http://www.treefarmsystem.org/cms/pages/69_1.html
Envirostars	Urban counties in the Puget Sound	Market Incentives	WA	Urban	Multiple	www.envirostars.com
Organic Certifications	WSDA	Market Incentives	WA	Ag	Multiple	http://agr.wa.gov/FoodAnimal/Organic/default.htm

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Puget Sound Fresh	NGO/counties	Market Incentives	WA	Ag	Multiple	http://dnr.metrokc.gov/wlr/farms/
Salmon Safe	Salmon Safe	Market Incentives	WA and OR	Ag; Urban; Natural Area, Campus	Salmon	www.salmonsafe.org
Smart Wood	Rainforest Alliance	Market Incentives	National?	Timber	Multiple	http://www.rainforest-alliance.org/programs/forestry/smartwood/
Earth Heroes	King County	Recognition	WA	Urban	Multiple	http://www.metrokc.gov/earthlegacy/
Farming and the Environment Vim Wright Award	Farming and the Environment	Recognition	WA	Ag	Multiple	http://www.farmingandtheenvironment.org/
Founders of a New NW	Sustainable NW	Recognition	WA?	Various	Multiple	http://www.sustainablenorthwest.org/programs/founders.php
WA Natural Heritage Register	WDNR	Recognition	WA	Various	Multiple	
Backyard Forest Stewardship	WDNR	Technical Assistance	WA	Timber	Multiple	
Cascade Land Conservancy	NGO	Technical Assistance	WA	Various	Multiple	http://cascadeland.org/

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Conservation Districts	WCC (Farm Bill)	Technical Assistance	National	Various	Multiple	
Conservation of Private Grazing Land Program (CPGL)	NRCS (Farm Bill)	Technical Assistance	National	Ag	Multiple	http://www.wa.nrcs.usda.gov/
Ecotrust	NGO	Technical Assistance	National	Ag, Timber, Salmon		http://www.ecotrust.org/forestry/
Forest Stewardship Council	NGO	Technical Assistance	International	Timber	Multiple	http://www.fsc.org/en/
Forest Stewardship Program	DNR/USFS	Technical Assistance	WA?	Timber	Multiple	http://www.dnr.wa.gov/htdocs/rp/steward.htm
Infrastructure DATABASE	WA State	Technical Assistance	WA	Various	Multiple	http://www.infrafunding.wa.gov/ContactInformation.htm
Jobs in the Woods	USFWS	Technical Assistance	National	Timber	Multiple	
Land Trust Alliance (local land trusts)	NGO	Technical Assistance	National	Various	Multiple	http://www.lta.org
Mountains to Sound Greenways Trust	NGO	Technical Assistance	Seattle to Cascades	Various	Multiple	http://mtsgreenway.org/
Nature Conservancy	NGO	Technical Assistance	National	Various	Multiple	http://www.nature.org/
NRCS Technical Assistance	NRCS	Technical Assistance	National	Ag?	Multiple	

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Northwest Natural Resources Group	NGO	Technical Assistance	WA	Timber	Multiple	http://www.nnrg.org/
Pacific Forest Trust Conservation Easements and Land Trusts	NGO	Technical Assistance	Regional	Timber	Multiple	www.pacificforest.org
Resource Conservation & Development Program	NRCS (Farm Bill)	Technical Assistance	National	Various	Multiple	
River Network	NGO	Technical Assistance	National	Various	Multiples	http://www.rivernetwork.org/
Small Forest Landowner Office	WA DNR	Technical Assistance	WA	Timber	Multiple	http://www.dnr.wa.gov/sflo/
Small Farms Team	WSU Coop Extension	Technical Assistance	WA	Ag	Multiple	http://ext.wsu.edu/
Stewardship Partners	NGO	Technical Assistance	WA	Ag, Timber, Sustainable Building	Multiple	http://www.stewardshippartners.org/index.html
Stewardship Planning Programs	King County	Technical Assistance	King County, WA	Various	Multiple	http://dnr.metrokc.gov/wlr/cao
Trust for Public Lands	NGO	Technical Assistance	National	Various	Multiple	http://www.tpl.org

DRAFT

Program Name	Lead Agency	Incentive Type	Geographic Scope	Sector (Land Use)	Species Focus	Website
Urban and Community Forestry Program	DNR/ Washington Community Forestry Council	Technical Assistance	WA	Urban	Multiple	http://www.dnr.wa.gov/htdocs/rp/urban/urban.htm
Washington Forest Stewardship	WSU Coop Extension	Technical Assistance	WA	Timber	Multiple	http://ext.wsu.edu/kudos/
Center for Sustaining Agriculture & Natural Resources (CSANR)	WSU Coop Extension	Technical Assistance, Research, Education	WA	Ag (including urbanizing areas)	Multiple	http://csanr.wsu.edu

DRAFT

PLACEHOLDER FOR APPENDIX P1-3 – TABLE OF LAND USES AND REGULATORY TOOLS

[UNDER CONSTRUCTION]

DRAFT

Policy Question 2 (P2): Using the S1, S2, P1 results and risk analysis provided by NOAA, what needs to be done to address the documented threats to habitat from land use practices in the Puget Sound region?

In answering Question P2, the Land Use/Habitat Topic Forum has considered the scientific studies and literature cited in the Responses to Questions S1 and S2, the regulations and incentives available under federal, state and local law and programs described in Response to Question P1, as well as our collective professional experience and judgment. We were not able to consider the NOAA risk analysis in our work because it was unavailable.

Introduction

Our system of protecting the environment wasn't designed to protect the entire ecosystem of Puget Sound. Instead, it often prioritizes the human consumption of ecosystem goods and services over the protection of ecosystem-forming processes, structures and functions that provide or support many of those goods and services. We protect components of the system, but not the entire ecosystem. This report presents an analysis of the gaps and limitations existing in the protection and incentive tools that exist today in Puget Sound. It makes recommendations for fundamental changes that will challenge the commitment of policymakers, scientists and most importantly, our citizens, to our goal of a healthy Puget Sound. It is intended to provoke and inspire a community discussion, debate and critical thinking about what is possible if we are to achieve our goal by 2020.

Gaps and Limitations of Our Management Tools

As noted in the Response to Question P1, Washington's tools have developed over many years driven by different issues. Although there are many tools available that can be used to protect some portions of the ecosystem, there is no "silver bullet" that will solve all of our concerns. GMA has proved to be an important tool for managing growth, not halting it. Even if it did, existing impacts of prior development and land alteration from human activities remain. Because regulations typically only address new development, improving the regulatory system for new development doesn't address this problem. A robust restoration program will still be needed to ensure the success of our efforts.

In order to take the next step forward in protecting Puget Sound, we need a specific examination of the limitations presented by our management tools. The following is a short summary of some of the criticisms that have been levied about them, when viewed in the context of protecting marine areas or terrestrial and freshwater systems from an ecosystem perspective.

Marine Areas

In marine areas, federal regulations present a myriad of regulations, conflicting institutional oversight and have focused mainly on the exploitation of resources to the detriment of marine life and with inadequate attention to the protection and restoration of the ecosystem processes, structures and functions they need to survive. At the state and local level, there is a burgeoning of beneficial programs and regulations, especially in recent years, beneficial programs (MRC research and policy developments, landowner incentives, marine protected areas) and regulations (Shoreline Management Act, SEPA and GMA). However, there is no comprehensive Puget Sound-wide ecosystem plan for protecting and restoring marine life and marine areas, including the nearshore. As we seek to improve our protection strategies, we should consider spending more time analyzing not just how a regulatory program could work to protect marine drift cells through an ecosystem approach, but also which voluntary incentive tools can be effective in protecting them as well. Although voluntary programs enjoy wide public support, such programs have not been planned, promoted or funded in a comprehensive way in Puget Sound. We believe these programs have good potential when coupled with regulatory protections to provide positive outcomes for both the environment and for people.

DRAFT

Terrestrial and Freshwater Aquatic Systems

Puget Sound's health and species use is greatly affected by the condition of its terrestrial and freshwater ecosystems. Historically, federal, state and local approaches were aimed mainly at in-water effects of land use activities – an ecosystem perspective was lacking. More recently however, federal agencies have implemented ecosystem approaches through such actions as the Pacific Northwest Forest plan (1994) and implementation of the federal Endangered Species Act, which explicitly calls for protecting listed species and their ecosystems. Arguably, the federal approaches are still being refined and there is much to learn, but they represent significant initial efforts to manage at the ecosystem level. State and local approaches have a similar history and are lagging behind the federal approaches.

Recently, Washington State has engaged in ecosystem-based approaches include the Forest and Fish Agreement and the SMA update process. In addition, the WDFW and Tribes created comprehensive management plans to address impacts to wild salmonids from hatcheries and recreational and commercial harvest activities. Local governments are behind farther still, but significant gains are being made at that level, too.[32] While historically, most governments have not pursued such comprehensive environmental planning, many have recently done so as part of the WRIA-based salmon recovery plans. These plans are focused on ESA-listed salmon, mainly Chinook and Chum salmon, but they provide a helpful template for assessing and understanding land use impacts on fresh and marine systems.

Typically, the least developed aspect of these plans is the linkages between fresh and marine waters and the role of healthy marine habitats, especially nearshore habitats and processes, on salmon recovery. This reflects the relatively immature state of our knowledge about the functions and values of marine nearshore environments; much of this knowledge deficit is being addressed by wide variety of studies. However, the management of habitat, harvest and hatcheries (the so-called *3-H's*) is not well-integrated at the WRIA level and an "H-Integration" process is underway to ensure that (a) the local role of all the H's is understood; (b) actions related to recovery actions are not working at cross-purposes; and (c) actions are sequenced properly and strategically to achieve the best environmental outcomes. Given the role of salmon as a keystone species in the Pacific Northwest, these WRIA plans represent a good start at addressing ecosystem needs of the Puget Sound.

Finally, as to the availability and use of voluntary incentive programs in terrestrial and freshwater areas, the same comments apply here as stated in the section immediately above.

Limitations of Specific Regulatory Tools

The Growth Management Act

Based on the fact that the Growth Management Act is a management tool of widespread applicability both geographically and substantively, in controlling the impacts of growth and development in Puget Sound, we single it out for special analysis.

The Growth Management Act has fundamentally changed the way that growth is dealt with in Washington. Growth (seen as new development for housing, jobs, recreation, other infrastructure and amenities) is now channeled into urban growth areas ("UGAs"). Outside UGAs, the Act restricts growth to prevent negative impacts on rural character

[32]For example, from the mid-1980s to late 1990s, King County developed several comprehensive Basin Plans to deal with habitat, flooding, erosion and water quality issues. These plans have affected zoning, stormwater, and habitat protection and restoration and they often provide the basis for many actions being developed for salmon recovery within the county.

and the environment.[33] While these changes are great improvements over the era of unrestricted growth prior to the adoption of the GMA in 1990, implementation of the Act hasn't always been easy, nor have local governments always understood the long-term implications of their planning choices. In some jurisdictions, the private market has quickly adapted to new restrictions and found new opportunities to exploit available land in ways that were unforeseen. As a respected commentator noted:

> *Some critics of urban growth areas suggest that they may exacerbate rather than solve growth problems. Unintended negative impacts of include escalating real estate prices for both residential and commercial/industrial land, which reduce the availability of affordable housing, shifting development from constrained land within the UGA to outlying jurisdictions more receptive to growth; and reinforcing existing trends that convert lands to "hobby" or "martini" farms outside the boundary. This inefficient use of land, in turn, contravenes growth management goals by creating low density sprawl, hastening the decline in commercially important resource land, and presenting problems for future expansion of the UGA. Additionally, pressure to infill urban growth in existing neighborhoods at high densities threatens the livability and viability of those neighborhoods. Further, unless carefully determined jointly by all jurisdictions within a metropolitan region, a UGA imposed in one subregion may simply shift growth to another adjacent subregion.*[34]

While not all of these concerns have come to fruition in every city or county planning under GMA, they have occurred in some places. Perhaps these negative effects could have been prevented with better advance planning; but, the reality is that with only 15 years of experience making public policy under GMA, local governments are still learning how to improve growth management.

This is particularly true in the area of rural land management. The continued rate of development in rural areas is a concern. In the four county region encompassed by Puget Sound Regional Council, rural development ranges between 4% and 45% of the population growth.[35] Although the trend in rural growth rates is downward from pre-GMA days, the potential for significant rural growth is still present given historical lot parcelization patterns in some areas and zoning in still other areas that allows lots less than 10 acres in size (some as small as 1 and 2 acres).

The concern for the ecosystem is based on the fact that it is in those areas where high quality habitat and significant ecological processes remain partially or largely intact. The concern is that rural area forest cover is being converted to housing and other uses in five acre and smaller patchwork patterns at a fast pace. The network of infrastructure (primarily roads, but also other utilities) constructed to serve such development will further fragment the landscape and interrupt or modify the flow of ecosystem materials, such as water, sediment, woody debris and migrating species.

There is also practical limitation in the GMA that has left some of its goals unrealized: Although state agencies such as CTED have the ability to review and comment on local ordinances before they are adopted, state agencies lack the authority to approve or deny proposed plans and regulations. Instead, citizens and state agencies must rely on an appeal process before the Growth Management Hearings Board (GMHB) and further appeals to court if they are not satisfied with the result. Where no appeals are filed, the GMHB has no jurisdiction to review a local plan or

---

[33] We should note that the terms "urbanization" or "urbanizing" are frequently used as shorthand to the refer not just to growth densities as defined under GMA, but to the host of human impacts that are seen as threats (or stressors) on ecosystem-forming processes, structures and function. In this summary, we intend the term to have its GMA meaning.
[34] K. Dearborn & A. Gygi, Planner's Panacea or Pandora's Box: A Realistic Assessment of the Role of Urban Growth Areas in Achieving Growth Management Goals, University of Puget Sound Law Review, 975, 977-79 (1993). (footnotes omitted).
[35] Puget Sound Trends, Nov. 2005 (Puget Sound Regional Council), available online at http://www.psrc.org/publications/pubs/trends/d5nov05.pdf

regulation adopted under GMA. This has added to the variability of protection afforded to the ecosystem across the Sound.

In addition, large-scale regional planning has yet to occur in the entirety of Puget Sound. Solid regional planning efforts, such as Puget Sound Regional Council, don't exist outside of the four counties participating in that effort.

SEPA

Although SEPA was originally envisioned as a powerful tool to provide environmental protection, it has become a tool that provides information, rather than one that mandates specific environmental outcomes, thus it is largely an ineffective tool in ensuring the best outcome(s) for Puget Sound. This is an outcome of regulatory reform efforts made during the 1990s.

Other Development Regulations

Where mitigation of impacts is required in local regulations, it often doesn't require cumulative impacts to be addressed. In any event, the "no net loss" standard for the protection of critical areas functions and values are not being met and is unlikely to be met without significant investment in comprehensive ecosystem restoration that transcends effects that occur beyond parcel boundaries. In part, this is because every jurisdiction in Puget Sound that has adopted critical areas regulations (and other development standards) offers numerous exemptions and compromises that allow for priority human activities and uses such as road and bridge crossings over streams, ongoing agriculture, vested lots with development potential, and the like. Another problem is the lack of an acceptable procedure for assessing cumulative effects and, when unavoidable, for mitigating for them.

Other Factors

It should be noted that all of the tools mentioned are limited by the laws that enact them, as well as other factors. Examples of these "other factors" include legal rights granted to various people through laws and legal entitlements. Examples of such factors include Washington's generous vesting laws[36], treaty rights owned by tribes to fish and hunt, rights to shellfish leases owned by some landowners, legal, nonconforming uses and preexisting development built in earlier years without adequate environmental protections or mitigation, and constitutional limitations (i.e., the takings clause and substantive due process) afforded to people under state and federal laws. These factors naturally limit the effectiveness of new regulatory tools designed to protect the ecosystem, because they authorize or excuse activities that may cause stress or impact to the ecosystem. These factors, like others, highlight the inherent limits of using regulatory tools and the need to use alternative approaches (such as voluntary incentive programs, acquisition of property rights through easements and purchases, and education) to achieve protection and restoration.

ESA Listings

Federal listings of specific species have resulted in watershed (WRIA) plans that address reach and watershed-scale conditions and processes. These plans are at various stages of early implementation, mostly focused on capital projects to protect and restore habitat. Prior to these plans -- and still ongoing -- are additional protections (mainly for

---

[36]The vested rights doctrine is a legal concept that protects a developer from having to comply with later-enacted changes in land use regulations. Washington's vesting doctrine grants such rights at the time that a developer files a complete permit application. The doctrine was created to protect a developer's investment expectations against fluctuating regulations (which people usually presume will be more stringent). Washington's vesting laws are commonly called "generous" because they "freeze" the land use control regulations that may be applied to a permit application at an earlier time than virtually any other state in the nation. Washington's vested rights doctrine runs contrary to the overwhelming majority rule that "development is *not* immune from subsequently adopted regulations until a building permit has been obtained *and* substantial development has occurred in reliance on that permit." Erickson & Assoc. v. McLerran, 123 Wn.2d 864, 868, 872 P.2d 1090 (1994) *citing* R. Settle, Washington Land Use and Environmental Practice, Section 2.7 (1983)).

the benefit of salmonids) provided by federal regulatory mechanisms such as Section 7 consultation[37] or where a Section 10 habitat conservation plan[38] is sought to allow activities that my result in incidental take of a species. While these ESA tools afford greater protection and scrutiny on specific listed species and their habitat needs, the listings have not yet resulted in noticeable ecosystem-wide benefits in Puget Sound. There are, however, a few examples of communities that have tried to take more of an ecosystem, multi-species approach to protect habitat against human-induced impacts, especially land development.[39] They include the San Diego Multi-Species Conservation Plan (MSCP) and the northern California gnatcatcher conservation plan.[40] These plans could prove useful as models for the creation of the Action Agenda, in terms of understanding the way in which scientists and policymakers worked together to make informed decisions to manage large ecosystems, and the tools that they used to accomplish the plans, monitor and adapt them over time.

Limitations of Voluntary Programs

Incentives, Education and Stewardship

These approaches address human behaviors and motivations through a combination of material (mostly monetary) incentives and education and involvement, the latter assumes well-informed and involved citizenry will modify behaviors for the sake of the larger system. Potentially, they can provide benefits over and above what regulations and capital projects could provide. Incentive programs are particularly important in addressing the impacts of existing development that the regulatory program is not able to affect. A broad range of programs exist in Puget Sound. A summary is provided in Appendix P1-2. As with any tool, these programs have limits on their applicability and the extent of their reach.

For example, the programs aren't available for everyone. Even if they were, not all people are motivated by financial gain or altruism. Secondly, given the diversity of people and perspectives in the region, the most willing may not be situated in areas with the greatest need or potential for benefits. Third, these approaches take time, can often be costly to implement and likely require sustained effort over time, all of which are difficult for a government to accomplish. One of the conservation approaches with the most certain outcomes, land acquisition, also has notable complexities. When the purchaser is governmental, it is important to remember that federal, state, and local agencies possess variable conservation missions and publicly-owned land does not always translate to habitat protection and/or conservation. Some agencies prioritize public access, resource extraction, or other land uses that may pose a conflict with certain habitat protection goals. Habitat protection through property acquisition requires a long term, well-funded, adaptive approach to resource management. Very few land managers and conservation easement holders possess long-term funding certainty for monitoring, maintenance, and resource management.[41] Finally, we haven't performed a comprehensive analysis of which tools are most effective in which situations. Regardless, we believe that these tools have great potential and should be studied further to determine which ones are effective and can be used strategically to provide protections for ecosystem health.

Habitat Restoration Projects

Historically, with regard to publicly funded habitat restoration projects, federal and state-funded projects haven't required an integrated, ecosystem plan as a pre-requisite to construction. Without such a plan, it is likely that restoration projects will be performed in an opportunistic fashion, instead of in a deliberate manner in which projects contribute to restoring or recreating the building blocks of ecosystem processes, structures and functions which will

---

[37] See, 16 U.S.C. Section 1536(a)(2) and 50 C.F.R. Section 402. *See,* Pacific Rivers Council v. Thomas, 30 F.3d 1050, 1054 (9th Cir. 1994); and Tennessee Valley Authority v. Hill, 437 U.S. 153, 98 S.Ct. 2279, 57 L.Ed.2d 117 (1978).
[38] *See*, 16 U.S.C. 1539(a)(2).

[39] Although this team did not have the time or resources to study them, some of the HCPs issued for large timber holdings may result in ecosystem benefits, given that they tend to be multi-species in coverage and extend across large areas of land.
[40] [Add cite here to the San Diego MSCP and northern Calif. MSCP –
[41] Pidott, *Reinventing Conservation Easements*, Land Lines, Volume 17, No. 2, Lincoln Institute of Public Policy (2005).

sustain over time. More recently however, the development of WRIA salmon recovery plans has led the Salmon Recovery Funding Board (SRFB) to require projects be an integral part of a WRIA or similar watershed-based plan.

Implementation of restoration projects, even within a landscape context is hindered by an artificial separation between compensatory mitigation and restoration. Local governments will typically not consider listed restoration projects or opportunities as appropriate mitigation for a variety of reasons. This results in most mitigation projects being conducted onsite, even if the mitigation project will result in an overall net loss of function. Currently, resource scientists find that a combination of onsite mitigation and offsite restoration is needed in order to attain "no net loss" of ecosystem function. (See Appendix P2-2).

Presumably, over time, as restoration project are implemented they will be better matched to their watershed context and, ultimately, much more successful at achieving the restoration goal. One of the more promising aspect of habitat restoration is the increasing emphasis on restoring natural process, such as by restoring forest cover or removing obstacles to floodplain processes, rather than simply creating overly engineered structures, such as pools or spawning substrates for salmon, in locales that would not historically or can no longer support those structures. Process-based restoration projects are complex, can take longer to plan and carry out and generally require a larger geographic scale to make a significant difference. They can be expensive and proponents are sometimes required to piece together the funding to support the project design, construction, monitoring and adaptive management. However, despite these barriers to moving such projects forward, process-based restoration and avoidance of artificial, out-of-context structure based restoration will be critical to long-term, cost and biologically effective restoration.

Recommendations for Achieving a Healthy Puget Sound by 2020

Between 1970 and 2000, Puget Sound grew by 1.3 million people, at an annual average growth rate of 1.8%.[42] The rate was greatest during the 1980s at 2.1%. The region's job base more than doubled during the same period, rising from about 760,000 to 1.9 million. The regional job growth rate averaged 3.1% per year, a full percentage point higher than the national average.

During the same period, human activities that threatened Puget Sound proceeded within a fragmented regulatory context where (1) governance was divided among hundreds of federal, state, local, and tribal governments; (2) consumption of natural resources accelerated, with economic goals often outweighing environmental protection; and (3) protection outcomes often differed or conflicted from agency to agency. While generally accepted by the public, voluntary programs have suffered from the same fragmentation in governance, protection and/or restoration goals and environmental results. Finally, until relatively recently, these laws and programs have been generally applied at a site scale, often without regard for the site's value and relationship to the larger context of ecosystem processes, structures and functions.

The result of this historic fragmented system is a Puget Sound ecosystem in serious decline and with an uncertain future. Regional planners tell us that between 2000 and 2040, the region is forecast to grow by an additional 1.7 million people, increasing 52% to reach a population of 5 million. The region's job base is expected to grow to more than 3.1 million, an increase of 64% during the period.[43] If we are going to continue to grow, we must do so in a manner that is smarter and more strategic than we have done in the past.

Given what we know about ecosystem processes, structures and functions, and the tools we have used to control human impacts to the ecosystem, the Topic Forum concluded that: In order to achieve the goal of a healthy Puget Sound by 2020 and support the predicted growth in people and jobs, this region needs a fundamental

---

[42] *Vision 2040*, Puget Sound Regional Council, February 14, 2008 at p. 5.

[43] Id.

change in the way in which it manages natural resources and the human activities that impact them. We believe these fundamental changes must achieve three outcomes: (1) a clear statement of the ecosystem processes, structures and functions that must be protected to sustain Puget Sound over time; (2) a consistent set of policy goals that will lead to a sustainable Puget Sound ecosystem; and (3) a governance structure charged with and capable of ensuring that the policy goals are being met.

The following are preliminary recommendations developed by the Topic Forum for consideration during upcoming discussions.

Science and Research Preliminary Recommendations

1. Create a clear science framework and database from which to measure and act.

Based on the consensus of the scientific community using the best science and research known today, we recommend identifying the important ecosystem processes, structures and function within marine drift cells and in the terrestrial and freshwater aquatic catchments in each action area of Puget Sound that should be protected or restored. Our lack of knowledge in these areas prevents us from being strategic in our efforts.

- Perform a comprehensive natural history survey. A major limitation on our ability to reach our first goal is the lack of a comprehensive natural history survey for Puget Sound. Such a survey would provide biological information on spatial and temporal distribution of its species and biological communities, which are both a primary resource and serve as an indicator of health for Puget Sound.
- Perform a comprehensive/credible study of the cumulative effects of multiple stressors on the ecosystem.
- Until a cumulative effects study is complete, create and use an additive model and uniform, qualitative descriptors to assess the status of Puget Sound Ecosystem. (i.e. use an additive model) and use more qualitative descriptors of the system state. (See, e.g., Jefferson County Nearshore Assessment, Thom et al., and the Bellingham watershed study performed by Stanley et al).
- Consider the conclusions of the NOAA Risk Assessment for Puget Sound. As this work becomes available, it should be added to the existing scientific knowledge to form the science framework within which we act to restore Puget Sound.

2. Implement a strong monitoring and adaptive management framework to ensure that the Action Agenda achieves the results it seeks.

This will require the development of a common methodology that is rapid, replicable and whose results can be readily interpreted and used by local governments and other actors at the watershed scale.

Status and Trends Monitoring

As to status and trends monitoring, in an ideal world it would be possible to monitor everything everywhere to address all questions. However, such an approach is cost prohibitive. Efficiencies can be gained by using an integrated framework and drawing upon existing efforts to the extent possible. Examples include the Monitoring and Adaptive Management Plan (MAMA Plan) for Puget Sound Chinook Salmon Recovery Plan, the "Comprehensive Monitoring Plan" adopted by the Governor's Forum on Monitoring, and the Washington Biodiversity Conservation Strategy.

With respect to implementation monitoring, we recommend that the plan should establish a reporting system which answers the following questions:

- Did we complete the number of priority actions that were planned for the year? If not, why not?

DRAFT

- Are the strategies detailed in the Action Agenda being implemented at a pace that will achieve the desired milestones?
- How well are we implementing our proposed strategies and actions?
- Do we have the necessary funding, staffing capacity, and public and political support necessary to sustain implementation over time?
- Are we implementing our strategies in an integrated way that maximizes efficiencies and the benefits of actions across Puget Sound?
- Have our efforts to implement the Action Agenda strategies been constrained in some way? If so, how?
- How many key uncertainties are being assessed through specific research plans?
- When assessing the overall effort to implement the Action Agenda, do key assumptions or hypotheses need to be revised? Does the Action Agenda need to be adjusted in some significant way?

With respect to effectiveness monitoring, the plan should ask "Did the actions taken cause a desired *physical change* and/or *expected biological response?"* Results from effectiveness monitoring will show progress in long-term time frames, approximately 10 to 20 year timeframes, so it is important to begin this type of monitoring soon. Effectiveness monitoring metrics should answer the following specific management questions:

- What is the hypothesis supporting each major strategy in the Action Agenda?
- What are the expected physical, biological changes and timeframes for those changes?
- What is the overall effectiveness of recovery actions? (e.g., are negative trends in habitat quality being reversed? Is quality habitat being restored faster than it is being lost?)
- Are there certain categories of actions that are consistently failing or succeeding?
- How does the integrated suite of actions across Puget Sound affect each parameter for a healthy Puget Sound?

3. Perform a rapid assessment of each Action Area. Using a consistent scientific framework, identify areas for protection of ecosystem processes, structures and functions where found to be still intact and restoration of areas with critical ecosystem processes, structures and functions.

The Topic Forum recommends performing a rapid assessment as soon as possible within each Action Area to allow scientists and policymakers to understand: (1) the present condition of marine drift cells and watersheds within each Action Area; (2) the land use policy decisions that have been made that may impact these areas; and (3) the areas that should be prioritized to preserve and restore ecosystem processes, structures and functions. This work will help inform policymakers and scientists needing to make strategic decisions about which areas need urgent action first. This information should also be provided to the NOAA Risk Assessment science team for their consideration.

[Note: A case study of Jefferson County was performed by the Land Use/Habitat Protection and Restoration Topic Forum in order to demonstrate how such a rapid assessment can be done. It will be available for public review and comment shortly].

4. Close our knowledge gaps through scientific research.

New research should be funded and, where it fills a needed gap in knowledge, existing research should continue that will advance our scientific knowledge of:

- How nearshore and watershed processes affect the structure and function of freshwater, nearshore/marine ecosystems.

DRAFT

- How human activities affect freshwater and nearshore processes, structure and function. (See goals 1 and 2 in Gelfenbaum et al. 2006). This includes a better understanding of how deep water habitat processes in Puget Sound may be affected by future development such as further shoreline modifications, wastewater discharge, and energy generation (see Beechie et al. 2007).
- The cumulative effects of multiple stressors on processes and habitat structure and function (see above).
- The effectiveness of riparian and upland (e.g. forests) buffers in protecting ecosystem-forming processes, structures and functions in freshwater systems.
- Resulting ecosystem process and habitat impacts from climate-induced changes in sea levels, air and water temperatures, precipitation and surface water movement patterns, Puget Sound circulation and water quality (Mantua et al. 2007).

5. Establish a scientifically based strategy to choose restoration projects based on probability of success.

The location, type and extent of projects should be chosen consistent with site and landscape context and condition. For example, sites with a high degree of disturbance on both scales, in general have a low probability for restoration (in the scientific sense of returning an area to a semblance of its pre-development condition), and instead creation of a new habitat or ecosystem or enhancement of selected attributes would be the most viable strategies to apply in these situations. In contrast, where the site and landscape are largely intact, restoration to historical (i.e., humans present, but insignificant disturbance) or pre-disturbance (i.e., before man) conditions would be viable options and the probability of success would be high. (See, e.g., Figure P2-1.)

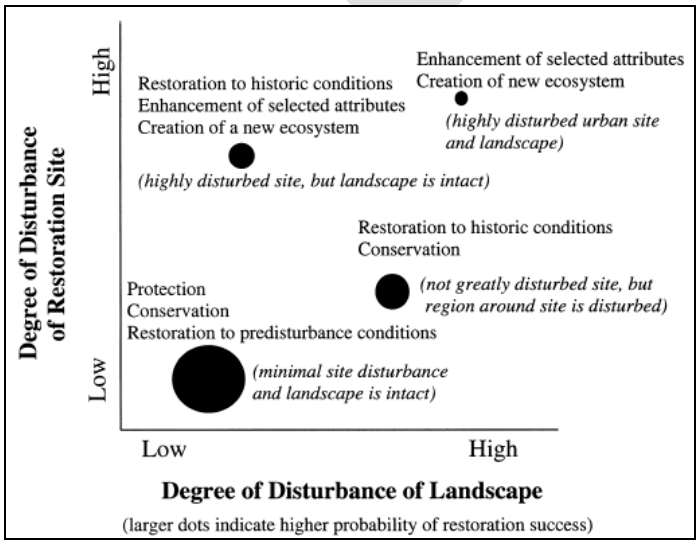


Figure P2-1. Restoration Strategies for Estuarine Systems Relative to Disturbance Levels at the Site and in the Landscape (from Shreffler and Thom 1993). The relative chance of success increases with the size of the dot.

6. Use a common philosophy to choose areas that require restoration of key processes.

The Topic Forum recommends prioritizing restoration of ecosystem processes for areas key to maintaining downstream aquatic ecosystems. Many lowland areas of Puget Sound have been significantly, but not permanently, altered (such as in rural areas). Processes in many of these lowland terraces and valleys support the structure and functions of aquatic resources (riverine, estuarine and nearshore areas). As these areas develop, watershed based restoration and development using smart growth or low impact measures will be essential to achieving no net loss of ecosystem processes, structures and functions. Examples of such project criteria are found in Appendix P2-3.

7. Build upon existing science-based conservation strategies and plans.

The Washington Biodiversity Conservation Strategy and Recovery Plans for Puget Sound chinook and Hood Canal summer chum salmon, Southern Resident killer whales and other species should be incorporated into the ecosystem plan for the restoration of Puget Sound.

Preliminary Policy Recommendations

1. Protection should be the preferred approach to ensuring that ecosystem processes, structures and functions are sustained over time. Where impacts have already occurred in areas that are critical to ecosystem processes, structures and functions, restoration projects should receive top priority for funding and other resources.

- Establish clear standards that state when impacts are to be avoided at all costs. Most protective regulations use a hierarchy to guide applicants and permit reviewers in how impacts will be evaluated. The hierarch usually is stated as impacts should be "avoided, minimized, mitigated or, when all else fails, habitat should be restored." Clear standards need to be established that state when impacts are to be avoided at all costs, and when the other approaches may be appropriate, based on the ecosystem processes, structures and functions that are present on a given site in relation to the entire ecosystem. This will improve the certainty of environmental outcomes during the permitting process.
- Select tools that provide the greatest level of certainty of result for the longest duration of time over other protection tools or programs.
- Prioritize restoration projects. Restoration projects that address impacts to the most important ecosystem processes, structures and functions should receive early attention and funding.

2. The region should discuss its vision for a future quality of life.

We recommend that the Puget Sound Partnership lead a regional conversation about the projected population growth of our region to 5 million people by 2040, in order to understand its impacts on the quality of life for humans, the ecosystem of Puget Sound and our economy. The discussion should include the concepts of the maximum capacity of the region to accommodate increased population from a quality of life standpoint, and from the viewpoint of the resiliency of the ecosystem to sustain stressors over time. [44] Examples from other communities which have faced similar situations should be studied to provide options for consideration by our state. (For a summary of the concept of "resiliency," see Appendix P2-1).

3. Growth throughout the Puget Sound region should be focused in a way that is consistent with the Puget Sound Regional Council's Vision 2040 plan.

This plan supports the preservation of forest and agricultural resource lands; reduces growth levels in rural areas; supports maintaining the current urban growth boundaries; and encourages growth inside the designated urban growth boundaries, especially within designated regional growth centers.

- The focus should be to minimize land conversion to urban-style uses or intensities outside UGAs and to require best management practices and low impact development standards within resource and rural lands which have the highest value for preservation of habitat and eco-systems that support the health of Puget Sound.

---

[44] Similar discussions have occurred in other communities which have sought to control growth, including Boulder, Colorado, Petaluma, California and Lake Oswego, Oregon.[44]

- Within urban growth boundaries, critical existing ecosystem processes, structures and functions should receive special protection. Where it does not exist, actions should concentrate on reducing polluted run-off, low impact development standards, and site-specific shoreline clean-up and restoration where it can make a difference.
- Local governments should work with neighborhoods slated for redevelopment to integrate new projects in a way that retains local character to the greatest extent possible.

4. Consider enacting at a state-level a single, integrated, set of regulations that apply in to the lands, streams and marine areas within Puget Sound to replace our present fragmented system of regulations.

In order to streamline permitting, avoid duplicative or conflicting regulatory requirements, and achieve consistent ecosystem outcomes, the Topic Forum recommends considering adoption of a single set of regulations to protect the ecosystem of Puget Sound.[45] The basic framework envisioned is as follows:

Standard: An integrated set of regulations should be adopted that protect the integrity of ecosystem-forming processes, structures and functions of marine drift cells and terrestrial and freshwater aquatic areas. It should take into account the full range of natural physical and chemical factors that control ecosystem processes, as well as the effects of natural factors such as predation, disease and climate change in establishing protective standards that must be met.

Applicability: The regulation should apply to a uniform set of human activities that have been identified as threats (or stressors) to the health of Puget Sound ecosystem.

Strategies to protect: Where protection at the highest levels is needed, regulations should prohibit activities altogether or the property (or development rights) should be acquired for permanent protection using the most appropriate acquisition tools (discussed in Response to Question P1). Where impacts are allowed to occur, net improvement of ecosystem processes, structures and/or function(s) (as applicable) should be required as a project outcome.[46] The regulation should provide a limited amount of time for nonconforming uses to continue before they are required to be removed.

What it would integrate: The regulation would integrate and replace the following regulations: FPA, HPA, SEPA, SMA, GMA, NPDES, critical areas regulations, and other contrary GMA requirements. To the greatest extent possible, overlapping federal regulations (e.g., 404, 401 permits, FEMA Flood hazard regulations) which apply for the purpose of protecting environmental functions should be suspended in favor of the Puget Sound ecosystem regulation in all areas where it applies or integrated with this program.

Local implementation with accountability requirements: Local governments would update their existing regulations to be consistent with the state guidelines. A governing agency or group would have approval authority before the regulations go into effect. Local governments would report permitting activity to the state agency. Monitoring of ecosystem conditions should be conducted the state or through the region, in consultation with local residents and governments to determine the effectiveness of the regulations and their implementation.

---

[45] The state laws most often discussed in this context are SEPA, SMA, and GMA. Previous efforts at integrating these laws have foundered for a variety of reasons. For a report on the most recent effort, see the final report of the Land Use Study Commission on a consolidated land use code at www.cted.wa.gov/landuse/report/index.html. One of the issues that the Land Use Study Commission was unable to resolve was the basic governance model. The two basic models in existing state law are the exemplified by the GMA and the SMA. (Our governance proposal is discussed in the next section).
[46] See Appendix 2.

Participation of key state, federal and tribal agencies: Successful implementation of a Sound-wide ecosystem-based management plan will require the full participation of the US Army Corps of Engineers, U.S. Fish and Wildlife Service, NMFS, EPA, Tribal governments and State agencies such as the Departments of Fish and Wildlife, Ecology, Community Trade and Economic Development, Puget Sound Partnership and perhaps others. An appropriate program or mechanism to issue 401 and 404 permits under the Clean Water Act must be created and agreed to by these agencies prior to the development of the plan.

5. At the federal level, the Congress should immediately adopt the recommendations of the 2003 Pew Oceans Commission.

The recommendations are set forth in its report entitled: *America's Living Oceans – Course for Change. Recommendations for a New Ocean Policy*, Pew Oceans Commission, May 2003. These recommendations include address five main challenges: reforming ocean governance, restoring America's fisheries, protecting our coasts, cleaning coastal waters, and guiding sustainable aquaculture.

6. Use acquisition and other voluntary tools as a strategy to gain permanent protection for existing, undeveloped lots in key areas.

Acquisition of private property (through easements, property purchase, purchase or transfer of development rights) should be considered as a high priority for removing old vacant or under-developed plats and vested lots, where development of those older lots poses high risk to the continued existence of important ecosystem processes, structures or functions.

7. Examine the entire spectrum of land ownership and ensure that management tools that protect the ecosystem are being used to address all phases of the process.

Land ownership can be understood to occur in phases across a time-continuum. These phases typically include lending, purchase, holding/occupancy, design (or re-design), permitting, construction, inspection, monitoring, and sale to a new owner. Understanding the factors that influence the decision-making of a landowner at each phase of their ownership will improve our use of management tools that protect the ecosystem.[47]

8. Examine and promote the best incentive programs at the local level

We recommend studying all available incentive programs to assess which ones will be most effective in concert with regulatory protections to provide the highest level of certainty for the protection of the Puget Sound ecosystem. Based on this study, a suite of locally appropriate incentive programs should be adopted by local jurisdictions or offered by non-governmental organizations within each Action Areas to support local protection efforts.

---

[47]At each phase in this cycle, opportunities arise for activities to occur that either promote or hinder the ecosystem processes, structures and/or functions that exist on or near the property. The factors that influence a landowners decision to make use of his or her property at each phase need to be examined, understood and management tools applied (voluntary or regulatory) to promote the protection or restoration of the ecosystem. For example, the banking industry may finance only certain types of construction practices, which are well known and understood, rather than innovative, low impact development projects where the timeframes for approval are uncertain and technologies are less known to them. If incentives are applied to encourage LID in construction practices, but the banking industry isn't offering financing for those projects, the incentive program may not be effective.

DRAFT

9. Require low impact development techniques to be used in all Puget Sound jurisdictions to reduce the loss of forest cover and increase in impervious surfaces.

Low impact development techniques include limitations on clearing in rural areas where maintenance of existing hydrology is most likely through maintenance of natural systems rather than reliance on engineered solutions.

10. Consider amending the state's vested rights doctrine to achieve promote opportunities for higher protection of ecosystem processes, structures and functions.

Examples of such approaches could include:

- Provide for a later vesting date for compliance with critical areas and shoreline regulations for development activities that pose a high risk to important ecosystem processes, structures and functions; or
- Provide for a later vesting date as a general rule, but offer early vesting for applicants that build projects using LID techniques or that agree to meet better environmental standards.

11. Establish a centralized and transparent approach to managing information, maps, studies, plans and data related to Puget Sound ecosystem and the Action Agenda.

A centralized approach to information management would maximize transparency, accessibility and the sharing of information to improve our scientific knowledge about the Puget Sound ecosystem.

12. Plan for wildlife on a watershed scale.

Iidentify what species would be present; plan for their needs; translate that into site scale. [Insert information from the Biodiversity team here

13. Use incentives and non-regulatory programs.

To protect habitat in places where legal impediments exist (e.g., where substandard lots exist or prior development patterns result in nonconforming uses), use incentives and non-regulatory programs to encourage protection. If possible, require the use of low impact development, clustering of structures and uses, or acquire important habitat using PDR, TDR or conservation easement tools.

14. Expand the availability of off-site mitigation programs both institutionally and functionally.

This needs coordination between federal/state/local governments to make this work. It will also require changes to many of the key state and local regulations highlighted in Response to Question P1.

15. Address cumulative effects of stressors on the ecosystem by adopting a new mitigation standard.

The cumulative impact of stressors on ecosystem processes, structures and functions over time is not adequately addressed by most regulatory regimes at the state or local level where they provide for mitigation of impacts. Consider adopting the standard illustrated in Appendix P2-2.

Preliminary Governance Recommendations

One of the key findings in Response to Question P1 is that there are simply too many governmental actors in Puget Sound with the authority to regulate human activities that pose threats to the ecosystem. They have acted in an

DRAFT

uncoordinated fashion, with varying purposes and results. With each government balancing competing needs and making regulatory decisions, the certainty of outcome decreases and the potential for further ecosystem decline increases.

What the region needs instead is a system of governance where leaders are charged with and capable of ensuring that the Puget Sound ecosystem policy goals are being met. We believe that this requires simplicity—a single agency or group charged with convening the region, reaching consensus on the science and a set of policies and actions that will lead us to a healthy Puget Sound. This agency or group should be charged with adopting the integrated set of standards referenced above and overseeing its implementation across Puget Sound by local governments.

We do not reach this conclusion lightly. Concentrating power in a single agency or group can sometimes create negative, unintended consequences. However, in this case, we believe it is warranted. The region has tried the uncoordinated, diffuse approach and it has not achieved success organically. Where a single agency or group has been empowered to bring people together to agree on the problem, set goals, and chart a course for correction (such as with salmon recovery planning or growth planning through PSRC) positive outcomes have been shown.

DRAFT

APPENDIX P2-1

A Discussion about Sustainable Living: What is the "Carrying Capacity" of Puget Sound – for people, for the ecosystem, and for the economy?

At *Policy Recommendation No. 2* in the Response to Question P2, we recommend that the PSP begin a community conversation about what the future holds for a healthy Puget Sound over the next 50 years, as we face staggering population growth projections. In order to achieve a healthy Puget Sound, we believe that this includes three inextricably linked parts: healthy people, a healthy ecosystem and a healthy economy.

The Quality of Life Topic Forum and Public Health Forum are discussing two of these components: how we define our "quality of life" in terms of physical and emotional or spiritual health for people living in Puget Sound, as well as the elements of a healthy economy. The Land Use/Habitat Protection and Restoration Topic Forum intends to contribute to this discussion by framing the question about what it means to have a healthy ecosystem. To do this, we asked our scientists a simple, yet scientifically complex, question in layman's terms: ***How much stress can the Puget Sound ecosystem tolerate before it breaks down?*** What follows is an insightful response which we hope contributes to this community conversation.

Q. How much stress can the Puget Sound ecosystem tolerate before it breaks down?

A. This question is stated a bit differently in the ecological literature, something like "At what point does the ecosystem assume another state?" The theory of stable ecosystem states is summarized in Gunderson, 2000[48]. It basically says that if you push a system hard enough it will shift to another state that is somewhat stable (i.e., resistant to change). By "state" we mean the quantitative and qualitative description of species types, the numbers of species, their abundances, the flow of energy, the support of resources, the functions, etc.

To move the system back up into the un-degraded state takes "energy" which means money (and lots of it) when it comes to restoring an ecosystem. That's why conservation/preservation of ecosystems is preferred because it takes less energy/money than restoring.

In terms of Puget Sound, the multiple stressors acting together (i.e., *accumulate*) result in a cumulative impact on the ecosystem and thus can alter its state. Once the cumulative impacts reach a certain point, the system shifts (degrades) to another state.

For Puget Sound, the system is stressed in various ways, but scientists don't think that the system overall has shifted into another state. We could verify this with an analysis of data on a variety of indicators. However, certain parts of the system, like Commencement Bay, are in an altered state. To bring Commencement Bay back to its un-degraded state would take a huge effort. In comparison, large portions of the straits and the San Juan Islands are in something approximating pre-disturbance states. So, at the least we have these contrasting end members (low stress/high function, vs high stress/low function). What we don't know is the shape of the curve between these two, and the amount and kind of stresses that causes the shift.

We are not nearly at a point where we can state accurately what level of stress (ie the threshold level), and what combinations of stressors, will move the entire Sound into an altered state. Major changes in fundamental controlling factors could do this, like what has happened in the Columbia River estuary. There, dams have significantly altered hydrodynamics, logging and land conversion in the watersheds, and levees and dikes have eliminated connections

---

[48]Gunderson, *Ecological Resilience in Theory and Application*, Annu. Rev. Ecol. Syst. 2000.31:425-439.

with vital floodplain wetland areas. The system has shifted from a marsh macrodetritus based food web to a plankton based food web with effects ramifying throughout the food web of the system.

Some researchers are trying to piece together information that shows a shift in the food web in Puget Sound, but that is not finished and probably won't be conclusive evidence. At this juncture we can point to loss of tidal habitats, degradation of existing habitats, alterations in fish communities, contamination in food webs, hypoxia events, loss of eelgrass in some areas, etc., as evidence that the system is stressed, and may be on the verge of shifting to a significantly altered system. However, what "on the verge" means is not known.

We need a comprehensive/credible study of the cumulative effects of multiple stressors on the ecosystem. Short of that, our scientists will need to rely on adding impacts up (i.e. use an additive model) and use more qualitative descriptors of the system state. An additive model is what we and others have applied to county shorelines (e.g. Jefferson County Nearshore Assessment) and watersheds (e.g., the Bellingham watershed study performed by Stephen Stanley et al). Extending these additive model assessments consistently throughout PS would go a long way toward addressing this question.[49]

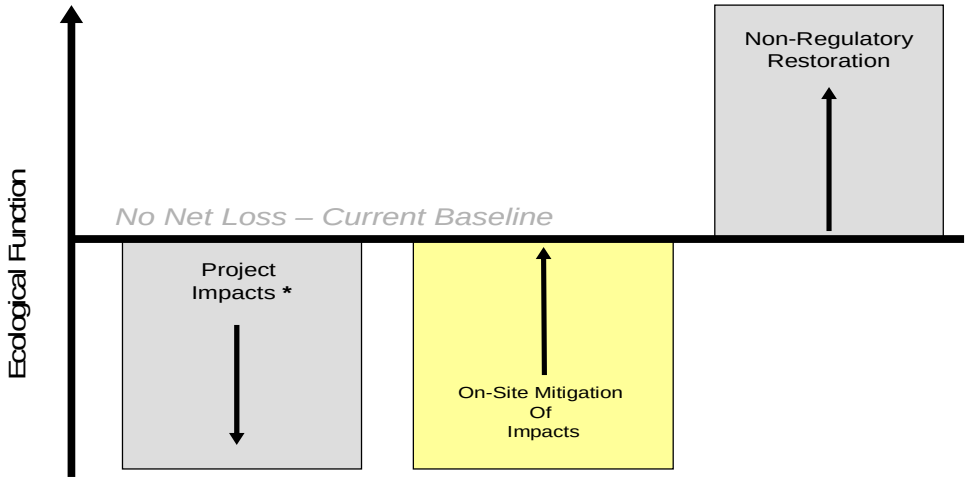
DRAFT

[49] Ron Thom, Ph.D., Battelle, Pacific Northwest Labs, Sequim, Washington 2008.

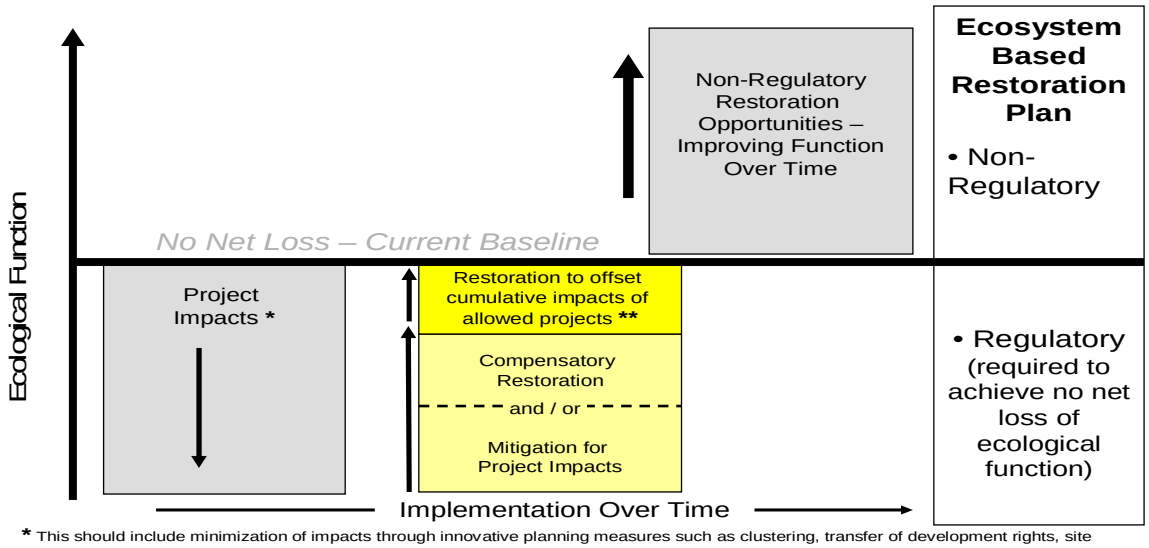
APPENDIX P2-2

An Illustration of Our Proposal to Create a New Restoration Standard

Existing No Net Loss Approach in Washington



No Net Loss of Ecological Function & Restoration



* This should include minimization of impacts through innovative planning measures such as clustering, transfer of development rights, site specific BMP's, and other green infrastructure measures to minimize impacts to ecosystem processes and function.

** Replacement of ongoing loss of functions. Occurs as result of inefficiencies of mitigation design and implementation, reasonable use exemptions, minimum size exemptions, etc. This could include implementation of other measures in the restoration plan .

APPENDIX P2-3

Protection and Restoration Strategies for Puget Sound Ecosystems

Examples of Project Types and Targeted Ecosystem Benefits (adapted from Johnson et al. 2003).

Strategy	Project Type	Targeted Ecosystem Benefit
Protection	Land acquisition	Preserves existing intact ecological features, functions, and processes at site scale and/or enables the application of additional strategies without human land use constraints.
	Land use regulations	Limits or prohibits potentially harmful land use activities on or adjacent to the land surrounding the site, thereby protecting habitat-forming processes and features.
Conservation	Land conservation	Limits land use impacts harmful to salmon habitat such as sediment, contaminants, nutrient loading.
	Easements	Benefits ecological features through legal protection of critical areas, potentially allowing for complimentary restoration strategies to take place.
	Riparian fencing	Deters livestock from degrading stream-side areas.
	Manure management	Minimizes the inputs of nutrients and bacteria into stream corridor.
Enhancement	Riparian plantings	Promotes water temperature reduction, contaminant removal, connection of terrestrial habitat corridors, sediment reduction, and water storage; future source of large woody debris input.
	Tide gate/culvert replacement	Promotes water temperature reduction, dissolved oxygen availability, increased habitat access.
	Invasive species removal	Increases opportunities for native species propagation.
	Bioengineered streambank stabilization	Reduces sediment load, diffuses hydrologic energy.
	Riparian fencing	Protects riparian zones from disturbances.
Restoration	Tide gate removal	Restores partial or full hydrologic connection to slough habitat improving water quality, access to lost habitat types and processes, and potential removal of invasive plant species.
	Dike breaching	Provides similar benefits as tide gate removal, this application requires significant earth moving activities to allow tidal energy to influence historic slough signatures and can involve tidal channel excavation
	Culvert upgrades/culvert installation	Provides similar benefits to above restoration activities through the improvement of water quality, access to lost habitat types and processes, and potential removal of invasive species.
	Elevation adjustment	Restores elevation of site to level that will support appropriate wetland vegetation.
Creation	Material placement	Mimics habitat function and complexity through the placement of material at a given elevation.
	Tidal channel modification	Restores more natural flows and mimics tidal channel structure.

DRAFT