



# 2012 State of the Sound

A Biannual Report on the Recovery of Puget Sound



**PugetSoundPartnership**

LEADING PUGET SOUND RECOVERY

LEADERSHIP COUNCIL DRAFT



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To be reviewed and approved October 26th, 2012

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To be reviewed and approved October 26th, 2012

# What is the State of the Sound

## Puget Sound: National Treasure

Puget Sound is one of the most spectacular places on earth. Carved by glaciers and fed by 10,000 rivers and streams, it is the second largest estuary in the United States. In this vast and beautiful place, salt water from the Pacific Ocean mixes with the freshwater that drains from the majestic landscape that surrounds it.

Puget Sound is an ecosystem defined by the movement of water. Freshwater begins as rain or snow from high in the Cascade and Olympic mountains, flows through streams and down fertile valleys, connecting to a complex network of salt marshes, wetlands, smaller estuaries, bluffs, beaches, and bays before meeting up with the shifting tides of the Sound.

## Gifts of Extraordinary Nature

Puget Sound's snowcapped mountains, marine waters, dynamic rivers and beaches, lush forests, and extraordinary wildlife draw millions of visitors each year. Puget Sound is also home to more than four million people.

We derive many benefits from Puget Sound. It provides us with drinking water and protects us from Pacific storms and flooding. It gives us timber to build our homes and food to nourish us, including world-renowned seafood. It also offers multiple opportunities for recreation and cultural activities.

Puget Sound is also an economic engine. Its shellfish and fish harvests alone bring in over \$100 million per year. Approximately another \$270 billion in goods and trade travel through its ports. Because of all the Sound has to offer, it has created an unparalleled quality of life that has attracted some of the most creative and innovative people from across the nation and around the world to live and work here.

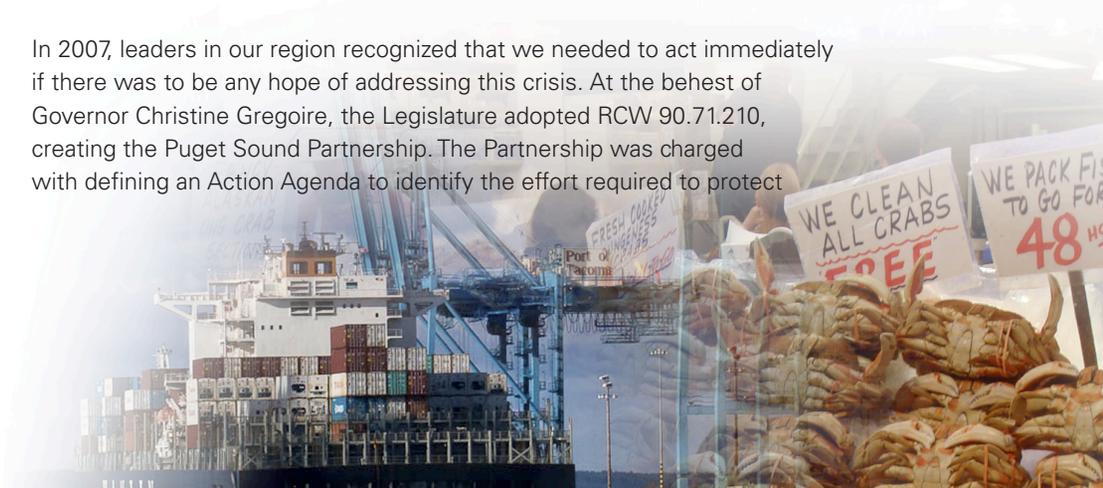
## Human Actions and Consequences

But decades of human use have impacted the health of Puget Sound's ecosystems. These changes were incremental: rural areas were converted to urban uses, new roads were built, new development was added to cities, shorelines were paved to protect adjacent uses. We used our waterways to dump our waste, assuming that its capacity to dilute the waste was unlimited.

Collectively these impacts have taken a huge toll on Puget Sound. We have threatened the survival of a number of its iconic species, including salmon and orca. Three quarters of its saltwater marsh habitat have been eliminated through dikes and drainage systems, and 90% of the estuaries and wetlands have been lost or degraded. We have removed over 70% of our old growth forests in the past 50 years and armored over one-third of our shorelines. We have spilled hundreds of thousands of gallons of oil and hazardous waste into our rivers and marine waters; we have built ten major dams and thousands of smaller diversions. Between 1991 and 2001 alone, we paved an additional 10% of our land to accommodate our homes, business, and roadways. As a result, we have stressed the functioning of the very systems that we rely upon for services to the point where there are no longer simple and inexpensive remedies.

## Puget Sound Partnership Goals and Responsibilities

In 2007, leaders in our region recognized that we needed to act immediately if there was to be any hope of addressing this crisis. At the behest of Governor Christine Gregoire, the Legislature adopted RCW 90.71.210, creating the Puget Sound Partnership. The Partnership was charged with defining an Action Agenda to identify the effort required to protect



and restore the Sound, to determine and measure accountability, to use money efficiently, and to promote public awareness and build support for changing practices that negatively affect the viability of the Sound. Recognizing that this was a difficult and ambitious undertaking, the Governor and Legislature understood there needed to be an organization in the region whose sole purpose was to focus the work and lead the recovery effort.

*“It is our task to ensure that the Puget Sound forever will be a thriving natural system, with clean marine and freshwaters, healthy and abundant native species, natural shorelines and places for public enjoyment and a vibrant economy that prospers in productive harmony with a healthy Sound.”*

– GOVERNOR GREGOIRE, 2007

## The 2012 State of the Sound

The 2012 State of the Sound is the second report to the Legislature on the status of this restoration effort. It is a report card on our efforts to recovery Puget Sound and addresses the following questions:

- Have we implemented the critical actions necessary to reverse the decline?
- To what extent have these actions been successful, and if not, why?
- Are we making progress toward our 2020 recovery targets?
- Have we addressed the fiscal challenges of funding a comprehensive ecosystem recovery effort?
- What opportunities and challenges lie ahead?

There are no simple answers to complex questions such as these, but the bottom line is this: Although we have made significant strides in restoring and protecting habitat, we continue to lose more ground than we are gaining. We have slowed the overall decline and are seeing improvements in many key parts of the ecosystem as a direct result of our investments, but not all changes are proceeding in the right direction or at the speed we had hoped in 2008.

Based on the results we have seen to date, progress has not been sufficient to meet our 2020 recovery targets. We were unable to fully fund all of the ongoing programs in the Action Agenda deemed key to recovery, and therefore the region did not complete all of the work we tasked ourselves to achieve. We raised public awareness of the crisis in Puget Sound, but even that sense of crisis has receded as competing issues and forces have taken center stage.

That said, the pace of change for many of our desired outcomes is consistent with what scientists would expect, given what we know about how slowly or quickly different part of the ecosystem respond to intervention. It is also consistent with the degree of intervention we have provided given economic realities and the level of public engagement.

## New Diagnosis: Serious Condition

A medical analogy may be the best way to explain the overall health of Puget Sound. Our patient (Puget Sound) was in critical condition—unable to function and in danger of imminent collapse. The patient was treated in the emergency room, stabilized and then moved to the hospital floor. The patient is not “out of the woods” and still needs constant monitoring, care and vigilance.

We know bad habits have led to the crisis, and that a radical change in lifestyle is needed in order to regain some semblance of health. We also know that even when the need for change is obvious and the best medical advice is available, altering long-held behaviors is slow and sometimes painful. Even under the best of possible outcomes, the patient will never be the same. But we hope that, over time, the patient can achieve good health and lead a long, vibrant, and productive life.

Like our current healthcare system, preventing illness is at the core of the high cost of recovery for Puget Sound. In some ways, you can think about the financial section of this report as an itemized list of the costs of a lengthy hospital stay, repeat doctor’s visits, frequent testing, and expensive prescriptions to treat a preventable illness. Were

it not for the investments of time and money made to date, Puget Sound would be in the intensive care unit on life support. Just as one hospital visit far exceeds the cost of the preventive care, the emergency measures that will be required to prevent the collapse of a failing ecosystem will greatly eclipse the preventative measures recommended in this report.

We set our targets for 2020 high, knowing they were ambitious. If we are to make progress towards our targets, we must continue to set our performance goals and measures high, report accurately on what has occurred, even if it is less than we had anticipated, and use what we learn from our successes and failures to make continuous improvements.

We must continue to communicate the message of the importance of Puget Sound to all of the communities that reside in its boundaries and rely on its resources. We must also make it clear that the work is far from complete.

Only with their support can we be successful.

To avoid this foreseeable and preventable fate, we must redouble our efforts to fund this critical work. The investments we have made to date and the estimated costs for the next biennium appear significant when contrasted with competing needs in our state, but they pale in comparison to the benefits we will derive from a healthy Puget Sound. These preventative measures may come at a price, but the benefits are INCALCULABLE.



## 2012 STATE OF THE SOUND: OVERVIEW

The Puget Sound Partnership is charged with preparing a State of the Sound report every two years to inform the legislature and the public on the status of the restoration effort, including how the ecosystem has been responding to the measures adopted and our success in implementing the actions proposed. The State of the Sound also reports on our accomplishments in the use of state and other funding and recommendations on what other measures are necessary to sustain the effort, including realignment in the use of funds.

The purpose of the analysis undertaken to prepare the 2012 State of the Sound is to sharpen our focus on the pathway ahead. Along with the 2012 Action Agenda—which identified Strategic Initiatives that contain what our partners believe represent the highest priorities—this report describes the measures we need to move forward.

*The 2012 State of the Sound report is organized around ecosystem indicators and targets adopted by the Leadership Council in 2010-2011, as the primary focus of reporting on our ecosystem recovery. These were incorporated into a dashboard of “Vital Signs.” It contains five major elements:*

- a) Information on the status of the ecosystem
- b) Status of the implementation effort
- c) Role of adaptive management in regional decision-making
- d) Allocation and effectiveness of funding for recovery
- e) Alignment of programs with priorities

Each of these elements is a critical component of a comprehensive system for managing and measuring performance. This information will in turn inform future decision-making regarding the adjustments that might be required to reduce the threats to Puget Sound health and reach both our short- and long-term goals.

## **Chapter 1** *Status of the Ecosystem: Progress Towards 2020*

Technical staff prepared reports for each indicator, which include information on whether the 2020 target has been achieved, and whether we are making progress toward the target. The report also includes data graphs and maps that further clarify the status of the indicator.

The individual indicator reports are prefaced by a synthesis submitted by the Puget Sound Ecosystem Monitoring Program (PSEMP). The synthesis fulfills a statutory requirement to report findings that arise from the assessment and monitoring program.

The analysis concludes that of the 21 indicators, two showed clear progress, five showed mixed results (only portions of targets were met or targets were met in one or more geographic areas), six demonstrated no progress, and eight were considered incomplete because there were no data or because the targets had not been adopted or were still in development.

Local Stories	Vital Sign or issue
<b>Orca Network (sound-wide)</b>	Orcas, Citizen Science
<b>Island City Eelgrass (San Juan Islands)</b>	Eelgrass, Herring, Citizen Science
<b>Skagit STORM (Skagit County)</b>	On-site sewage, marine & freshwater quality, shellfish beds
<b>Funding Mechanisms (Snohomish County Public Works and the Nisqually Land Trust)</b>	Summer stream flows
<b>Elwha(North Olympic Peninsula) National Park Service</b>	Salmon, stream flows
<b>Land Use: Water Typing (Hood canal, Kitsap County)</b>	Land use/development, salmon, freshwater quality
<b>Bainbridge Shoreline Armoring (Bainbridge Island Land Trust)</b>	Shoreline armoring
<b>Estuary: Carpenter Creek (Kitsap County)</b>	Estuary
<b>Puyallup Rain Garden (City of Puyallup)</b>	Stormwater, fresh and marine water quality, toxics in fish
<b>Thea Foss Waterway (City of Tacoma)</b>	Marine water quality, marine sediment quality

## LOCAL STORIES

Although the 2012 State of the Sound primarily relies on the data collected by state and federal agencies to describe region-wide progress in meeting our ecosystem targets, there are many important projects in each of our subregions that are contributing toward the recovery of Puget Sound. Since these may or may not be reflected in the regional databases, we highlight some of them in this report. These efforts and the data generated by these projects are important contributors to the collective work required to meet our goals in reversing degradation in Puget Sound.

We have identified ten projects in the region, each of which is linked to one of the indicators in our Vital Signs Dashboard. For each, the indicator report includes a brief summary of that effort. A lengthier discussion of the project as well as the data provided by the project sponsors will be included in the electronic version of the State of the Sound. We are grateful to the project sponsors and staff for assisting us in developing these stories and for their contributions to our understanding of what will be required collectively to progress recovery.

We hope to expand the number of local stories in subsequent editions of the State of the Sound.

Chapter 1 also includes a discussion of how the work of recovering Puget Sound is affected by climate change and what considerations are necessary in integrating this information into ongoing and future decision-making. This discussion is based upon a report prepared for the Puget Sound Partnership by the Climate Action Group at the University of Washington.

## ***CHAPTER 2 Performance Management: Tracking the Action Agenda***

The discussion in the Performance Management chapter of the State of the Sound focuses on our progress in implementing the actions outlined in the 2008 Action Agenda, the regional blueprint that identifies the work necessary to protect and restore Puget Sound. The chapter includes a discussion of what work was completed, what remains and which of the actions that were not completed were carried forward to the 2012 Action Agenda. Only 72% of the near term actions in the 2008 Action Agenda were completed or had made the progress anticipated by owners during the biennium.

This section also discusses a) the approach and tools that were utilized to track implementation of the 2008 Action Agenda and b) new tools that have been subsequently developed to aid the region in better tracking our progress.

There have been significant barriers to full implementation of the Action Agenda as well as all of the programs and projects that are critical to our regional mission. We have included a discussion of the barriers to implementation as both an evaluation of why we were not completely successful in implementing the 2008 Action Agenda as well as what will be required for us to succeed moving forward.

Chapter 2 concludes with a memo from the Science Panel to the Leadership Council, which provides the Panel's perspective on our progress in implementing the Action Agenda.

### ***CHAPTER 3 Adaptive Management: How We Make Decisions***

Adaptive management is a scientific approach to management in complex systems that tests assumptions in order to learn and adapt. The Partnership has been working with leaders from many of its partner organizations to improve adaptive management in the region and build a performance framework with which to assess progress toward ecosystem recovery. Through this process we are engaging scientists, policy leaders, decision makers, resource managers, conservation practitioners, communications experts, and other key leaders integral to our success in improving the health of the Sound. We are using the Open Standards for the Practice of Conservation to develop our adaptive management framework and to develop products that will support adaptive management and recovery planning at multiple scales throughout the region.

Chapter 3 describes the role of adaptive management in regional decision-making in greater detail including examples of how this tool has successfully been employed to inform the decisions that have been made within the region, such as integrating information on implementation, ecosystem indicators, and costs as well as the implications of policy changes.

### ***Chapter 4: Action Agenda Funding: Tracking costs, accomplishments, and recommendations***

The fourth section of the State of the Sound focuses on the financial aspects of the recovery effort. It includes information provided by the owners of near term actions on the costs of implementing the 2008 Action Agenda and cost estimates for the recently adopted 2012 Action Agenda. The 2008 Action Agenda costs are compared to the cost estimates provided in 2009 to generate an assessment of the gap between what implementers indicated it would cost to fully implement the necessary actions against what funding was provided. There was an estimated gap of \$187 million between the amount that was considered necessary for carrying out the near term actions and the amount of funding received.

Similarly, for the 2012 Action Agenda, cost estimates are compared to the amounts that implementers assume are available in their budgets, as well as existing or prospective grants. The gap between the estimated cost for implementation of the 2012 Action Agenda and the budget currently available is approximately \$461 million. This number does not include the cost for ongoing programs in the region nor for current and future costs for stormwater protection.

This section also lists the key accomplishments that have been achieved as a result of the funding that has been obtained. The list has been provided by our regional Partners.

The final discussion in this section provides recommendations to the Governor and legislature on how the expenditure of state funds could be better linked to the Action Agenda and to better achieve the recovery goals that have been outlined.

## ***CHAPTER 5 Public Views on Recovery: Aligning Programs with Priorities***

Chapter 5 presents an analysis of actions by implementing agencies that may or may not be consistent with the Action Agenda. This analysis, which was initiated in 2011, was utilized to help inform the development of the updated 2012 Action Agenda.

The Partnership has developed a robust program addressing public engagement in the work of recovery. The role of citizens in this effort was recognized by the Legislature in its creation of the Partnership and it remains one of our key measures of success. Chapter 5 includes a description of the public engagement program, what we have learned and challenges ahead.

The chapter concludes with a summary of the comments received by members of the public regarding the work of the Partnership with a focus on the content of the Action Agenda.

## ***Electronic elements of the 2012 State of the Sound***

The 2012 State of the Sound will be presented in two formats. This draft hardcopy version includes all of the required elements outlined in statute as well as summaries and syntheses of the information underpinning the analysis. We recognize, however, that the public and decision-makers may wish to have access to more detailed information on the indicators, status of near-term actions, and other information. Accordingly, we are preparing an electronic version of the document that includes links to data, information on a particular subject, and links to tools on the Partnership website and other organizational websites that meets the diverse needs of decision-makers and members of the public. Many of these links will be noted throughout the final hardcopy edition.

LEADERSHIP COUNCIL DRAFT

# 1. STATUS OF THE ECOSYSTEM

*PROGRESS TOWARDS 2020*

The overall purpose of this chapter is to report on the status of the ecosystem based on the indicators adopted by the Leadership Council and on progress towards meeting the 2020 ecosystem recovery targets.

In the following pages of this chapter, you will find:

- An overview of the development of the 2012 Vital Sign dashboard for indicators and 2020 ecosystem recovery targets.
- Our approach to evaluating the status of indicators and progress towards the 2020 ecosystem recovery targets.
- The synthesis of the status of Vital Signs and progress towards 2020 ecosystem recovery targets.
- Individual technical summaries of each indicator and target.
- Highlights of four cases of high caliber volunteer-driven monitoring programs that collect data in support of Puget Sound recovery.
- Local stories presenting on-the-ground work that is underway to address many of the Vital Signs.
- An evaluation of our current understanding of the ways that climate change will affect ecosystem recovery.

## **Development of the 2012 Vital Sign Dashboard for Indicators and Targets**

In the 2009 State of the Sound, we reported on the health of Puget Sound based on an initial set of ecosystem indicators suggested by the Puget Sound Science Panel and regional experts. These indicators were organized and linked to the six over-arching goals for ecosystem recovery defined in the statute that created the Puget Sound Partnership: 1) human health; 2) human well-being; 3) species and food web; 4) habitat; 5) water quantity; and 6) water quality.

Work to improve the indicators continued, and in 2010 the Puget Sound Partnership Leadership Council formally adopted a slightly modified and refined list of 21 “dashboard” indicators. The dashboard concept was intended to more easily communicate to the public about a small set of ecologically important and socially resonant indicators that collectively reflect the status of the ecosystem and progress towards meeting the statutory goals for ecosystem recovery.

Then, recruiting the expertise of state, local and federal agencies, Tribes, academic institutions, businesses and non-governmental organizations (NGOs), and following extensive stakeholder engagement and review by both the Science Panel and Ecosystem Coordination Board, the Leadership Council began in 2011 to adopt specific targets for the indicators to reach by the year 2020.

Targets serve as explicit policy statements that articulate the ecosystem conditions desired by 2020, and reflect the region’s commitment to and expectations for a measurable path to recovery. In the process of adopting targets, the Leadership Council further refined and added to the 2010 list of indicators. (For a complete list of targets, please refer to the 2012 Action Agenda, or go to: [http://www.psp.wa.gov/LC\\_resolutions.php](http://www.psp.wa.gov/LC_resolutions.php).) Targets are still under development for some indicators and will be adopted once technical work is completed.

The indicators recommended to the Leadership Council for adoption were based on a variety of scientific sources including the “Environmental Indicators for the Puget Sound Partnership: A Regional Effort to Select Provisional Indicators (Phase 1)” (O’Neill et al. 2008), the Puget Sound Science Update 2010, recommendations from an independent team of scientists (Puget Sound Partnership’s Indicator Action Team 2010), and recommendations of subject matter experts (referred to as “Indicator Leads”).



Figure 1. Vital Signs

## *The Puget Sound Vital Signs*

To better advertise and communicate the status of the adopted indicators and 2020 targets, the Partnership created the Puget Sound Vital Signs wheel. The 21 Vital Signs incorporate the complete set of dashboard indicators adopted by the Leadership Council, grouped in segments according to the six broad recovery goals set in statute. (<http://www.psp.wa.gov/vitalsigns/index.php>; Figure 1).

The Puget Sound Vital Signs dashboard combines selected programmatic and ecosystem indicators to help track and communicate progress in recovering the health of Puget Sound. Most of the ecosystem indicators are measures of the status of specific ecosystem components or impacts to them, such as eelgrass area and number of orcas. Others are measures of the pressures on Puget Sound. For instance, the indicator “amount of shoreline armoring” is a proxy for alterations to shorelines by the construction of seawalls, a practice that is detrimental to ecosystem functions and processes vital to the conditions of shorelines.

One Vital Sign, on-site sewage system, consists of a programmatic measure of key actions to restore the health of Puget Sound, defined as the percent of current on-site sewage system inspections that are current. A number of the Vital Signs combine both environmental and administrative measures, such as swimming beaches, shellfish bed classifications, and freshwater impairments under the Clean Water Act.

Some of the Vital Signs are specific to human dimensions of the ecosystem, as defined by human health and human quality of life. Two of these, the Quality of Life Index and the Sound Behavior Index, are in development. Two others, recreational fishing license sales and commercial fishing harvest, do not have targets but we report on their status and trends.

The Vital Signs were chosen as the most readily available data sets that could be evaluated to assess the longer-term outcomes of the restoration activities in Puget Sound. However, these indicators are also subject to natural drivers such as annual climate conditions, local weather patterns, ocean-climate factors such as El Niño vs La Niña cycles, natural species interactions, and many other factors. Therefore, management actions may

not always have a direct and immediate effect on the status and trends of these indicators.

Furthermore, some of the Vital Signs can be slow to respond to changes in the environment. One example is the orca population size, which is due to low reproductive and maturity rates. However, we expect that the Vital Signs will respond in a positive direction towards the targets if management actions are working.

The Vital Signs are not meant to impart a comprehensive understanding of the complexity and dynamics of the Puget Sound ecosystem, as that would require a much more extensive collection of indicators. However, the indicators were chosen deliberately to represent all recovery goals, major ecological domains such as freshwater, marine waters, terrestrial habitats, and key ecological attributes such as population size and condition. Choosing indicators was a challenging task and that is why they will continually be improved and updated as new knowledge and data become available.

## **Approach To Evaluating The Status Of Indicators And Progress Towards The 2020 Ecosystem Recovery Targets**

We focused our reporting on the Vital Signs as defined by their associated indicators and 2020 targets.

For each, we provide answers to two simple questions:

1. Has the 2020 target been met?
2. Is there progress toward the target?

Status provides the most recent estimate of the indicator. For the purposes of this report, we used either the value for year 2011 as the current status or when data were not available for 2011, we used values from previous years. Yet in other cases, the current status was the average of some number of years, particularly when data exhibited a lot of year-to-year variability.

We assessed progress by comparing the estimate for the current status relative to a value defined as the baseline reference. If the estimate of current status was between the target value and the baseline reference, we called that progress. If the estimate of current status was at the baseline or outside the interval between the baseline reference and the target value, we determined that there was no progress.

In many cases, the baseline reference was not specifically defined when the target was adopted. In fact, eelgrass, land development, and floodplains are the only indicators that have specific baseline reference in their target language. In other cases, the target language defines a time period over which to evaluate the progress, including the orca and shoreline armoring indicators. In those cases, we used the first year of that time period as the baseline reference year.

In the remaining cases, we chose a baseline reference year or value based on what made sense for the monitoring programs, the data, and how the target was defined. For instance, the baseline reference chosen for swimming beaches is the first year that the BEACH (Beach Environmental Assessment, Communication & Health) program was launched. In other cases, the baseline was an average of years, such as the herring indicator. In still other cases, there was no baseline data available, such as the on-site sewage and shoreline armoring indicators.

The choice of baseline reference is critical. Because there is annual variability in the data, depending on the year that is chosen, the conclusion may be slight to significant progress or negligible progress. Choosing a range of years can help dampen that effect. Sometimes, there may be no progress over the short-term, but progress over the long-term, as was the case for orcas.

## Monitoring

Ecosystem monitoring is inherently complex, difficult, and often confounding. We want to know about everything from phytoplankton to whales, from the chemical toxicity of sediments in deep marine basins to the retreat of glaciers in the high mountains. The basic life history of many key species still eludes us: where do herring migrate? What triggers certain species of algae to produce toxins? Managers struggle to know which actions are most likely to produce desired results—difficult choices when data seem equivocal and predictive models are beset with uncertainty.

We look to monitoring to help answer many important questions. We need pertinent, reliable data focused on the right questions. We need data collected with enough frequency and over long-enough periods of time to account for the large annual differences that can result from simple changes in year-to-year weather patterns. We need standardized, high quality, and well-documented data that can be analyzed and compared across the region. Such data are surprisingly rare.

Monitoring programs are scattered across agencies with limited jurisdiction, often using different methods, focusing on slightly different questions, and managing data in a multitude of different data management systems. Funding decisions around monitoring are left to individual agencies, with the potential for a patchwork of monitoring gaps across the Sound as many local, state, tribal, and federal agencies struggle individually to fund their most important objectives. Without a dedicated purpose, coordination among programs is typically ad hoc and incomplete.



Photo Credit: NWCIF PENDING

## What is the Puget Sound Ecosystem Monitoring Program?

The Puget Sound Partnership is leading efforts to develop and implement the Puget Sound Ecosystem Monitoring Program (PSEMP). PSEMP is an independent collaboration of monitoring practitioners, researchers, and data users from across the region. The program is directed by a Steering Committee representing some 23 different state, federal, tribal, and local government agencies; universities; non-governmental organizations; watershed groups; business; and other private and volunteer groups and organizations.

The goal of PSEMP is to create and support a collaborative, inclusive, and transparent approach to regional monitoring and assessment. PSEMP's intent is to work with all of our partners to coordinate monitoring efforts in order to avoid overlaps and duplication in monitoring, and to provide credible, high quality, and accessible monitoring findings for our partners, decision-makers, and ultimately, the public.

PSEMP helps standardize monitoring across jurisdictions, identify monitoring gaps, and propose strategies to effectively address priority needs.

PSEMP partners and indicator leads provided the data for the technical summaries of the indicators and 2020 ecosystem recovery targets reported here, and they have contributed significantly to the evaluation of the progress towards ecosystem recovery goals. The information contained in each technical summary and the synthesis represents a significant collaboration among partner agencies and contributors from across the region, and benefited from input from PSEMP Steering Committee and the Science Panel.



# Synthesis of the Status of Vital Signs and Progress Towards 2020

## Ecosystem Recovery Targets

Overall, the technical summaries on indicators and targets suggest that progress towards the 2020 goals for recovering the health of Puget Sound remains an ambitious challenge.

### Approach

This synthesis was compiled by Partnership staff with guidance from the PSEMP Steering Committee. It presents a compilation of the status and trends of the indicators and the progress made towards the 2020 ecosystem recovery targets drawn from the technical summaries.

Two evaluations, one nested in the other, are presented. The first evaluation summarizes progress towards the 2020 targets for each of the Vital Signs (Table XXXX). The second evaluation of progress is for each of the six overarching ecosystem recovery goals, based on their associated Vital Signs.

Although individual Vital Signs are primarily associated with a particular recovery goal, they are in fact often related to additional goals. For instance, the Marine Sediment Quality Triad Index, an indicator under the Marine Sediment Quality Vital Sign, is an indicator that informs about both water quality and habitat. We related each Vital Sign to one or more statutory goal based on previously published work<sup>1</sup> and the Leadership Council's target resolutions ([http://www.psp.wa.gov/LC\\_resolutions.php](http://www.psp.wa.gov/LC_resolutions.php)). We limited our assignment of Vital Sign to goals where the strength of association between them was strongest.

<sup>1</sup> Johnston et al. 2011, Levin et al. 2011

### Progress Towards The 2020 Targets For Each Of The Vital Signs

Six of the 21 indicators show no progress or, in some cases, have actually gotten worse relative to their baseline reference conditions (Table xxx). Five vital signs show mixed progress towards their 2020 target. These five vital signs each have multiple targets and their respective indicators reveal a mix of improving and declining conditions. For example, freshwater quality in major rivers has improved slightly over the past five years (as indicated by the Freshwater Quality Index) while the biological condition of wadeable streams (as measured by the Benthic Index of Biotic Integrity) has declined.

Only two indicators show clear progress: shellfish bed health and estuarine restoration. However, in both cases recent progress is not sufficient to assure they will meet their larger 2020 targets.

Eight of the 21 indicator reports exhibit some degree of incomplete results. Of these:

- Four are still being developed: Quality of Life, Sound Behavior Index, floodplains, and birds, which are examples of how the development of indicators and targets is often complicated by the multiple factors. In the case of the bird indicator, diverse migratory strategies of many species as well as our desire for a quantifiable measure of the way birds uniquely reflect the health and function of the Puget Sound ecosystem.
- Two indicators, land development and shoreline armoring, have enough data to establish current baseline/reference conditions, but not enough to evaluate progress toward their 2020 targets.

- Two other indicators—commercial fisheries harvest, and sales of recreational fishing licenses—were adopted without setting specific 2020 targets because annual goals are set through separate regulatory processes. These two indicators mark important commercial and cultural aspects of Puget Sound, and reflect our long-standing connection to the Puget Sound food web. These indicators will be fully reported in future editions of the State of the Sound.

### *Variability of the data*

In almost every case, progress (or decline) is rarely uniform across all years, or across all localities within the larger Puget Sound basin. Many indicators show significant year-to-year variability, and some even show possible longer-term (decades or more) fluctuations. Indicators often show short-term improvement in some years but declines in other years, including herring, orcas, shellfish beds, beaches, stream flows, and marine and freshwater quality,

Other indicators show important regional or local variability, such as marine sediment quality and freshwater quality. These short-term variations, combined with local or sub-regional differences, can mask long-term and region-wide trends. Yet this variability may actually be an important, functional characteristic of the ecosystem, which we need to understand and take into consideration when evaluating progress towards ecosystem recovery, and when making local or regional decisions about management actions.

This short-term and local variability greatly complicates our interpretation of the results. For now, the indicator reports focus primarily on the data and factual results, and generally do not hypothesize cause-and-effect relationships, which often require dedicated research efforts to tease out. Observed changes and trends most likely reflect the net effect of a wide range of human activities and management efforts, but also annual climate conditions, local weather patterns, ocean-climate factors such as el nino vs la nina cycles, natural species interactions, and many other factors.

Long-term monitoring is necessary to overcome short-term variability and to gain insight into the causative factors of change. However, long-term ecosystem-scale monitoring is always more efficient and effective when designed for that purpose, and when sufficiently robust and integrated to provide the necessary data for all key factors.

### *Sensitivity of the indicators to change*

The fact that most indicators did not make significant progress towards their 2020 targets is not greatly surprising. Many of the indicators adopted by the Leadership Council were done so knowing they would change slowly over time, including orca whales, shoreline armoring, eelgrass, land development and cover, marine sediment quality, and toxics in fish. These indicators were selected because data were readily available, they represent key aspects of the Puget Sound ecosystem, and policy statements about the future desired state could be articulated (i.e., target defined). However, they may better reflect long-term pressures on the system. Tracking these vital signs over time will provide much insight into our overall progress towards ecosystem recovery.

It is important to recognize that the indicators and many of the targets are complex and technically demanding to measure with needed confidence. In many cases, the only data available were drawn from monitoring programs designed to meet other objectives. For example, water quality is monitored primarily to support state and federal Clean Water Act regulatory actions. Relatively little of the data reported for the vital signs come from monitoring programs specifically designed to characterize the overall, unbiased health of Puget Sound. When monitoring is targeted to known problems, and not representative of the entire Sound, it can take considerable effort—and require excluding much data—to screen, compile, and properly evaluate the datasets. Over time, tracking the indicators could be significantly improved by designing monitoring efforts with assessing the progress of ecosystem recovery as the primary objective.

## GOAL-LEVEL SYNTHESIS

### HUMAN HEALTH GOAL

**Related Vital Signs:** shellfish beds, swimming beaches, toxics in fish, and on-site sewage systems.

Vital Signs for the human health goal continued to show evidence of impacts and some risks to human health:

- There is continuing contamination of swimming beaches (12 beaches failed to meet standards in 2011; five of these have chronic bacteria issues), harvest restrictions at commercial shellfish beds (thousands of acres are closed to harvest due to pollution concerns), and contaminants in fish tissue (especially PCB contamination in flat fish from central Sound urban bays and in salmon from south and central Puget Sound).
- Among human health-related vital signs, only restoration of shellfish beds is showing clear progress toward 2020 recovery targets. Thanks to improvements in water quality, there has been a net increase of over 1,300 acres in harvestable shellfish beds – a positive step towards the 2020 target of restoring 7,000 acres.
- It appears that conditions at swimming beaches improved in 2011 compared to 2009 and 2010. However, this is most likely an artifact of the program adding 30 previously unsampled beaches in 2011 rather than bacteria problems being solved. At best, conditions at swimming beaches over the longer-term have not changed much, therefore, progress towards the 2020 target may be very slow.
- The indicator for on-site sewage systems focused on percent of inspections that are current. This is a programmatic indicator rather than an ecosystem indicator, and does not provide any direct information about whether the systems are failing, how much they are contributing to pollution problems, or if on-site septic management programs are reducing pollution. Information on efforts to fix failed systems is anticipated in future reporting

### HUMAN QUALITY OF LIFE GOAL

**Related Vital Signs:** shellfish beds, estuaries, swimming beaches, land development, shoreline armoring, recreational fishing licenses, commercial fishing harvest, floodplains, quality of life index, and sound behavior index.

While robust measures for quality of life and sound behavior are still under development, the Vital Signs do indicate that Puget Sound provides important services that contribute to recreational and commercial fishing. However, these indicators have not increased much over the past decade or kept pace with a growing human population, suggesting that the Puget Sound ecosystem has not improved or been able to keep up with the growing demand for these key services:

- The two indicators that most directly relate to the human quality of life goal are under development: Quality Of Life Index and Sound Behavior Index.
- Many recreational activities continue, including fishing (hundreds of thousands of recreational fishing licenses issued annually) and swimming (dozens of beaches open for swimming),
- Commercial salmon fishing continued at low but fairly steady levels through the 2000s.
- Tens of thousands of acres of shellfish beds are currently open for commercial harvest.

## SPECIES AND FOOD WEB GOAL

**Related Vital Signs:** shellfish beds, Chinook salmon, orcas, pacific herring, eelgrass, toxics in fish, commercial fisheries harvest, and birds.

Vital signs for this goal indicate continuing concerns for the status of Puget Sound species and the integrity of the food web:

- Cherry Point herring biomass remains at critically low levels with no sign of recovery while other stocks show much variability around levels closer to (but still below) those observed historically.
- Puget Sound Chinook continue to face a moderate risk of extinction and their overall abundance remains very low and possibly in decline. Only two of 22 populations show statistical increases in the past five years.
- Orca numbers show slow progress over the longer term but their numbers have dropped in the past couple of years.
- Eelgrass has not increased in extent and is well short of meeting the 2020 target.
- A variety of fish species continue to show contamination by persistent, bioaccumulative toxic chemicals and estrogen disrupting compounds. This points to potential impacts throughout the food chain, especially for apex predators like orca whales and upper food-chain species like salmon and people.

## PROTECT AND RESTORE HABITAT GOAL

**Related Vital Signs:** estuaries, eelgrass, marine water quality, marine sediment quality, summer stream flows, freshwater quality, land development, shoreline armoring, and floodplains.

Some vital sign reports show continuing, even if slow, loss of some habitat types and trending away from the 2020 targets:

- There was a six-mile net increase in shoreline armoring from 2007 to 2010.
- Continuing loss of forest lands to development; more areas losing eelgrass than gaining at sites where change was detected).
- Other habitat measures have shown progress in restoring, recovering, or protecting habitat. For example, 2,300 acres of estuarine habitat restoration projects were completed between 2007-2011, and an increasing proportion of development is occurring within Urban Growth Areas in central Puget Sound. However, the net sum of habitat losses vs gains is not well measured by the indicators.

## WATER QUANTITY GOAL

**Related Vital Signs:** summer stream flows and land development and cover.

- Low summer stream flows continue to be of concern with no significant progress toward recovery targets. Declining trends for the Deschutes, North Fork Stillaguamish, and Issaquah Creek have not been reversed, and stable flows in the Nooksack River have not been maintained.
- Continuing forest conversion as described in the land development and land cover indicators may cause an increase in stormwater flows from developed lands due to decreased infiltration and loss of water from soil and plants (evapotranspiration).

## WATER QUALITY GOAL

**Related Vital Signs:** shellfish beds, swimming beaches, marine water quality, marine sediment quality, freshwater quality, toxics in fish, on-site sewage, and land development and cover.

Indicator reports indicate on-going marine and fresh water quality issues in the Puget Sound basin, including:

- Toxic contamination in sediments, especially in urban bays
- Marine benthic communities adversely affected by poor sediment conditions, which may be related to toxic chemicals and/or biogeophysical condition of sediments.
- Low dissolved oxygen and increasing eutrophication (nutrient enrichment often leading to low dissolved oxygen) in Hood Canal, areas of Puget Sound where circulation is limited, and also along the main axis of the Sound from the central basin through Admiralty Inlet.
- A variety of fish species continue to show contamination by persistent, bioaccumulative toxic chemicals and endocrine disrupting compounds in urban bays
- A number of routinely monitored rivers consistently fail to achieve goals for fresh water quality, often in more heavily developed watersheds.
- Vital Sign summaries do suggest limited progress toward some water quality related targets. A growing proportion of freshwater sites—up to 30% in 2011—are achieving the target for the Freshwater Quality Index, and 1,400 acres of commercial shellfish beds have had their classifications upgraded in recent years. However, most measures do not show progress.

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O'Neill S.M., C.F. Bravo, and T.K. Collier. 2008. Environmental Indicators for the Puget Sound Partnership: A Regional Effort to Select Provisional Indicators (Phase 1). Summary Report. Seattle, WA: National Oceanic and Atmospheric Administration.

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<b>Vital Sign</b>	<b>Vital Sign showing progress towards 2020 target?</b>	<b>Basis for decision about progress</b>	<b>Primary goal associated with Vital Sign</b>
<b>Shellfish beds</b>	Yes	1,384 net acres restored between 2007 and 2011	Human Health Human Quality of Life Water Quality Species and Food Webs
<b>Estuaries</b>	Yes	Approximately 2,300 acres of habitat restoration projects were completed from 2007-2011 in the 16 major river delta estuaries.	Habitat Human Quality of Life
<b>Swimming beaches</b>	No	Percent of beaches meeting standards in 2011 was lower than the 2007 baseline reference	Human Health, Human Quality of Life, Water Quality
<b>Chinook salmon</b>	No	The total number of Chinook salmon in Puget Sound declined from 2006-2010, and no regions have yet met their target to improve 2-4 populations	Species and Food Webs
<b>Orcas</b>	No	Fewer whales in August 2012 than in 2010 baseline year	Species and Food Webs
<b>Herring</b>	No	No significant increase of spawning herring in any of the stocks. Cherry Point stock remains severely depressed.	Species and Food Webs
<b>Eelgrass</b>	No	No change in eelgrass area in 2011 relative to baseline reference of 2000-2008	Habitat, Species and Food Webs
<b>Marine water quality</b>	No	The marine water condition index shows a recent declining trend. Data not available yet for the dissolved oxygen target.	Water Quality, Habitat
<b>Marine sediment quality</b>	No	Sediment chemistry index results have not changed from baseline conditions. Chemicals meeting SQS standards, and Sediment Quality Triad Index both show progress towards their target, but most individual SQT1 scores have declined compared to the baseline.	Water Quality, Habitat
<b>Summer stream flows</b>	Mixed	Some streams maintained or increased flow (7 of 8 rivers) but others lost ground: stable flows were not maintained where they should have been maintained (1 of 3 rivers); flows were not restored where they should have been restored (3 of 4 rivers); (1975-2011)	Water Quantity
<b>Freshwater quality</b>	Mixed	Fresh water quality in 2007-2011 was slightly better than 2003-2007 baseline conditions, but there was a net decline in B-IBI scores for wadeable streams. Although the total number of impaired waters was down in 2008-2010, the trend is expected to reverse in the next round of assessments	Water Quality, Habitat
<b>Toxics in fish</b>	Mixed	Concentrations of PBDEs and PAHs in fish appear to be dropping. PCB's are holding steady, while endocrine disrupting compounds are on the rise in certain areas of the Sound.	Water Quality, Species and Food Webs, Human Health

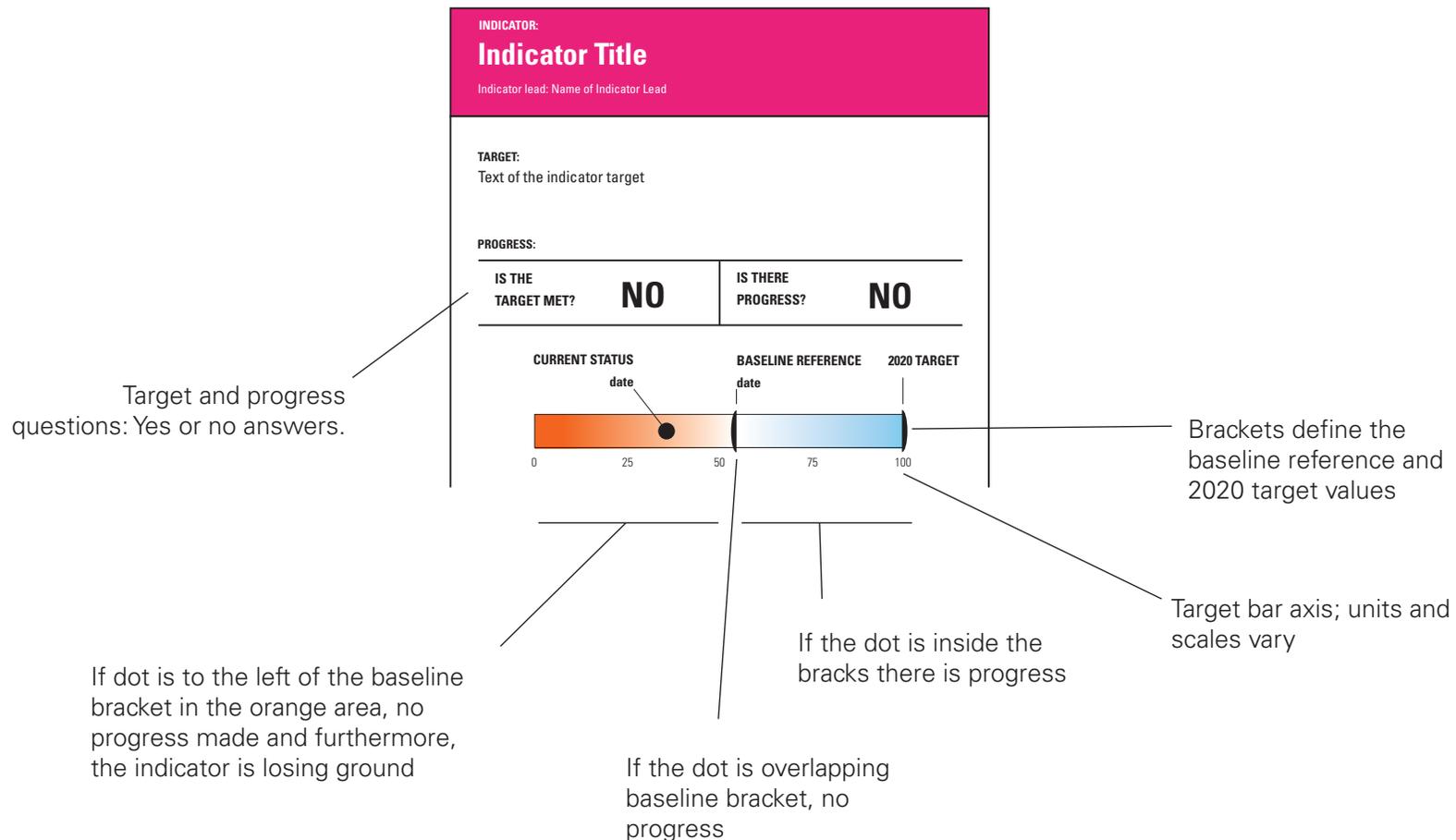
<b>Vital Sign</b>	<b>Vital Sign showing progress towards 2020 target?</b>	<b>Basis for decision about progress</b>	<b>Primary goal associated with Vital Sign</b>
<b>Land development and cover</b>	?	The number of systems inventoried and the percent of systems current with inspections have both increased. Data for the other targets are under development	Habitat, Water Quantity
<b>Onsite sewage systems</b>	?	The number of systems inventoried and the percent of systems current with inspections have both increased. Data for the other targets are under development.	Water Quality, Human Health
<b>Shoreline armoring</b>	n/a	Data for the net change in armoring from 2011-2020 is not yet available. Two other targets still in development.	Habitat
<b>Recreational fishing license sales</b>	n/a	This indicator is tracked, but no 2020 targets has been set.	Human Quality of Life
<b>Commercial fisheries harvest</b>	n/a	This indicator is tracked, but no 2020 targets has been set.	Human Quality of Life
<b>Floodplains</b>	n/a	Indicator is under development	Habitat
<b>Quality of Life Index</b>	n/a	Indicator is under development	Human Quality of Life
<b>Sound behavior index</b>	n/a	Indicator is under development	Human Quality of Life
<b>Birds</b>	n/a	Indicator is under development	Species and Food Webs

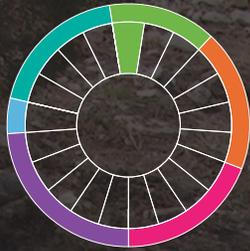
# Puget Sound Vital Signs

## How to read the State of the Sound target bars

The data that we used to track indicators and targets are often complex and variable over time. Yet, there is a desire for simple and clear messages. To this end, we distilled this complex information down with the aid a diagram that we refer to as target bars.

Our objective was for the reader to quickly grasp whether there was progress, and how close the current status estimate is to the target. The advantage of our distillation is that it is easy to read and gets a simple message across. The disadvantage is that the nuances and variability are absent. We strongly encourage readers to continue reading to get a better picture and more comprehensive understanding of health of Puget Sound and challenges ahead.





## On-site Sewage

On-site sewage systems, commonly known as septic systems, are widely used around Puget Sound on properties not served by municipal sewers. These systems safeguard public health and water quality, and allow people to flexibly live and work in all parts of the region. There are more than a half million systems in the Puget Sound region.

Systems that receive good use and care will provide very good treatment of sewage. However, when homeowners don't take care of their systems through regular inspections and repair—including pumping as needed—the systems can break down, leaking sewage into the groundwater and putting people and water resources at risk. Inadequately treated sewage can contaminate marine and fresh waters and impact drinking water supplies, swimming beaches, and shellfish beds for recreational and commercial uses.

All on-site systems need periodic inspections and good operation and maintenance to ensure effective, ongoing treatment.

# On-site Sewage

**INDICATOR:**  
**On-site Sewage Inspection, Repair, and Maintenance**  
 Indicator lead: Stuart Glasoe, Washington State Department of Health

**TARGET:**  
**Part 1:** inventory on-site sewage systems and fix all failures in Marine Recovery Areas and other specially designated areas, and to be current with inspections at 95%.  
**Part 2:** Phase in an extension of this program to cover 90% of Puget Sound's unsewered marine shoreline.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>Part 1 YES</b>	<b>Part 2 NO</b>
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**CURRENT STATUS** 2012 = 38% **2020 TARGET**

0% 25% 50% 75% 95%

95% current with all required inspections

As of July 1, 2012, inspections were current on 38% of on-site sewage systems in Marine Recovery Areas and other specially designated areas. The total number of systems inventoried was nearly 60,000 and the percent documented was 91%. Reporting on the percent of failed systems fixed or mitigated will be phased in.

## Progress towards 2020 target

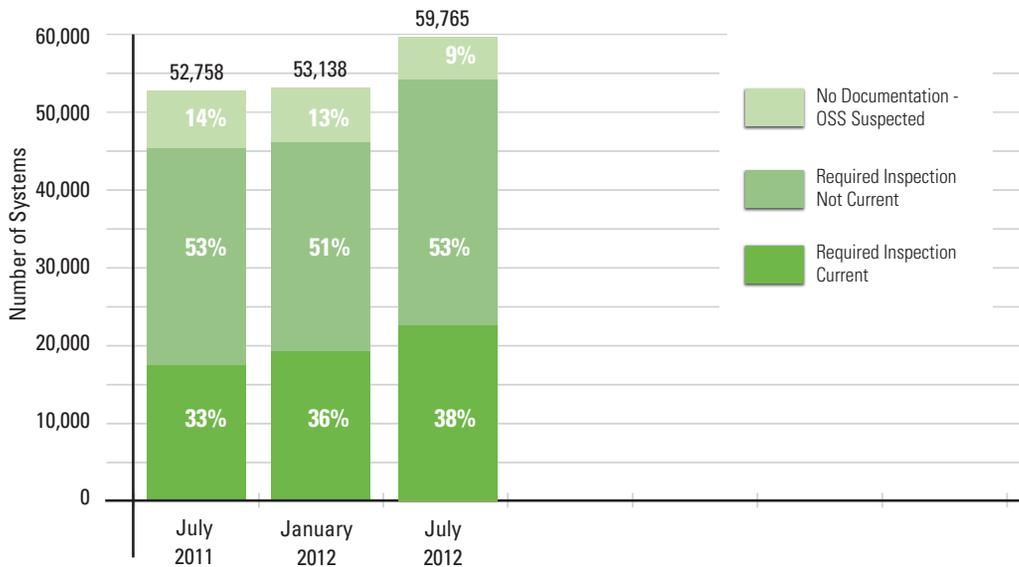
The target has not been met. This is a relatively new target in the state's existing performance management programs. The twelve Puget Sound local health jurisdictions (LHJs) report data semiannually to the Washington State Department of Health (DOH). Only three reporting cycles have been completed so far.

The results of the first three cycles show an increase in the percent of systems current with inspections from 33% to 38%. During this same period, the total number of systems inventoried increased by about 7,000 and the percent of systems documented rose from 86% to 91%.

The interim inspection target is 60% by January 2015. The designated areas currently cover about 10% of the region's on-site systems. This coverage will continue to expand as more areas and on-site systems are designated for enhanced management, resulting in more systems to inventory and inspect.

The second target will be phased in, and the implementing agencies will need to develop a system to measure and report results. DOH estimates that the existing designated areas cover approximately 450 miles of unsewered Puget Sound shoreline. This represents roughly 20% of Puget Sound's unsewered shorelines, compared to the 90% target for 2020.

**Number of On-site Sewage Systems Inventoried and Inspected in Designated<sup>1</sup> Areas**  
*Semi Annual Figures 2011-2012*



**Figure1.** Caption forthcoming

Source: Washington State Department of Health, Office of Shellfish and Water Protection

<sup>1</sup> Designated areas include Marine Recovery Areas and other areas with comparable requirements.

**What is this indicator?**

The goal of this indicator is to track and advance the proper use and care of on-site sewage systems in sensitive and high-risk areas of Puget Sound to protect public health and water quality.

State rules require all homeowners to regularly inspect and maintain their on-site sewage systems. However, in marine recovery areas and other designated areas, LHJs engage more directly with homeowners to help ensure systems are inspected and maintained to reduce public health risks.

All 12 Puget Sound LHJs have adopted comprehensive management plans for on-site sewage systems under the state on-site sewage rule. The management plans frame the local Operation and Maintenance (O&M) programs. The local O&M programs share a set of common elements but they are all uniquely designed and implemented. DOH oversees the statewide on-site sewage rule and collects and interprets data for the Puget Sound targets.

**Interpretation of Data**

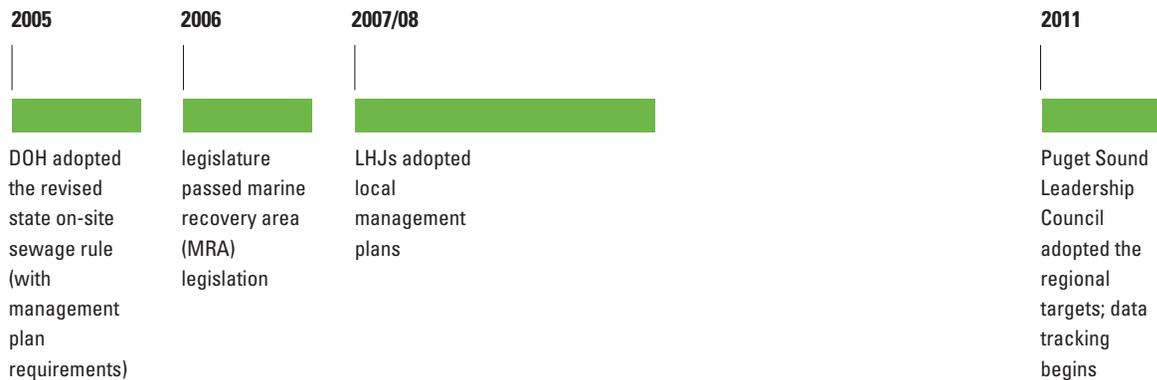
The LHJs are currently working to adapt and align their programs to fit with these ambitious regional targets.

The Puget Sound O&M programs are inherently complex and costly to implement. They all work from the same rule requirements and core elements, but are all tailored to local conditions, budgets, and ways of doing business. They require significant planning, infrastructure, personnel, public education, political support, community buy-in, financial resources, and smart execution.

At all levels of government, funding for decentralized wastewater programs and infrastructure dramatically lags behind public investment in centralized sewer systems. State financial support for the Puget Sound O&M programs has never materialized at a scale originally envisioned when the state on-site sewage and MRA laws were enacted. Most O&M program costs are covered locally and are complemented by state and federal grants. In 2009 the Puget Sound counties conservatively estimated unmet needs at approximately \$4 million annually. State pass-through funds and federal EPA

# On-site Sewage

## On-site Sewage Program Timeline



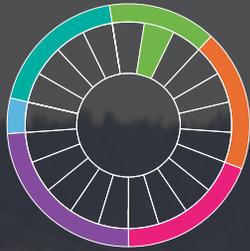
**Figure 2.** Several key milestones have been achieved for the On-Site Sewage Program

Pathogen Funds administered by DOH help augment this shortfall, adding about \$4 million to work by the Puget Sound counties in the 2011-2013 biennium.

The targets provide a small window into the workings of the local O&M programs. These programs include such diverse activities as financial lending for system repairs, code enforcement, homeowner inspection training, data management, certification of O&M professionals, homeowner notification and reporting, and community outreach.

“Management”—characterized here as O&M—has long been recognized as the weak link in the widespread use of on-site sewages systems when compared to centralized sewers. This picture is gradually changing in the Puget Sound region as local O&M programs take root, but it will continue to take significant investments and smart thinking to effectively design and deliver these utility-style programs and services on an ever-expanding scale.

Homeowners and elected officials alike are increasingly seeing the need for and benefits of these programs. The Action Agenda and regional targets will continue to shape and guide these efforts.

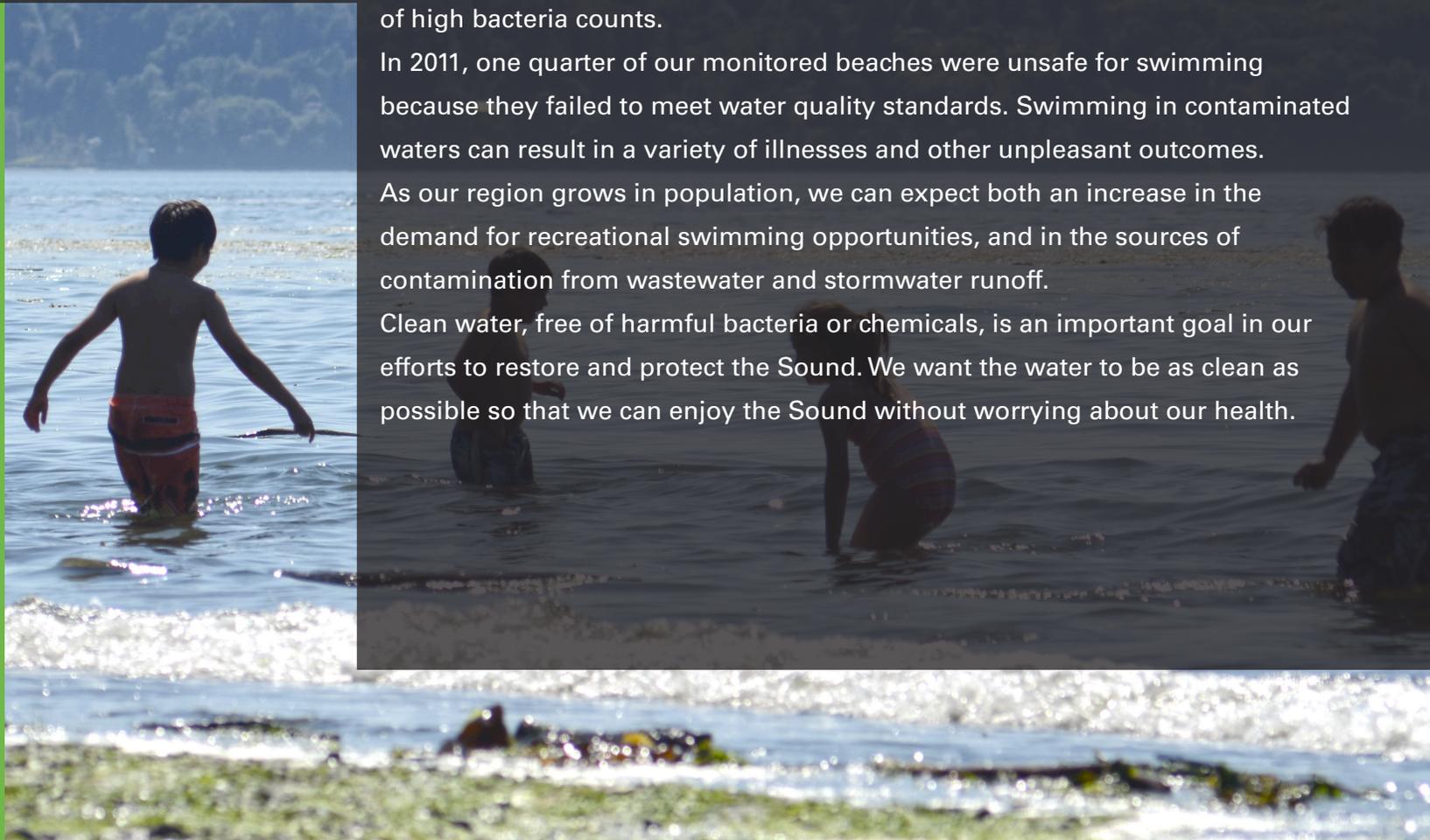


## Swimming Beaches

On a warm day, the waters of Puget Sound present an alluring invitation to wade, swim, or SCUBA dive. Although many of our beaches meet high standards for water quality, every year beaches are closed to the public because of high bacteria counts.

In 2011, one quarter of our monitored beaches were unsafe for swimming because they failed to meet water quality standards. Swimming in contaminated waters can result in a variety of illnesses and other unpleasant outcomes. As our region grows in population, we can expect both an increase in the demand for recreational swimming opportunities, and in the sources of contamination from wastewater and stormwater runoff.

Clean water, free of harmful bacteria or chemicals, is an important goal in our efforts to restore and protect the Sound. We want the water to be as clean as possible so that we can enjoy the Sound without worrying about our health.



# Swimming Beaches

**INDICATOR:**  
**Conditions of Swimming Beaches**  
 Indicator lead: Julie Lowe, Washington Department of Ecology

**TARGET:**  
 To have all monitored beaches in Puget Sound meet standards for what is called *enterococcus*, a type of fecal bacteria.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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**CURRENT STATUS 2011**      **BASELINE REFERENCE 2004**      **2020 TARGET**

60%      70%      80%      90%      100%

of all swimming beaches meet fecal bacteria standard

In 2011, 75% of all monitored swimming beaches met fecal bacteria standards, which is down 12% from the 2004 baseline reference of 85%.

## Progress towards 2020 target

Statewide monitoring of water quality at marine recreational beaches was initiated in 2004 by the Washington State’s BEACH (Beach Environment Assessment, Communication, and Health) program. The target of 100% of all monitored swimming beaches meeting the EPA standards has not been met to date. Furthermore, no progress has been made relative to the 2004 baseline. In fact, the percent of core swimming beaches meeting standards initially improved, but has subsequently declined during the same time period, indicating that the conditions at swimming beaches have somewhat worsened.

## What is this indicator?

The swimming beaches indicator reflects marine water quality conditions in areas heavily used for recreation. Conditions are measured using the percent of monitored Puget Sound swimming beaches that meet EPA water quality standards for the fecal bacteria enterococcus. Swimming beaches not meeting enterococci water quality standards indicate poor water quality that can result in negative human health outcomes such as gastrointestinal illnesses, respiratory illnesses, and skin infections.

Washington’s BEACH Program was launched in 2003 in response to the BEACH Act, which amended the US Clean Water Act in 2000. A collaboration between the Department of Ecology and Department of Health, the program monitors high use/high risk beaches throughout the Puget Sound and Washington’s coast.

The number of monitored beaches varied from year to year (Table 1). However, a total of approximately 47 core swimming beaches are monitored every year. Core beaches are those that are heavily used by the public and also present a higher risk to human health. A certain number of additional

swimming beaches are monitored every year depending on funding, public input, and local health jurisdiction feedback.

For the purposes of this indicator, a beach is considered to meet EPA standards for a particular year if the beach has only one or less instance of a weekly result greater than or equal to 104 cfu/100mL.

The output of the indicator goal may not adequately reflect a long-term outlook for the quality of our beaches, since the number of beaches monitored changes from year to year.

### Interpretation of data

#### Status and trend

Overall, the majority of monitored swimming beaches met enterococcus standards every year since 2004, the first year when the program was in full operation (Table 1). However, the number of beaches meeting the standards has varied from year to year ranging from a low of 74% in 2010 to a high of 88% in 2005 (Table 1). Monitored swimming beaches that did not meet standards in 2011 are scattered throughout Central and North Puget Sound (Figure 1).



**Swimming Beaches Monitoring 2011**

- |  |   |
|--|---|
| <span style="color: blue;">●</span> Passed | <span style="background-color: #f4b084; border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Cities and Urban Growth Areas         |
| <span style="color: red;">●</span> Failed  | <span style="border: 1px solid black; display: inline-block; width: 10px; height: 10px; margin-right: 5px;"></span> County Border                                 |
|  | <span style="border: 2px solid green; border-radius: 50%; display: inline-block; width: 15px; height: 15px; margin-right: 5px;"></span> Salish Sea Basin Boundary |

**Figure 1.** Distribution of all monitored swimming beaches, categorized by whether they passed or failed to meet water quality standards during the 2011 swimming season.

Source: Washington Department of Ecology, BEACH program

# Swimming Beaches

Furthermore, some swimming beaches have had multiple violations since 2004. Five of the 19 swimming beaches that failed to meet standards in 2011 are considered beaches with chronic bacteria issues, namely:

- Freeland County Park, Holmes Harbor
- Larrabee State Park, Wildcat Cove
- Pomeroy Park, Manchester Beach
- Silverdale Waterfront Park
- Windjammer Park

The remaining 14 Puget Sound beaches that did not meet standards failed to do so during routine weekly sampling; however, they have met the standard on most occasions.

When the sample size is reduced to just the core beaches and tracked over time, the number of beaches meeting standards has slightly decreased since 2004, although numbers have varied from year to year (Figure 2).

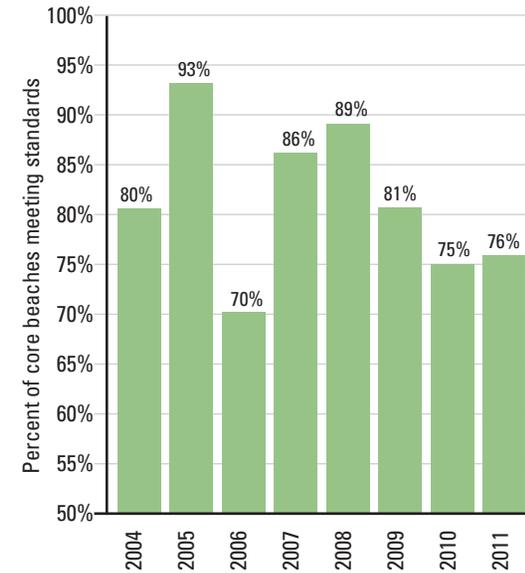
## Monitoring results for conditions at all monitored swimming beaches in Puget Sound.

	2004	2005	2006	2007	2008	2009	2010	2011
<b>Number of swimming beaches sampled</b>	68	67	71	62	53	68	46	75
<b>Percentage of swimming beaches failing to meet standards</b>	15%	12%	20%	12%	13%	22%	26%	25%
<b>Percentage of swimming beaches meeting standards</b>	85%	88%	80%	87%	87%	78%	74%	75%

**Table 1.** Monitoring results for conditions at swimming beaches in Puget Sound.

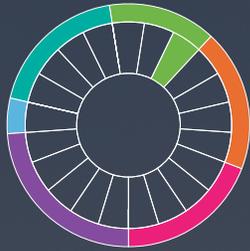
Source: Washington Department of Ecology, BEACH program

**Core Puget Sound Swimming Beaches Meeting Enterococcus Standards**  
Annual, 2004-2011



**Figure 2.** The percentage of core Puget Sound swimming beaches meeting enterococcus standards every year since 2004.

Source: Washington Department of Ecology, BEACH program



## Shellfish Beds

At low tide, the waters of Puget Sound reveal an amazing abundance of oysters, clams, mussels, and more – a bounty unparalleled elsewhere. Gathering shellfish is a time-honored tradition for the public, and today it is an industry that supports thousands of jobs and brings millions of dollars into the region.

Around Puget Sound, there are an estimated 190,000 acres of classified commercial and recreational shellfish beds. However, about 36,000 acres of shellfish beds—approximately 19%—are closed due to pollution, most of which comes from fecal bacteria from humans, livestock, and pets. When fecal bacteria and other contaminants get into the water, they threaten the areas where these prized oysters, clams, and other bivalve shellfish grow.

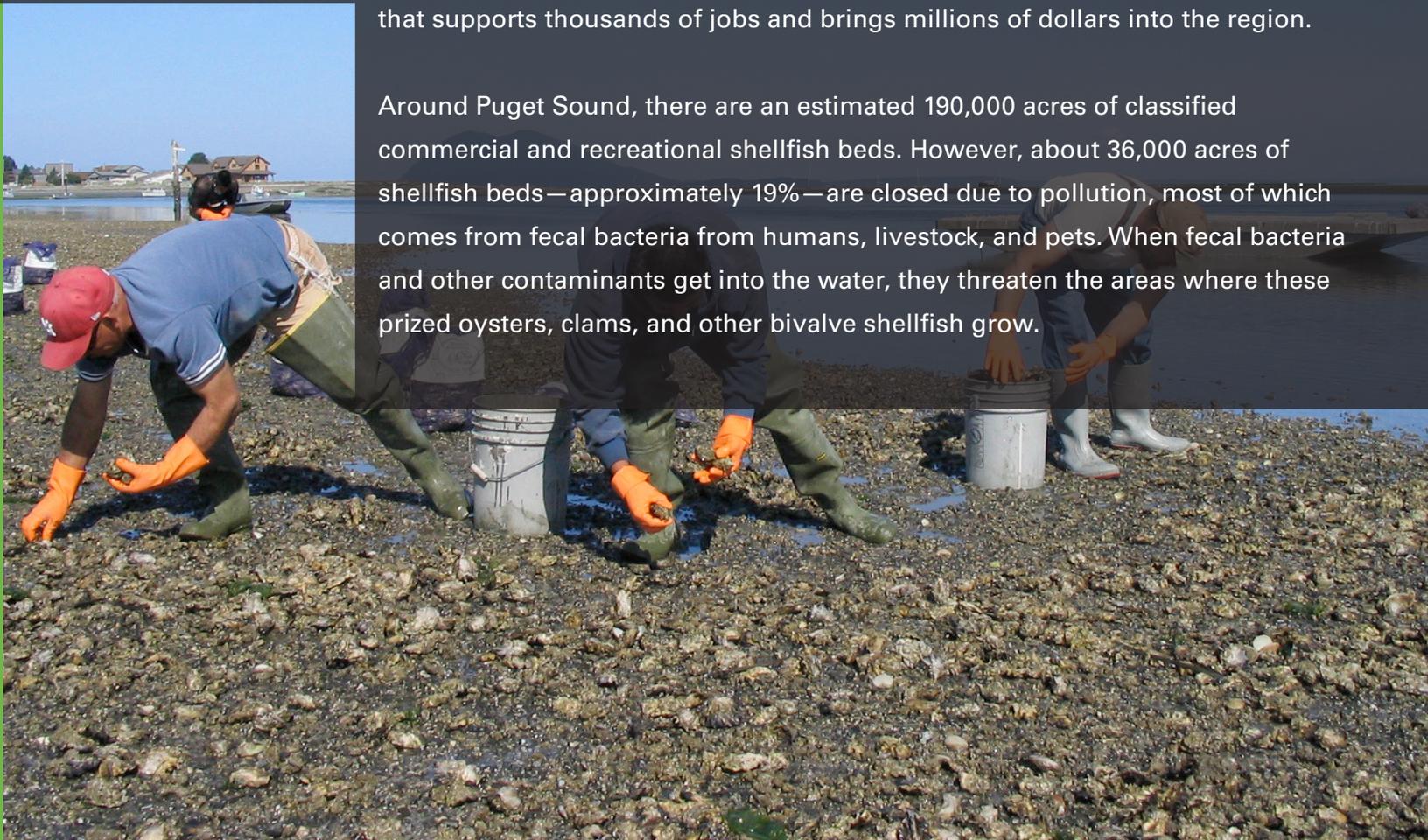


Photo Credit: Taylor Shellfish

# Shellfish Beds

**INDICATOR:**  
**Acres of harvestable shellfish beds**  
 Indicator lead: Scott Berbells, Washington State Department of Health

**TARGET:**  
 A net increase of 10,800 harvestable shellfish acres, including 7,000 acres where harvest had been prohibited, between 2007 to 2020.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>YES</b>
---------------------------	-----------	---------------------------	------------

**CURRENT STATUS 2011** | **2020 TARGET**

-10,800    -5,400    0    5,400    10,800 acres upgraded

Since 2007, some shellfish harvest areas were upgraded while others were downgraded. The net result was an increase of 1,384 acres of shellfish beds open for harvest.

## Progress towards 2020 target

The 2020 target has not been reached yet, but there has been some progress. Shellfish beds are considered harvestable when their status is upgraded. Between 2007 and 2011, more acres of shellfish beds were upgraded than downgraded across all classifications, resulting in a net increase of 1,384 acres of harvestable shellfish beds. A net 3,290 acres of shellfish beds were upgraded from the prohibited classification (3,437 acres upgraded minus 147 acres downgraded to prohibited).

However, these upgrades in growing area classifications from 2007 through 2011 were dramatically offset by the recent downgrade of the Samish Bay shellfish growing area (4,037 acres), impacting the overall net acreage gained since 2007 and slowing progress toward the 2020 goal.

## What is this indicator?

The shellfish harvest area classification process is defined in federal rules and adopted in state regulations. The Department of Health (DOH) implements the rules at the state level. The purpose of the DOH program is to assure that harvested shellfish are safe to consume. This also includes making certain that pollution sources are continually assessed and marine water quality monitored around every classified harvest area. The data collected for the classification process not only represent the conditions that dictate shellfish harvest, but their trends can also indicate a healthier Puget Sound.

Classification	Definition	Acreage in 2011
<b>Approved:</b> commercial harvest for direct marketing allowed	Sanitary survey shows the area is not subject to contamination that presents an actual or potential public health hazard.	141,081
<b>Conditionally approved:</b> opened or closed for predictable periods of time	Meets approved criteria some of the time, but not during predictable periods. The length of closure is based on data that show the amount of time it takes for water quality to recover before the area can be reopened.	11,384
<b>Restricted:</b> cannot be marketed directly and must be transplanted to Approved growing areas for a specified amount of time	Meets standards for Approved criteria, but the sanitary survey indicates a limited degree of pollution from non-human sources. Harvest must be transplanted to Approved growing areas to allow shellfish to naturally cleanse themselves of contaminants before they can be marketed.	307
<b>Prohibited:</b> closed to commercial and recreational harvest	When the sanitary survey indicates that harmful substances may be present in concentrations that pose a health risk. Growing areas that have not undergone a sanitary survey are also classified as Prohibited.	35,683

**Table 1.** Classification of shellfish areas in Puget Sound.

DOH classifies 91 different shellfish growing areas in Puget Sound, covering roughly 190,000 acres. Sites are classified as “approved,” “conditionally approved,” “restricted,” or “prohibited” (Table 1). Upgrades in classification mean that water quality has improved, allowing for fewer restrictions on shellfish harvest. Downgrades mean there are either more restrictions on when shellfish may be harvested or no harvest allowed at any time. Downgrades are generally caused by fecal bacteria or other pollutants in the water that make the shellfish unsafe to eat. The “acres of harvestable shellfish beds” indicator refers to those shellfish harvest areas that are upgraded.

DOH samples over 1,200 marine water stations between six and 12 times each year for fecal coliform bacteria, salinity, and temperature. Between 2.5 to five years of bacteria sampling data are used in the classification of each marine water station. In addition, shoreline pollution sources, including wastewater treatment plants, individual on-site sewage systems, marinas, farms, and any other activity with the potential to impact the shellfish area, are evaluated periodically and results are integrated in the classification process.

# Shellfish Beds

## Interpretation of data

### Status and trend

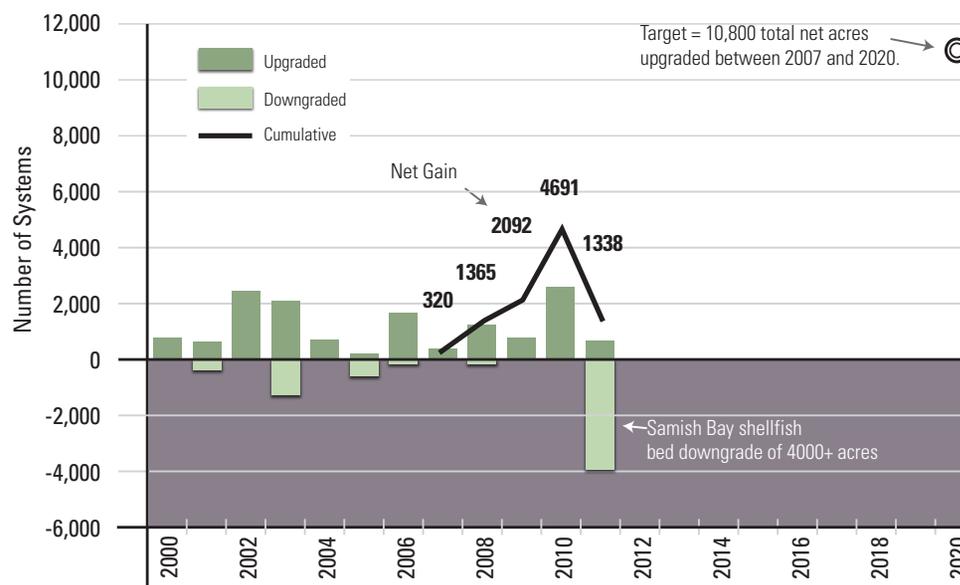
Of the total harvest area classified in 2011, 81% was approved or conditionally approved for harvest. Thus, shellfish harvest is possible in most of the areas under DOH jurisdiction, and these areas are distributed across all sub-basins of Puget Sound (Figure 2).

In contrast, over 35,000 acres (19%) of shellfish harvest areas were classified as prohibited due to the proximity of pollution sources or poor water quality (Table 1). Over 60% of this acreage is prohibited because of a nearby wastewater treatment plant outfall, 29% because of nonpoint pollution sources, 8% because of marinas, and 2% because of other factors that could impact public health.

From 2007 through 2011 improved sanitary conditions resulted in net upgrades in classifications totaling 1,384 acres (Figure 1). A classification downgrade in April 2011 within the Samish Bay shellfish growing area (4,037 acres) dramatically impacted the net acreage gained since 2007.

The DOH predicted that 8,738 acres could potentially be upgraded between 2012 and 2020. This analysis incorporates information

**Acres of Upgraded and Downgraded Shellfish Beds in Puget Sound 2000–2020**



**Figure 1.** Number of acres in Puget Sound by annual harvest area classification changes from 2000

about the known or suspected causes of harvest restrictions and an area-by-area evaluation of the current activities and water quality trends. These projections, coupled with the current 2007 through 2011 net acreage increase (1,384 acres) results in a predicted increase of 10,122 acres by 2020, just short of the 10,800 acres target value. However, downgrades are almost certain to occur during the same timeframe, thereby counteracting the upgrades and further widening the gap to the target value.

Although the sound-wide trend in improvement is positive, many factors affect the long-term ability to reach the target. Intensive efforts to restore growing efforts, such as in the Samish harvest area, are counterbalanced by shoreline development and polluted runoff from stormwater, onsite septic systems, and farms near existing open areas. Unless there are aggressive actions to improve wastewater treatment plant outfall locations, onsite septic system operation and maintenance, and agricultural best management practices, the 2020 target will likely not be met.



**Classified shellfish harvest areas**



**Figure 2.** Distribution of classified shellfish harvest areas in Puget Sound.  
 Source: Washington Department of Health, Office of Shellfish and Water Protection

# Skagit Stream Team and Storm Team

Sponsored by the Skagit Conservation District in partnership with the Padilla Bay National Estuarine Research Reserve, the cities of Mount Vernon, Anacortes, Burlington, Sedro-Woolley, and Skagit County, the Skagit Stream Team began in 1998 with a mission to educate and involve local citizens in the protection and stewardship of local streams. Currently, 70 dedicated Stream Team volunteers regularly measure water quality in ten watersheds in Skagit County.

## STORM TEAM

A high fecal coliform result during a heavy rain event in 2008 in the Samish watershed, an important commercial shellfish growing area, raised concerns and led to the creation of the Storm Team. Although Samish Bay usually has good water quality, tests showed that during storms large volumes of pollutants wash off the landscape into local streams and rivers and contaminate the bay.

As a result of Storm Team and Skagit County sampling, DOH changed the classification of most of Samish Bay from Approved to Conditionally Approved in 2011. Samish Bay commercial shellfish growing areas are now closed automatically when the river reaches 4.7 trillion fecal coliform colonies per day—a level determined to pose a risk for shellfish consumption.

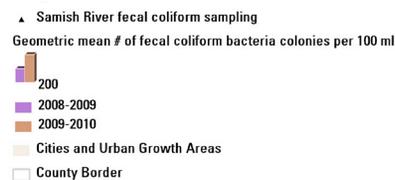
Storm Team sampling efforts were critical in documenting fecal coliform contamination problems in the Samish watershed. The Clean Samish Initiative (CSI), a partnership of local, state, and federal agencies and organizations, was launched in 2010 by Skagit County with funding from the US Environmental Protection Agency. The CSI effort was put together to identify sources of fecal contamination and to find ways to correct them. With increased County sampling efforts under the CSI, the Skagit Storm Team has been able to redirect efforts over the last two years to the Bay View and No Name Slough drainages in the Padilla Bay watershed.

More information about the Skagit Stream Team and Storm Team can be found at [www.skagitcd.org/stream\\_team](http://www.skagitcd.org/stream_team)

Information about the Clean Samish Initiative can be found at [skagitcounty.net/cleanwater](http://skagitcounty.net/cleanwater)



### Skagit Storm Team



The Storm Team is a dedicated core of volunteers that head out in the middle of rainstorms as streams and rivers are rising to collect water samples for fecal coliform bacteria testing. Testing during high flow conditions is an important complement to the Stream Team's regular ambient monitoring, and it has been instrumental in identifying priority areas for clean up efforts.

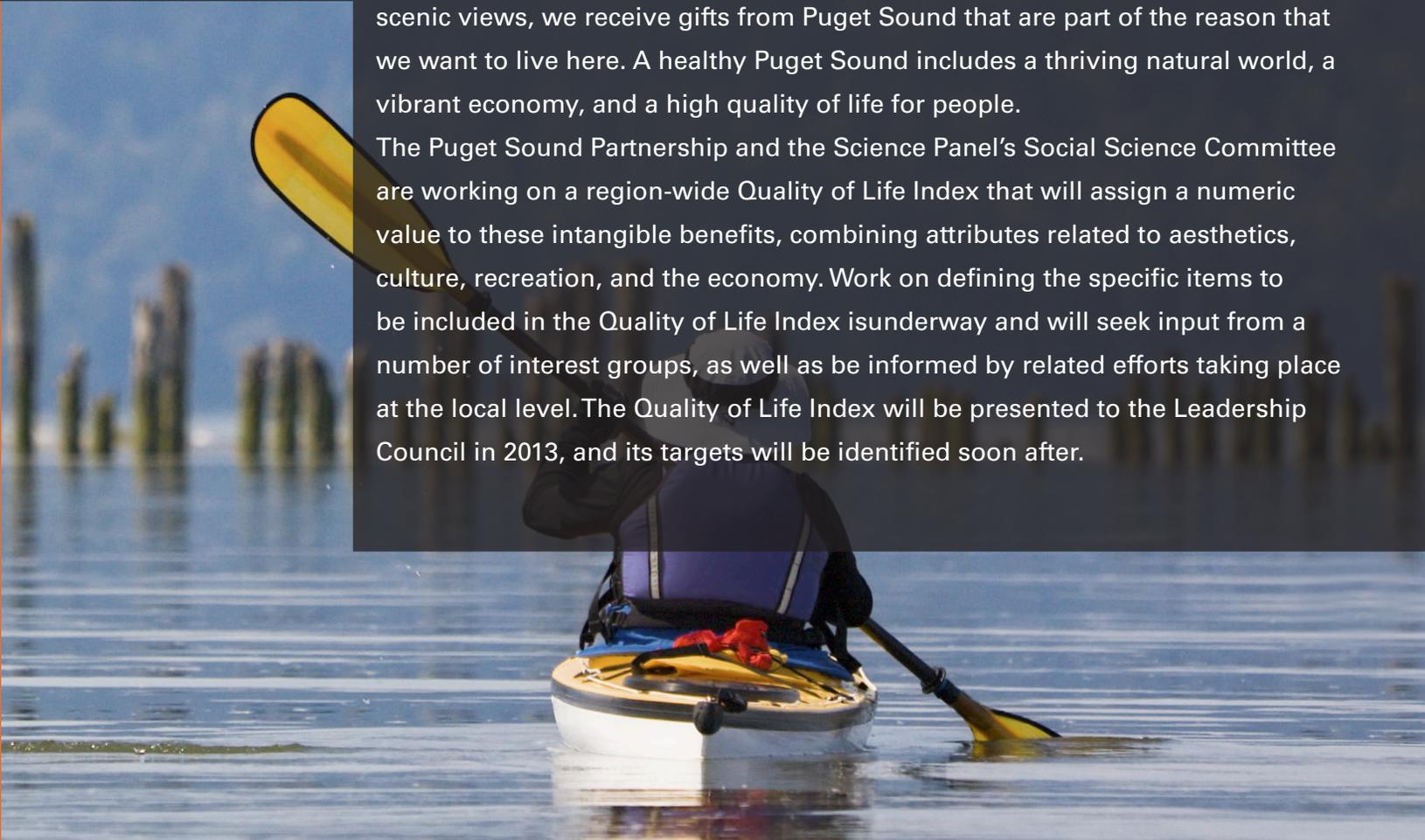
Initial Storm Team efforts in the Samish watershed helped establish baseline data for the river during storm events for the Washington State Department of Health (DOH) Office of Shellfish & Water Protection, which regulates the commercial shellfish industry. DOH uses fecal coliform loading to determine when to issue a pollution closure.



# Puget Sound Quality of Life Index

Recovering the Puget Sound ecosystem will reap many benefits—both tangible and intangible—for all of our residents. Whether we are employed in a marine industry, celebrating our cultural traditions, boating, or simply enjoying the scenic views, we receive gifts from Puget Sound that are part of the reason that we want to live here. A healthy Puget Sound includes a thriving natural world, a vibrant economy, and a high quality of life for people.

The Puget Sound Partnership and the Science Panel’s Social Science Committee are working on a region-wide Quality of Life Index that will assign a numeric value to these intangible benefits, combining attributes related to aesthetics, culture, recreation, and the economy. Work on defining the specific items to be included in the Quality of Life Index is underway and will seek input from a number of interest groups, as well as be informed by related efforts taking place at the local level. The Quality of Life Index will be presented to the Leadership Council in 2013, and its targets will be identified soon after.



# Sound Behavior Index

Many of our common day-to-day behaviors and practices may seem benign on their own, but when multiplied by 4.5 million residents, their cumulative effects can harm Puget Sound. A crucial step in Puget Sound's recovery is fostering beneficial behaviors and reducing harmful ones in order to reverse negative trends influenced by human actions.

The Puget Sound Partnership has recently developed a Sound Behavior Index that is based on a survey that will be conducted every two years among a scientifically selected sample of Puget Sound residents. The survey asks them about specific, measurable, repetitive behaviors that affect water quality and aquatic health. This index also measures social capital—the bonds that bring people together and signify a society's ability to solve complex issues such as environmental problems.

The Sound Behavior Index will distill the region's environmental performance into a single score, which can be tracked across time. By measuring long-term shifts in behaviors and practices across the Puget Sound region, the index gives policy makers a tool to set priorities for regional and local programs. Data for the Index will be available in late 2012.





# Recreational Fishing Permits

Recreational fishing is part of the lifestyle of Puget Sound. For generations, residents of Puget Sound and our many visitors have enjoyed fishing in the Sound and along its numerous rivers and streams. Recreational fishing provides an opportunity to enjoy the outdoors and is part of the lifestyle of Puget Sound. Today, because of the decline in some populations of fish, recreational fishing is closely managed to allow recreational fishing without harming individual species or stocks that need protection. Our long term vision, as recovery proceeds, is to restore the ecosystem and health of Puget Sound to ensure sustainable, ongoing recreational fishing.

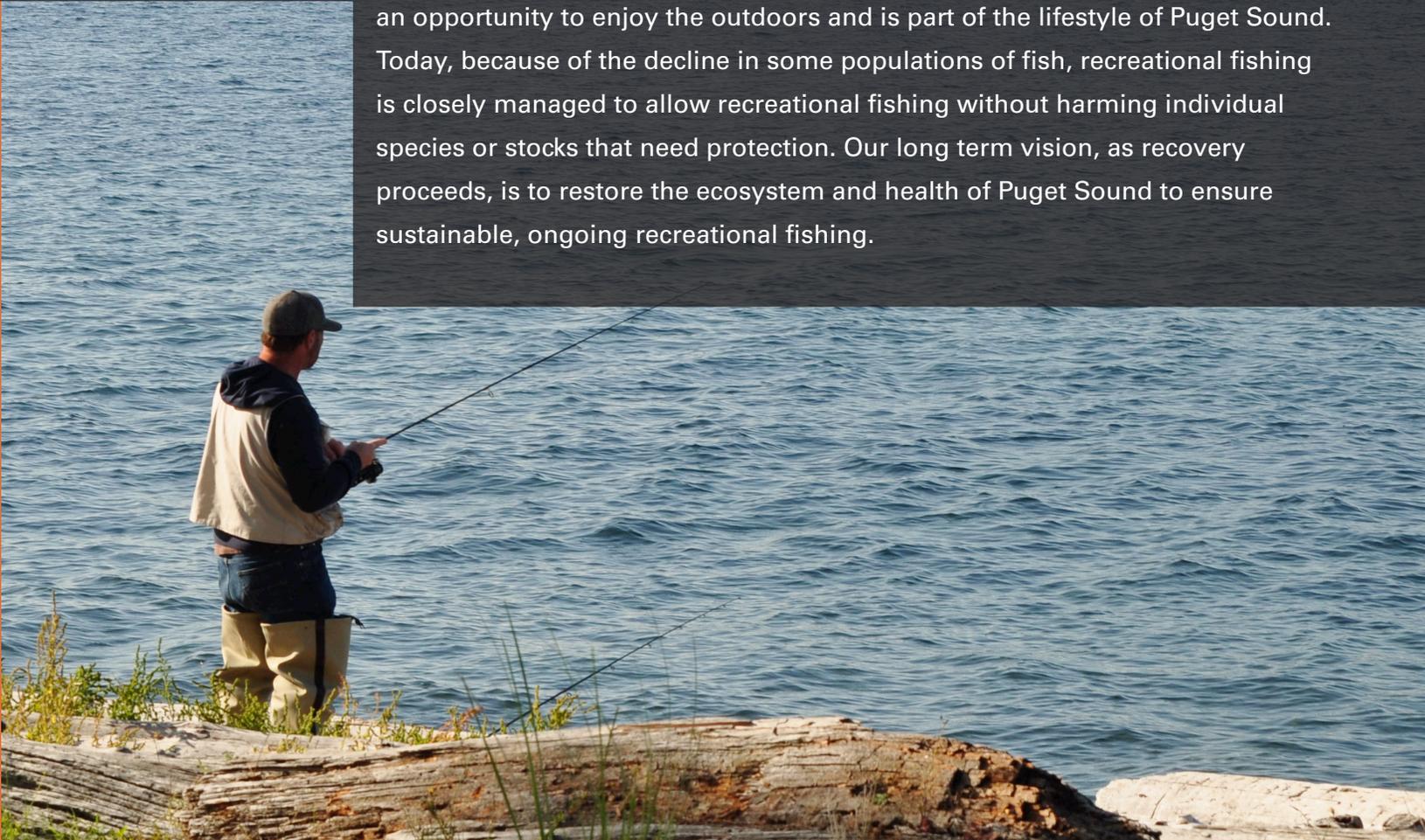


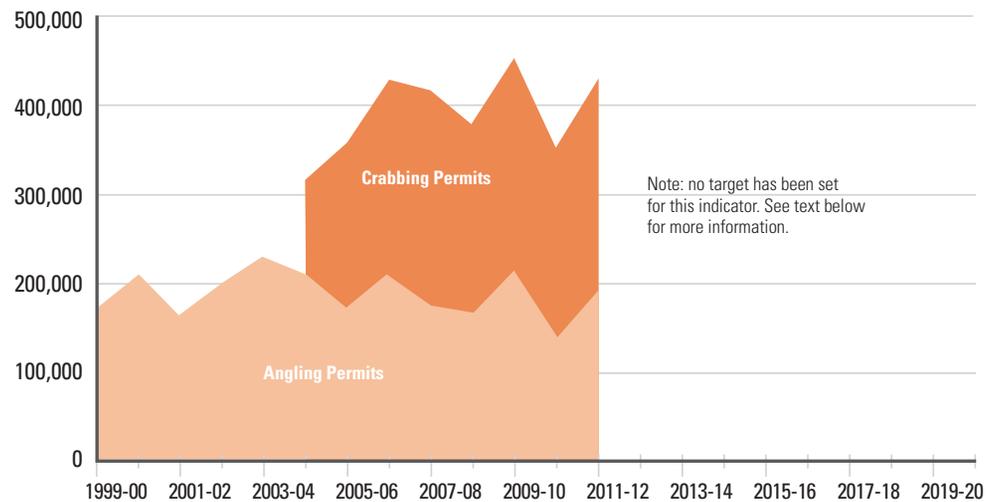
Photo Credit: WSDOT

## Recreational Fishing License

Recreational fishing license sales are being tracked as an indicator of Puget Sound’s overall health, and the prosperity and quality of life for the people in the region. There are currently no 2020 targets for recreational fishing license sales, because the Leadership Council chose not to set a target for recreational fishing licenses at this time.

Staff are considering including this parameter in the Quality of Life Index that is under development.

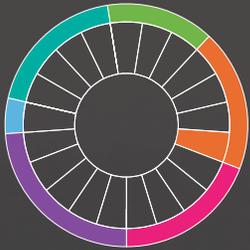
**Recreational Fishing and Crabbing Permits for the Puget Sound**  
 1999-2000 Season through 2019-2020 Season



**Figure1.** Fishing licenses: Number of saltwater or combination license holders that fished or intended to fish in Puget Sound, as estimated by the Dedicated Funds telephone survey conducted after the end of the license year. License years run April 1 through March 31.

Crabbing licenses: Number of shellfish-only license holders that purchased a Puget Sound Crab endorsement. Available since 2004-05, when the Washington State Legislature created the Puget Sound Dungeness crab endorsement, which allows data to be collected.

*Source: Catch Record Card Data, Washington State Department of Fish and Wildlife, Washington Interactive License Database (WILD) Dedicated Fund Telephone Survey*



# Commercial Fisheries Harvest

Commercial fishing is a key industry in Puget Sound. Millions of dollars of revenue are generated annually from fish sales. The 17 federally-recognized tribes in Puget Sound, along with Washington State, jointly manage the fish and shellfish resources. By treaty, tribal fishers collectively and non-tribal fishers collectively are each entitled to up to one half of the harvestable amount. Every year, limits are set based upon a complicated set of factors that are used to predict how many fish will be available for harvest, taking into account the status of protected and non-protected stocks. Overall harvest limits are set to ensure that harvests are sustainable and there will be adequate salmon resources into the future. Then this must be divided into commercial, recreational, subsistence, and ceremonial harvest. Our long-term vision, as recovery proceeds is to restore the ecosystem and health of Puget Sound to ensure sustainable ongoing fishing, including commercial..



Photo Credit: Canopic@flickr

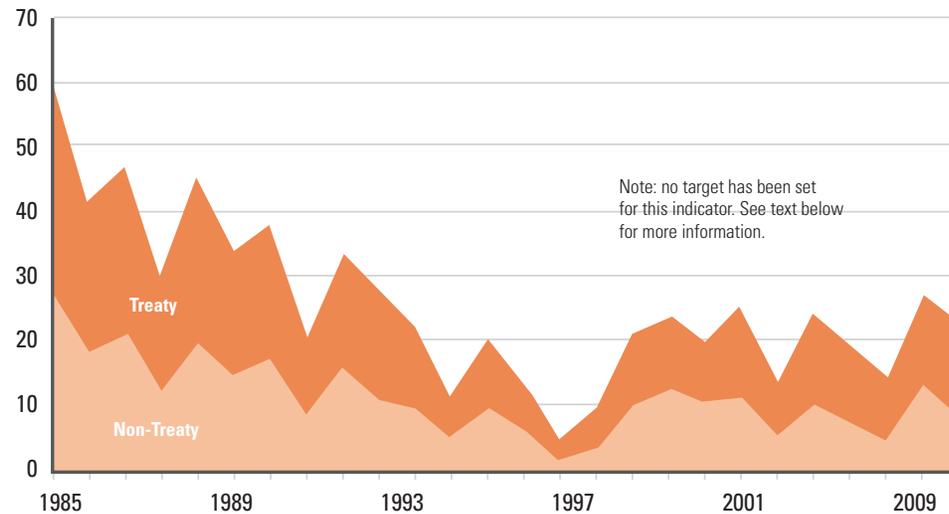
# Commercial Fisheries Harvest

2020 Target: There are currently no targets for commercial fishing

As in the case of recreational fishing permits, the governing board of the Puget Sound Partnership, the Leadership Council, chose not to set a target for commercial fisheries harvest at this time.

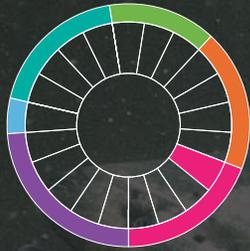
Staff are considering including this parameter in the Quality of Life Index, which is under development.

**Pounds of All Salmon Caught in Puget Sound Commercial Harvest**  
*In Millions, 2000-2020*



**Figure1.** The graph shows the pounds (in millions) of all salmon sold in commercial fisheries. Additional commercial benefit accrues from secondary businesses (e.g. restaurant sales) and recreational fisheries as well (not shown here). Note that commercial harvest also does not represent all harvest impacts on a species (e.g. unsold by-catch or gear-related mortalities). The treaty/non-treaty breakout shown here does not reflect allocation balance for a number of reasons.

*Source: Historic Catch and Landing System (HCLS) and TOCAS and LIFT systems, jointly maintained by the treaty tribes and the Washington Department of Fish and Wildlife.*



## Chinook Salmon

Chinook salmon are a cultural icon of the Pacific Northwest. Truly the “King” of Pacific salmon, Chinook are the largest species. Adults often exceed 40 pounds and reports of 100-pound fish are common. Returning Chinook are highly prized by anglers and commercial fisherman and are a favorite food of Orca whales. Puget Sound Chinook return in the summer and fall to spawn, build gravel nests, and lay their eggs in rivers and streams. Their carcasses provide nutrients for freshwater invertebrates which in turn provide food for young fish. As they grow, juvenile Chinook move from freshwater to estuaries and nearshore areas to find food and cover to hide from predators. They eventually move to more exposed shorelines where they depend on eelgrass and kelp beds as they continue their migration to the ocean. Puget Sound Chinook are about one-third as abundant as they were in the early 1900s they were listed in 1999 as “threatened” under the federal Endangered Species Act.

# Chinook Salmon

**INDICATOR:**  
**Chinook Salmon Population Abundance as measured by spawning escapement**

**TARGET:**  
 2020 Target: stop the overall decline and start seeing improvements in wild Chinook abundance in 2-4 populations in each biogeographic region. (note: for the purposes of tracking this target, we report abundance as the number of natural spawners)

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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**CURRENT STATUS** 2006-2010      **BASELINE REFERENCE**      **2020 TARGET**

All 5 regions with declining populations      No change (no regions show any overall improvement or decline from baseline)      All 5 regions meeting target for improving populations

From 2006-2010, most Chinook populations showed large annual variability in abundance but no discernable increasing or decreasing trends. Overall, only two populations showed a clear improving trend, and 1 population showed a declining trend. None of the 5 regions have yet met their targets for improving population abundance.

## Progress towards target

For the 22 remaining populations of Puget Sound Chinook salmon, two increased and one declined in abundance from 2006 to 2010 (Table 1). Thus, none of the five regions are currently meeting their target of improving trends in 2-4 populations in each region.

After remaining between 30,000 – 40,000 between 1985 and 1991, the total number of Puget Sound Chinook spawners dropped to just over 20,000 in 1993 before beginning an overall upward series of ups and downs to a high of 60,000 in 2004. Numbers have declined since then to just over 20,000 in 2009 (Figure 1; NOAA Status Review Update, 2011).

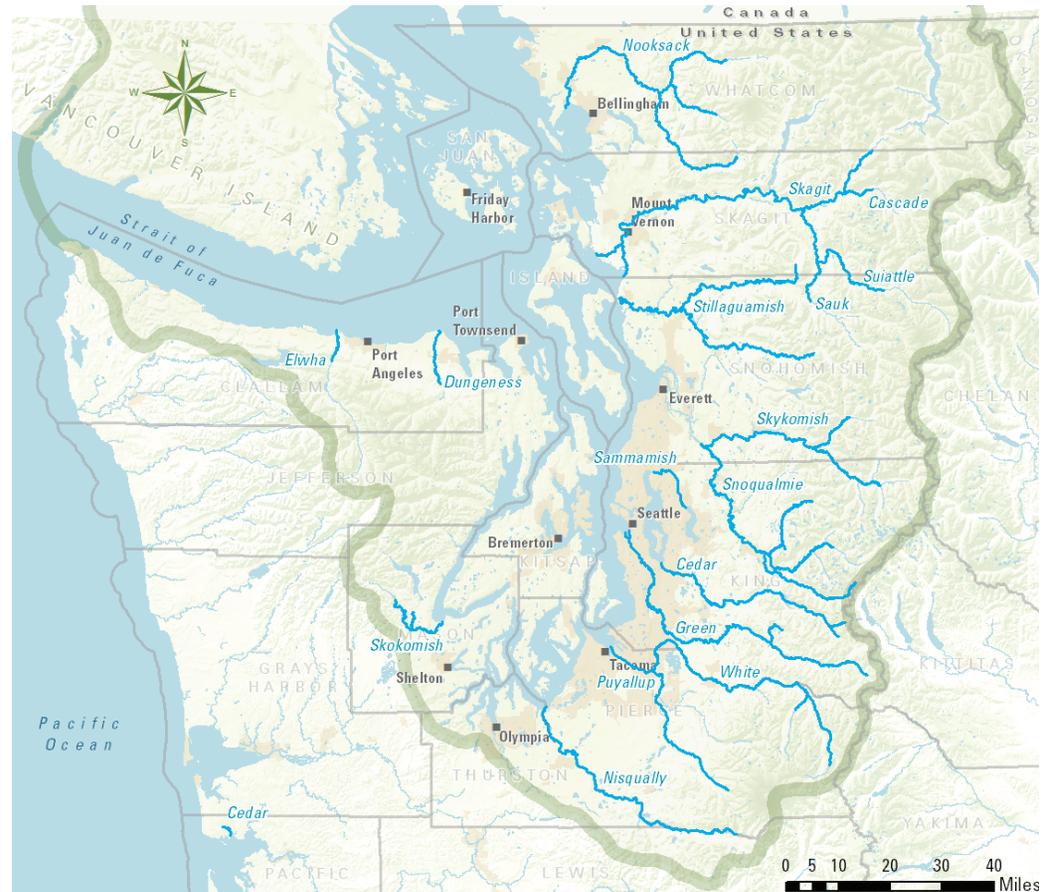
Numbers of Chinook salmon have not increased, and most populations remain well short of their recovery goals. Nonetheless, the fact that we have any natural-origin Chinook left is testament to the success of our restoration and harvest reduction work so far.

## What is this indicator?

Population abundance of Chinook salmon is represented by spawning escapement numbers, which are typically estimated by counting the number of redds (gravel nests) in a river. Redds are counted by walking the stream or from a boat or aircraft. There are 22 populations of Chinook that return to specific watersheds in the Puget Sound Region. Historically, there is

evidence of additional populations of Chinook that are now extinct.

Natural spawners are reported here and include both natural origin spawners and hatchery origin spawners. The percent of the total spawners that are hatchery-origin varies across populations from 0 to 78%. The proportion of spawners that were natural or hatchery origin is estimated based on composition of carcasses, which may or may not be equal to the percentage of spawners that were actually natural or hatchery origin.



**Chinook Salmon**

	Rivers having Chinook salmon populations		County Border
			Salish Sea Basin Boundary
			Cities and Urban Growth Areas

Source: National Hydrography Dataset

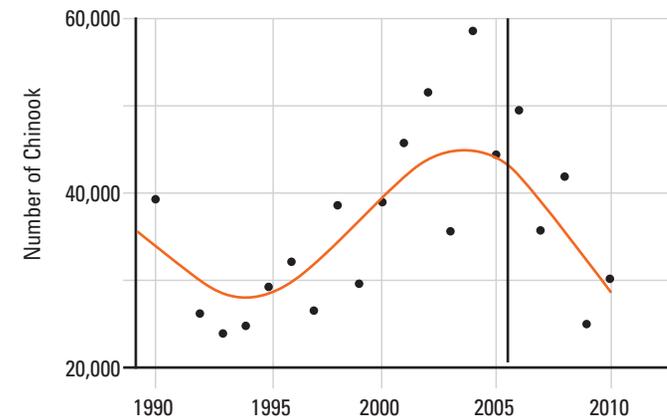
# Chinook Salmon

## Interpretation of data

### Status and trend

- Chinook salmon populations in Puget Sound exhibit large annual variations in abundance, and possibly long-term (10 or more year) fluctuations that confuse simple evaluations of short or long-term “trends” in numbers (Fig 1).
- All Puget Sound Chinook populations are currently well below abundance levels (planning ranges) identified as required for recovery to low extinction risk in the recovery plan
- Looking at just the most recent 5-year period for which we have consistent data, most populations do not exhibit any statistically significant trends. Only two populations show an increasing trend, and 1 population shows a decreasing trend ( $p < 0.05$ ; Table 1).
- Although total spawner abundance has not changed significantly over the period from 1985-2009, the total number of natural origin recruits and overall productivity has declined according to NOAA.
- Long-term spawner abundance numbers have shown little progress towards the target, with numbers declining since the early 2000's. However, in their recent 5-year Status Review (Ford 2011), NOAA determined that the available information does not suggest that a change in biological risk category (i.e. “likely to become endangered”) is likely for Chinook salmon in Puget Sound, and they continue to be listed as “Threatened” under the Endangered Species Act.

**Abundance of Chinook spawners in Puget Sound  
1990 - 2010**



**Figure 1.** Total natural spawners of Chinook salmon observed in Puget Sound watersheds. Included in the counts are natural-origin and hatchery-origin spawners. Shown are natural spawners for each year (points) and a fitted line derived from locally weighted scatterplot smoothing tables.

Source: NOAA A&P tables

**Table 1.** (opposite) Puget Sound Salmon Populations.

Data Sources: Washington Department of Fish and Wildlife. NOAA's Salmon Population Summary (SPS) Database. NOAA's Abundance and Productivity Tables. Unpublished, Personal communication, Mindy Rowse. Ford, M. J. (ed.). 2011. Status Review Update for Pacific Salmon and Steelhead Listed Under the Endangered Species Act: Pacific Northwest. U.S. Department of Commerce, NOAA Technical Memo.

<sup>1</sup> Recovery Plan for the Puget Sound Chinook Salmon (National Marine Fisheries Service, 2006).

<sup>2</sup> NOAA's Abundance and Productivity tables. Trends are significant at the 95% confidence level.

<sup>3</sup> Status Review Update for Pacific Salmon and Steelhead Listed under the Endangered Species Act (Ford [ed.], 2011, NOAA).

**Puget Sound Chinook Spawner abundance and trends**

Region/Population	Recovery Goal <sup>1</sup>	5-yr average <sup>2</sup>	% of average recovery goal	Trend <sup>3</sup> (1999-2008)	Trend <sup>2</sup> (2006-2010)
<b>Strait of Georgia</b>					
N Fk Nooksack	3,800 -16,000	1,530	15%	Increasing	Increasing
S Fk Nooksack	2,000-9,100	460	8%		
<b>Strait of Juan de Fuca</b>					
Elwha	6,900-17,000	1478	12%		
Dungeness	1,200-4,700	340	12%		
<b>Hood Canal</b>					
Skokomish	Unknown	1001			
Mid-Hood Canal	1,300-5,200	91	3%		
<b>Whidbey Basin</b>					
Suiattle	160-610	226	59%		
N Fk Stillaquamish	4,000-18,000	903	8%		
S Fk Stillaquamish	3,600-15,000	73	1%	Declining	
Cascade	290-1,200	320	43%		
Upper Sauk	750-3,030	606	32%		
Lower Sauk	1,400-5,600	458	13%		
Skykomish	8,700-39,000	3152	13%		
Snoqualmie	5,500-25,000	1702	11%		
Upper Skagit	5,380-26,000	8,606	55%		Declining
Lower Skagit	3,900-16,000	1,708	17%		
<b>Central/South Puget Sound</b>					
White R	unknown	1,629		Increasing	
Green/Duwamish	27,000	2,964	11%		
Sammamish	1,000-4,000	379	15%		Increasing
Cedar	2,000-8,200	921	118%	Increasing	
Nisqually	3,400-13,000	1,876	23%		
Puyallup	5,300-18,000	2,117	18%		

Local Story - Elwha



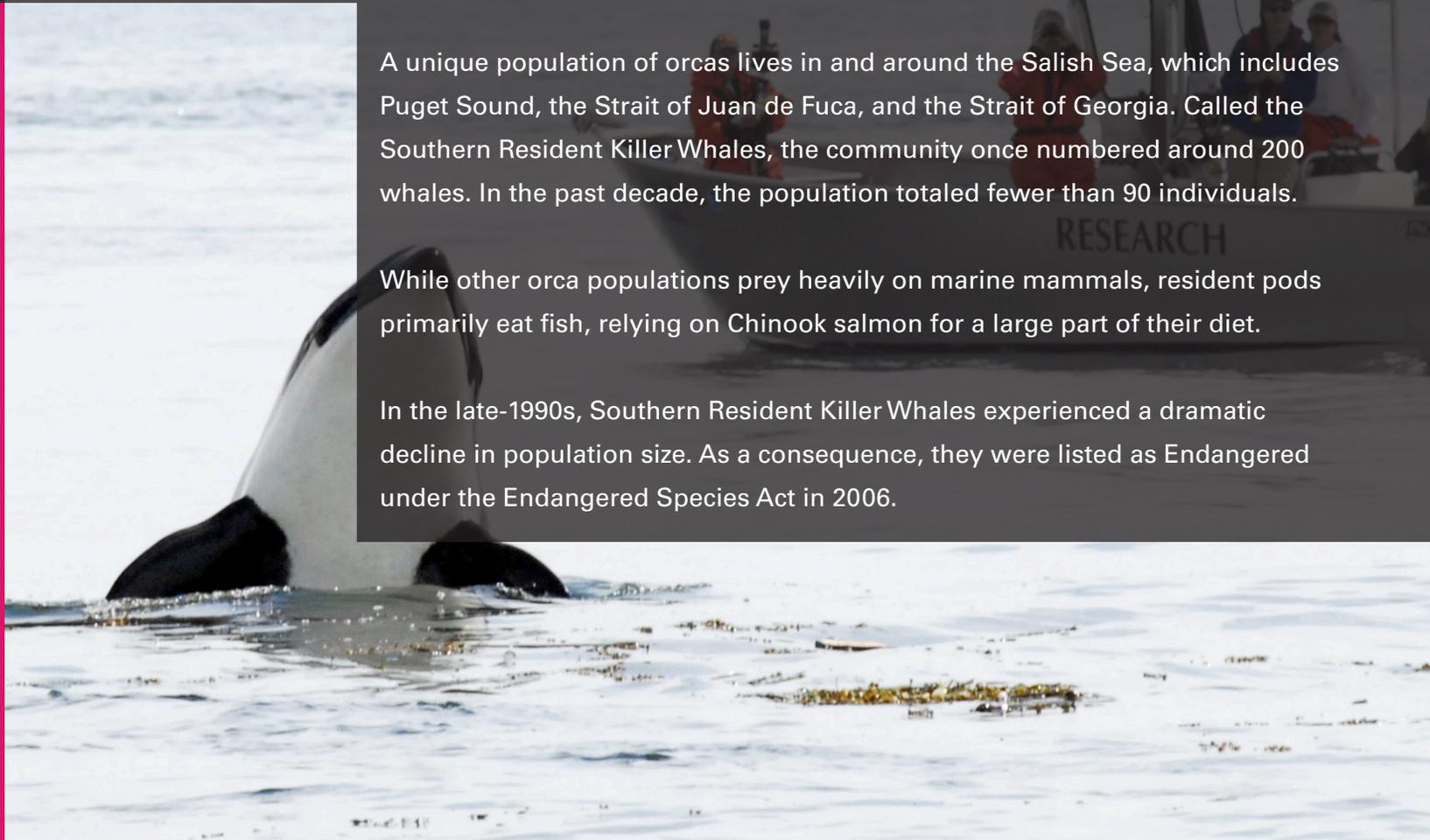
## Orcas

Killer whales, also called orcas, are among Puget Sound's most distinctive and charismatic inhabitants. They occupy an important niche at the top of the food web and support a multi-million dollar whale watching industry.

A unique population of orcas lives in and around the Salish Sea, which includes Puget Sound, the Strait of Juan de Fuca, and the Strait of Georgia. Called the Southern Resident Killer Whales, the community once numbered around 200 whales. In the past decade, the population totaled fewer than 90 individuals.

While other orca populations prey heavily on marine mammals, resident pods primarily eat fish, relying on Chinook salmon for a large part of their diet.

In the late-1990s, Southern Resident Killer Whales experienced a dramatic decline in population size. As a consequence, they were listed as Endangered under the Endangered Species Act in 2006.



# Orcas

**INDICATOR:**  
**Number of Southern Resident Killer Whales**  
 Indicator lead: Ken Balcomb, Center for Whale Research

**TARGET:**  
 By 2020, achieve an end of year census of Southern Resident Killer Whales of 95 individuals, which would represent a 1% annual average growth rate from 2010 to 2020

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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There were a total of 85 Southern Resident Killer Whales as of mid-August 2012. This was one less whale than the baseline reference of 86 whales.

## Progress towards 2020 target

The 2020 target of reaching 95 whales has not been met, and in the short-term there has been no progress. Since 2010, the Southern Resident Killer Whale population has never been larger than 88 whales. Furthermore, as of August 2012, the size of the population was smaller by one whale relative to the 2010 baseline reference of 86 whales.

Although there has been no progress made since 2010, the population has been growing, albeit slowly at about 1% per year, over the longer term (1979 to 2010). This population growth trend is consistent with the 2020 target. However, trends could easily be reversed, as the Southern Resident Killer Whale population is very vulnerable to a variety of factors, making progress towards the 2020 target tenuous at best.

## What is this indicator?

The Southern Resident Killer Whale population in Puget Sound is actually a large extended family, or clan, comprised of three pods: J, K, and L pods. Although they can be seen throughout the year in Puget Sound, they are most often seen during the summer, especially in Haro Strait west of San Juan Island, the Strait of Juan de Fuca, and in the Strait of Georgia near the Fraser River.

Threats to Southern Resident Killer Whales include contaminants, prey availability, vessels, and noise pollution. Additional human activities, such as underwater military activities, have been identified as a potential concern for killer whales, particularly on the outer coast, although this issue has not been fully evaluated. Their small population size and social structure put them at risk for a catastrophic event, such as an oil spill, or a disease outbreak, that could impact the entire population.

Resident orcas were chosen as an indicator because they are top-level predators, spend a portion of the year in Puget Sound to feed and socialize, and are threatened by some of the pressures on the Sound, such as pollution and declining salmon and herring runs. Although a robust orca population is an important recovery goal both at the state and federal level, there may be limits to how much the orca indicator tells us about the overall health of Puget Sound. The Southern Resident Killer Whale population migrates in and out of the area, and thus is not entirely dependent on Puget Sound and its resources.

## Interpretation of data

### *Current Status and Trend*

The census of the Southern Resident Killer Whale population, conducted annually by the Center for Whale Research, is an important method by which to assess the status and trends of this endangered population. The entire population is counted with a high degree of certainty using photo identification techniques. Sighting networks throughout Puget Sound support the census. Two of these networks are showcased elsewhere in this report (please see “Volunteers Gather Important Data on Orcas” on page 55).

Other populations of whales, such as Transients and Northern Resident Killer Whales, also frequent the Salish Sea, but their numbers are not reported here because the indicator and target focus only on Southern Resident Killer Whales.

The population size of Southern Resident Killer Whales changes temporarily throughout the year as whales are born and die. For example, as of the end of 2011 there were 88 Southern Resident Killer Whales in total, with 26 in J pod, 20 in K pod and 42 in L pod (Figure 1). Since December 2011 four whales have gone missing (J30, K40, L5, L12) and are presumed dead. A

fifth missing whale (L112), drifted ashore dead in February on the outer coast of Washington. However, two new calves (J49, L119) have been seen since the beginning of 2012 such that, at the time of publication, there were 85 Southern Resident Killer Whales in Puget Sound.

Thus, abundance did not change significantly in the last decade (Figure 1). However, although there has been no progress in the short term, analysis of historic data shows modest growth.

### *Historic trends*

Since data became available in 1973, the Southern Resident Killer Whale population has by turns declined and grown. Despite year-to-year variability, total population size grew over the past four decades by about 1% per year: there were fewer than 70 whales in the early 1970s, and an annual average of 85 whales in the 2000s (Figure 1). Yet, compared to the Northern Resident Killer Whale population living in the Strait of Georgia, the Southern Resident Killer Whale population is smaller and has been growing more slowly overall.

At the pod level, the long-term population growth rate (from 1979 and 2010) is slightly higher for J and K pods combined (~1.02) than for L pod (~1.01). L pod is the largest of all pods. However, this pod has been in decline since the early 1990s.

The other two pods, J and K, are roughly the same size. Both J and K pods are growing, with J pod increasing more rapidly than K pod. This is likely due to the limited reproductive potential in K and L pods. Indeed, the sex ratio of K and L pods is skewed toward males. The lack of reproductive females, poor survival of calves, and factors associated with small population sizes such as inbreeding, along with human-caused threats, are a concern for the viability of this population.

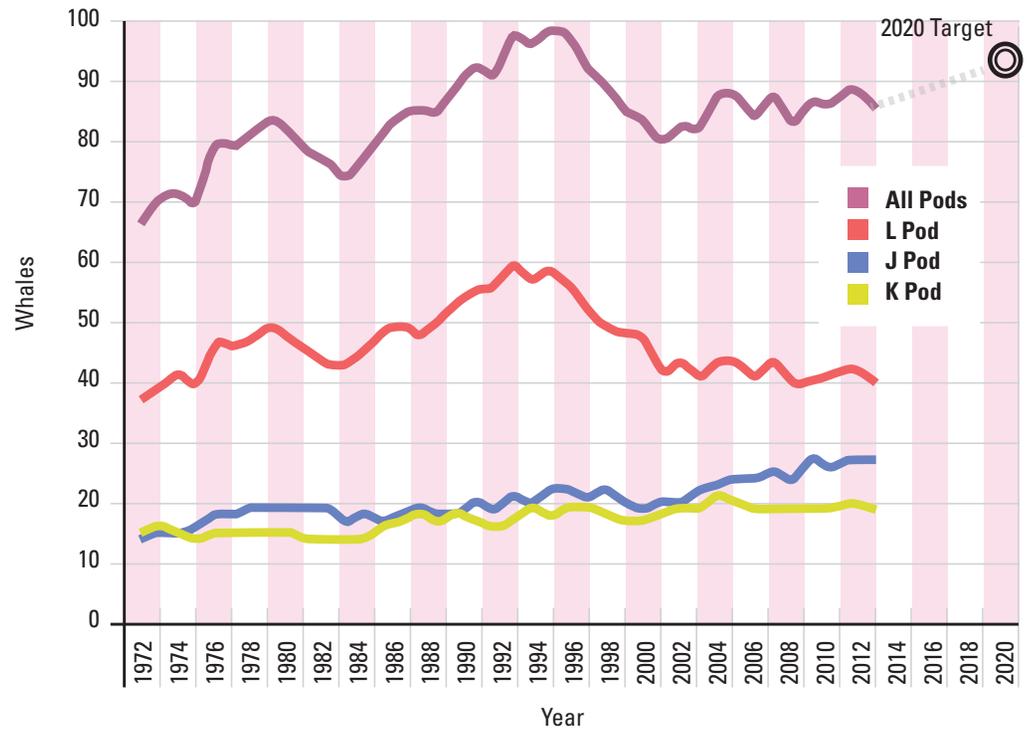
# Orcas

J pod is also the pod that spends the most time in Puget Sound compared to the other two. The fact that Southern Resident Killer Whales only spend part of their lives in Puget Sound, and that the pod that spends the least time in Puget Sound has the steepest decline, suggests that the whales are impacted by conditions outside of Puget Sound.

Although the Southern Resident Killer Whale population's long-term trend for population growth meets the PSP growth rate target, the population growth rate does not meet the legal recovery criteria to delist the Southern Resident Killer Whales from the Endangered list (i.e., meeting an average growth rate of 2.3% per year for 28 years).

Restoration of this population of long-lived, slow-reproducing killer whales is a long-term effort that requires cooperation and coordination of West Coast communities from California to British Columbia. It will take many years to fill key data gaps and assess the effectiveness of ongoing recovery actions for the whales, salmon, and their habitat, and to observe significant increases in the Southern Resident population.

**Number of Southern Resident Killer Whales in Puget Sound**  
Annual, 1972-2011



**Figure 1.** Number of Southern Resident Killer Whales in Puget Sound each year between 1972 and 2011.  
Source: Center for Whale Research

## LOCAL STORY

# Volunteers Gather Important Data on Orcas

## Salish Sea Hydrophone Network and Orca Network

The Salish Sea Hydrophone Network and Orca Network are two citizen science projects dedicated to furthering our understanding of abundance, distribution, behavior, and habitat use by the endangered population of Southern Resident Killer Whales, also called orcas. The Hydrophone Network lets the public listen for orcas through their computers, while the Orca Network gathers and disseminates sightings of orcas as they move between Puget Sound, the Fraser River, and the Pacific Ocean.

## Listening in on Orcas

The Salish Sea Hydrophone Network started in 2007 and now includes five hydrophones (underwater microphones): two on San Juan Island, and one each at Port Townsend Marine Science Center, the Seattle Aquarium, and Neah Bay. By monitoring the sounds streaming live on orcasound.net, scientists, educators, and the public can help detect loud calls and clicks made by orcas as they communicate and hunt. Listeners can also help detect noise pollution caused by Naval sonar and vessel traffic.

For orcas and other whales, the underwater sound environment is critical to their sensory experience and behavior. Orcas communicate with each other over short and long

distances with a variety of clicks, chirps, squeaks, and whistles. They also use echolocation to locate prey and to navigate.

Hydrophone Network volunteers log their observations on a collaborative Google spreadsheet online or report detections via email. Volunteer observations help to direct field research, including prey sampling studies that revealed the orcas strong preference Chinook salmon and fecal sampling studies that show orcas may be prey limited. In addition, the hydrophone network enabled early detection of a new orca calf in 2009.

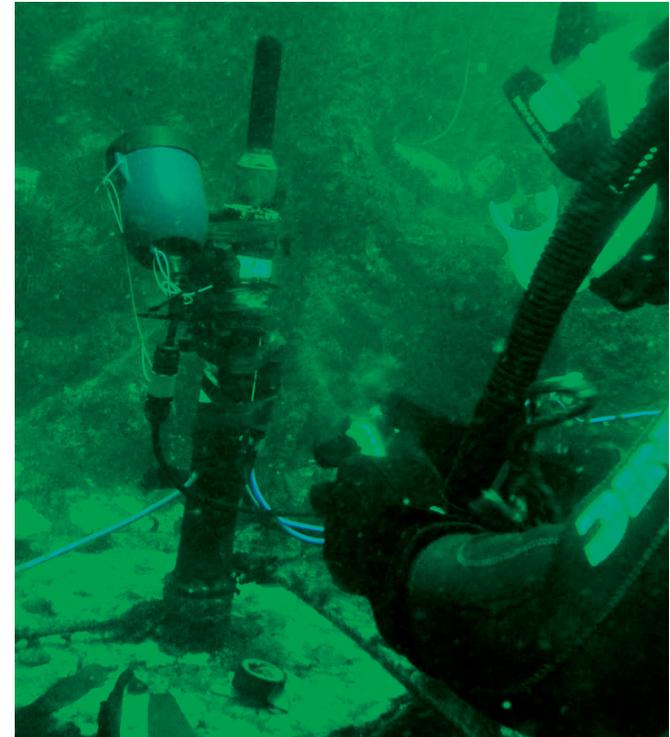
The Network allows friendly competition and collaboration between volunteer listeners and computers. In detecting when orcas passed by a proposed tidal turbine site near Port Townsend, human listeners heard the orcas 10 of the 22 times they passed by (45%) while auto-detection software detected them 14 times (64%). When both approaches were combined, orcas were detected 17 times (77%).

The number of orcasound.net visitors per day rises from a mid-winter low of about ten to a summertime average of approximately 100, with occasional spikes to 200-350. Listeners are predominantly from the U.S. (75%) and Canada (13%), so observers from distant time zones are

sought to boost nighttime detection rates.

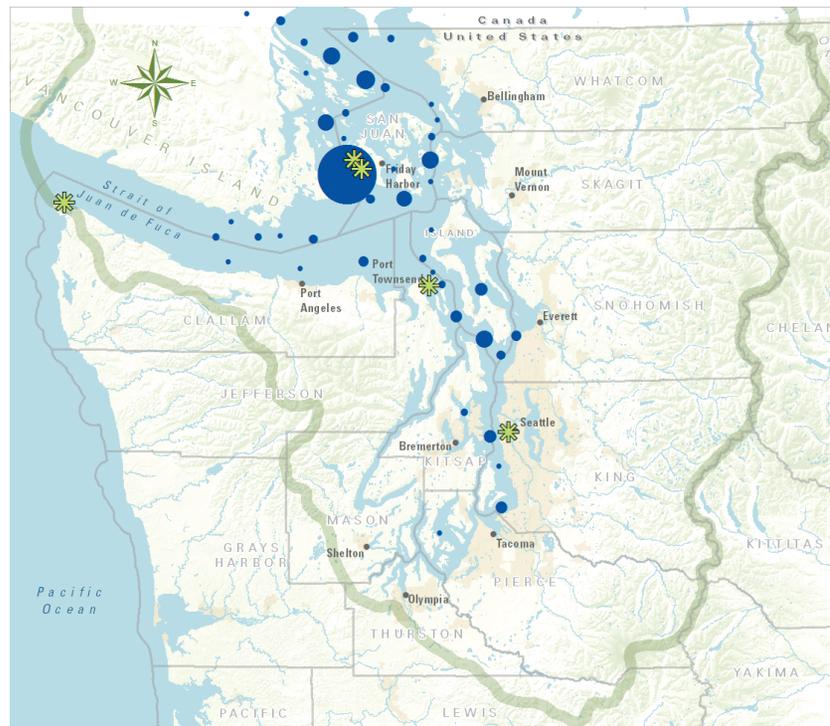
## Watching for Orcas

Given the wide-ranging travels of the Southern Resident Killer Whales and other whales in the Salish Sea, it is impossible for the few whale researchers to track all the individuals on a regular basis.

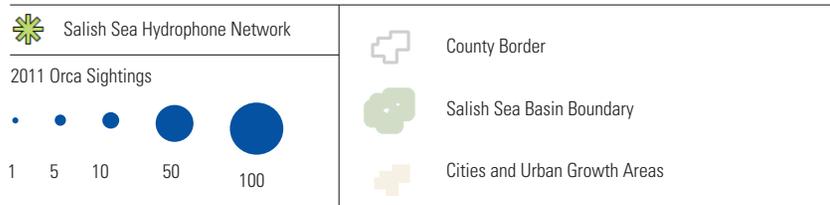


Lime Kiln Hydrophone. Photo Courtesy of Dave Howitt

## LOCAL STORY



### Whale Sightings Networks



**Figure.** Salish Sea Hydrophone Network locations and 2011 orca sightings from the Orca Network Whale Sightings Network. Orca sightings data were compiled from monthly sighting maps and include only orca (resident or unknown) reports and only one report per location per day (although it is possible that the Network received more than one report per location per day).

Source: Salish Sea Hydrophone Network and Orca Network

Orca Network's Whale Sighting Network was started in 2001 to provide more information on Southern Resident Killer Whale travels in inland and coastal waters. In addition, the network also raises awareness, educates the public, and provides a networking and communication system for researchers, educators, and the public. There are currently more than 7,000 participants on the Sighting Network email list, and more than 14,000 subscribers to the Facebook page.

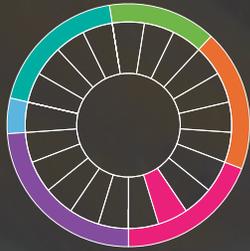
With more than 15,000 sightings reported to date by the hundreds of participants in the Sighting Network, Orca Network harnesses broad public interest in whales to provide researchers with critical information for tracking these endangered whales.

Through the Sighting Network, volunteers report sightings of whales, which provide valuable information on habitat use, social and foraging patterns, and behaviors for researchers managing the recovery of Southern Resident Killer Whales. Reports are compiled and sent to researchers, natural resource managers, and educators and are available on the Orca Network website, Facebook page, and Twitter feed.

The Sighting Network also provides an important communication and tracking tool during emergency situations such as oil spills and entangled whales. It also helps identify orcas out of their usual habitat, such as Springer, the Northern Resident orca calf who was reported through the Sighting Network in Swinomish Channel, then off Edmonds, before showing up off Vashon Island. She was relocated to her home in Canadian waters in 2002.

More information about the Salish Sea Hydrophone Network and the the Orca Network's Whale Sighting Network can be found at:

[www.orcasound.net](http://www.orcasound.net) | [www.orcanetwork.org](http://www.orcanetwork.org)



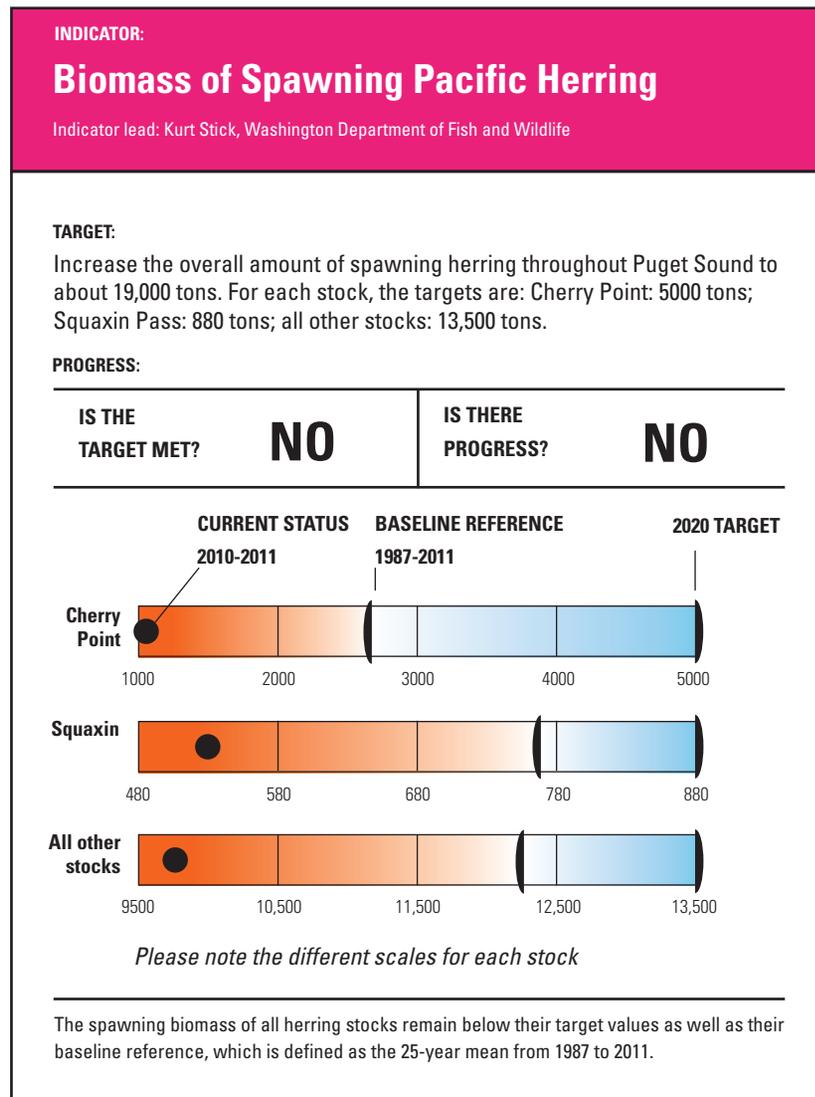
## Pacific Herring

Pacific Herring are one of the most abundant forage fish species in Puget Sound. These small, schooling fish play a unique role in the food web: they are an essential source of food for larger fish, seabirds, and marine mammals, and as such, transfer energy from their plankton prey to these higher-level consumers.

Because they are a vital component of the marine food web, Pacific Herring are one key indicator of the overall health of Puget Sound. Herring stocks require clean water and natural shorelines, so their continued survival depends on maintaining links between nearshore and open-water habitats.

Although the number of herring in Central and Southern Puget Sound, while variable, has shown little trend over the past 40 years, the population of this genetically unique stock of Pacific Herring, the spring spawning Cherry Point stock in North Puget Sound, has declined by 90% since 1973.

# Pacific Herring



## Progress towards 2020 target

None of the 2020 target values for individual Pacific herring stocks or groups of stocks are met, and no progress has been made. Instead, the current spawning biomass of all stocks are below both their 25-year mean baseline reference and their 2020 target values (Figure 1).

The Cherry Point herring stock in North Puget Sound, once the largest stock in the Sound, has declined by 90% since the earliest sampling date in 1973 and shows little sign of recovery.

The Squaxin Pass and other Puget Sound stocks do not exhibit the sharp decline seen in the Cherry Point stock. Although they show broad annual fluctuations, these stocks are relatively closer to their target values. In fact, in some years, these stocks have gone above their target values. However, these stocks are currently at biomass levels below their target values (Figure 1).

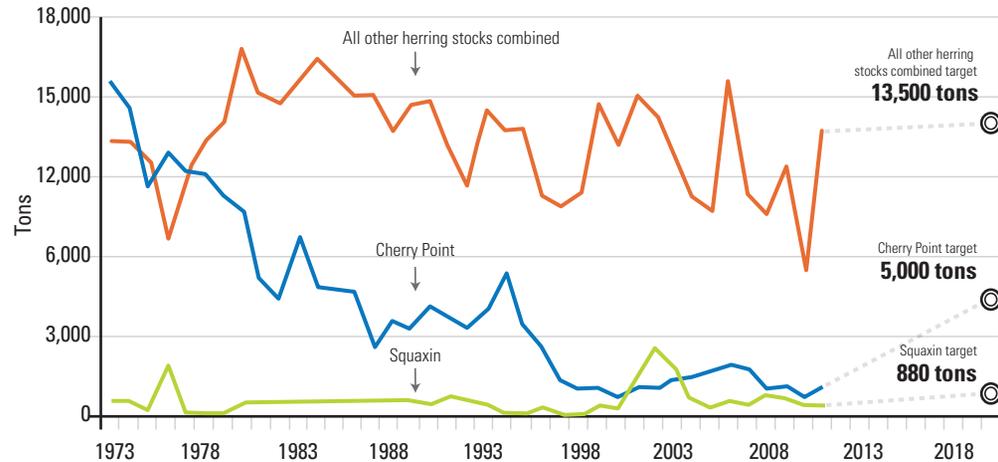
Predicting the future condition of herring spawning biomass is difficult. Owing simply to natural fluctuations in abundance, the Squaxin and other Puget Sound stocks in Central and South Puget Sound may reach their respective target values again over the next eight years. However, there is no evidence to suggest that herring spawning biomass at Cherry Point will increase and reach its target value by 2020, or that the biomass of all other stocks will be sustained at or above their target values. Although potential threats have been identified, there is no consensus on which threats limit the stocks or how best to manage these stocks to achieve the 2020 target.

### What is this indicator?

The spawning biomass of Pacific herring is the estimated annual tonnage of spawning herring in Puget Sound. Herring spawning biomass is currently based on spawn deposition surveys conducted by the Washington Department of Fish and Wildlife (WDFW) to estimate the quantity of eggs deposited by herring on marine vegetation. Egg abundance is then converted to the estimated biomass of spawning herring.

Reflecting genetic studies that have identified three separate groupings of Puget Sound herring stocks (Figure 2), the Partnership has established three separate targets for Cherry Point, Squaxin Pass and all other stocks combined. Estimates of spawning biomass have been attempted for all known Puget Sound herring stocks by WDFW annually since 1996, and for Cherry Point herring since the early 1970s. The baseline references, the 25-year mean biomass for each stock (1987 – 2011), are intended to provide perspective for the current status of each stock (the 2-year mean of 2010 and 2011) and the targets. The baseline reference and evaluation of current stock status reported here are not based on a conventional fishery stock assessment, which takes into account growth, maturity, fecundity, and mortalities.

**Spawning biomass of Pacific Herring stocks in Puget Sound**  
*In tons, 1973 - 2011*



**Figure 1.** Annual estimates of Puget Sound herring spawning biomass, by genetic grouping (1973 to 2011) with associated targets.

*Source: Washington Department of Fish and Wildlife, Fish Program*

# Pacific Herring

## Interpretation of data

The Puget Sound herring data are characterized by broad year-to-year fluctuations, which is typical of Pacific herring populations and likely reflects natural environmental and demographic variability. Indeed, in Puget Sound the bulk of the biomass of the “all other stocks” grouping is contributed by different stocks in different years, further implicating the role of site-specific variability.

The exact causes of the Cherry Point decline are unknown, but it has been variously attributed to many potential factors such as chronic pollution (e.g., PCB and PAH contaminants), oil spills, overfishing, parasites, disease and changes in abundance of predators or prey. Changes to the natural shoreline, including nearby industrial construction and operation, also may play a role. Finally, the extent to which food-web interactions may limit herring populations, and how such interactions are mediated by the effects of climate change, are not well understood. Further studies are needed to elucidate the effect of these possible pressures.

Several factors contribute to difficulties in understanding Cherry Point stock declines and in the trends of other herring stocks, including survey methods and exploitation rate analysis.

Since 1973 at Cherry Point and 1986 for the rest of the stocks, WDFW has conducted a combination of spawn deposition surveys and Acoustic-Trawl (AT) surveys to estimate herring spawning biomass. Until 1996, the spawning biomass of the larger Puget Sound stocks typically was assessed by both methods each year while the smaller stocks were surveyed by spawn deposition surveys every three-years. Since 1996, the spatial coverage of both survey methods has been progressively reduced until the AT surveys were finally discontinued in 2009 due to budget reductions. Spawn deposition surveys and AT surveys each have their advantages depending on the size and type of substrate for eggs, therefore work at their best when used together.

In addition to spawning biomass, biological samples used to estimate growth, mortality, and recruitment were obtained from the AT surveys. These data which, are not currently being collected, are useful for assessing the stocks’ population dynamics and capacity to meet the targets, and to understand the mechanisms driving these trends.

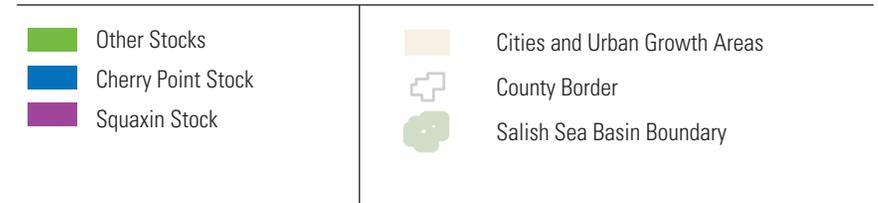
For example, for the Cherry Point and most other Puget Sound stocks, there has been a shift in the age structure of the population since the late 1970s and early 1980s towards younger fish, which probably affected their productivity and slowed down their recovery.

As mentioned above, not all spawning grounds/stocks have been surveyed every year. To complete the time series depicted in Figure 1, data gaps were filled in with the long-term average for the stocks with missing data. Given the importance of this indicator to the recovery of the Sound, monitoring methods and analysis should be reviewed and improved to more completely and accurately report status and trends.

Commercial exploitation of Puget Sound herring is limited to a bait fishery, which is allowed to take up to 10% of the cumulative Puget Sound spawning biomass of Central and South Puget Sound stocks. Landings in the past 10 years have ranged from 3 to 5% of this total and are not expected to increase significantly in the near future. This is a conservative exploitation rate, compared to a typical global exploitation rate of 20%. Although a 10% exploitation rate is precautionary, a more rigorous analysis of an appropriate exploitation rate, that accounts for current population dynamics (including age composition) and ecosystem needs (e.g., the extent of predator dependency on forage fish), is desirable to ensure sustainability of the Puget Sound herring stock.



**Pacific Herring Spawning Grounds**



**Figure 2.** Distribution of Pacific herring spawning grounds in Puget Sound.  
*Source: Washington Department of Fish and Wildlife, Fish Program.*

# Birds

A large community of aquatic and terrestrial bird species depend on Puget Sound's watershed for survival. Walk along the shores of Boundary Bay in any season, and you'll see an ever-changing cast of birds. Thousands of seabirds, seaducks, and waterfowl migrate from all directions to converge in the relatively calm and food-rich waters of Puget Sound each winter. In summer, colonies of seabirds are busy attending their young. In spring and fall, the shorelines are full of shorebirds that stop to feed and rest during migration.

Birds serve as useful indicators of ecosystem change and ecosystem health. The Partnership is currently working with the Washington Department of Fish and Wildlife, U.S. Geological Survey, and the Puget Sound Ecosystem Monitoring Program's Birds & Mammals workgroup to develop a meaningful marine and terrestrial bird indicator and potential targets to help achieve its recovery goal of healthy and sustaining populations of native species. Upon completion later this year, the Science Panel and Leadership Council will review the recommendations and make final decisions on the indicators and targets.





## Shoreline Armoring

Puget Sound's 2,500 miles of shoreline are among the most valuable and fragile of our natural resources. A dynamic area where land and marine ecosystems meet, the shoreline is constantly changing with the action of wind, waves, tides, and erosion. These same shaping forces are also the reason why people often build bulkheads or other structures to harden the shoreline. Indeed, more than 25% of the shoreline has been armored to protect public and private property, ports and marinas, roads and railways, and other uses.

Shoreline armoring, the practice of constructing bulkheads (also known as seawalls) and rock revetments, disrupts the natural process of erosion, which supplies much of the sand and gravel that forms and maintains our beaches. Erosion also creates habitat for herring, surf smelt, salmon and many other species in Puget Sound. Over time, shoreline armoring may cause once sandy beaches to become rocky and sediment starved, making them inhospitable to many of our native species.

# Shoreline Armoring

**INDICATOR:**  
**Amount of shoreline armoring**  
 Indicator leads: Randy Carman, Washington Department of Fish and Wildlife and Hugh Shipman, Washington Department of Ecology

**TARGET:**  
 From 2011 to 2020, the total amount of armoring removed should be greater than the total amount of new armoring in Puget Sound (total miles removed is greater than the total miles added).

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>UNKNOWN</b>
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2005 - 2010: net gain of 6 miles  
 2010 only: net gain of .8 miles

2020 TARGET

NET GAIN      NET LOSS

New armoring > removed armoring from 2011 to 2020      0%      New armoring < removed armoring from 2011 to 2020

New armoring = removed armoring

For years where data were available, 2005 through 2010, there was a net gain of six miles of shoreline armoring.

## Progress towards 2020 target

The analysis of current progress is pending due to ongoing compilation and analysis of 2011 data. However, we can use data from 2005 through 2010 to report on status and trends of shoreline armoring and make some predictions about progress toward reaching the target by 2020.

The amount of new shoreline armoring in Puget Sound was substantially greater than the amount removed for every year from 2005 through 2010 (Figure 1). Cumulatively, a net amount (new armoring minus removed armoring) of six miles of new armoring was constructed during this time frame, or on average, one mile of additional armoring per year. This pattern of net gain in armoring is the opposite of what is needed to meet the 2020 target.

However, the net amount of armoring per year declined by roughly 50% over these six years. This result is driven by the fact that more and more armoring has been removed annually since 2005, while additions have remained fairly constant. A notable exception occurred during 2006 and 2007, when new construction was highest, perhaps due to significant storms and shoreline damage that occurred early in the period. Despite this, the general trend of new versus removed armor has shown some movement towards the target. Even so, the fact remains that new armoring in Puget Sound was four to 400 times greater than removals from 2005 through 2010, overwhelming the small advance in removing armoring.

Although more armoring was removed each year between 2005 and 2010, it will take significant progress on both: a) decreasing the amount of new armoring and b) increasing the amount of removed armoring to meet the target by 2020. If the recent pace of adding and removing armoring continues, an additional 10 miles of new armoring will be added to Puget Sound shorelines between 2010 and 2020, making it unlikely that the 2020 target will be met.

### What is this indicator?

Although shoreline armoring is one of the indicators that measure the pressures on Puget Sound, rather than a measure of the state of the ecosystem such as the biomass of Pacific herring, it is an important indicator of ecological conditions in Puget Sound.

Shoreline armoring is the most common type of shoreline modification on Puget Sound. Armoring directly alters geologic processes that build and maintain beaches and spits. Bulkheads also impact erosion patterns on nearby beaches, alter beach substrate and hydrology, and reduce the availability of large wood.

These physical changes to beaches can diminish the availability and condition of key shoreline habitats. Armoring can also directly impact organisms and ecological processes by burying or displacing upper beach habitat and altering the natural transition between terrestrial and aquatic ecosystems. Impacts of armoring differ from one coastal setting to another, but have been demonstrated both on Puget Sound and elsewhere to impact habitat for fish, birds, and invertebrates.

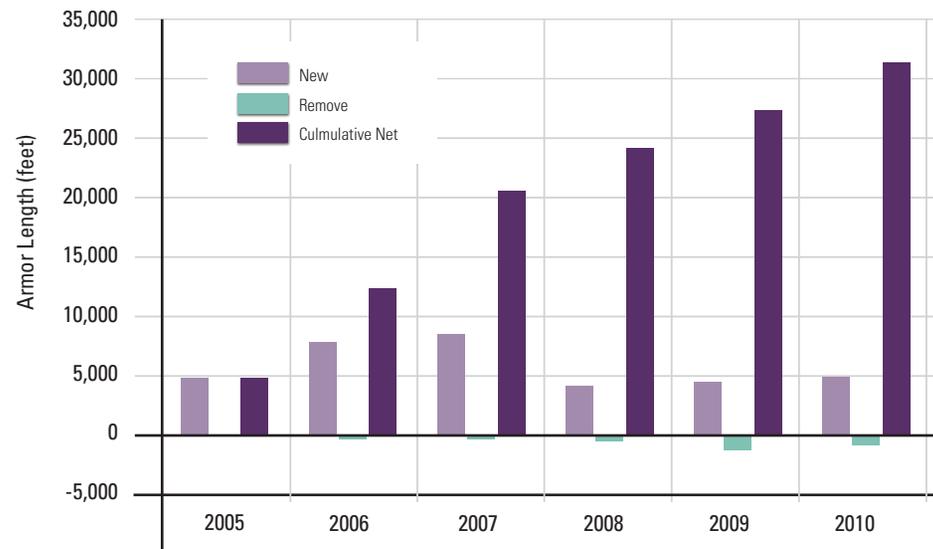
Because of these adverse impacts on coastal processes and shoreline habitat, the goal is to decrease the amount of new armoring that occurs on Puget Sound, while also seeking opportunities to reduce armoring where feasible.

As new armoring is being constructed, concurrent efforts are deployed to remove armoring primarily for habitat

restoration. Thus, it is the difference between new and removed armoring that is of interest to address the target specifically, reported here as the net amount of shoreline armoring. To reach the target, there has to be a net loss of armoring cumulatively over 2011 to 2020.

Alterations to the shoreline are regulated primarily by two state laws, the Shoreline Management Act and the Hydraulic Code. Under the Hydraulic

**Puget Sound Shoreline Armoring Summary  
2005–2010**



**Figure 1.** Amount of new armoring and removed armoring reported annually from 2005 to 2010 in Puget Sound, and the net amount of armoring accumulated since 2005. Data were compiled from the Hydraulic Project Approvals permits issued by the Washington Department of Fish and Wildlife.

Source: Washington Department of Fish and Wildlife. Habitat Program.

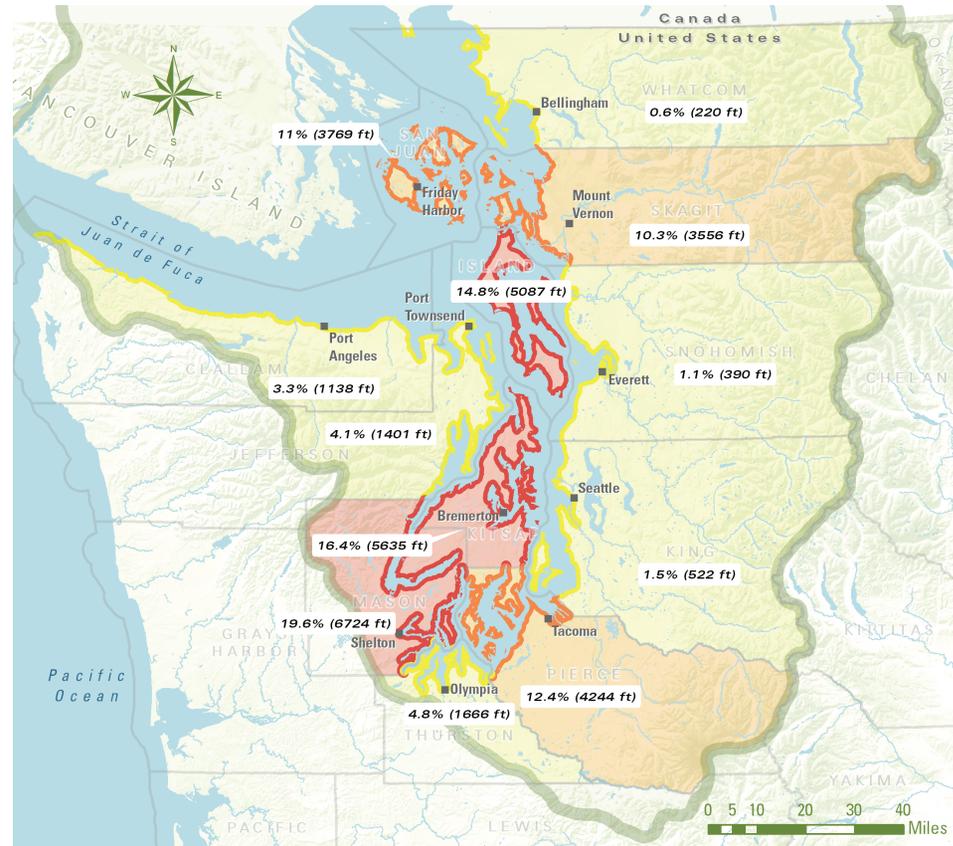
# Shoreline Armoring

Code, project proponents seeking a permit for in-water and shoreline construction activities declare the amount of armoring they plan on adding, replacing, or removing in their application. Thus, data reported here were compiled from HPAs (Hydraulic Project Approval) issued from January 2005 through December 2010 by the Washington Department of Fish and Wildlife (WDFW). Projects were identified as: 1) new (previously unarmored shoreline), 2) replacement (complete replacement of existing armoring), and 3) removals (removal of existing armoring without replacement).

The Puget Sound Nearshore Ecosystem Restoration Project (PSNERP) has been instrumental in compiling and reporting on changes to shorelines in Puget Sound over the past several decades. We relied on their data to report the length of shoreline and the overall amount of shoreline armoring in Puget Sound and by county.

### Other targets

Part of the 2020 target for shoreline armoring includes a focus on preventing new armoring and reducing existing armoring on feeder bluffs that supply sediments to Puget Sound shorelines. Activities are currently in progress to complete mapping of feeder bluffs in Puget Sound, including the condition of the



**New Shoreline Armoring Distribution by County (2005-2010)**



**Figure 2.** Amount of new armoring, county by county, as a percent of all new armoring in Puget Sound, cumulatively between 2005 and 2010. The numbers in the boxes are the percent of all new armoring and the amount of new armoring in feet for each county.

Source: Washington Department of Fish and Wildlife, Habitat Program.

bluffs. Until the feeder bluff mapping project is completed, it will not be possible to report on the amount of new armoring added or removed on feeder bluffs.

Similar language in the 2020 target refers to the use of soft shore techniques for new and replacement armoring where feasible. Reporting on this metric is currently constrained by the lack of adequate agreement on what constitutes a true soft shore project. Progress is being made to address this issue as part of a design guidance document currently being developed by WDFW and a consultant.

A total of 980 HPAs were issued for shoreline armoring projects in Puget Sound from January 2005 through December 2010. In all years, the amount of new armoring exceeded the amount removed (Figure 1). Just in 2010, the last year for which data were available, there were approximately 4,869 feet (0.9 miles) of new armoring, six times more than the amount of armoring removed (Figure 1). Furthermore, the amount of armoring replaced greatly exceeded either new or removed armoring.

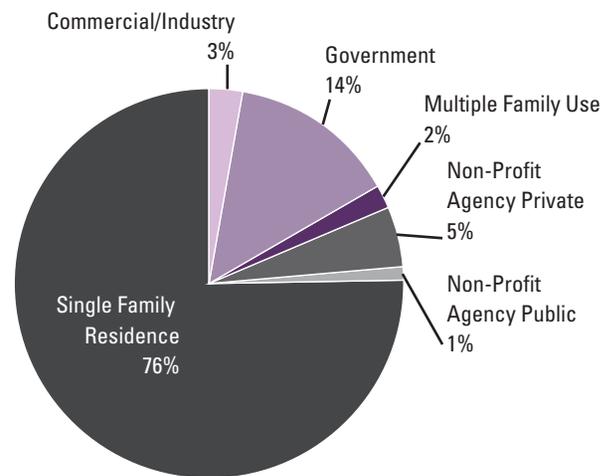
Cumulatively, a net total of six miles of armoring was added in Puget Sound from 2005-2010, or, on average, one mile of additional armoring per year.

### Interpretation of data

#### Status and trends of Puget Sound wide armoring

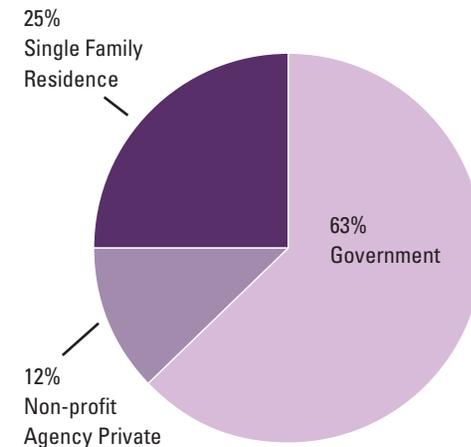
Based on a compilation of a variety of data sources by the PSNERP, 27% of the shoreline of Puget Sound is armored (666 miles). Armoring is particularly extensive in highly developed residential, urban, or industrial centers. While most alterations to nearshore areas are heavily regulated, new and replacement shoreline armoring is still relatively commonplace for single-family residences, which accounted for more than three-quarters of the HPA permit applicants wishing to construct new armoring between 2005 and 2010 (Figure 3).

**New shoreline armoring by applicant type**



**Figure 3.** Percent of new armoring, by applicant type for years 2005-2010.

**Armoring removal by applicant group**



**Figure 4.** Percent of removed armoring, by applicant group for years 2005-2010.

## Shoreline Armoring

Overall, all project applications resulted in 6.5 miles of new shoreline armor, 0.61 miles of armor removal, and 14.45 miles of replacement armor.

There were no statistically significant linear trends in the amount of new or replacement armoring constructed through the six-year period. However, the amount of removed armoring significantly and steadily increased over the study period, albeit at a very small fraction of new armoring.

Increases in removals coupled with a reduced amount of new armoring for the second half of this period meant that the net amount of armoring declined between 2005 and 2010. During the first three years, the total net increase in armoring was 20,397 feet, compared to a total of 10,736 feet during the last three years. This is a 47% decrease in net new armoring constructed between the first and second half of the six-year period.

### *Armoring by counties*

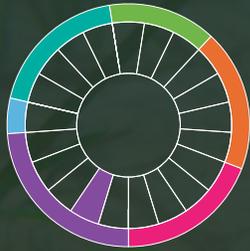
The total amount of shoreline armoring varies considerably across the twelve counties that border Puget Sound. Three counties account for nearly 50% of all the armoring in Puget Sound: King (13%), Pierce (18%), and Kitsap (16%) counties. These counties all have a high percentage of their shorelines armored: King 73%, Pierce 51%, and Kitsap 43%.

However, the HPA data revealed that most of the new armoring that was constructed between 2005-2010 has been concentrated in somewhat different areas (Figure 2). Mason, Kitsap, and Island counties had the highest percentage of the new armoring, comprising a total of 51%. Pierce, San Juan and Skagit counties also accounted for a substantial amount of the new

armoring with a combined total of 34%. Therefore, six of the twelve counties in Puget Sound accounted for 85% of the new armoring from 2005 through 2010.

The same dataset indicates that armoring was removed in seven counties from 2005-2010. More armoring was removed in Kitsap County, totaling 1,873 feet (0.4 miles), than in any other county. A combined total of 1,353 feet (0.3 miles) was removed among the other six counties that included King, Pierce, Mason, San Juan, Island, and Jefferson. The remaining six counties in Puget Sound did not conduct any armor removal projects during the same time period.

The type of applicant that conducts new or armor removal projects was also compiled from the HPA data for years 2005-2010. Not surprisingly, most new armoring in Puget Sound (76%) was constructed on single family residence properties (Figure 3). In contrast, armor removal projects were primarily conducted on government properties (63%), whereas only 25% of the removals were on single family residential properties (Figure 4).



## Eelgrass

Eelgrass grows in dense beds in the shallow waters of Puget Sound. This important marine plant serves as food source, nursery, and haven for birds, fish, crabs, shellfish and other marine organisms. Eelgrass also filters sediments and nutrients, improving water clarity, and stabilizes the sea floor, which protects shorelines from erosion.

Eelgrass is valuable to the health of Puget Sound not only for the ecosystem functions it provides, but because it is sensitive to environmental stressors. Eelgrass health is an indicator of changing conditions in our watersheds and estuaries.

Although some larger Puget Sound eelgrass beds are stable, many of the smaller, fringing beds throughout the Sound are in decline. The reasons for this decline are not fully understood, but nitrogen pollution entering Puget Sound from human sources is likely having major impacts in many locations. If eelgrass loss continues, the effects will reverberate throughout the food web.

# Eelgrass

**INDICATOR:**  
**Eelgrass Area**  
 Indicator lead: Fred Short, Washington Department of Natural Resources

**TARGET:**  
 A 20% increase in the area of eelgrass in Puget Sound relative to the 2000–2008 baseline reference by the year 2020.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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There was a 0% increase in eelgrass area in 2011 relative to the 2000-2008 baseline.

## Progress towards the target

The sound-wide area of eelgrass measured in 2011 has not changed relative to the 2000-2008 baseline reference, and thus there has been no progress towards the eelgrass 2020 target. The overall finding is that the majority of sampling sites across the Sound show no gains in eelgrass area. Furthermore, sites with decreasing trends in eelgrass area greatly outnumber those with increases, a concern for the health of eelgrass beds around the Sound.

Monitoring information indicates that the goal to achieve 20% increase in eelgrass area by 2020 cannot be met with current management practices: the stresses on eelgrass in Puget Sound must be significantly reduced to see gains in eelgrass area and health.

## What is this indicator?

Eelgrass is an important submerged marine plant growing throughout Puget Sound. Changes in the abundance or distribution of this resource reflect changes in environmental conditions.

Eelgrass and other seagrass species are used as indicators of ecosystem health throughout the world because they respond sensitively to many natural and human-caused environmental factors that affect water quality and shoreline conditions. These factors are also likely to affect many other species that depend on eelgrass habitat.

For example, excess nutrients, sewage, and algae can reduce water clarity, while storms, runoff and dredging can stir up sediment, preventing light from penetrating the water and reaching the eelgrass. Boat wakes, propellers, and docks can also disturb eelgrass beds.

Also, since eelgrass is protected by many regulations, its condition reflects, in part, the success of management actions. The Washington Department of Natural Resources assesses status and trends in eelgrass by evaluating eelgrass area and depth range at over 100 sites throughout Puget Sound annually, using a statistical sampling framework.

Two measures are used to demonstrate eelgrass status and trends in Puget Sound:

1. Sound-wide eelgrass area. The total area of eelgrass beds in Puget Sound.
2. Number of increasing, decreasing or stable eelgrass beds. Count of eelgrass gains and losses on a site basis.

### Interpretation of Data

#### Measure 1: Sound-wide eelgrass area

Puget Sound supports roughly 22,600 hectares of eelgrass beds (Figure 1). Eelgrass distribution patterns vary by sub-basin, with two main types of eelgrass beds: narrow fringing beds and broad beds on shallow flats. Approximately 25% of the total eelgrass area occurs in only two embayments: Padilla and Samish Bays.

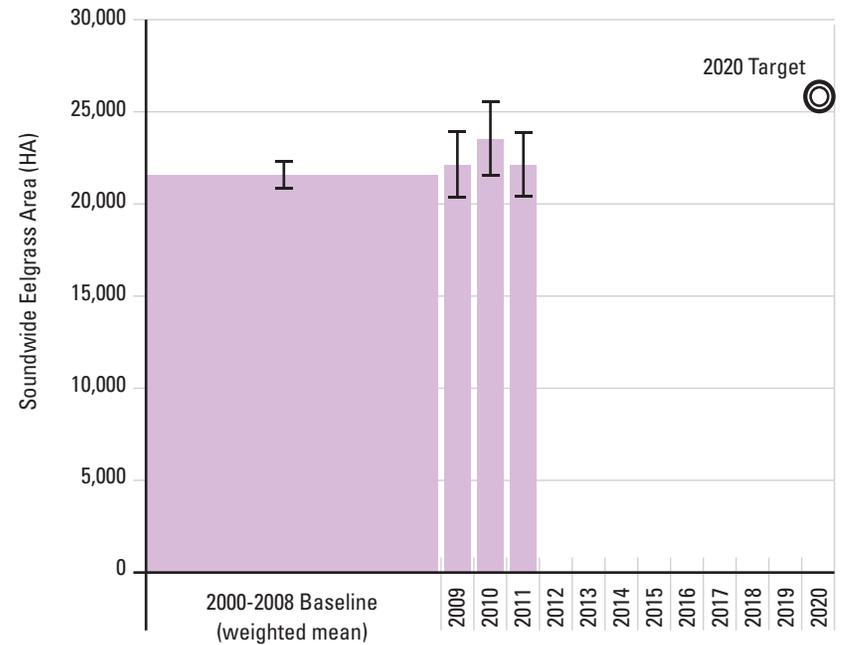
There was no significant increasing or decreasing trend in eelgrass area in 2011 relative to the 2000-2008 baseline, calculated as the weighed mean of eelgrass area in that time period (Figure 1).

#### Measure 2: Count of eelgrass gains and losses on a site-by-site basis

A total of 211 sites are classified for eelgrass area trends. The majority of these sites are eelgrass beds where no change or trend in the size of the bed has been detected (170 sites; Figure 2).

### Acres of Eelgrass in Puget Sound

*in thousands, 2000-2008 baseline and 2009-2011 annual data*



**Figure 1.** The annual estimates of Sound-wide eelgrass area for 2009-2011 compared to the baseline eelgrass area established by the Puget Sound Partnership and the Partnership’s 2020 target for eelgrass area recovery. Mean ± standard error are shown.

*Source: Washington Department of Natural Resources, Submerged Vegetation Monitoring Program*

However, there are more than twice as many sites where the size of the eelgrass bed decreased than sites that increased. Of all sites analyzed, there were five cases of total eelgrass loss. In no region do improving eelgrass sites outnumber declining eelgrass sites.

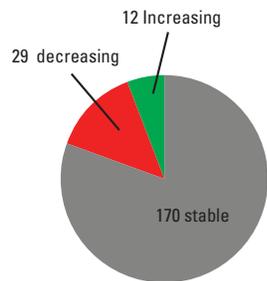
# Eelgrass

## Concerns about Hood Canal

Among the five eelgrass monitoring regions of Puget Sound, Hood Canal has the greatest number of sites where the amount of eelgrass decreased (Figure 3), including two sites where eelgrass beds completely disappeared. The Hood Canal region is a major concern particularly because many more eelgrass sites decreased (83%) than increased. Another region of concern is the Saratoga-Whidbey Basin where 71% of changing sites are in decline.

Several factors contribute to the eelgrass losses seen in Hood Canal. The deep fjord-like basin is stratified and has poor water circulation. Hood Canal is showing signs of eutrophication: excess nitrogen loading from human sources contributes to the formation of seaweed blooms, which are abundant along the shoreline and accumulate in eelgrass beds, stressing eelgrass and contributing to anoxic conditions. Such localized eutrophic conditions are evident throughout Puget Sound and pose a major threat to eelgrass and the health of the Sound.

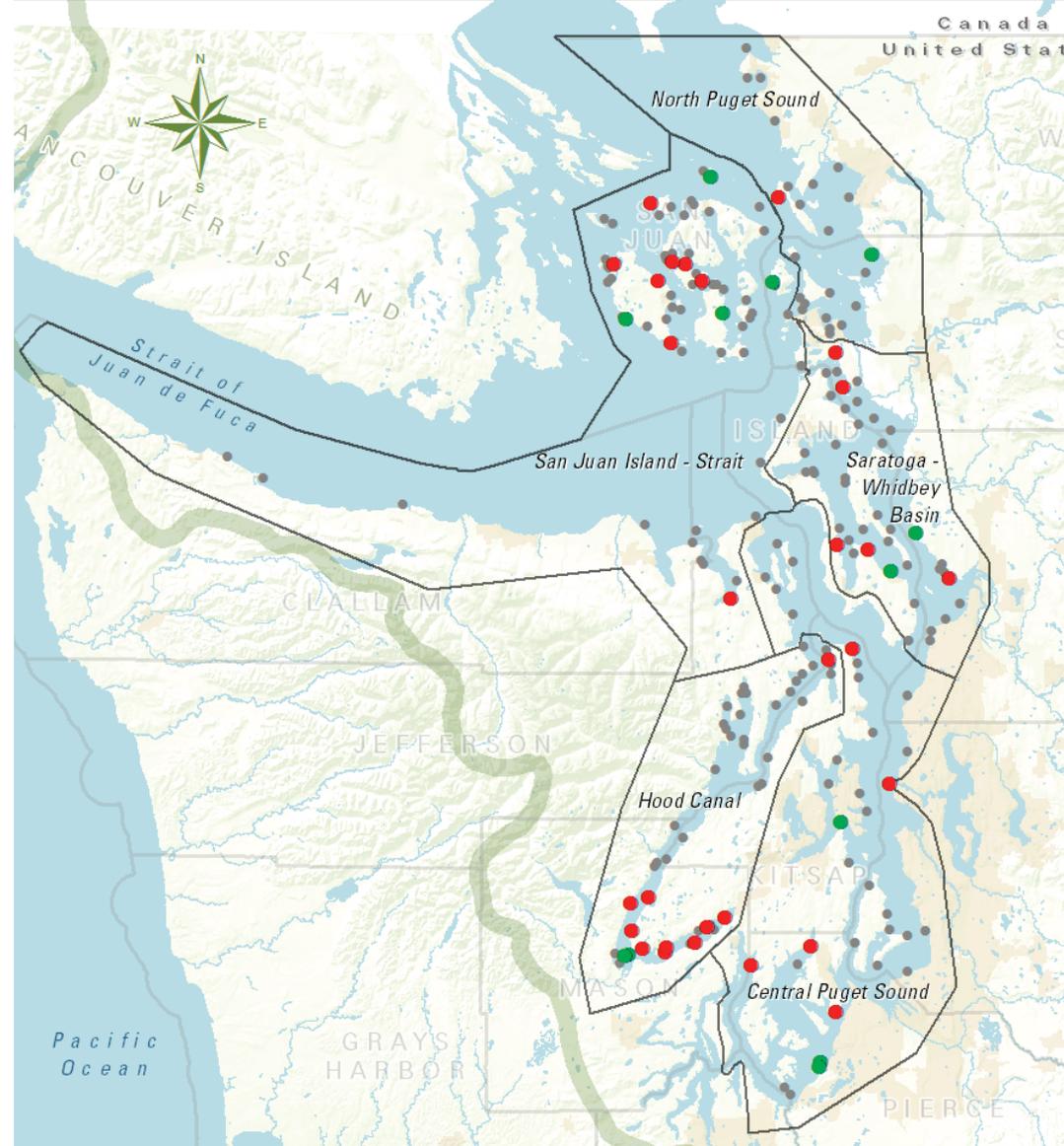
Status of eelgrass sites in Puget Sound



**Figure 2.** Number of sites in Puget Sound where the size of eelgrass beds increased, decreased, or remained stable since 2000.

Source: Washington Department of Natural Resources, Submerged Vegetation Monitoring Program

**Figure 3.** Distribution of eelgrass monitoring sites and their status. Source: Washington Department of Natural Resources, Submerged Vegetation Monitoring Program



Eelgrass Monitoring Sites

- |  |  |
|--|--|
| <span style="color: green;">●</span> Increasing Eelgrass | <span style="border: 1px solid black; display: inline-block; width: 15px; height: 10px;"></span> Cities and Urban Growth Areas                   |
| <span style="color: grey;">●</span> Stable Eelgrass      | <span style="background-color: #f0e68c; display: inline-block; width: 15px; height: 10px;"></span> Cities and Urban Growth Areas                 |
| <span style="color: red;">●</span> Decreasing Eelgrass   | <span style="border: 1px dashed black; display: inline-block; width: 15px; height: 10px;"></span> County Border                                  |
|  | <span style="background-color: #c8e6c9; border-radius: 50%; display: inline-block; width: 15px; height: 10px;"></span> Salish Sea Basin Boundary |

## LOCAL STORY

# Beachwatchers keeping an eye on the eelgrass

### Washington State University Extension Island County Beach Watchers – Eelgrass Monitoring Project

Lush, subtidal beds of eelgrass provide habitat where snails and fish lay eggs, larvae thrive, crabs and forage fish reside, and young salmon seek shelter. Eelgrass dampens the impact of waves and resists the pressures of erosion. Knowledge about eelgrass in Island County is fueled by the Washington State University (WSU) Extension Island County Beach Watchers' Eelgrass Monitoring Project, which was born from a combination of university vision, knowledgeable and resourceful volunteers, a compelling question, and collaboration.

In the late 1990s, WSU Extension launched Beach Watchers to provide education, outreach, research and stewardship for the marine environment in Puget Sound and the Salish Sea. Since its inception, the program in Island County has trained more than 400 volunteers, and each year it records approximately 20,000 volunteer hours and monitors 30 beaches. In 2002, Beach Watchers turned attention to eelgrass in a membership survey. Information and educational materials about eelgrass continued. The combination

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*...more than 50 volunteers have  
contributed more than 1000 hours  
to collecting eelgrass data.*

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Photo from Island County Beachwatchers - need citation



of increased eelgrass awareness, knowledge of the marine environment and skillful observation fostered an important observation in 2007 when a Beach Watcher noted some eelgrass beds at Holmes Harbor had disappeared. The idea for the Eelgrass Monitoring Project soon followed. With funding from the Island County Marine Resource Committee, advice and assistance from the University of Washington Friday Harbor Labs and Washington State Department of Natural Resources (DNR), and a pilot study in 2008, the Eelgrass Monitoring Project was up and running at full-scale in 2009.

The Eelgrass Monitoring Project is conducted annually and

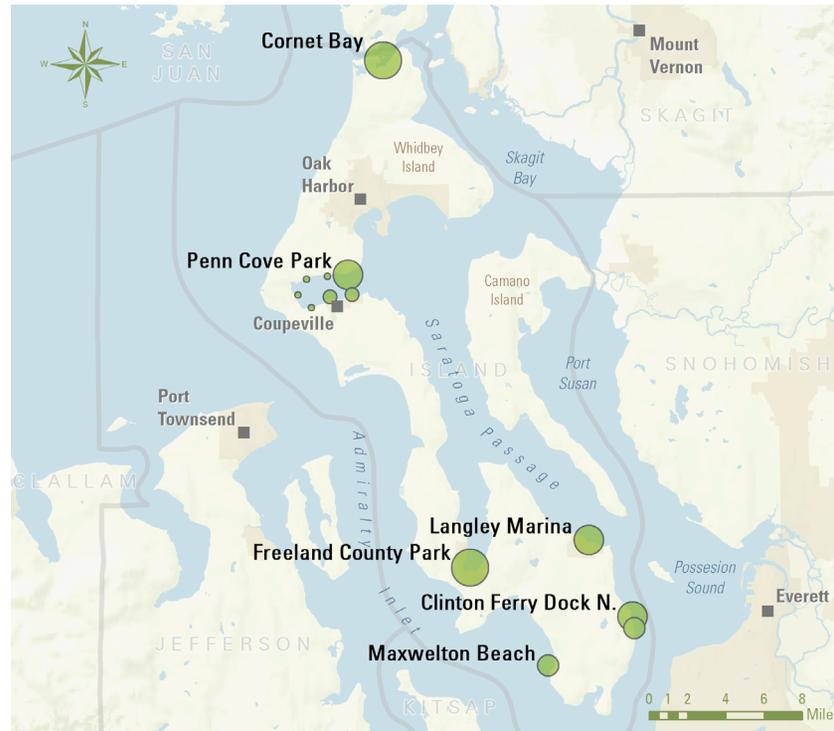
includes three components— a boat survey using underwater videography to document presence and absence of eelgrass along DNR-specified transects perpendicular to the shoreline at ten sites, aerial photography during summer low tides to provide a broader look at eelgrass extent over a larger area, and a boots-in-the-muck survey to count eelgrass leaves, measure plant density and water temperature, and gather vegetation samples in Holmes Harbor. Since program inception, more than 50 volunteers have contributed more than 1000 hours to collecting eelgrass data.

Surveys in 2009 and 2010 confirmed extensive eelgrass beds



## LOCAL STORY

in Cornet Bay and Holmes Harbor. Damage to eelgrass beds was documented in Cornet Bay with the patterns suggesting possible damage from boating activities. Penn Cove surveys showed relatively few eelgrass beds with an unusual number of green sea urchins. Three years of study in Holmes Harbor point to eelgrass return and relatively stable beds since 2007 and suggest an unusual 2006-2007 winter storm from the north that coincided with an extreme low tide may have influenced the 2007 losses. Data from the eelgrass monitoring project are provided to DNR and are available on the Island County Marine Resource Committee's Sound IQ data system ([www.iqmap.org/icSound-IQ/](http://www.iqmap.org/icSound-IQ/)). These data on eelgrass, combined with other data on birds and mammals, intertidal habitats, fish distribution and more are contributing to the overall understanding of the nearshore ecosystem around Whidbey Island.



### WSU Extension Island County Beach Watchers

#### 2010 - 2011 Eelgrass Surveys

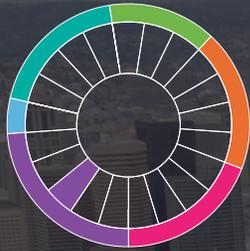
Estimated Bed Area (Acres)



County Border

Salish Sea Basin Boundary

Cities and Urban Growth Areas



# Land Development and Cover

In the Puget Sound region, we have lost at least two-thirds of our remaining old growth forests, more than 90% of our native prairies, and 80% of our marshes in the past 50 years.

The land surrounding Puget Sound is home to several million people who live, work, and play in our region. The need for homes, businesses, roads, and agriculture must be balanced with ecosystem protection. Forest and riparian areas provide important habitat for many species and reduce the rate of polluted runoff flowing into Puget Sound.

Land development and cover indicators measure how well we are directing our region's ongoing growth to protect our best remaining natural areas and working forests. In the future, with an additional Land Development Pressure indicator focused on the form and location of development, we expect to be able to determine how well we are concentrating population growth in those areas identified as most suitable for development.

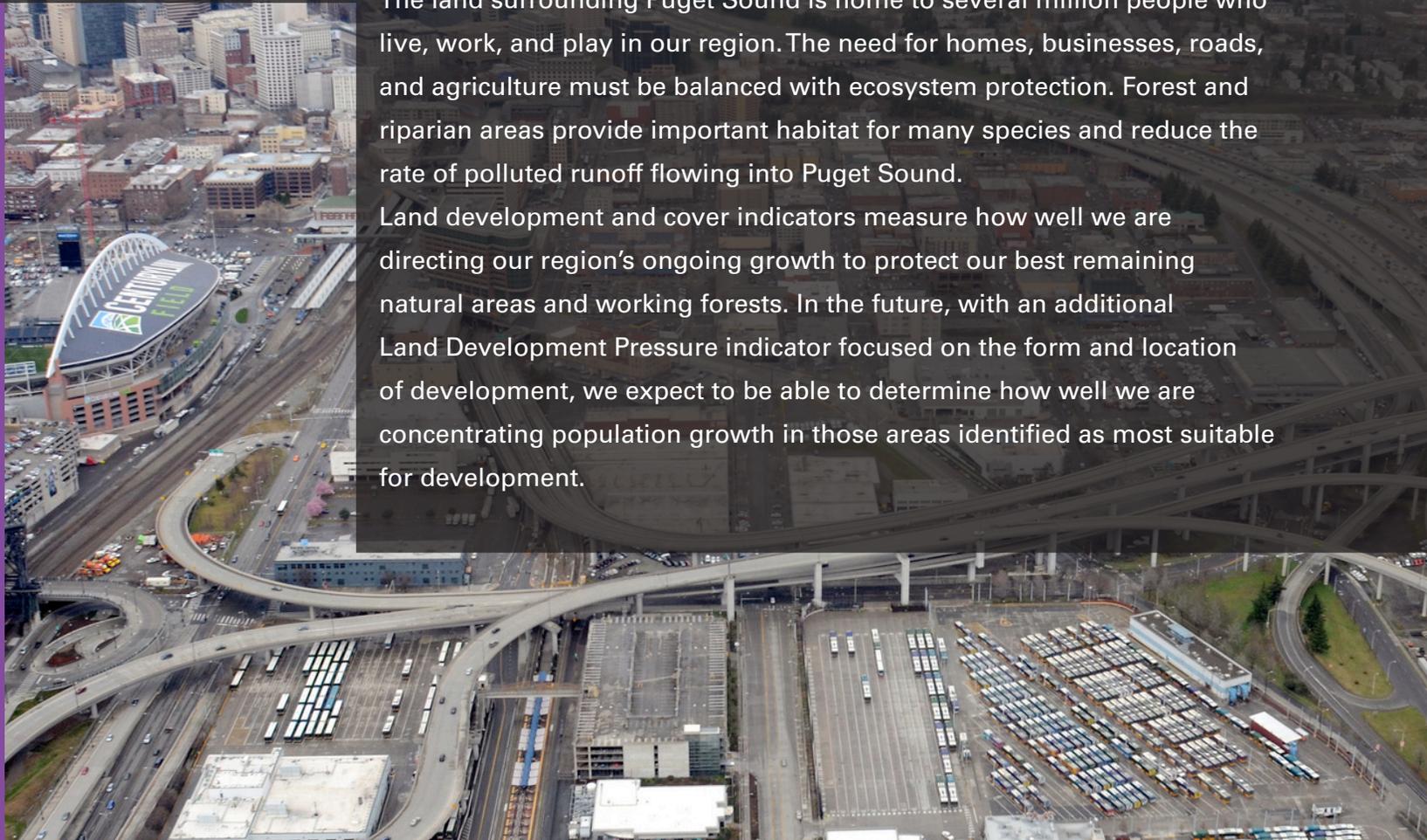


Photo Credit: Jon Bridgman, Puget Sound Partnership

# Land Development and Cover

INDICATOR:

## Land Cover Change: Forest to Developed

Indicator lead: Kenneth B. Pierce Jr. PhD, Washington Department of Fish and Wildlife

**TARGET:**

The average annual loss of forested land cover to developed land cover in non-federal lands does not exceed 1,000 acres per year, as measured with Landsat-based change detection.

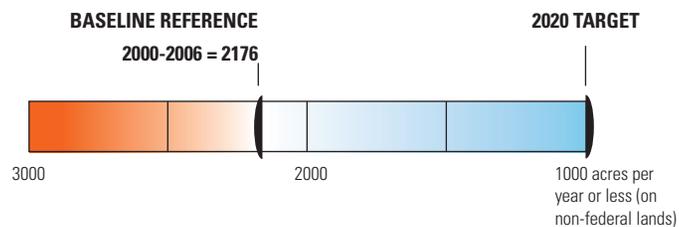
**PROGRESS:**

IS THE TARGET MET?

**NO**

IS THERE PROGRESS?

**UNKNOWN**



Baseline conversion rates: 2001-2006 conversion of forested cover to developed cover was 2,176 acres per year; 1992-2001 conversion of forested cover to developed cover was 5,048 acres per year. Information on the rate of conversion from 2006 to 2011 is expected to be available in 2013.

### Progress towards 2020 target

The 2020 target has not yet been reached, and progress towards the target is unknown due to lack of data.

Non-federal Puget Sound basin forest was converted to developed cover at a rate of 2,176 acres per year for the period 2001-2006. Data needed to calculate an updated conversion rate for the period 2006-2011 were not yet available, but are expected in 2013.

Achievement of the 2020 target rate of 1,000 acres converted per year would represent a roughly 50% reduction from the 2001-2006 annual conversion rate, or an 80% reduction from the 1991-2001 conversion rate of 5,048 acres per year.

## **What is this indicator?**

Forest conversion measures the loss of forested land cover to developed land cover. The indicator provides a check on our regional success in maintaining forest cover throughout the Puget Sound Basin.

Forested landscapes, as measured by forest cover, provide the following: 1) habitat functions that support terrestrial species, 2) watershed functions that support freshwater systems, and 3) provisioning and cultural services for humans.

## **Interpretation of data**

Change in forested lands is monitored using NOAA analysis of satellite imagery to track change from forested land cover, including coniferous, deciduous, and mixed forest classes, to developed land cover using four classes of development intensity, on a five-year basis. Forest cover conversion in the Puget Sound basin has been consistently measured every four to five years since 1992 with the next results expected in late 2012 for change during the period 2006-2011.

The current trends and targets were set using land-cover change information for lands not in federal ownership as determined by the Landsat satellite imaging system. Due to image element limitations, this approach does not capture relatively small land use change, such as clearing for single homes or lot expansion, and therefore only larger events (more than two acres) are reliably captured in these values.

# Land Development and Cover

**INDICATOR:**  
**Land Cover Change: Riparian Restoration**  
 Indicator lead: Alex Mitchell, Puget Sound Partnership

**TARGET:**  
 Restore 268 miles of riparian vegetation or have an equivalent extent of restoration projects underway.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>YES</b>
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**BASELINE REFERENCE** 2011 | **2020 TARGET** 268 miles restored

Nineteen projects conducted from October 2009 to September 2012 restored 76 miles riparian miles in the Puget Sound basin. This is 28 percent of the 2020 target of 268 miles.

### Progress towards 2020 target

The 2020 target has not yet been reached. Habitat data collected by the Puget Sound Partnership on behalf the Environmental Protection Agency indicates that 19 riparian restoration projects were conducted in the Puget Sound basin from October 2009 through September 2012.

### What is this indicator?

Riparian vegetation restoration measures the amount of new vegetated cover delivered by restoration projects along riparian corridors. It is intended to evaluate the effect of direct efforts to improve the health of a critical component of the Puget Sound ecosystem—riparian corridors. Intact, vegetated riparian corridors are critical for the following reasons: 1) keeping fresh and marine waters clean and cool, 2) for moderating variability in water volume and timing of flow (i.e. flood storage), and 3) as key habitat for myriad terrestrial, freshwater and interface (e.g. salmon) species.

The amount of riparian area restored to vegetated cover will be measured through collection of acreage or linear riparian shoreline restoration reported for Puget Sound restoration projects. Riparian restoration effort is being measured instead of riparian condition due to the difficulty in assessing riparian condition Sound-wide and the length of time necessary to call a specific location successfully restored. Although tracking total riparian condition is a much more difficult task than tracking regional forest cover, the initiation and completion of restoration activities are tractable measures. Successful restoration may take many years and measuring its success requires ongoing monitoring.

## **Interpretation of data**

Recent restoration efforts in the Puget Sound basin have included 19 projects completed from October 2009 to September 2012 to restore riparian vegetation. These projects involved planting and other actions beyond treatment to remove invasive species. A project length was reported for 13 of the projects. The sum of these lengths is about 76 miles, which is 28 percent of the 2020 target. If the median project length were applied to the six projects with no length estimate provided, we would estimate that the total mileage restored in this three-year period at 86 miles, which is 32 percent of the 2020 target.

### ***Data Source***

Puget Sound Partnership staff analysis of data for federal fiscal years 2010, 2011, and 2012 primarily from the Recreation and Conservation Office's PRISM database and reports of Natural Resource Conservation Service (NRCS) habitat programs.

# Land Development and Cover

**INDICATOR:**  
**Land Development Pressure: conversion of ecologically important lands**

Indicator lead: Kenneth B. Pierce Jr., Washington Department of Fish and Wildlife  
 Kari Stiles, PhD, Puget Sound Institute, University of Washington

**TARGET:**  
 Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15% of the total 2011 baseline land area over a five-year period

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>UNKNOWN</b>
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**BASELINE REFERENCE**  
 2001 - 2006 = 0.28%

**2020 TARGET**  
 0.15% conversion in 5 years

0.45%      0.30%      0.15%

Baseline rate of change of 0.28% is equivalent to the proportion of total indicator land area converted from vegetated to developed cover for the five-year period of 2001-2006. Information on the rate of conversion from 2006 to 2011 is expected to be available in 2013.

### Progress towards 2020 target

The 2020 target has not been met yet, and progress towards the target is unknown due to the lack of data, which will not be available until 2013. However, achieving the 2020 target will require reducing the conversion of ecologically important lands to development to just over one-half the rate of conversion observed in 2001 – 2006.

The five-year baseline rate of land cover change on the indicator base lands across all 12 counties in Puget Sound for the period 2001-2006 was 0.28% of the total indicator base land area. Similar analyses will be completed every five years to track change over the periods 2006-2011, 2011-2016, and 2016-2021.

### What is this indicator?

The indicator tracks the conversion from vegetated cover to developed cover on undeveloped lands identified as ecologically important and under to high pressure from development for residential, commercial, and industrial uses. The indicator land base was identified in 2011 as areas that have not reached maximum developed capacity, are not protected from development, and are identified as ecologically significant.

Because of the coarse-scale approach to defining ecologically important lands in the indicator land base, this indicator is appropriately used to identify broad regional trends. This indicator’s results are not intended for use in local decision-making, permitting or planning.

This indicator provides a regional measure of the effectiveness of local jurisdictions’ efforts to direct growth away from undeveloped ecologically functional areas. Specifically, the indicator provides a measure of the success of local governments in identifying and protecting ecologically

significant and intact lands within and outside of Urban Growth Areas, a priority strategy in the Puget Sound Action Agenda.

It is also an indicator, though perhaps a weaker one, of how effectively local jurisdictions are using or incorporating landscape characterization methods, or other ecologically based information, into their land use decision-making.

### Interpretation of data

A 12-county analysis of Puget Sound basin land cover change indicates a loss of vegetative cover on 0.28 % of the indicator land base (2,996 of 1,084,785 acres) over the period 2001-2006 (Table 1). In contrast, only 0.02% of important ecological lands under low pressure from development (1,140 of 5,737,559 acres) were converted for the same five-year period. Lands of low ecological importance were converted at a rate of roughly 1% per five years, or 0.92% and 1.09% for high and low development pressure lands, respectively.

Overall, the indicator land base represents 13% of total Puget Sound land area. The remaining land area includes 68% of high ecological importance but under low pressure from development, 13% of lands under high pressure from development but of low ecological importance, and 7% of low ecological importance and under low pressure from development.

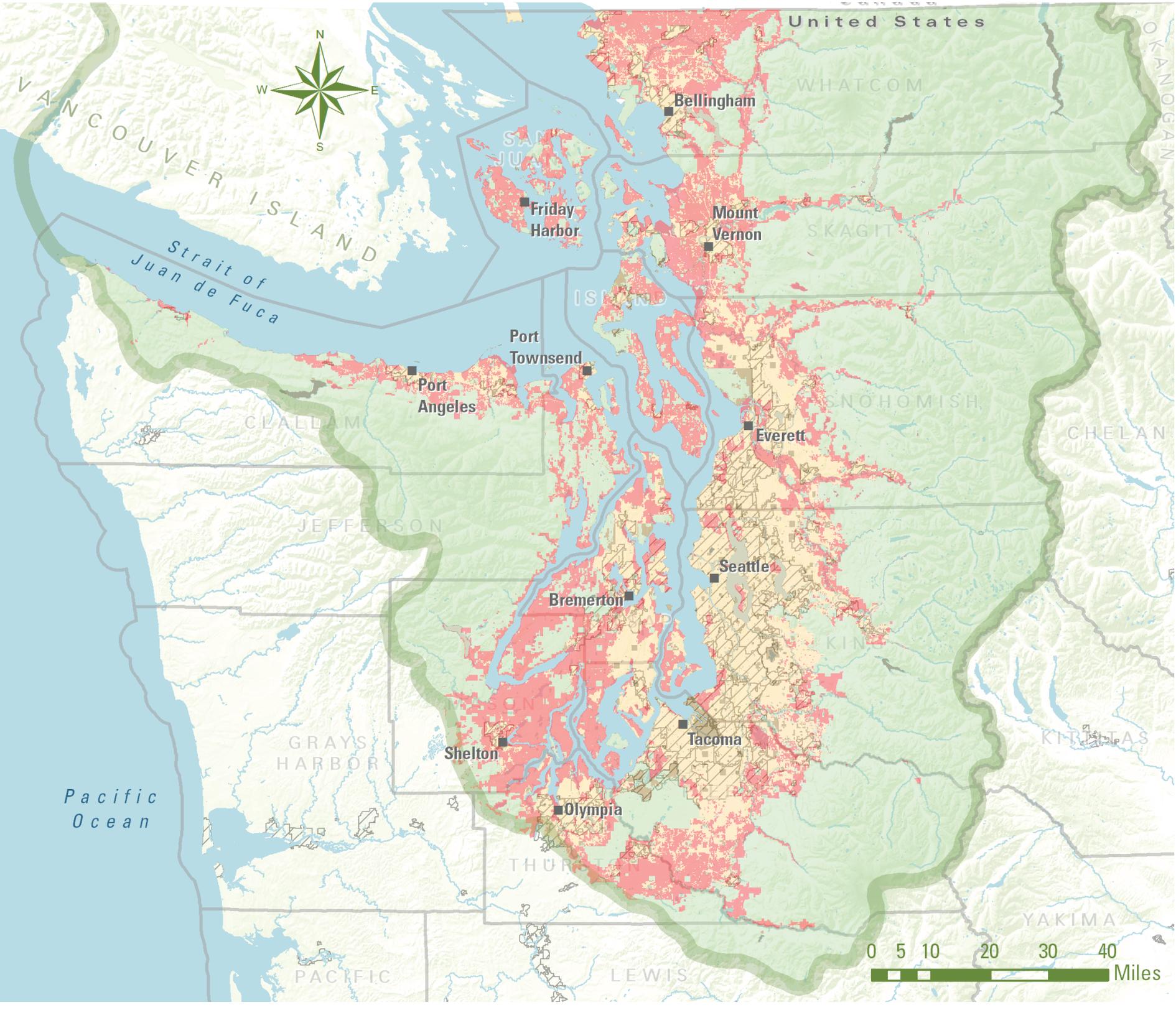
Conversion of indicator lands represents 15% of total land conversion in Puget Sound for period 2001-2006. An additional 6% of land conversion occurred on lands that are of high ecological importance but classified as low pressure from development. About 80% of land conversion for this five-year period occurred on lands classified as low ecological importance, with 50% and 30% conversion happening on high and low development pressure lands, respectively.

### Land cover change from a vegetated class to a developed class over the period 2001-2006 in twelve Puget Sound counties

Land Base Type	Land area (proportion of total Puget Sound land area)	Area converted 2001-2006 (acres)	Proportion of area converted 2001-2006	Proportion of total Puget Sound 2001-2006 conversion
<b>Indicator Land Base high ecological importance, high development pressure</b>	1,084,785 (12.8%)	2,996	0.28%	14.7%
<b>high ecological importance, low development pressure</b>	5,737,559 (67.6%)	1,140	0.02%	5.6%
<b>low ecological importance, high development pressure</b>	1,101,134 (13.0%)	10,136	0.92%	49.8%
<b>low ecological importance, low development pressure</b>	558,315 (6.6%)	6,077	1.09%	29.9%
<b>TOTAL</b>	<b>8,481,793</b>	<b>20,349</b>	<b>0.24%</b>	

**Table 1.** Land cover change from a vegetated class to a developed class over the period 2001-2006 in twelve Puget Sound counties.

Source: Washington Department of Fish and Wildlife



◀ **Ecologically important base lands under high pressure from development in Puget Sound**

	High Development Pressure: Higher Ecological Importance		Cities and Urban Growth Areas
	High Development Pressure: Lower Ecological Importance		County Border
	Low Development Pressure: Higher Ecological Importance		Salish Sea Basin Boundary
	Low Development Pressure: Lower Ecological Importance		

**Figure X.** Caption forthcoming.

Source: Forthcoming

# Land Development and Cover

**INDICATOR:**  
**Land Development Pressure: proportion of basin-wide population growth distribution within Urban Growth Areas (UGAs)**  
 Indicator lead: Kenneth B. Pierce Jr., Washington Department of Fish and Wildlife  
 Kari Stiles, PhD, Puget Sound Institute, University of Washington

**TARGET:**  
 Basin-wide loss of vegetation cover on ecologically important lands under high pressure from development does not exceed 0.15% of the total 2011 baseline land area over a five-year period.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>UNKNOWN</b>
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**BASELINE REFERENCE**  
 2001 - 2010 = 83%

**2020 TARGET**  
 85.5% of new growth is in UGAs

Based on basin-wide census data from 2000-2010, 83% of new growth occurred in UGAs.

## Progress Towards 2020 Target

The 2020 target has not been met yet, and progress towards the target is unknown because the status for this indicator has not been updated since 2011 when analysis was completed to establish an indicator baseline and 2020 recovery targets.

The 2020 recovery target established a basin-wide goal of 86.5% of population growth occurring within UGAs, equivalent to a 3.5% increase in the proportion of new population growth occurring within all Puget Sound UGAs, and a minimum goal of increasing the proportion of growth occurring within UGAs in all counties. This target represents an ambitious basin-wide goal to direct more growth to those areas deemed best suited for development, while also respecting that Puget Sound includes very urban as well as very rural counties with very different growth management needs and objectives.

## What is this indicator?

The indicator tracks the conversion from vegetated cover to developed cover on undeveloped lands identified as ecologically important due to high pressure from development for residential, commercial, and industrial uses. The indicator land base was identified in 2011-2012 as areas that have not reached maximum developed capacity, are not protected from development, and are identified as ecologically significant.

Because of the coarse-scale approach to defining ecologically important lands in the indicator land base, this indicator is appropriately used to identify broad regional trends. This indicator's results are not intended for use in local decision-making, permitting or planning.

This indicator provides a regional measure of the effectiveness of local jurisdictions' efforts to direct growth away from undeveloped

### Percent of population growth occurring within UGA's

County	% pop growth occurring within UGAs (2000-2010)
<b>Clallam</b>	47%
<b>Island</b>	40%
<b>Jefferson</b>	28%
<b>King</b>	101%*
<b>Kitsap</b>	65%
<b>Mason</b>	28%
<b>Pierce</b>	85%
<b>San Juan</b>	37%
<b>Skagit</b>	83%
<b>Snohomish</b>	92%
<b>Thurston</b>	50%
<b>Whatcom</b>	78%

**Table 1.** Baseline counties, 2000-2010

Source: TBD

\* This number reflects new growth occurring within UGAs and migration of some existing population into UGAs.

### Interpretation of data

Washington population data, based on 2010 U.S. Census data, was used for the baseline analysis of population growth distribution for UGAs and rural areas between 2000 and 2010 (Table 1). Basin-wide, 83% of new population growth from 2000 to 2010 occurred within UGAs. For individual counties, the proportion of growth occurring within UGAs ranged from a low of 28% for Mason and Jefferson counties to highs of 92% and 101%\* for Snohomish and King counties, respectively.

This indicator will not be updated until U.S. Census data are next available in 2020. However, in between the ten-year census, the American Community Survey conducted by the U.S. Census, although less accurate than the census, can be used as surrogate population data to generate intermediate measures of population growth distribution.

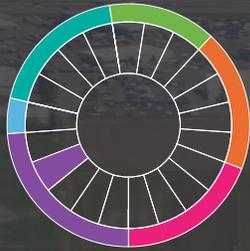
A related measure provides information about more recent trends in development patterns in the region and suggests that new development is increasingly occurring within UGAs. The proportion of permits for new development within UGAs for five central Puget Sound counties increased at an average rate of 0.85% per year from 2001 to 2010, as compared to a 0.35% average annual increase that would be needed to meet the 202 recovery target. While permit activity does not correlate exactly to population increase, these reports provide an indication of progress (in a six county area) toward the 2020 recovery goal of an increasing proportion of population growth with UGAs.

**Number of people within and outside UGAs from 2000-2010**

	2010 population	2000-2010 Total New Population	% new population within UGA 2010	% New Growth (2000-2010) occurring within UGA
<b>Clallam</b>	64,262	7,546	50.0%	47%
<b>Island</b>	78,506	7,878	30.9%	40%
<b>Jefferson</b>	28,605	3,532	41.4%	28%
<b>King</b>	1,931,249	195,569	93.6%	101%
<b>Kitsap</b>	251,133	20,418	62.1%	65%
<b>Mason</b>	60,699	13,931	27.1%	28%
<b>Pierce</b>	795,225	95,538	82.5%	85%
<b>San Juan</b>	15,769	1,986	21.6%	37%
<b>Skagit</b>	116,901	14,608	67.6%	83%
<b>Snohomish</b>	713,335	107,775	83.0%	92%
<b>Thurston</b>	252,264	76,584	67.6%	50%
<b>Whatcom</b>	201,140	35,034	67.4%	78%
<b>Basin-wide</b>	4,509,088	580,399	81.7%	83%

**Table 2.** Number of people within and outside UGAs from 2000 – 2010, both at the county level and basin-wide\*

Source: Washington Department of Fish and Wildlife



# Floodplains

Floodplains work like giant sponges. As rains increase with fall storms and snowpack melts in the mountains in spring and early summer, waters in the rivers around Puget Sound rise and flood onto the low-lying land along the rivers and streams. In addition to absorbing this overflow, floodplains provide functions and services like refuge, food and fresh water for a variety of species, good agricultural land through soil and habitat formation, and flat land that supports a variety of human uses.

Unfortunately, the functions and services in large areas of floodplains in Puget Sound have been lost through a combination of shoreline armoring and levees, as well as residential, commercial, industrial, and agricultural development. Improving riverside and floodplain habitat is a key part of virtually all recovery plans for endangered salmon. Restoration and better management of floodplains are essential for both recovering salmon and Puget Sound.

# Floodplains

## The Leadership Council set two 2020 targets for floodplains:

1. Restore, or have projects underway to restore, 15% of Puget Sound floodplain area.
2. Have no net loss of floodplain function in any watershed.

## What is this indicator?

Currently there is no agreed-upon definition of a floodplain. A working group comprised of floodplain experts is late developing definitions and data for this target, which will be available in 2012.

Although floodplains data are under development, based on other studies the National Oceanic and Atmospheric Administration (NOAA) estimates that almost three-quarters of wetlands have been lost in Puget Sound, the vast majority of which occurred in floodplains. Floodplains functions and services have been lost through a combination of shoreline armoring, levees, and residential, commercial, industrial, and agricultural development.



# Estuary Restoration

River delta estuaries form where river floodplains meet the sea, creating a unique and important environment where freshwater mixes with salt water and sediments collect. A diverse array of specially-adapted plants and animals thrive and take advantage of the fertility there, moving in and out with the tides. Estuaries provide important feeding and resting habitat for young salmon, migratory birds, and many other species that cannot find these unique benefits in any other place in our landscape. For example, young salmon that can rear longer in delta estuaries grow faster and are more likely to survive their ocean migration.

# Estuary Restoration

**INDICATOR:**  
**Estuary Restoration**  
Indicator lead: Paul Cereghino (NOAA Restoration Center)

**TARGET #1:**  
By 2020, all Chinook natal river deltas meet 10-year salmon recovery goals (or 10% of restoration need as proxy for river deltas lacking quantitative acreage goals in salmon recovery plans)

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>N/A</b>
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Salmon recovery plans are in the process of being updated, and measurable restoration goals are being defined.

**INDICATOR:**  
**Estuary Restoration**  
Indicator lead: Paul Cereghino (NOAA Restoration Center)

**TARGET #2:**  
7,380 quality acres are restored basin-wide, which is 20% of restoration need.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>YES</b>
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**CURRENT STATUS**  
2011 = 2,350 acres restored to tidal inundation (32%)

**2020 TARGET**



As of 2011, approximately 2,350 acres of estuary lands have been restored to tidal inundation since 2006.

### Progress towards the 2020 target

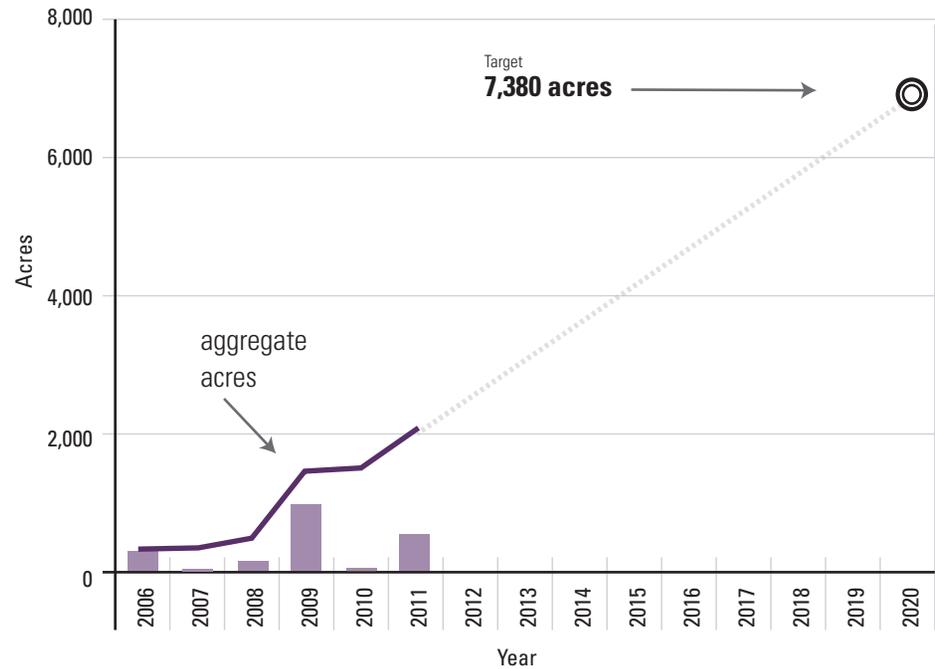
Neither of the two 2020 targets for estuaries have been met yet, but there has been progress on target 2 (number of quality acres restored). Although this may indicate progress towards salmon recovery goals, progress towards target 1 cannot be measured because recovery plans are in the process of being updated, and measurable restoration goals are being defined.

Approximately 2,350 acres of estuary lands have been restored to tidal inundation in the 16 major Puget Sound river mouth estuaries (Figure 1). Data summarized here are provisional because each watershed characterizes estuary restoration differently. The Partnership is working with other agencies and watershed groups to standardize how estuary restoration is measured and reported.

Significant restoration work has been implemented in the Nisqually, Skokomish, and Quilcene river delta systems, restoring a large proportion of area historically subject to tidal flooding. Substantial projects have also been completed in the Nooksack, Skagit, Snohomish, and Stilliquamish estuaries, but these remain modest when compared to the original historic extent of these larger river delta systems. Smaller projects have been completed in two deltas that are among the least degraded in Puget Sound: the Duckabush and the Dosewallips.

The Duwamish and the Puyallup river deltas, two of the most industrialized in Puget Sound, have seen substantial activity associated with Natural Resource Damage Assessment efforts. But acreage gains there are modest in terms of restoring tidal inundation, and there are fewer options in those highly developed systems compared to some levee and dike setback opportunities in less developed systems.

### Estuary acres restored to tidal inundation by year



**Figure 1.** Approximate acres of estuarine lands where tidal flow has been restored for projects completed between 2006-2011 in the 16 major Puget Sound river mouth estuaries (data for 2009 includes the Nisqually estuary refuge restoration project of 762 acres). Columns show annual amounts, and the line shows the cumulative acres.

Source: National Estuary Program Online Reporting Tool (NEPORT), Environmental Protection Agency

# Estuary Restoration

## What is this indicator?

The estuary restoration indicator tracks the amount of land returned to a natural pattern of tidal inundation. Until more robust measures become available, we generally assume that restoring tidal flooding to historic estuarine lands will improve the natural habitat functions and productivity of those lands.

Many estuarine restoration projects have been undertaken in Puget Sound. However, they have been planned, funded, and implemented over a decade or more by many different organizations, including local governments, state and federal agencies, watershed groups, tribes, and private organizations and landowners. Unfortunately, project reporting is scattered and inconsistent, mapping and survey methods are not standardized, and the accuracy of completed (“as-built”) project reporting is highly variable.

Consequently, the data reported here represent only a rough estimate of the actual area treated. Project reporting has been subject to considerable variability over the years, and our results were obtained from several different and inconsistent databases designed to collect project data (including PRISM, Habitat Work Schedule, and NEPORT). Efforts are currently underway to standardize how estuarine restoration efforts are reported and characterized. The intent is to eliminate inconsistencies and gaps in data and improve our ability to track actual net gains and losses of estuarine habitat.

## Interpretation of data

### *Historic trends*

In Puget Sound there are 16 large river-mouth estuaries: nine larger deltas drain the Cascade Mountains, and seven smaller deltas drain the Olympics. These estuaries and wetlands were a cornerstone of the Puget Sound ecosystem and served as a critical nursery for historically large populations of now-threatened Pacific salmon.

Over the last 150 years, the region has suffered dramatic losses of intertidal wetlands. Of the approximately 62,000 acres of mapped historical swamp and marsh, only an estimated 14,640 acres remain. The swamps of the Skagit and Snohomish once contained over 37,000 acres alone (compared to around 1,620 acres for all the Olympic deltas combined). In the most highly developed river mouth estuaries, such as the Duwamish and Puyallup Rivers, estuarine habitat has been reduced to only a minute fragment of its original extent, and may never be recovered.

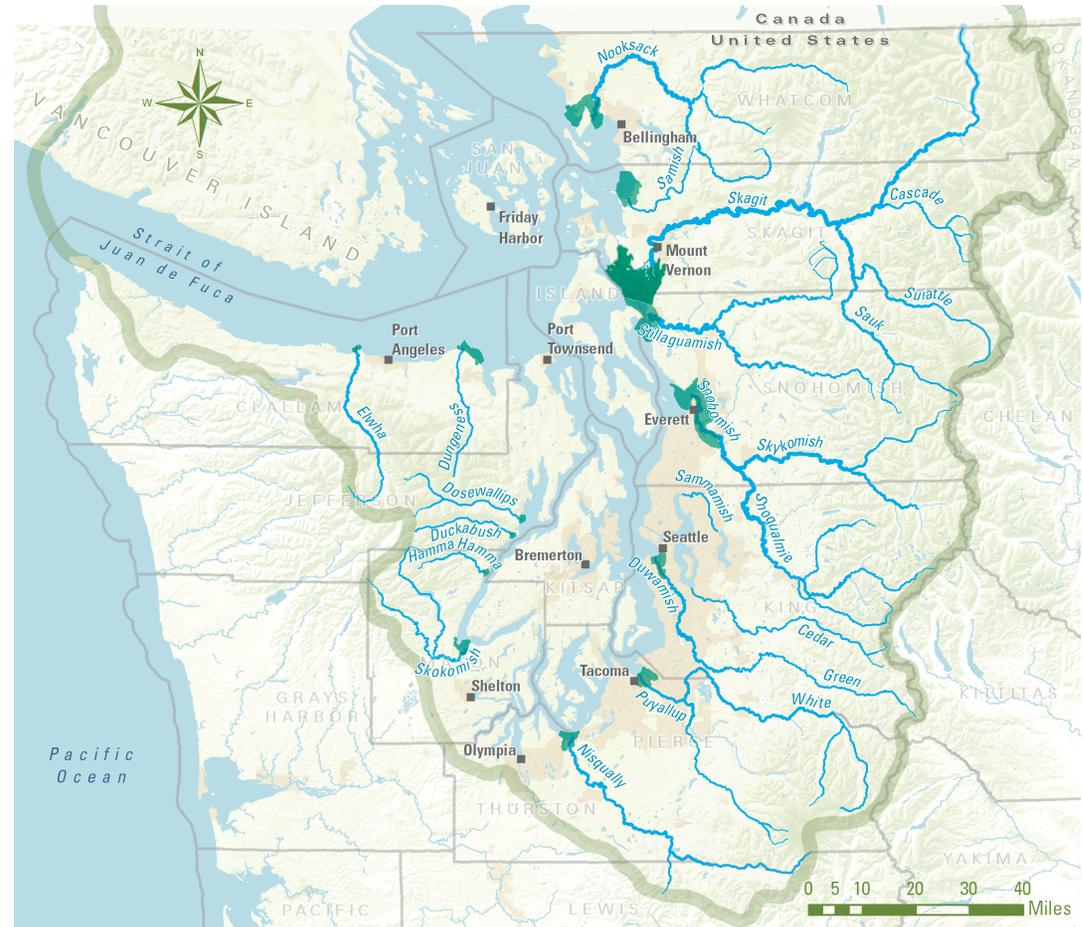
Much of the loss can be attributed to the development of natural waterways for economic and commercial purposes. Across the region, estuaries and tidal wetlands have been diked, drained, or filled. They have been converted to farms and agriculture, or developed into modern ports and industrial sites. Loss of intertidal wetlands has contributed to the decline of many species, including especially Chinook and chum salmon that depend on river delta estuaries for essential juvenile rearing habitat.

**Recent trends**

Recent trends remain challenging to quantify. A number of efforts are now under way to restore estuarine habitat because it is believed to be a bottleneck to the recovery and success of wild salmon and other species. Salmon recovery and watershed restoration groups are working with the support of state and federal partners to set local watershed-specific restoration targets, identify willing landowners, work through intense local politics, and restore habitat as part of their salmon recovery planning process. These efforts are technically complex, and often require public-private partnerships in a complex social, economic, and natural environment.

In contrast to project restoration efforts, habitat losses still occur. Habitat is still being impacted by on-going development, changes in river hydrology and sediment loads, and even the long-term effects of geologic subsidence of delta areas and sea level rise.

Recent advances in remote sensing technologies, improved geographic analysis tools, new ways of tracking fish movements, and better understanding of habitat functions all promise to improve our understanding of the net effect of habitat losses and gains over the coming years.



**Chinook salmon river deltas**



**Figure 2.** Caption forthcoming.  
Source: Forthcoming.

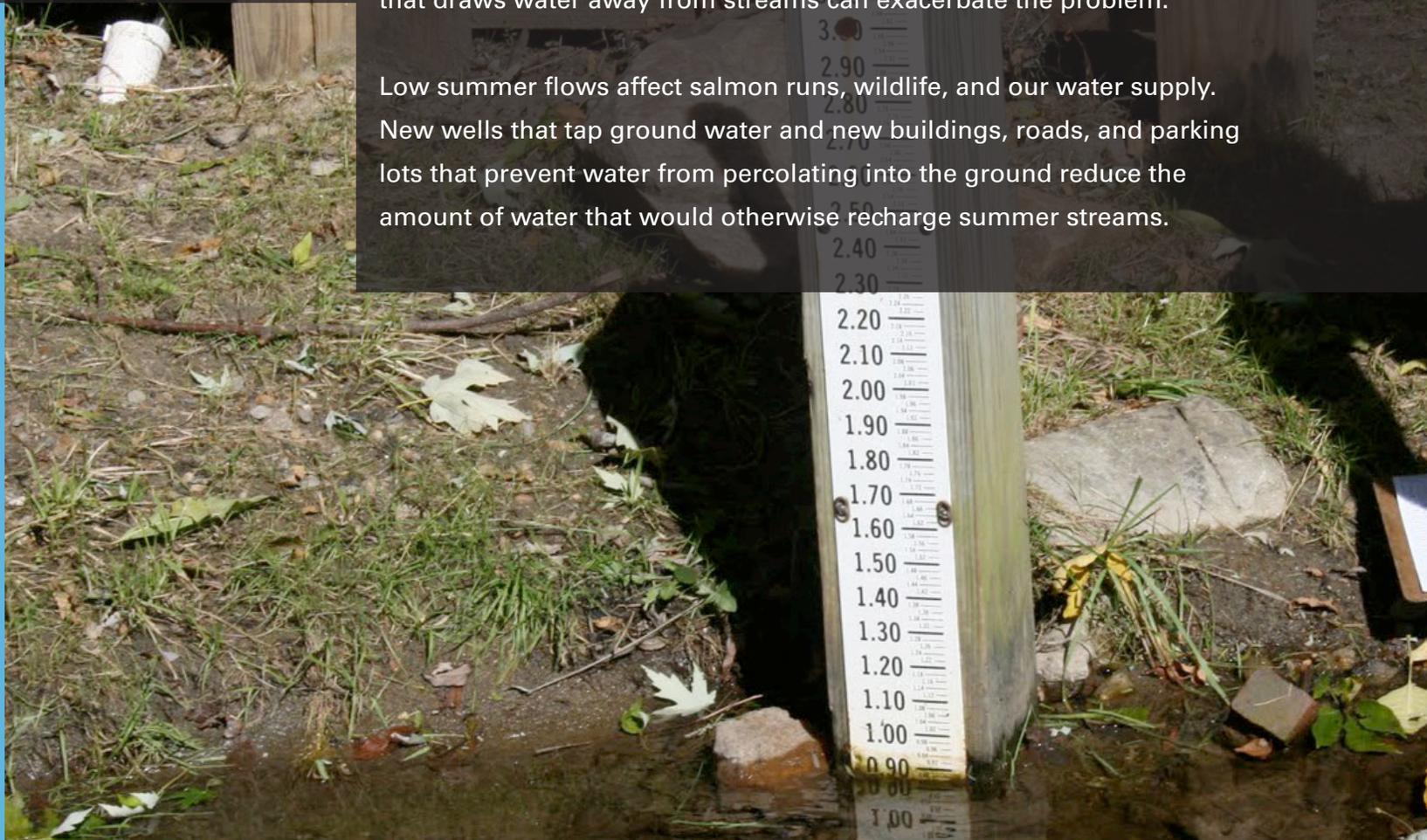
Carpenter creek Local Story



# Freshwater Quantity

Although Puget Sound is known for plentiful rain most of the year, the roaring torrents of spring can slow to a trickle during our dry and sunny summer months. Although this seasonal variation is normal, development that draws water away from streams can exacerbate the problem.

Low summer flows affect salmon runs, wildlife, and our water supply. New wells that tap ground water and new buildings, roads, and parking lots that prevent water from percolating into the ground reduce the amount of water that would otherwise recharge summer streams.



# Freshwater Quantity

**INDICATOR:**  
**Summer Low Flows**  
 Indicator lead: Paul Pickett, Washington Department of Ecology

**TARGET:**  
 Increase, maintain, monitor, and/or restore summer flows in 12 key rivers, including those regulated by dams (Nisqually, Cedar, Skokomish, Skagit, and Green Rivers,) and those that are not (Elwha, Puyallup, Dungeness, Nooksack, Snohomish, Deschutes, North Fork Stillaguamish, and Issaquah Rivers).

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>Mixed</b>
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**CURRENT STATUS**      **2020 TARGET**  
 1975-2011 = 7 or 12 targets met (58%)

-100% No river-specific targets met      -50%      0      +50%      100% All river-specific targets met

Targets for summer low flows were met in 2011 for seven out of 12 rivers.

## Progress towards the 2020 target

The trend in summer low flows for seven of the 12 rivers met their targets in 2011. With just 58% of target rivers trending positively, progress is mixed.

The target for low summer flows (maintain, increase, monitor, or restore) varies per river:

- Maintain stable or increasing flows in highly regulated rivers: Nisqually, Cedar, Skokomish, Skagit, and Green.
- Monitor low flow in the Elwha River after dam removal. (The Elwha River gage was removed from the indicator because of the dynamic changes occurring from river restoration activities). See page XX for more information on the Elwha Dam removal.
- Maintain stable flows in unregulated rivers that currently are stable: Puyallup, Dungeness, and Nooksack.
- Restore low flows to bring the Snohomish River from a weakly decreasing trend to no trend.
- Restore low flows to bring the Deschutes River, North Fork Stillaguamish River, and Issaquah Creek from a strongly decreasing trend to a weakly decreasing trend.

All five rivers that are highly regulated by dams were expected to maintain stable or increase their flows. The Green and Skagit Rivers were stable and the Nisqually, Cedar and Skokomish Rivers had strongly increasing flows.

Three rivers not regulated by dams were expected to maintain their stable flows. The Puyallup and Dungeness Rivers had weak increasing flows and Nooksack had a weak decreasing flow; thus, two out of three met their target.

The Snohomish River remained weakly decreasing and did not meet its target. The Deschutes River, North Fork Stillaguamish River, and Issaquah Creek did not improve from strongly decreasing trends; thus, all three failed to meet their target.

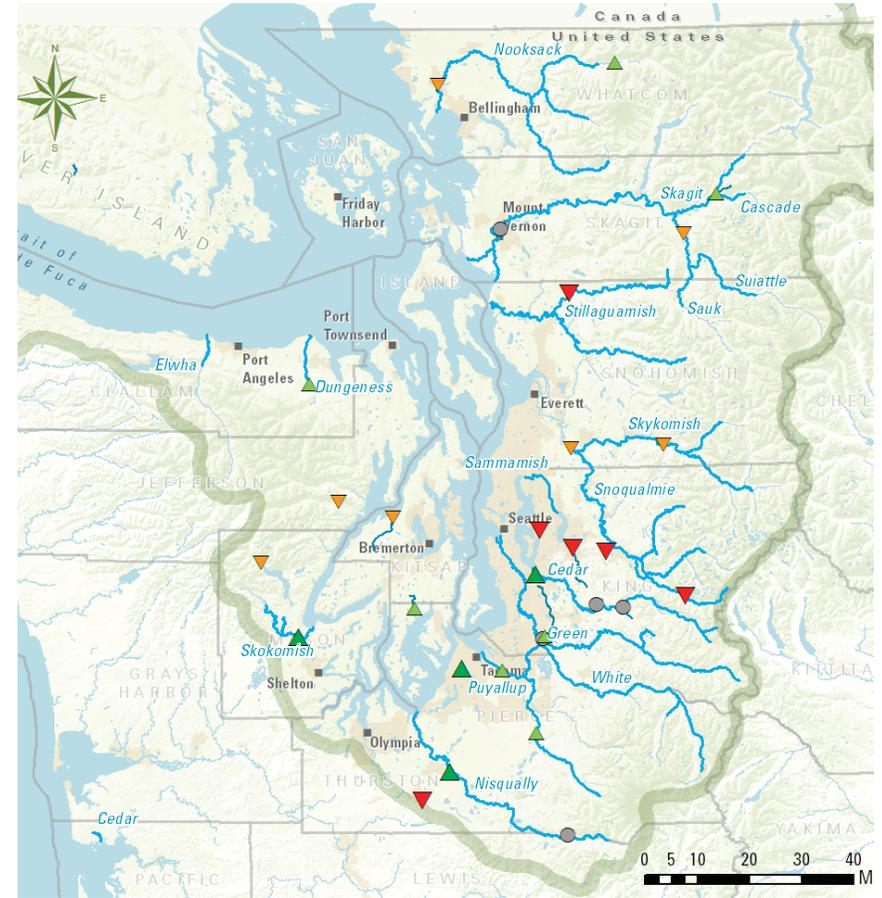
### What is this indicator?

Low flow occurs during summer months when there is less rain and warmer temperatures. Summer low flow is measured as the 30-day minimum water flow at river and stream gaging stations.

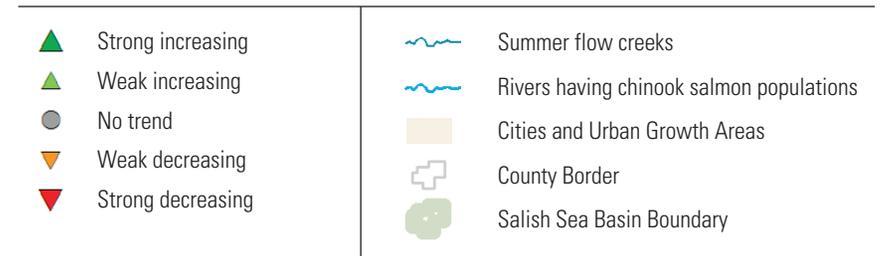
The summer low flow indicator measures trend over a long time period. The indicator tracks how flow conditions are changing over the years, rather than comparing flow levels to a fixed value. The indicator is not sensitive to changes over a shorter time period, which makes it difficult to measure improving trends by 2020, even if significant flow restoration occurs. To measure a change, either large changes in flow must occur, such as a dam setting minimum downstream flows, or a very consistent change over a long period of time is needed.

The indicator tests whether the long-term trends of annual summer low flow levels are declining or increasing. The trend test uses data collected since 1975, representing more than 30 years of measurements. The advantage of a long-term data set is that the influence of climatic changes associated with regional cooling and warming cycles (e.g., the phases of the Pacific Decadal Oscillation) are minimized over time.

One possible way to address this limitation would be to develop a method to evaluate trend over a shorter time period. One approach to accomplish this would be to standardize flows by removing the influence of climate and rainfall over a shorter time period (five-10 years).



**30-day average summer low flow (1975–2011)**



# Fresh Water Quantity

## Interpretation of data

### Status and trend

River-specific targets were created for 12 locations for the Action Agenda. To provide a more complete regional picture, 17 additional gages were also evaluated. Of the 29 gages used to measure summer low flow (Table 1):

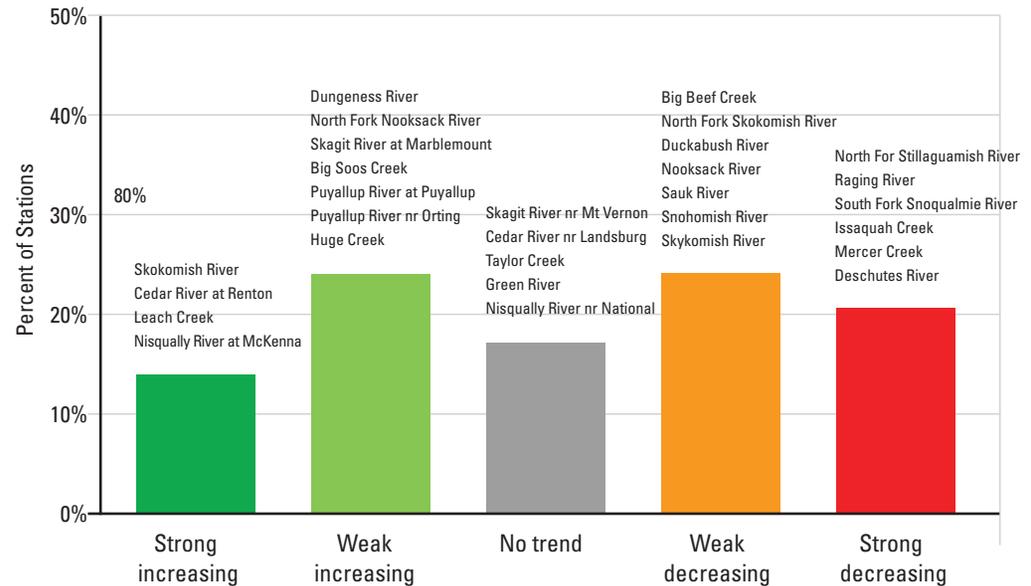
- 15 gages are located near the mouth of major rivers or small streams that drain directly to Puget Sound
- 6 gages are from upstream sites on the mainstem of major rivers
- 8 gages are from tributaries to major rivers.

Of the stations assessed, 55% had stable or increasing summer low flows (16 out of 29; Figure 1). Rivers regulated by dams with mandatory minimum downstream flows generally showed increasing or no trends (Skagit, Cedar, Green, Puyallup, Nisqually, and Skokomish Rivers). Some of the glacier-fed upper tributaries had increasing trends (North Fork Nooksack River, Puyallup River at Orting). This could be the result of climatic warming trends and glacial recession.

The Cedar River near Landsburg immediately below the reservoir but above the City of Seattle water diversion showed no trend, while the Cedar River at Renton (near the mouth) showed a strong increasing trend. Low flows upstream were almost twice the low flows downstream. Taken together this shows the effect of the implementation of the City of Seattle Habitat Conservation Plan.

Unregulated rivers and streams that showed decreasing summer low flows included the Issaquah and Mercer Creeks, which are in urban areas, and the

**Stream flow trends in 29 Puget Sound rivers**  
30-day average summer low flow, 1975-2011



**Figure 1.** Summer low flow trends by category.

Source: River and Stream Flow Monitoring Network, Department of Ecology

North Fork Stillaguamish, South Fork Snoqualmie, and Raging Rivers, which are in areas of rapid population growth. The effect of increased impervious surfaces and ground and surface water withdrawals may be affecting summer low flow levels. The Deschutes River showed a strong decreasing trend even though the watershed above the gaging station is mostly forested land. Decreasing summer low flows may be due to forest practices or climate change.

# How much is water worth?

## The Nisqually and Snohomish Pilot Watersheds Services Transaction Projects

Two Washington state watersheds – the Nisqually and Snohomish - have been credited with protecting and restoring the largest amount of habitat in Puget Sound to date. Now these watersheds have been selected as the most likely candidates for an innovative strategy to keep working forests in the State of Washington from being converted to non-forest uses. How? By getting potential buyers, such as utilities, flood districts or tribal nations, to pay forest landowners to undertake specific land management activities that achieve measurable improvements in watershed services and enhance water quality, increase water supplies, and improve salmon habitat protection.

The Watershed Services Transaction Project was launched in June 2011 by the State Department of Natural Resources in collaboration with the University of Washington Northwest Environmental Forum. After extensive deliberation during the Forums held in 2010 and 2011, the

Snohomish and Nisqually watersheds were identified as the most likely pilot locations for watershed services transactions, primarily because critical organizations presented themselves to lead the projects.

Forested watersheds provide almost two-thirds of the drinking water in the United States. Many other critical services, such as timber, flood control, habitat for animals and birds, carbon sequestration and recreation, are provided by forests, but we too often assume that forest landowners will continue to manage their lands to realize all of these values and that they do not need to be compensated.

A few locations around the country are developing comprehensive valuations of the benefits provided by forests, and creating incentives for private landowners to manage their forests for these diverse public values. “Payments for watershed services” is an approach that has been imple-

mented successfully in a few communities, and is now being considered in Washington.

The Snohomish River Basin pilot project addresses the second largest drainage in Puget Sound. Seventy four percent of the drainage is forest land. The basin is also one of the fastest growing areas in the region, and it is critical to balance the area’s growth needs with maintaining a healthy ecosystem. A recent study valued the potential benefits provided in the watershed to range from a low of \$383.1 million to a high of \$5.2 billion. Snohomish County Department of Public Works is leading this demonstration transaction, joined by several key watershed partners, including the Tulalip Tribes, Forterra, King County and Washington DNR.

The Nisqually pilot project focuses on the Nisqually watershed, which encompasses 78 miles of habitat, from the Nisqually Glacier on Mount Rainier to the delta in the

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*A recent study valued the potential benefits provided in the watershed to range from a low of \$383.1 million to a high of \$5.2 billion.*

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## LOCAL STORY

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Nisqually National Wildlife Refuge. The watershed has a range of land uses, including rural communities; parks, such as Mt Rainier; hydropower projects; military bases and the Nisqually Indian Reservation. The communities, tribes and organizations in the watershed have worked together to conserve, restore and protect habitat in the basin. The Nisqually River Council, Nisqually Land Trust and Northwest Natural Resource Group are spearheading the watershed services pilot project. As in the Snohomish project, their focus will be to provide a demonstration transaction and deliver new sources of income to forest landowners that help them offset the costs of new practices that improve water quality and quantity.

The pilot projects are intended to benefit the individual watersheds, and also provide an effective and transferable model for a state or perhaps national watershed services program. A successful Watershed Services Transaction Project in these two locations can lead the way to address future water supply and water flow needs and create a new financing mechanism for restoration and recovery of the Puget Sound and to sustain Washington's valuable private forest lands.



## Marine Water Quality

Every time we visit the beach, fish, or dig clams in Puget Sound, we rely on good water quality. Marine water quality in much of Puget Sound is poorer than we would like, especially in areas where the circulation of water is restricted.

The marine waters of Puget Sound are affected by many different factors including weather and climate, inflow from rivers and streams, discharges from wastewater treatment plants and industries, off-shore ocean conditions, storm-water runoff, and even ground water.

Excess pollution can force beach closures and shellfish harvesting restrictions, and may cause algae blooms that eventually deplete oxygen levels leading to fish kills.

# Marine Water Quality

**INDICATOR:**  
**Marine Water Condition Index**  
 Indicator lead: Christopher Krembs, Washington Department of Ecology

**TARGET:**  
 The Leadership Council has not adopted a specific target for the Marine Water Condition Index. They did, however, adopt a target related to one key component of the index: Keep dissolved oxygen levels from declining more than 0.2 milligrams per liter in any part of Puget Sound as a result of human input.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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Using 1999-2008 as the baseline period with zero indicating conditions unchanged from the baseline, water quality conditions were slightly worse, on average, from 2009-2011.

## Progress towards 2020 target

### Marine Water Condition Index

Marine water quality was generally lower throughout Puget Sound in 2009 and 2010 relative to the ten year, 1999–2008 baseline. Conditions improved somewhat in 2011, with higher index scores reported in every one of the 12 regions monitored (Fig 1).

### Dissolved Oxygen

For the most part, comprehensive studies to evaluate human contributions to low dissolved oxygen have not yet been completed in Puget Sound. A number of previous studies have suggested human inputs may be contributing to low dissolved oxygen problems. However, a recent study of Hood Canal indicated that human releases of nitrogen are unlikely to be contributing to low dissolved oxygen in the main arm of the Canal. The same study found that human inputs to Lynch Cove (in the southern part of Hood Canal) may be cause for concern, although the available data remains unclear.

Additional studies will be required to refine current models and improve our understanding of the degree to which human inputs contribute to low dissolved oxygen problems in Puget Sound, and what management actions may be necessary to address them.

## What are these indicators?

### Marine Water Condition Index

The Washington State Department of Ecology developed the Marine Water Condition Index (MWCI) to better address the large amount of variability inherent in marine water quality measures, in order to detect subtle changes over time.

The MWCI integrates 12 variables that describe an important aspect of water quality conditions (e.g. temperature, salinity, nutrients, algae biomass, dissolved oxygen, etc.). The goal of the MWCI is to provide a framework that links changes in local water quality and physical conditions to a larger context of oceanic water quality and natural variability. The MWCI can detect subtle changes in water conditions relevant to eutrophication and physical conditions against site and seasonal-specific baseline conditions measured from 1999 to 2008.

The index is reported on a scale of -50 to 50 indicating a complete change from baseline conditions, with zero indicating unchanged conditions relative to the baseline. The index is reported for 12 regions (Figure 1).

### Dissolved Oxygen

Low dissolved oxygen has been observed in a number of locations in Puget Sound and can create significant problems, such as extensive fish kills, human inputs, especially nutrients, are often suspected of creating, or exacerbating, the conditions which lead to low oxygen in Puget Sound. To reduce the frequency and severity of oxygen problems in Puget Sound, the Leadership Council adopted a target intended to minimize any human contributions to low dissolved oxygen in Puget

Sound.

The problem is, dissolved oxygen naturally exhibits a high degree of variability in marine waters, changing almost continuously with time of day, location, season, tidal cycle, depth, the mixing and movement of different water sources, and many other factors. Also, there are several main sources of nitrogen to Puget Sound, including the ocean (generally the largest overall source), terrestrial sources (some of which are natural, and some of which are human), groundwater, and the atmosphere.

Consequently, determining the precise degree to which human inputs are responsible for a relatively small decline in dissolved oxygen, relative to the normal range of variability, is a complex issue. Addressing the issue requires a combination of good monitoring data, studies on the sources of nitrogen, and sophisticated mathematical models.

**Marine Water Condition Index Scores  
1999-2011**

	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Admiralty Reach	20	13	8	4	0	-5	-3	-5	4	0	-3	-2	14
Georgia Basin	-2	14	13	1	-2	10	-2	-7	1	9	-9	7	16
South Hood Canal	16	7	9	3	-4	-9	-1	-11	6	10	-1	-14	-11
Central Basin	15	14	12	8	0	-6	-8	-3	4	1	-7	-10	7
Bellingham Bay	10	13	23	-3	1	6	-12	-8	7	2	-12	-14	7
Sinclair Inlet	8	16	13	1	-1	-6	-5	-11	4	1	3	-13	3
Oakland Bay	16	13	14	-4	-6	-9	-5	1	4	-3	1	-6	1
South Sound	19	14	14	-2	4	0	-4	-2	3	0	-8	-12	9
Elliot Bay	28	19	5	-3	-9	3	-15	-9	3	4	-8	-5	5
Commencement Bay	17	8	13	-3	-6	0	-3	-1	7	0	-5	-8	2
Whidbey Basin	11	8	8	-5	-2	-10	-1	1	9	7	-9	-14	-3
Budd Inlet	8	14	17	1	-12	-9	-7	-1	8	5	3	-8	1

**Figure1.** Marine Water Condition Index scores for twelve regions of Puget Sound, between 2001 and 2010. Changes in water quality relative to the 1999 to 2008 baseline are reported, with numbers greater than zero indicating improving water quality (in green), and numbers smaller than zero indicating decreasing water quality (in red).

Source: Washington Department of Ecology, Environmental Assessment Program, Marine

# Marine Water Quality

## Interpretation of data

### *Status and trend*

Marine Water Condition Index scores have generally declined over the past ten years, illustrated by a shift from green to red colors and an increase in negative scores (Figure 1). These results indicate that conditions overall are shifting in the direction of lower water quality, although recent, more stable conditions have slowed the apparent decline. The largest changes, more than 20% decline, were in South Sound, Bellingham Bay, and Central Sound.

The largest driver of declining marine water quality has been nitrate concentrations. Over the past ten years, nitrate levels have increased significantly. Because nitrate is an important plant nutrient, increasing nitrate loads can fuel algae blooms which, as the algae subsequently die and decay, can drive low dissolved oxygen events.

There are two main sources of nitrate in Puget Sound waters: input from ocean waters flowing into Puget Sound, and human pollution. Recent evidence suggests that increasing nitrate loads to Puget Sound are predominately non-oceanic. However, as discussed earlier, the overall contribution of human inputs to low dissolved oxygen in Puget Sound remains a topic of active study.



## Freshwater Quality

The rivers and streams that flow into Puget Sound are the lifeblood of our region's ecosystems and our health, economy, and quality of life. Yet only 64% of the major rivers in Puget Sound meet water quality goals.

Clean water is vital to people and to healthy fish and wildlife populations. When our rivers and streams pick up pollutants, toxic contaminants, or excessive sediments and nutrients, it adversely affects the health of our watersheds, marine waters, swimming beaches, and shellfish beds.

Three key indicators help us monitor the health of Puget Sound: the number of impaired waters, the Water Quality Index (WQI), and the Benthic Index of Biotic Integrity (B-IBI). Under the federal Clean Water Act of 1972, waters that fail to meet water quality standards are considered impaired. The WQI integrates complex water quality data into a readily understood scale. The B-IBI measures the abundance and diversity of macroinvertebrates in a streambed. Also known as stream bugs, these creatures are a critical part of the aquatic food web and are sensitive to changes in the environment.

# Freshwater Quality

**INDICATOR:**  
**Freshwater Quality Index**

Indicator lead: David Hallock, Washington Department of Ecology

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**TARGET:**  
At least half of all monitored streams should score 80 or above on the fresh water quality index.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>IS THERE PROGRESS?</b>
<b>NO</b>	<b>YES</b>

<b>BASELINE REFERENCE</b>	<b>CURRENT STATUS</b>	<b>2020 TARGET</b>
2003 - 2007 = 29%	2008 - 2011 = 31%	50% of streams score >80

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During the 2003-2007 baseline period, 16 of 55 stations (29%) met the target value based on averaging index scores for each site during this period (Fresh Water Quality Index >80). During 2008-2011, 17 of 55 stations (31%) met the target value (a slight increase).

## Progress towards 2020 target

Monitored sites showed a very slight increase in the number of sites with Fresh Water Quality Index (WQI) scores of 80 or above. However, results from the trend analysis of 14 of the major rivers at their most downstream sites suggest that we are not likely to reach the target by 2020.

The earliest projection to meet the target for these 14 rivers would be 2025. When adjusted for differences in seasonal flows, the trend is much slower: average flow-adjusted scores of 80 are projected for 2060. (Flow-adjusting accounts for the effect of flow on the parameters underlying the index.)

However, this kind of estimate is a best guess due to fluctuations in drivers like the rate of population growth, global warming, and effectiveness of management activities, as well as possible long-term cycles not visible in the current 15-year dataset. For example, management tends to address the easier and more egregious problems first. As those problems get fixed, remaining problems become more difficult to correct with less effect on the water body for a given level of effort. Consequently, the rate of improvement in the index could be less, perhaps much less, than predicted by simply extending current trends.

## What is this indicator?

The Fresh WQI for rivers and streams combines eight measures of water quality. Expectations for four of the component measures (dissolved oxygen, pH, temperature, and fecal coliform bacteria) are tied to the State's Water Quality Standards for protecting aquatic life and contact recreation. The other four measures (nitrogen, phosphorus, suspended sediment, and turbidity) do not have numeric standards. Toxics are not included in the index.

## Water Quality Index

Annual, 2000-2012

	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Duckabush River nr Brinnon	94	92	96	78	92	89	93	95	94	90	74	94	89	85	88	96	86	89
Skokomish River nr Potlach	88	93	87	86	75	87	95	95	94	85	70	67	92	89	89	94	86	70
Snohomish River at Snohomish	83	77	82	76	89	83	92	91	89	81	74	75	89	75	81	85	79	77
Elwha River nr Port Angeles	83	83	79	80	87	74	86	88	83	76	73	74	89	67	66	81	81	76
Cedar River at Logan st/Renton	81	76	68	75	65	83	87	76	60	78	72	84	81	79	79	81	77	75
Skagit River at Marblemount	90	78	75	64	87	71	87	86	59	85	64	81	84	75	75	81	56	77
Skagit River nr Mount Vernon	75	73	72	65	84	77	89	91	71	76	61	73	77	77	75	76	74	73
Nisqually River at Nisqually	65	74	58	59	76	60	40	60	79	79	69	71	74	75	91	74	83	86
Deschutes River at East St Bridge		67	74	47	61	62	62	72	70	73	61	83	88	88	82	76	74	60
Stillaguamish River nr Silvana	83	70	66	58	71	70	81	60	44	72	55	67	71	69	75	75	71	59
Green River at Tukwila	62	52	35	50	63	70	82	73	66	67	75	49	72	68	60	69	63	68
Samish River nr Burlington		66	59	50	58	66	86	75	32	49	34	71	67	74	59	80	63	52
Nooksack River at Brennan	73	56	49	41	62	42	65	68	58	57	52	54	61	51	60	69	56	55
Puyallup River at Meridian St	49	52	47	48	41	62	60	58	57	55	51	58	59	58	61	49	62	56

**Table 1.** Annual Water Quality Index scores for monitoring stations near the mouth of 14 major rivers. Scores are calculated for each water year from October 1st to September 30th. Higher numbers indicate better water quality. Scores above 80 are shown in green, 70 to 80 in orange, 40 to 70 in pink, and scores <40 are in red.

Index values are based on monthly monitoring at individual stations. The index values range from 1 to 100; a higher number is indicative of better water quality. However, a particular station may receive a good WQI score, and yet have water quality impaired by parameters not included in the index. Similarly, some locations may have poor WQI scores based on measures that do not have Water Quality Standards.

## Interpretation of data

### Status and trend

From 2008-2011, 17 of the 55 long-term monitoring stations reported average Water Quality Index scores of 80 or more, indicating that they support water quality goals for conventional pollutants (toxics are not included); 11 stations had values that were “borderline” (70 – 79); 25 had “poor” scores (40 – 69); and two stations had a very poor index score (< 40) (Figure 1). For major rivers, three out of 14 stations reported average Water Quality Index scores of 80 or higher during this time period (Table 1).

## Freshwater Quality

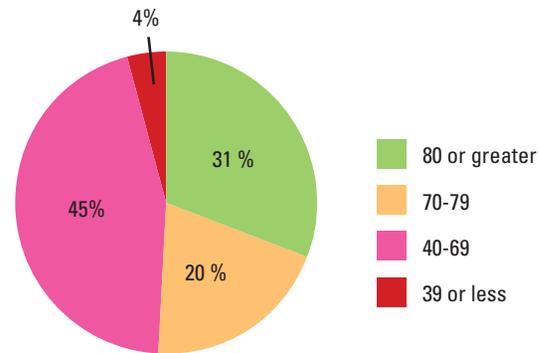
Freshwater Quality Index scores for major rivers in Puget Sound are in the mid 70s. These scores have slowly improved at a rate of about 0.4 units per year since 1995 (seasonal Kendall analysis,  $p < 0.10$ ). Flow-adjusted scores have improved at a slower rate, 0.16 units per year ( $p < 0.20$ ).

Scores have improved most strongly in the Nisqually and Deschutes systems (1.4 and 1.6 units per year, respectively,  $p < 0.05$ ). No Puget Sound basins have had significantly declining scores ( $p > 0.20$ ).

In addition to improvements in the overall scores for major rivers in Puget Sound, fecal coliform bacteria and total nitrogen index scores have improved. Other parameters are unchanged in freshwater systems as a whole, though there may be system-specific trends.

Stations meeting water quality goals are all in the relatively undeveloped Olympic Peninsula, except for the Snohomish River. Stations not meeting water quality goals tend to be in watersheds with more people and more agricultural development.

**Freshwater Quality Index scores (averaged) for 55 sites in Puget Sound 2008-2011**



**Figure 1.** Freshwater Quality Index scores (averaged) from 2008-2011. Shown are percentages of 55 sites by category for WQI. Higher numbers indicate better water quality.

Sources: Statewide Water Quality Monitoring Network, Washington Department of Ecology; Stream and River Water Quality Monitoring, King

**INDICATOR:**  
**Number of Impaired Waters**  
 Indicator lead: Ken Koch, Washington Department of Ecology

**TARGET:**  
 Reduce the number of “impaired” waters

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>YES</b>
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From 2008–2010, the number of impairments decreased by 77. However, the next assessment (due in 2013) is expected to show a significant increase in impairments (a trend away from the 2020 target) due to an increase in data and the number of sites assessed.

**Progress towards the 2020 target**

Although the number of impairments for rivers and streams decreased by 77 segments in 2010 (Figure 1), it does not mean that these segments now meet water quality standards. Instead, the change in number of impairments was largely due to the number of segments receiving approval for their water quality improvement project plans or pollution control programs.

Having a plan in place removes a segment from the impairment list, but does not necessarily mean that the area has been restored or that water quality standards are being met. For example, only four segments from the 2010 list were removed from the impaired list because they met water quality standards.

New data for freshwater were not reviewed in 2010; the next water quality assessment for 2012 will use new data and be published in 2013. The number of freshwater impairments is likely to rise significantly in 2012 due to an increase in data and the number of sites assessed. Comparing the number of impairments for 2008 to 2012 will be difficult because the method used to map and count segments will change.

**What is this indicator?**

Impaired waters are segments of streams, rivers, or lakes that do not meet Washington State’s Water Quality Standards for bacteria, dissolved oxygen, temperature, toxics, or other pollutants. Cool, clean water is a key ingredient for a healthy Puget Sound. When lakes and streams have a reduced ability to support native species and human uses, then they are listed as Impaired.

Washington Department of Ecology reviews data from a variety of sources every four years to identify impairments. The data used to list segments as impaired must meet rigorous data quality standards as outlined in

# Freshwater Quality

Washington's Water Quality Policy 1-11.

Under the Federal Clean Water Act of 1972, waters are considered impaired when they fail to meet water quality standards or minimum requirements for certain uses. Every two years, states are required to prepare a list of water bodies that do not meet water quality standards. This list is called the 303(d) list, because the process is described in Section 303(d) of the Clean Water Act. To achieve this goal, Washington State established water quality standards designed to protect and restore water quality for drinking, recreation, and habitat for fish and other aquatic life.

More than one segment of a river may be listed as impaired, and a single segment may be listed for more than one pollutant. Once a segment is listed as impaired, a plan must be created and implemented to control pollution or improve water quality. The effects of these restoration programs can take many years to have a positive impact.

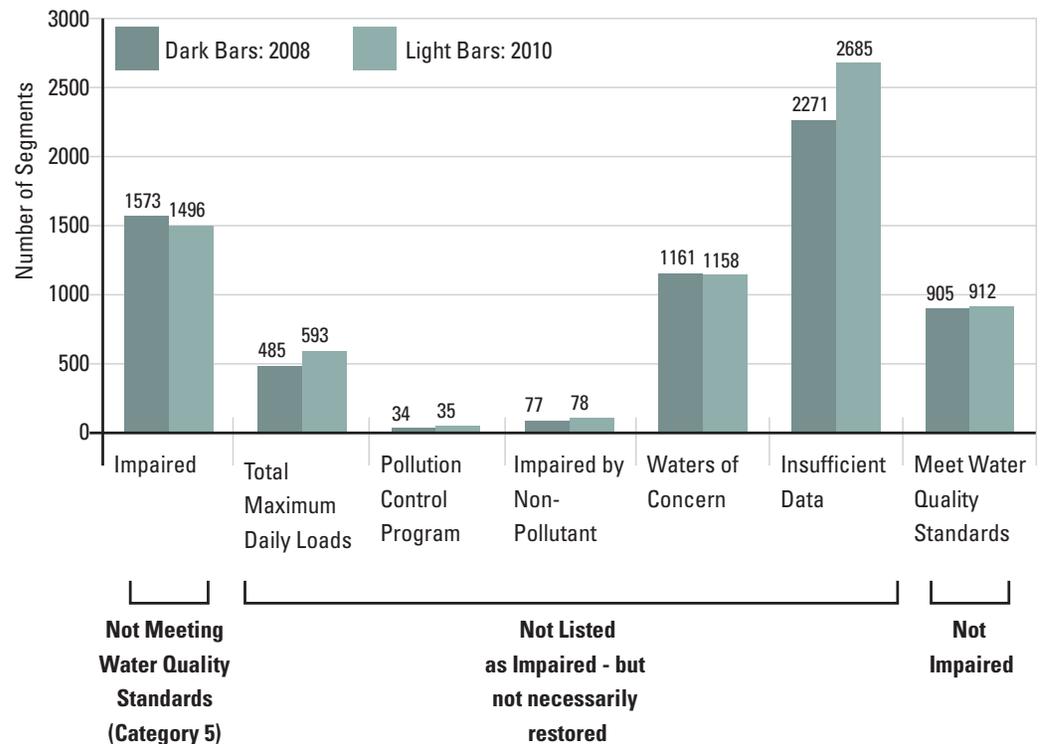
## Interpretation of data

### Status and trend

In the Puget Sound basin, the 2010 Water Quality Assessment showed a total of 6,957 segment and parameters combinations were assessed. A total of 1,496 river and stream segments, in 525 rivers and streams, did not meet Water Quality Standards and thus were listed as impaired.

Impairments occurred in all 19 Water Resource Inventory Areas (WRIAs) in the Puget Sound basin (Figures 2 to 4). More than 60% of the total number of listings for Puget Sound rivers and streams were in five watersheds: Nooksack (296 listings), Kitsap

**Number of stream and river segments listed in each assessment category 2008 and 2010**



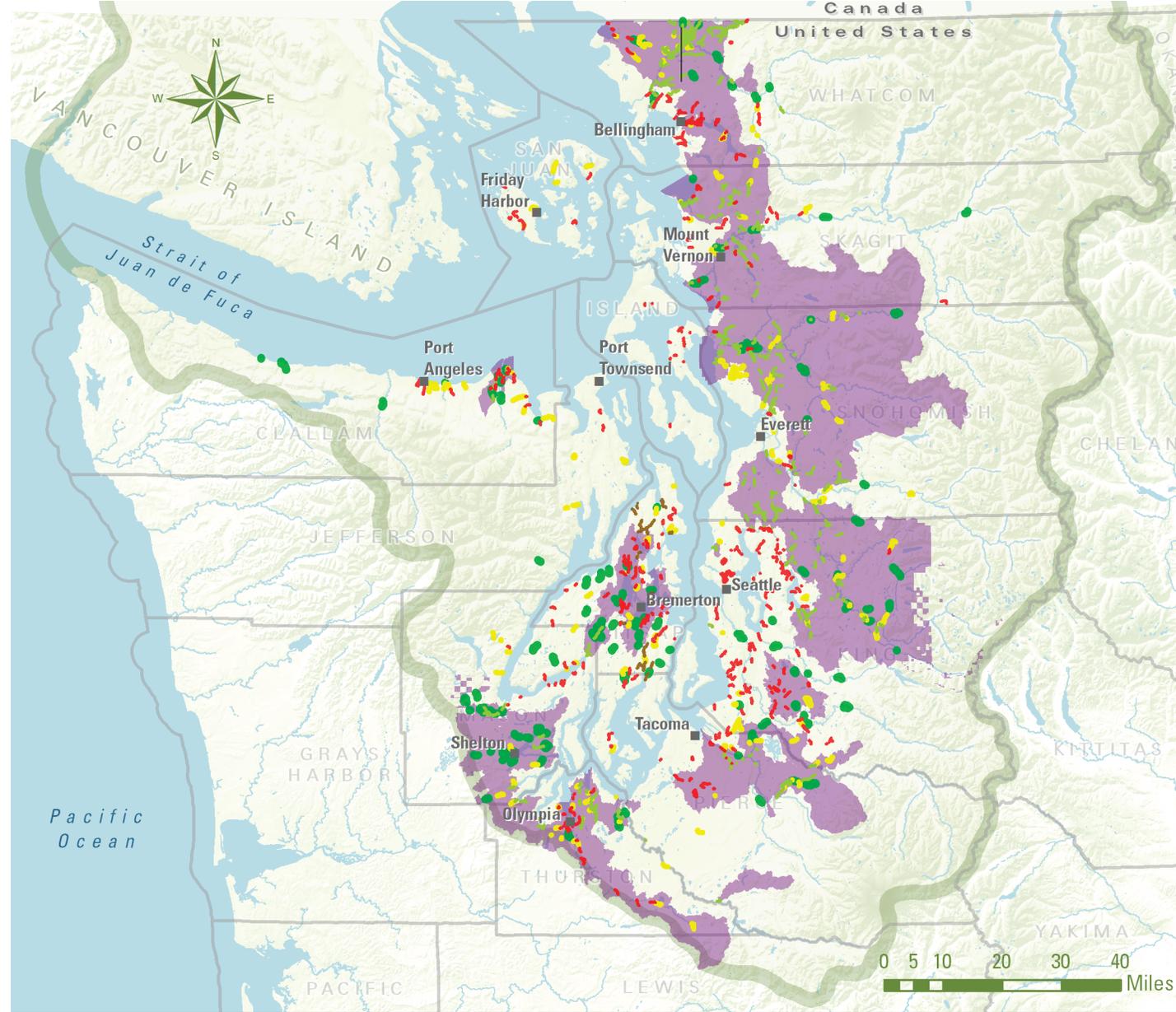
**Figure 1.** Number of stream and river segments listed in each assessment category for 2008 and 2010. Category assignments are from Washington Department of Ecology's Water Quality Assessment process for Puget Sound watersheds. The 2010 Assessment was focused on marine waters and, therefore, showed minimal changes to freshwater listings.

Source: Forthcoming

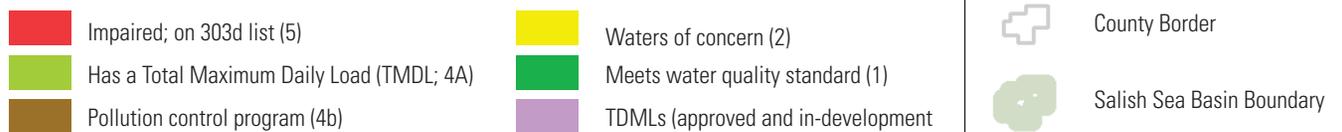
(194), Cedar/Sammamish (181), Duwamish-Green (132), and Lower Skagit-Samish (109). For Puget Sound lakes, 52 were listed as impaired; 48% were listed for bacteria and total phosphorus, and approximately one half were listed for toxic chemical contamination.

The most frequently cited data for listing segments as impaired were bacteria (524 listings), dissolved oxygen (460), temperature (353), and pH (97). However, the largest number of segments (39%) could not be categorized because of insufficient data. Water Quality Standards include strict rules about the number of samples required to determine whether a segment is impaired or meeting standards.

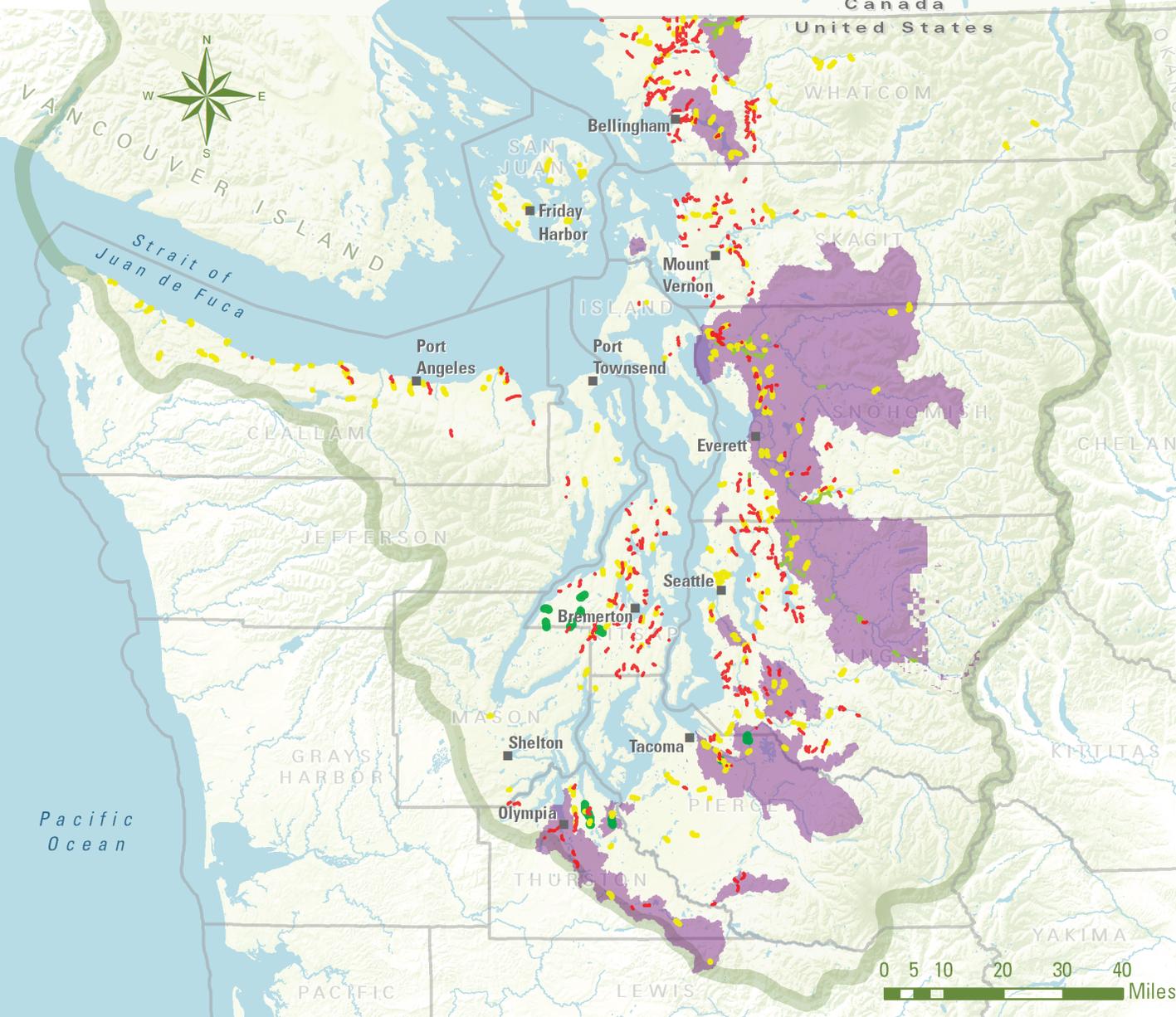
Segments listed as waters of concern have data that indicate a problem, but not enough data to make a determination of impairment.



### Water Quality Impairments; Bacteria



**Figure 2.** Rivers and stream segments listed as impaired for bacteria.



Sampling of streams, rivers, and lakes tends to focus in areas with known problems; therefore, not all segments have been assessed, and some impairments may be missed. Consequently, impairment data are not a complete reflection of the overall health of all streams, rivers, and lakes in Puget Sound watersheds.

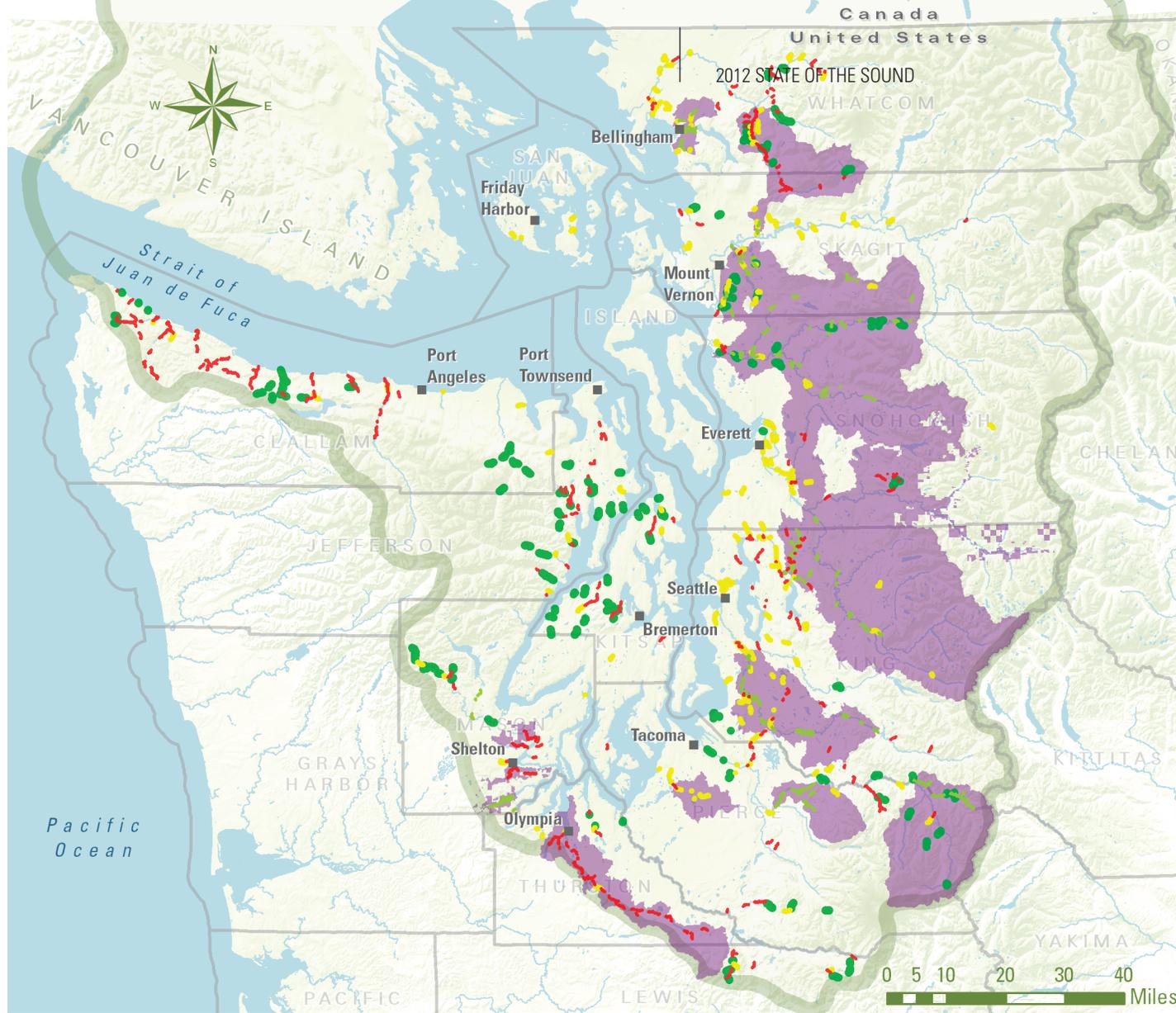
In addition, selection of monitoring sites is frequently constrained by funding. Monitoring efforts are split between monitoring established sites and looking for new problems. This limits the numbers of new waters that are addressed during a cycle.

**Water Quality Impairments: Dissolved Oxygen**

- Impaired; on 303d list (5)
- Waters of concern (2)
- Has a Total Maximum Daily Load (TMDL; 4A)
- Meets water quality standard (1)
- Pollution control program (4b)
- TDMLs (approved and in-development)

- County Border
- Salish Sea Basin Boundary

**Figure 3.** Rivers and stream segments listed as impaired for dissolved oxygen.



**Water Quality Impairments: Temperature**

**Figure 4.** Rivers and stream segments listed as impaired for temperature. Source: Washington Department of Ecology, Water Quality Program

- |   |   |   |
|---|---|---|
|  Impaired; on 303d list (5)                |  Waters of concern (2)               |  County Border             |
|  Has a Total Maximum Daily Load (TMDL; 4A) |  Meets water quality standard (1)    |  Salish Sea Basin Boundary |
|  Pollution control program (4b)            |  TMDLs (approved and in-development) |   |

# Freshwater Quality

**INDICATOR:**  
**Benthic Index of Biotic Integrity (B-IBI)**  
 Indicator lead: Jo Wilhelm, King County

**TARGET:**  
 Protect small streams that are currently ranked “excellent” by B-IBI for biological condition; and improve and restore streams ranked “fair” so their average scores become “good.”

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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For 128 sites with repeat visits during the last five years (2007 – 2011) more (26 sites) declined in condition to “poor” or “very poor” than improved to “good” or “excellent” (11 sites).

## Progress towards 2020 target

No progress has been made. Overall, there was a net decline in condition of 12% of the 128 streams initially ranked “fair.”

From 2007-2011, a total of 245 stream sites were sampled more than once. Of these, a total of 91 sites had B-IBI scores indicating “fair” condition. Of these, 11 sites improved and changed categories to “good” or “excellent.” In contrast, a total of 26 stream sites declined and changed from “fair” to “poor” or “very poor.”

For the streams with “excellent” biological condition as rated by B-IBI, some streams are already protected. A detailed analysis has not been done to identify which streams and watersheds should be protected for this target. The watersheds will likely be small, five to 20 square miles.

## What is this indicator?

The indicator is the Benthic Index of Biotic Integrity (B-IBI). This index describes the biological condition of stream sites and their surrounding habitat based on the diversity and relative abundance of the benthic (bottom dwelling) macroinvertebrates living there, such as mayfly larvae, stonefly larvae, caddisfly larvae, worms, beetles, snails, dragonfly larvae, and many others.

Ten measures of biological condition are scored and summarized as the B-IBI, which ranges from a score of 10, indicating a very poor stream condition, to 50, indicating excellent condition.

B-IBI data are routinely collected and reported by more than 20 local jurisdictions, tribes, and other state and federal organizations in Puget Sound for a variety of reasons. In contrast, the Washington State Department of Ecology sampled 50 randomly-selected stream sites in 2009 and will sample again in 2013 to assess status and trend at the regional scale. Snohomish and King Counties also randomly select stream sites and report unbiased estimates of regional stream condition using B-IBI. For 84 sites with long-term data in King County, B-IBI scores for 68 sites did not change (81%), ten improved (12%), and six declined (7%).

## Interpretation of data

### *Status and trend*

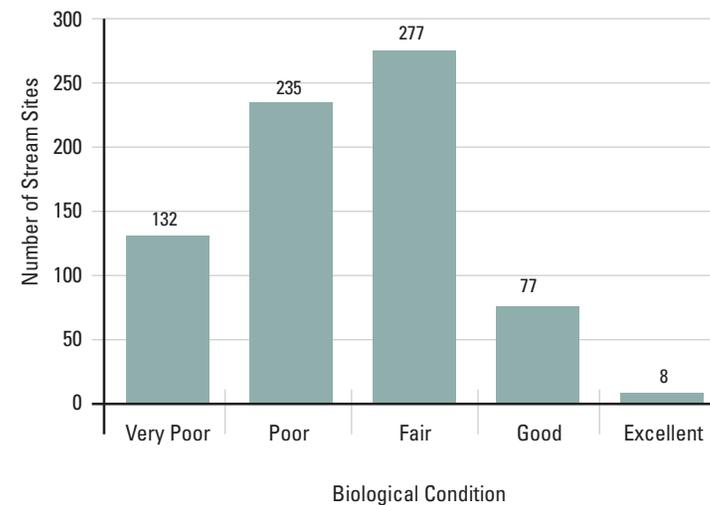
Biological condition ranged from very poor to excellent for streams assessed between 2007 and 2011. The majority of streams (88%) rated very poor, poor or fair, while fewer than 12% of streams were rated as good or excellent (Figure 1).

Not surprisingly, B-IBI scores were lower in areas with greater urban development (Figure 2). B-IBI is highly correlated with development and component metrics respond to specific aspects of disturbance. For example, long-lived species tend to decline as stream flows become higher in wet periods and lower in dry periods. Stoneflies also decline when natural vegetation near the stream is removed. Stream invertebrates are also sensitive to sediment, toxics, increased temperatures, and loss of habitat.

For sites with repeat visits during the last five years, more sites have declined in biological condition from “fair” to “poor” or “very poor” (29%)

than have improved to “good” or “excellent” condition (9%; Figure 3). These B-IBI scores were not derived from a random sample design and, therefore, do not necessarily represent the entire Puget Sound area.

### **B-IBI scores by category of biological condition for Puget Sound streams Annual, 2000-2012**

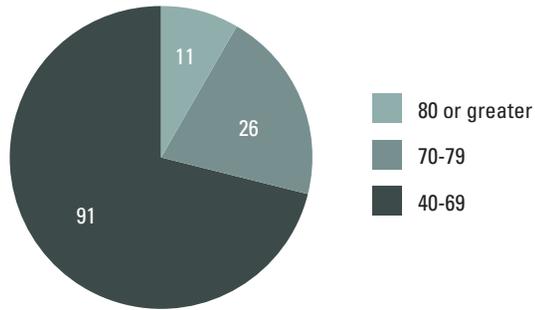


**Figure 1.** B-IBI scores by category of biological condition for Puget Sound streams. Shown are most recent data for each site.

*Source: Benthic Conditions needs source*

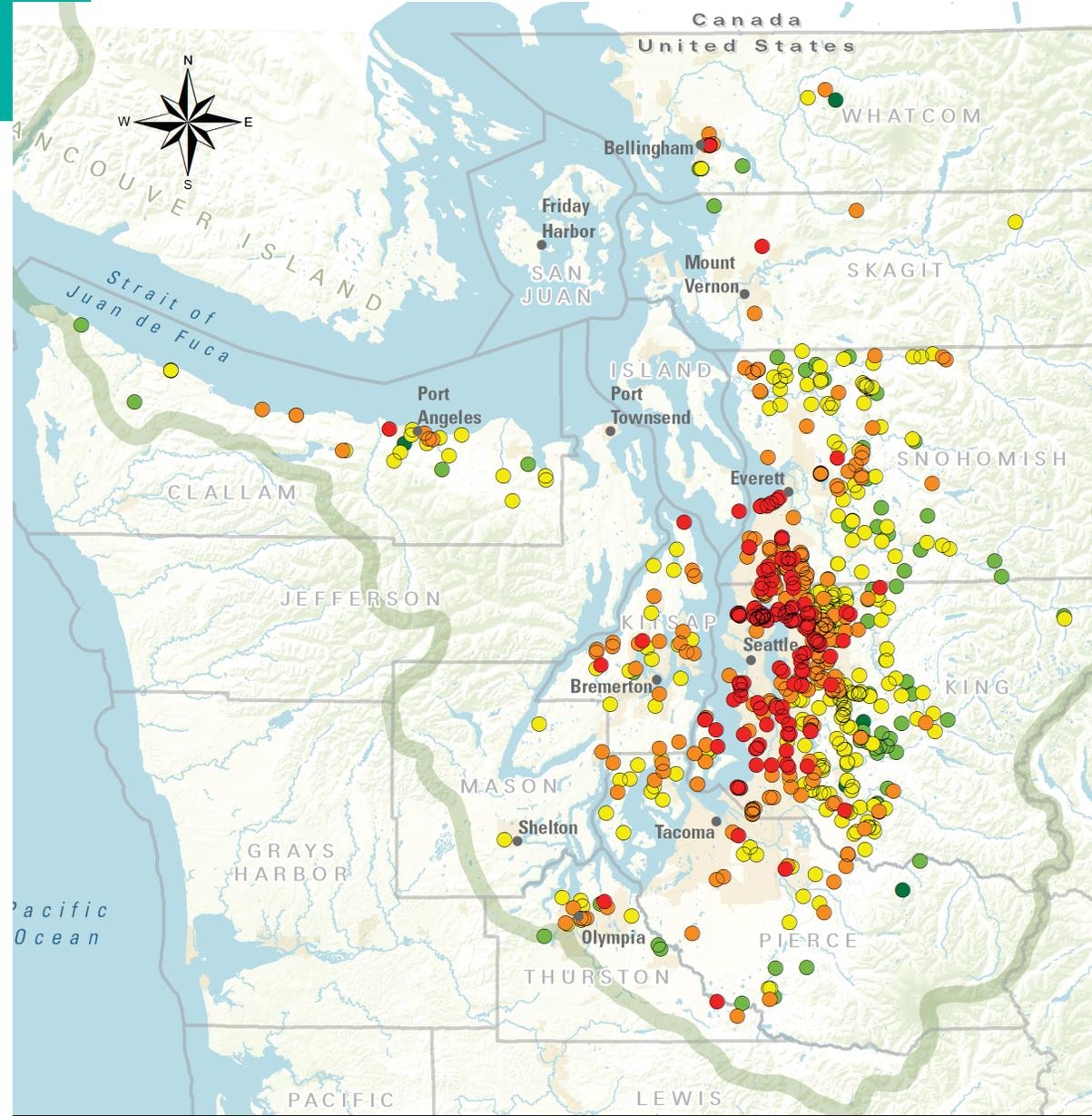
# Freshwater Quality

**B-IBI scores for 128 streams in Puget Sound**  
Annual, 2000-2012



**Figure 3.** From 2007–2011, B-IBI was measured more than once at 245 sites. Of these, 128 stream sites were rated as “fair” by B-IBI for the first visit. Of these, 11 of these 128 improved in condition to “good” or “excellent” condition; 26 declined in condition to “poor” or “very poor;” and 91 were still rated as “fair.”.

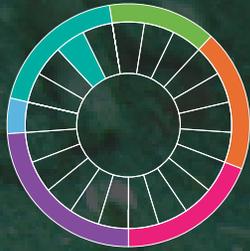
Sources: Benthic Pie needs sources?



**Biological Condition**

- Very Poor
- Poor
- Fair
- Good
- Excellent

- County Border
- Salish Sea Basin Boundary
- Cities and Urban Growth Areas



## Marine Sediment Quality

Much of the “floor” of Puget Sound is covered with sediment—the mud, sand, silt, and clay that has accumulated over years, decades, centuries, and even millennia. The accumulation of sediment is a natural estuarine process that occurs as beaches and bluffs erode, as streams and rivers carve their way through watersheds and carry sediments from the land into the water, as glaciers grind down the rocks of mountains, and even as the teeming algae and microscopic animals die and settle slowly to the bottom.

These sediments form a unique habitat that is home to clams, marine worms, burrowing shrimp, bottom-dwelling fish, and thousands of other unique species that live in, or on, the bottom sediments. In turn, these animals form a critical part of the marine food web, help filter the overlying water, and even process and help breakdown the sediments themselves—much as earthworms and other soil organisms process and enrich the soils of our farms, gardens, and forests.

In a well-functioning estuary, marine sediments support a healthy biological community. But in Puget Sound sediments have become contaminated and adversely affect aquatic life that rely upon them.

# Marine Sediment Quality

**INDICATOR:**  
**Sediment Quality Triad Index**  
 Indicator lead: Maggie Dutch, Department of Ecology

**TARGET:**  
 All Puget Sound regions and bays, as characterized by ambient monitoring, achieve the following: Sediment Quality Triad Index (SQTI) scores reflect “unimpacted” conditions (i.e., SQTI values >81)  
 The threshold criteria for “unimpacted” sediments has been revised from 83 (when the Leadership council adopted the target in 2011) to 81, based on quality control checks indicating the original calculation was incorrect.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>Yes*</b>
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**BASELINE REFERENCE (1997-1999)– all regions and bays combined = 71%**  
**CURRENT STATUS (2004-2009) all regions and bays combined = 86% meeting target**  
**2020 TARGET**

0% of regions and bays score > 81    25%    50%    75%    100% of regions and bays score > 81

Four Puget Sound regions and three urban bays were first sampled in 1997-1999 and then re-sampled from 2004-2009. The most recent results showed an increase in the number of regions and bays meeting the target.

\*Caution must be used in this interpretation as the weighted mean SQTI

## Progress towards 2020 target

Sediment Quality Triad Index results suggest that much of Puget Sound has relatively healthy sediments. In the initial round of baseline sampling conducted between 1997 and 2003, four of eight regional areas and all three urban bays (64% of all areas combined) exceeded or were statistically no different from the target value of 81, indicating “unimpacted” sediments (Table 1, Figure 1). The remaining four regions (36% of all areas combined) had somewhat lower scores, but still fell within the range normally characterized as “likely unimpacted” (SQTI >57-81).

While the SQTI scores for the regions and bays fell in the two highest quality categories, values measured in resampled regions and bays still raise a concern. Among four regions and three bays that were re-sampled from 2004-2009, SQTI scores improved in only one area—Whidbey Basin—and declined in the other six areas (Figure 1). The improved score for Whidbey Basin increased the number of regions and bays meeting, or not statistically different from, the 2020 target (now six of seven areas = 86%), despite declining scores at all six other sampled locations. While the results indicate progress towards the target, there is also a somewhat concerning pattern of declining condition evident in sediments across the majority of regions and bays.

## What is this indicator?

Sediment quality is a key indicator of a healthy ecosystem, and high quality sediments support a diverse and important biological community. We monitor sediment quality in Puget Sound by measuring the levels of chemical contamination, assessing the toxicity of the sediments to marine life, and examining the diversity and health of the biological community.

**Classification of sediment quality based on SQTl scores**

Category	SQTl score	Interpretation
<b>Unimpacted</b>	>81-100	Confident that contamination and/or other stressors are not causing significantly adverse impacts to aquatic life in the sediment.
<b>Likely Unimpacted</b>	>57-81	Contamination and/or other stressors are not expected to cause adverse impacts to aquatic life in the sediment, but some disagreement among lines of evidence reduces certainty that the site is unimpacted.
<b>Possibly Impacted</b>	>36-57	Contamination and/or other stressors may be causing adverse impacts to aquatic life in the sediment, but the level of impact is either small or is uncertain because of disagreement among lines of evidence.
<b>Likely Impacted</b>	>5-36	Evidence of contaminant and/or other stressor-related impacts to aquatic life in the sediment is persuasive, in spite of some disagreement among lines of evidence.
<b>Clearly Impacted</b>	0-5	Sediment contamination and/or other stressors are causing clear and severe adverse impacts to aquatic life in the sediment.
<b>Inconclusive</b>	No SQTl score	Disagreement among or within lines of evidence suggests that either the data are suspect or additional information is needed for classification.

**Table 1.** Classification of sediment quality based on SQTl scores  
*Source: Washington Department of Ecology, Marine Sediment Monitoring Unit*

**Citations** Dutch, M.E., E.R. Long, S. Weakland, V. Partridge, and K. Welch. 2012. Sediment Quality Indicators for Puget Sound.  
 Long, E.R., S. Aasen, M. Dutch, K. Welch, and V. Partridge and D. Shull. 2007. Relationships between the Composition of the Benthos and Sediment and Water Quality Parameters in Hood Canal, WA: Task IV – Hood Canal Dissolved Oxygen Program.

## Marine Sediment Quality

In Puget Sound and many estuaries around the world, sediments have become contaminated with toxic chemicals from industrial discharges, contaminated run-off from urban streets and roads, discharges from wastewater treatment plants, agricultural and forest chemicals carried down rivers and streams, oil spills, and even chemicals carried long distances through the atmosphere that eventually fall out of the sky with our rain. As the forests around Puget Sound have been logged, our streams and rivers channelized, and towns and cities built up, the amount, rate, and quality of sediment deposited into Puget Sound has changed dramatically.

The Sediment Quality Triad Index (SQTI) provides a weight-of-evidence approach that combines three different types of data into a single index measured from 1 – 100, with higher index values indicating higher quality sediments (Table 1).

The SQTI combines the Sediment Chemistry Index (SCI), sediment toxicity data, and benthic invertebrate community (small animals in sediment) data into a single, broad measure of sediment quality<sup>1</sup>. The SCI measures the concentrations of chemical contaminants. Laboratory toxicity tests measure the combined (synergistic) effects of those chemicals and other sediment characteristics on laboratory test animals. And the benthic invertebrate data reflects the actual biological condition of the sediments as a response to all possible human-caused and natural stressors, whether measured or not.

Together, the SCI and SQTI Indicators describe the overall “health” of the sediments, including their ability to sustain the sediment-dwelling invertebrates that form an important component of the Puget Sound food web.

### *Sampling Design*

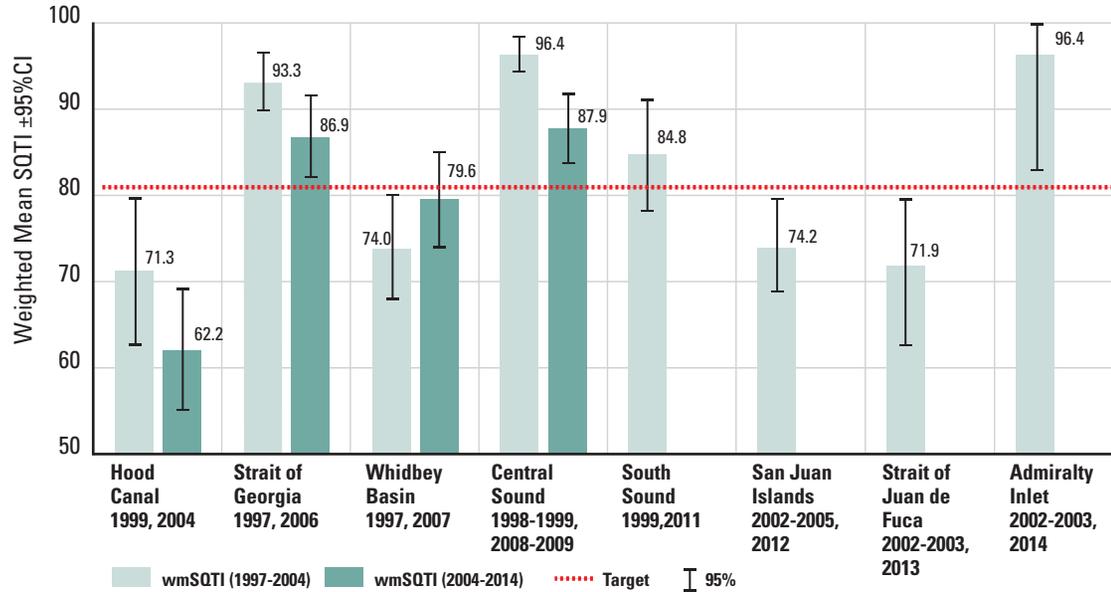
The Washington Department of Ecology monitors sediments in eight regional areas across Puget Sound and, separately, in six urban bays (see map). Multiple replicate samples are collected during each sampling effort, and weighted according to the size of the area each sample represents. Because sediment condition is not generally expected to change quickly over time, regions and urban bays are sampled on a rotating basis over a ten- and six-year period, respectively, thus it takes ten years to complete one full round of regional sampling, and six years to complete one full round of urban bay sampling in Puget Sound.

In order to evaluate progress toward the targets, results are discussed here primarily for areas that have been sampled twice: generally first sampled in the late 1990s, and then re-sampled in the mid to late 2000s. Results are evaluated separately for regions (Figure 1, top panel) and urban bays (Figure 1, bottom panel). This allows comparison of sediment quality in areas more closely associated with urban and industrial discharges and runoff to areas with less intensively developed landscapes, keeping in mind that some pesticides and certain other contaminants and natural impacts may in fact be more closely associated with agriculture and rural land uses.

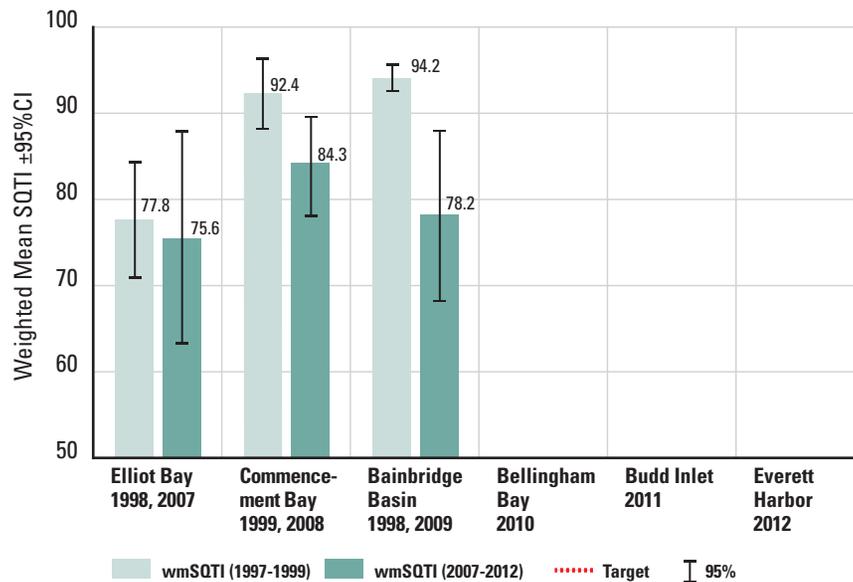
Finally, it is important to note that results presented here are representative of only those regions and urban bays that have been sampled, and not necessarily all of Puget Sound since we do not have data for areas not sampled.

<sup>1</sup>Dutch, et al., 2012

### Weighted Mean Sediment Quality Triad Index Scores in eight Puget Sound Regions



### Weighted Mean Sediment Quality Triad Index Scores in six Puget Sound Urban Bays



**Figure 1.** Sediment Quality Triad Index, reported for eight regions (top panel) and six urban bays in Puget Sound (bottom panel). The light bars show the overall SQTI scores for samples collected in 1997-2003. The dark bars show the overall SQTI scores for samples collected in 2007-2009. The higher the index value, the higher the sediment quality.

Source: Washington Department of Ecology, Marine Sediment Monitoring Unit

## Marine Sediment Quality

### Interpretation of data

Sediment quality monitoring in Puget Sound shows that about two-thirds of the areas monitored have sediments classified as “unimpacted,” as indicated by low chemical concentrations, absence of toxicity, and the presence of abundant and diverse benthic invertebrate communities. The remaining one-third of the monitoring areas generally have sediments of “likely unimpacted” quality (Figure 1, Table 1).

Only a small percentage (~3.2%) of the sediment monitoring area in Puget Sound has sediments classified as “possibly, likely, or clearly impacted” (Table 1) with impairment in one, two, or all three components of the SQTI. These impacted sediments are located in and around both the urban and industrial bays with measurable levels of chemical contaminants in the sediments, and in more rural bays which are likely experiencing pressure from other stressors, such as low dissolved oxygen in bottom waters. Although small in total area, the proximity of these impaired sediments to important river mouths and nearshore habitats may disproportionately affect fish, shellfish, and other aquatic life.

### Trends

Despite the small improvement shown in this indicator relative to the target, the most striking feature of the data is the apparent widespread decline in overall SQTI scores. This decline was statistically significant in two areas: Central Sound and Bainbridge Basin.

The lower SQTI values were driven primarily by reductions in the benthic invertebrate community measures. There appear to be large increases in the incidence and spatial extent of adversely affected benthos between the first (baseline) samples collected in the late 1990s and more recent samples.

Invertebrate abundance and species richness has decreased significantly in some areas. The reasons for the decline in benthic health are not known. Decline in benthic invertebrate communities is evident in both urban and nonurban areas, with only limited correlation with changes in sediment chemistry or toxicity.

Since changes in the benthos aren’t closely correlated to the chemical and toxicity-related environmental parameters currently being measured, other factors must be important. Benthic invertebrate communities are affected by a complex interplay of natural and human-caused variables, and there are many environmental factors that can impact benthic invertebrate populations that aren’t measured by the SQTI. These include low dissolved oxygen, pH, sediment flux and loading, natural population cycles, and a variety of species interactions. All of these factors can have important local effects. For example, benthic communities sampled in Hood Canal in 2004 appeared to be adversely affected by very low, near-bottom dissolved oxygen concentrations.

Other possible factors include the introduction of new chemicals of concern not currently monitored, and sub-lethal toxic effects such as reproductive impairment, that are not easily identified by current toxicity testing methods.

Over time, changes in sediment quality reflect the cumulative effects of many factors impacting the chemistry, physical processes, and biological responses of the Puget Sound ecosystem. The Sediment Quality Triad is a useful integrating measure of sediment condition, which can both explain observed effects, and help focus new inquiries on emerging problems.

<sup>2</sup> unpublished data, Washington State Dept of Ecology; data not displayed.

<sup>3</sup> Long et al., 2007



### Marine sediment monitoring regions and urban bays

- |                                    |                               |
|------------------------------------|-------------------------------|
| <b>Sediment monitoring regions</b> | Cities and Urban Growth Areas |
| Admiralty Inlet                    | County Borders                |
| Central Sound                      | Salish Sea Basin Boundary     |
| Eastern Strait of Juan de Fuca     |                               |
| Hood Canal                         |                               |
| San Juan Archipelago               |                               |
| Strait of Georgia                  |                               |
| South Sound                        |                               |
| Whidbey Basin                      |                               |

# Clean sewers, Clean Thea Foss Waterway

Located in the heart of downtown Tacoma, the Thea Foss Waterway was once characterized by dilapidated buildings, oil sheens, coal tar deposits, and contaminated bottom sediments which led the Environmental Protection Agency to declare the waterway a Superfund site in 1983. For more than 100 years, the Thea Foss Waterway had been a sink for waste from industrial dischargers and runoff from the upland drainages.

Today, it's a very different picture. The Thea Foss Waterway is the centerpiece of bustling marinas, internationally renowned museums, restaurants, grass esplanades, luxury apartments, and a variety of business and industry.

Even before the City of Tacoma and its partners finished the \$105 million remediation of the Thea Foss Waterway in 2006, they knew it was imperative to find ways to protect the quality of the sediment and receiving water in the waterway.

While significant efforts were made by the City to reduce or eliminate ongoing sources of contamination to the storm drainage system, it was found that elevated levels of PAHs, PCBs, and mercury remained in sediment and debris collected from Tacoma's 100-year-old storm sewer lines. This legacy pollution was being washed into the Thea Foss by stormwater, threatening to degrade the quality of the newly remediated marine sediment.



Photo Credit: mash187@flickr

In response, Tacoma launched two new enhanced maintenance programs to prevent new and legacy contaminants from reaching the waterway.

- Storm Line Cleaning - completed in four entire drainages and part of a fifth between 2006 and 2011. This program was intended to remove legacy contaminants from storm pipe.
- Street sweeping - expanded to a more aggressive city-wide street sweeping program in 2007. This program was intended to remove more street contaminants preventing them from entering the storm system.

These two maintenance efforts, storm cleaning and street sweeping, were above and beyond Tacoma's NPDES permit requirements. This enhanced maintenance resulted in dramatic reductions in contaminant levels:

- PAH<sup>1</sup> concentrations showed 59-92% reductions in four drainages tested.
- DEHP<sup>2</sup> concentrations showed 26-68% reductions in three of the four drainages tested.
- TSS<sup>3</sup> concentrations showed 17- 44% reductions in three of the four drainages tested.
- Lead and zinc concentrations showed 11- 36% reductions in three drainages.

These programs were so successful that they are now part of Tacoma's city-wide operating procedures. The work is not over. The City of Tacoma's team of innovative stormwater professionals will continue to use every tool at its disposal—science, investigation, education, enforcement and even intuition – to do its part to protect the investment in the Thea Foss Waterway. Their mission is to create an asset for future generations by making sure stormwater discharges do not harm the health of the water and sediments in the Foss.

<sup>1</sup> PAH = Polycyclic aromatic hydrocarbons, PCB = polychlorinated biphenyl

<sup>2</sup> DEHP = Di-(2-Ethylhexyl) phthalate

<sup>3</sup> TSS = Total suspended solids

# Marine Sediment Quality

**INDICATOR:**  
**Sediment Chemistry Index**  
 Indicator lead: Maggie Dutch, Department of Ecology

**TARGET:**  
 By 2020, all Puget Sound regions and bays achieve chemistry measures reflecting “minimum exposure” with Sediment Chemistry Index (SCI) scores >93.3.

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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**BASELINE REFERENCE (1997-1999) 8 regions and bays combined = 87% met or exceeded target**

**CURRENT STATUS (2004-2011) 8 regions and bays combined = 87% meeting target**

**2020 TARGET**

0% of regions and bays score > 93.3      25%      50%      75%      100% of regions and bays score > 93.3

Five Puget Sound regions and three urban bays were sampled from 1997-1999, and re-sampled from 2004-2011. Results show no significant change between sampling periods, with seven of eight areas (87%) meeting (or not statistically different from) the target during both periods.

**INDICATOR:**  
**Sediment Quality Standards**  
 Indicator lead: Maggie Dutch, Department of Ecology

**TARGET:**  
 Have no sediment chemistry measurements exceeding the Sediment Quality Standards (SQS) set for Washington State

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>Yes</b>
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**BASELINE REFERENCE (1997-1999)– all regions and bays combined = 0%**

**CURRENT STATUS (2004-2009) all regions and bays combined = 38% meeting target**

**2020 TARGET**

0% of regions and bays with no measurements exceeding SQS      25%      50%      75%      100% of regions and bays with no measurements exceeding SQS

For five regions and three urban bays evaluated from 1997-1999, no area met the target that 0% of sediment chemistry measurements exceed Washington State Sediment Quality Standards. However, three of the eight areas re-sampled from 2004-2011 did meet this target.

## Progress towards 2020 target

Sediment chemistry index values have met or exceeded the 2020 target in all areas sampled so far except Elliott Bay (Figure 1). In all areas that have been sampled twice, none showed any statistically significant change from their original results, including Elliott Bay. Even though the SCI score in Elliott Bay has improved, the change was not statistically different, hence our conclusion that we are not yet seeing progress in this target. Therefore, we remain slightly short of the 2020 goal that all regions and bays show an SCI score >93.3.

The number of individual chemicals exceeding state sediment quality standards (SQS) over the past decade is typically small (mostly less than 1%) except for Central Sound, Elliott Bay, and Commencement Bay, where the number still never exceeded 5%. Even fewer chemicals exceeded state SQS in the most recent round of sampling, with three areas dropping to zero and now meeting the target in those areas. Although the target is not fully met across all of Puget Sound, recent improvements suggest progress toward the target.

## What are these indicators?

The Sediment Chemistry Index (SCI) is one component of the Sediment Quality Triad Index. It combines data on the concentrations of a variety of chemicals into an overall index of chemical exposure (Table 1). Contaminants measured as part of the SCI include metals, polychlorinated biphenyls (PCBs), polynuclear aromatic hydrocarbons (PAHs), polybrominated diphenyl ethers (PBDEs – flame retardants), chlorinated pesticides, phthalates, some solvents, and various other pollutants. Note that analyses for newer chemicals of concern, such as dioxins, furans, endocrine disrupting chemicals, pharmaceuticals, personal care products, and perfluorinated chemicals, are not conducted as part of the PSEMP sediment component, and therefore not included in these Sediment Quality Dashboard Indicators.

Higher index values indicate less exposure to chemicals and thus healthier

sediments (Table 1). Tracking the SCI gives an indication of how concentrations of those chemicals in marine sediments change over time, primarily in response to anthropogenic input, such as stormwater runoff and direct discharge, as well as cleanup activities and passive burial as cleaner sediments settle over older, and sometimes more contaminated, sediments.

Sediment Chemistry Category	Sediment Chemistry Index
Minimum Exposure	>93.0-100.0
Low Exposure	>80.0 - 93.0
Moderate Exposure	>66.0 - 80.0
Maximum Exposure	>0- 66.0

**Table 1.** Categories of exposure to chemicals and associated index values

The second (related) indicator reports the percent of individual chemical measurements that exceed the Washington Sediment Quality Standards (SQS). SQS values have been determined for a total of 47 chemicals in Puget Sound. Of those, 39 are included in the SCI and evaluated for this indicator.

## Interpretation of data

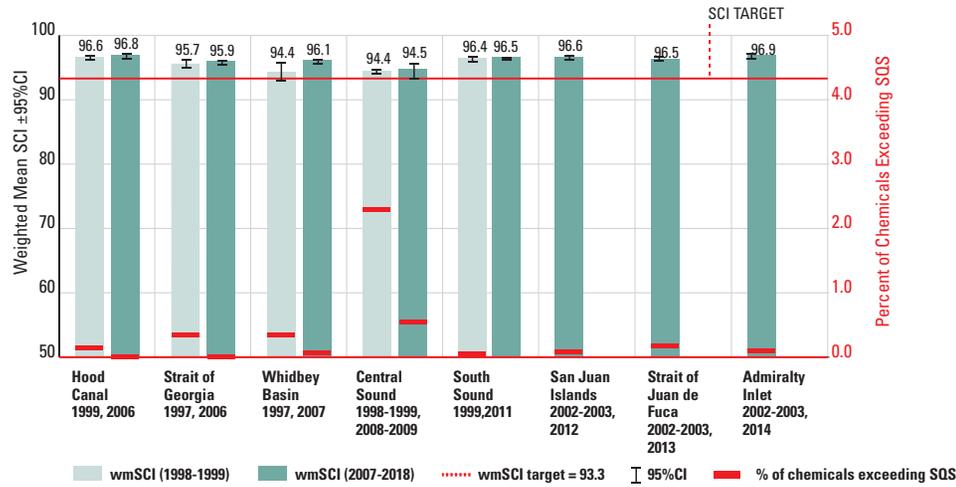
Overall, sediments in Puget Sound appear to be in generally good condition with regard to the measured suite of chemicals. Since 1997, all of the eight sampled regions and four of five urban bays met the SCI target, and values in most areas have changed little since the late 1990s.

In general, levels of toxic chemicals have been, and continue to be, highest in urban bays, but only Elliott Bay was clearly not meeting the SCI target in the low exposure category. The target has not been met in Elliott Bay since SCI scores were first calculated for data collected there in 1998, and only barely met in Commencement Bay, although scores in both bays appear to have improved over the years.

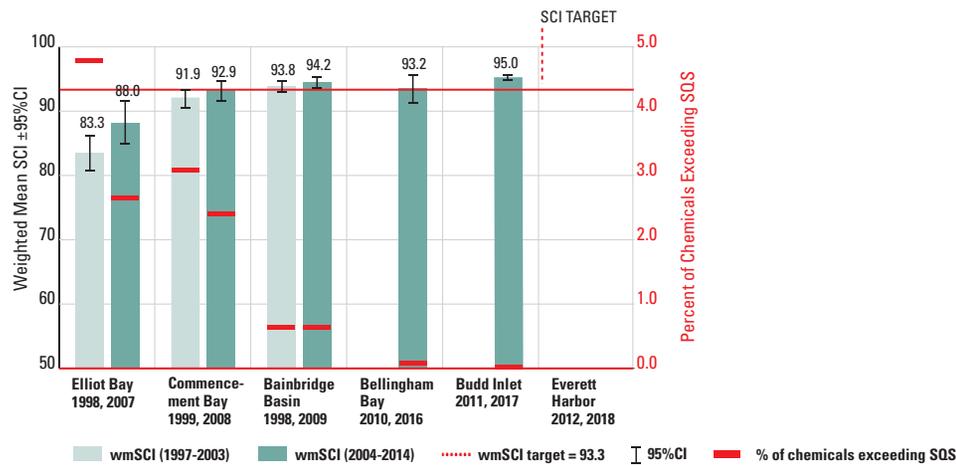
Given that sediment contamination generally changes very slowly, we expect most areas currently meeting the target to continue to do so through 2020 unless contaminant inputs to the areas increase. It is possible that the target may eventually be reached in Elliott Bay if conditions there continue to improve.

The second target, chemicals exceeding state sediment quality standards, was not met over the past decade in most regions and bays, again with urban bays—particularly Commencement and Elliott bays—showing the highest numbers. But the percent of chemicals exceeding the SQS value has declined in most areas that have been re-sampled, with three regions—Hood Canal, Strait of Georgia, and South Puget Sound—now showing no sediment chemical values exceeding SQS, and both Commencement and Elliott bays dropping to below 3%. The value for Bainbridge Basin remained the same, below 1% for 1998 and 2009. Given the direction of the data, it is possible that values will continue to improve and may reach, or come very close to, the target by 2020.

**Weighted Mean Sediment Chemistry Index (SCI) Scores for 8 Puget Sound Regions and Percent of Chemicals Exceeding Sediment Quality Standards (SQS)**



**Weighted Mean Sediment Chemistry Index (SCI) Scores for 6 Puget Sound Urban Bays and Percent of Chemicals Exceeding Sediment Quality Standards (SQS)**



**Figure 1.** The Sediment Chemistry Index (SCI) is shown for eight regions (top panel) and six urban bays (bottom panel). Light bars show results for first-round sampling efforts. Dark bars show results for second-round re-sampling. Higher values indicate healthier sediments. Also shown (red squares) are the percent of chemicals exceeding Sediment Quality Standards (SQS) for each sampling event.  
 Source: Washington Department of Ecology, Marine Sediment Monitoring Unit





## Toxics in Fish

Toxic pollutants in our bays, rivers, and streams can show up in the fish that live there, causing them to become diseased and posing a health threat to us when we eat the fish. Pollutants in the Puget Sound ecosystem include several important classes of chemicals including, PCBs, PBDEs, PAHs, and Endocrine Disrupting Compounds.

Concern over these chemicals in Puget Sound is high because they are toxic, they last for a long time in the ecosystem, and their levels increase in predators as the chemicals move up the food chain, a process called biomagnification. Measuring these pollutants in fish tissues tells us whether present-day levels are harmful to the fish or the predators that consume them and whether they are safe for us to eat.

Scientists have been tracking contaminant levels in Puget Sound fish since 1989 and have established threshold limits for these chemicals in fish tissues. These thresholds give us a guideline for the level of toxic chemicals that fish can tolerate, before they become diseased or show other harmful effects.

# Toxics in Fish

**INDICATOR:**  
**1) Levels of four types of toxic contaminants in several species of fish**  
**2) Contaminant-related disease in fish**

Indicator lead: Jim West, Washington Department of Fish and Wildlife

**TARGET:**  
 Target 1) By 2020, contaminant levels in fish will be below health effects thresholds (i.e. levels considered harmful to fish health, or harmful to the health of people who consume them)  
 Target 2) By 2020, contaminant-related disease or impairments in fish are reduced to background levels

Contaminant Type 1  
**Polychlorinated Biphenyls (PCBs)**

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>NO</b>
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**CURRENT STATUS** 2010-2011 = 30% **2020 TARGET**

0% of samples meeting targets 25 50 75 100% of samples meeting targets

PCBs exceeded health effects thresholds or have been identified as a risk to seafood consumers in recent years for (1) urban English sole, (2) adult Chinook salmon returning to Puget Sound rivers, (3) juvenile Chinook salmon in Puget Sound or its river mouths, and (4) Pacific herring in Southern and Central Puget Sound. There has been no significant decline in PCBs in these species for the period monitored. However, adult coho salmon returning to Puget Sound rivers were below thresholds.

## Progress towards 2020 targets

The full 2020 target language for toxics in fish that was adopted by the Leadership Council is complex, relating four different classes of chemical contaminants to three different types of fish (herring, English sole, and salmon/steelhead), with four different concentration thresholds that range from no adverse effects to no toxics-related reproductive impairment.

Making progress towards 2020 targets requires identifying which chemicals are most problematic, and then controlling their sources or cleaning up pollutants that have accumulated in the environment.

Contaminant Type 2  
**Flame Retardants (polybrominated diphenyls, or PBDEs)**

**PROGRESS:**

<b>IS THE TARGET MET?</b>	<b>NO</b>	<b>IS THERE PROGRESS?</b>	<b>YES</b>
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**CURRENT STATUS** 2010-2011 = 80% **2020 TARGET**

0% of samples meeting targets 25 50 75 100% of samples meeting targets

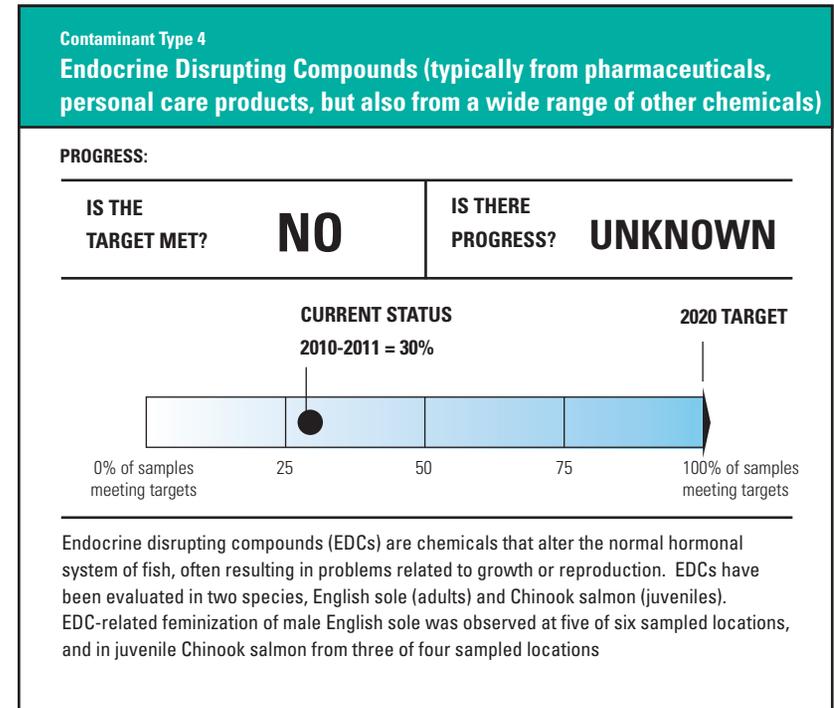
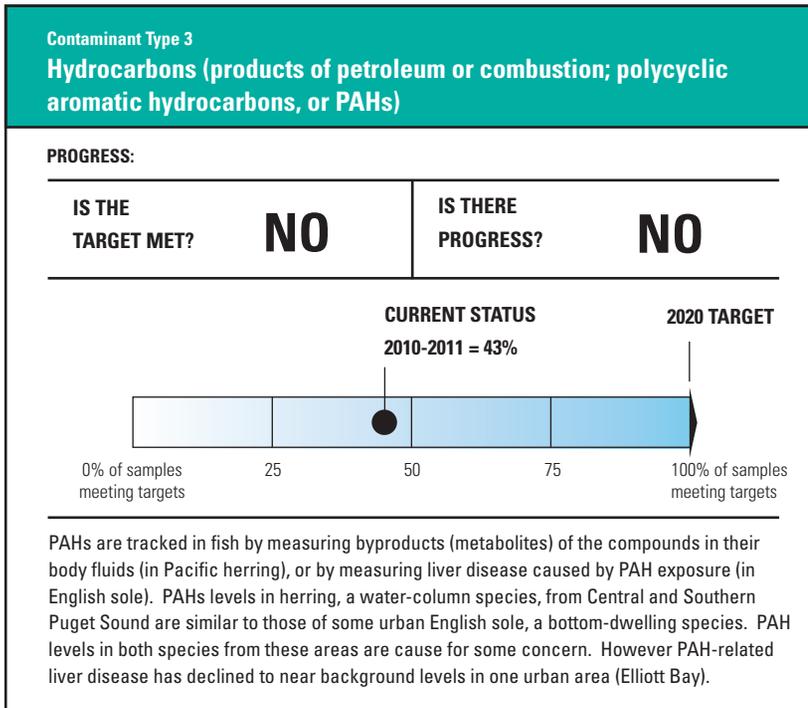
Evaluation of PBDEs is challenging because health effects thresholds are not yet available for some species. However, it appears that levels in most species are at levels below obvious, immediate concern for most areas. In addition, PBDE levels appear to be declining in Pacific herring from Central and Southern Puget Sound.

The danger of some chemicals (such as PCBs) was identified, and source controls imposed, over thirty years ago. PCB levels in Puget Sound fish today are probably ten times lower than they were in the 1970s, but they have not changed appreciably in the past 20 years. Current PCB levels are high enough to trigger Department of Health consumption advisories for Chinook salmon and other species, and are probably still high enough to harm fish health. Further reduction of PCBs in the ecosystem will likely require a combination of activities, including cleaning up contaminated sediments, identifying and halting new sources of PCBs into the system, and waiting for existing PCBs in the system to degrade or become unavailable.

Some progress towards 2020 targets for PBDEs has been made. The danger of flame retardants (polybrominated diphenyl ethers, or PBDEs) was recognized relatively recently, and source controls have been imposed. These include a legislated ban on the use of certain PBDE compounds

and voluntary reduction in production of other compounds by industry. Although it is unclear whether these actions were responsible, PBDEs have been declining in one monitored species, Pacific herring, from Central and Southern Puget Sound, to levels that are likely below cause for concern.

Progress related to hydrocarbons (polycyclic aromatic hydrocarbons, or PAHs) has been mixed. This is probably related to the huge range of sources for these compounds (they come from petroleum, and from burning fossil fuels), and the difficulty in controlling such pervasive sources. Some effects of PAHs in the ecosystem may be significant but are currently not monitored. Of the effects represented by this indicator, we have seen a dramatic decline in PAH-related liver disease from prevalence rates of over 30% to less than 10% in English sole from Elliott Bay, one of Puget Sound's most highly contaminated bays. The reason for this recovery is unclear, but could be related to sediment cleanup, removal of creosote-treated pilings, or



## Toxics in Fish

control of new inputs to the bay.

Not enough monitoring has been conducted yet to fully evaluate progress towards the target of reducing Endocrine Disrupting Compounds (EDCs). These chemicals originate from a huge range of sources including pharmaceuticals, personal care products, plastics, other industrial, agricultural or household products, and some of the chemicals described above. EDC effects were observed in fish, primarily as a trend towards feminization of males, in most places where English sole and juvenile salmon were sampled. Only one status survey has been conducted for these species so far. Unlike the pollutants above, EDC effects have been observed in fish from waters surrounded by rural areas. Many of these chemicals can be introduced to aquatic systems via wastewater.

### What are these indicators?

#### *Indicators*

Each of the Toxics in Fish indicator metrics begins with a measure of the degree to which fish are exposed to toxic contaminants. In most cases this means measuring the chemicals in fish tissues, in the form of “tissue residues.” In some cases fish systems can break down or metabolize the chemicals, in which case the pollutants don’t accumulate in their bodies. In these cases chemists measure “metabolites” of the chemicals, usually in the bile or blood of the fish.

In order to understand the potential harm these chemicals may cause, these metrics also incorporate an understanding of the “health effects threshold” of each chemical for each species. This is the level of contamination an individual can tolerate before it experiences some health effect. The combination of knowing what contaminant levels the fish is exposed to with its tolerance for a chemical provides a guide for selecting recovery targets.

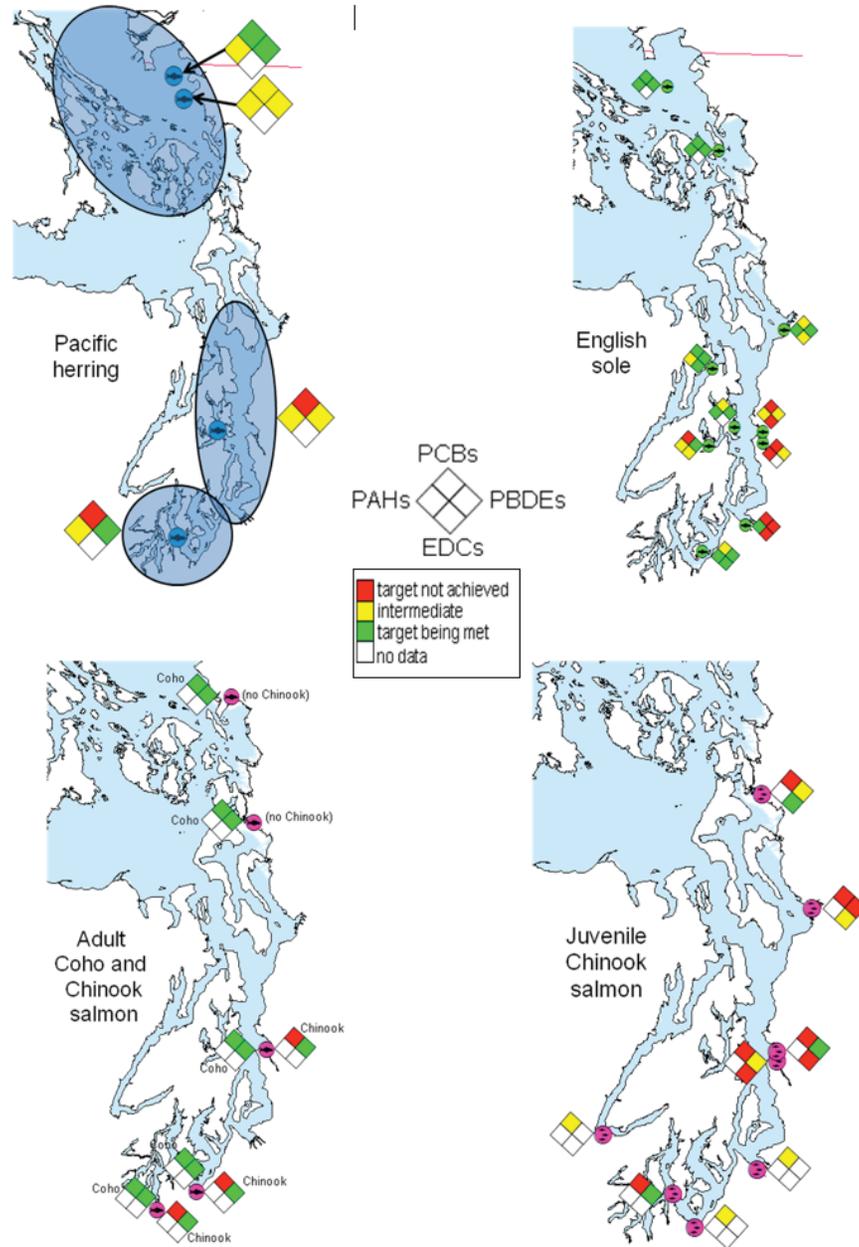
In some cases it is easier to measure contaminant-induced disease or other health impairment directly. Examples of these metrics in the Toxics in Fish Indicator are PAH-related liver disease and EDC-related reproductive impairment in English sole. In these cases it is possible to observe recovery of fish health directly, after exposure to the contaminant is removed from the fish’s habitat.

#### *The Contaminant Monitoring Program*

The Washington Department of Fish and Wildlife monitors toxic contaminants in fish and other organisms, as a member of the Puget Sound Ecosystem Monitoring Program (PSEMP). This program has tracked the indicator metrics described above for several species in the ecosystem, in addition to a number of chemicals not covered here. In addition, the PSEMP Toxics in Fish Unit has conducted a number of focus and diagnostic studies, along with partners including NOAA Fisheries, to develop new markers and investigate contaminants in the food web.

### Interpretation of data

The Indicator metrics provided in this summary simplify a highly complex relationship between exposure of organisms to pollutants, and the effects such exposure might have on their health. Toxic contaminants in Puget Sound are found in fish throughout the ecosystem – not just in urban areas, and not just in bottom-dwelling fish. In addition, many contaminants accumulate in fish as they age. Some of these “bioaccumulative” contaminants also move up the food chain, increasing to high concentrations in apex predators. It is important to interpret data with reference to where the fish live, where they were sampled, their age, and their position in Puget Sound’s food web.



# Climate Change and Its Impact on the Status of the Ecosystem

Puget Sound is especially vulnerable to climate change, which has already disrupted its environment, economy, and communities. Without action, climate change will negatively affect nearly every part of Washington's economy through changes in temperature, sea level, and water availability.

Climate change pressures in Puget Sound include changes in stream flow timing and volume, air and water temperature, loss of snow-fed water supplies, sea level rise, and ocean acidification. These pressures will have serious consequences for human health, including reduced water supply, losses to agriculture and forest industries, losses of fish and wildlife, impaired functioning of natural systems, and increased frequency, and intensity of extreme weather event such as droughts, floods, heat waves, wildfires, and heavy rain and snow storms. Other impacts to natural resources and Puget Sound communities will vary, but these are not as readily predictable.

Puget Sound climate is also affected by large-scale patterns of natural variability, particularly the El Niño/Southern Oscillation (ENSO) and Pacific Decadal Oscillation (PDO). While it is not clear at this time how climate change will affect the frequency or intensity of ENSO or PDO, we should expect continued year-to-year and decade-to-decade variability in regional conditions even as the long-term mean around which we vary is affected by climate change.

Adapting to our changing climate means understanding how climate change could affect priority recovery issues and using that knowledge to take steps that will reduce or avoid the negative impacts of climate change. Although we should seize opportunities that exist now, adaptation is part of long-term risk management, not a one-time effort. Decision-makers must consider the impacts of climate change when funding and prioritizing restoration projects.

Climate change affects more than just the weather and the seasons. Climate patterns play a fundamental role in shaping natural ecosystems

as well as the human economies and cultures that depend on them. Because so many systems are tied to climate, a change in climate can affect many related aspects of where and how people, plants, and animals live, including food production, availability and use of water, and health risks. For example, a change in the usual timing of rains or temperatures can affect when plants bloom and set fruit, when insects hatch or when streams are their fullest. This can affect historically synchronized pollination of crops, food for migrating birds, spawning of fish, water supplies for drinking and irrigation, forest health, and more.

## Climate Change and the 2012 Action Agenda

To ensure that the 2012 Action Agenda is consistent with state strategies and actions for responding to climate change, its approximately 250 strategies, sub-strategies, and actions were reviewed to determine their degree of climate sensitivity. Roughly half reflected observed and predicted changes in climate or aligned to the state's climate response strategy. Based on this review, achieving our long-term goal of Puget Sound ecosystem

## What are climate change and global warming?

**Global warming** refers to the recent and ongoing rise in global average temperature near Earth's surface. It is caused mostly by increasing concentrations of greenhouse gases in the atmosphere. Global warming is causing climate patterns to change. However, global warming itself represents only one aspect of climate change.

**Climate change** refers to any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, or wind patterns, among other effects, that occur over several decades or longer.

*Source: EPA*

recovery requires consideration of the relevance of climate change to strategies and actions beyond the 2020 time horizon of the Action Agenda.

The Department of Ecology recently released *Preparing for a Changing Climate: Washington State's Integrated Climate Response Strategy* (April 2012). Adaptation steps reduce the vulnerability of human and natural systems, increase the capacity to withstand or cope with changes in climate, and transform the system to be compatible with likely future conditions. Many adaptation strategies are considered win-win strategies because they address existing stresses on communities, economy, and environment while also helping reduce climate-related risks.

State climate response strategies and actions were integrated into the 2012 Action Agenda. Each strategy or sub-strategy of the Action Agenda includes a description of climate change impacts and related state strategies. Where possible, a climate change adaptation step was included in Near Term Actions. Climate change next steps are included in the future opportunities and emerging issues for each strategy section.

Fully integrating climate change into the Action Agenda will require looking at the implications of a changing climate beyond 2020. This will entail revisiting and possibly adjusting our definitions of a healthy Puget Sound, how we measure and evaluate progress, our use of value terms such as priority, ecologically important, sensitive, and high value. This also means that we will continually design and adjust policies, plans and tools so they account for a changing and variable climate.

This year and next, the Puget Sound Partnership and the Puget Sound Institute are working with the University of Washington's Climate Impacts Group to synthesize and update a growing body of climate change science. This new information will become part of the Puget Sound Science Review in the Encyclopedia of Puget Sound.

## How Climate Change Guidance Is Applied to Near Term Actions

The degree of climate sensitivity for each Near Term Action was evaluated based on the following questions:

- Do proposed restoration projects take into account observed or likely changes in climate? If not, is it possible to do so?
- Given the likelihood of climate change, will a proposed project provide even some recovery benefits?

*Can the Near Term Action meet its objectives "as is" given its sensitivity to climate?*

While the act of preparing the criteria described in this Near Term Action is not sensitive to climate, the criteria may be inadequate if they do not consider how climate change may affect target habitats.

*Suggested adjustments for implementation:*

1. climate change should be considered when designating "high risk habitat"
2. the criteria should include an assessment of how climate change is anticipated to affect habitat being evaluated.

### Example: 2008 Action Agenda Near Term Action A.1.2

Near Term Action A.1.2: Prepare a set of criteria to guide decisions for acquiring and protecting high-value, high-risk habitat.

*Is the Near Term Action sensitive to changes in climate?*

Yes. Habitat type, quality, and distribution may be affected by changes in temperature, precipitation, salinity, sea level, and other climate-related factors. Therefore, climate change may affect what is currently defined as "high-value, high-risk habitat."

## Climate Changes

- ☑ **Changes in streamflow timing and volume:** Watersheds with streamflow based mostly or partially on snowmelt are projected to have the greatest hydrological shifts associated with climate change. Impacts to streamflow include earlier peak streamflows, decreasing runoff in late spring and summer, and increasing runoff in fall and winter.
- ☑ **Temperature changes:** Despite natural climate variability between years and decades, average annual and seasonal temperature is expected to continue to increase over the coming century. Most models project an enhanced seasonal precipitation cycle with wetter winters and drier summers.
- ☑ **Loss of snowpack and glacial retreat:** The loss of snowpack and glacial retreat are one of the most far-reaching impacts of rising temperature, affecting water availability for both people and wildlife. Under a moderate warming scenario, average spring snowpack in Washington State is projected to decrease 29% by the 2020s.
- ☑ **Sea Level Rise:** Global sea level is rising due to ocean thermal expansion and melting of land-based ice sheets. A medium estimate of sea level rise in the Puget Sound region is +6 inches (range of 3 to 22 inches) by 2050. Major impacts associated with sea level rise are likely to be inundation of low-lying areas, flooding, erosion, and infrastructure damage, with the largest impacts occurring when storm and river flooding events converge with high tides. Shifts in or loss of coastal habitat types is another major concern associated with sea level rise.
- ☑ **Ocean Acidification:** As the global ocean absorbs atmospheric carbon dioxide, these increasing concentrations are reducing ocean pH and carbonate ion concentrations, resulting in ocean acidification. Impacts of ocean acidification include altered marine food web, loss of shellfish production, and impacts to the growing environment for sea grasses like eelgrass.

## Consequences of Climate Change

- ☑ Severe impacts and risks to human health from increased injuries and disease due to higher temperatures, heat waves, declining urban air quality, and smoke from more frequent wildfires. More frequent extreme storms are likely to cause river and coastal flooding that could lead to increased injuries and loss of life.
- ☑ Increased damage costs and disruptions to communities, transportation systems, and other infrastructure. Damage to roads, bridges, ports, rail, power, and communication transmission systems, and communities due to extreme storms, flooding, erosion, landslides, sea level rise, and storm surges could occur. In Puget Sound counties, structures valued at \$29 billion are located in flood hazard areas. Ports, rail, highways, wastewater treatment plans, and other infrastructure could require retrofits or relocation to accommodate rising sea levels and stronger coastal storms.
- ☑ Reduced summer water supply. Increasing temperatures will significantly reduce snowpack in the Cascade and Olympic Mountains. This will lead to reduced summer streamflows, reduced soil moisture, higher summer stream temperatures, and an increased risk of drought for Washington's water users, including agriculture, municipalities, and fish and wildlife. Increased water demand could increase the potential for conflict among users.
- ☑ Loss of fish, wildlife, and natural systems. Species will be forced to move northward or higher in elevation, and some will perish. Higher summer stream temperatures and reduced flows are projected to increase lethal stream conditions for salmon and other coldwater species. Increased forest fires will destroy habitat, leading to erosion and degraded water quality. Sea level rise is projected to eliminate valuable habitat, and increasing ocean acidity and upland runoff threatens shellfish aquaculture.
- ☑ Losses to agriculture and forest industries. Increased disease, pests, weeds, and fire, along with reduced summer water supplies, are already affecting Washington's farms and forests. Crops and yields are also likely to be impacted.

LEADERSHIP COUNCIL DRAFT

## 2. PERFORMANCE MANAGEMENT

*TRACKING THE ACTION AGENDA*

# Performance Management: Tracking and Reporting on Action Agenda Progress

The Revised Code of Washington (RCW) 90.71.370(3)—the legislation that established the Puget Sound Partnership—requires an assessment of the progress made by state and non-state entities in implementing the Action Agenda, including accomplishments in the use of state funds.

This chapter reviews the approaches used by the Partnership in tracking regional progress in implementing the 2008 Action Agenda and the results of that analysis. It also includes a discussion of the barriers to implementation and how those barriers might be overcome. Accomplishments in the use of funds are presented in Chapter 4.

The Partnership's founding statute also requires the Science Panel to provide comments on progress in implementing the plan. The Science Panel reviewed the status information provided by the Partnership performance management team, but did not reach any specific conclusions regarding the implications of incomplete or not launched Near Term Actions. They did note the importance of improving the specificity of the performance measures that are developed to track implementation of the near term actions in the 2012 Action Agenda. The letter from the Science Panel to the Leadership Council is provided at the end of this chapter.<sup>1</sup>

## Implementing the 2008 Action Agenda

The 2008 Action Agenda contained 146 Near Term Actions that represented the most concrete actions that regional partners identified as necessary to improve the health of Puget Sound at the sound-wide scale.

The Near Term Actions were organized around five strategic priorities established by the Legislature:

*Priority A Protect intact ecosystem processes, structures, and functions*

*Priority B Restore ecosystem processes, structures, and functions*

*Priority C Reduce the sources of water pollution*

*Priority D Work effectively and efficiently together on priority actions*

*Priority E Build an implementation, monitoring, and accountability management system.*

Actions in Priorities A-C were ranked in the Action Agenda based upon ecological benefits and other factors such as cost, readiness, and likelihood of effectiveness of each action. The ten highest ranked Near Term Actions under each of priorities A, B, and C were considered the 30 highest priority and were tracked separately in reports to the region.

However, when the 2008 Action Agenda was adopted, a system for tracking progress in implementing the proposed measures had not yet been established. Lead implementers and partners were identified for each of the Near Term Actions. The Near Term Actions themselves varied from measures that were programmatic in nature such as continuing the oil spill prevention program, to those with specific

<sup>1</sup> Science Panel Comments on Progress in Implementing the Action Agenda and Findings from the Puget Sound Ecosystem Monitoring Program September 28, 2012.

outputs such as develop low-impact development incentives. None of the Near Term Actions had specific performance measures that referenced calendar milestones, outputs, or outcomes.

### **Review of Performance Management, 2009 – 2011**

The 2009 State of the Sound recognized the importance of establishing a performance management system that would allow the region to measure how well the Action Agenda was being implemented, whether the health of Puget Sound was improving, and the extent to which investments in recovery were producing anticipated results. Having this information would enable decision-makers to set priorities, allocate resources, and systematically adapt and align strategies and actions to reduce threats to Puget Sound and achieve our ecosystem protection and restoration goals.

In 2009 the Science Panel initiated discussions to identify ecosystem indicators that could be used to inform the progress towards achieving 2020 goals. They also adopted an initial set of indicators to describe the status of the ecosystem. However, additional work was required to set quantitative 2020 targets, interim targets and prioritizing threats to the ecosystem.

Implementers prepared detailed spreadsheets, which were provided to the Partnership to represent the cost estimates for implementing the Action Agenda and budget requests in 2009. Once compiled, the system needed an ongoing mechanism for updating either cost estimates or updated budget requests and funding.

During 2009 and 2010, progress was reported more generally in the form of technical presentations to the Leadership Council on such topics as oil spill protection or shoreline management. By the end of 2010, there had been one informal review of status conducted by Partnership staff based on their understanding of the work that had been undertaken by our partners.

In February 2011, in consultation with all of the implementers, the Partnership initiated a formal reporting system that was entered into an existing Quick Base system as an interim solution, pending development of a more sophisticated Performance Accountability Application. The 2011 reporting included quarterly reports on status, status narrative, and approach for making progress if problems had been identified. The data collected were entered into spreadsheets, then re-entered into the database. Staff then had to distill the information into summary graphs for public presentations. This information was compiled and presented to the Governor's Government Management Accountability and Performance office for each quarter of 2011. Financial data was handled similarly, although reporting is annual.

### ***Status Categories***

Status categories for reporting progress were identified as well as exception reporting categories to enable implementers to describe impediments to full implementation. Status categories included:

*Completed:* Near Term Action is completed as described.

*On-Plan:* Near Term Action will be completed by the end of the cycle or work anticipated for this planning cycle will be accomplished.

*Needs attention:* Work is not on schedule. It may or may not be recoverable, depending on level of effort, funding, and political realities.

*Not launched:* Near Term Action did not proceed because of major resource obstacles or may have been reconsidered and suspended or required re-evaluation before proceeding.

Near Term Actions that were categorized as Needs Attention or Not Launched we assigned one or more of the following exception subcategories:

- Progress slower than anticipated*
- Funding/staff concerns*
- Reassessed/re-planned*
- Readdressed in the next Action Agenda*
- Competing state/federal priorities*

### Final status of 2008 Action Agenda Near Term Actions

Final status reports for the 146 Near Term Actions in the 2008 Action Agenda were provided in December 2011. Of the 146, a total of 105 (72%) were completed or on plan. The remaining 41 (28%) were not launched or needed attention (Figure 1). A detailed analysis of the status of each of Near Term Actions is provided in Appendix XX.

Of the 41 Near Term Actions for 2008 that were not launched or needed attention, 19 had been identified as top ecosystem protection and restoration priorities (priorities A, B, and C). Based on the exception subcategories assigned to each of the 19, the main factor was lack of funding or staff (Figure 2). Of these, 15 were converted to ongoing programs or revised as new Near Term Actions in the 2012 Action Agenda.

The December 2011 reports also distinguished the status of the 30 highest-priority Near Term Actions: 23 were completed or on plan, six needed attention, and one was not launched (Figure 3). Lack of funding and slower progress than anticipated were the primary obstacles to implementation cited by implementers. Six of the of the seven that needed attention or were not launched were

### Final Status of all 2008 Near Term Actions

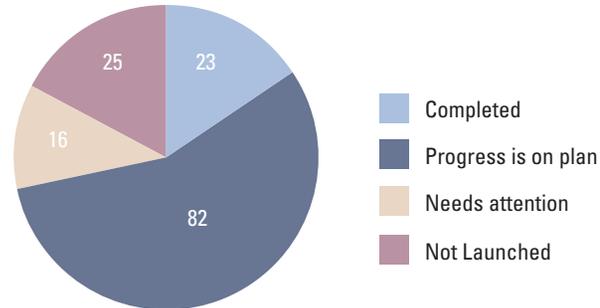


Figure 1. Status of all 146 Near Term Actions for 2008 by category.

### Reasons that all 2008 Near Term Actions were “Needs Attention or “Not Launched” December 2011

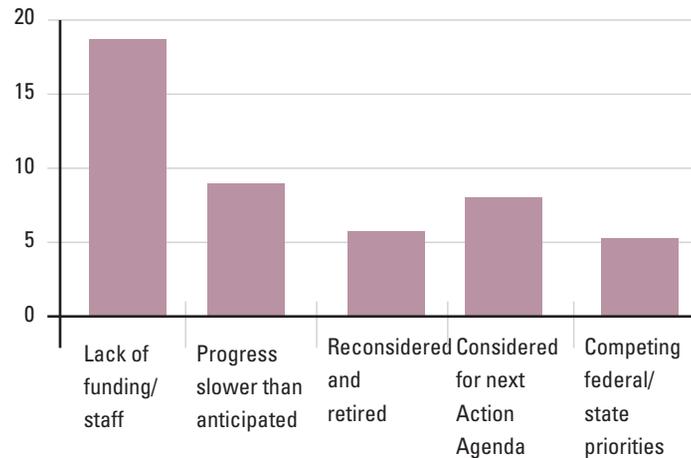
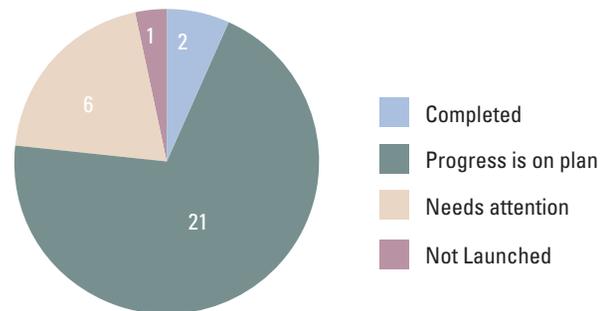


Figure 1. Exception subcategories for why 41 of the Near Term Actions for 2008 were categorized as Needs Attention or Not Launched. Note: some actions were assigned more than one subcategory.

### Status of 30 Highest-Priority 2008 Near Term Actions December 2011



**Figure 1.** Status of the 30 highest-priority Near Term Actions for 2008 by category

included in the 2012 Action Agenda and remain high priorities for funding and action (see appendix XX).

### Implementation of the Performance Accountability Application for the 2012 Action Agenda

Based on the experience in tracking the progress of the 2008 Action Agenda, Partnership staff and regional partners recognized the need for a more efficient, less cumbersome system for tracking implementation of the Action Agenda that would also be more accessible and transparent to the public. Accordingly, the Partnership initiated the development of a Performance Accountability Application that would initially include a tool related to Action Agenda implementation, such as performance and budgeting, but could be expanded to include other components, including effectiveness monitoring and outcomes.

Rather than relying on a retrospective analysis, the Leadership Council has asked Partnership staff to design an Action Agenda Report Card Forum that would consist of public workshops at the Leadership Council. This process will better enable the Leadership Council and the public to track our progress on the 2012 Near Term Actions and identify

problems and solutions early in the biennium, especially with respect to our highest priority measures.

### Action Agenda Report Card

The Action Agenda Report Card was designed to address the issues encountered in tracking performance and expenditures for the 2008 Action Agenda. To improve the ability to define and determine progress, the Partnership worked with its partners to include specific performance measures for each Near Term Action in the 2012 Action Agenda. These performance measures address implementation milestones as well as numeric outputs and outcomes, and are captured for each Near Term Action and tracked quarterly by owners in the Report Card tool.

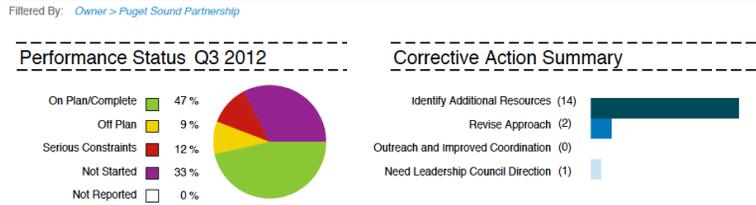
Completed in June 2012, the Report Card enables owners to describe obstacles they have encountered to progress (Exception Reporting) and what steps they might propose to address these obstacles (Corrective Actions). The tool produces a report that both summarizes the status of all of the Near Term Actions in a data query and provides details on each individual measure. It also provides an ongoing mechanism for calculating continued funding gaps.

Accessible through the Partnership website, The Report Card gives the region the ability to ascertain overall progress, action-by-action status, opportunities for improving performance, and strategize on how to address obstacles. Users can, at a glance, determine progress on each Near Term Action and understand the challenges and strategies for addressing those challenges. Fiscal data fields provide a more complete picture of funding sources, availability, and obstacles to obtaining the necessary resources. It contains data on the status of each Near Term Action with respect to work as well as status of funding. It also allows users to sort the 2012 Near Term Actions by owner (implementer), vital sign, key words, status of completion, and funding status.

Two excerpts from the Report Card are provided above. Figure 1 depicts all of the Near Term Actions that address restoration of eelgrass in Puget Sound. Figure 2 provides an example of a more detailed analysis of a Near Term Action that addresses integrated stormwater management.

# Puget Sound Action Agenda Summary Report Card

Report Date: 10/10/2012



### Performance Status Details by Quarter

CORRECTIVE ACTION	ACTION ID	NEAR-TERM ACTION	OWNER	STATUS														
				2012			2013			2014			2015					
				Q	3	4	1	2	3	4	1	2	3	4	1	2	3	4
<input type="checkbox"/>	A1.3.1	ECB Address Regulatory Exemptions	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A2.1.4	Funding Mechanism for Properties at Imminent Risk of Conversion	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A3.2.2	Agriculture strategy	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A5.1.1	Floodplain Protection and Policy Team Actions	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A5.3.3	BiOp Compliance and Floodplain Target	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A5.3.4	Levee Vegetation	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A6.1.1	Secure Annual Chinook investment	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A6.1.2	Restoration Permit Barriers	Puget Sound Partnership	<input type="checkbox"/>														
<input checked="" type="checkbox"/>	A6.1.3	BNSF Railroad Cooperative Agreement	Puget Sound Partnership	<input type="checkbox"/>														

Figure 1. Action Agenda summary report card

## Vital Signs

The Dashboard of Vital Signs (figure 3) described in Chapter 1 is a tool on the Partnership's website that houses up-to-date information on the status of each of the ecosystem indicators that are tracked by the Partnership. The Dashboard is updated periodically based upon the timeframe for data collection for each of the indicators. The Dashboard also contains information on ongoing programs and key projects in the region that relate to a particular indicator as well as special sections on what the individual citizen or organization can do to contribute to the recover effort. The Dashboard is linked to the Report Card and to the Project Atlas.

# Puget Sound Action Agenda Report Card

Report Date: 10/10/2012

**ACTION ID** A5.3.4    **ACTION TITLE** Levee Vegetation    **OVERALL STATUS**  3 | 4 | 1 | 2 | 3 | 4 | 1 | 2

**ACTION DESCRIPTION** PSP will continue to work with the Army Corps of Engineers to craft a regional variance to their vegetation on levees policy.    **EXCEPTION**     **CORRECTIVE ACTION**

**OWNER** Puget Sound Partnership

**TOTAL COST ESTIMATE** \$660,000

**VITAL SIGNS** Floodplains

**FUNDING SOURCE** General Fund-State

**YEAR FUNDED** 2013    **BUDGET AMOUNT** \$11,667

STATUS	EXCEPTION	CORRECTIVE ACTION SUMMARY
<input checked="" type="checkbox"/> On Plan/Complete	<input type="checkbox"/> Lack of Funding/Staff Resources	<input checked="" type="checkbox"/> Identify Additional Resources
<input type="checkbox"/> Off Plan	<input type="checkbox"/> Progress Slower than Anticipated	<input type="checkbox"/> Revise Approach
<input type="checkbox"/> Serious Constrains	<input type="checkbox"/> Proposed for Revision	<input type="checkbox"/> Outreach and Improved Coordination
<input type="checkbox"/> Not Started	<input type="checkbox"/> Competing Fed/State Priorities	<input type="checkbox"/> Need Leadership Council Direction
<input type="checkbox"/> Not Reported		

**Milestones**    2012    2013    2014

**Milestone 1: Adopt regional variance**    **START DATE** 8/1/2012    **END DATE**  3 | 4 | 1 | 2 | 3 | 4 | 1 | 2

By June 2013, new language for regional variance developed and adopted.    **COMMENT**

Figure 2. Action Agenda summary report card detail

## Project Atlas

In collaboration with the Washington State Recreation Conservation Office (RCO), the Partnership developed a mapping tool that extracts data from the RCO PRISM database on protection and restoration projects in Puget Sound. The information currently included in the Project Atlas represents a subset of Puget Sound protection and restoration projects. All projects included were financed, in part, by state funded grants administered or tracked by RCO as of October 2005 or later. Projects in the database advance, either directly or indirectly, one or more Puget Sound Vital Signs.

The Project Atlas (figure 4) enables the viewer to determine what projects have been completed or are in process in Puget Sound. Data may be sorted by County, legislative district, watershed, funding source and status and vital sign/ecosystem indicator. The tool provides



approaches to funding and attracting investment in Puget Sound.

- Insufficient monitoring and effectiveness data. As noted by both our Science Panel and Puget Sound Ecosystem Monitoring Program Steering Committee (PSEMP), we did not have sufficient funding for complete data collection either geographically or time-wise for several of our vital sign indicators, including swimming beaches and toxics in fish. In addition, data on the effectiveness of actions are only available for a small portion of the Action Agenda's strategies. This lack of region-wide, up-to-date data impedes our ability to understand what adaptive management actions are necessary and to update and enhance Near Term Actions.
- More robust performance data. Most of the 2008 Near Term Actions and a majority of the 2012 Near Term Actions lack clear, outcome-oriented performance measures. This is in part due to the lack of monitoring effectiveness data as described above, but also to the difficulty of linking single actions with specific ecosystem outcomes.
- Attention to on-the-ground implementation. Every watershed in Puget Sound has different needs and a different context in which actions can be undertaken and completed. For the region to be successful, we must design actions to be effective at the watershed scale. Many actions in the Action Agenda are at a region-wide level; however, to make progress on many of the targets, such as estuary restoration, summer stream flows, freshwater quality, and marine sediment quality, actions must be designed in a specific and location-appropriate manner. Also, we need a better understanding of what can be achieved at the local level to contribute to regional recovery.
- Need for an overarching outreach strategy. Many of the priority actions identified require greater public awareness and support. We must have a clear, effective strategy on how to reach the relevant stakeholders and the general public to ensure that people are willing to take the necessary actions and more importantly, to support our politicians in difficult decisions.
- Understanding the role of ongoing programs. To date, we do not have a sound-wide inventory of ongoing programs, nor do we have a complete picture of how all of this work contributes to recovery. Without this

information, we are not able to evaluate the benefits of shifting funding from existing programs to new programs or initiatives. Making shifts such as this would involve making difficult, and likely controversial, decisions that would be more easily supported if the characteristics and the relative importance of programs were better understood.

- Filling our gaps in information on recovery (science). As noted by the Science Panel and detailed in the 2012 Biennial Science Workplan, we often overlook the need to fully fund the research necessary to fill gaps in information critical to regional decision-making on recovery strategies.
- Understanding the relationship between science and policy. The scientists in our region must be our partners if a successful, science-based recovery effort is to be forged and carried out. We can ask our scientists for their recommendations on the best courses of action to address a specific set of problems. But many of the hard choices are not just scientific; they also relate to the allocation of scarce resources and an assessment of public tolerance for change. Consequently, dialogue between scientific advisors and policy makers is the only way we can fulfill what state statute requires: creating an effective, focused agenda that is based on science.
- Making unpopular decisions. Change is difficult. Change can be unpopular. Many of the decisions necessary to protect and restore an ecosystem as complex as Puget Sound require actions that seem too costly to different segments of our population, even when these actions many benefit the whole. We initiated a robust recovery effort just as the country and Washington State were entering a severe national and international economic downturn. Addressing economic interests and constraints as being fundamental to ecosystem recovery requires an understanding of many complex systems. Balancing expectations for ecosystem recovery with all of the competing demands for services—health, transportation, education, social welfare—in lean economic times requires a distribution of available resources for which there are no correct answers, only choices.

## Comments from the Science Panel on Implementation

September 28th, 2012

To: Martha Kongsgaard, Chair, Leadership Council

From: Joseph K. Gaydos, Chair, Science Panel  
William Labiosa, Vice-Chair, Science Panel

Subject: Science Panel comments on progress in implementing the Action Agenda and findings from the Puget Sound Ecosystem Monitoring Program (PSEMP)

### Background

This memorandum addresses RCW 90.71.370(3) instructing that the State of the Sound report includes “comments by the (Science) panel on progress in implementing the plan (i.e., the Action Agenda), as well as findings arising from the assessment and monitoring program.”

Progress in implementing the Action Agenda requires an examination of the details of implementation tracking by the lead entities responsible for each action, a qualitative set of performance measures against which to measure the status of implementation, robust science and monitoring programs to help inform the adaptive management process and finally, continuous dialogue between the Science Panel and policy makers. Without all of these elements, we cannot hope to make all of the linkages between implementation of the Action Agenda and the results provided by the monitoring program that help inform us on progress in protecting and recovering the Sound.

To meet this charge, this memorandum consists of the following:

1. An interpretation of the charge and defining the scope of this memorandum,
2. Progress and challenges in implementation of the 2008 Action Agenda
3. Progress and challenges in implementation of the 2009-2011 Biennial Science Work Plan
4. Progress and challenges in building the necessary science-policy dialog
5. Progress in establishing an effective adaptive management framework and system

### Purpose and Scope of Science Panel Comments

The purpose of this memorandum is to provide a perspective on the key science-policy issues facing the Puget Sound Partnership (PSP) as they implemented and revised the 2008 Action Agenda. The legislation establishing the Puget Sound Partnership, including the Leadership Council, the Ecosystem Coordination Board, and the Science Panel, calls for an appropriately aggressive approach to address the degradation of the state of Puget Sound.

In this memorandum, we review actions of the Puget Sound Partnership since its inception, including the work conducted under the first (2008) Action Agenda and companion Strategic Science Plan and the 2010 Biennial Science Work Plan, as well as the 2012 revision of the Action Agenda and the 2012 Biennial Science Work Plan. The original high priority placed on developing the Action Agenda within one year of creating the Partnership precluded developing a well-reasoned and highly focused scientific assessment to identify and rank pressures and threats to the ecosystem. The short timeframe for the first Action Agenda also limited the ability to establish an adequate baseline monitoring program and lessened the ability to create a scientifically-informed prioritization of needed recovery actions. Since the 2008 Action Agenda, progress has been made on multiple fronts, as described below

## **Progress and challenges in implementation of the 2008 Action Agenda**

The PSP Performance Management team has reported that, of the 146 recovery actions in the 2008 Action Agenda, 23 have been reported as completed, 81 are “on plan,” 17 have been started, but “need attention,” and 25 were not launched. PSP staff has provided the Science Panel with summary charts for each of these categories, with some basic analysis of the breakdowns for different recovery actions types. It should be noted that these categories are not sufficiently detailed to adequately relate recovery actions to monitoring information. It should also be noted that the categories

do not have well-defined objective measures to describe what “being on plan” or “needs attention” means, although the new report card process that requires reporting on “milestones” should be a step in the right direction. The selection of detailed milestones that are clearly linked to robust performance measures will be crucial to whether or not PSP can clearly describe the status of implementation of the 2012 Action Agenda.

While there is a great deal of interest in attempting to link the status of implementation with interpretations of monitoring information collected since the last State of the Sound report, the PSP should articulate realistic expectations about the timeframes needed for making such broad interpretations. Assessing recovery will require more detailed information about individual recovery actions, longer monitoring records, and careful interpretation grounded in models that incorporate considerations of important ecosystem processes, spatial and temporal scales, and other factors. In the shorter-term (within biennial tracking periods), we can perhaps expect to see signals in the monitoring data at smaller scales (e.g., the scale of Local Implementing Organizations; LIOs) that can be linked to local actions. The ability to detect these signals will be dependent on the LIOs tracking local recovery activities/projects, interpreting local ecological and human well-being data (including PSP indicators), and sharing information with the Puget Sound Ecosystem Monitoring Program, the Lead Organizations, and PSP staff. In the longer-term (multiples of biennial tracking periods), we can expect to see regional patterns emerge that will allow an assessment of Puget Sound recovery within the Adaptive Management Framework, with the potential for significant differences in time lags for the respective indicators of change.

The ecological impact ranking (“prioritization”) approach used to prioritize the 2012 Action Agenda sub-strategies is a notable improvement over the prioritization approach used for the 2008 Action Agenda. The ability to cross-walk the near term actions within the “Strategic Initiatives” and within the implementation status categories provide useful information to assess on how implementation is proceeding. While a lot of work remains to be done to support Action Agenda prioritization for local implementation of near-term actions and for future Action Agenda updates, this effort was a positive step towards developing robust decision support approaches that incorporate the best available science.

## Progress and challenges in implementation of the 2009 Biennial Science Work Plan

The 2009-2011 Puget Sound Biennial Science Work Plan (BSWP) detailed high-priority science activities required to: (1) support the implementation of the Action Agenda, (2) build capacity to revise and improve future Action Agendas, and (3) enhance the PSP's ability to lead the ecosystem protection and restoration effort. The plan called for two parallel tracks: synthesis of available Puget Sound information, while filling critical gaps with new investigations; and building the capacity and organizational structure, and establishing procedures required for an efficient, transparent, and adaptable science program. Some priorities identified in the 2009 BSWP and progress towards implementation (or lack thereof) are as follows:

### 1. Synthesize available information on Puget Sound to guide recovery efforts:

Advances were made towards synthesizing available information on Puget Sound with the development of the 2010 Strategic Science Plan, which detailed what we know about Puget Sound and the science needed to restore the ecosystem. The completion of the very comprehensive 2010 Puget Sound Science Update provided a much larger synthesis of what we know about the system. This document, which is now available on-line as PDFs and as a web-published document, contains detailed chapters on understanding future and desired system states, the current condition of the Puget Sound Ecosystem, the impacts of natural events and human activities on the system and the effectiveness of strategies to protect and restore the system.

### 2. Fund and conduct studies to fill critical science information gaps:

Although a science account was established to help fund science that would fill critical information gaps, the account was never funded. Instead, some of the science priorities established in the 2009 BSWP were addressed in a more circuitous route. For example, priorities set in the 2009 BSWP were used by the EPA to help identify the \$13 million in science projects funded in September 2010. Additionally, it was hoped that State Agencies would use the BSWP to identify science priorities that were within their purview and address those gaps by funding projects. A method for identifying parties responsible for certain priority science projects, funding for those projects and an adaptive feedback loop for incorporating findings into Puget Sound restoration efforts was lacking with the 2009 BSWP. With the recent adoption of the 2012 BSWP the Partnership's Performance Management Team will assist with better tracking of needs identified in the BSWP.

### 3. Identify ecosystem services and socioeconomic indicators for recovery:

A Social Science Workgroup was established to help identify research needs to address questions associated with ecosystem services and socioeconomic indicators for recovery. There are examples of individual projects that occurred since 2009 that are relevant to this need, but much more effort is required to systematically support this need.

### 4. A system for peer review of materials forming the science basis for Partnership decisions:

The Science Panel established a protocol for the timely peer review of technical materials used by the Partnership to make decisions, set priorities, and update and implement the Action Agenda. A white paper was developed and is now used by the Science Panel and Partnership Staff to identify what needs to be peer-reviewed as well as the different levels of peer review. This process should be formalized and incorporated into the process for delivering results and products produced by the Partnership and co-partners.

5. Invest in capacity for modeling current and future ecosystem impacts:

The Partnership and collaborators have initiated a process to develop analytical tools that can be used to predict important ecological, economic, and social consequences of alternative future scenarios for the Puget Sound ecosystem. This work is still in the early stages.

6. Develop and implement a coordinated regional monitoring program:

The Partnership has developed a monitoring group, the Puget Sound Ecosystem Monitoring Program (PSEMP) that is working to coordinate monitoring with indicators and targets and to ensure we can detect change from restoration actions designed to improve the system. Subcommittees have been developed for different aspects of monitoring and Partnership and other staff are coordinating these sub-committees. To date the PSEMP Steering Committee has developed a charter and work plan, overseen the establishment of 9 working groups, and tasked the working groups with developing an inventory and gap analysis for monitoring requirements. Products include release of the Puget Sound Marine Waters 2011 Year in Review, preparation of the State of the Sound 2012 (SOS2012) vital signs summary and synthesis, and drafting the salmonid viable salmon population (VSP) report. The Washington Academy of Sciences was commissioned to provide an independent review of the Partnership's progress in this area and the Academy issued a report that noted deficiencies in the underlying conceptual framework and recommended refinements and improvements for the suite of indicators chosen (with implications for some of the targets). Currently, the Science Panel, Partnership Staff, and the monitoring working groups are working to address the concerns and implement recommendations identified by the Academy's review.

In summary, the 2009 BSWP and Partnership Science Panel helped to identify prioritized science and science implementation needs, but to date the Science Staff capacity at the Partnership and the capacity to fund science have been insufficient to move these identified needs forward in a timely and concerted way. It is fortunate that the EPA Region 10 has been able to fund some of the priority science needs, however the Science Panel recommends adopting a more direct route for funding and tracking science needed for ecosystem recovery. The Science Panel is working with the Leadership Council, the Partnership Staff and the Puget Sound Institute to develop a method for doing this and to better incorporate new scientific findings into decision making.

### **Progress and challenges in building the necessary science-policy dialogue**

As discussed, the PSP uses adaptive management as a strategy to implement Puget Sound protection and restoration programs. At the core of adaptive management is a periodic cycle of actions, assessment, evaluation, and planning, including discussions about how new information (including science findings) can improve current restoration actions. Over the last several years, the Science Panel has worked to increase dialog between the Science Panel, the Ecosystem Coordination Board and the Partnership's Leadership Council. Annual meetings to discuss issues at the science-policy interface have been instrumental in helping to move forward specific projects like target setting for ecosystem indicators, developing ecological priorities for restoration actions and helping to scope an ecological pressure or risk assessment. Additionally, the Science Panel has tried to increase its presence and participation at Leadership Council and Ecosystem Coordination Board meetings.

The Partnership's goals will not be met without a strong interface between science and policy. While current efforts to better integrate science and policy are steps in the right direction, what is needed eventually is seamless constant communication between the Science Panel and policy makers so that scientists can better understand the needs of the policy makers and the policy makers can better understand the science and tools available to support decision making.

### **Progress in establishing an effective adaptive management framework and system**

In early 2012, PSP staff began developing a draft Adaptive Management Framework document and has provided a draft to the Science Panel (a sub-group) for comment. The Science Panel has provided advice that this effort should describe a framework for adaptation and learning as it should occur and not simply describe the approaches used by the Partnership to date. While much work remains to be done in developing an adaptive management framework in practice that recognizes and deals with the difficulties in assessing progress and sharing information within the institutional complexities of the broader Partnership, the PSP has made progress in several important elements of the anticipated adaptive management framework, including: 1) the choice of ecosystem indicators (including human well-being indicators); 2) the creation of the "dashboard" of indicators from the broader set of ecosystem indicators; 3) the setting of targets for the dashboard indicators; 4) the progress to date in the development of the Puget Sound Ecosystem Monitoring Program; and 5) progress towards developing a prioritization approach for recovery actions that include statements about expected results, incorporating ecosystem threats assessment information.

### **Summary**

The PSP has established a structure that ultimately will enable it to identify goals, identify and enact priority actions that will help achieve those goals, and be able to measure progress along the way. As would be expected at this early stage in the game, the PSP has made some significant accomplishments, has faced some challenges and has opportunities for improving its work. A summary of those identified by the Science Panel is as follows:

#### *Accomplishments*

1. Of the 146 recovery actions in the 2008 Action Agenda, 23 have been reported as completed, 81 are "on plan" and 17 have been started, but "need attention."
2. For the first time, the Science Panel and the Ecosystem Coordination Board worked together to develop an ecologically prioritized list of actions identified in the 2012 Action Agenda as needed to restore Puget Sound.
3. The Partnership has developed a monitoring group, the Puget Sound Ecosystem Monitoring Program (PSEMP) that is working to coordinate monitoring, indicators, targets and their relationship to restoration actions designed to improve the system.
4. Advances have been made to synthesize available information on Puget Sound and are being organized into an Encyclopedia of Puget Sound for easy referencing by scientists, educators and the general public. A system is being put into place to continually update our current understanding of the ecosystem.

5. A Social Science Workgroup was established to help identify research needs to address questions associated with ecosystem services and socioeconomic indicators for Puget Sound recovery.
6. A protocol was created for the timely peer review of technical materials used by the Partnership to make decisions, set priorities, and update and implement the Action Agenda.
7. Dialog has increased between the Science Panel, the Ecosystem Coordination Board and the Partnership's Leadership Council.

### *Challenges*

1. Of the 146 recovery actions listed in the 2008 Action Agenda, 25 were not launched.
2. The categories used in Performance Management for evaluating the recovery actions detailed in the Action Agenda are not sufficiently detailed enough to relate recovery actions to monitoring information. Also, each of the categories should have well-defined objective measures that describe them progress on individual actions such that they can be compared and evaluated on a case-by-case basis.
3. While there is a great deal of interest in attempting to link the status of implementation with interpretations of monitoring information collected since the last State of the Sound report, the PSP should articulate realistic expectations about the timeframes needed for making such broad connections.
4. It is fortunate that the EPA Region 10 has been able to fund some of the priority science needs, but a more direct route for funding needed science, tracking progress and integrating results back into decision making is necessary.
5. The Science Staff capacity at the Partnership and the capacity to fund science have been insufficient to move identified scientific needs forward in a timely and concerted way.

### *Opportunities*

1. Assessing recovery will require much more detailed information about individual recovery actions, longer monitoring records, and careful interpretation grounded in models that incorporate considerations of important ecosystem processes, spatial and temporal scales, and other factors.
2. Current collaborative efforts by the Science Panel, Ecosystem Coordination Board and Leadership Council should improve our ability to prioritize actions for local implementation the next Action Agenda update.
3. Dialog between the Leadership Council, Ecosystem Coordination Board and Science Panel needs to grow to the point that the three groups seem to be in continual conversation so that scientists can better understand the needs of the policy makers and the policy makers can better understand the science and tools available to support decision making.
4. While the PSP has made progress in choosing ecosystem indicators, creating a "dashboard" of indicators from the broader set of ecosystem indicators, setting targets and developing the Puget Sound Ecosystem Monitoring Program, the Washington Academy of Science's external review of the PSP's indicators should be used as a tool to improve the Partnership's indicators, targets and overall monitoring.

# 3. ADAPTIVE MANAGEMENT

*HOW WE MAKE DECISIONS*

## How Do We Make Decisions? *Adaptive Management*

### How the Puget Sound Partnership does adaptive management

As we take action to recover the Puget Sound ecosystem, the Puget Sound Partnership and our numerous partner agencies and organizations also ask:

- What have we learned about Puget Sound and ecosystem recovery?
  - \* What are the specific concerns to be addressed by recovery efforts?
  - \* What are the best approaches for protection and restoration?
- How can we use new understandings to improve ecosystem-based management of Puget Sound?

By asking and answering these questions across the multitude of recovery efforts occurring throughout the region, we aim to develop science-based innovations for recovery, diffuse information and conclusions about best practices, and improve Puget Sound ecosystem recovery. This approach has been called evolutionary problem solving – a form of adaptive management.

Grounded in an adaptive management framework, the Puget Sound Partnership leads collaborative efforts to plan, evaluate, and improve solutions to achieve Puget Sound recovery. This means that we:

- Develop and prioritize solutions by
  - \* Selecting indicators for assessing recovery
  - \* Articulating desired future conditions
  - \* Developing and articulating the logic of strategies and actions by illustrating how they act on ecosystem pressures and contributing factors
  - \* Projecting the expected results of actions relative to recovery goals and objectives
- Track and monitor results by
  - \* Monitoring implementation, effects of actions, and ecosystem conditions
  - \* Assessing outcomes to compare measured results to expected results
  - \* Evaluating the accumulated information about actions and monitoring results

Connecting these efforts in an adaptive cycle (see figure), we learn, capture and share this learning, and apply this learning to adjust plans and actions. The Partnership engages in an ongoing process of feedback and learning to periodically revisit decisions – e.g., about the specific goals and objectives of ecosystem recovery, the strategies and actions to include in the Action Agenda, and the relative priority of strategies and actions – and to clearly and transparently update the assumptions underlying each decision.

The Partnership’s experiences in adaptively managing the Action Agenda’s foundation of ecosystem indicators, recovery targets, and pressures include:

- **Adopting a Dashboard of ecosystem indicators.** In early 2010, a team of scientists developed candidate portfolios of ecosystem indicators to represent the Puget Sound ecosystem using a scientific process outlined in the Puget Sound Science Update. The Leadership Council used these candidate portfolios and their judgments about the “resonance” of the candidate indicators to adopt a Dashboard of 20 ecosystem indicators in July 2010. The decision to adopt the Dashboard of indicators concluded an adaptation of the Partnership’s suite of indicators, transitioning from the provisional indicators selected by the Science Panel in 2009, building from published scientific information and scientific advice.
- **Setting 2020 ecosystem recovery targets.** In late 2010, the Science Panel advised that a “first iteration of target setting should commence immediately and consider ecological and social tradeoffs by simultaneously examining, and providing targets for as many of the 20 dashboard indicators as possible.” In 2011, the Partnership established 2020 ecosystem recovery targets for most of the Dashboard indicators and for reductions in a few high priority pressures. The 2011 target setting effort did not accomplish simultaneous consideration of targets, but did allow stakeholders and decision makers to consider ecological and social tradeoffs in considering specific targets. The Leadership Council adopted 2020 ecosystem recovery targets were informed by scientific input, considered stakeholder perspectives, and reflected a balance between being achievable and results-oriented. The adoption of specific targets as guides for ecosystem recovery was a significant adaptation in the Partnership’s approach to ecosystem recovery and was responsive to scientific advice.
- **Articulating the pressures affecting ecosystem recovery.** The Science Panel advised in late 2010 that “there is an urgent need [for] a comprehensive analysis of threats” to the Puget Sound ecosystem. As of fall 2012, work is underway to design this type analysis and resources have been allotted to carrying it out. To support the 2012 revisions to the Action Agenda, the Partnership refined the pressures presented in the 2009 State of the Sound report to (1) address

## What is Adaptive Management?

*Adaptive management is an explicitly scientific approach to management in complex systems to test assumptions in order to learn and adapt.*

☑ **Testing assumptions** involves developing and stating assumptions about a situation, designing and implementing an action, and monitoring to see how actual results compare to what was predicted.

☑ **Learning** is about systematically documenting the processes used and the results achieved.

☑ **Adaptation** is about improving actions based on the results of monitoring and learning.

concerns raised by reviewers, (2) better align the list of the pressures with published categorization schemes, and (3) better articulate pressures as stressors, sources of stress, and stressed conditions of ecosystem components. In 2012, the Partnership elicited expert opinions re-evaluate pressures whose definitions had changed or whose 2009 ratings were criticized by reviewers. More complete revisions will occur through the “comprehensive analysis” recommended by the Partnership’s science advisors.

Building on this foundation, the Partnership led a process of revising Action Agenda strategies and actions in 2012, including:

- **Revising strategies for five key pressures.** In 2011, the Partnership convened interdisciplinary teams to discuss approaches to reducing five key pressures on the Puget Sound ecosystem: land development, shoreline alteration, floodplain alteration, stormwater, and wastewater. Each team combined scientific and policy expertise to create a conceptual model reflecting current understandings of the situation and to identify and evaluate opportunities for management intervention. The output from these teams was a key contribution to revised protection, restoration, and pollution control strategies presented in the December 2011 draft Action Agenda.<sup>1</sup>
- **Selecting near-term actions for the 2012 Action Agenda.** Combining information from the interdisciplinary team-led efforts described above with information on implementation of near-term actions in the 2009 Action Agenda, Partnership staff and partners proposed near-term actions and key ongoing program activities to include in the December 2011 draft Action Agenda. Unfortunately, information about the effects of prior-implemented actions was not generally available to inform the selection or refinement of near-term actions for the 2012 Action Agenda.

One exception is the measured effectiveness of storm system cleaning by the City of Tacoma to reduce legacy pollutant loads – see local story on page xx – which provided the rationale for including additional storm system cleaning as a near-term action in the 2012 Action Agenda. The primary scientific basis for the selection of most near-term actions was the conceptual understanding of expected results.

- **Rating 2012 Action Agenda sub-strategies based on an evaluation of their ecological importance.** The Partnership’s science program and Science Panel members led an effort concluded in June 2012 to assist decision makers in identifying priority Action Agenda sub-strategies. Using the professional expertise and knowledge of 40 individuals, the ecological outcomes of Action Agenda sub-strategies were characterized based on the pressures addressed; the ecosystem components affected; and the ecosystem structures, processes, species, and food webs protected and restored. The characteristics used to evaluate sub-strategies and their relative weighting were developed by Partnership scientists following guidance from the Partnership’s Ecosystem Coordination Board. This approach provided a more transparent and objective basis for ranking sub-strategies compared to the approach used in 2008. Note, however, that this approach has not yet been combined with information on implementation issues to generate a priority list of sub-strategies. The results available in the 2012 Action Agenda (Appendix G) are ordered lists of sub-strategies based on evaluation of their ecological outcomes.
- **Defining strategic initiatives to guide Partnership and partners’ priorities for 2012 and 2013.** In the 2012 Action Agenda, the Partnership has identified three strategic initiatives meant to deliver a

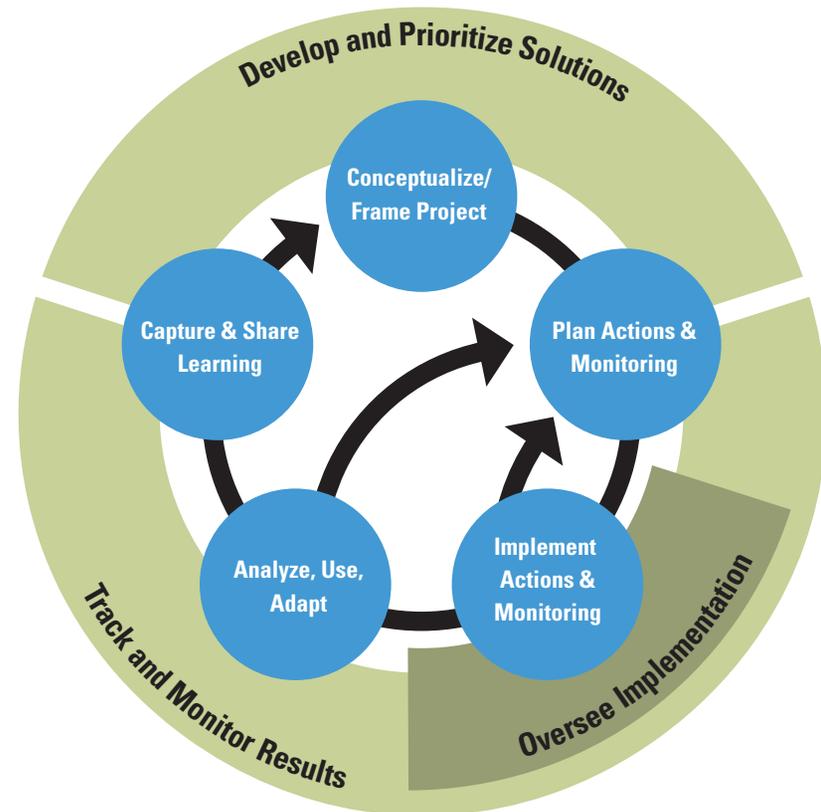
<sup>1</sup> Revisions to other strategies were identified by Partnership staff discussions with lead implementers (e.g., consulted with the Department of Ecology and their core team for toxic chemicals and nutrient controls to revise toxic chemical control strategies to better align with Ecology initiatives and strategies).

substantial level of progress on focused, strategic sets of actions related to the challenges of urban stormwater runoff, protection and restoration of habitat, and recovery of shellfish beds. The specific actions included within each strategic initiative were drawn from policy discussions and were checked against the rating of strategies based on the importance to achieving ecological outcomes.

Adaptive management depends on the integration of the scientific process, investigation, and findings into ecosystem recovery. The following efforts of the Partnership's strategic science program, as supported by the regional scientific community, have fueled recent adaptations:

- Puget Sound Science Update.** In 2010, the Science Panel delivered an initial publication of the Puget Sound Science Update to the Partnership's Executive Director. This document provided critical information to support the adaptations discussed above related to adoption of a Dashboard of ecosystem indicators and adoption of ecosystem recovery targets. The section of the Update on ecosystem protection and restoration strategies provides relatively little information about the effectiveness of strategies and actions; this gap in information has affected the ability of the Partnership to base revisions of the Action Agenda on an evaluation of the effects of actions.
- Establishing a Puget Sound Ecosystem Monitoring Program.** Please see the discussion of PSEMP in chapter 1 for an introduction to the results from, and development of, capacity for ecosystem monitoring.
- Engaging the Partnership's Science Panel and the regional science community to provide scientific review and advice.** As described in many of the paragraphs above, the science community

**The Puget Sound Partnership's Primary Responsibilities (shown in green) are interrelated in an adaptive cycle (shown in blue)<sup>2</sup>**



<sup>2</sup>This is a modification of the project management cycle presented in the *Open Standards for the Practice of Conservation (CMP 2007)*

## Adaptive Management Example: *Revising implementation strategies based on the importance of contaminants released from creosote-treated wood*

In late 2011, the Department of Ecology completed a multi-year scientific study of toxic chemical loading to Puget Sound and published, "Primary Sources of Selected Toxic Chemicals and Quantities Released in the Puget Sound Basin." This report identified creosote-treated wood as one of the largest sources of PAHs (polycyclic aromatic hydrocarbons) released to the Puget Sound environment

This result was surprising to a number of people engaged in toxic chemical control issues. As people learned of this finding, an effort was made to adjust toxic chemical control strategies to reflect this finding. For example:

- A near-term action to inventory and remove creosote pilings (B2.2 NTA4) is included in the 2012 Action Agenda. This continues work that DNR and others have been undertaking since 2007 but represents a substantially greater prominence for this issue in the Action Agenda compared to the 2009 version.
- As the lead organization for controlling toxic chemical and nutrient pollution, the Department of Ecology has recently awarded approximately \$500,000 to DNR for removal of creosote piling as a key investment for PAH control.

has supported adaptation by providing scientific advice related to ecosystem recovery, e.g., adopting indicators and setting targets. In addition, conducting scientific review ensures the credibility of the processes and information the Partnership uses to fuel adaptations. For example, the third-party review of the assessment report concluding the multi-year study of toxic contaminants loading to Puget Sound provided some assurance that the study conclusions reflected the findings and provided a sound basis for revised strategies and actions (see sidebar on creosote materials).

Finally, adaptive management depends on individual and institutional learning. The Partnership's application of adaptive management has included the following efforts to facilitate, capture, and share learning:

- **Encyclopedia of Puget Sound.** A project of the University of Washington's Puget Sound Initiative, the Encyclopedia of Puget Sound is designed to facilitate collaborations and partnerships among leading researchers and agencies to help deliver scientific findings to scientists and policymakers. By maintaining and improving the information presented in the Puget Sound Science Update as part of the Encyclopedia of Puget Sound, the Institute and Partnership hope to encourage information sharing and synthesis to facilitate learning within the scientific community and to provide a means for that learning to spread to those engaged as implementers and stakeholders for ecosystem recovery actions.
- **2011 Salish Sea Ecosystem Conference.** Building on a nearly 25-year history of conferences on Puget Sound ecosystem science and management, the Partnership worked with Environment Canada and others to convene the 2011 Salish Sea Ecosystem Conference. This event offers a forum for presentation and discussion of scientific findings that facilitates learning by scientists, implementers, and stakeholders.

## 4. ACTION AGENDA FUNDING

*TRACKING COSTS, ACCOMPLISHMENTS AND RECOMMENDATIONS*

LEADERSHIP COUNCIL DRAFT

The Action Agenda and its performance management system are intended to help guide spending on the most important priorities. In this section, the Partnership presents information on the funding that was provided to implement the measures in the 2008 Action Agenda and funding estimates for implementation of the 2012 Action Agenda.

## **A. COST OF IMPLEMENTING THE 2008 ACTION AGENDA**

In 2008, owners of near-term actions provided two-year estimates of what it would cost to implement the nearly adopted Action Agenda and information on available funds for completing the work for the 2009-2011 biennium. In 2012, PSP asked these owners to provide information on what they had actually expended/budgeted for these same near-term actions in order to determine the funding gap between “need” and funding available. The estimates were based on budgeted amounts for the 2009-2011 biennium as well as for fiscal year 2012. The additional year was requested because the timeframe for implementing the 2008 Action Agenda had continued beyond the original two year timeframe (based on the schedule for updating the Action Agenda) and it was important to capture the additional work and expenditures in that third year. The cost estimates and estimated expenditures were converted to average annual estimates in this report, so that they could be compared to determine the funding gap.

During this period, the region benefited from receipt of federal stimulus funding of an estimated \$150.8 million that was critical to our accomplishing a number of key actions. The region also received \$77.5 million in federal dollars invested in Puget Sound recovery.

Approximately \$232 million was allocated through the state budget to actions in the Action Agenda for the years 2010-2012. Non-state funding was approximately \$117 million.

Exhibit A-1 is a summary table that distinguishes the estimated annual cost for strategic priorities compared to estimated expenditures to determine the funding gap. The 2008 Action Agenda included the following strategic priorities:

Priority A- Protect intact ecosystem processes, structures and functions

Priority B- Restore the ecosystem process, structures and functions

Priority C- Prevent water pollution at its source

Priority D- Work together as a coordinated system

Priority E- Build an implementation, monitoring and accountability management system

As illustrated in Figure A-1, the estimated annual cost<sup>1</sup> for state agencies for the 2008 Action Agenda was \$418 million whereas the estimated annual expenditures was only \$232 million, resulting in a funding gap of just under \$187 million. Without the federal stimulus funding received by Washington State during the last few years the gap would have been even larger. However, these stimulus funds were provided on a one-time basis and the state is now facing federal funding cuts rather than increases. This, in addition to the recession the state has faced, which has resulted in significant cuts to state funding, will likely mean that there will continue to be an even larger funding gap between the cost of implementing the Action Agenda and funding available for this work.

<sup>1</sup>Based on original data for the 2009 State of the Sound report

**Figure A-1: Annual estimates for 2008 Action Agenda Strategic Priorities**

(Dollars in 000s)

Strategic Priority	Annual Cost Estimate <sup>1</sup>	Annual Estimated Expenditures	Estimated Funding Gap
A- Protect	\$86,212	\$44,148	\$42,064
B- Restore	\$73,259	\$40,741	\$32,518
C- Prevent	\$185,136	\$101,640	\$83,496
D- Work together	\$28,416	\$21,694	\$6,722
E- Build	\$45,246	\$23,550	\$21,696
TOTAL	\$418,269	\$231,772	\$186,497

The strategic priority D “Working together as a coordinated system” received about 76% of the funding needed for this work. Collectively, the other strategic priorities received only half of the funding needed with the largest shortfall in water pollution prevention activities (\$83 million). The lack of funding has a direct impact on the ability to implement and complete the critical actions necessary that ultimately lead to achievement of 2020 recovery goals.

A breakdown of the estimates and expenditures for each of the Near Term Actions is provided in the Appendix.

Figure A-2 shows the estimated expenditures by operating, capital, and transportation budgets. Thirty percent of the expenditures were in the operating budget, 62% in capital, and 8% in transportation. Major capital projects include investments in upgrades to municipal and industrial wastewater facilities, retrofitting stormwater systems, and protecting and restoring ecosystem habitat.

**Figure A-2: Estimated annual expenditures by strategic priority and budget type**

(Dollars in 000s)

Strategic Priority	Estimated Operating Expenditures	Estimated Capital Expenditures	Estimated Transportation Expenditures	Total Estimated Expenditures
A. Protect	\$20,935	\$23,213	\$0	\$44,148
B. Restore	\$2,012	\$26,412	\$12,317	\$40,741
C. Prevent	\$19,436	\$76,314	\$5,890	\$101,640
D. Work together	\$4,304	\$17,390	\$0	\$21,694
E. Build	\$23,441	\$0	\$109	\$23,550
TOTAL	\$69,955	\$143,329	\$18,316	\$231,772

### ***OTHER ACTION AGENDA IMPLEMENTATION FUNDING***

In addition to the investments in Puget Sound recovery work by state agencies, non-state partners such as federal agencies and local governments also provided funding for Action Agenda implementation during this three-year time period. For example, the Environmental Protection Agency invested \$51 million toward implementing high-priority remediation and clean-up projects in the Puget Sound and to support federal and other facilities in the reduction of nutrients and pathogens especially in already impaired areas. The U.S. National Parks Service spent over \$51 million during this period on the Elwha dam removal and ecosystem restoration (see Chapter 1 for additional information about this project). The U.S. Fish and Wildlife Service invested over \$7 million to complete large-scale restoration projects at the mouths of major river systems in Puget Sound to restore ecosystem function. In addition, the National Oceanic and Atmospheric Administration contributed \$2.5 million toward implementing the southern resident killer whale plan.

Local governments and non-government project partners were also significant contributors to Action Agenda implementation. For example, locals provide considerable matching funds to habitat restoration and protection projects funded by Washington State’s Recreation and Conservation Office. Additionally, the Northwest Straits Commission received over \$5 million in funding during this period to remove derelict fishing gear.

***ENVIRONMENTAL PROTECTION AGENCY FUNDING FOR PUGET SOUND***

In 2011, Region 10 EPA was appropriated federal funding specifically for Puget Sound Recovery efforts. Since that time, EPA has awarded over \$77.5 million to Washington state, local, and tribal governments.

Funding is distributed through lead organizations to implement targeted strategies, mostly through sub-awards to a variety of other entities, for Puget Sound projects. Exhibit A-3 lists the lead organizations, their targeted strategies, and funding received to date.

Of the \$77.5 million that will be distributed, an estimated 60% of the funding helps implement near term actions, and 40% helps implement projects related to the higher level sub-strategies within the Action Agenda. An estimated \$49.2 million of the funding will go to local governments for implementation of projects, \$20.8 million for regional projects, and \$7.5 million for program management. Of the total funding, about 46% will be distributed through competitive processes giving a wide range of entities and projects the opportunity to receive funding for high-priority actions that will help achieve 2020 targets to protect and restore the Puget Sound.

**Figure A-3: Environmental Protection Agency Puget Sound Recovery Funding**

Lead Organization	Focus	Amount of Funding received
Dept. of Ecology	Toxics and nutrients reduction and prevention	\$12.3 million
Dept. of Ecology	Protection of at-risk watersheds	\$14.2 million
Dept. of Health	Pathogen reduction and prevention	\$12.2 million
Dept. of Fish and Wildlife	Marine and nearshore habitat restoration and protection	\$12.2 million
Northwest Indian Fisheries Commission	Support implementation of Action Agenda strategies	\$12.1 million
Puget Sound Partnership	Oversee implementation of Action Agenda and stewardship of Puget Sound	\$14.5 million
Total		\$77.5 million

## **B. COST ESTIMATES – IMPLEMENTATION OF THE 2012 ACTION AGENDA**

The Leadership Council adopted an updated Action Agenda on August 9, 2012. It includes 199 near term actions, including three sets of Strategic Initiatives and lists a number of the key ongoing programs that are conducted throughout the region. Near term actions are the new initiatives, critical next steps in ongoing work and targeted efforts to improve implementation of ongoing activities or ensure these programs have adequate resources to deliver on objectives. Ongoing activities create the foundation for recovery efforts and the regulatory, policy and incentive-based framework upon which near-term actions are built. Regional leaders are not proposing to reallocate funding away from ongoing activities to the “change agenda” measures called out in the near-term actions. The Strategic Initiatives (prevention of pollution from urban stormwater runoff, protection and restoration of habitat, and recovery of shellfish beds) were developed by regional partners to deliver progress at a substantial level over the next two or three years on a more focused set of regional priorities. They are intended to focus our efforts to seek changes in policy, report success and challenges, and educate and engage the Puget Sound community in the recovery effort. They should also be the focus of spending and resources in the next two to three year timeframe.

In September 2012, Near Term Action owners provided cost estimates for each of the near-term actions that they agreed to lead and estimates of the funding they already have available in their respective budgets. The cost estimates included costs that might be incurred by other entities that shared responsibility for the proposed work. Some of the owners were unable to provide total costs for the Near Term Action because the work itself required a lengthy effort to determine total future cost for the work, such as costs for removing shoreline armoring, infrastructure retrofit projects, and land

purchases. Where relevant, these are footnoted in the summary charts. Although the Department of Fish and Wildlife provided cost estimates, this agency did not submit budget estimates.

The measures in the 2012 Action Agenda are organized differently from those in the 2008 Action Agenda. The work is divided into five broad categories:

Category A- Freshwater and terrestrial Protection and Restoration

Category B- Marine and Nearshore protection and Restoration

Category C- Pollution prevention and Cleanup

Category D- Strategic leadership and collaboration; and

Category E- Funding strategy

Below are charts that summarize the cost estimates and available budgets for the 2012 Action Agenda near term actions for state fiscal year 2013 and the 2013-15 biennium. The implementation period for these NTAs is from one to three years. The budgeted amount does not include estimated new capital expenditures for the 2013-15 Biennium because, unlike operating appropriations, new capital budget appropriations are zero-based (that is, they assume zero carry-forward level) each biennium. Figure B-1 represents the overall NTA costs and estimated budgets for state agencies by strategy. Figure B-2 is a subset of the overall data that illustrates the NTA estimates for each of the Strategic Initiatives.

**Exhibit B-1: State Agencies’ Three-year Near Term Action estimates for 2012 Action Agenda**

(Dollars in 000s)

Strategies	Cost Estimate	Estimated Budget	Estimated Funding Gap
A Freshwater	<sup>2</sup> \$396,565	\$33,437	\$363,127
B Marine & Near-shore	\$24,090	\$6,364	\$17,726
C Pollution	\$79,773	\$58,721	\$21,052
D Leadership	\$4,282	\$4,218	\$63
E Funding Strategy	\$13,883	\$10,830	\$3,052
<b>TOTAL</b>	<b>\$518,595</b>	<b>\$113,572</b>	<b>\$405,022</b>

Note: Washington State Department of Fish and Wildlife did not provide budget estimates.

Figure B-1 shows that there is currently a budget gap of over \$400 million for state agencies’ near term actions across all Action Agenda strategies. Based on cost estimates, state agency owners (leading on 160 of 199 near term actions) account for the vast majority (87%) of funding need for near term action implementation. It should be noted that budget estimates do not include capital funding for the 2014-15 biennium. This is particularly relevant to Strategy A – Freshwater and terrestrial Protection and Restoration – where 2014-15 biennium capital budgets are likely to have a significant effect on the funding gap. For example, on average the state has provided \$32.5 million in capital funding per year for implementing the three-year workplans over the last three biennia. The cost estimate also includes \$36.5 million in near term actions for the Department of Fish and Wildlife, however, the agency did not provide budget estimates and therefore no estimates are included.

<sup>2</sup> Strategy A – Freshwater, cost estimate includes \$350 million in capital costs related to Chinook investment (NTA A6.1.1)

The Action Agenda for Puget Sound includes three Strategic Initiatives designed to guide our priorities for 2012 and 2013. These are the areas where we intend to focus time and resources, to increase funding, to seek changes that improve policy, to report success and apply lessons learned, and to educate and engage citizens in the recovery effort. Exhibit B-2 shows the financial estimates for the near-term actions aligned to the three strategic initiatives: prevention of pollution from urban stormwater runoff; Protection and restoration of habitat; and Recovery of shellfish beds. As the table shows, in these priority areas of focus there is currently an estimated funding gap of over \$370 million. It is important to understand that this funding gap is simply for those near term actions identified for Strategic Initiatives and does not account for shortfalls of all ongoing programs that are the centerpiece of the work of all of the state, federal, local agencies and Puget Sound tribes, such as current and future costs for stormwater protection.

**Exhibit B-2: Three-year estimates for 2012 Action Agenda Strategic Initiatives, all Near Term Action Owners**

(Dollars in 000s)

Strategic Initiative	Cost Estimate	Estimated Budget	Estimated Funding Gap
Protect Habitat	<sup>2</sup> \$379,297	\$16,942	\$362,354
Prevent Pollution from Urban Stormwater Runoff	\$20,916	\$13,910	\$7,006
Recover Shellfish	\$8,342	\$7,264	\$1,077
<b>TOTAL</b>	<b>\$408,556</b>	<b>\$38,118</b>	<b>\$370,438</b>

Note: The cost estimates do not represent costs for recovery Puget Sound but are for implementing the Action Agenda near term actions. Cost estimates do not account for shortfalls of all ongoing programs that are the centerpiece of the work of all of the state, federal, local agencies and Puget Sound tribes, such as current and future costs for stormwater protection. Washington State Department of Fish and Wildlife did not provide budget estimates.

### ***OTHER ACTION AGENDA IMPLEMENTATION FUNDING***

A significant number of near-term actions are also owned by local, federal, tribal and non-governmental entities. It is estimated that those NTAs not owned by a state agency would cost \$77 million to implement. Exhibit B-3, shows that \$14.5 million of the \$77 million of total funding required has been secured for those near-term actions, leaving a funding gap of over \$62 million.

**Figure B-3: Three-year Near Term Action estimates for 2012 Action Agenda, All Strategies – Federal, Local, Non-Governmental and Tribal Owners**

(Dollars in 000s)

Owner Type	Cost Estimate	Estimated Budget	Estimated Funding Gap
Federal <sup>3</sup>	1,410	1,410	-
Local	19,027	4,241	14,786
Non-Governmental	50,721	8,769	41,952
Tribal	5,970	90	5,880
<b>TOTAL</b>	<b>77,129</b>	<b>14,511</b>	<b>62,618</b>

The 2012 Action Agenda contains a sizeable number of locally focused near-term actions owned by local jurisdictions and non-governmental organizations involving a range of specific implementing actions, including on the ground capital projects such as stormwater retrofits, wastewater infrastructure, legacy net removal and habitat protection and restoration. The estimated cost to implement local and NGO owned near-term actions is just under \$70 million, with an amount currently budgeted of \$13 million.

Of the three federal agency owners of near term actions, the Environmental Protection Agency and the National Oceanic and Atmospheric Administration were unable to provide financial information for their near term actions.

<sup>3</sup>EPA and NOAA near term action financial estimates not available at this time.

Notably, EPA has not yet had the opportunity to gather the Puget Sound federal caucus agencies in order to estimate costs and budgets. The Federal Emergency Management Agency estimated that their near term action related to National Flood Insurance reporting would cost \$1.4 million to implement over three years. The Suquamish and Tulalip tribes also estimated a total cost of almost \$6 million to implement their near term actions, however, the tribes report that only \$90,000 of that amount is currently budgeted.

In total, cost estimates to implement all near term actions over the one to three year period are \$596 million, compared to a current budget estimate of \$128 million. This represents a funding gap of \$468 million. The largest share of the overall near term action cost estimate is covered by strategy A – Freshwater, at almost three quarters of the total (\$443 million, with \$44 million currently budgeted).

### ***SUMMARY***

The cost estimates provided in the charts specifically focus on the costs for implementing the Action Agenda near term actions and therefore should not be represented as the cost for recovering Puget Sound. It does not include the cost for all of the ongoing programs that are the centerpiece of the work of all of the state, federal, local agencies and Puget Sound tribes. It represents only a portion of the costs for the on-the-ground protection and restoration work that is occurring in the region, and it does not include the costs for remediation of existing pollution and both the current and future costs for stormwater protection and water quality treatment that is incurred by agencies and the public who defray these costs. For example, PSP estimates that the cost of addressing stormwater impacts of existing development alone will be on the order of at least \$3 billion. Lastly, it does not include the costs incurred by individual citizens and the business community that are either required by statute, such as pollution control and property management, or those voluntarily important actions that contribute to Puget Sound recovery, such as the purchase of “green” products,

recycling, or low impact development for yards.

The estimated budget to implement the Near Term Actions and Strategic Initiatives in the Action Agenda only includes capital funding for FY 2013 for state agencies. Estimated capital budget amounts for the 2013-15 biennium are not included. If it is assumed that state funding will continue at the historic levels of \$32 million a fiscal year in the capital budget for activities to implement Chinook recovery three year work plans, the estimated funding gap for state owned near term actions is reduced to \$341 million for all strategies and \$306 million for implementing the strategic initiatives.

These estimates are provided to inform the Governor and Legislature on what the region believes are the key priorities in the near future that require public support with the understanding that there are competing priorities that are equally compelling and challenging. The section below summarizes the approaches that are outlined in the Action Agenda to increase funding for these efforts. They include strategies that will help focus our efforts, strategies that seek to maximize our investments, and new approaches for funding that have not been utilized in the past, but which show promise of “expanding the pot” as we move forward.

### ***APPENDICES:***

Spreadsheet 2008 Aa Costs Sorted By Chapters (p.XX)

Spreadsheet 2012 Aa Cost Estimates Sorted By Chapters (p.XX)

## **C. FUNDING STRATEGIES IN THE ACTION AGENDA**

There is a critical need for more stable, diverse and dedicated sources of funding that can be relied upon to continue and ultimately complete the work of protecting and restoring Puget Sound. Increased capacity can be built by identifying new sources for key programs, using existing funding more strategically and efficiently, and developing innovative market-based approaches. The Action Agenda identifies six key programmatic strategies:

- Maintain and enhance federal funding for implementation
- Focus federal agency budgets and national programs
- Maintain, enhance and focus state funding
- Maintain and enhance local funding
- Develop opportunities for private sector and philanthropic funding
- Develop and implement market-based mechanisms

Several of the innovative near-term actions that address funding needs include:

A3.1 NTA 3: Forest Watershed Services – DNR will support pilot market transactions for delivery of watershed services from private forest landowners to downstream water beneficiaries in at least the Snohomish and Nisqually watersheds (see local story Chapter 1 Stream Flows Indicator Report).

A5.4 NTA 2: Ag Land Ecosystem Services Markets – By December 2012, the State Conservation Commission, working with Conservation Districts and Watershed Groups and counties, will have three pilot projects underway that demonstrate ecosystem services markets associated with flood hazard prevention and agricultural lands in floodplains.

A6.1 NTA 1: Secure Annual Chinook Investment – PSP, in collaboration with the Salmon Recovery council, will secure the annual investment as required to fully implement the approved Puget Sound Chinook Salmon Recovery Plan, and work to align that funding in support of the highest priority

protection and restoration projects as identified by the salmon recovery lead entities. This investment strategy will be developed as part of the overall Puget Sound recovery funding strategy.

The Leadership Council requested that the ECB form a sub-committee to work with PSP and our regional partners to coordinate the development and implementation of the funding strategy with a focus on the Strategic Initiatives. It will also address funding local agency needs that have been identified. That work is underway. The sub-committee, using the gap analysis as the base for their work, will produce a more detailed report with proposals on how to fill the gaps by the end of the calendar year, 2012.

The detailed description of the funding strategy may be found in Section E of the 2012 Action Agenda.

## **D. ACTION AGENDA IMPLEMENTATION: HIGHLIGHTS OF ACCOMPLISHMENTS IN THE USE OF STATE FUNDS**

The 2008 Action Agenda featured near-term actions owned by 11 different state agencies: the Departments of Agriculture; Commerce; Ecology; Fish and Wildlife; Health; Natural Resources; Transportation; the Conservation Commission; Puget Sound Partnership; the Recreation and Conservation Office and State Parks. The following examples show a selection of highlights in the use of state funds towards Action Agenda implementation. See the link to the electronic version of this report for a more complete list.

### *Department of Ecology*

**Stormwater & Water Quality** – Ecology is currently providing funding for 118 stormwater design and construction projects statewide totaling over \$66 million awarded through the 2012 Supplemental Capital Budget. This adds to the existing 43 stormwater projects that are under construction from \$23 million awarded in the 2010 Supplemental Capital Budget. Approximately two-thirds of this work and funding is focused in Puget Sound.

In addition to Ecology's priority focus on stormwater, the agency has provided funding for 62 projects worth approximately \$115 million through its annual grant and loan programs for clean water projects in Puget Sound over the past three years.

### **Case Study: City of Arlington Wastewater Treatment Plant Upgrade and Stormwater Wetland Project**

–The Department of Ecology provided grant and loan funding to the City of Arlington to facilitate improvements to their wastewater treatment plant and construct a wetland to mitigate pollutants in stormwater runoff. The expansion and upgrade of the wastewater facility included a multi-faceted approach which meets the requirements of the National Pollutant Discharge Elimination System (NPDES) permit and will significantly improve oxygen levels and reduce nutrients in the Stillaguamish River. Additionally the City of Arlington constructed a four cell stormwater wetland, complete with nearly a mile of walking trails and educational signage, to treat stormwater runoff and provide flow control for stormwater that was previously discharged to the Stillaguamish untreated. Education and outreach efforts have been focused on the creation of urban wildlife habitat as well as the integration of proper stormwater treatment in this urban ecosystem.

**Stormwater Case Study Examples** – the following are real examples of water quality problems fixed through implementation of the municipal stormwater permit:

- **City of Seattle housing development (New Holly):** Seattle Public Utilities found nearly 50 homes with the sewer pipes connected to the stormwater system. They were found in field screening for illicit discharges. Correcting these, some of which have been in place for 10 years, removed pollution by untreated sewage that was flowing to Lake Washington.
- **Port Angeles fish processing plant** – City staff found the plant was bypassing the sewer line several times a year and sending the processing waste directly into Port Angeles Harbor. The plant corrected the problem.

**Shorelines and Coastal Wetlands** – Ecology is currently providing \$6.3 million in legislatively-approved grants to 70 cities and counties in the Puget Sound region to help modernize their existing shoreline policies and development regulations. The local regulations are designed to protect water quality and critical habitat, control beach and stream bank erosion, and reduce flood hazards along marine shorelines. The \$6.3 million is divided among six counties and 64 cities based on factors such as miles of shoreline, number of shoreline types, population and growth rates. The money will protect and restore more than 3,000 miles of marine, stream and lake shorelines throughout Puget Sound.

**Case Study: San Juan Creosote Debris Removal Project** – In late 2011, crew members from Washington Conservation Corps removed more than 70 tons of creosote-treated debris from several nearshore locations on Lopez Island. One crew located and staged debris at the Fisherman Bay Spit Preserve site for two days in preparation of the helicopter removal. At the end of the first week of work, this same crew headed to Weeks Wetland where they hand carried most of the debris from the wetland to the road edge for removal by the heavy equipment operator. A second WCC crew hand carried debris from several sites.

**Toxic Cleanup Case Study: Scott Paper Site Cleanup** – In 2011, cleanup was completed on the former Scott Paper site on the shore of Fidalgo Bay in Anacortes. The site historically was used for pulp and paper operations; after those mills closed, the site later was used for other industrial purposes. At the time cleanup started in mid-2009, the site had been unused for several years.

**Toxics Reduction: Local Source Control Specialists** – The Legislature provided \$2.3 million in the 2007-09 biennium to make sure small businesses had the help they needed to reduce toxic pollution in Washington, especially Puget Sound. The program has proved valuable so state funding has continued, augmented by federal funds. In January 2008, Ecology entered into 14 partnership contracts to use existing expertise in local health agencies and public utility districts to help small business owners prevent pollution. That number has grown to 25 partnerships.

#### **Toxics Source Control Case Study Examples:**

- A marine business in Kitsap County had unlabeled drums of chemicals stored outside and didn't have tools on hand in case something spilled. With help from the Kitsap Public Health District, the drums were moved inside and labeled, and a plan was put into place for cleaning up spills in case they occurred. The business also given with a pre-packaged spill kit.
- According to the Puget Sound Toxics Assessment, an estimated 9,200 metric tons of petroleum products are released to the Puget Sound basin every year. A major source of this toxic pollution comes from the motor oil drips and leaks from our motor vehicles. Environmental educators from Seattle Public Utilities and Washington Department of Ecology teamed up to create a program through South Seattle Community College to host about 50 free monthly auto leaks workshops at the school's automotive training center. The program was offered to low-income vehicle owners to help them learn how to identify leaks, undertake preventative maintenance, repair minor leaks, clean up spills, properly dispose of auto fluids, and understand how auto leaks affect Puget Sound. For 2012 and 2013, SPU and Ecology are using a \$200,000 EPA National Estuary Program grant to conduct another 100 auto prevention leak workshops in and around Seattle. SPU and Ecology will conduct post-workshop surveys to assess behavior change.

**Spill Prevention, Preparedness and Response** – Ecology's legislative direction is to implement a "zero spills" strategy for Puget Sound and other state waters. To support this goal, Ecology implements a range of effective spill prevention activities including ship and oil transfer inspections, and oil spill prevention plan reviews. As a result of the Spills Program requirements, approximately 90% of all Puget Sound high volume oil transfers are being pre-boomed by industry, reducing the rate of oil transfer spills to approximately 1 gallon discharged per 100 million gallons of oil transferred.

**Case Study: Deep Sea Spill** – Ecology led the state’s response efforts to the burning and sinking of the 140-foot fishing vessel Deep Sea, in Penn Cove off of Whidbey Island. During May and June Ecology worked with DNR and the Coast Guard to contain and clean up the spill, and remove the vessel that sank next to the Penn Cove commercial shellfish operation in Coupeville. Penn Cove has some of the world’s most productive commercial shellfish operations as well as being the state’s most popular recreational shellfish area. The Department of Health closed commercial and recreational shellfish beds in Penn Cove until June 8th. The state and federal government spent \$3 million cleaning up the 7,000 plus gallon spill and salvaging the abandoned derelict ship (picture below).



The 140-foot fishing Vessel DEEP SEA burning in Penn Cove, Island County on May 1, 2012.

### *Department of Natural Resources*

Washington State Department of Natural Resources (DNR) manages or has regulatory responsibility for 41% of the uplands and underwater lands in the Puget Sound basin. DNR implements many programs to protect working forest lands and aquatic lands in support of the state’s goal to recover Puget Sound to health by 2020. In the past three years, DNR has posted many accomplishments for the Sound, often in collaboration with partners, including the following:

- **Puget Sound Corps** – DNR passed legislation in 2011 creating Puget Sound Corps, work-crews of youth and military veterans employed on projects to protect and restore Puget Sound. By September 2012, five crews of six people each were deployed by DNR on water quality work in state forests, removal of invasive species on state owned aquatic lands, and urban forestry restoration projects in the Puget Sound basin.
- **Derelict Vessel Removal** – Since 2009, DNR has worked with local governments and vessel owners to remove 147 derelict vessels, many of these from the waters and shorelines of Puget Sound, where they posed a threat to both navigation and the environment. This biennium, the derelict vessel removal program was directly responsible for the removal of 40 vessels from Washington’s waters. This includes the removal of the Deep Sea from Penn Cove. In addition to these 40 vessels, DNR facilitated the removal of 25 vessels led by other agencies and local governments.
- **Aquatic Reserves** – DNR has designated and protected four new Aquatic Reserves in Puget Sound since 2009 at Cherry Point, Smith and Minor Islands, Protection Island, and Nisqually Reach.
- **Ediz Hook Restoration** – The Aquatic Restoration program, in partnership with the Lower Elwha Klallam Tribe, completed work to restore an 1,800 linear foot section of Ediz Hook, formerly known as the A-Frame site. The project removed fill, remnant pilings, and a pile bulkhead, and re-graded the shoreline to restore habitat function. DNR and the Tribe have been working together since 2005 on several phases to complete this effort. Additional restoration activities include the continued planning and design for a salt marsh restoration project at

Secret Harbor on Cypress Island as well as restoration of a section of the south shoreline of Lake Washington adjacent to the mouth of the Cedar River.

- **Decking and Creosote Pier Removal** – DNR removed 66,795 square feet of overwater decking at the former Asarco smelting site at Point Ruston in 2009-10 and removed an additional 120 tons of creosote-soak piers and debris from the shorelines around Puget in the 2009-11 period.
- **Restore Upland Fish Habitat** – DNR continues its work with industrial forest landowners to restore upland fish habitat and disconnect logging roads from transporting sediment into streams, which impairs water quality and harms salmon habitat. For the period of 2009-2011, landowners brought 3,719 miles of road up to state standards, put 659 miles of unneeded roads to bed, and corrected 1,387 barriers to fish passage that opened 741 miles of habitat.

### *Department of Health*

#### **Improvements in Vital Water Quality Measure in Puget Sound Shellfish Areas**

– Puget Sound shellfish areas long-impacted by contamination from human and animal waste have seen a steady reduction in fecal pollution since 2003. The state Department of Health analyzed results of over 50,000 water quality tests, taken from the same locations at the same frequency for more than a decade, from 38 shellfish growing areas most affected by fecal coliform pollution. The water quality improvements are due to better management of sewage systems, agricultural waste, boating waste, and stormwater runoff near shellfish areas. Many of the 38 areas had been targeted for long-term pollution control efforts carried out by property owners, local governments, tribes, state and federal agencies, volunteer groups, and shellfish farmers.

**Shellfish Bed Upgrade in Oakland Bay, Mason County** – Improvements to Shelton’s wastewater treatment plant, on-site sewage systems, and farm practices have led to the upgrade of 799 acres of shellfish beds in Oakland Bay in Mason County. This progress has allowed the state Department of Health to change the classification from “Conditionally Approved” to “Approved.” Oakland Bay is home to 19 commercial shellfish companies

and a popular public shellfish beach at Bayshore. Mason County created a Shellfish Protection District around Oakland Bay in 2007 because water quality had declined. This group led the work that resulted in noticeable improvement of marine water quality. The City of Shelton upgraded the Shelton Wastewater Treatment Plant and its sewage collection system to reduce impacts on shellfish harvesting areas. The Squaxin Island Tribe, shellfish growers, and hundreds of property owners joined the effort to improve water quality, and the successful collaboration led to this upgraded classification.

#### **Henderson Inlet Commercial Shellfish Area Gains 100 more Acres**

– The Department of Health recently upgraded 100 acres of commercial shellfish beds in Henderson Inlet because of improving water quality. This adds to the 240 acres in that area that were upgraded in 2010. Thurston County, the city of Lacey, shellfish growers, and thousands of property owners came together to make a difference. Thurston County created a watershed protection area in Henderson Inlet to improve septic operation and maintenance with a goal of reducing human sources of bacteria. The Henderson Inlet Shellfish Protection District, which the county formed in 2001, contacted area residents to educate them about how livestock and pets can cause water quality problems.

### *Conservation Commission and Conservation Districts*

#### **District Caucus Action Agenda**

– In 2009, the State Conservation Commission assisted the 12 Puget Sound conservation districts in the development of the District Caucus Action Agenda. This document reflected the districts implementation of their elements of the broader Puget Sound 2020 Action Agenda. The conservation districts first used data developed at the Puget Sound Partnership Science Panel and Action Areas where resource threats were identified in each of their conservation district areas. The districts then linked their annual plan of work to these resource threats. The result was a document, the District Action Agenda, describing the work of the conservation districts across the Sound and linking that work to threats and activities in the Puget Sound Partnership Action Agenda. This approach allowed the Commission and districts to ensure their work supported the work of the Partnership and supported the broader goals of Puget Sound.

Funding and Technical Assistance Leveraging – During the period 2009- 2011 (state fiscal years), the Conservation Commission provided funding and technical assistance to the 12 Puget Sound conservation districts that in turn used and leveraged those funds to:

- Assist 10,350 landowners;
- Improve or enhance 17,022 miles of stream;
- Apply practices to 7,509 acres of land;
- Install 1,191 practices to address resource concerns;
- Contact 2,451 landowners resulting in new actions.

### *Puget Sound Partnership*

**Levee Vegetation:** public safety, economic security and salmon recovery. Puget Sound levee owners were faced with a Catch-22: in order to receive US Army Corps funding, they were required to remove trees from riverside levees to meet flood protection standards; however, by removing trees, they would raise stream temperature, reduce cover, and potentially violate the Endangered Species Act by impacting Chinook salmon. PSP worked with regional leaders and the Corp to develop a policy that would be mutually beneficial by supporting safe levees, improving habitat and addressing system-wide needs in a cost effective and timely manner.

In July 2012, PSP executed an historic agreement with the Corps, NMFS, and USFWS to advance the regional framework approach necessary for durable policy and program solutions. PSP continues to work with levee owners to participate in the program and to obtain funding to proceed forward.

**Port Susan** – Construction of a levee setback at the Nature Conservancy’s Port Susan Preserve will remove 7,350 feet of existing dike and create 5,000 feet of new dike to protect and enhance neighboring farmland. This project is near completion and will restore process to 150 acres of tidal marsh in the Stillaguamish River estuary while improving tidal flushing in thousands of

acres of Port Susan Bay. The Nature Conservancy is managing this project. Funding for protection and restoration is from the Puget Sound Acquisition and Restoration, Estuarine & Salmon Restoration Program, Salmon Recovery Funding Board, and at the federal level, NOAA and U.S. Fish and Wildlife.

### *Recreation and Conservation Office*

The Recreation and Conservation Office supports Puget Sound health by managing grants for conservation, restoration, planning, and administration. In 2011-2012, the Recreation and Conservation Office distributed over \$72.7 million in funds to recover Puget Sound.

**D. vexillum Eradication at Dockton Park** – In 2007, Washington Department of Fish and Wildlife biologists discovered a thriving infestation of the invasive colonial tunicate (*Didemnumvexillum*) at Dockton Park in central Puget Sound. For three years, colonies were removed. Annual removals of *D. vexillum* at this location have proved sufficient to prevent any further large-scale outbreaks and the logistics of the follow-up removals are easily manageable and conducted at low cost.

### *State Parks*

**Kukutali Preserve Purchase** – State Parks, in partnership with the Swinomish Indian Tribal Community, has protected unique habitat through the purchase of Kukutali Preserve on Kiket, Flagstaff, and Fidalgo islands. Kukutali Preserve includes 84 upland acres on Kiket and Flagstaff islands and about nine upland acres on Fidalgo Island. The Preserve has more than two miles of nearly intact shoreline, with native eelgrass beds and diverse populations of fish and shellfish. Kukutali Preserve is home to numerous endangered or threatened species and has a broad spectrum of habitats, including mixed deciduous and conifer forests, with significant old-growth trees. Flagstaff Island supports a rare type of environment called a “rocky bald,” which has a fragile, thin soil that hosts a unique community of native plants not found elsewhere.

Lagoon at Kukutali Preserve on Kiket Island

**Fish Passage Corrections** – Washington State Department of Transportation and the Washington Department of Fish and Wildlife have worked cooperatively on a program since 1991 to inventory and correct fish barriers on our highway system. Removal of these barriers increases access to critical spawning and rearing habitat. As of June 30, 2012, WSDOT had completed 168 fish passage correction projects in Puget Sound, improving access to about 422 miles of potential upstream habitat. WSDOT and WDFW are continuing to prioritize the 785 remaining barriers identified in Puget Sound based on potential habitat gain for the greatest number of “at-risk” species, as well as potential return on investment. Barrier corrections are either funded as “stand-alone” corrections, or are combined with large highway projects.

**Stand-alone Stormwater Retrofits** – WSDOT also makes significant investments in stand-alone stormwater retrofits in the Puget Sound Basin. Not including pavement, which is retrofitted routinely as part of projects, WSDOT invested \$2.6 million in three stand-alone stormwater retrofit projects between state fiscal years 2009 and 2012.

## **E. RECOMMENDATIONS REGARDING FUTURE ALIGNMENT OF PRIORITIES AND FUNDING**

Washington State has a long and successful tradition of protecting its natural resources while using a bottoms-up approach to selecting and implementing priorities. There are significant numbers of collaborative efforts around Puget Sound with numerous coalitions of interest groups within every watershed. Coalition members may differ in their individual missions, but have learned that when they work to identify common goals, they can achieve results that are mutually beneficial. Our partners have done the difficult work of building the foundation of cooperation that is critical to success. Yet, funding programs and policies have not evolved to meet the demands of multi-interest ecosystem conservation.

RCW 90.71.370(3) requires that the State of the Sound include recommendations on how future state expenditures for all entities, including the Partnership, could better match the priorities of the Action agenda. The following recommendations are put forward to effectively fund and promote the significant regional priorities that must be achieved for the restoration and protection of Puget Sound.

### 1. Focus on Strategic Initiatives

As noted above, the Puget Sound Partnership has achieved consensus on three Strategic Initiatives that are intended to guide our region’s highest priorities for 2012-2013. We should focus our time and resources to provide adequate multi-year funding for these priorities.

Our funding strategy should address the capacity of all partners, including tribal, federal, state and local governments, nonprofits, businesses, private landowners, and other community members. Our implementation strategies should account for differences in the needs and context of each of the watersheds where programs and policies are implemented. Finally, we must monitor, establish and track measureable results, and apply the lessons learned to subsequent efforts so that we may be effective and efficient in what we select to implement and how we use our funding to achieve desired outcomes.

## 2. Promote outcomes and remove stovepipes

At all levels of government, programs have encountered obstacles to successful project implementation because of the restrictions built into funding sources and policies that limit the use of funds to very specific purposes- purposes, which may not meet the complex demands of restoration at the Puget Sound scale. We also encounter policies that do not foster collaboration nor accommodate blending funding sources to meet collective goals. Accordingly, a project that may only partially meet the criteria for a grant either cannot be funded or must be modified to better meet the purpose of the grant rather than the purpose of the project. The grantor does not have flexibility to modify the criteria even if the proposed project meets a critical purpose that is recognized by the agency or multiple purposes unless the entire project conforms to the criteria.

At a recent Leadership Council workshop, representatives of a number of the Local Integrating Organizations (LIOs) emphasized the need for funding that spanned jurisdictional boundaries to accomplish work that would have ecosystem-wide benefits. Other examples included restrictions on the use of infrastructure funds for projects that might have multiple benefits because bond and fee program criteria do not allow them to pay for the portion of the work that might have ecosystem benefits. An example at the federal level are Farm Bill programs that are tailored to individual landowner activities and are unable to fund landscape-level planning and ecosystem monitoring that would could achieve results for water quality or species conservation as well as agricultural production goals.

To address these problems, we recommend policy changes to funding programs, streamlining application and permitting processes and pooling of multi-agency funding sources to focus on accomplishing objectives. At the federal level, we recommend that the Council on Environmental Quality and the Office of Management and Budget review and amend existing laws and procedures to allow agencies to pool funds and allow multi-year budgeting that is flexible and focused on meeting outcomes.

## 3. Transform collaborative funding models to increase the pace of recovery.

As mentioned earlier, the region has been successful in employing a collaborative model to fund and implement projects. These efforts have proceeded through the initial stages of a project – e.g. developed a scope of work, complete project design, and have linked together numerous matching grant programs for implementation. Yet, they find themselves unable to proceed to the next phase either because they are competing for funds with a number of smaller initial projects, or because regional funding is limited to small grants. Restrictions on what will considered for matching as well as the limitations of some of the smaller entities to provide matching dollars has impeded our ability to move forward with larger scale projects.

The Salmon Recovery Council has taken one of the first steps in addressing this issue by modifying the formula for project funding allocation to prioritize some of the larger scale projects that have regional benefit.

We recommend that public funding agencies and the private philanthropic sectors support a catalyst funding approach for completing the high

priority large scale projects that have been developed through collaborative partnerships. We request that funders use the multi-interest goals and past performance of partners as evidence of the effectiveness of the collaborative proposal as opposed to how many small grants the proposers can cobble together. We also recommend that funders examine their matching requirements to accommodate the realities of some of the partners with limited budgets but who will be contributing to project success.

#### 4. Identify and fund and reform incentive programs

The 2012 Action Agenda contains a number of incentive programs proposed as Near Term Actions, including waste disposal for boat owners, property setbacks, best management practices, and low impact development. Within our region, we have emphasized the importance of incentive programs in enabling and motivating business owners and individuals in our communities to modify their practices or incur expenses that they are not required to incur in order to benefit the ecosystem. [We need to identify what it will take to fully fund these incentive programs in order to ensure that they produce the results we are seeking. We also need to work with the communities that these programs seek to attract to determine what incentives are attractive to them rather than only creating incentives programs that meet an existing regulatory framework.]

In establishing the Partnership, the Legislature emphasized the importance of the public in the ecosystem recovery effort. Public support for the changes necessary to achieve recovery are critical to success on many levels. This includes providing feedback on the content and pace of the effort.

# PUBLIC VIEWS ON RECOVERY

*ALIGNING PROGRAMS WITH PRIORITIES*

LEADERSHIP COUNCIL DRAFT

RCW 90.71.370(3) requires the Partnership to report on actions taken by implementing entities that are not consistent with the Action Agenda and to describe steps taken to remedy the inconsistency. The Statute also requires that the Partnership provide a review of citizen concerns and the disposition of those concerns.

Chapter 5 includes:

- Overview of regional efforts to engage the public in ecosystem recovery
- Summary of an analysis by the Partnership in 2011 of implementing inconsistencies
- Discussion of ongoing efforts to review funding decisions for consistency with the Action Agenda
- Synthesis of comments received by the public in 2011-2012 through the 2012 Action Agenda update process

## **PUBLIC ENGAGEMENT IN PUGET SOUND RECOVERY**

The statutory foundation for the Puget Sound Partnership, RCW 90.71, contains multiple references to the need for public involvement, engagement, education, awareness, and participation in Puget Sound protection and recovery:

- "... public involvement will be integral to the success of efforts to restore and protect Puget Sound." RCW 90.71.200.1d
- "... educate and engage the public ..." RCW 90.71.200.1d
- "Promote extensive public awareness, education, and participation in Puget Sound protection and recovery" RCW 90.71.230.1g
- "Engaging and educating the public regarding Puget Sound's health, including efforts and opportunities to restore Puget Sound ecosystems" RCW 90.71.240.5b
- "... conducting public education activities regarding threats to Puget Sound and about local implementation strategies to support the action agenda" RCW 90.71.250.5d

The Leadership Council, Ecosystem Coordination Board, Science Panel, elected officials, and numerous local and regional planning bodies frequently emphasize the importance of public engagement in the recovery effort. Many Action Agenda sub-strategies and near-term actions relate to engagement of, or with, Puget Sound's 4.5 million residents.

Though public involvement is broadly recognized as important to Puget Sound recovery, clear and effective strategies to achieve productive engagement are not generally discussed nor understood. Four major barriers compound this:

- 1) a blended and confused understanding of education, communication, and outreach, their differences, limitations and how they are applied;
- 2) limited understanding or knowledge of what effective strategies look like and the skill to apply them;
- 3) the broadly-held misperception that “if people only knew the Sound was unhealthy, they would take action.” Unfortunately, awareness alone is not an effective tool to achieve public support and/or behavior change; and
- 4) limited experience with a regional-scale, shared strategy designed to reach 4.5 million people.

### ***PROGRAM DEVELOPMENT***

As the Partnership began implementing the first Action Agenda in 2009, a regional dialog emerged - reflecting a collective desire to use the Partnership’s formation as an opportunity to frame a better, more strategic approach. These discussions included environmental education and communication specialists, agency and non-profit partners, a cross-board work group (with representatives of the Leadership Council, Ecosystem Coordination Board and Science Panel), the STORM coalition (Stormwater Outreach for Regional Municipalities) and others.

These discussions narrowed in on the following questions:

**WHY:** Why do we need public engagement? What outcomes do we need and expect from this engagement?

**Answer:** 1) to reduce cumulative impacts from citizen actions (pollution, habitat degradation) and 2) to build support for policy change and public investment in the recovery effort.

**WHAT:** What strategies do we focus on, and what tactics do we use to achieve them?

**Answer:** Focus on awareness-building and supporting actions and behavior change initiatives. Focus on behaviors which are (1) citizen-scale and relatively widespread, 2) directly contributing to Puget Sound pressures, and 3) possible to address via a stewardship approach.

**HOW:** How do we implement awareness-building and behavior change most effectively across the Puget Sound region? How do we build an effective regional/local implementation structure?

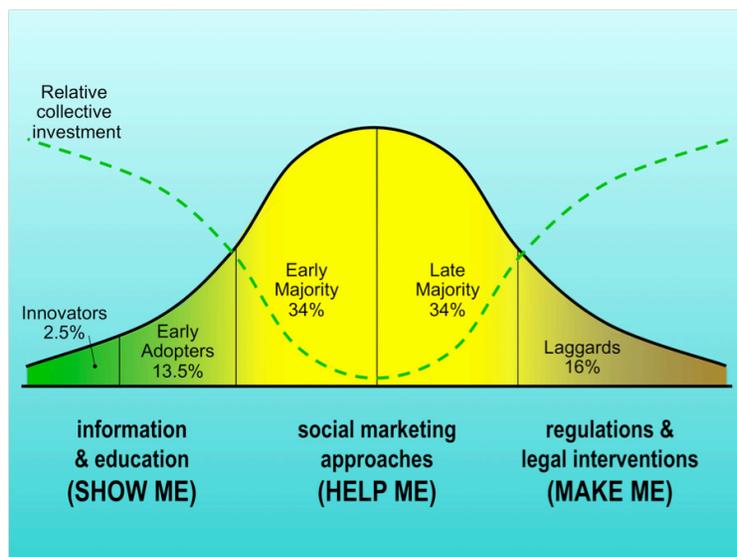
**Answer:** Work at two scales, regional and local. Ensure that the strategies used are effective and strategic for the scale they are addressing. Integrate the two scales within a cohesive strategy.

## PROGRAM FRAMEWORK

A program framework emerged from the regional dialog, based on the collective expertise of the developing coalition as well as a body of social science that includes behavioral economics.

One element is shown in Figure 1 – a model of how innovations (such as best practices for water quality and habitat) spread across society.

In natural resource fields, historic investments have tended to be at both ends of the curve (information and education, and regulatory approaches), but not in the middle (directly motivating or supporting targeted actions - best described as a social marketing approach). It is only in the past ten years that social marketing has even entered the natural resource management vocabulary; by comparison, it has been employed in the health field for disease and injury prevention since the 1970's.



**Figure 1.** Conceptual model of public adoption of best practices, and associated approaches to stimulate adoption. The green dashed line shows relative historic levels of investment in each approach. Based on Everett Rogers, *Diffusion of Innovations*; Michael L. Rothschild, *Carrots, Sticks, and Promises: A Conceptual Framework for the Management of Public Health and Social Issue Behaviors*.

## FUNDING AWARDED

In 2010, the Environmental Protection Agency (EPA) decided to create “Lead Organizations” to manage federal funding it administered for Puget Sound - consolidating programmatic leadership and sub-awards relative to specific topical areas of the Action Agenda. The Partnership applied for and received funding to serve as the Lead Organization for a regional stewardship program, incorporating the awareness-building and behavior change elements of the Action Agenda. Six million dollars in grant funding was awarded over five years, with a 1:1 match.

## PSP'S REGIONAL STEWARDSHIP PROGRAM

With the program model developed and a five-year commitment of funding secured, the Partnership began actively implementing the regional Stewardship Program in 2010. As described above, the program was strategically focused to increase regional efforts around behavior change – the gap illustrated by bell curve in Figure 1 - not only because it had been a historically under-served component of public engagement, but also because this is where the majority of Puget Sound’s residents exist relative to “Sound-friendly” actions.

To achieve this, the regional program organized around three integrated areas of investment: 1) Awareness-Building – to reach and engage the region’s 4.5 million residents; 2) Behavior Change – targeting specific citizen behaviors that impact the health of Puget Sound, and 3) Implementing Network Support – to increase capacity, effectiveness and efficiencies among partners to conduct the needed work. Elements within each of the three areas were then allocated between regional and local implementation. The Partnership and other regional providers conduct centralized/regional work (research, evaluation, regional campaign). Local Partners conduct the local and direct-delivery elements of the work (local awareness building, stewardship programs/initiatives).

## *PROGRESS AND EXPECTED OUTCOMES*

Since 2010, the program made progress in these three areas:

### **Awareness-Building: regional, local and K-12**

- Implemented the regional Puget Sound Starts Here campaign through a coalition of more than 850 public, nonprofit, and private organizations
- Grants to local groups to customize the regional campaign, connect to local issues and economic drivers
- Grants to local organizations for targeted awareness programs focused on Action Agenda priorities such as pollution prevention and shoreline habitat.
- Introduced a Puget Sound K-12 curriculum model into 30 percent of Puget Sound school districts, through grants to the Pacific Education Institute.

### **Behavior Change: strategies, program funding and measuring progress**

- Grants to local groups for targeted programs to reduce pollution-causing and/or habitat degradation activities behaviors.
- Grants for expanding regional behavior change initiatives that build upon proven local models. Programs targeted for expansion emphasize the Action Agenda's strategic initiatives.
- Grants to develop new regional behavior change initiatives where no proven model currently exists. These also are consistent with the Action Agenda's strategic initiatives.
- Established the Sound Behavior Index to measure regional progress in environmental behaviors.
- Conducted market research to inform local stormwater and habitat programs. Compiled a library of market research from public and private sources for partners to draw upon for their respective programs.

### **Support Implementer Network: coordination, training and resources**

- Developed a regional Education, Communication and Outreach Network (ECO Net) of more than 470 organizations who now coordinate, develop collaborative programs, and share resources – in support of the Action Agenda as well as their respective individual programs.
- Provided resources and training to strengthen these groups and increase the effectiveness of their individual and collective programs. Topics have included evaluation, social marketing, social media, strategic planning, program design and more.
- Activated an advisory group of social scientists to provide guidance and increase sophistication within the field of practice.

### **Targets for the first five years (through June 2015) of the program include:**

- Puget Sound Starts Here brand awareness increased from 26 percent to 50 percent among Puget Sound residents, with improved understanding of best practices for stormwater and habitat
- Eight regional stewardship initiatives completed
- 50 percent of Puget Sound school districts using a Puget Sound place-based curriculum model
- Over 470 organizations actively collaborating in ECO Net, and engaged in Action Agenda implementation

- Upward trend-line on Sound Behavior Index
- Measures of how the public values Puget Sound continue to exceed 60%
- Majority of partner organizations have changed to evidence-based methods for program delivery
- Majority of partner organizations are addressing specific behaviors that impact the health of Puget Sound
- Public messages related to best practices are consistent across the region and are based on appropriate research
- Up to 24 new local program models addressing stormwater, shorelines, salmon, shellfish, and habitat have been developed and can be replicated in other localities

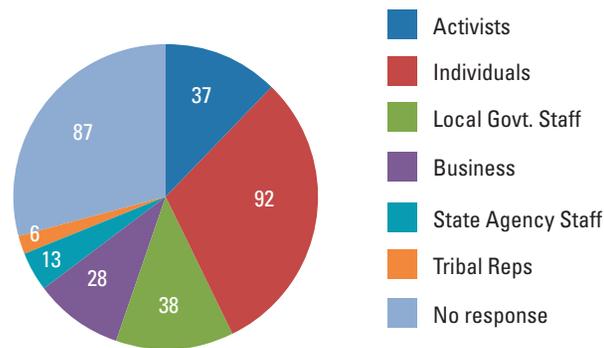
## INCONSISTENCY ANALYSIS

In October 2011, as part of the 2012 Action Agenda update, the Partnership and a consultant developed a survey questionnaire on inconsistent actions in the Puget Sound, versus the expectations set forth in the 2008/09 Action Agenda per RCW 90.71.350(2). “Inconsistency” was defined as an action that is contrary to the letter or spirit of an element of the 2008/2009 Action Agenda or will hinder or is incompatible with the achievement of a goal, objective, or strategic priority (RCW 90.71.300). The questionnaire was focused on programmatic or policy issues.

A total of 301 people responded to the survey respondents included the community in general, activists, business, government staff, and tribal representatives. They broadly represented the regions of Puget Sound.

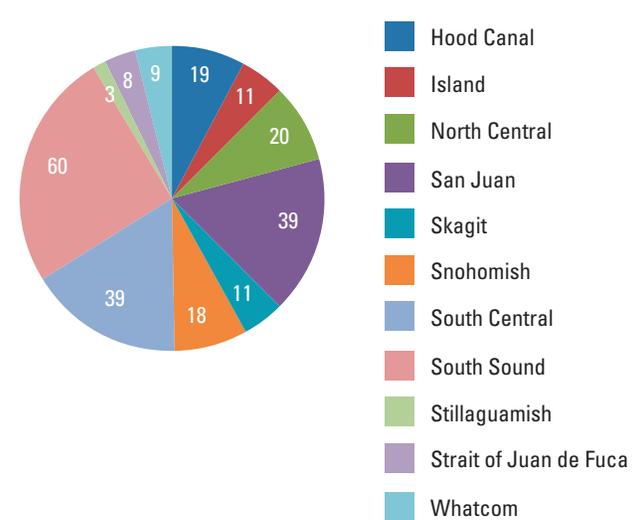
Respondents were offered two ways to identify inconsistencies: through a multiple-choice list of questions and from a written response. Of the 301 people surveyed, 210 responded that they had an inconsistency to report; of those, 90 chose to provide both multiple choice and written responses, while an additional 109 responded only through multiple-choice questions.

**Survey Respondents by Type**



**Figure 1.** Survey respondents by type (n=301)

**Survey Respondents by Action Area**



**Figure 2.** Survey respondents by Action Area (n=237)

**Sample Written Response Comments from Survey**

Please describe the inconsistency	Please provide details about what you think is the cause of this inconsistency	Please identify ideas you have to remedy or otherwise address this inconsistency
5. Bulkhead exemption for homes in Shoreline Management Act. HPA permits are generally ignored	5. SMA exemption for Single Family Home bulkheads and shoreline armoring. HPA is required but mostly ignored and WDFW does not enforce. Poor local development regulations in Shoreline Master Plans. Corps of Engineers permit is structure is below high watermark and most homeowners are unaware of permit and largely ignored.	5. Amend the SMA, WDFW enforce HPA, Corps enforce permits
33. You Identify retaining working farms as a goal, yet also identify assisting counties with revisions to CAO's that will stop development in floodplains and assisting communities with relocating out of flood plains. IF WE CANNOT CONTINUE TO BUILD AND GROW AND UPDATE OUR FARMS, INCLUDING ADDING BUILDINGS AND INFRASTRUCTURE THEN HOW DO YOU EXPECT FARMERS TO STAY HERE?	33. Failure to understand that farms need to build, rebuild and adapt as different crops, processing needs become available... Failure to recognize that commercial farms are complex... and they stay in farming for numerous reasons... but the conflict I see is that if you "protect" the farm land but then pile regulations on the family they will just sell out and move anyway. Yes this is a balance... but farms are in flood plains, its [sic] where the dirt is...it's also a preferred [sic] land use versus stripmalls. we plead for the ability to build and maintain healthy farms, farm infrastructure and an understanding that saving farms is not as simple as a few PDR's and expanding a local farmers market.	33. FEMA, County CAO's and building and Development Reg's must allow farmers to farm build and maintain the infrastructure we need for healthy businesses -from small farms to large farms.

**Examples of Ways that Inconsistencies are addressed in the 2012 Action Agenda**

Near Term Action B.2.3. 1 Homeowner Incentives for Landward Setbacks, promotes the use of incentives to remove hard shoreline armoring and encourage setting homes further back from the shoreline.

Near Term Action A.1.2.1. Land Use Planning Barriers, BMPs [Best Management Practices], and Example Policies, will identify barriers to implementing the Action Agenda in local land use decisions and determine how to overcome those barriers.

Near Term Action C.1.4.3 Conduct Local Source Control Business Assistance Visits, provides on-site visits to help small businesses reduce stormwater pollution and hazardous waste pollution from their work.

This survey was administered during the development of the 2012 Action Agenda. Partnership staff used the information to clarify sub-strategies and actions related to many of the concerns raised including enforcement of environmental regulations, development in the shoreline, growth management, and flood plain issues. (See sidebar)

Now that the Action Agenda update is complete, the Partnership will continue to involve the public and implementing entities in developing and refining standards and processes to identify and address actions that are inconsistent with the Action Agenda and Puget Sound recovery.

In addition, in 2011, the Ecosystem Coordination Board (ECB) formed a Regulatory Subcommittee to consider potential actions to improve compliance with, and enforcement of, existing laws. The Subcommittee is also evaluating strategies to improve environmental regulations where needed. The committee is evaluating several different tools or approaches including education, technical assistance, incentives, monitoring, enforcement, and funding. Their work is focused on regulations and tools directly related to the strategic initiatives. The committee will consider information collected through the inconsistencies process to inform their work.

## Top 20 Inconsistent Actions vs. 2008 Action Agenda Intentions

Written Responses (90)	Multiple Choice Responses (199)
<ul style="list-style-type: none"> <li>• Enforcement (or lack thereof) on the part of PSP and other state agencies               <ul style="list-style-type: none"> <li>* Shoreline alteration - negative effects of armoring, bulkheading</li> </ul> </li> <li>• Several comments were critical of the US Army Corps of Engineer’s levee maintenance requirements that prohibit tree planting on levees</li> <li>• PSP’s role in the protection and restoration of Puget Sound (included a variety of criticisms)</li> <li>• Lack of action / too much process</li> <li>• Conflicting policies; need for federal consistency               <ul style="list-style-type: none"> <li>* FEMA flood insurance;</li> <li>* ‘no net rise’ policy;</li> <li>* farmland preservation vs. riparian habitat protection;</li> <li>* levee maintenance vs. riparian habitat protection</li> </ul> </li> <li>• Science — best available science not necessarily being used</li> <li>• Need for better stormwater management</li> <li>• Need to restore instream flows</li> <li>• Outreach—needs improvement; too much</li> <li>• NMFS Biological Opinion about FEMA flood insurance program</li> </ul>	<ul style="list-style-type: none"> <li>• The majority of respondents identified “land development/ land use” and “organization/infrastructure” as the topics most related to the inconsistency, and the geographic scope of the inconsistencies identified was predominantly statewide or Sound-wide.</li> <li>• Other responses for the topic most related to the inconsistency included “lack of enforcement of existing programs/regulations”, “inconsistent approving and/or permitting projects”, and “not a high enough priority/other competing priorities”.</li> <li>• Local inconsistencies were distributed fairly evenly across Puget Sound Action Areas/Counties.</li> <li>• When asked about the cause of the inconsistency, “conflicting directions between goals, plans, and programs”, and “political will/lack of other options to resolve problems and conflicts” were the most numerous responses.</li> <li>• The majority of respondents indicated that their responses would not be different based on the emerging content of the 2011 Action Agenda update.</li> </ul>

**Cause of Inconsistency**



**Figure 3.** Cause of inconsistency (n=199)

Lastly, the Partnership is working with members of the ECB to develop sets of interim targets for each of the Vital Signs that were reviewed in Chapter 1. These interim targets include desired outcomes for each of the two-year increments between 2012 and 2020. The interim targets are intended to both guide the performance review that will be conducted for each of the subsequent State of the Sound reports, as well as inform regional implementers regarding what inconsistencies in programs and actions remain that must be addressed for the region to reach its 2020 targets. The interim targets are slated for adoption by the Leadership Council in 2012.

## Review of Programs for Consistency with the Action Agenda

Several mechanisms are in place to ensure that major programs funded within the region are consistent with the Action Agenda. As described in Chapter 4, EPA provides grants to Lead Organizations in the region that are directed to implementation of key programs and projects to address threats to Puget Sound health. EPA requires that proposals funded by the Lead Organizations be reviewed for consistency with specific sections of the Action Agenda—either how the proposal links to sub-strategies in the Action Agenda or to a specific near term action.

The Partnership also provides review of grant applications in the region for consistency. For example, RCO routinely submits potential grant decision packages pertaining to Washington Wildlife and Recreation Program (WWRP) and Aquatic Land Enhancement Account (ALEA) funds to the Partnership for review. Similarly, EPA asks the Partnership to review projects for consistency that are funded by the tribal lead organization, Northwest Indian Fisheries Commission.

Last, as part of the 2013-15 Biennial Budget Instructions, the Office of Financial Management required state agencies to specify whether a proposed request implements any portion of the Action Agenda. The instructions also required agencies to provide estimates of their costs to implement Near Term Actions for the 2013-2015 biennium. This information was summarized in Chapter 4, with details provided in the Appendix XX.

## Comments on the Action Agenda

The draft 2012 Action Agenda was available for public comment from December 10, 2011 to February 3, 2012. A total of 90 comment letters were received. In addition, over 1,000 postcards and emails were submitted. The letters ranged in length from one to 27 pages.

In addition to general comments on the scope and direction of the Action Agenda, the Partnership received numerous, detailed comments on the specific language of various strategies, sub-strategies and near term actions. As part of responding to these comments, the Partnership conducted conversations with many of the commenters individually and in groups. All entities that would potentially be responsible for implementation of an action were included in discussion about revisions to near term actions. The Leadership Council was provided a spreadsheet that summarized each of the specific comments as part of its consideration in the adoption of the 2012 Action Agenda.

The comment themes and responses included:

1. The Action Agenda is too long and lacks a strategic focus.

In response to these comments, staff created a highlights of the Action Agenda component that could stand alone from the longer version of the Action Agenda and still include all of the key information. In addition, the final Action Agenda included more specific details on the content of the three strategic initiatives that had been proposed in the draft, including how the region would approach obtaining funding for these measures.

2. The Action Agenda does not create clear links between strategies.

The Partnership addressed these concerns through target views in the Action Agenda that identify the key strategies and actions that will contribute towards recovery, through the development of strategic initiatives and through the prioritization process.

3. The Action Agenda does not establish a clear path towards 2020 recovery targets.

As discussed above, the Action Agenda includes target views that outline action strategies, sub-strategies, and expected intermediate results on the path to achieving the 2020 targets. The specific Near Term Actions are all associated with the strategies and sub-strategies and are to be implemented in a two-year timeframe. In addition, the Partnership is working with regional partners to develop sets of interim targets that will chart the path to 2020 with more precision.

4. The prioritization process is critical and the proposed approach is flawed.

There were a range of views on the prioritization process. In response, the Partnership Science Director worked with the ECB to revise the approach and then engaged the Science Panel to develop a scoring system that reflected the input received. The rank order of sub-strategies is expressed on ecological impact. Future efforts will include other information such as human well being and economics.

5. Ongoing programs are not effectively captured or integrated or prioritized with near-term actions.

The Action Agenda represents important progress in distinguishing ongoing programs from near term actions with a focus on state agencies. Ongoing programs are described under sub-strategies, which have been ranked by the Science Panel based on ecological criteria. The Partnership received subsequent information from federal agencies on their detailed work programs related to habitat and these were included as an appendix to the Action Agenda.

6. There needs to be more emphasis on Tribal treaty rights.

There were substantial improvements from the draft to the final in relation to Tribal treaty rights. Tribal partners provided information to the Partnership and to the Leadership Council as part of their input on the strategic initiatives, with a focus on habitat restoration and protection. Tribal habitat priorities are detailed in Book 1 of the Action Agenda. The federal response to "Treaty Rights at Risk" is included in the Appendix.

7. Local area information and local integrating organizations (LIOs) should be better represented, including local funding challenges.

The Partnership worked with Local integrating organizations to refine their profiles. Local Near Term Actions were integrated into the Action Agenda under the appropriate sub-strategy to ensure that these actions received equal consideration in performance tracking, cost estimation and budgeting. The Leadership Council will include additional Near Term Actions that might be proposed by LIOs for inclusion in amendments to the Action Agenda through the Report Card process. In addition, there is an ECB subcommittee that will be quantifying local need and identifying potential funding sources.

8. Federal actions should be better represented.

Federal agencies provided a detailed spreadsheet of ongoing federal actions and new actions related to habitat, which were included as an appendix in the Action Agenda. A new Near Term Action was also added to address implementation: A 6.2 NTA 1 “Implement the Puget Sound Federal Agency Action Plan.”

9. Near Term Actions are either too ambitious or not ambitious enough and are underfunded.

There was a range of views on this subject. A number of near term actions were refined after release of the draft to reduce the number of actions that were process or study oriented. This included the development of the Strategic Initiatives. Chapter 4 provides greater detail on the fiscal issues related to funding the 2012 Action Agenda.

10. There needs to be more focus on the economic health as part of recovery.

The Partnership agreed with commenters that improving economic health is part of protecting and recovering Puget Sound and agrees with data that demonstrates that Puget Sound is an economic driver in the region. Development of the Quality of Life Index, and economic targets related to the index, will further advance this work. There are also a number of Near Term Actions that focus on the development of fiscal incentives that are intended to address economic concerns of stakeholders in the region who are being challenged to contribute to the recovery effort.

11. There needs to be more attention on climate change.

The final Action Agenda incorporated many more climate change considerations than the draft. In addition, a consultant to the Partnership conducted a consistency review of the action agenda. This work is discussed in Chapter 1 of the State of the Sound (pp.xx-xx). The Action Agenda acknowledges that climate change will continue to be a key element of any future adaptive management considerations in the region as well as in the development of future near term actions.

# APPENDICES

LEADERSHIP COUNCIL DRAFT



## Appendix XX

Near-Term ID	Near-Term Action	Lead Implementer	Final status	Final exception report	Disposition in 2012 Action Agenda	Associated 2012 NTAs/substrategies
A.2.N5	Provide funding and technical assistance to local jurisdictions to update local shoreline management programs by current deadlines, with all updates complete by 2013.	Local Government	Needs Attention	Lack of funding/staff, Progress slower than anticipated	Variation in 2012 Action Agenda	A.1.2.1 Land Use Planning Barriers, BMPs and Example Policies. By December 2012, Ecology and Commerce, working with local governments, will identify the primary barriers to incorporating policies consistent with implementation of the Action Agenda into local land use planning and decisions and identify best practices and assistance needed to overcome these barriers. This will address implementation of protection strategies, encouraging compact growth patterns, increased density, water quality standards, redevelopment, and rural lands protection. By December 2013, Ecology and Commerce will distribute example growth policies that include best practices that are consistent with protection and recovery targets and the Growth Management and Shoreline Management Acts.

Near-Term ID	Near-Term Action	Lead Implementer	Final status	Final exception report	Disposition in 2012 Action Agenda	Associated 2012 NTAs/substrategies
A.2.N7	Change Shoreline Management Act statutes and regulations to require a shoreline conditional use permit for: bulkheads and docks associated with all residential development; all new and replacement shoreline hardening; all seawall/bulkhead/revetment repair projects; and new docks and piers.	PSP	not launched	Competing Federal/state legislative priorities	Not in 2012 Action Agenda	
A.5.N1	Advocate for national or West Coast regional ballast water discharge standards.	Ecology	Needs Attention	Lack of funding/staff	Variation in 2012 Action Agenda	B.5.3.4 Ballast Water Treatment effectiveness. By June 2015, DFW will complete an assessment of and make recommendations to improve the effectiveness of open sea exchange and treatment in meeting state ballast water standards.
A.5.N2	Enhance state ballast water compliance program and support a federal/state and/or West Coast cooperative management approach.	WDFW	needs attention		Variation in 2012 Action Agenda	B.5.3.4 Ballast Water Treatment effectiveness. By June 2015, DFW will complete an assessment of and make recommendations to improve the effectiveness of open sea exchange and treatment in meeting state ballast water standards.

Near-Term ID	Near-Term Action	Lead Implementer	Final status	Final exception report	Disposition in 2012 Action Agenda	Associated 2012 NTAs/substrategies
B.2.N1	Fund a one-year demonstration program to develop a coordinated cleanup and restoration plan for the Port Angeles Harbor and waterfront and work plan for project completion.	Ports	Needs Attention		Continued in 2012 Action Agenda	Strait ERN lists Port Angeles Harbor Ecosystem Recovery as one of 19 strategic priorities.
C.1.N2	Assist the Department of Ecology in implementing its PBT program to reduce and eventually eliminate the use of all chemicals on the PBT list, and other programs to reduce toxins such as metals.	Ecology	Needs Attention	Lack of funding/staff	Variation in 2012 Action Agenda	C.1.1.6 Emerging Contaminants. Ecology and PSP will assemble information on chemicals of emerging concern, beyond the 17 chemicals of concern in the Puget Sound Toxics Loading Studies, including PBTs, endocrine disruptors, other chemicals, and nanotechnology and nanomaterials, and will recommend actions to (1) better understand the threats to Puget Sound and (2) address the highest priority problems.
C.1.N9	Implement priority strategies and actions to address low dissolved oxygen in South Sound, targeted areas of the Whidbey Basin, and other vulnerable areas. This includes the Ecology-led South Sound Dissolved Oxygen Study.	Ecology	Needs Attention	Progress slower than anticipated	Part of ongoing Puget Sound work	ongoing program under substrategy C9.1 Complete Total Maximum Daily Load (TMDL) studies and other necessary water cleanup plans for Puget Sound to set pollution discharge limits and determine response strategies to address water quality impairments.

# Appendix A

<b>APPENDIX A</b>					
<b>2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners</b>					
<b>NTA Funded Agency</b>	<b>NTA Number</b>	<b>Near-Term Action Title</b>	<b>2009 SoS Original Cost Estimates (annualized)</b>	<b>Non-State Match Cost Estimates (annualized)</b>	<b>Annual Estimated Expenditures</b>
PSP	A.1.N1	Convene a regional planning forum to create a coordinated vision for guiding growth at an ecosystem scale.	\$40,000	\$-	\$-
PSP	A.1.N2	Prepare a set of criteria to guide decisions for acquiring and protecting high-value, high-risk habitat.	\$40,000	\$-	\$594
DOE	A.1.N3	Initiate or complete Action Agenda-based watershed assessment and related maps for each of the watersheds within the Puget Sound basin to identify sites and functions that are the most urgent and important for protection.	\$700,000	\$-	\$526,667
PSP	A.1.N3	Initiate or complete Action Agenda-based watershed assessment and related maps for each of the watersheds within the Puget Sound basin to identify sites and functions that are the most urgent and important for protection.	\$650,000	\$-	\$2,673
DOC	A.1.N4	Support legislation that seeks to continue to direct growth away from rural and working resource lands and into cities.	\$321,250	\$-	\$93,333
DNR	A.2.N1	Protect high-value habitat and land at immediate risk of conversion as identified through existing processes such as the salmon recovery plans and others.	\$5,750,000	\$-	\$4,117,633
DOE	A.2.N1	Protect high-value habitat and land at immediate risk of conversion as identified through existing processes such as the salmon recovery plans and others.	\$2,990,000	\$-	\$7,545,914
Parks	A.2.N1	Protect high-value habitat and land at immediate risk of conversion as identified through existing processes such as the salmon recovery plans and others.	\$1,000,000	\$-	\$-
RCO	A.2.N1	Protect high-value habitat and land at immediate risk of conversion as identified through existing processes such as the salmon recovery plans and others.	\$17,601,046	\$15,566,385	\$17,516,978
WDFW	A.2.N1	Protect high-value habitat and land at immediate risk of conversion as identified through existing processes such as the salmon recovery plans and others.	\$531,500	\$-	\$988,167
WWC	A.2.N2	Advocate for proposed Wilderness designations: a) support Alpine Lakes Wilderness addition and b) Pratt River Wild and Scenic Designation	\$10,000	\$-	\$-
PSP	A.2.N3	Convene a task force to develop a funding mechanism to rapidly acquire properties with high ecological value and imminent risk of conversion.	\$40,000	\$-	\$-
PSP	A.2.N4	Work with the Marine Managed Protected Areas Work Group chaired by DFW to develop recommendations to improve the effectiveness of MPAs by December 2009.	\$5,131	\$-	\$3,421
WDFW	A.2.N4	Work with the Marine Managed Areas Work Group chaired by DFW to develop recommendations to improve the effectiveness of MPAs by December 2009.	\$52,500	\$-	\$20,000
DOE	A.2.N5	Provide funding and technical assistance to local jurisdictions to update local shoreline management programs by current deadlines, with all updates complete by 2013.	\$5,754,960	\$-	\$3,036,200
PSP	A.2.N5	Provide funding and technical assistance to local jurisdictions to update local shoreline management programs by current deadlines, with all updates complete by 2013.	\$7,926	\$-	\$7,925

**APPENDIX A****2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

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WDFW	A.2.N5	Provide funding and technical assistance to local jurisdictions to update local shoreline management programs by current deadlines, with all updates complete by 2013.	\$188,287	\$-	\$144,664
DOE	A.2.N6	Provide local governments with guidance on how to achieve and measure no-net-loss of ecological function as required by the Shoreline Management Act and the Shoreline Master Program guidelines.	\$175,000	\$-	\$-
PSP	A.2.N7	Change Shoreline Management Act statues and regulations to require a shoreline conditional use permit for: bulkheads and docks associated with all residential development; all new and replacement shoreline hardening; all seawall/bulkhead/revetment repair projects; and new docks and piers.	\$80,000	\$-	\$1,333
DOC	A.2.N8	Provide funding and technical assistance to local governments that have not yet completed their Critical Area Ordinance updates.	\$3,450,000	\$-	\$66,667
WDFW	A.2.N8	Provide funding and technical assistance to local governments that have not yet completed their Critical Area Ordinance updates.	\$68,204	\$-	\$54,222
DOC	A.2.N9	Support and implement recommendations from the CTED TDR Policy Advisory Committee.	\$400,000	\$-	\$345,789
PSP	A.2.N9	Support and implement recommendations from the CTED TDR Policy Advisory Committee.	\$32,887	\$-	\$-
DOE	A.3.N1	Set flow rules in watersheds that currently do not have instream flow rules, with priority given to critical basins or those with known significant problems meeting instream or out-of-stream demands.	\$177,790	\$-	\$201,065
WDFW	A.3.N1	Set flow rules in watersheds that currently do not have instream flow rules, with priority given to critical basins or those with known significant problems meeting instream or out-of-stream demands.	\$-	\$-	\$-
DOE	A.3.N2	Update instream flow rules based on current science.	\$864,000	\$-	\$-
WDFW	A.3.N2	Update instream flow rules based on current science.	\$-	\$-	\$-
DOE	A.3.N3	Develop and implement the comprehensive basin flow protection and enhancement programs called for in the recovery plans for Puget Sound Chinook and Hood Canal/Strait of Juan de Fuca summer chum.	\$160,000	\$-	\$37,416
DOE	A.3.N4	Implement the recommendations from approved watershed plans prepared under the Watershed Planning Act (RCW 90.82) consistent with the Action Agenda and coordinated with other local restoration and protection efforts.	\$18,274,303	\$-	\$1,359,535
DOE	A.3.N5	Evaluate and implement solutions to exempt well issues.	\$80,000	\$-	\$-
DOE	A.3.N6	Establish local water masters in each watershed to increase water code compliance and enforcement.	\$888,924	\$-	\$260,624
DOH	A.3.N7	Support municipal water systems' implementation of Washington Department of Health's Water Use Efficiency Rule, including establishing water conservation goals, metering, and reporting from all municipal suppliers.	\$81,964	\$-	\$-
DOH	A.3.N8	Develop a treated grey water reuse rule by December 31, 2010.	\$125,000	\$-	\$33,333
DOE	A.3.N9	Adopt water reuse rules.	\$448,570	\$-	\$299,047

**APPENDIX A**

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NTA Funded Agency	NTA Number	Near-Term Action Title	2009 SoS Original Cost Estimates (annualized)	Non-State Match Cost Estimates (annualized)	Annual Estimated Expenditures
DOC	A.4.N1	Purchase or transfer development rights or use conservation easements for working lands at immediate risk of conversion	\$12,500,000	\$-	\$-
WSCC	A.4.N2	Coordinate with the SSB 5248 project by the Ruckelshaus Center that is working to resolve conflicts between agricultural activities and critical areas regulations.	\$40,000	\$-	\$30,000
WSCC	A.4.N3	Support the Conservation Commission's efforts to protect productive agricultural areas consistent with the Action Agenda priorities.	\$850,000	\$-	\$1,749,187
DNR	A.4.N4	Continue to implement existing forest practice plans and regulations consistent with the Action Agenda, including the state trust lands HCP, state forest practices rules, and Road Maintenance and Abandonment Plans as informed by the Forest and Fish Plan, and others.	\$5,245,692	\$-	\$3,778,600
WDFW	A.4.N4	Continue to implement existing forest plans consistent with the Action Agenda: Forest Practices HCP and Forest and Fish Plan and others	\$550,000	\$-	\$550,000
DOE	A.4.N5	Continue ongoing work to resolve conflicts between aquaculture and upland uses.	\$2,026,900	\$-	\$-
PSP	A.4.N5	Continue ongoing work to resolve conflicts between aquaculture and upland uses.	\$22,833	\$-	\$22,833
WSG	A.4.N5	Continue ongoing work to resolve conflicts between aquaculture and upland uses.	\$189,728	\$-	\$207,544
DNR	A.4.N6	Implement components of the Washington Department of Natural Resources Aquatic HCP that protect critical habitat.	\$2,100,000	\$-	\$269,667
PSP	A.4.N6	Implement components of the Washington Department of Natural Resources Aquatic HCP that protect critical habitat.	\$32,887	\$-	\$-
DOE	A.5.N1	Advocate for national or West Coast regional ballast water discharge standards.	\$30,000	\$-	\$11,101
WDFW	A.5.N1	Advocate for national or West Coast regional ballast water discharge standards.	\$30,000	\$-	\$4,500
PSP	A.5.N2	Enhance state ballast water compliance program and support a federal/state and/or West Coast cooperative management approach.	\$13,450	\$-	\$8,967
WDFW	A.5.N2	Enhance state ballast water compliance program and support a federal/state and/or West Coast cooperative management approach.	\$269,200	\$-	\$225,000
RCO	A.5.N3	Develop a Puget Sound baseline and database of invasive species to guide control efforts.	\$347,000	\$-	\$86,803
WSG	A.5.N3	Develop a Puget Sound baseline and database of invasive species to guide control efforts.	\$20,000	\$-	\$33,449
WDFW	A.5.N3	Develop a Puget Sound baseline and database of invasive species to guide control efforts.	\$5,500	\$-	\$5,500
PSP	A.5.N4	Enhance and target existing capacity to rapidly respond to immediate invasive species risks.	\$600,000	\$-	\$152,000
WDFW	A.5.N4	Enhance and target existing capacity to rapidly respond to immediate invasive species risks.	\$-	\$-	\$-
WSDA	A.5.N4	Enhance and target existing capacity to rapidly respond to immediate invasive species risks.	\$350,000	\$-	\$350,000

**APPENDIX A****2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

NTA Funded Agency	NTA Number	Near-Term Action Title	2009 SoS Original Cost Estimates (annualized)	Non-State Match Cost Estimates (annualized)	Annual Estimated Expenditures
		Average Annual Estimates for Strategy A (rounded):	\$86,212,000	\$15,566,000	\$44,148,000
DNR	B.1.N1	Implement restoration projects in the salmon recovery three-year work plans and the Estuary and Salmon Restoration Program of the Nearshore Partnership.	\$100,000	\$-	\$57,000
PSP	B.1.N1	Implement restoration projects in the salmon recovery three-year work plans and the Estuary and Salmon Restoration Program of the Nearshore Partnership.	\$34,555,000	\$-	\$224,605
RCO	B.1.N1	Implement restoration projects in the salmon recovery three-year work plans and the Estuary and Salmon Restoration Program of the Nearshore Partnership.	\$3,691,129	\$1,734,251	\$13,418,739
WDFW	B.1.N1	Implement restoration projects in the salmon recovery three-year work plans and the Estuary and Salmon Restoration Program of the Nearshore Partnership.	\$207,500	\$-	\$-
PSP	B.1.N2	Complete large-scale restoration projects at the mouths of major river systems in Puget Sound where there is a high likelihood of re-creating ecosystem function.	\$8,350,000	\$-	\$-
RCO	B.1.N2	Complete large-scale restoration projects at the mouths of major river systems in Puget Sound where there is a high likelihood of re-creating ecosystem function.	\$6,943,735	\$1,753,521	\$3,754,739
USFWS	B.1.N2	Complete large-scale restoration projects at the mouths of major river systems in Puget Sound where there is a high likelihood of re-creating ecosystem function.	\$-	\$3,200,000	\$7,463,000
NOAA	B.1.N2	Complete large-scale restoration projects at the mouths of major river systems in Puget Sound where there is a high likelihood of re-creating ecosystem function.	\$-	\$8,900,000	*
PSP	B.1.N3	Restore floodplain and river processes where there is a high likelihood of re-creating ecosystem function.	\$-	\$-	\$-
RCO	B.1.N3	Restore floodplain and river processes where there is a high likelihood of re-creating ecosystem function.	\$8,360,732	\$1,554,935	\$4,030,342
NOAA	B.1.N3	Restore floodplain and river processes where there is a high likelihood of re-creating ecosystem function.	\$-	\$2,988,000	*
RCO	B.1.N4	Remove significant blockages of ecosystem processes and provide access to habitat.	\$317,571	\$356,318	\$272,880
WDFW	B.1.N4	Remove significant blockages of ecosystem processes and provide access to habitat.	\$500,000	\$-	\$293,833
WSDOT	B.1.N4	Remove significant blockages of ecosystem processes and provide access to habitat.	\$9,383,000	\$-	\$12,317,277
USNPS	B.1.N4	Remove significant blockages of ecosystem processes and provide access to habitat.	\$-	\$54,700,000	\$50,645,610
WDFW	B.1.N5	Complete the Puget Sound Nearshore Partnership's General Investigation in a timely way to help identify and refine nearshore restoration opportunities and move toward implementation.	\$400,000	\$-	\$1,292,494
USACE	B.1.N5	Complete the Puget Sound Nearshore Partnership's General Investigation in a timely way to help identify and refine nearshore restoration opportunities and move toward implementation.	\$-	\$800,000	*

**APPENDIX A**

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WDFW	B.1.N6	Remove derelict fishing gear as proposed by the Northwest Straits Commission and local Marine Resource Committees in sites with known problems for species.	\$50,000	\$-	\$50,000
NWSC	B.1.N6	Remove derelict fishing gear as proposed by the Northwest Straits Commission and local Marine Resource Committees in sites with known problems for species.	\$1,225,000	\$4,600,000	\$5,067,773
DOE	B.2.N1	Fund a one-year demonstration program to develop a coordinated cleanup and restoration plan for the Port Angeles Harbor and waterfront and work plan for project completion.	\$-	\$-	\$-
DOE	B.2.N2	Continue Bellingham Bay Pilot Program to clean up Bellingham Bay in a coordinated way.	see C.5.N1	\$-	\$3,500,000
DOE	B.2.N3	Continue to control pollutant sources and remediate toxics in Elliott Bay.	\$150,000	\$-	\$400,000
WSCC	B.3.N1	Implement coordinated incentive and technical assistance programs for private landowners through the Conservation Commission, Conservation Districts, Department of Natural Resources, other state agencies, Washington State University Extension, local governments, non-governmental organizations, and others as appropriate.	\$250,000	\$-	\$1,128,803
		Average Annual Estimates for Strategy B (rounded):	\$74,484,000	\$80,587,000	\$103,917,000
DOE	C.1.N1	Conduct a focused outreach campaign for the public and businesses to reduce pollutants identified in toxic loading and other studies that are priority threats to Puget Sound.	\$485,000	\$-	\$-
WSG	C.1.N1	Conduct a focused outreach campaign for the public and businesses to reduce pollutants identified in toxic loading and other studies that are priority threats to Puget Sound.	\$6,667	\$-	\$54,354
DOE	C.1.N2	Assist the Department of Ecology in implementing its PBT program to reduce and eventually eliminate the use of all chemicals on the PBT list, and other programs to reduce toxins such as metals.	\$329,277	\$-	\$785,564
DOE	C.1.N2	Assist the Department of Ecology in implementing its PBT program to reduce and eventually eliminate the use of all chemicals on the PBT list, and other programs to reduce toxins such as metals.	\$72,836	\$-	\$48,557
DOE	C.1.N3	Permanently fund a rescue tug at Neah Bay.	\$3,200,000	\$-	\$1,200,000
DOE	C.1.N4	Continue the Department of Ecology's oil spill inspection and prevention programs. Obtain delegated authority from the Coast Guard to expand and enhance the scope of authority of the Department of Ecology's vessel and facility inspections, marine incident investigations, and the agency's ability to augment Coast Guard prevention activities and review spill prevention and response plans on behalf of the Coast Guard.	\$2,808,771	\$-	\$-
DOE	C.1.N4	Prevent oil spills from vessels and oil handling facilities [Prepare for aggressive response to oil and hazardous material incidents. Rapidly respond to and clean up oil and hazardous material spills. Continue the Department of Ecology's oil spill inspection and prevention programs. Obtain delegated authority from the Coast Guard to expand and enhance the scope of authority of the Department of Ecology's vessel and facility inspections, marine incident investigations, and the agency's ability to augment Coast Guard prevention activities and review spill prevention and response plans on behalf of the Coast Guard].	\$2,105,040	\$-	\$2,205,040

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DOE	C.1.N4	Prepare for aggressive response to oil and hazardous material incidents	\$930,309	\$-	\$1,053,809
DOE	C.1.N4	Rapidly respond to and clean up oil and hazardous material spills	\$2,877,661	\$-	\$3,030,994
PSP	C.1.N4	Continue the Department of Ecology's oil spill inspection and prevention programs. Obtain delegated authority from the Coast Guard to expand and enhance the scope of authority of the Department of Ecology's vessel and facility inspections, marine incident investigations, and the agency's ability to augment Coast Guard prevention activities and review spill prevention and response plans on behalf of the Coast Guard.	\$75,000	\$-	\$40,100
WSG	C.1.N4	Continue the Department of Ecology's oil spill inspection and prevention programs. Obtain delegated authority from the Coast Guard to expand and enhance the scope of authority of the Department of Ecology's vessel and facility inspections, marine incident investigations, and the agency's ability to augment Coast Guard prevention activities and review spill prevention and response plans on behalf of the Coast Guard.	\$22,500	\$-	\$85,000
WDFW	C.1.N4	Continue the State's oil spill inspection, prevention, and response programs. Obtain delegated authority from the Coast Guard to expand and enhance the scope of authority of the Department of Ecology's vessel and facility inspections, marine incident investigations, and the agency's ability to augment Coast Guard prevention activities and review spill prevention and response plans on behalf of the Coast Guard. NOTE: Everything past the first sentence in the NTA description seems like it should be Ecology's agency specific set of activities and objectives. Recommend removing this text from the actual NTA language.	\$435,000	\$-	\$435,000
DOE	C.1.N5	Petition EPA to establish Puget Sound as a No Discharge Zone for commercial and/or recreational vessels to eliminate bacteria, nutrients, and pathogens from being discharged into Puget Sound.	\$150,000	\$-	\$33,333
DOE	C.1.N6	Implement existing air management plans consistent with the Action Agenda.	\$6,789,557	\$-	\$2,247,163
DOH	C.1.N7	Implement Shellfish Protection District plans and related projects to restore water quality at commercial and recreational shellfish areas that are degraded or threatened.	\$579,650	\$-	\$547,111
PSP	C.1.N7	Implement Shellfish Protection District plans, on-site sewage treatment plans in marine recovery areas, and related projects to restore water quality at commercial and recreational shellfish areas that are degraded or threatened.	\$122,000	\$-	\$-
DOE	C.1.N8	Implement immediate remediation actions to address Hood Canal's low dissolved oxygen concentrations through the Hood Canal Dissolved Oxygen Program.	\$15,500,000	\$-	\$3,944,615
PSP	C.1.N8	Implement immediate remediation actions to address Hood Canal's low dissolved oxygen concentrations through the Hood Canal Dissolved Oxygen Program.	\$38,207	\$-	\$80,000
DOE	C.1.N9	Implement priority strategies and actions to address low dissolved oxygen in South Sound, targeted areas of the Whidbey Basin, and other vulnerable areas. This includes the Ecology-led South Sound Dissolved Oxygen Study.	\$2,867,000	\$-	\$487,986
PSP	C.1.N9	Implement priority strategies and actions to address low dissolved oxygen in South Sound, targeted areas of the Whidbey Basin, and other vulnerable areas. This includes the Ecology-led South Sound Dissolved Oxygen Study.	\$38,207	\$-	\$-
DOE	C.2.N1	Establish a regional coordinated monitoring program for stormwater, working with the Monitoring Consortium of the Stormwater Work Group.	\$191,515	\$-	\$218,869

**APPENDIX A**

**2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

NTA Funded Agency	NTA Number	Near-Term Action Title	2009 SoS Original Cost Estimates (annualized)	Non-State Match Cost Estimates (annualized)	Annual Estimated Expenditures
PSP	C.2.N1	Establish a regional coordinated monitoring program for stormwater, working with the Monitoring Consortium of the Stormwater Work Group.	\$74,000	\$-	\$4,789
DOE	C.2.N2	Provide financial and technical assistance to cities and counties to implement NPDES Phase I and II permits, as well as Ecology for permit oversight and implementation.	\$2,233,000	\$-	\$3,976,142
PSP	C.2.N2	Provide financial and technical assistance to cities and counties to implement NPDES Phase I and II permits, as well as Ecology for permit oversight and implementation.	\$2,233,000	\$-	\$4,789
DOE	C.2.N3	Assist cities and counties in incorporating LID requirements for development and redevelopment into all stormwater codes.	\$250,000	\$-	\$176,735
PSP	C.2.N3	Assist cities and counties in incorporating LID requirements for development and redevelopment into all stormwater codes.	\$250,000	\$-	\$69,158
DOE	C.2.N4	Develop and implement LID incentives.	\$5,000,000	\$-	\$-
PSP	C.2.N4	Develop and implement LID incentives.	\$175,000	\$-	\$82,946
PSP	C.2.N5	Convene a group of regulating agencies, implementers with key funding responsibilities, and other stakeholders as appropriate to evaluate the technical and programmatic solutions for CSOs to meet overall program goals of improving water quality in fresh and marine water.	\$80,000	\$-	\$-
DOE	C.2.N6	Retrofit existing stormwater systems by: a) developing high-level criteria that can be used in 2009 to determine the highest priority areas around the Sound for stormwater retrofits and b) implementing stormwater retrofit projects in the highest priority areas based upon these criteria to bring areas into compliance with current stormwater regulations.	\$5,373,903	\$-	\$15,485,262
PSP	C.2.N6	Retrofit existing stormwater systems by: a) developing high-level criteria that can be used in 2009 to determine the highest priority areas around the Sound for stormwater retrofits and b) implementing stormwater retrofit projects in the highest priority areas based upon these criteria to bring areas into compliance with current stormwater regulations.	\$15,000,000	\$-	\$4,247
WSDOT	C.2.N6	Retrofit existing stormwater systems by: a) developing high-level criteria that can be used in 2009 to determine the highest priority areas around the Sound for stormwater retrofits and b) implementing stormwater retrofit projects in the highest priority areas based upon these criteria to bring areas into compliance with current stormwater regulations.	\$1,143,000	\$-	\$1,100,667
DNR	C.2.N7	Continue to implement road maintenance and abandonment programs for federal, state (including trustlands), and private timber lands.	\$9,215,510	\$-	\$2,821,554
WDFW	C.2.N7	Continue to implement road maintenance and abandonment programs for federal, state (including trustlands), and private timber lands.	\$53,816	\$-	\$-
WSG	C.2.N8	Implement private property stewardship, incentive, and technical assistant programs (e.g. Conservation Districts, WSU Extension, Washington Sea Grant, local government programs) that focus on reducing sources of water pollution, from commercial and non-commercial farms and other nonpoint sources, particularly in priority areas.	\$-	\$-	\$20,906

**APPENDIX A****2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

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WSCC	C.2.N8	Implement private property stewardship, incentive, and technical assistant programs (e.g. Conservation Districts, WSU Extension, Washington Sea Grant, local government programs) that focus on reducing sources of water pollution, from commercial and non-commercial farms and other nonpoint sources, particularly in priority areas.	\$3,100,000	\$-	\$949,753
WDFW	C.2.N8	Implement private property stewardship, incentive, and technical assistant programs (e.g. Conservation Districts, WSU Extension, Washington Sea Grant, local government programs) that focus on reducing sources of water pollution, from commercial and non-commercial farms and other nonpoint sources, particularly in priority areas.	\$50,000	\$-	\$50,000
DOE	C.2.N9	Implement NPDES industrial permits and Washington State Department of Transportation permits, including Ecology for permit oversight and implementation.	\$8,427,313	\$-	\$444,237
WSDOT	C.2.N9	Implement NPDES industrial permits and Washington State Department of Transportation permits, including Ecology for permit oversight and implementation.	\$1,192,500	\$-	\$4,767,997
DOE	C.3.N1	Use advanced wastewater treatment where needed in nutrient sensitive recoverable shellfish, and tribal shellfish areas, such as Hood Canal, South Sound, and the Whidbey Basin.	\$80,000	\$-	\$133,333
DOE	C.3.N2	Pursue stimulus package funding to implement priority upgrades of municipal and industrial wastewater facilities, especially in nutrient sensitive, recoverable shellfish, and tribal shellfish areas of Puget Sound.	\$45,095,404	\$-	\$24,052,089
Parks	C.3.N2	Pursue stimulus package funding to implement priority upgrades of municipal and industrial wastewater facilities, especially in nutrient sensitive, recoverable shellfish, and tribal shellfish areas of Puget Sound.	\$2,836,000	\$-	\$3,966,667
EPA	C.3.N3	Support federal and other facilities in reducing nutrient and pathogens, particularly in already impaired areas.	\$-	\$40,000	\$676,309
DOH	C.4.N1	Develop and implement on-site sewage system management plans in each Puget Sound county.	\$6,372,400	\$-	\$1,905,847
DOH	C.4.N2	Revise the current on-site sewage treatment rule no later than June 30, 2011, so standards are established to address new on-site sewage treatment technologies.	\$197,000	\$-	\$-
DOE	C.4.N3	Enhance and target on-site sewage treatment loan programs and grants to ensure programs are targeted to areas of with demonstrated loading issues and vulnerable waters.	\$20,000	\$-	\$4,559,498
DOE	C.5.N1	Continue to implement ongoing, high-priority remediation and cleanup projects.	\$34,610,083	\$-	\$19,708,600
WSDOT	C.5.N1	Continue to implement ongoing, high-priority remediation and cleanup projects.	\$65,000	\$-	\$21,349
EPA	C.5.N1	Continue to implement ongoing, high-priority remediation and cleanup projects.	\$-	\$15,000,000	\$50,660,974
DOE	C.5.N2	Refine the Department of Ecology near-term prioritization criteria for site cleanups to be consistent with the Action Agenda and incorporate criteria into toxic cleanup grant programs.	\$20,000	\$-	\$-
PSP	C.5.N2	Refine the Department of Ecology near-term prioritization criteria for site cleanups to be consistent with the Action Agenda and incorporate criteria into toxic cleanup grant programs.	\$-	\$-	\$-
DOH	C.6.N1	Continue to fund the swimming beach monitoring program.	\$548,000	\$-	\$116,667

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**2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

NTA Funded Agency	NTA Number	Near-Term Action Title	2009 SoS Original Cost Estimates (annualized)	Non-State Match Cost Estimates (annualized)	Annual Estimated Expenditures
DOE	C.6.N1	Continue to fund the swimming beach monitoring program.	\$548,000	\$-	\$360,000
WSG	C.6.N1	Continue to fund the swimming beach monitoring program.	\$6,667	\$-	\$-
DOH	C.6.N2	Continue to fund the shellfish and fish advisory monitoring and advisory programs.	\$1,255,650	\$-	\$337,839
WSG	C.6.N2	Continue to fund the shellfish and fish advisory monitoring and advisory programs.	\$6,667	\$-	\$20,906
		Average Annual Estimates for Strategy C (rounded):	\$185,136,000	\$15,040,000	\$152,977,000
PSP	D.1.N1	Coordinate implementation of existing plans and programs that support the Action Agenda, and realign or discontinue plans and programs that conflict with the strategies and actions set forth in the Action Agenda.	\$160,000	\$-	\$-
PSP	D.1.N2	Develop and implement the required Steelhead Recovery Plan, building on the Chinook Recovery Plan and integrating the Action Agenda priorities.	\$6,275	\$-	\$10,100
WDFW	D.1.N2	Develop and implement the required Steelhead Recovery Plan, building on the Chinook Recovery Plan and integrating the Action Agenda priorities.	\$85,500	\$-	\$57,595
NOAA NMFS	D.1.N2	Develop and implement the required Steelhead Recovery Plan, building on the Chinook Recovery Plan and integrating the Action Agenda priorities.		\$1,180,000	*
PSP	D.1.N3	Continue the integration of habitat, harvest, and hatchery efforts in the salmon recovery plans and watershed three-year work plans.	\$80,000	\$-	\$-
NOAA NMFS	D.1.N4	Implement the southern resident killer whale plan and continue to prioritize and identify actionable recovery measures with assignments and implementation timelines.		\$4,300,000	\$2,500,000
WDFW	D.1.N5	Implement the 2008 revision to the Pacific Salmon Treaty.	\$601,000	\$-	\$890,940
WDFW	D.1.N6	Implement the priority hatchery reform recommendations to update state and tribal hatcheries to protect wild salmon stocks, as well as achieve fisheries objectives.	\$6,500,000	\$-	\$11,613,092
PSP	D.2.N1	Once the recommendations of the Climate Change Study Groups are available, integrate and coordinate them with the Action Agenda.	\$40,000	\$-	\$12,555
PSP	D.3.N1	Integrate the work of PSNERP, including the Estuary and Salmon Restoration Program, into the Puget Sound Partnership to improve efficiency, coordination, and to avoid overlap and duplication of efforts, as well as focus sufficient state, federal, tribal, and nonprofit organizational resources on protecting and restoring sites identified as part of the General Investigation.	\$45,712	\$-	\$8,799
PSP	D.3.N2	Fund salmon recovery lead entities and other collaborative groups such as Regional Fisheries Enhancement Groups, marine resource committees, and RCW 90.82 watershed planning groups in the near term to continue existing work and address Action Agenda priorities.	\$1,707,650	\$-	\$384,639

**APPENDIX A****2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

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RCO	D.3.N2	Fund salmon recovery lead entities and other collaborative groups such as Regional Fisheries Enhancement Groups, marine resource committees, and RCW 90.82 watershed planning groups in the near term to continue existing work and address Action Agenda priorities.	\$1,016,552	\$-	\$5,572,324
WDFW	D.3.N2	Fund salmon recovery lead entities and other collaborative groups such as Regional Fisheries Enhancement Groups, marine resource committees, and RCW 90.82 watershed planning groups in the near term to continue existing work and address Action Agenda priorities.	\$507,500	\$-	\$507,500
PSP	D.3.N3	Fund tribes to participate in the refinement and implementation of the Action Agenda, including salmon recovery plans.	\$2,200,000	\$-	\$2,093
PSP	D.3.N4	Establish a Federal Puget Sound Office. Work with congressional delegation to pass federal legislation explicitly authorizing Puget Sound recovery work, including establish a federal Puget Sound Office to improve coordination of federal agencies and codify ongoing federal authorization for funding.	\$3,556	\$-	\$2,370
PSP	D.3.N5	Consider the recommendations of the Partnership's Local Integration Task Force and implement appropriate follow up actions.	\$12,075	\$-	\$12,075
PSP	D.3.N6	Support appropriations to federal agencies to implement specific priorities in the Action Agenda, especially those that are actively coordinating with state and local partners to implement Action Agenda priorities.	\$80,000	\$-	\$32,552
PSP	D.3.N7	Engage with stakeholders throughout the region to advance shared priorities.	\$240,000	\$-	\$-
WSG	D.3.N7	Engage with stakeholders throughout the region to advance shared priorities.	\$-	\$-	\$20,906
PSP	D.3.N8	Develop a joint federal agency work plan for Puget Sound restoration and protection actions in coordination with the Partnership	\$6,277	\$-	\$4,185
EPA	D.3.N8	Develop a joint federal agency work plan for Puget Sound restoration and protection actions in coordination with the Partnership.	\$-	\$-	\$-
PSP	D.3.N9	Work with federal delegation to support reauthorization of the Coastal Zone Management Act and other federal legislation vital to Puget Sound protection and restoration.	\$17,025	\$-	\$13,683
PSP	D.4.N1	Conduct an institutional analysis of local, state, and federal agencies with regulatory authority over upland terrestrial and aquatic habitats, species protection, and water quality.	\$80,000	\$-	\$1,046
PSP	D.4.N1	Conduct an institutional analysis of local, state, and federal agencies with regulatory authority over upland terrestrial and aquatic habitats, species protection, and water quality.	\$-	\$-	\$-
DOC	D.4.N2	Evaluate the effectiveness of the Clark County pilot project related to aquatic habitats of the Office of Regulatory Assistance's permit program.	\$125,000	\$-	\$-
PSP	D.4.N3	Convene a process for making recommendations to the Partnership about streamlining permitting processes for habitat restoration projects.	\$40,000	\$-	\$1,046
PSP	D.4.N4	Convene a process with Corps, NMFS, USFWS, jurisdictions responsible for levee maintenance, and stakeholders to identify and describe conflicts between levee maintenance standards and healthy habitat.	\$10,998	\$-	\$49,933

**APPENDIX A**

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DOC	D.4.N5	Support funding and legislation to allow state loans to local governments to conduct environmental reviews under SEPA at the planning or programmatic level.	\$-	\$-	\$-
DOE	D.4.N6	Develop, fund, and implement a pilot in-lieu-fee mitigation program for aquatic habitats in one to three Puget Sound watersheds.	\$2,200,000	\$-	\$2,218,333
PSP	D.4.N6	Develop, fund, and implement a pilot in-lieu-fee mitigation program for aquatic habitats in one to three Puget Sound watersheds.	\$5,511,342	\$-	\$12,433
WDFW	D.4.N7	Resolve issues related to the Hydraulic Project Approval including effectiveness, compliance, and enforcement.	\$58,069	\$-	\$58,069
PSP	D.5.N1	Convene a process with federal, state, and local jurisdictions and tribes to develop an ideal compliance assistance and inspection program that would leverage existing fragmented inspection programs into an integrated program without co-opting the regulatory and enforcement authority of any jurisdiction.	\$40,000	\$-	\$-
DOE	D.5.N2	Provide additional state compliance inspectors to ensure that businesses producing hazardous waste are complying with regulations.	\$3,589,300	\$-	\$166,000
DOE	D.5.N3	Support state water quality fee revisions and short-term funding to maintain existing, and if possible, enhance compliance staff at Department of Ecology	\$2,300,000	\$-	\$41,931
DOE	D.5.N4	Provide additional staff at the Department of Ecology to conduct field visits to improve compliance with shoreline and aquatic regulations.	\$1,027,000	\$-	\$-
PSP	D.5.N5	Develop and implement a training program for designers and contractors who work in nearshore areas.	\$125,000	\$-	\$-
		Average Annual Estimates for Strategy D (rounded):	\$28,416,000	\$5,480,000	\$24,194,000
PSP	E.1.N1	Develop a performance management framework by November 1, 2009. This will include: a. Identifying measurable ecosystem outcomes and indicators for reporting. b. Identifying measurable intermediate outcomes with targets and benchmarks. c. Developing a logic framework that links the actions in the Action Agenda to funding, intermediate outcomes, and ecosystem goals and objectives. d. Creating an updated list of near-term actions based on 2009 funding decisions. e. Identifying processes by November 1, 2009 by which ecosystem results and action performance will be assessed and adaptive management actions identified. f. Identifying a management cycle for the Action Agenda with processes, timing, and reporting by November 1, 2009. This will include a schedule and process to update the near-term actions, the work plan, and revise the Action Agenda strategies as necessary. Incorporate salmon recovery planning adaptive management plan as much as possible. g. Submitting recommendations to the Legislature to better align funding and resources with the Action Agenda as required in the Partnership statute (RCW 90.71.370 (3)).	\$40,000	\$-	\$325,366

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PSP	E.1.N2	Clarify and document roles of the Leadership Council, Ecosystem Coordination Board, Science Panel, and Partnership staff. Clarify relationships with the Salmon Recovery Council, local coordinating groups, caucuses, and strategic planning bodies working on issues relevant to the Action Agenda.	\$20,000	\$-	\$13,859
PSP	E.1.N3	Develop a detailed work plan for near-term actions in the Action Agenda, identifying lead implementers, partners, timelines, and funding source and amount. Negotiate performance agreements with action leads related to salmon recovery plans, state agency work programs, and projects funded by state grant or loan programs to include timelines, outputs, immediate outcomes, intermediate outcomes, and environmental outcomes, as well as reporting requirements.	\$20,000	\$-	\$45,967
PSP	E.1.N4	Develop a Web-based reporting system. a. Develop an "activity integration database" to support the Action Agenda accountability where implementers will report on outcomes and use of funds. The system will rely on existing data sources whenever possible to avoid burdening implementers with additional reporting requirements. The system will capture salmon actions, monitoring programs, science, and any other administrative or staff support funded through the Action Agenda priorities. b. Implementers of monitoring supported by the Action Agenda will make monitoring data accessible to the Partnership and begin steps to make it available to the other implementers, scientists, and the public. c. Begin reporting ecosystem and action implementation results on the Web by November 1, 2009.	\$367,000	\$-	\$194,552
PSP	E.1.N5	Finalize the salmon recovery adaptive management plan as required by NOAA and incorporate this program into the broader ecosystem adaptive management approach.	\$40,000	\$-	\$250,000
PSP	E.1.N6	Develop a system to identify and track actions that are inconsistent with the Action Agenda.	\$-	\$-	\$3,333
PSP	E.1.N7	Develop and implement a Partner Program as specified in the Partnership statute (RCW 90.71.340 (3)).	\$20,000	\$-	\$4,107
PSP	E.2.N1	Align state agency budget proposals for the 2009-2011 and 2011-2013 biennial budgets with the priorities in the Action Agenda.	\$40,000	\$-	\$18,000
PSP	E.2.N10	Identify and implement one or more pilot projects to demonstrate the application of the in-lieu-fee program.	\$-	\$-	see D.4.N6
PSP	E.2.N11	Evaluate, and if possible implement a water quality trading program to address dissolved oxygen issues in southern Puget Sound.	\$-	\$-	\$-
PSP	E.2.N12	Develop proposals for the 2011-2013 biennium to establish, improve, or expand the use of ecosystem markets.	\$5,000	\$-	\$-
PSP	E.2.N13	In cooperation with a local government or stormwater utility, implement a pilot cap-and-trade program for the removal of impervious surface and/or removal of shoreline armoring.	\$5,000	\$-	\$-
PSP	E.2.N14	Evaluate, and incorporate as appropriate into the Action Agenda, the recommendations in the Washington State Conservation Commission's 2008 conservation markets study for farmlands and forest landowners.	\$-	\$-	\$-
PSP	E.2.N2	Pursue state legislation authorizing the creation of a Puget Sound regional improvement district.	\$1,051	\$-	\$700
PSP	E.2.N3	For grant requests to the state, per RCW 90.71.340, review grant and loan criteria to prohibit the funding of projects that are in conflict with the Action Agenda.	\$16,625	\$-	\$7,500

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PSP	E.2.N4	For federal and local budgets, to the extent possible, review and comment to encourage alignment with the Action Agenda.	\$16,625	\$-	\$-
PSP	E.2.N5	Implement targeted procurement on a pilot basis for a portion of the Puget Sound Acquisition and Restoration program that is focused on salmon recovery.	\$-	\$-	\$-
PSP	E.2.N6	Continue to evaluate potential state funding sources in greater detail, including full legal and fiscal analysis, and prepare proposals for enactment of revenue sources in the 2010 or 2011 legislative sessions.	\$10,000	\$-	\$33,167
PSP	E.2.N7	For state agency grant programs, advocate for changes to policies and priorities of the Public Works Trust Fund, Salmon Recovery Funding Board, Washington Wildlife and Recreation Program, and other state grant and loan programs, to encourage consistency with Action Agenda goals.	\$20,000	\$-	\$-
PSP	E.2.N8	Develop financial incentives and provide financial and technical assistance to local governments to develop high-priority projects in the Action Agenda for funding with existing Department of Ecology and the Public Works Board programs.	\$-	\$-	\$-
PSP	E.2.N9	As part of implementing the Mitigation That Works recommendations (D.4.2), develop agreements with Corps, Ecology, and other relevant permitting agencies by 2010 on the design of a regional in-lieu-fee program.	\$-	\$-	see D.4.N6
DNR	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$5,980,183	\$-	\$5,887,233
DOH	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$234,000	\$-	\$233,468
DOE	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$3,011,500	\$-	\$3,722,667
PSP	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$17,540,000	\$-	\$36,623
RCO	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$150,500	\$-	\$65,282
WDFW	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$1,317,000	\$-	\$9,140,920
WSDA	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$380,000	\$-	\$380,000
WSDOT	E.3.N1	Sustain ongoing monitoring programs to provide status, trend, and effectiveness information to inform State of the Sound reporting and other synthesis.	\$115,000	\$-	\$109,000
PSP	E.3.N10	Develop a technical plan for increasing capabilities for modeling future scenarios by identifying the goals and milestones for this work, defining the requirements, functions and assets needed to support ecosystem recovery, and describing the roles and relationships of collaborators carrying forward portions of this work.	\$290,000	\$-	\$3,200

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PSP	E.3.N11	Identify priorities for research to fill gaps in knowledge about ecosystem processes; design and implement studies to fill gaps.	\$250,000	\$-	\$3,200
PSP	E.3.N12	Coordinate with science programs of state and federal agencies to better align them with Partnership interests and contribute to Partnership science program needs.	\$100,000	\$-	\$9,633
PSP	E.3.N2	Implement transition to a coordinated regional program for monitoring ecosystem status and trends, program and project effectiveness, and cause-and-effect relationships.	\$5,240,000	\$-	\$38,301
PSP	E.3.N3	Use the framework of Integrated Ecosystem Assessment to refine ecosystem indicators, assess threats to the ecosystem, and evaluate potential management strategies.	\$1,936,000	\$-	\$14,233
PSP	E.3.N4	Design and implement studies to collect new information about: a) the effects of a nearshore restoration actions; b) watershed-wide pollutant loading and effects of runoff; c) stressors affecting forage fish and pelagic food webs; and d) ecosystem services and socioeconomic indicators.	\$3,980,000	\$-	\$-
PSP	E.3.N5	Assemble and synthesize findings that describe ecosystem conditions and threats for the 2009 State of the Sound report during mid-2009. using the indicators in the Action Agenda. Conduct peer review of science contributions to 2009 State of the Sound.	\$140,000	\$-	\$18,100
PSP	E.3.N6	Publish 2010 Puget Sound Science Update, required by the Partnership statute (RCW 90.71.290 (3)) to provide best available answers about how the ecosystem works, how it has changed over time, and how it is affected by management actions. Producing the Science Update will include commissioning lead authors for various sections of the report, encouraging peer contributions, and conducting an open peer review.	\$290,000	\$-	\$158,800
PSP	E.3.N7	Identify research priorities and recommend topics for Partnership sponsored science in 2011-13 (e.g., for the next Biennial Science Work Plan).	\$14,192	\$-	\$44,233
PSP	E.3.N8	Develop and coordinate the organization to support implementation of the Partnership's science program, especially by convening working groups to organize the regional science community's participation.	\$336,000	\$-	\$138,733
PSP	E.3.N9	Develop processes for: a) soliciting science projects via competitive requests for proposals; b) conducting peer review of materials that form the science basis for Partnership decisions; and c) establishing a process for external peer review of the Partnership's science program.	\$99,000	\$-	\$14,700
PSP	E.4.N1	Develop a science-based, prioritized menu of best management practices for residents to be targeted through various outreach strategies.	\$7,500	\$-	\$95,000
PSP	E.4.N10	Promote the inclusion of Puget Sound-related environmental, social, and economic issues in curriculum where possibleK-12 curricula and work to increase Puget Sound environmentally related environmental service projects.	\$140,000	\$-	\$96,233
WDFW	E.4.N10	Promote the inclusion of Puget Sound-related environmental, social, and economic issues in curriculum where possibleK-12 curricula and work to increase Puget Sound environmentally related environmental service projects.	\$70,000	\$-	\$70,000

**APPENDIX A**

**2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

NTA Funded Agency	NTA Number	Near-Term Action Title	2009 SoS Original Cost Estimates (annualized)	Non-State Match Cost Estimates (annualized)	Annual Estimated Expenditures
PSP	E.4.N11	Develop and implement a coordinated citizen science program. This will include cataloging and analyzing existing efforts, coordinating existing efforts, and replicating those that are effective, providing technical and scientific assistance to community members to conduct local monitoring and assessment that supports connect citizens and scientists to not only increase engagement opportunities but provide cost-effective data collection in support of Action Agenda priorities.	\$250,000	\$-	\$667
WSG	E.4.N11	Develop and implement a coordinated citizen science program. This will connect citizens and scientists to not only increase engagement opportunities but provide cost-effective data collection in support of Action Agenda priorities.	\$-	\$-	\$16,725
PSP	E.4.N12	Coordinate with the Pacific Northwest NOAA B-WET grant provider to increase the "Meaningful Watershed Education Experience" model for students in Puget Sound.	\$425,000	\$-	\$-
PSP	E.4.N13	Promote Conduct a pilot program with the use of Washington State Ferries to inform and engage riders in Puget Sound-related curriculum widely available to all teachers recovery.	\$10,000	\$-	\$3,333
PSP	E.4.N14	Develop a "toolbox" program of awareness, education, and schools stewardship programs. Include program strategies, materials, information, templates, evaluation metrics, etc. to be used by a range of implementers. Highlight and disseminate effective programs and models from around the region and beyond.	\$80,000	\$-	\$50,267
PSP	E.4.N15	Procure funding for and implement a grant program to support local and regional organizations engaged in outreach. Use funding to stimulate innovation, collaboration, implementation of targeted strategies, and/or reaching new audiences to advance recovery efforts.	\$450,000	\$-	\$114,100
PSP	E.4.N2	Identify and develop solutions for barriers (individual and institutional) to the adoption of targeted practices and behaviors.	\$25,000	\$-	\$70,633
PSP	E.4.N3	Create a prioritized list of potential audiences according to issue and best management practices. Conduct formative research and message development work for priority audiences for use by local practitioners. Implement identified communication strategies at regional and local levels, through both centralized and de-centralized means.	\$15,000	\$-	\$38,667
PSP	E.4.N4	Maintain and enhance ECO Net (Education, Communication, and Outreach Network), a Soundwide network that builds and strengthens relationships among Puget Sound organizations working on public awareness, involvement, and environmental education. Utilize the broad ECO Net, as well as local and regional networks, to align and enhance participant efforts in support of Action Agenda goals.	\$110,000	\$-	\$237,233
PSP	E.4.N5	Assess regional dissemination opportunities. Identify gaps, and prioritize mechanisms by their ability to reach targeted audiences, incorporate new messages/elements into appropriate existing programs.	\$10,000	\$-	\$214,633
PSP	E.4.N6	Develop and support regional multi-media awareness campaigns related to Puget Sound health.	\$400,000	\$-	\$305,833
PSP	E.4.N7	Develop and maintain the technology/social media infrastructure necessary to coordinate implementers and connect the public to local activities and resources related to education, volunteerism, and stewardship.	\$120,000	\$-	\$173,358
PSP	E.4.N8	Expand regional coordination of communication efforts and behavior change programs. Support regional coalitions, such as the STORM coalition (Storm water Outreach for Regional Municipalities), a Sound-wide consortium of municipalities collaborating on a Sound-focused campaign, and effectiveness enhancement of respective local programs.	\$87,000	\$-	\$139,100

**APPENDIX A****2008 Action Agenda Near Term Action Estimates, All Near Term Action Owners**

NTA Funded Agency	NTA Number	Near-Term Action Title	2009 SoS Original Cost Estimates (annualized)	Non-State Match Cost Estimates (annualized)	Annual Estimated Expenditures
DOE	E.4.N9	Develop a coordinated regional system of place-based K-12 education programs, and adult education and stewardship programs, such as WSU Beachwatchers, restoration/volunteer programs, and related efforts.	\$886,000	\$-	\$515,333
PSP	E.4.N9	Develop a coordinated regional system of place-based K-12 education programs, and adult education and stewardship programs, such as WSU Beachwatchers, restoration/volunteer programs, and related efforts.	\$10,150	\$-	\$410,033
WSCC	E.4.N9	Develop a coordinated regional system of place-based K-12 education programs, and adult education and stewardship programs, such as WSU Beachwatchers, restoration/volunteer programs, and related efforts.	\$37,500	\$-	\$-
WDFW	E.4.N9	Develop a coordinated regional system of place-based K-12 education programs, and adult education and stewardship programs, such as WSU Beachwatchers, restoration/volunteer programs, and related efforts.	\$88,371	\$-	\$84,240
		Average Annual Estimates for Strategy E (rounded):	\$45,246,000	\$-	\$23,550,000
		STATE AGENCIES TOTAL 2008 ACTION AGENDA NTAs	\$419,494,000	\$116,673,000	\$348,786,000
DOA - WA State Department of Agriculture; DOC - WA State Department of Commerce; DOH - WA State Department of Health; DOE - WA Department of Ecology; DNR - WA State Department of Natural Resources EPA - Environmental Protection Agency; NOAA - National Oceanic and Atmospheric Administration; NOAA NMFS - NOAA National Marine Fisheries Service; NWSC - Northwest Straits Commission; Parks - WA State Parks and Recreation Commission; PSP - Puget Sound Partnership; RCO - WA State Recreation and Conservation Office; USACE - US Army Corps of Engineers; USFWS - US Fish and Wildlife Service; USNPS - US National Parks Service; WWC - WA Wilderness Coalition; WDFW - WA Department of Fish and Wildlife; WSG - WA Sea Grant; WSCC - WA State Conservation Commission; WSDOT - WA State Department of Transportation					
Note: Original Cost Estimates, and Non-State Match Cost Estimates are based on dollar amounts provided by NTA owners for the 2009 State of the Sound report, appendix tables D-1 and D-2. Original Cost Estimates represent annualized Action Agenda Proposed FY 09-11 Budgets from the 2009 report. In the absence of Proposed FY 09-11 Budgets for some NTAs, Confirmed FY 09-11 Budgets, were used.					
* Estimates not provided					

**APPENDIX B**

**2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
DOE	A1.1.1		Apply Watershed Characterization Results	\$1,559,590	\$1,082,485
PSI	A1.1.2		Web-Based Data Tool to Support Land Use Decisions	\$22,031	\$22,031
WSWC	A1.1.WS1		West Sound Inventory of Transportation Infrastructure Projects	\$4,560	\$-
DOE	A1.2.1	Habitat	Land Use Planning Barriers, BMPs and Example Policies	\$30,000	\$-
DOC	A1.2.2		Financial Support for GMA updates	\$13,000,000	\$13,000,000
PSP (ECB)	A1.3.1	Habitat	ECB Address Regulatory Exemptions	\$16,000	\$16,000
HCCC	A1.4.HC2		HCCC In Lieu Fee Mitigation	\$378,700	\$175,000
DNR	A2.1.1		Community Forestry Conservation Act	\$5,400	\$5,400
DOE	A2.1.2		Updated Avoidance and Minimization Guidance	\$36,600	\$16,000
Forterra	A2.1.3		Port Gamble Land Conservation	\$35,175,000	\$7,100,000
PSP	A2.1.4		Funding Mechanism for Properties at Imminent Risk of Conversion	\$11,000	\$11,000
WDFW	A2.2.1		Prairie and Oak Woodland Restoration	\$15,000,000	*
Suquamish Tr.	A2.2.WS12		West Sound Priority Watersheds for Protection and Restoration	\$270,000	\$90,000
WACC	A3.1.1		Use of Agriculture Conservation Program Funds	\$60,000	\$30,000
DOE	A3.1.2		Landowner Incentives for TDRs and Ecosystem Markets	\$2,650,733	\$1,592,768
DNR	A3.1.3		Forest Watershed Services	\$85,000	\$85,000
DNR	A3.2.1		Working Forest Strategy	\$340,000	\$340,000
PSP	A3.2.2		Agriculture Strategy	\$40,000	\$40,000
DOC	A4.1.1		Regional Sustainable Communities Program	\$120,000	\$120,000
PSP	A5.1.1	Habitat	Floodplain Protection and Policy Team Actions	\$150,000	\$41,667
FEMA	A5.3.1		FEMA Annual Reporting for NFIP BiOp	\$1,410,000	\$1,410,000
DOE	A5.3.2		CAO Updates on Frequently Flooded Areas	\$207,000	\$-
PSP	A5.3.3		BiOp Compliance and Floodplain Target	\$40,000	\$11,667
PSP	A5.3.4	Habitat	Levee Vegetation	\$660,000	\$11,667
WSDOT	A5.4.1		Prioritization of State Highways with Floodplain Impacts	*	*

**APPENDIX B****2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
WACC	A5.4.2		Ag Land Ecosystem Services Markets	\$40,000	\$10,000
WACC	A5.4.3		Candidate Areas for Land Swaps	\$20,000	\$5,000
PSP	A6.1.1	Habitat	Secure Annual Chinook Investment	\$352,086,732	\$14,180,732
PSP	A6.1.2	Habitat	Restoration Permit Barriers	\$88,606	\$88,606
PSP	A6.1.3	Habitat	BNSF Railroad Cooperative Agreement	\$365,065	\$62,470
HCCC LE	A6.1.HC6	Habitat	Hood Canal Salmon Recovery	\$663,900	\$320,000
SJC LE	A6.1.SJ19	Habitat	San Juan County Lead Entity	\$828,000	\$828,000
EFC	A6.1.STRT1	Habitat	Elwha River Ecosystem Recovery	\$3,580,000	\$-
NOPL, HCCC LE	A6.1.STRT2	Habitat	Straits Salmon Recovery Plans	\$3,514,000	\$-
WS LIO	A6.1.WS9	Habitat	West Sound SR3 Chico Creek Culvert Replacement	\$165,000	\$165,000
EPA	A6.2.1		Implement the Puget Sound Federal Agency Action Plan	*	*
PSP	A6.2.2		Develop a State Authorities Matrix	\$5,000	\$5,000
WDFW (& Tribes)	A6.3.1		Implementation of Hatchery Actions	\$875,739	*
PSP	A6.3.2		Salmon Recovery Monitoring and Adaptive Management Plans	\$1,000,000	\$1,000,000
NOAA	A6.4.1		Steelhead Population Identification Report and Viability Criteria	*	*
PSP	A6.4.2		Steelhead Recovery Plan	\$2,916,546	\$356,278
WSWC	A6.4.WS11		West Sound Steelhead Recovery Chapter	\$125,000	\$-
PSP	A6.5.1		Lead Entity and Partner Funding Strategy	\$261,155	\$261,155
DOE	A7.1.1	Habitat	Set Instream Flows in Priority Watersheds	\$1,500,000	\$300,000
DOE	A7.1.2	Habitat	PEP Development and Implementation	\$-	\$-
DOE	A7.1.3	Habitat	Water Code Compliance and Enforcement	\$1,395,000	\$465,000
DOE	A7.1.STRT6	Habitat	Strait Instream Flow Rules	\$2,000,000	\$300,000
DOE	A7.3.1		Exempt Wells	\$-	\$-
<b>A - Freshwater Total (Rounded)</b>				<b>\$442,701,000</b>	<b>\$43,548,000</b>

**APPENDIX B**

**2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
PSP	B1.1.1		Integrated Nearshore Priorities	\$189,500	\$-
DOE	B1.1.2		Human Use Patterns in Marine Areas	\$45,376	\$5,376
WSWC	B1.1.WS3		West Sound Eelgrass and Forage Fish Surveys	\$36,020	\$-
DOE	B1.2.1	Habitat	Update Local Shoreline Master Program	\$9,272,118	\$-
Strait ERN	B1.2.STRT4		Straits Shoreline Master Programs	\$5,625,006	\$-
WSWC	B1.2.WS2		West Sound SMP Update Alternatives to Shoreline Armoring	\$4,560	\$-
WDFW	B1.3.1		HPA Capacity Effectiveness	\$3,750,000	*
WDFW	B1.3.2	Habitat	Hydraulic Code Rules Revision	\$1,250,000	*
SJC	B1.3.SJI7		SJI Technical Assistance	\$250,000	\$63,000
SJC	B1.3.SJI8		SJI Technical Assistance Capacity	see B1.3.SJI7	see B1.3.SJI7
PSP	B2.1.1	Habitat	Protect 10% of Bluff-Backed Beaches	\$17,000	\$15,000
DNR	B2.1.2		Community Use Dock Incentives	\$22,975	\$22,975
DNR	B2.1.3		Overwater Structures Design Guidance	\$45,951	\$45,951
SJC LE	B2.1.SJI10		San Juan Lead Entity Shoreline Protection	\$354,950	\$354,950
WDFW	B2.2.1	Habitat	Implementation of Projects Identified by PSNERP	\$1,565,000	*
Parks	B2.2.2		State Parks Nearshore Restoration	\$560,000	\$10,000
DNR	B2.2.3		Prioritizing Restoration on State-Owned Aquatic Lands	\$1,282,477	\$1,282,477
DNR	B2.2.4		Creosote Piling Inventory and Removal	\$2,650,000	\$2,650,000
PSP	B2.3.1	Habitat	Homeowner Incentives for Landward Setbacks	\$17,000	\$15,000
DNR	B2.4.1		Eelgrass Recovery Target Strategy	\$96,022	\$96,022
DNR	B2.4.2		Identification of Eelgrass Restoration Sites	\$696,403	\$696,403
PSP	B3.1.1		Marine Protected Area Effectiveness	\$762,000	\$762,000
DNR	B3.1.2	Shellfish	Outfall Strategy on State-Owned Aquatic Lands	\$375,863	\$375,863

**APPENDIX B****2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
NWSF	B3.2.1		Legacy Net Removal	\$1,104,000	\$972,000
NWSF	B3.2.2		Deep Water Net Removal	\$400,000	\$15,000
Parks	B4.2.1		State Parks Interpretive Experiences	\$5,000	\$5,000
WDFW	B5.1.1		Develop and Implement Species Plans	*	*
WDFW	B5.1.2		Fish and Wildlife Action Plan	\$110,000	*
RCO	B5.3.1		Invasive Species Baseline Assessment	\$302,000	\$302,000
RCO	B5.3.2	Habitat	Invasive Species Early Detection and Monitoring	\$30,000	\$30,000
WDFW	B5.3.3		Managing Invasive Species On/In Boats and Ships	\$796,110	*
WDFW	B5.3.4		Ballast Water Treatment Effectiveness	\$139,943	*
WDFW	B5.3.5		Zebra/Quagga and New Zealand Mud Snail Plans	\$60,000	*
RCO	B5.4.1		Environmental and Economic Impact of Invasive Species	\$50,000	\$50,000
<b>B - Marine &amp; Nearshore Total (Rounded)</b>				<b>\$31,865,000</b>	<b>\$7,769,000</b>
DOE	C1.1.1		PAH and PFOS Chemical Action Plans	\$722,000	\$702,000
DOE	C1.1.2		Mercury Lamp Product Stewardship	\$252,000	\$252,000
DOE	C1.1.3	Stormwater	Fish Consumption Rates	\$119,000	\$119,000
DOA	C1.1.4		Estimates of Copper in Pesticides	\$6,000	\$6,000
DOA	C1.1.5		Pesticide Use Survey	\$135,000	\$135,000
DOE	C1.1.6		Emerging Contaminants	\$1,650,000	\$500,000
DOE	C1.2.1		Chemical Alternatives Assessments	\$876,000	\$876,000
DOE	C1.2.2		Toxics in Roofing Materials	\$394,046	\$394,046
DOE	C1.2.3		Green Chemistry Road Map	\$1,863,700	\$1,863,700
DOE	C1.4.1		Landscaper Accreditation	\$300,000	\$300,000
DOE	C1.4.2		Environmentally Preferable Purchasing	\$246,240	\$246,240
DOE	C1.4.3		Conduct Local Source Control Business Assistance Visits	\$6,018,000	\$6,018,000

**APPENDIX B**

**2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
DOE	C1.5.1	Shellfish	No Discharge Zone Evaluation and Petition	\$200,631	\$200,631
DOE	C1.5.2		Pump-Out Station Improvements	\$513,000	\$513,000
Kitsap C.	C1.5.WS9		West Sound Pump Out Stations	\$8,000	\$8,000
DOE	C1.6.1		Hazardous Waste, Wastewater, and Air Quality Compliance and Enforcement	\$6,471,000	\$6,471,000
DOE	C1.6.2		Compliance for Use of Toxics in Products	\$49,725	\$49,725
DOE	C1.6.3	Shellfish	Water Quality Enforcement.	\$1,067,900	\$674,975
PSP	C2.1.1	Stormwater	Watershed Based Stormwater Management	\$60,000	\$10,000
King C.	C2.1.2		Protect Best Remaining Streams	\$133,291	\$-
King C.	C2.1.3		Stormwater System Mapping	\$165,969	\$165,969
DOE	C2.2.1	Stormwater	NPDES Municipal Permits	\$9,122,000	\$9,011,000
DOE	C2.2.2		Stormwater Treatment Standards	\$332,925	\$-
DOE	C2.2.3	Stormwater	Stormwater Management Outside Permitted Areas	\$332,925	\$-
DOE	C2.2.4		New Development Under Earlier Stormwater Programs	\$136,000	\$-
SJC	C2.2.SJI3		SJ Improve Stormwater Permit Review	\$27,500	\$15,000
Strait Jurisdictions	C2.2.STRT5		Straits Stormwater Management Programs	\$11,162,500	\$-
DOE	C2.3.1	Stormwater	Stormwater Retrofit Projects	\$1,949,200	\$1,828,000
King C.	C2.3.2		Map, Prioritize, and Restore Degraded Streams	See C2.1.2	See C2.1.2
DOE	C2.3.3		Legacy Pollutant Removal	\$916,717	\$916,717
HCCC	C2.3.HC4		HCCC Stormwater Retrofit Program	\$271,650	\$250,000
Kitsap C.	C2.3.WS5		West Sound Stormwater Retrofit Projects	\$1,000,000	\$1,000,000
DOE	C2.4.1	Stormwater	Inspection, Technical Assistance and Enforcement	\$666,000	\$-
King C.	C2.4.2		Vehicle Leak Detection Program	\$8,128	\$8,128
SJC	C2.4.SJI5		SJI Coordinated Best Management Practices	\$62,500	\$55,000
SJC	C2.4.SJI6		SJI Stormwater Monitoring	\$250,000	\$250,000
DOE	C2.5.1	Stormwater	LID Training and Certification	\$1,939,144	\$1,939,144

**APPENDIX B****2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
Tulalip Tr.	C2.5.2	Stormwater	Education for the Next Generation of Stormwater Professionals	\$5,700,000	\$-
Kitsap C.	C2.5.WS4		West Sound LID Training	\$25,000	\$25,000
DOE	C3.1.1		Water Quality Best Management Practices	\$163,224	\$163,224
WACC	C3.1.2		Effectiveness of Incentive Programs	\$30,000	\$12,000
WACC	C3.1.3		Voluntary Stewardship Program	\$750,000	\$30,000
WACC	C3.2.1	Shellfish	Priority Areas for Voluntary Incentive and Regulatory Programs	\$40,000	\$15,000
DOA	C3.2.2		Dairy Lagoon Assessment	\$50,000	\$50,000
DOA	C3.2.3		Dairy Rule Final Agronomic Applications	\$8,000	\$8,000
DOE	C3.2.4		CAFO Permit	\$180,000	\$180,000
DNR	C4.1.1		Forest Practices Adaptive Management Program Review	\$311,000	\$161,000
DNR	C4.1.2		Forest Practices Adaptive Management Program	\$3,617,100	\$1,109,000
DNR	C4.2.1		Risk Assessment of Small Forest Landowner Roads	\$207,000	\$207,000
DNR	C4.2.2		Accelerate Family Forest Fish Passage Program Implementation	\$13,500,000	\$13,500,000
WDFW	C4.2.3		Fish Passage Barriers	\$12,500,000	*
DNR	C4.2.4		Enhance RMAP Database	\$505,800	\$505,800
DNR	C4.2.5		RMAP Coordination with Federal Partners.	\$320,695	\$320,695
DOH	C5.1.1		Effective of OSS Rule	\$106,000	\$106,000
DOH	C5.1.2		OSS O&M Best Practices	\$387,000	\$387,000
DOH	C5.1.3		OSS Nitrogen Treatment Technologies	\$184,661	\$184,661
DOC	C5.1.4		Centralized Treatment Outside UGAs	\$65,000	\$65,000
SJC	C5.1.SJI4		San Juan County OSS Program	\$800,000	\$175,000
Kitsap C.	C5.1.WS7		West Sound OSS Repairs	\$1,000	\$1,000
Kitsap C.	C5.2.WS6		West Sound Sewer Feasibility	\$1,575,000	\$-
DOH	C5.3.1	Shellfish	Regional OSS Homeowner Loan Program	\$216,775	\$216,775
DOH	C5.3.2	Shellfish	Regional OSS Program Funding Source	\$195,000	\$195,000

**APPENDIX B**

**2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
DOH	C5.3.3		Funding Mechanism for Local OSS Programs	\$-	\$-
PSP	C6.2.1		Integrated Municipal Stormwater and Wastewater Plans	\$60,459	\$20,000
DOE	C6.4.1		Water Quality Standards Update	\$575,852	\$275,852
DOH	C7.1.1		Shellfish Best Practices Library	\$64,000	\$64,000
PSP	C7.1.2		Annual Evaluation of Shellfish Restoration Efforts	\$7,150	\$7,150
DOE	C7.1.3	Shellfish	Pollution Control Action Team	\$1,299,000	\$639,000
Kitsap C.	C7.2.WS13		West Sound Shellfish Gardening	\$15,000	\$-
DOE	C7.3.1		Aquaculture Shoreline Master Program Handbook	\$16,131	\$-
DOE	C7.3.2		Areas Suitable for Future Shellfish Aquaculture	\$232,947	\$32,947
DOE	C7.3.3	Shellfish	Shellfish Model Permitting Program	\$279,067	\$279,067
DOE	C7.3.4		Nitrogen Control Pilots Using Shellfish	\$1,000,000	\$1,000,000
Parks	C7.4.1		Shellfish Interpretive Programs and Events	\$251,000	\$59,000
WSG	C7.4.2		Shellfish Messages, Events, and Materials	\$14,000	\$14,000
DOE	C7.5.1		Point Source Dilution Analyses Modeling	\$351,779	\$351,779
DOH	C7.5.2		Expand Biotxin Monitoring	\$237,000	\$237,000
DOH	C7.5.3		Water Quality and Seasonal Harvest Restrictions	\$170,000	\$60,000
DOE	C7.5.4		Ocean Acidification Blue Ribbon Panel	\$47,300	\$47,300
DOE	C8.1.1		Traffic and Incident Trends	\$25,993	\$25,993
DOE	C8.1.2	Habitat	Evaluate Risk Assessments for Update Needs	\$103,817	\$103,817
SJ MRC	C8.1.SJI1		SJI Marine Manager Workshop	\$11,783	\$11,675
Strait ERN	C8.2.STRT2		Straits Spill Prevention, Preparedness, and Response	\$225,000	\$-
DOE	C8.3.1		WAC 173-182 Revision to Achieve Protection from Spills	\$145,418	\$145,418
DOE	C8.3.3		Increase Natural Resource Damage Assessment Values	\$-	\$-
WDFW	C8.3.4		Identify Species and Locations at Risk in Spills	\$300,000	*
IOSA	C8.3.SJI2		Island Oil Spill Association Spill Readiness and Response	\$250,000	\$4,180

**APPENDIX B****2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
DOE	C9.3.1		Freshwater Swimming Beach Program	\$6,045	\$6,045
DOE	C9.3.2		Correct Pollution Problems at Marine Beaches	\$241,663	\$241,663
DOH	C9.4.1	Shellfish	Pollution Identification and Correction Programs	\$4,668,462	\$4,668,642
HCCC	C9.4.HC3		Hood Canal PIC Program	\$242,950	\$88,700
Kitsap C.	C9.4.WS8		West Sound Septic System Repairs Using PIC	\$4,000	\$4,000
<b>C - Pollution Total (Rounded)</b>				<b>\$101,713,000</b>	<b>\$60,783,000</b>
PSP	D1.2.1		Establish Interim Milestones for Targets	\$75,400	\$75,400
PSP	D1.2.2		RCW 90.71.370(4)(b) Program Review	\$70,000	\$70,000
PSP	D1.2.3		Alignment with Strategic Initiatives	\$10,000	\$10,000
HCCC	D2.1.HC1		HCCC Integrated Watershed Management Plan	\$740,500	\$455,000
HCCC	D2.1.HC5		HCCC Climate Change Symposium	\$59,400	\$-
PSP	D2.2.1		Tribal Habitat Priorities	\$282,579	\$282,579
PSP	D3.2.1		Best Practices Forums	\$42,806	\$22,806
PSP	D4.1.1		Adaptive Framework and Cycle	\$100,000	\$103,053
PSP	D5.2.1		Strategic Social Marketing Frameworks	\$1,723,000	\$1,708,000
PSP	D5.3.1		BMPs for Stewardship and Tree Planting	\$617,000	\$613,000
PSP	D6.1.1	Stormwater	Phase 2 of Puget Sound Starts Here	\$1,028,000	\$1,003,000
PEI	D6.3.1		K-12 Curricula	\$480,000	\$480,000
PSP	D7.2.1		Behavior Change Program Guidance	\$12,000	\$12,000
PSP	D7.4.1		Citizen Action Training School	\$322,000	\$319,000
<b>D - Leadership Total (Rounded)</b>				<b>\$5,563,000</b>	<b>\$5,154,000</b>
PSP	E1.1.1		Puget Sound Recovery Act Passage	\$34,500	\$34,500
PSP	E1.1.2		Pacific Coast Salmon Recovery Funds	\$34,500	\$34,500

**APPENDIX B**

**2012 Action Agenda Near Term Action Estimates, All Owners**

<b>NTA Owner</b>	<b>NTA Number</b>	<b>Strategic Initiative</b>	<b>Near-Term Action Title</b>	<b>Total Cost Estimate (FY 2013, 2014 &amp; 2015)</b>	<b>Budget Estimate</b>
PSP	E1.2.1		Farm Bill and Water Quality	\$11,500	\$11,500
PSP	E1.2.2		DOD Readiness and Environmental Protection	\$13,206,437	\$10,206,500
PSP	E1.3.1		Stormwater Priorities	\$37,744	\$10,000
PSP	E1.3.2		Puget Sound Acquisition and Restoration Fund	\$363,928	\$363,928
PSP	E1.3.3		State Funding	\$80,000	\$80,000
PSP	E1.4.1		Local Funding Mechanism	\$50,000	\$30,000
PSP	E1.4.2		Rate study of Special Purpose Districts	\$40,000	\$40,000
PSP	E1.5.1		Coordination with Philanthropic Community	\$10,000	\$10,000
PSP	E1.6.1		Compensatory Mitigation Programs	\$15,000	\$10,000
<b>E - Funding Strategy Total (Rounded)</b>				<b>\$13,884,000</b>	<b>\$10,831,000</b>
<b>TOTAL 2012 ACTION AGENDA NTAs, ALL OWNERS</b>				<b>\$595,726,000</b>	<b>\$128,085,000</b>
<p>DOA - WA State Department of Agriculture; DOC - WA State Department of Commerce; DOE - WA State Department of Ecology; DOH - WA State Department of Health; DNR - WA State Department of Natural Resources; EFC - Elwha Fish Committee; EPA - Environmental Protection Agency; FEMA - Federal Emergency Management Agency; HCCC - Hood Canal Coordinating Council; IOSA - Islands Oil Spill Association; King C. - King County; Kitsap C. - Kitsap County; NOAA - National Oceanic and Atmospheric Administration; NOPL - North Olympic Peninsula Lead Entity; NWSF - Northwest Straits Foundation; PEI - Pacific Education Institute; PSI - Puget Sound Institute; PSP - Puget Sound Partnership; ECB - PSP Ecosystem Coordination Board; RCO - Recreation and Conservation Office (Invasive Species Council); SJC - San Juan County; SJC LE - San Juan County Lead Entity; SJ MRC - San Juan Marine Resources Committee; Strait ERN - Strait of Juan de Fuca Ecosystem Recovery Network; Strait Jurisdictions - Strait of Juan de Fuca local jurisdictions; Suquamish Tr. - Suquamish Tribe; Tulalip Tr. - Tulalip Tribe; WDFW - Washington Department of Fish and Wildlife; WSG - WA Sea Grant; WSDOT - WA State Department of Transportation; WSCC - WA State Conservation Commission; Parks - WA State Parks and Recreation Commission; WS LIO - West Sound Local Integrating Organization; WSWC - West Sound Watersheds Council</p>					
* Estimates not provided					
Note: Total cost estimates are based on the funding gap only for NTAs A6.1.STRT1, A6.1.STRT2, B1.2.STRT4, C2.2.STRT5 & C8.2.STRT2					
For more details about Near Term Actions please visit the Puget Sound Partnership website to download the 2012 Action Agenda at the following address: <a href="http://www.psp.wa.gov/action_agenda_2011_update_home.php">http://www.psp.wa.gov/action_agenda_2011_update_home.php</a>					





