

Restoring Puget Sound floodplains and estuaries

2021 Update

July 21, 2021



Leque Island restoration and surrounding farmland, Skagit River Delta, Spring 2020. Used with permission.

Habitat Strategic Initiative

Co-led by

**Washington Department of Fish and Wildlife
Washington Department of Natural Resources**

*Updated from the Implementation Strategy
developed in 2016 in collaboration with:*

Puget Sound Partnership

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Floodplains Interdisciplinary Team

Puget Sound Institute

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PUGET SOUND

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Summary:

The Floodplains and Estuaries Implementation Strategy describes the outcomes necessary to accelerate progress towards two Puget Sound Partnership Vital Sign indicator targets. It is a road map for aligning opportunities across agencies, programs, projects, and funding and to highlight the areas requiring the most attention to sustain and accelerate the progress achieved to-date. The Implementation Strategy identifies three strategies to increase and accelerate floodplains and estuaries habitat restoration: a Sound-wide strategy defining regional integrated management support; a river-basin strategy describing integrated planning and project implementation; and a risks and costs strategy defining the risk tolerance and cost subsidy framework and analyses to the advance regional and river-basin strategies.



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Executive Summary



Floodplains and estuaries are dynamic and diverse landscapes that extend from the uppermost river reaches to the intertidal mudflats and salt marshes at the mouths of rivers entering Puget Sound. These habitats provide critical connections between terrestrial and aquatic systems, linking freshwater and marine processes. They have also been integral to Native Americans' lives and cultural practices for millennia. Intact floodplains and estuaries provide invaluable ecosystem services including flood

damage mitigation, improved water quality, economically valuable farmlands, recreational opportunities, and critical habitat for a suite of flora and fauna.

Since 1900, ~60% of floodplain areas have been lost or impaired due to land conversion (ESA et al. 2019) while ~56% of Puget Sound's tidal wetland habitat in large river delta estuaries has been lost (Fresh et al. 2011). As population growth and associated development have continued to modify these habitats, the loss of ecosystem services has led to adverse consequences for our communities – culturally, economically, and with respect to food security and flood safety. With continued population growth anticipated, ambitious recovery targets and strategies are needed to protect and restore floodplains and estuaries for the benefit of all Puget Sound communities.

The Floodplains and Estuaries Implementation Strategy acknowledges that multiple community interests drive planning efforts to protect and restore these valuable habitats, and that an integrated management approach supports greater trust building and cooperation across these interests, ultimately accelerating recovery progress for the entire community.

What is an Implementation Strategy? The Floodplains and Estuaries Implementation Strategy describes the outcomes necessary to accelerate progress toward the Vital Sign (see

[Floodplains Vital Sign](#)

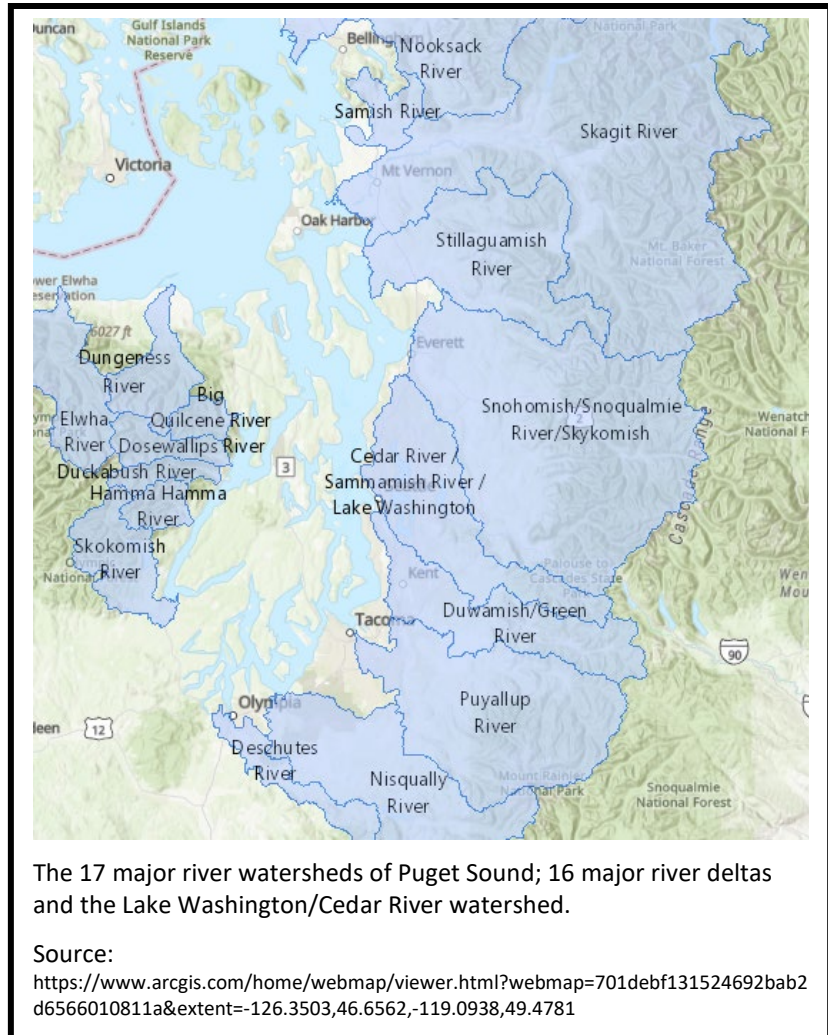
The Floodplains Vital Sign monitors the protection, loss, and restoration of functional floodplain areas in the 17 major rivers of Puget Sound in support of recovery planning, land use protection, and recovery investments.

[Estuaries Vital Sign](#)

The Estuaries Vital Sign tracks indicators of restoration in the 16 largest river delta estuaries in Puget Sound.

Learn more: [Partnership Vital Sign website](#)

inset box) indicator targets. This Implementation Strategy is a road map for aligning opportunities across agencies, programs, projects, and funding to highlight areas requiring the most attention to sustain and accelerate the progress achieved to-date. Implementation Strategies aim to ultimately increase the confidence and consensus of the entire Puget Sound recovery community in the collective approaches for success. To better highlight the interconnections across the planning processes for floodplains and estuaries, this Implementation Strategy presents the critical issues and strategies that had previously been described separately in the Floodplains Implementation Strategy (Partnership 2016) and the Estuaries Implementation Strategy (Partnership 2015). Considerations that are unique to either floodplains or estuaries habitats are highlighted as appropriate.



Goal The Implementation Strategy’s goal is to accelerate progress toward achieving the Floodplains and Estuaries Vital Sign restoration acreage indicator targets (Area of floodplains protected and restored; Area of estuarine wetlands restored to tidal flooding). By achieving these Vital Sign indicator targets, we expect restore processes that increase the acreage of functioning floodplains and estuaries for species and food webs, as well as restore critical ecosystems services that support our communities.

The 17 largest rivers and their associated river delta estuaries traverse a diverse Puget Sound human and natural landscape - including urban centers, agricultural communities, and upland forests. Historically, each of the largest rivers and river delta estuaries contributed to the overall floodplain and estuarine habitat in Puget Sound, although some had a larger footprint on the landscape than others. The interaction between the historic contribution of rivers and river deltas to habitat and the current landscape context has large implications for the scale and type

of restoration opportunity in each river basin. For example, Nooksack, Samish, Skagit, Stillaguamish, and Snohomish river delta estuaries comprised 80% of the historic tidal wetland area; agriculture is one of the major land uses in these areas. The scope for large acreage process-based restoration in these river delta estuaries may not be feasible in urban estuaries such as the Duwamish or Puyallup. However, development pressures in the associated floodplains of these agricultural river basins may reduce overall floodplain restoration opportunity as well as increase the overall constraints of the agricultural communities in these river basins to maintain viable farming communities.

Strategies Three strategies will help Puget Sound accelerate progress towards the Floodplains and Estuaries Vital Sign indicator restoration targets, building a crucial link between regional strategies and local implementation.

1. Sound-Wide Integrated Floodplain and Estuary Management	
Why this strategy?	What do we need to achieve the strategy?
Promotes a coordinated vision of integrated management of floodplains and estuaries, which enhances outcomes for fish populations, flood risk, and agricultural viability throughout Puget Sound.	• Communicate benefits of integrated management to build public support and political will. • Develop a Sound-wide integrated management vision that mobilizes financial resources. • Develop and provide capacity to a network of regional and local practitioners to build opportunities for coordination and shared learning. • Develop Sound-wide integrated management goals and metrics to track and communicate progress across watersheds. • Address regulatory and permitting process barriers through Sound-wide forums. • Refine Sound-wide goals and approach based on lessons learned.

2. River-Basin Scale Planning and Project Implementation	
Why this strategy?	What do we need to achieve the strategy?
Supports communities to develop and implement restoration and protection plans which address local needs and goals within an integrated floodplain management system.	• Enhance understanding of floodplain and estuarine processes, including future projections, to inform reach-scale project prioritization and design. • Address challenges for integrated planning across land uses. • Highlight locally-relevant benefits and challenges of integrated management. • Enable diverse communities to engage in integrated management forums. • River-basin integrated planning efforts consider diverse community needs when identifying restoration and protection priorities. • Implement integrated reach-scale plans. • Refine river-basin planning approaches based on lessons learned.

3. Risk Tolerance and Cost Subsidies Analyses	
Why this strategy?	What do we need to achieve the strategy?
Incorporating risk tolerance and cost subsidy analyses will reduce development within floodplains and estuary habitats, prioritize the best areas for the purchase of development rights, and determine the long-term costs of development within floodplains and estuaries.	• Make available hazard risk tolerance and cost subsidy data and results to improve planning and permitting decisions in an integrated management context • Improve prioritization of land uses and emergency preparedness in flood-prone areas through outreach to public and decision-makers. • Risk tolerance and cost subsidy data and results inform adaptive management of regulatory and permitting decisions. • Improve river-basin scale planning using risk tolerance and cost subsidy analyses.

Research The 2021 update of the Floodplain and Estuaries Implementation Strategy does not re-evaluate research needs identified in the initial Implementation Strategies development (Partnership 2015, Partnership 2016). These initial priority research needs focused on both natural and social science questions to improve on-the-ground restoration practices, support strategic planning and integrated management approaches, and improve stakeholder engagement and support for restoration. These research needs are documented in the [Grand Uncertainties Matrix](#). Since the initial identification of these research needs, there has been substantial progress made in addressing many of the questions in either individual river basins or on the Puget Sound-Wide scale, while other questions have been left un-addressed. A recent Nearshore Summit (March 2021) and upcoming Proceedings will inform an update on the status of many of these research questions and identify ongoing and new areas of research to improve restoration planning and outcomes. Future adaptive management of the Implementation Strategy will evaluate the past research needs in the context of the Summit proceedings and other syntheses of the best-available science.

Climate change Both floodplains and estuaries are expected to be affected by climate change driven alterations to streamflow including decreases in low flows, declining snowpack, and higher peak flows (Mauger and Vogel 2020). Other primary impacts on estuaries include sea level rise, changes in sediment delivery and transport, and increased water temperature (Mauger and Vogel 2020). Future adaptive management of the Implementation Strategy should include strategy-specific assessment to enhance climate resiliency and incorporate the substantial progress made in regionally specific datasets, locally downscaled projections, and planning guidance at the regional, basin, and site scales.

Implementation and Partners Achieving the outcomes described in the Implementation Strategy will require the ongoing and coordinated efforts of partners throughout the Puget Sound region. The current efforts of local, state, and federal governments, tribes, NGOs, Conservation Districts, and restoration and recovery groups are crucial to achieving the

Strategy's goal. Throughout this Implementation Strategy, there is a strong theme of consistent, standardized, and transparent decisions, coordination, and communication that will better allow individual organizations and agencies to collectively assess the causes and consequences of our actions for Puget Sound floodplains and estuaries. The Habitat Strategic Initiative has supported strategy implementation through grant funding, staff capacity, and communication.

Adaptively managing the strategy Adaptive management—the process of continuous improvement based on new data, analysis, and learning—forms the basis for planning, implementing and improving Puget Sound recovery. The Habitat Strategic Initiative, in collaboration with partners will provide a regular opportunity to highlight new information that is vital to the strategy and determine if the regional planning community (or the Habitat Strategic Initiative) should make any changes to the strategy. The Habitat Strategic Initiative will collaborate with the Puget Sound Partnership and other partners on developing appropriate performance measures to inform adaptive management. It is not expected that progress made toward achieving strategy priorities will show immediate signal in the Vital Sign indicator target tracking data. However, the tracking of accomplishments and outcomes of work related to each the strategies will help inform the evaluation of overall Implementation Strategy progress and updated needs. Taking time to reflect on and evaluate the effectiveness of the strategies identified is a critical step to ensuring that our actions continue to target the most relevant barriers to progress.

1. Overview and Context

Floodplains and estuaries form diverse habitat types including riparian forests, wetlands, river channels, salt marshes, and eelgrass beds. The floodplain and estuary habitat continuum provides rearing and refuge areas for endangered Chinook salmon (US Endangered Species Act), an important species to generations of tribes and Southern Resident Orca.

Floodplains are low-lying areas adjacent to rivers that can be inundated by flood water or channel migration, including the main tributaries to the main river channel (as mapped by FEMA and USGS). Estuaries form where rivers meet the sea, slow down, and deposit their sediment loads. In this transitional zone between fresh and saltwater, tides interact with river flows, and distinctive habitats with steep salinity gradients form along low elevation.

Puget Sound's 17 largest rivers historically had more than 450,000 acres of floodplain habitat (ESA et al. 2019) while their associated 16 large-river delta estuaries had over 100,000 acres of tidal wetland habitat (Simenstad et al. 2011). Ten of these rivers drain from the Cascade Mountains to the east while seven drain from the Olympic Mountains to the west (Figure 1). Over half of the mapped floodplain extent in 2011 was within three watersheds: Nooksack, Skagit, and Snohomish/Snoqualmie/ Skykomish (ESA et al. 2019). Similarly, when looking only at the large river delta estuaries, the five estuaries of North Puget Sound (Nooksack, Samish, Skagit, Stillaguamish and Snohomish) historically made up over 80 percent of the tidal wetland habitat, with the 'great swamps' of the Skagit and Snohomish contributing over half of the total historical vegetated area (~37,000 acres) (Simenstad et al. 2011).

Estuaries are hotspots of productivity and biodiversity are continually resupplied with nutrients and new sediment deposits that support rich food webs. Many marine organisms, including commercially important species of fish and invertebrates, use estuaries as juvenile nursery and rearing habitat (Hughes et al. 2014). For example, out-migrating juvenile salmon pause to rest and grow in the sheltered waters. Estuaries also provide vital resources for migratory birds that stop to rest and re-fuel (Buchanan 2006).

Definitions

Connectivity = unrestricted movement of water, biota, sediment, wood, and other materials

Ecosystem Service = benefit to humans provided by functional and connected floodplains and estuaries

River Delta Estuary = tidally-influenced habitats formed where freshwater from rivers and streams mixes with saltwater from Puget Sound

Floodplain = A low-lying area adjacent to a river channel or estuarine embayment that can be inundated by flood water or subject to channel migration (Partnership 2016)

Hydrogeomorphology = study of the linkage of hydrologic processes with landforms or earth materials, and the interaction of geomorphic processes with surface and subsurface water

Indicator = Specific and measurable metrics for Vital Signs (Partnership)

Riparian = interface between land and a watercourse or water body characterized by hydrophilic vegetation

Vital Sign = Measures of ecosystem health and progress towards Puget Sound recovery goals (Partnership Vital Signs website)

Floodplains and estuaries have been integral to Native Americans' lives and cultural practices for millennia. The abundant resources and ease of transport along rivers also attracted European settlers in the 1800s. Floodplains and estuaries support the Puget Sound region's richest farmlands, as well as culturally and economically significant fishing and hunting.

Over the years, riverbanks have been channelized and hardened, and estuaries have been diked and filled in to serve the needs of growing towns, industries, and agriculture. The natural meandering and flooding of the rivers, which spread nutrient-rich soils on adjacent lands, were controlled with dikes and levees. Dams and tidegates further control water flow, and culverts associated with roads and railways impede fish passage.

Since the early 1900s, 60% of floodplain areas have been lost or impaired due to land conversion (ESA et al. 2019), resulting in over 280,000 acres of degraded floodplain habitat (ESA et al. 2019). Floodplain degradation has not been equal across all of the large river systems. Many of the rivers draining from the Olympic Mountains have larger proportions of function floodplain area remaining while the greatest proportional degradation has occurred in the Duwamish and the Samish (ESA et al. 2019).

Over the same time period, about 56% of Puget Sound's tidal wetland habitat in large river delta estuaries has been lost and the shoreline of these river delta estuaries has been severely simplified with a ~26.6% decrease in length (Fresh et al. 2011). Estuary habitat loss over the past 150 years has not been uniform. The greatest declines have been in two types of vegetated tidal wetlands: areas of consistent low salinity (oligohaline transition, 98.5% loss) and tidal freshwater zones (90.2% loss) (Simenstad et al. 2011, Figure 2). The large river deltas in North Puget Sound have experienced the greatest total areas of tidal wetlands while the most developed estuaries, such as the Duwamish and Puyallup in Central Puget Sound, have little remaining estuarine habitat.

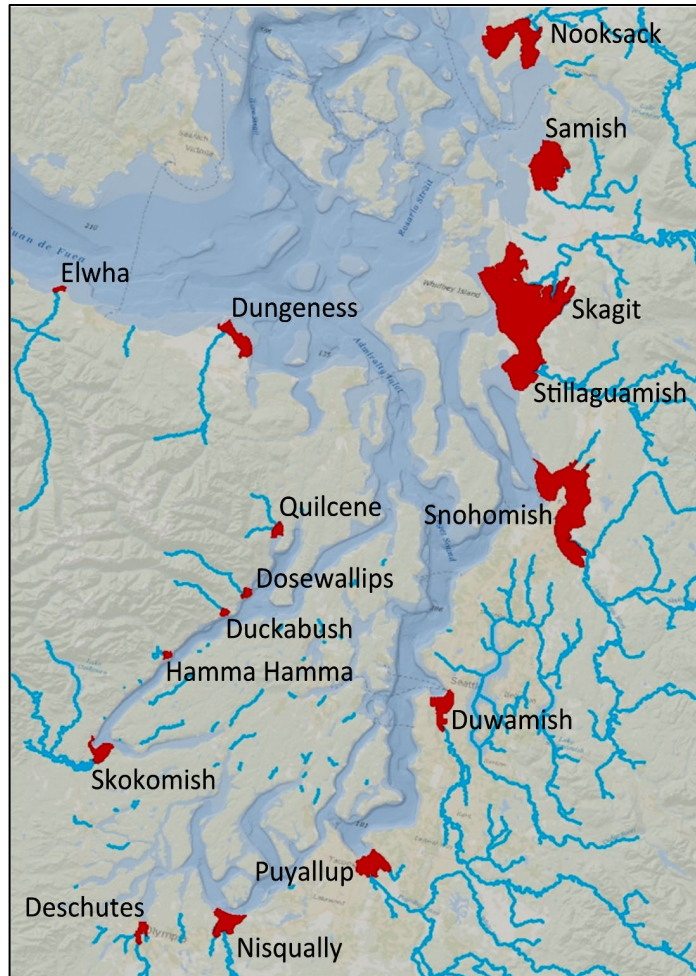


Figure 1. Historical footprints of Puget Sound's 17 large rivers and 16 large river delta estuaries (Simenstad et al. 2011)

Today, healthy floodplains protect ~\$18 million dollars of residential, commercial, and industrial development and infrastructure from floods (Floodplains by Design 2016). An estimated \$7.7M – \$1.1B in estuary ecosystem services value have been lost annually due to land conversion (based upon valuation by Molner et al. 2012 and areal loss determined by Simenstad et al. 2011). The conversion of working or open lands to residential development results in a net loss of revenue (\$0.16) when factoring in the provision of public services needed to accommodate rural residential development. Conversely, working or open lands yield a net revenue of \$0.65 with costs of \$0.35 for every dollar of revenue raised to provide public services on those lands (American Farmland Trust, August 2010). Farmland offsets the financial shortfall created by residential development through the provision of public services needed to support residential development (American Farmland Trust 2010). This net financial loss is further exacerbated by the costs of flood infrastructure needed to protect residential development in the floodplain.

Floodplain and estuary functions and services are irreplaceable, and are disproportionate in scope and scale to the size of the area they occupy, warranting greater attention and careful management. The

Floodplains and Estuaries Implementation Strategy builds on the lessons learned from past management approaches which exacerbated conflicts over competing interests for the use of these lands. The Implementation Strategy acknowledges that multiple community interests drive planning efforts to protect and restore these valuable habitats, and that an integrated management approach supports greater trust building and cooperation across these interests, ultimately accelerating recovery progress for the entire community.

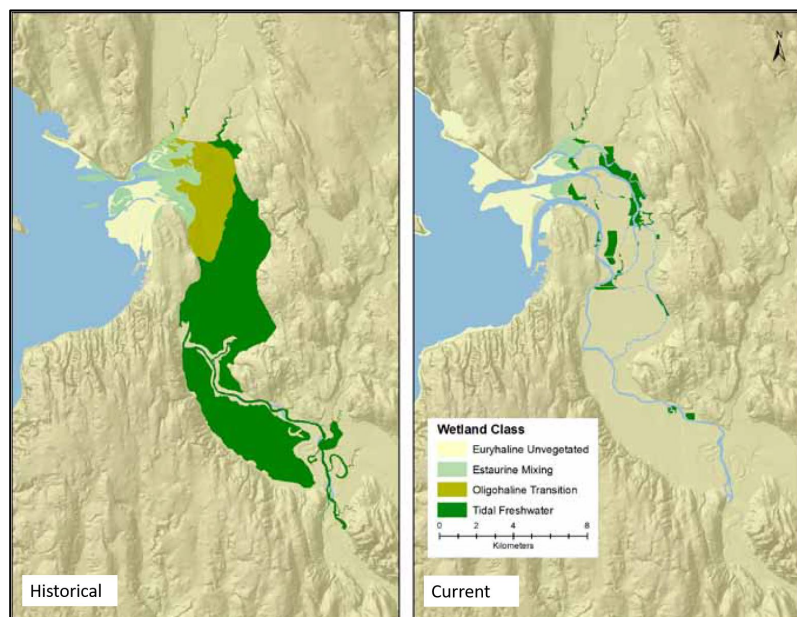


Figure 2. Estuary habitat loss in the Snohomish River delta (from Simenstad et al. 2011).

1.1 Purpose of this document

This document describes the Floodplains and Estuaries Vital Sign Implementation Strategy for two restoration indicators and the regional outcomes necessary to accelerate progress towards the Vital Sign recovery target. It is intended to be a road map for aligning opportunities across agencies, programs, projects, and funding and to highlight the areas requiring the most attention to sustain the progress achieved to-date. Implementation Strategies are the

framework for adaptively managing Puget Sound recovery. The initial Estuaries Implementation Strategy (Partnership 2015) and initial Floodplains Implementation Strategy (Partnership 2016) describe the processes for generating the strategies and supporting information presented in this document.

1.2 History of the pressures affecting floodplains and estuaries

The systems of freshwater and marine levees, tidegates, and floodgates are a major pressure on the function of these large river systems. Channelization and bank stabilization are additional sources of pressure on ecosystem function. Impacts from invasive species, and degraded water quality from marine industry and agricultural run-off, also affects the quality of the habitat. These pressures have largely been driven by population growth and different land use pressures over time. Through the early 1900s, in some of the largest river deltas, conversion to farmland occurred early (primarily before the mid-twentieth century). The pace of development has been low for at least two decades (Bartz et al. 2015). The current urban deltas were also converted relatively early on with industrialization pressures.

In floodplains, ongoing demand for floodplain development, combined with the cumulative effects of historical growth patterns, continue to degrade floodplain habitat throughout the Puget Sound. Population growth in the central Puget Sound region is expected to grow from 4.0 million residents in 2017 to 5.8 million residents by 2050 (Puget Sound Regional Council 2020). Accordingly, the number of households is expected to increase by 830,000 by 2050. As population and associated pressures on floodplains continue to grow, agricultural lands are at risk of conversion to rural residential development affecting agricultural viability and restoration opportunity.

Both floodplains and estuaries are expected to be affected by climate change driven alterations to streamflow including decreases in low flows, declining snowpack, and higher peak flows (Mauger and Vogel 2020). Other primary impacts on estuaries include sea level rise, changes in sediment delivery and transport, and increased water temperature (Mauger and Vogel 2020).

1.3 Managing Puget Sound floodplains and estuaries

- **Growth Management Act (GMA)** was authorized in 1990 (RCW 36.70A) to address land use planning and accommodate growth. It requires that the fastest-growing cities and counties complete comprehensive plans and development regulations to guide future growth. All jurisdictions are required to protect critical environmental areas and conserve natural resource lands, such as farms and forests.
- In the Revised Code of Washington **Diking and Drainage (Title 85), Flood Control (Title 86), and Irrigation (Title 87)** are three key areas of legislation which guide the management and funding frameworks for activities within the large river basins. This include the establishment of Flood Control Districts (RCW 86.09) and Flood Control by Counties (RCW 86.12). For example, RCW 86.12.200 Flood Control by Counties gives local County legislative body the authority to adopt a comprehensive flood control management plan for each drainage basin. Two other chapters address the state role in

flood control including Floodplain Management (86.16) and State participation in flood control maintenance (RCW 86.26).

- **National Flood Insurance Program (NFIP)** is a federal program that provides flood insurance to homeowners and property owners under the Federal Emergency Management Agency (FEMA). Local governments are responsible for managing development in floodplains under the NFIP. The Federal Emergency Management Agency (FEMA) received a National Marine Fisheries Service (NMFS) Biological Opinion (BiOp) in 2008 on the impacts of the NFIP on Endangered Species Act (ESA)-listed species.
- **Shoreline Management Act (SMA)** and Shoreline Master Programs (SMP). The SMA (RCW 90.58) was originally passed in 1971 and adopted by voters in 1972. It applies to all local jurisdictions with “shorelines of the state” (RCW 90.58.030(2)) and requires that local jurisdictions develop SMPs which are reviewed and supported by the Washington Department of Ecology (Ecology). Major updates to the SMA statute and associated rules for local SMPs were completed in 2003 and jurisdictions were also directed to comprehensively update their SMPs to meet the new requirements.
- **Hydraulic Code.** Since 1943, the Washington State Hydraulic Code Statute (RCW 77.55) has required anyone planning certain construction projects or activities in or near state waters to obtain a permit.
- **Clean Water Act** establishes the basic structure for regulations discharges of pollutants into the waters of the United States and regulating quality standards for surface waters. Section 404 of the Clean Water Act (CWA) is administered by the US Army Corps of Engineers (USACE) to regulate the discharge of dredged or fill material into the waters of the United States. The state (Ecology) carries out other Clean Water Act administration, including water quality permitting, water quality improvement projects, and clean water financial assistance (Section 401). The state also maintains a [database of polluted waters](#) (Section 303d), which is part of the water quality assessment process to track how clean rivers, lakes, and marine water bodies are in Washington.

1.4 Ecosystem impacts

The [Puget Sound Nearshore Ecosystem Restoration Project](#) (PSNERP) provided a foundational conceptual framework to understand the ecosystem consequences of human-directed modifications to ecosystem processes, structures, and functions in Puget Sound (Clancy et al. 2009; Schlenger et al. 2011). While PSNERP research focused on the nearshore and does not encompass the entire river basin the conceptual approach is broadly applicable.

Processes: Levees, tidegates and floodgates prevent the flow of sediment, debris, and water in estuaries and floodplains. Channelization and bank stabilization reduce the movement of sediment and alter the hydrologic properties of tidal and riverine systems. The effects of these pressures on ecosystem processes are likely to be exacerbated by changing climate conditions.

Structure: Floodplain and estuary ecosystems have lost much of the structural complexity, that supports ecosystem function, through channelization and bank stabilizations, or armoring. In the river delta estuaries, the loss of complexity is indicated by a 26% decrease in shoreline length (Fresh et al. 2019). Habitat structure provided by vegetation has also been heavily impacted by

reduction in tidal flow and land conversion. Temperature, salinity, and velocity are also all structural features that are altered through process changes. Invasive species may alter the structure of habitats. For example, the aquatic grass *Spartina alterniflora* converts open mud feeding habitats of shorebirds into high intertidal vegetated salt marsh, altering the hydrology, structure, and function of wetlands.

Function: The fragmentation and loss of floodplain and estuary habitat has had negative impacts on a suite of ecosystem services, including flood damage mitigation, improved water quality, economically valuable farmlands, and recreational opportunities. These areas are also critical habitats for a suite of flora and fauna, including for Chinook salmon rearing and survival (Fresh et al. 2006). Loss of estuary habitat has also negatively affected more than 30 species of shore birds that migrate through the Puget Sound (Fresh et al. 2011). Invasive species, such as the European Green Crab *Carcinus maenas*, may out-compete native species, including rare and endangered species, reducing biodiversity and ecology functions.

1.5 Existing approaches to restoring floodplains and estuaries

Identifying and reconnecting floodplain areas, including full restoration through bank hardening removal, infrastructure relocation, and other methods benefit downstream communities and estuaries. In some cases, to restore sediment dynamics and stream flow regimes, extreme restoration methods such as dam removal may be necessary. Tidal inundation, in both marine and freshwater zones, is required to recover estuarine and freshwater tidal habitat. In the large agricultural estuaries, this entails modifying drainage infrastructure, altering the operating regimes of tide gates and floodgates, and removing, breaching, or setting back physical structures (levees) built to prevent inundation. In urban estuaries, removing fill prior to habitat restoration is the primary approach. These engineering and landscaping interventions are well understood, but they are costly (Cereghino 2015), and can proceed only if landowners and the communities are in agreement.

2. Vital Sign indicators status

Recognition of the socio-economic and ecosystem impacts caused by large-scale conversion of the Puget Sound floodplains and estuaries prompted efforts to track recovery progress toward recovery of these critical habitats (Mulvihill-Kuntz et al. 2011). The following sections describe the extent and location of degraded floodplains and estuaries in Puget Sound, how changes are tracked in total acreage, and opportunities to address limitations of the current indicators.

On June 10, 2020, the Puget Sound Partnership's Leadership Council approved revisions to the Puget Sound Vital Signs and indicators. The revised Vital Signs and their indicators help set a new course for the 2022-2026 Action Agenda.

Floodplains Vital Sign

Restoration of floodplains indicator 2020 Target

- 42,386 acres of functionally-impaired floodplains restored basin-wide which is 15% of total estimated restoration need.
- [See the most up-to-date reporting](#) on the Vital Signs website

Estuaries Vital Sign

Areas of estuarine wetlands restored to tidal flooding 2020 Target

- 7,380 quality acres of estuarine wetlands are restored basin-wide, which is 20% of total estimated restoration need.
- See the [most up-to-date reporting](#) on the Vital Signs website

Learn more: [Partnership Vital Signs website](#)

2.1 Vital Sign indicators and 2020 recovery targets

This Implementation Strategy was developed to address two currently tracked Vital Sign indicators: "Restoration of floodplains" and "Areas of estuarine wetlands restored to tidal flooding" The Floodplains Vital Sign indicator monitors the protection, loss, and restoration of functional floodplain areas in the 17 major rivers of Puget Sound in support of recovery planning, land use protection, and recovery investments. The Estuaries Vital Sign indicator is the area of estuarine wetlands restored to tidal flooding in Puget Sound's 16 largest river deltas (Figure 1) associated with those 17 major rivers.

The Floodplain Vital Sign and the Estuaries Vital Sign each have a second indicator which is not currently tracked and were not the focus of the Implementation Strategy.

The 2020 recovery targets recommended by Target Setting Team and adopted in 2011 are shown in the inset box. The Puget Sound Partnership [Vital Signs website](#) includes more detail on the indicator definitions, data, and methodology.

2.2 Indicator status and trends: Restoration progress

2.2.1 Floodplains

At the time of this 2021 update, an estimated 8,162 acres of degraded floodplain areas have been improved or restored through 188 improvement projects (Figure 3), approximately 19% of the 2020 target acreage. These results are based upon an improved methodology for assessing floodplain conditions and defining the indicator protocols (ESA et al. 2019). Additional details on

status and methodology is available on the Partnership Vital Signs website (<https://www.pugetsoundinfo.wa.gov/ProgressMeasure/Detail/13/VitalSigns>).

2.2.2 Estuaries

The area recovered in the 16 larger river delta estuaries from 2006-2020 is 3,430 acres, or about 46% of the 2020 indicator target (Figure 4, <https://vitalsigns.pugetsoundinfo.wa.gov/VitalSignIndicator/Detail/11>). These results reflect using a new, standardized method to delineate estuary restoration (Ramirez 2019) which eliminated inconsistencies in the project tracking. Further discussion on the progress towards the indicator target and details regarding the data can be found on the Partnership Vital Signs website (<https://www.pugetsoundinfo.wa.gov/ProgressMeasure/Detail/11/VitalSigns>)

2.3 Improving indicators and targets

The Puget Sound Partnership has recently facilitated a Vital Sign Revision process to evaluate the biophysical Vital Signs and indicators beyond 2020 (McManus et al. 2020). Both the Floodplains and Estuaries Vital Sign indicators will carry forward and the Partnership will identify needs and next steps for indicators over the coming year.

3. Goal and strategies

3.1 Goal

The goal of this Implementation Strategy is to accelerate regional progress towards the Floodplains and Estuaries Vital Sign Indicator Targets: increasing functional acreage of floodplains and associated river delta estuaries. Progress toward the targets help to restore critical ecosystem services in support of human well-being (cultural, economic, and flood safety) and ecological productivity and diversity. The benefits of an integrated management approach need to be communicated and understood through these multiple lenses to build political and community support for restoration and protection efforts. Reconnecting degraded floodplains and restoring tidal wetlands will also improve resiliency to anticipated climate change stressors. Reducing impacts of flooding reduces long-term response and buy-out costs, improves quality of life for residents and therefore also reduces barriers to public support for restoration.

3.2 Strategies

The following three strategies will support the Puget Sound recovery community's efforts to accelerate progress towards the Floodplains and Estuaries Vital Sign Indicator Targets.

- **Sound-Wide Strategy: Sound-Wide Integrated Management Support** – Promotes a coordinated vision of integrated management of floodplains and estuaries, which enhances outcomes for fish populations, flood risk, and agricultural viability throughout Puget Sound. ([Section 3.3](#))
- **River-Basin Strategy: River Basin-Scale Integrated Planning and Project Implementation** – Supports communities to develop and implement restoration and

protection plans which address local needs and goals within an integrated floodplain management system. ([Section 3.4](#))

- **Risks and Costs Strategy: Risk Tolerance and Cost Subsidy Analyses** – Highlights the opportunities to incorporate the flood hazard risks and long-term costs of development into land-use planning in floodplain and estuary habitats, which will dis-incentive development, prioritize the best areas for the purchase of development rights, and determine the long-term costs of conversion. ([Section 3.5](#))

Each strategy section details the key barriers addressed, the desired outcome, example actions and research to support achieving the outcome. The relationship amongst the strategies is described in Section 3.2.1, and the alignment of the Floodplain and Estuaries strategies with other Implementation Strategies is described in Section 5.6.

Section 3.2.1 Relationship between strategies

In combination, these three strategies advance a comprehensive integrated management system throughout Puget Sound, through coordinated watershed and regional efforts. Implementation of the Sound-wide and River-Basin Strategies are strengthened by targeted economic analyses (Risk Tolerance and Cost Subsidy Analyses). The Sound-wide Strategy provides the guiding vision that will connect and leverage the outcomes of the River-Basin Strategy, and provides the context for evaluating overall progress. The River-Basin Strategy describes the watershed and reach-scale planning processes that occur within a river basin to achieve the integrated management principles appropriate to a geography.

3.2.2 Strategy summaries

Summaries of each strategy include:

- **Introduction:** What is this strategy about and why is it important?
- **Key needs identified:** What are the highest priority needs this strategy must address to accelerate protection and restoration of Floodplains and Estuaries?
- **Strategy Description:** What are the key regional priorities and outcomes needed to meet these challenges? What actions are needed to achieve these outcomes and by whom?
- **Near-term priority outcomes:** What priority outcomes should be achieved in the next two to four years to accelerate progress? What are some examples of the actions and research needed to achieve these outcomes?
- **Longer-term priorities:** What would be strategic to start now to realize maximum benefits in the coming decades?
- **Research Needs:** What research needs have been identified that would enhance our understanding of floodplains and their related estuaries and accelerate implementation of this strategy?
- **Climate vulnerabilities:** What kind of actions will reduce the strategy's vulnerability, increase resilience to predicted negative impacts, and support adaptation decision making and implementation? Will more frequent storm surge or sea level rise (for example) alter the strategy success?

- **LIO priority alignment:** How does this strategy align with priorities identified by Local Integrating Organizations (LIOs)?
- **Adaptively managing the strategy:** How should the region adaptively manage the strategy over time? What should we monitor to evaluate the strategy success, especially the near-term priority outcomes?

The processes for developing the initial Implementation Strategies are described in their respective narratives (Partnership 2015, Partnership 2016). The [Habitat Strategic Initiative Implementation Strategy Work Plan 2020-2021](#) describes the scope and process for the 2021 Status Update.

For readers interested in additional detail and background, additional resources include:

- i) **Results chain:** The sequence of outcomes that represent the strategy successfully making progress towards the indicator target. These are currently available for each of the Implementation Strategies as they were initially developed individually. These results chains were the basis for this 2021 update to develop a cohesive Floodplains and Estuaries Implementation Strategy. Future adaptive management will integrate and update the results chains. [Floodplains 2016 Results Chains](#). [Estuaries 2015 Results chains](#).
- ii) **Action table:** Proposed actions to achieve outcomes identified in the results chains. In addition to proposed new actions, the table includes completed projects to reference as models or guidance as well as ongoing projects (*may be developed in the future*).
- iii) **Ongoing programs** are an essential component of the ongoing work and recent progress made in the region that are reviewed in a Base Program Analysis (*may be developed in the future*).

3.3 Sound-Wide Strategy: Sound-Wide Integrated Management Support

The Sound-wide Strategy focuses on developing and maintaining an overarching framework to promote and implement an integrated management approach throughout the Puget Sound region. This strategy is grounded in the principle that progress toward protecting and restoring floodplain and estuary habitats is achieved most effectively with broad community buy-in and political support. Developing a regional vision through coordination across watersheds amplifies shared learning and networking, enables more efficient fund management, and provides support to practitioners at the river-basin scale. Collaborations of practitioners operating at multiple geographic scales through partner networks is a crucial component of this strategy to create a shared vision, with goals and metrics to measure progress.

3.3.1 Key barriers addressed

The Sound-wide Strategy advances protection and restoration efforts across the region by addressing key barriers. There are competing community dependencies on floodplain and estuary habitats (including salmon fishing, agriculture, and residential and commercial infrastructure flood protection) which create social conflict. This emerges from a management system for floodplains and estuaries that had historically been focused primarily on reducing

flood risk and creating efficient water delivery/drainage. As a result of disconnected management practices between flood risk, drainage, and restoration and protection, complex permitting processes are overseen by multiple agencies and jurisdictions. Likewise, many funding programs supporting management actions in floodplains and estuaries do not incentivize integrated management approaches.

3.3.2 Strategy description

- **Communicate benefits of integrated management to build public support and political will.** Broad public and political support are critical to establish integrated management approaches within and across watersheds (Cereghino 2015). This includes understanding the advantages of an integrated approach and communicating the ecological and economic trade-offs with respect to flood risks to property and public safety. Climate change and population growth are expected to further exacerbate impacts to salmon habitat, agricultural viability, and flood risks, underscoring the need to pursue collaborative solutions. The UW Climate Impacts Group has been working with integrated management groups around Puget Sound (including Pierce, Snohomish, and Whatcom counties) to raise awareness about climate change, identify key impacts to habitat, synthesize the relevant science, and coordinate priorities for new science.
- **Develop a regional integrated management vision that mobilizes financial resources.** Watershed-scale integrated management efforts require substantial time and financial investment for planning and project implementation to be successful. Developing a regional vision that defines integrated management objectives in clear terms provides the foundation for regional funding opportunities to align and advance this approach.

In 2013, the Washington Department of Ecology partnered with The Nature Conservancy and the Puget Sound Partnership to initiate the development of a state-funded capital grant program, called Floodplains by Design, focused on reducing flood risks and restoring floodplain habitat (Washington Department of Ecology 2019). With further investments from the National Estuary Program Habitat Strategic Initiative, The Nature Conservancy convened practitioner workshops and shared-learning events, worked toward building a strategic vision and a strong network in support of integrated management. In 2018, the Floodplains by Design partnership produced a vision and guidance document, highlighting ten elements of integration and the cyclical but expanding nature of integrated floodplain management in practice (The Nature Conservancy et al. 2018).

- **Develop and provide capacity to a network of regional and local practitioners to build opportunities for coordination and shared learning.** The visioning and implementation of integrated management approaches in Puget Sound is still relatively new. Practitioners are learning how to use the best-available science and latest tools to support productive planning processes and project designs. Regional and river-basin practitioners can harness the collective knowledge and skills across all watersheds by building a regional support network. Coordination across the network will amplify shared learning and networking, provide support to practitioners at the river-basin scale, and refine regional integrated management principles and objectives.

The Floodplains by Design network is made up of more than 700 floodplain practitioners throughout Washington State and beyond, providing a powerful forum in support of integrated management for the Puget Sound region. For example, the Floodplains by Design network has several active working groups to support network members in some of the most impactful topics for integrated floodplain and estuary management. One working group focuses on the culture and capacity of integrated management practitioners and sharing best practices to increase capacity of those working to improve the system. Over the course of a year, the Culture and Capacity working group hosted multiple peer-learning sessions to support the practitioners that were working to translate their integrated management work to a virtual platform. This led to improved coordination among the network as well as improved coordination for practitioners in the working group to apply to their own teams.

- **Develop regional integrated management goals and metrics to track and communicate progress across watersheds.** Identifying shared goals and metrics across watersheds, including climate resilience metrics, is needed to track regional progress and to communicate collective accomplishments. By using common metrics, project outcomes can be more effectively aggregated to showcase progress toward diverse goals. In addition, funding programs can reduce reporting burden on grantees, and improve the relevance to integrated management, by adopting the shared network goals and metrics. Using regional metrics in project planning will also encourage local and regional leaders to support large-scale actions that will result in more substantial progress toward the goals. Currently, different funding sources and permit types require different metrics tracked at the project scale. For example, the Floodplains by Design grant program tracks metrics that are relevant to habitat area and function, as well as socio-economic improvements (e.g. number of people with reduced flood risk, number of jobs touched, area of farmland acquired and preserved for agricultural use), which reflect the multiple goals of integrated management. Other grant programs, including the Washington State Recreation and Conservation Office (RCO) tracks several metrics associated with restoration projects through PRISM – the online system that is used for applying, selecting, and managing projects for multiple state funded capital restoration programs.
- **Address regulatory and permitting process barriers through Sound-wide forums.** Reducing permit application complexity and processing time would support greater buy-in into the design and implementation of restoration and protection plans. Many regulatory agencies may have jurisdiction over a specific project or area, each with different and potentially conflicting mandates. Some regulatory and permitting frameworks incentivize residential and commercial development rather than restoration or protection. The Risks and Costs Strategy (see Section 3.5) and the [Land Development and Cover Implementation Strategy](#) identifies approaches to addressing this barrier.
- **Refine Sound-wide goals and approach based on lessons learned.** The Sound-wide Strategy approaches work holistically to create the regional conditions that will buoy river-basin scale integrated management efforts (see section 3.4), including reach-scale prioritization and planning, and project implementation. The successes and collective lessons learned from

these efforts will inform adaptive management of the regional vision, goals, and metrics. Through targeted dialogue within the network of practitioners, and by examining progress measures, opportunities for program efficiencies will be developed and additional barriers that need to be addressed will be identified. The Floodplains by Design Culture and Capacity Workgroup

3.3.3 Example actions

Example actions to advance this strategy are found in the following 2018-2022 Action Agenda Regional Priority Approaches for Floodplains and Estuaries

(<https://actionagenda.pugetsoundinfo.wa.gov/ProgramInfo/Taxonomy>):

- 1.1: Gain a better understanding of current floodplain and estuary habitat
- 1.2: Increase understanding of social, economic, and political factors affecting floodplain and estuary habitat
- 1.3: Increase understanding of floodplain and estuary habitat change due to climate change and population growth
- 1.4: Increase understanding of future social, economic, and political factors affecting floodplain and estuary habitat
- 1.5: Increase staff capacity for planning, implementation, and enforcement related to floodplains and estuaries
- 2.1: Collaborative, multi-benefit groups develop prioritized restoration/protection plans for floodplains and estuaries
- 2.2: Address barriers to improve floodplain and estuary implementation plans, policies, and regulations
- 3.1: Develop and implement outreach, education, and or/incentive programs related to floodplain and estuary habitat
- 3.4: Collect and analyze data to adaptively manage floodplain and estuary recovery practices

Future adaptive management may identify near-term priority outcomes for a specific time period and examples actions to achieve those near-term priorities.

3.3.4 LIO priority alignment

The 2022-2026 Action Agenda development process will elicit updated information on the alignment between Action Agenda outcomes and strategies identified from the Implementation Strategies with LIO priorities and ecosystem recovery plans (*some in the process of undergoing updates*).

3.3.5 Longer-term implications

Longer-term priorities for this strategy will be developed during future adaptive management.

3.3.6 Climate vulnerabilities

Future adaptive management will meaningfully and tangibly consider how climate change could put recovery efforts at risk.

3.3.7 Adaptively managing this strategy

Additional protocols for incorporating aspects of climate change and human dimensions (Tillman and Chang 2020; Trimbach et al. 2020) into each strategy have been developed since the initial development of the Implementation Strategies. Future adaptive management will incorporate impactful aspects identified from the protocol processes into these strategies. Finally, as the context around the recovery strategies changes over time and some of the desired outcomes are achieved, information relevant to each strategy should be adapted over time. Using the most up to date tools and information should be a standard protocol for Puget Sound recovery.

3.4 River-Basin Strategy: Integrated Planning and Project Implementation

This strategy supports an integrated management approach to prioritize, design, and implement reach-scale restoration and protection projects within a river basin or watershed. Strategic planning of reach-scale projects is a critical step to securing funding and permits, and building community support. An integrated management approach requires that all parties are willing to come to the planning table and are able to effectively represent diverse community perspectives. With community buy-in, and with funding and permitting support from the region, projects will target areas that will yield the biggest gains for the community. Sharing the successes of the integrated approach will encourage greater participation in future planning efforts.

3.4.1 Key barriers addressed

The River-Basin Strategy addresses key barriers to advance protection and restoration efforts within a river basin or watershed. Historically, management for flood, farm, and restoration objectives and have been disconnected and mired in conflict. Decades of conflicts have created challenging conditions for pursuing an integrated management approach, which relies on a foundation of trust and a willingness to collaborate. Additionally, an integrated management approach to reach-scale planning requires a broad suite of data and decision-making tools to support discussions and actions but these data and tools can be difficult to communicate to groups with diverse non-technical backgrounds. Using these tools for prioritization of reaches for restoration or protection planning also requires an understanding of the economic and ecological value of lands. The ecosystem services of restored habitat have largely not been quantified, limiting effective evaluation of economic trade-offs which could inform prioritization (see section 3.5). Reach-scale project implementation faces additional barriers due to the complexity of regulations and permitting processes, and the slow pace of restoration. Finally, large-scale restoration projects, which could result in the largest recovery gains, are historically particularly slow-paced due to the time to design, fund, permit, and engage stakeholders in these projects.

3.4.2 Strategy description

- **Enhance understanding of floodplain and estuarine processes, including future projections, to inform reach-scale project prioritization and design.** Broadly-supported landscape-scale plans should use data and develop decision-making tools that consider current and future ecological, social, and economic outcomes.

Technical analyses should be available for land uses within the river basin area to determine the current conditions, including sedimentation, flows, and water supply. Upland land uses, such as forestry, can affect floodplain condition through increasing sedimentation and raising riverbed elevations. More developed upland areas can contribute higher stormwater loads to downstream floodplains. Determining the influence of sedimentation and drainage infrastructure on the movement of water through agricultural lands is important to consider during reach-scale planning. The continued movement of water improves soil health and water retention, and reduces the need for supplemental irrigation and soil amendments. Improving information and consistently tracking metrics for all land uses provides the foundational information for integrated planning discussions. Identifying the existing agriculture and forestry land base can inform planning and zoning to reduce fragmentation and the degree of potential habitat loss. Likewise, inventorying bank hardening will help to identify connected or disconnected habitat. These analyses will also highlight areas that may be appropriate for specific land uses, or in need of restoration or protection.

Future climate and population projection models, and the data to support them, are needed to enable forward-looking planning efforts that aim to improve community resilience. These analyses should use updated regional information on warming trends and hydrology to evaluate the future water storage potential and flood control needs in a river basin. To calibrate the models, stream gauges should be added to ensure long-term monitoring of flows affected by climate change and other influences over time. These models may help identify vulnerable existing infrastructure under different climate change scenarios. Cost-subsidy and risk tolerance analyses will provide important economic context for current and future land uses (*see section 3.5*).

- **Address challenges for integrated planning across land uses.** Continued development pressure in the floodplains and estuaries is a major challenge to advancing restoration and protection projects that will ultimately improve overall socio-ecological resilience (*see Land Development and Cover Implementation Strategy*, Habitat Strategic Initiative 2021). River-basin and reach-scale area planning should utilize existing information from GMA Comprehensive Planning and SMP update processes (including critical areas inventories), Shoreline inventory and characterizations, Shoreline Restoration Plans, Salmon Recovery Plans, and Hazard Mitigation Plans to identify appropriate sites for development away from sensitive floodplain and estuary habitats. Cost subsidy and risk tolerance analyses which incorporate ecosystem services further identify areas that are vulnerable to development (*see section 3.5*). The following are examples of existing rules that support river-basin and reach-scale planning:
 - [RCW 86.12.200](#) Flood Control by Counties gives local County legislative body the authority to adopt a comprehensive flood control management plan for each drainage basin.
 - [RCW 86.16](#) regarding local floodplain management ordinance requirements.
 - [RCW 86.26](#) pursuant to State participation in flood control maintenance.
 - [RCW 90.58](#) Shoreline Management Act – specifically [WAC 173-26-221](#)(2)(iv) Critical freshwater habitats and [WAC 173-26-221](#)(3) Flood hazard reduction.

[RCW 36.70A](#) Growth Management Act - [WAC 365-190](#), [WAC 365-190-020\(2\)](#), [WAC 365-196-485](#) and [WAC 365-196-830](#).

Robust community engagement, with entities like WSDOT, USACE and private landowners is needed when local jurisdictions are considering updates to existing plans or undergoing a new planning effort that impacts existing floodplain infrastructure. Multi-benefit solutions may incur local resistance, in part because they are complex and unfamiliar. Outreach efforts aim to build awareness of the diverse community needs and the value of an integrated management approach.

- **Highlights locally-relevant benefits and challenges of integrated management.** Ongoing outreach and education within communities is key to developing and maintaining support for integrated management efforts. Education and outreach efforts should highlight the costs and risks of operating within local flood-prone areas (*see Section 3.5*) as well as the benefits of functioning floodplains and estuaries. Outreach messages that link the community to restoration projects would include messages about specific local habitat areas for salmon and other species that could be negatively impacted, the costs to local agricultural operations, and the risk to infrastructure within their community. Many of the river-basin integrated management groups effectively share these relatable messages of success through their websites (e.g. [Floodplains for the Future](#)) and local forums. By communicating these types of local risks and providing a venue for integrated decision-making, participation at the local level will increase.

Generally, the public is aware of population growth trends and the risk these trends pose to the environment and wildlife in the Puget Sound region. This awareness is limited when it comes to the correlation between the exponential population growth trend and escalating flood risks. The costs associated with flood protection need to be further researched and communicated to the public in a clear and relatable manner. This level of public education will in-turn further enable data-driven solutions and multi-benefit planning.

- **Enable diverse communities to engage in integrated management forums.** Successful planning forums will empower diverse groups within the community to participate and effectively represent their needs and ideas. This level of engagement requires building trust and relationships among parties, and communicating a coordinated vision from all participants. It also requires increasing the capacity of programs that provide opportunities for community members to support and influence planning decisions. In rural counties, dominated by agricultural land use, practitioners recommend the long-term retention of specialized staff. In addition, planning teams need to be supported by applied research on topics such as sediment dynamics and saltwater intrusion to provide the technical basis for planning and design of a multi-benefit and climate resilient plan.

Throughout Puget Sound, several river-basin scale coalitions and groups have formed to advance integrated management principles and approaches. The [Sustainable Lands Strategy](#), operating in Snohomish County since 2010, recognized that agricultural needs were diverse and inadequately represented in the discussions. In order to elevate the

agricultural goals and needs during discussions, the forum leads worked with local producers to develop an [agricultural resilience plan](#). The plan identifies residential and commercial development pressure as the biggest threat to agricultural lands in the river basin, and that improving viability of the agricultural sector is key to preserving connected floodplains. Agricultural viability depends on improved irrigation, drainage, and flood protection as well as purchasing of agricultural easements and instituting best management practices to reduce negative impacts to the floodplain and estuary. The plan serves to enable broad understanding of the needs and goals of the agricultural sector within the river basin, and invites greater participation of farmers in the integrated planning process.

- **River-basin integrated planning efforts consider diverse community needs when identifying restoration and protection priorities.** To effectively collaborate on integrative approaches to prioritizing restoration and protection projects, each of the parties needs to first identify goals and needs within their own communities. Resources (plans, data, and analyses) specific to each river basin should be available to support the groups, individually and collectively. Each community should consider how climate change may affect their goals and what may need to be done to address risks.

Planning teams for each river basin or watershed operate within different socio-economic and ecological conditions, and each will develop goals and metrics that are specific to the needs of their communities. Rural river basins which support agricultural communities typically face different restoration and protection challenges than more-developed urban river basins. Therefore, the information needs, tools, and approaches necessary for integrated planning within these types of communities vary greatly. For all communities, outreach and engagement are critical for broad support and momentum behind planning processes and projects.

Using existing datasets, planning and technical teams conduct reach-scale analyses to prioritize areas for restoration, agricultural protection, and other important land uses. Through these analyses, the communities can develop a shared understanding of the social, ecologic, and economic trade-offs among different management actions. Based on this shared understanding, the forum participants develop an integrated plan that can support the best overall outcomes related to the goals and needs of the community.

Many different approaches exist for evaluating potential projects sites and the cumulative effects of many reach-scale projects. Forums should consider agricultural land base needs and drainage and flood protection assurances, as well as flood protections for homes, businesses, and critical infrastructure in developed areas. Existing salmon recovery plans should be reviewed and incorporated to identify the most critical areas to restore and the appropriate actions to take (such as levee setback and riparian zone planting.) Flood protection elements should also be incorporated into rehabilitation projects after floods.

While some decisions may not support each sector equally, the goal is for the decision-making process to be transparent and inclusive so that each group is satisfied with the overall plan. For example, agricultural lands are under such pressure from development that

farmers in some areas have adopted a policy of ‘no net losses’ of cropland to any alternative uses, including restoration. Conversations around estuary restoration, in particular, must be sensitive to the impact on the region’s agricultural economy. Setbacks of dikes and levees to reclaim the historical extent of a river delta area will likely only be supported through a process of assent that yields benefits to both farmers and habitat. Two recovery approaches that have been suggested, but are untested include relocating farmland to less ecologically-sensitive areas, or using dredge spoils to build new habitat *in front of* levees (rather than by setting levees back). The latter option avoids converting existing farmland by effectively converting mudflats into marsh, which would be expensive and may only be a temporary solution due to tidal erosion.

Agreements to trade land for benefits such as flood control or infrastructure improvements, need not be confined, geographically or conceptually, to the property in question. In principle, deal-making should be limited only by the creativity of deal framers (and in practice by the complexity of regulations). Incentive programs that enable landowners to receive compensation for land providing ecological value would support multi-benefit restoration planning. Ecosystem service values provided by potential parcels of restored estuarine habitat are not likely to be incorporated into conventional methods of appraisal that assess fair market value (Cereghino 2015). The omission of ecosystem services valuation limits the opportunities for public entities to provide above-market compensation for parcels that may be highly sought-after due to their location (improving connectivity) or higher functional potential (enhancing productivity). However, other entities such as tribal councils and private interests may have more leeway to develop incentive programs. One approach is being applied by the Farms, Fish, and Flood Initiative (3FI) in the Skagit, which evaluates potential restoration project sites for all three attributes to determine priorities for restoration through the [Skagit Hydrodynamic Modeling Project](#).

Climate change imposes common stressors upon farmers and the restoration community—in particular, increased flooding and sea level rise. Opportunities to achieve multiple benefits may arise where farmland in former estuary habitat, for example, is un-useable due to persistent flooding in areas of subsidence (following disconnection from rivers), where drainage systems no longer function, and where rising sea levels pose a risk of increasing salinity or inundation. Improving resilience to climate change impacts could serve both groups. The planning forums may also identify funding and regulatory mechanisms that could also be linked to ventures that serve mutual needs but this requires advanced planning and agreement (Cereghino 2015). One example is the Skagit Tidegate Initiative, which provides economic and regulatory incentives for the agricultural community to participate in restoration.

- **Implement integrated reach-scale plans.** Once the planning process has developed an agreed-upon reach-scale plan, design, funding, and implementation of projects needs to occur. Expanding the financial capacity for restoration is necessary if we are going to continue to increase the area of tidally inundated lands. Ongoing programs that fund estuary restoration include WDFW’s Estuary and Salmon Restoration Program, USFWS National Coastal Wetland Grant, and Salmon Recovery Funding Board. Aligning and

integrating restoration and agricultural land conservation programs is a key opportunity to increase financial capacity for restoration and to accelerate the rate at which projects on non-public lands progress. Moreover, because it is common for restoration projects to take many years, nimble funding mechanisms that allow for project managers to acquire and control lands over long transition periods provide a pathway for success to achieving the target for this Implementation Strategy.

- **Refine river-basin planning approaches based on lessons learned.** A well-designed and implemented monitoring plan of local floodplain protection and restoration efforts reflects a shared understanding among stakeholders of the multiple benefits of an integrated management plan. The integrated planning process is intended to promote long-term stewardship and adaptive management of plans and practices that in-turn produce better ecosystem and human outcomes. The results of reach-scale project implementation should inform adaptive management of approaches for both the river-basin and Puget Sound scales. As lessons are learned, program efficiencies develop that bolster the success of programs implemented and the overall program will continue to expand its capability, effectiveness, and efficiency in achieving the Vital Sign Targets for both floodplains and estuaries. The Sound-wide Strategy builds support for integrated management approaches, in part, through peer-learning opportunities. River basin and Reach-scale planning efforts are key in shaping, implementing, and adaptively managing the Sound-wide Strategy (see *Section 3.3*). Linking local decision-making and implementation to regional goals will aid in the assessment of the scale of impact local actions have on regional floodplain recovery targets.

3.4.3 Example actions

Example actions to advance this strategy are found in the following 2018-2022 Action Agenda Regional Priority Approaches for Floodplains and Estuaries

(<https://actionagenda.pugetsoundinfo.wa.gov/ProgramInfo/Taxonomy>):

- 1.1: Gain a better understanding of current floodplain and estuary habitat
- 1.2: Increase understanding of social, economic, and political factors affecting floodplain and estuary habitat
- 1.3: Increase understanding of floodplain and estuary habitat change due to climate change and population growth
- 1.4: Increase understanding of future social, economic, and political factors affecting floodplain and estuary habitat
- 2.1: Collaborative, multi-benefit groups develop prioritized restoration/protection plans for floodplains and estuaries
- 3.1: Develop and implement outreach, education, and or/incentive programs related to floodplain and estuary habitat
- 3.2: Implement plans and priorities to protect floodplain and estuary habitat
- 3.3: Implement plans and priorities to restore floodplain and estuary habitat
- 3.4: Collect and analyze data to adaptively manage floodplain and estuary recovery practices

Future adaptive management may identify near-term priority outcomes for a specific time period and examples actions to achieve those near-term priorities.

3.4.4 LIO priority alignment

The 2022-2026 Action Agenda development process will elicit updated information on the alignment between Action Agenda outcomes and strategies identified from the Implementation Strategies with LIO priorities and ecosystem recovery plans (*some in the process of undergoing updates*).

3.4.5 Longer-term implications

Longer-term priorities for this strategy will be developed during future adaptive management.

3.4.6 Climate vulnerabilities

Future adaptive management will meaningfully and tangibly consider how climate change could put recovery efforts at risk.

3.4.7 Adaptively managing this strategy

Additional protocols for incorporating aspects of climate change and human dimensions (Tillman and Chang 2020; Trimbach et al. 2020) into each strategy have been developed since the initial development of the Implementation Strategies. Future adaptive management will incorporate impactful aspects identified from the protocol processes into these strategies. Finally, as the context around the recovery strategies changes over time and some of the desired outcomes are achieved, information relevant to each strategy should be adapted over time. Using the most up to date tools and information should be a standard protocol for Puget Sound recovery.

3.5 Risks and Costs Strategy: Risk Tolerance and Cost Subsidy Analyses

The Risks and Costs Strategy highlights the opportunities to incorporate into land use planning the flood risks and long-term economic costs of developing floodplain and estuary habitats. Risk tolerance analyses quantify the flood hazard probability and vulnerability in an area for human health, economic activities, ecological services, and cultural heritage. Cost subsidy analyses consider the long-term economic costs that may outweigh (subsidize) the benefits of developing in flood-prone habitats. The long-term costs of development can include public infrastructure, emergency service provision, utilities, and the option of rebuilding after flood damage.

Incorporating risk tolerance and cost subsidy analyses into land-use planning will dis-incentivize development, prioritize the best areas for the purchase of development rights, and determine the long-term costs of conversion. Central to this approach is developing and communicating information so it can be understood by communities, local policy makers, and the jurisdiction's land use planners. Completing and integrating a local comprehensive risk assessment into local planning, policies, and regulations enables more resilient development in floodplains and often reduces the number of new developments in flood-prone areas. When risk tolerance analyses are linked to the cost subsidy analyses, the long-term costs of supporting floodplain and estuary development can be examined. These analyses lay the groundwork for planning forums to identify implementation-ready actions (i.e. levee setback projects and more resilient infrastructure projects) in response to large floods or when the political environment is ripe for change.

3.5.1 Key barriers addressed

There continues to be a legacy of past operational norms where regional and river-basin scale planners and communities did not fully consider the total cost of building and operating in floodplains and estuaries. To achieve this strategy, behavioral changes by planners, the public, and the agricultural community will be required. Further research is needed to evaluate the social dimension of land-use planning and how best to accomplish this strategy.

3.5.2 Strategy description

- **Make available hazard risk tolerance and cost subsidy data and results to improve planning and permitting decisions in an integrated management context.** Without data on the hazard risks and associated costs relative to the public benefit of developing structures in flood-prone areas, planning and permitting decisions continue to favor development over restoration projects. To support more strategic planning, the comprehensive risks and costs of developing in the floodplain, including incentives for agriculture, development, and buy-outs or emergency responses must be available and communicated. To assess future risks and costs, analyses should incorporate projected flood patterns and anticipated future use to develop flood damage curves. Because we expect climate change to result in more frequent and larger flooding events, projections of flood risk should include scenarios with extreme weather events. FEMA's RiskMAP products and Washington State Department of Transportation's 2011 Climate Impacts Vulnerability Assessment Report are useful resources for river-basin planners. Developing a methodology to track dollars spent within flood-prone

areas will be important to change or integrate policies affecting growth patterns and legacy issues in these sensitive habitats.

- **Improve prioritization of land uses and emergency preparedness in flood-prone areas through outreach to public and decision-makers.** Clear messaging to the public and to local decision-makers will be necessary in order to shift long-held mindsets and to build support for land uses that are compatible with flooding, which may include agriculture depending on the severity of flooding and the crop. When people understand and incorporate risk considerations into their choices about where to live and work, and when floodplain-friendly alternatives are available and affordable, communities and habitats will become more resilient.

Having comprehensive risk assessments, such as WSDOT's Climate Impacts Vulnerability Assessment Report (2011), available for decision-makers encourages changes to local planning, policies, and regulations to avoid risky development (i.e. development of residences in a flood-prone area). Further into the future, aligning incentives (e.g. regulatory or economic) to move (instead of protect) development in floodplains, prioritizing flood risk considerations for public infrastructure, and better accommodating flood risk for development that has to stay in floodplains would reduce the strain on the tax base, development, residents, communities, habitat, and wildlife.

- **Risk tolerance and cost subsidy data and results inform adaptive management of regulatory and permitting decisions.** The results of risk tolerance and cost subsidy analyses will inform adaptive management of regulations and permitting decisions in flood-prone areas to prioritize restoration and protection from development. For existing development, emergency conditions should not result in expansion or raising of levees where not necessary. Alternative emergency responses should be identified, and vulnerable properties should be prioritized for buy-out. Decision-makers should understand and value the benefits of not developing in flood-prone areas so that public dollars shift to land uses with higher public benefit (e.g. water quality, recreation, flood storage, agriculture). Regional regulations should require that river-basin plans incorporate risks and costs of changing flood conditions into planning and permitting decisions, and that any new development pays for costs of services, including infrastructure and emergency responses. The King County 2011 Biological Opinion provides an example of an analysis that can inform adaptive management of land use prioritization and regulations to better align with recovery targets.
- **Improve river-basin scale planning using risk tolerance and cost subsidy analyses.** An integrated planning process should prioritize flood-prone areas, incorporate risk tolerance information, cost subsidy information, the best available science on ecosystem functions, as well as gauge the feasibility of the political climate. Infrastructure that supports development (e.g. levee systems) plays a role in the disconnection and degradation of Puget Sound floodplains and estuaries. This infrastructure is subject to increasing risk of damage or failure due to climate change, creating additional costs that are externalized. Areas of high risk and high costs should be identified as priorities for restoration or protection from development. Public spending should be focused on crucial buy-outs of residential and

commercial lands in these priority areas (high-risk, high-cost), to maximize restoration impacts in terms of increased public safety and cost benefits. The priority areas should be opportunistically, or proactively, purchased as possible to reduce the pressure to expand or raise levees during emergency conditions. Likewise, public infrastructure in floodways should not be redeveloped following a major flooding event. If communities must stay in flood-prone areas, planners should work with the communities to accommodate infrastructure and homes that cannot be moved while minimizing the impacts on habitat and wildlife.

To reduce pressure for new development in flood-prone areas, risk tolerance and cost subsidy information should be used to dis-incentivize residential or commercial development. Rather, development that can accommodate flooding should be prioritized and decisions about the siting of public infrastructure (e.g. roads, water treatment plants, water intakes, schools) should incorporate flood risks. Additional recommendations and priorities for development would discourage unnecessary expansion of levees, prioritize crucial buy-outs in flood-prone areas, and shift public spending to areas with high restoration and public benefit.

Developing cost subsidies may also help balance agricultural and flood infrastructure needs within a community. Puget Sound flood infrastructure, such as dikes and levees, protect development from flood-water inundation while also disconnecting agricultural land from water and the ecology of the watercourse. Using subsidies to promote agricultural uses within the floodplain can preserve ecological connectivity by shifting levees further from waterways while still protecting residential land from flooding.

If these changes are made, in addition to new development paying for infrastructure and emergency services, sensitive flood-prone habitats would not be as desirable for residential and commercial development, existing residents would be encouraged to sell, and existing public infrastructure would not be redeveloped. This work – reflected in the reductions of the total number of structures (permitted and unpermitted) in the floodplains, as well as reduced numbers of levees raised or expanded – would:

- Create more resilient communities and ecosystems
- Reduce flood risks to residents and businesses
- Make farmland less vulnerable to development, flooding, and climate change impacts
- Advance progress toward recovery targets for Puget Sound

3.5.3 Example actions

Example actions to advance this strategy are found in the following 2018-2022 Action Agenda Regional Priority Approaches for Floodplains and Estuaries

(<https://actionagenda.pugetsoundinfo.wa.gov/ProgramInfo/Taxonomy>):

- 1.2: Increase understanding of social, economic, and political factors affecting floodplain and estuary habitat
- 1.3: Increase understanding of floodplain and estuary habitat change due to climate

- change and population growth
- 1.4: Increase understanding of future social, economic, and political factors affecting floodplain and estuary habitat
- 2.1: Collaborative, multi-benefit groups develop prioritized restoration/protection plans for floodplains and estuaries
- 3.2: Implement plans and priorities to restore floodplain habitat

Future adaptive management may identify near-term priority outcomes for a specific time period and examples actions to achieve those near-term priorities.

3.5.4 LIO priority alignment

The 2022-2026 Action Agenda development process will elicit updated information on the alignment between Action Agenda outcomes and strategies identified from the Implementation Strategies with LIO priorities and ecosystem recovery plans (*some in the process of undergoing updates*).

3.5.5 Longer-term implications

Longer-term priorities for this strategy will be developed during future adaptive management.

3.5.6 Climate vulnerabilities

Future adaptive management will meaningfully and tangibly consider how climate change could put recovery efforts at risk.

3.5.7 Adaptively managing this strategy

Additional protocols for incorporating aspects of climate change and human dimensions (Tillman and Chang 2020; Trimbach et al. 2020) into each strategy have been developed since the initial development of the Implementation Strategies. Future adaptive management will incorporate impactful aspects identified from the protocol processes into these strategies. Finally, as the context around the recovery strategies changes over time and some of the desired outcomes are achieved, information relevant to each strategy should be adapted over time. Using the most up to date tools and information should be a standard protocol for Puget Sound recovery.

4. Strategy implications for key partners

Achieving the outcomes described in this Implementation Strategy will require the ongoing and coordinated efforts of partners throughout Puget Sound. The sections below describe the ongoing work of partners and how that work supports role that they can play to achieve the outcomes of this Implementation Strategy.

4.1 State agencies

State agencies have an integral role in addressing floodplain and estuary restoration in the Puget Sound. State agencies run capital grant programs that fund a large portion of restoration activities. These include the Estuary and Salmon Restoration Program (WDFW & RCO), Floodplains by Design (Ecology), and Puget Sound Acquisition and Restoration (Partnership and

RCO). State agencies also provide planning guidance (Commerce, Ecology) on the implementation of local regulations and standards through the GMA, SMA, as well as NFIP. As land managers (WDFW, DNR, State Parks), state agencies are direct implement restoration on public lands. State agencies provide the best available science, guidance, and technical assistance (WDFW, Ecology, Emergency Management Agency, State Conservation Commission) to advance restoration outcomes, hazard mitigation, and agricultural viability throughout the Puget Sound.

4.2 Federal agencies

Federal agencies have a clear regulatory responsibility across the large river basins while also engaging heavily in research and restoration efforts. The Army Corps of Engineers (Corps), National Marine Fisheries Service, and FEMA all have regulatory authorities that affect floodplains and estuary restoration and integrated management frameworks. FEMA and the Corps are involved in the complex topics of risk tolerance, insurance and liability, and cost subsidies for developments and agricultural industries that rely on floodplain functions. The US Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), and US Fish and Wildlife Service (USFWS) are leaders and partners in advancing scientific understanding of floodplains and estuaries, as well as endangered and threatened species. NOAA, the Corps, EPA, and USFWS are also important funders of restoration activities. The federal agencies coordinate their advancement of Puget Sound Recovery through the Federal Task Force (see [Section 5.4](#))

4.3 Local jurisdictions

The purpose of this Implementation Strategy is to support enabling conditions that support success at the river-basin and reach-scale.

Local jurisdictions (counties and cities) operationalize many of the regulatory frameworks that governs land-use, flood hazard, and restoration planning including the GMA, SMA, and NFIP. To achieve an integrated management approach, the local jurisdiction's implementation of these regulatory systems must support an integrated approach, including adequate staff capacity and training. For example, local jurisdiction regulation and code should explicitly state that flood prone areas should remain rural, and that agriculture and forest working lands should not be converted to residential or commercial development.

Conservation Districts are local authorities with a unique role engaging landowners both residential and agricultural and bringing these perspectives to the integrated management forums. Their role in providing non-regulatory technical and cost-share assistance can also strengthen landowner buy-in and willingness to participate in the larger integrated management conversation.

Dike and drainage districts are local authorities that play an important role in managing water and infrastructure resources. These stakeholders are crucial to have at the integrated management table to ensure successful identification of integrated management needs.

Local Integrating Organizations (LIO) and salmon recovery Lead Entities are locally directed forums that bring together diverse local jurisdictions, state partnership, tribes, non-governmental organizations and others to address ecosystem and salmon recovery. Depending on the river-basin, these forums can be a stakeholder in the integrated management forum or may encompass the integrated management forums for floodplains and estuaries.

4.4 Practitioners

Practitioners are a diverse collection of on-the-ground actors including contractors, consultants (technical specialists), and restoration professionals housed at NGOs, local, state, and federal agencies.

Consultants complement the expertise held in local, state and federal agencies while also engaging widely in on-the-ground assessment and design. Some experts have been at the forefront of restoration technique innovation, and they can be leaders within their community and professional associations for pursuing restoration project implementation through an integrated management framework.

Restoration professionals are key integrators who can help identify and connect property owners whose parcels could contribute to improved ecosystem outcomes to the resources and programs necessary to achieve those outcomes. These practitioners may have a sub-regional focus, such as through a Regional Fishery Enhancement Group, Lead Entity, etc. or a local focus tied to a narrow geographic area. Restoration practitioners often have important expertise in a specific species (e.g. salmonid species) or habitat that can ensure restoration projects maximize benefits to these species or habitats.

4.5 Education, outreach, and incentive programs

The Implementation Strategy focuses on the enabling conditions that promote an integrated management approach to floodplains and estuaries within and across watersheds. There is a strong need for outreach and education efforts to the public and decision-makers about the multiple benefits of healthy floodplains and estuaries, and the opportunities for enhancing the resilience of our socio-economic and ecological systems. Incentive programs can provide technical and financial assistance to landowners to participate in reach-scale planning efforts and restoration project implementation.

4.6 Funding organizations

Funding organizations can be defined by the institutions they are a part of and the authorities or rules governing how funding can be spent. These include federal and state capital (construction) restoration accounts, hazard mitigation funding, agricultural conservation and viability programs, federal Clean Water Act funds (e.g. National Estuary Program), and private foundations. The integrated management community has long identified (Cereghino 2015) that the silos of work among funding organizations reduce the flexibility and coordination of funder for individual projects or larger, strategic efforts. The NOAA Restoration Center coordinates an "Align" workgroup of funders in the Puget Sound which works to advance funding coordination.

4.7 Academic institutions

Strengthening regional research models, creating forums and mechanisms through which partners can work with local agencies to support their research, as well as completing regional studies that identify the most efficient investment strategies are essential to assisting local jurisdictions implement integrated management strategies that address the values and objectives identified by stakeholders. Many academic disciplines, not all historically connected to restoration planning, can contribute research necessary for successful integrated management where objectives are social, economic, cultural, and biological.

4.8 Tribes

Tribes are sovereign nations that have regulatory authority over land-use planning and activities on the lands they govern. Tribes are key knowledge holders who inform management and restoration practices through both cultural and traditional knowledge built over millennia as well as through active Western science research led by natural resources departments. Tribes serve as restoration project implementers, land managers, and funders.

5. Alignment with regional and local strategies

This section briefly describes existing local and regional plans and their alignment with the goals and strategies of the Floodplains and Estuaries Implementation Strategy.

5.1 Action Agendas for Puget Sound

The Washington State Legislature established the Puget Sound Partnership to chart the course of recovery of the Puget Sound. The Action Agenda for Puget Sound complements and incorporates the work of partners by describing regional strategies and specific actions that will assist with Puget Sound recovery. The Floodplains and Estuaries Vital Signs are collaboratively-defined focus areas for Puget Sound recovery. The outcomes from this Implementation Strategy have been directly included in the 2016-2018 and 2018-2022 Action Agendas for Puget Sound and will influence the actions listed in the 2022-2026 Action Agenda.

The [2018-2022 Action Agenda for Puget Sound](#)'s Implementation Plan contains Regional Priorities for Floodplains and Estuaries Vital Signs that are aligned to the strategies in this Implementation Strategy. Three [Regional Priorities and eleven Regional Priority Approaches](#) (RPAs) were developed based upon the Implementation Strategy and have associated desired outcomes and example actions sourced from the Implementation Strategy. The RPAs were used to solicit Near Term Actions (NTAs) for the Implementation Plan and included proposal guidance drawn from the best practices and existing tools identified in the Implementation Strategy.

5.2 Tribal Habitat Strategy

The Northwest Treaty tribes, in conjunction with the Northwest Indian Fisheries Commission, developed the Tribal Habitat Strategy (2018) as an approach to identify and protect the lands, waters, and ecological processes that are critical to the resources, cultures, and homelands of the treaty Indian tribes in western Washington.

The Tribal Habitat Strategy includes target areas, overarching tasks, and specific actions for five priority habitat areas (the Pacific Ocean, inland marine and nearshore (Salish Sea), floodplains, riparian, and water) that are relevant to this Implementation Strategy. The overarching tasks include land-use management, coordinated land acquisitions for ecosystem health, local government engagement, tribal science evaluation, and outreach and coalition development.

The recommended actions under the Floodplains and Riparian target areas in particular align with and highlight some of the most important aspects of the Floodplains and Estuaries Implementation Strategy. The goal to protect, restore, and enhance hydrological and geomorphic connectivity between rivers and their floodplains and deltas is directly in line with all three strategies in this Implementation Strategy.

5.3 Orca Task Force

The Southern Resident Orca Task Force was convened by request of Governor Jay Inslee and released a final comprehensive report and [two-year recommendations](#) on November 8, 2019 (Southern Resident Orca Task Force, 2019). In the report, the Orca Task Force recognized six goals and made 49 recommendations for Southern Resident killer whale recovery. Southern Residents rely heavily on Chinook for their diet and need healthy ecosystems and food sources. Chinook populations in Puget Sound need to be abundant, diverse, and accessible, which required productive and protected habitat and a reliable fish food source for Chinook and other salmon. The Floodplains and Estuaries Implementation Strategy closely aligns with the goals, recommendations, and associated actions or regulatory changes listed below:

- Goal 1: Increase Chinook abundance- Habitat restoration and acquisition to increase Chinook abundance by restoring and acquiring salmon habitat and food sources.
- Goal 6: Reduce the threat that population growth and development on the important habitats, sensitive ecosystems and food webs that Southern Residents orcas rely on.

5.4 Federal Task Force Action Plan

Co-led by the National Oceanic and Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA), the Puget Sound Federal Task Force adopted the 2017-2021 [Action Plan in 2017](#). The plan identifies tasks and actions where federal partners contribute to a healthy and sustainable Puget Sound ecosystem. The Federal Task Force uses this plan to coordinate actions leverage alignment with other partners working in protection and recovery in Puget Sound.

The Federal Action Plan lists several relevant Federal actions where federal partners are committed to objective to “Protect and restore floodplains, and in-stream and riparian habitat”. Many of the actions listed highlight coordinated investments for things like reach-scale planning, riparian restoration, and floodplain management tools. There is an opportunity for alignment between these strategies to improve community resilience through both climate change science and through incentives to move development away from high risk areas.

5.5 LIO Recovery Plans

[Local Integrating Organization](#) (LIO) priority strategies are identified in each of the LIO Recovery Plans or have been identified by LIO coordinators to identify key synergies between the LIO plans and the Implementation Strategy. According to the Partnership's LIO Synthesis (2017), six LIO plans include strategies to make progress towards the Floodplains Vital Sign target and 7 LIO plans include strategies to make progress towards the Estuaries Vital Sign target. These LIOs include Whatcom LIO, Snohomish/Stillaguamish LIO, Island LIO, West Sound Partners for Ecosystem Recovery, South Central Action Area Caucus Group, Hood Canal Coordinating Council, and Strait Ecosystem Recovery Network. Many of the LIO strategies addressed pressures from development, flooding, or riparian areas.

5.6 State agency strategic plans

Many Washington State agencies create strategic plans that focus on elements identified in the Floodplains and Estuaries Implementation Strategy. Implementation of these plans and alignment of conservation objectives throughout the state agency missions are essential for reducing flood risk and impacts from population growth in Puget Sound. This section identifies State agency partners and elements of their strategic plans that align with the Implementation Strategy to identify opportunities for coordination and support within state government.

5.6.1 Washington Department of Ecology

Ecology's [2021-2023 Strategic Plan](#) (Ecology 2020) includes three goals with direct relevance to this Implementation Strategy:

- Reduce and prepare for climate impacts
- Protect and manage our state's waters
- Protect and restore Puget Sound

The Strategic Plan also identifies strategies to achieve each of the goals set out in the plan. There are several strategies the Strategic Plan outlines that align strongly with this Implementation Strategy, including:

- Strategy 4.1 - Develop water resource solutions that consider legal and historical context, impacts of climate change, population growth, impacts to fish, and other resource constraints while balancing the needs of people and communities, contributing to a robust economy, and protecting the natural environment.
- Strategy 4.2 - Use innovative solutions that align with regulatory requirements and environmental justice considerations to:
 - Address long-term water project investment, monitoring, and funding needs.
 - Restore and manage floodplains.
- Strategy 5.1 - Monitor Puget Sound health and restoration to address environmental impacts, including those that affect tribes and underserved communities. (Ecology 2020)

5.6.2 Washington Department of Fish and Wildlife

[WDFW's 25-year Strategic Plan](#) (WDFW 2020) has three strategies relevant to this Implementation Strategy:

- Proactively address conservation challenges
- Engage communities through recreation and stewardship
- Deliver science that informs Washington's most pressing fish and wildlife questions

WDFW will implement these strategies through near-term actions (four years) and longer-term actions to achieve 25-year desired outcomes that are aligned with the Implementation Strategy. For example, a near-term action is to "Ensure that land-use planning and decisions are contributing to the conservation and recovery of fish and wildlife" which is aligned with the Sound-Wide Strategy: Sound-Wide Integrated Management Support in this Implementation Strategy.

5.6.3 Washington Department of Natural Resources

DNR's [2018-2021 Strategic Plan](#) (DNR 2018) outlines their strategic priorities with identified goals, many of which are relevant to this Implementation Strategy:

- Strengthen and build partnerships with federal, state, and local stakeholders and tribes in order to help address community economic development issues.
- Develop and implement collaborative solutions to protect working farms and forests, including landowner assistance and incentives.
- Restore and protect high-priority habitats and water quality that support salmon and other aquatic species through collaborative upland and nearshore protection and restoration activities.
- Increase public awareness about the importance of sustainable natural resource management and the wide-ranging value of public lands for Washington's communities.
- Advance climate resilience throughout the natural resource sectors DNR manages. The goal of [DNR's Plan for Climate Resilience](#) is to increase the health and integrity of natural systems and enhance their ability to absorb and recover from disturbance (DNR 2020b).

5.6.4 Washington Department of Transportation

The current WSDOT Strategic Plan (WSDOT 2018) advances the goals of inclusion, practical solutions, and workforce development. Opportunities for alignment with this Implementation Strategy include:

- Implementing the inclusion goal through "Community Engagement - engage stakeholders during all phases of projects to develop and maintain relationships with WSDOT"

Implementing the practical solutions goal through working "with stakeholders to develop coordinated data-driven solutions that address preservation, safety, mobility, economic vitality, stewardship and the environment"

5.6.5 Washington State Parks

The [Washington State Parks 2021-2031 Strategic Plan](#)'s (WA State Parks 2020) priorities include "Protect ecosystems and habitat for long-term sustainability" to "enhance the function of ecosystems within the parks." This priority aligns with the Implementation Strategy and highlights opportunities for agency and partner collaboration.

5.7 Other Implementation Strategies

The Floodplains and Estuaries Implementation Strategy shares common strategies, information needs, and action types with other Implementation Strategies. The Floodplains and Estuaries Implementation Strategy highlights the importance of a regional planning framework, also identified in Chinook, Land Development and Cover, and Shoreline Armoring Implementation Strategies. The importance of engaging agricultural landowners through incentives and technical assistance is a shared activity across B-IBI, Chinook, Land Development and Cover, Shellfish, and Shoreline Armoring Implementation Strategies. These strategies have a common goal of increasing voluntary stewardship (restoration and protection) among private landowners to achieve large-scale recovery.

Continuing to advance and operationalize the Floodplains and Estuaries Implementation Strategy will also help achieve broader Puget Sound recovery goals identified in other Vital Signs and their indicators. For example, increasing the connectivity of the floodplain and estuarine tidal flow may support improvements to Economic Vitality, Cultural Practices, Resilient Communities, and the Sense of Place associated with a healthy, robust natural resource industries. As Floodplain and Estuaries are crucial habitat for Chinook salmon and other salmon species, increasing the quality and quantity of these habitat is expected to advance achieving the Chinook Vital Sign indicator target. Marine Water Quality is expected to be improved through increased nutrient uptake that functional estuaries can provide as well as through restoration activities on agricultural lands that reduce the nutrient runoff transported by larger river systems into the Puget Sound.

6. Research needs

The Implementation Strategy is grounded in our best understanding of how the ecological and social systems of the Puget Sound work. Research can help address major gaps in our understanding which may underpin assumptions that are inherent within the Implementation Strategy outcomes and actions or are impediments to informed decisions required to achieve Implementation Strategy outcomes. More broadly, uncertainties may exist in the social-ecological system dynamics which are not easily addressed in research projects but may have large consequences for the success of the Implementation Strategy. Research questions related to improving the Vital Sign indicator or indicator target are not included in this section.

Research needs to advance the overall Implementation Strategy or an individual strategy in its landscape context (e.g. estuarine or floodplain habitat) as well as large-scale uncertainties have been compiled into the [Grand Uncertainties Matrix](#). The Grand Uncertainties Matrix provides the most comprehensive assessment of research needs identified during the initial Implementation Strategy development (Partnership 2015, Partnership 2016) and raised during reviews of those products. Areas of research and uncertainties that arose in both the floodplains and estuaries context included ecosystem function, climate change and decision-support and prioritization information, and restoration effectiveness information, especially regarding land use planning. Areas of research that arose uniquely in the floodplains context included effective regulations and incentives available, cost-benefit analysis information, human behavior, and spatial mapping while for estuaries ocean acidification was a key area for large uncertainties and associated research needs.

Grand Uncertainties Matrix

A compilation of research needs and broader uncertainties supporting their integration across all Implementation Strategies. The Grand Uncertainties Matrix was also one of several inputs used to develop the Puget Sound Partnership's Science Panel's [2020-2024 Science Work Plan](#).

This document is maintained by the Puget Sound Institute and Puget Sound Partnership. *(link to be provided TBD)*

Adaptive management of the Floodplains and Estuaries Implementation Strategy (see [Section 9](#)) will need to evaluate the current research needs identified in the context of substantial investments in many of these questions at both the site, watershed, river basin, and regional scale over the past 5 years or more. The [2021 Nearshore Summit](#) included a full two-days of presentations and discussions focused on river deltas, including the status of research to information restoration, and the ongoing needs of restoration practitioners. This, along with research needs compiled through river basin planning efforts and salmon recovery plans, should be used to bring together the best available science for floodplain and estuary restoration as well as identify the most immediate research needs. Furthermore, knowledge or approaches may be transferrable across river basins, providing opportunities to apply lessons learned when advancing a specific topic in a new river basin.

7. Cost estimates for the Implementation Strategy

According to MacIlroy et al. 2014, the combined estimated cost for reducing flood risk and restoring salmon habitat in Puget Sound floodplains over the next decade is approximately \$3 billion, with approximately \$2.2 billion associated with flood risk reduction projects and \$800 million associated with salmon recovery. This includes estimated long-term capital floodplain project costs in the two categories (flood risk reduction and salmon recovery) for 13 of the 17 major Puget Sound river floodplain systems.

The estimated costs in MacIlroy et al. (2014) were based upon flood and salmon recovery planning efforts and capital needs including feasibility studies, land acquisition, and project design and construction. Estimated costs were derived from hazard management plans, Comprehensive Flood Hazard Management Plans, Capital Investment Programs, 3-Year Salmon Recovery Work plans, USACE General Investigations, and other planning efforts as deemed appropriate by the local sources of information.

One type of cost estimate that may be most useful to the communities working towards floodplains restoration is an estimate of local costs to restore degraded floodplains. Although cost estimates are available at the watershed scale, refined information from stream survey data and watershed assessments are essential to accurately estimate the cost of prioritized projects to restore an entire watershed. High-quality data on the watershed's existing conditions and a sense of prioritized projects are necessary for a larger scale cost estimate. At this stage, these are the general cost estimates per mile of river work for each element of a project. This information is intended to allow each watershed or reach to use good data and a prioritized project list to estimate the cost of restoration for the watershed, river, or reach.

Table 2. Estimated restoration costs per river mile of typical floodplain and riparian area restoration costs, including the high, low, and reasonable mean estimates per river mile. MacIlroy et al. 2014

Item	Low end	High end	Reasonable mean
	Cost/river mile		
Plan, design, and permit	\$21,833	\$110,040	\$68,880
Materials (trees)	\$14,747	\$64,900	\$20,566
Mobilization	\$1,333	\$8,200	\$2,777
Equipment	\$17,333	\$122,000	\$20,800
Labor	\$112	\$17,167	\$5,000
Riparian planting/maintenance	\$3,893	\$7,646	\$5,513
Instream structure maintenance	\$4,760	\$24,640	\$5,600
Total	\$64,011	\$354,593	\$129,135

Funders and project sponsors maybe be able to improve funding coordination and leverage funding sources if project specific costs are available. Table 2 provides the estimated cost range for element types including a range for bank stabilization, channel rehabilitation, riparian restoration, planning, and materials and equipment (MacIlroy et al. 2014). Project costs depend on many site-specific factors:

- Scope, treatment intensity, and stream size: Larger projects tend to have lower costs per river mile.
- Access: Usually dictates the equipment type and labor intensity required for restoration.
- Available material: Obtaining the quantity and quality of large wood can be a challenge.

- Type of contract: Hourly equipment rentals versus construction contracts change the cost dynamics, but they also change the liability associated with the work.
- Time: Timing and the permitting process is affected by all of the other factors.

Any local entity attempting to do reach-scale restoration may use these estimates as a starting point to request funding and design a proposal.

8. Habitat Strategic Initiative Implementation Plan

The Habitat Strategic Initiative, through its work as the Implementation Strategy Lead and its role supporting the Action Agenda through strategic planning and funding, commits to implementing actions to achieve the goals as described in this Implementation Strategy. This section describes the work that was accomplished by the Habitat Strategic Initiative to advance the Floodplains and Estuaries Implementation Strategy (*see Section 8.1*), and outlines recommendations for future implementation (*see Section 8.2*).

However, the efforts of the Habitat Strategic Initiative alone are insufficient to accelerate regional progress towards the Vital Sign indicator target. Engagement and efforts by every partner in Puget Sound are necessary for meaningful change. Each partner can use the 15% solution approach (*see inset box*) to act now within their purview to contribute towards achieving the regional near-term priorities.

Steps to identifying your 15% Solution

1. Select a near-term priority
2. What are the next steps the region needs to do to move forward?
3. What do you have the power and authority to contribute?
4. What is a small part (15%) of the next steps that you could tackle? This is something that is in addition to your current work.
5. Take action to implement your 15% solution
6. Share your action with the Puget Sound recovery community
7. Repeat

Adapted from:

<http://www.liberatingstructures.com/7-15-solutions/>

8.1 2016-2021 Implementation

The Habitat Strategic Initiative used the strategies in this document to align funding as well as their capacity work to move pieces of the Implementation Strategy forward.

8.1.1 Alignment of NEP Funding to the Action Agenda Priorities and Near Term Actions

The Habitat Strategic Initiative worked closely with their Habitat Strategic Initiative Advisory Team to select a suite of actions to invest in with EPA National Estuary Program Geographic Funds (commonly known as NEP Funds) to advance Puget Sound recovery goals described in the Action Agenda for Puget Sound. NEP funds are aimed at investing in traditionally difficult-to-fund actions that catalyze greater opportunities for future recovery progress. The Habitat Strategic Initiative Advisory Team identified four types of actions that NEP funds are particularly well-suited to support that are traditionally difficult to fund – Monitoring and Information Gaps, Behavior Change and Incentives, Geographic Scale Integration, and Regulatory Effectiveness.

- The list of funding from the 2016-2018 Action Agenda and 2018-2022 Action Agenda that implement this Implementation Strategy can be found in [Appendix IIIb](#).

8.1.2 Regional Priorities for the 2018-2022 Action Agenda

The Habitat Strategic Initiative Advisory Team (SIAT), facilitated by the Habitat Strategic Initiative, developed [Regional Priorities](#) for the 2018-2022 Action Agenda. This Implementation Strategy was the basis for the Regional Priorities and proposal guidance provided to ensure high quality NTAs in alignment with the Strategy.

8.1.3 Habitat SIL Capacity Work

Salish Sea Ecosystem Conference

At the Salish Sea Ecosystem Conference 2018, the Habitat Strategic Initiative Lead (Habitat SIL) hosted a well-attended session on [Integrated Floodplain Management](#). This session was an opportunity to provide an overview of the integrated floodplain management vision, discuss the trend towards an integrated approach, share success stories from floodplain managers throughout the Salish Sea, and communicate areas of focus for the next five years.

The Habitat Strategic Initiative was also an active contributor to the 2020 Salish Sea Ecosystem Conference. The Conference selected the Habitat Strategic Initiative's proposed session titled "[Best Land Use Practices for Conservation in a World of Growing Populations and Increasing Sprawl](#)." With the COVID-19 Pandemic of 2020, a shortened conference was held virtually and this session was not held.

Support Regional Integrated Floodplain Strategy

The Habitat Strategic Initiative supported [Floodplains by Design](#) by serving on their management team. The Habitat Strategic Initiative has also participated in regional floodplain manager workshops throughout 2016 to 2020 to strengthen the regional network, understanding, and learning exchange with local floodplains managers, and stay updated on regulatory needs.

Puget Sound Ecosystem Monitoring Program (PSEMP) Nearshore Working Group

The Habitat Strategic Initiative works with the Puget Sound Ecosystem Monitoring Program (PSEMP) [Nearshore Workgroup](#) lead to identify monitoring related actions aligned to both the Implementation Strategy and the Workgroup goals. The Habitat Strategic Initiative also served on the Steering Committee for the PSEMP [Nearshore Restoration Summit](#), which connected restoration scientists and practitioners to synthesize nearshore science and restoration actions in Puget Sound. Led by the PSEMP Nearshore Work Group and the WDFW's Estuary and Salmon Restoration Program (ESRP), the Summit includes two full day sessions focusing on major deltas in Puget Sound.

Coordinating Funding Across Programs

Recognizing that coordinated funding is a core element to the Implementation Strategy, the Habitat Strategic Initiative as the Implementation Strategy lead achieved this through a variety of mechanisms. Team members served as reviewers for other funding programs (including but not limited to ESRP, Floodplains by Design, Puget Sound Acquisition and Restoration fund, and

Shore Friendly) decision packages. Habitat Strategic Initiative also contributed to the federally led coordinated investment efforts for restoration in the Skagit River system.

Guide the development of the Watershed Lead Organization Synthesis Volume 1 (Puget Sound Institute)

The Habitat Strategic Initiative submitted a joint-proposal with the Watershed Lead Organization (Watershed LO) partners and guided a process for the Puget Sound Institute to evaluate the results of the NEP Watershed Lead Organization land-use grants (Wright 2020).

Supporting the Vital Sign and Common Indicators Programs

As the Implementation Strategy Lead for floodplains and estuaries, the Habitat Strategic Initiative served on the advisory committee for the [Floodplains Condition Assessment and Vital Signs Refinement](#), which improved the process of monitoring floodplains for PSP's Vital Sign and Common Indicators programs.

8.1.4 Guiding and Coordinating Strategy Elements to Completion

This section covers work that the Habitat Strategic Initiative used team capacity for in pursuit of achieving elements in the Implementation Strategy.

Guide the synthesis report of Local Integrated Floodplain Management in Puget Sound Agricultural River Systems

The Habitat Strategic Initiative worked with Puget Sound Institute (PSI) to develop a synthesis report titled "Local Integrated Floodplain Management in Puget Sound Agricultural River Systems." The report, anticipated to be released in 2021, will inform the adaptive management of this Implementation Strategy as well as support the Floodplains by Design network.

8.2 2022 and Beyond: Recommendations for Future Implementation

The Habitat SIL acknowledges that implementing the efforts in this Implementation Strategy are not complete. The Implementation Strategy lead needs to review the strategy and determine adaptive management steps at regular intervals for continuous improvement of the plan. This includes the incorporation of new data, analysis, and management tools as they become available. The previous information in Section 8 show the implementation and Habitat SIL capacity work through mid-2021. This section outlines additional information and coordination on topics that is necessary to advance the Implementation Strategy outcomes in the future. This includes:

- Incorporate climate change vulnerabilities, impacts, and actions into the Implementation Strategy using the Implementation Strategy Protocol as a guide (Tillman and Chang 2020).
- Incorporate diversity, equity, inclusion, and environmental justice considerations into the Implementation Strategy using the Human Dimensions Protocols as a guide (Trimbach et al. 2020).

9. Adaptively managing the recovery of the Vital Signs

Adaptive management—the process of continuous improvement based on new data, analysis, and learning—forms the basis for planning, implementing and improving Puget Sound recovery.

9.1 Evaluating the Implementation Strategy

The information in the Implementation Strategy should be regularly reviewed and updated when new information or changes occur within the recovery system as related to the strategy. The Habitat Strategic Initiative, in collaboration with partners, will examine performance metrics that are relevant to each strategy, highlight new information that is vital to the strategy, and determine if any changes to the strategy are warranted. It is not expected that progress made toward achieving strategy priorities will show immediate signal in the Vital Sign indicator target tracking data. However, the tracking of accomplishments and outcomes of work related to each the strategies will help inform the evaluation of overall Implementation Strategy progress and updated needs. Taking time to reflect on and evaluate the effectiveness of the strategies identified is a critical step to ensuring that our actions continue to target the most relevant barriers to progress.

9.2 Learning from ongoing work

The Floodplains and Estuaries Implementation Strategy draws upon the experiences and lessons learned based on the substantial investments in targeted actions and ongoing work of the past decade. There are many facets of floodplain and estuary protection and restoration challenges, and new issues will emerge or be understood as we make progress over time. As these strategies are implemented, it is important to test any underlying assumptions that may affect the approaches described in the recovery strategies. The Habitat Strategic Initiative anticipates working with partners and existing forums to ensure the work is leveraging multiple opportunities for knowledge exchange.

9.3 Updating the strategies

The Strategic Initiatives, Puget Sound Partnership, Puget Sound Institute, and EPA are working together to develop a common understanding of the update process, as progress is made toward the goals of the Implementation Strategies and new issues and ideas emerge. Climate change and human dimensions have both been considered and integrated into the Implementation Strategies to varying degrees, and warrant more targeted evaluation and discussion.

The Floodplains and Estuaries Implementation Strategies were originally developed separately in August 2013 (Estuaries) and September 2016 (Floodplains). Since then, the Strategic Initiatives and the Puget Sound Partnership developed a standardized structure and format for the narratives that supports clear and consistent messaging within and across the Implementation Strategies. Updating the Floodplains and Estuaries Implementation Strategies offered the opportunity to advance strategy coordination and better reflect the social-ecological system in which these Vital Signs exist. For the 2021 update to the Floodplains and Estuaries Implementation Strategy, the Habitat SI worked to:

- Better represent the interconnected and overlapping strategies of the Floodplains and Estuaries Implementation Strategies
- Translate the initial Implementation Strategy content into the updated structure and format, in order to create a consistent framework to inform the 2022-2026 Action Agenda development
- Represent the products and knowledge learned from Near Term Actions supported by the Habitat SI funding (grants and capacity)
- Ensure that all standard sections are complete, or pathways for completion are recommended
- Highlight connections to the other Implementation Strategies
- Ensure institutional knowledge transfer via the Implementation Strategies to the next Habitat SIL (HSIL 2.0)

The results of this 2021 update revealed multiple opportunities for further content development and adaptive management of the strategies, as well as approaches to tracking progress.

10. Conclusions

The Floodplains and Estuaries Implementation Strategy identifies three strategies to help Puget Sound accelerate progress towards underlying conditions associated with the Floodplains and Estuaries Vital Sign indicator targets. The strategies work together to enable large- and small-scale coordination among partners to protect and restore floodplains and estuaries; support local scale planning in large river deltas and estuaries; and support the development and coordination of best-available science to inform decision making. The three strategies are:

- **Sound-wide Strategy: Sound-Wide Integrated Floodplain and Estuary Management:** Promotes a coordinated vision of integrated management of floodplains and estuaries, which enhances outcomes for fish populations, flood risk, and agricultural viability throughout Puget Sound. (Section 3.3)
- **River Basin Strategy: River-Basin Scale Planning and Project Implementation:** Supports communities to develop and implement restoration and protection plans which address local needs and goals within an integrated floodplain management system. (Section 3.4)
- **Risk and Costs Strategy: Risk Tolerance and Cost Subsidies Analysis** Fills critical knowledge gaps that inform incentives to restoring and protecting floodplains and estuaries from development in areas that do not provide a long-term benefit to the community. (Section 3.5)

Partners operating throughout Puget Sound, at local and regional scales, are necessary for the success of the Implementation Strategy. Communication and collaboration is a common theme throughout the Implementation Strategy and is essential to leveraging existing resources and accelerating progress. The outcomes identified in the Implementation Strategy, along with the overall strategies, are well-aligned with the objectives of partners throughout the Sound. Enactment of this Implementation Strategy should increase the health of the floodplains and estuaries while ensuring people have a place to reside, travel, and support their livelihoods.

11. Links to Appendices

- I. Strategy documents – *relevant appendices for this section will be developed through future adaptive management.*
- II. Supporting resources
 - a. Floodplains Implementation Strategy - Phase 1 (see Reference section, Partnership 2016)
 - b. Estuaries Implementation Strategy – Phase 1 (see Reference section, Partnership 2015)
- III. Communications
 - a. [Floodplains and Estuaries Implementation Strategy Factsheet](#)
 - b. [Habitat Strategic Initiative funded Floodplains and Estuary Near Term Actions](#)
- IV. Process documents
 - a. [Habitat IS Update Workplan 2020-2021](#)
 - b. [Feedback on Narrative Update 2021](#)

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