# ASRP INTERIM PROJECT GUIDANCE FOR THE ESTUARY ECOREGION

## Background

The *Aquatic Species Restoration Plan* (ASRP; ASRPSC 2019) is based on habitat protection, restoration, and management actions that work in harmony with—and support the restoration of—watershed processes. When planning a restoration project, it is important to consider the relevant processes operating on the project site within the larger watershed context.

Grays Harbor was recognized as important but was not included in the original 2019 ASRP, which initially focused on restoration of freshwater areas. The tidally influenced reaches of tributaries to Grays Harbor were considered in the 2019 ASRP, including the lower Chehalis River from river mile (RM) 0 to RM 20. A newly published Estuary Ecological Region supplement to the ASRP outlines the available information about the history and current state of this ecoregion (ASRPSC 2024). The approach to the estuary is necessarily different than the rest of the Chehalis Basin, as restoration techniques for marine environments are different than freshwater habitat restoration practices. The estuary has different stressors impacting it, different habitat-forming processes, and a different regulatory environment.

> The **Estuary Ecological Region supplement to the ASRP** outlines the available information about the history and current state of this ecoregion (ASRPSC 2024).

The approach to, and guidance for, restoration and protection in the estuary will be refined once linkages between habitat restoration in the estuary and species-level responses are evaluated in more detail, including modeling the connections between habitat and salmonid abundance with the Ecosystem Diagnosis and Treatment (EDT) model. Until that is completed, information has been compiled and summarized from discussions among the ASRP Regional Implementation Teams and the ASRP Technical Advisory Group (TAG[1]), who considered the best available science to make recommendations for interim restoration actions.

The purpose of this document is to provide interim guidance to sponsors on estuary actions that are considered near-term priorities at this time. This document provides a brief overview and rationale for these actions by area. It is anticipated that guidance will continue to be refined in future years, informed by additional habitat data, habitat modeling,

> **This document provides interim guidance to sponsors on estuary actions** that are considered high priority at this time. Guidance will continue to be refined in future years, informed by emerging science and feasibility considerations.

[1] TAG supports monitoring and adaptive management of the ASRP. TAG replaced the Science and Technical Review Team and the Monitoring and Adaptive Management Team, who guided technical development of the ASRP prior to 2021. Regional Implementation Teams of project sponsors, community members, and other interested parties coordinate and collaborate on ASRP project implementation under the leadership of local conservation districts.

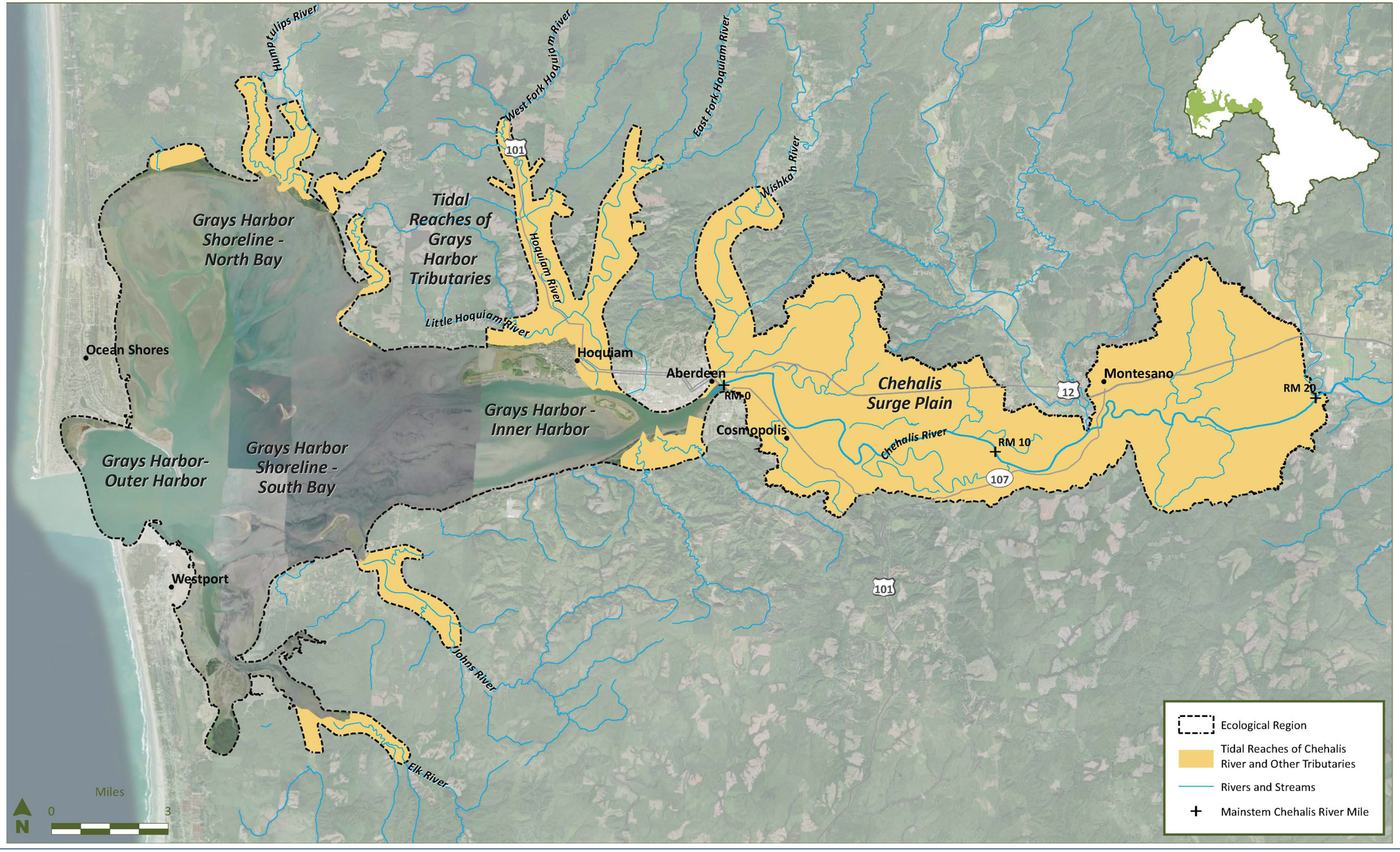
other emerging science, and consideration by TAG. In addition, events to connect the science and implementation groups in Grays Harbor were held in 2024 with a new specific focus on project development and growing project sponsor capacity in the estuary. These materials and discussions were documented in two poster presentations and a report for the Joint ASRP Science and Implementation Workshop held on June 20, 2024.

## Interim Approach to Restoration Actions

The Estuary Ecological Region encompasses Grays Harbor, the tidally influenced portions of its tributaries (including both tidal saltwater and tidal freshwater reaches of the Humptulips, Hoquiam, East Fork Hoquiam, West Fork Hoquiam, Little Hoquiam, Wishkah, Johns, and Elk rivers, as well as smaller creeks and tidal sloughs), and the mainstem Chehalis River and its floodplain from approximately RM 0 to RM 20 (Satsop River confluence; Figure 1).

Major geographic areas of the estuary have been defined with a broad brush for this interim guidance, based on different characteristics that may require different interim priority actions. The interim recommended actions for each geographic area are summarized in a table (Figure 2) and followed by a narrative describing the intent and importance of those actions by area.

**Figure 1**
**Interim Estuary Priority Areas**




Note: The Estuary Ecological Region boundaries shown here reflect the approximated extent of tidal influence around Grays Harbor, in the Chehalis River, and in other tributaries (ASRPSC 2024). These boundaries are not exact, and site-specific information should be used when considering future projects located near the tidal boundaries.

**Figure 2**
**Interim Estuary Near-Term Priority Areas and Actions**

| Ecological Region | Estuary Areas | Protect Intact Habitat<br>Protect remaining intact areas that are not currently protected. | Reduce Shoreline Armoring<br>Remove hard shoreline armoring and/or replace with bioengineered techniques. | Remove Creosote-Treated Piling<br>Remove creosote-treated piling. | Reconnect/Restore Tidal Floodplains<br>Set back roads that function as dikes along the shoreline or expand openings to reconnect tidal and floodplain habitats. | Restore Wetlands<br>Restore shrub and forest tidal wetlands that are currently rare and expand upstream to accommodate sea level rise. | Remove/Reconfigure Tide Gates<br>Remove/reconfigure tide gates to reconnect tidal sloughs and wetlands for fish access and export of detritus and invertebrates for food web support. | Restore Riparian Areas<br>Restore shoreline riparian buffers. | Place Large Wood<br>Install large wood on the shoreline and in tidal wetlands. | Restore Former Industrial Lands<br>Opportunistically restore industrial portions of the estuary. | Minimize Dredging Impacts<br>Support relevant agencies to align the navigation channel dredging schedule to avoid impacts to native fish species. | Manage Invasive Species<br>Work with partner agencies and organizations to support the management of European green crab and other invasive species of emerging concern. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Restoration Actions | | | | | | | | | | |
| Estuary | Chehalis Surge Plain | High | Medium | Low | High | High | High | Low | Medium | | | Medium |
| | Tidal Reaches of Grays Harbor Tributaries | High | Medium | Low | High | High | High | Medium | Medium | | | High |
| | Grays Harbor Shoreline - South Bay | High | Medium | Low | High | Medium | Medium | Medium | Medium | | | High |
| | Grays Harbor Shoreline - North Bay | High | Medium | Low | High | Medium | Medium | Low | Medium | | | High |
| | Grays Harbor - Inner Harbor | Low | High | High | High | Low | Low | Medium | Medium | High | High | High |
| | Grays Harbor - Outer Harbor | Medium | Medium | Low | High | Low | Low | Low | Medium | | High | High |

High Priority  Medium Priority  Low Priority

## *Estuary Areas and Near-Term Priorities*

This document refers to the following geographic areas, which have different characteristics and will require different interim priority actions:

- Chehalis Surge Plain
- Tidal Reaches of Grays Harbor Tributaries
- Grays Harbor – Inner Harbor
- Grays Harbor – Outer Harbor
- Grays Harbor Shoreline – North Bay
- Grays Harbor Shoreline – South Bay

- **Chehalis Surge Plain:** The Chehalis surge plain includes tidally influenced areas of the Chehalis River (from the end of the navigable channel at RM 3 near Cosmopolis upstream to approximately RM 20) and lower Chehalis tributaries.
  - The priority actions for this area are relatively straightforward: protect existing high-quality habitat, restore and reconnect tidal floodplain habitat by setting back barriers such as dikes, restore wetlands, and remove or reconfigure tide gates.
  - Restoring and reconnecting tidal sloughs and wetlands will allow for fish access and the export of detritus and invertebrates into the main waterways for food web support.
- **Tidal Reaches of Grays Harbor Tributaries:** Several other tributaries feed into Grays Harbor. The tidal reaches include tidally influenced areas of the Humptulips, Hoquiam, East Fork Hoquiam, West Fork Hoquiam, Little Hoquiam, Wishkah, Johns, and Elk rivers, as well as smaller creeks and tidal sloughs.
  - The priority actions for these areas are similar to the Chehalis Surge Plain area: protect existing high-quality habitat, restore and reconnect tidal floodplain habitat, restore wetlands, and remove or reconfigure tide gates.
  - Monitoring and managing invasive species is an additional priority action for these tributaries.
- **Grays Harbor – Inner Harbor:** The inner harbor extends from the end of the federal navigation channel near RM 3 at Cosmopolis in the east to the end of the heavily developed areas approximately 5 miles to the west of the mouth of the Chehalis River. The shoreline in this part of the estuary has been extensively modified by dredging and filling to create uplands, roads and dikes, past and current industrial development and discharges, and shoreline armoring, particularly through Cosmopolis, Aberdeen, and Hoquiam. Most industrial impacts to the estuary are concentrated in this area. All anadromous species migrating from the Chehalis, Hoquiam, and Wishkah rivers must pass through this area, increasing the likelihood that any habitat uplift achieved in this area will benefit this full suite of species. Reducing and reversing impacts from past and current industrial activity is the highest-priority action in this area.
  - Specific priority actions to restore post-industrial areas include removing creosote piling, removing or bioengineering shoreline armoring, restoring industrial areas as opportunities arise, minimizing dredging impacts, and reconnecting floodplains.

  - As climate change-driven sea level rise continues to impact coastal areas, the pressure to armor shorelines will likely increase in the future. When possible, additional shoreline armoring should be discouraged.
  - Invasive species management is also a high-priority action in this area of the estuary.
  - Removing creosote-treated wood is important everywhere in the estuary; however, this action has been ranked as a near-term priority in the inner harbor area only to focus efforts where the majority of creosote-treated wood occurs (DNR 2012). For perspective, a single cluster of derelict creosote-treated piles near Aberdeen contains approximately 60% of the creosote-treated piling in all of Grays Harbor (DNR 2012).
  - Opportunistic road and dike setbacks to reconnect tidal marsh habitat have also been identified as key restoration objectives for this area. ASRP-funded projects should tie to specific habitat improvements, including (but not limited to) removing shoreline hardening, rather than just transportation system improvements. Highway 105 has been identified as the highest-priority candidate for setback from a habitat perspective.
- **Grays Harbor – Outer Harbor:** The outer harbor refers approximately to the area within Grays Harbor near the cities of Ocean Shores and Westport, characterized by the sand spits that form the outer boundary of the harbor and the outlet to the Pacific Ocean.
  - The priority actions in the outer harbor are to set back road and dikes where possible, monitor and manage invasive species (particularly European green crab [*Carcinus maenas*]), and minimize dredging impacts.
  - Dikes and roads that cut off large areas of wetlands or sloughs should be considered high priority for setbacks or reconnection wherever possible.
- **Grays Harbor Shoreline – North Bay:** The shoreline areas of the North Bay are relatively intact compared to the industrialized inner harbor.
  - Priority actions for this area include protecting existing shoreline and intertidal habitat, setting back roads and dikes where possible, and monitoring and managing invasive species (particularly European green crab).
- **Grays Harbor Shoreline – South Bay:** The shoreline area of the South Bay is relatively intact compared to the industrialized inner harbor.
  - Priority actions for this area include protecting existing shoreline and intertidal habitat, setting back roads and dikes where possible, and monitoring and managing invasive species (particularly European green crab).
  - TAG recognizes that road and dike setbacks are major undertakings that do not happen quickly or easily and so are unlikely to be feasible in the immediate future. However, they are considered a near-term priority action that should start with planning phases as soon as possible, particularly roads and dikes very close to the shoreline that cut off connections to tidal marsh or slough habitats.

## *Interim Near-Term Priority Restoration Actions*

Certain restoration actions have been identified as near-term priorities for each estuary area to kickstart restoration and planning during this interim period while additional information is gathered and project sponsor capacity grows.

- **Protect Intact Habitat:** Actions should be taken to protect remaining intact areas that are not currently protected. Many areas of the Grays Harbor shoreline are relatively intact, particularly in the North and South bays, pockets adjacent to the existing Surge Plain Natural Area Preserve, and tidally influenced tributaries. Identifying and protecting parcels that contain high-quality habitat such as intact wetlands is a high-priority action. Protection can involve direct purchasing of land, negotiation of conservation easements, or other actions that limit adverse human impacts to habitat. There is increasing evidence that a "habitat mosaic" within nearshore areas can provide habitat for a wide range of intertidal species (Gross et al. 2017). Salmon tend to move through estuaries over the course of weeks or months, pausing to acclimate to higher salinity, forage, and rest in different types of high-quality habitat. An action that would benefit salmon is to protect "stepping-stone" habitats (ERTG 2019), patches of existing high-quality shoreline habitat across the North and South bays of Grays Harbor. Existing complex vertical structure such as eelgrass meadows and oyster reefs provide foraging and refuge habitat for juvenile fish and crabs, including commercially and culturally important Dungeness crab (*Metacarcinus magister*) and salmonids (Dumbauld et al. 2015; Rubin et al. 2018; Veggerby et al. 2024). Complex vertical structure provides attachment points for algae and invertebrates, as well as predator refuge.
- **Reduce Shoreline Armoring:** Shoreline armoring is common in the developed areas of the inner harbor to protect buildings and infrastructure. Armoring reduces habitat function in many ways. It increases wave intensity along the shore, resulting in deepening and coarsening of sediments in nearshore habitats and a reduction in shallow shoreline habitat. Armoring also interrupts the connectivity between terrestrial and nearshore habitats that is a key to ecosystem processes. Armoring replaces cover vegetation and interrupts the export of nutrients, sediment, detritus, prey, and other terrestrial-based resources into the marine environment. Armoring also reduces habitat for forage fish (e.g., surf smelt [*Hypomesus pretiosus*]), which require shallow beaches with fine substrate to spawn. Forage fish play a critical role in marine and estuarine food webs because they are prey for larger ecologically, recreationally, culturally, and commercially important fish, marine mammals, and sea birds (Bakun 2006; Cury et al. 2000; WDFW 2024a). As sea levels continue to rise with the changing climate, there may be increasing local opposition to removing shoreline armoring or a desire to add armoring around industrial areas because it is often seen as a go-to erosion defense. Similar to floodplain and tidal marsh reconnection, responding to sea level rise with actions that do not contribute to more shoreline armoring will require long-term planning, so preliminary steps should be considered for pursuit in the near term.

- **Remove Creosote-Treated Piling:** Creosote piling continuously leach contaminants into the surrounding soil and water, causing physiological harm to nearby organisms, especially species that spend a greater amount of time near the source (Ehinger et al. 2024). Creosote piling can retain 75% of their original creosote 40 years after installation (Ehinger et al. 2024; Hutton and Samis 2000) and continue to leach contaminants into nearby sediment for approximately 100 years after abandonment (Ehinger et al. 2024). On average, a creosote-treated piling will contaminate nearby sediment within a 10.4-foot radius (Ehinger et al. 2024). Cutting creosote piling where they meet the substrate can increase leaching from newly exposed wood, worsening the localized contamination (Ehinger et al. 2024; Parametrix 2011), so removal efforts should aim to pull the entire piling out if possible (Ehinger et al. 2024; Hutton and Samis 2000). Removal of piling will generate short-term increases in contamination from sediment disturbance (Ehinger et al. 2024). It takes approximately 9 years for remaining contamination in sediment and nearby organisms to be metabolized and no longer be considered harmful (Ehinger et al. 2024). Because of this delay in realizing full benefits, removal of creosote-treated wood is prioritized in the near term. The most recent creosote piling inventory in Grays Harbor is from 2012, with a map and inventory of the approximately 5,000 to 6,000 remaining creosote piles in Grays Harbor (DNR 2012). The Washington State Department of Natural Resources (DNR) has a creosote piling removal program in place (DNR 2024). Coordinating efforts with DNR is highly encouraged to streamline piling removal efforts, avoid duplicating efforts in locations they may have already prioritized for removal, and ensure best practices and techniques are utilized. The ASRP Steering Committee has identified the need for an updated creosote piling prioritization exercise to be completed before considering non-opportunistic creosote removal proposals in Grays Harbor. Some creosote piling are still in use around Hoquiam and Aberdeen; a project removing derelict piling will likely be substantially easier and less controversial than replacing those still being used.
- **Reconnect/Restore Tidal Floodplains and Wetlands:** Tidal floodplain, forested tidal wetlands, and tidal marsh habitats are used as rearing habitat for some fish species and as exporters of detritus and macroinvertebrates, which can be important components of the nearshore food web (Simenstad et al. 1982; PNNL and NMFS 2020; Roegner and Johnson 2023). Shrub and forested tidal wetlands in Grays Harbor have decreased approximately 30% relative to historical levels (Simenstad et al. 1982), and 45% of all Grays Harbor estuary habitat has been lost relative to historical levels (Brophy et al. 2019). Restoration should consider the need to expand these habitat types upstream to accommodate sea level rise. Dikes and roads that cut off large areas of floodplain or wetlands are a near-term priority for setback whenever possible. TAG recognizes that road and dike setbacks are major undertakings that do not happen quickly or easily, and it is not possible to set back every road or dike. These projects are unlikely to be feasible in the immediate future; however, setting back roads and dikes will require long-term planning and community and

stakeholder engagement, so preliminary planning should be considered in the near term. Opportunistic sites with the potential to open additional marsh habitat should be prioritized.

- **Remove/Reconfigure Tide Gates:** Correction of this type of barrier allows for fish to access more tidal slough and wetland habitat and allows for more export of detritus and invertebrates that are the foundation of the aquatic food web (Maier and Simenstad 2009; Simenstad et al. 1982). If malfunctioning, tide gates and water control structures can strand juvenile salmon in areas with poor water quality (McNatt et al. 2017), and they can be hotspots for invasive and predatory fish (Scott et al. 2016). Tide gate removals or reconfigurations are the most effective with tide gates located near river mouths or tributary confluences, compared to gates located higher in the drainage that block a smaller percentage of the stream (Souder et al. 2018).
- **Restore Riparian Areas:** Like freshwater riparian areas, estuary shoreline riparian buffers are important because they help moderate surface runoff (Brennan et al. 2009) and export invertebrates and detritus into the marine environment (Duffy et al. 2010; Toft et al. 2021). Material inputs may consist of dead organic matter, large woody material, and insects, which serve as food for nearshore organisms. The riparian zone may also provide shading to the upper shore, which can reduce desiccation of forage fish eggs (Lee and Levings 2007).
- **Place Large Wood:** Large wood in shorelines and tidal habitats is important because it provides complex structure for benthic invertebrates and provides erosion control that is a softer alternative to other structural shoreline hardening (Everett and Ruiz 1993; Hood 2007; McMahon and Holtby 1992). The benefits of large wood in estuary shorelines are under-studied compared to the large compilation of literature available on the benefits of wood in freshwater systems. Projects that utilize shoreline wood installation should include a monitoring component and coordination with TAG to inform the benefits of this technique relative to other shoreline restoration actions.
- **Restore Former Industrial Lands:** Industrial land uses have substantially altered Grays Harbor through filling and development, including lumber and pulp mills, sewage treatment plants, and other large facilities requiring access to the shoreline. These facilities also led to a legacy of contaminated water and sediment in the harbor that have degraded habitats for the food web and the fish and wildlife using harbor resources. Ongoing industrial uses of the estuary shorelines limit restoration actions; opportunities to restore formerly (and currently, in some cases) industrialized areas should be prioritized when they arise. Improvement or restoration of intermittent sections of the industrialized Inner Harbor corridor can create “stepping-stone” habitats that benefit migrating salmon. Community involvement efforts should include outreach to industrial landowners to identify non-regulatory opportunities for habitat restoration.
- **Minimize Dredging Impacts:** Dredging of the navigation channel and working industrial ports within Grays Harbor is necessary for port operations (ASRPSC 2023). The estuary-spanning 22-mile federal navigation channel extends from the mouth of Grays Harbor to

south Aberdeen to enable commercial shipping. Maintenance dredging occurs annually, with an average of 1.7 million cubic yards of material removed each year (USACE 2024). Dredging can impact nearby organisms by generating turbidity plumes that smother eelgrass and invertebrate prey and clog fish gills (Mortensen et al. 1976; Simenstad et al. 1982). Ideally, dredging to maintain navigation channels is timed to avoid key migration periods for green sturgeon (*Acipenser medirostris*) and other anadromous species such as salmonids and eulachon (*Thaleichthys pacificus*). If suitable, dredged sediment could be used for beach nourishment in other areas to offset erosion and protect infrastructure (USACE 2024).

- **Manage Invasive Species:** Invasive plants and animals are numerous in the estuary (ASRPSC 2024). European green crab are an emerging invasive species of concern throughout the West Coast of North America. They are fast-breeding, opportunistic, and voracious predators that have the potential to damage native species because they are able to exploit a wide variety of prey resources, including native shellfish. Recent work in Willapa Bay suggests that European green crab feed primarily on hairy shore crab (*Hemigrapsus oregonensis*), sand shrimp (*Crangon septemspinosa*), and Pacific staghorn sculpin (*Leptocottus armatus*) (Fisher et al. 2023). They also dig and destabilize eelgrass beds that provide key habitat for native species (WDFW 2024b). Another invasive animal of concern is New Zealand mud snail (*Potamopyrgus antipodarum*), which reproduce rapidly and compete with native invertebrates at the base of the aquatic food web but do not themselves provide a good food sources for fish (WDFW 2024b).

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