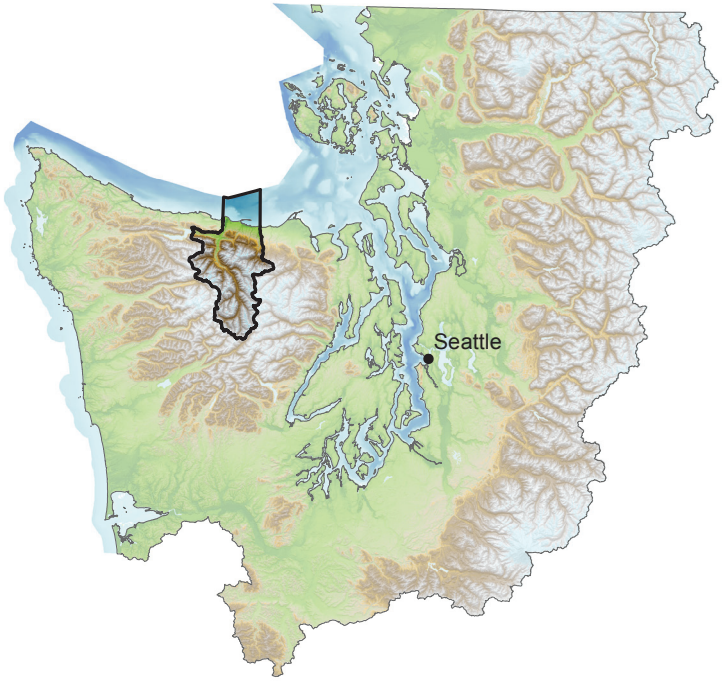
2016 State of Our Watersheds Report
West WRIA 18 – Morse Creek to Elwha River

Dam removal seemed like an elusive target over the years and many citizens were skeptical of the benefits. However in just four years the river has transported over 60% of the stored sediment, resulting in a rebirth of the estuary and the floodplain. Salmon are ascending to historic habitats and the recovery of the ecosystem is about to blossom.

-Mike McHenry
Fisheries Habitat Manager



Lower Elwha Klallam Tribe

The Lower Elwha Klallam Tribe is part of the Klallam Band of Indians that have resided throughout the Strait of Juan de Fuca, Hood Canal and Port Gamble Bay for generations. They are party to the Point No Point Treaty of 1855, when tribes ceded most their traditional lands to the U.S. government. The Dungeness-Elwha Basin (WRIA 18) has remained largely rural and forested with a natural resources-based economy focused on shellfish harvesting, commercial forestry, commercial fisheries, tourism, and agriculture. Major land-use impacts on salmon habitat have occurred from floodplain and shoreline development, road construction and past logging practices. This report will focus on the northwest portion of WRIA 18 basin and surrounding marine waters, which is only a portion of the area that the Lower Elwha Klallam Tribe co-manages.

Elwha Basin

The Area of Concern for the Lower Elwha Klallam Tribe (Elwha Tribe) is the western portion of WRIA 18, from the Elwha River watershed to Morse Creek, east of Port Angeles. This area is the ancestral home of the Klallam Indians, the first human inhabitants to the Eastern Strait region, with villages and fishing camps most often associated with stream mouths where they could take advantage of plentiful fish and shellfish resources. Federal lands compose 82% of the Area of Concern and combined with other government-managed lands, mostly by the Washington Department of Natural Resources, only 12% of the area is likely to see future population growth. This land ownership pattern concentrates development in the watershed's lower elevations. Consequently, major land-use impacts on salmon habitat have occurred primarily from floodplain and shoreline development, as well as road construction and past logging practices.

At the 10-year mark of the Puget Sound Salmon Recovery Plan, a review of key environmental indicators for the Dungeness-Elwha Basin recovery planning area reveals a continued decline in water quality and quantity, floodplain and riparian processes, and shoreline habitat conditions. Both internal and outside reviews have concluded that recovery efforts are behind the expected pace of implementation.[1]

Funding shortfalls for both large-scale projects and adequate staff capacity are cited as contributing factors for this finding. In addition, progress on many non-capital regulatory and protection actions governed by other entities are also negatively affected by these same funding shortfalls, as it takes staff to engage on these issues.

Technical analysis has identified significant habitat limiting factors for the region's declining salmonid populations as:

- Estuarine habitat loss and degradation;
- Loss of channel complexity from loss of recruitment of large woody debris;
- Floodplain modifications;
- Sediment aggradation; and
- Loss of littoral drift.[2]

Recovery Plan Includes Habitat Restoration

The overall recovery strategy for the region seeks to maintain and improve habitat integrity to protect and strengthen wild stocks while restoring habitat for formerly productive but currently weak wild stocks.

The North Olympic Peninsula Lead Entity (NOPLE) developed a habitat recovery strategy that incorporates specific recovery goals, focused areas and prioritized actions that were developed through various recovery planning processes. NOPLE established priorities for both watershed and nearshore processes. The prioritized processes include hydrologic regimes, sediment supply, lower river hydrodynamics, water quality, canopy cover and nutrient input.

The identified goals for the NOPLE Recovery Plan are:

- Maintain and improve ecosystem productivity and genetic diversity;
- Protect highly productive habitats and populations, and restore impaired habitat and populations with productive potential;
- Utilize the best available science to set regional priorities;
- Recognize socio-political factors in decision-making; and
- Provide direction and focus for project sponsors.[3]

Tiffany Royal, NWIFC

Habitat restoration crew technician Kim Williams plants seedlings in the former Lake Aldwell, as part of the tribe's revegetation restoration efforts.

Recovery Efforts Show Signs of Improvement But Still Lagging in Key Indicators

At the 10-year mark of the Puget Sound Salmon Recovery Plan, a review of key environmental indicators for the Lower Elwha area shows improvements for floodplain processes and restoration efforts (Elwha Dam removal), but degradation of water quantity, increase of impervious surface areas and degradation of forestland cover. In general, there is a shortage of staff at all levels (e.g., federal, state, tribal, county) needed to address the issues and implement actions to restore and protect habitat, and to monitor and enforce compliance of existing regulations. In addition, funding shortfalls for large-scale projects contribute to the slow pace of progress.

Review of the trend for these key environmental indicators since the 2012 State of Our Watersheds Report shows improvement for some indicators and a steady loss for others in habitat status:

Tribal Indicator	Status	Trend Since SOW 2012 Report
Shoreline Modifications / Forage Fish	Washington state's HPA database shows that between 2005 and 2014, Clallam County had 1,933 feet of new shoreline armor, 5,337 feet of replacement armor and no removal of existing armoring. However, within the Lower Elwha Tribe's Area of Interest, the Tribe has removed 2,700 feet of hardened shoreline and is on track to complete the removal of an additional 1,750 feet in 2016.	**Declining**
Impervious Surface	From 2006-2011, most watersheds outside Olympic National Park showed low level (< 1%) of change in impervious surface area.	**Slight Decline**
Timber Harvest	From 2006 to 2011, saw a negative trend in forest cover, with a reduction ranging from 0.1% to 10% on those lands outside of Olympic National Park.	**Declining**
Water Wells	There are 1,003 wells which affect groundwater supply and instream flows in the Lower Elwha Area of Concern. Between 1980 and 2009, 801 wells were completed at a rate of about 27 new wells per year. Since then, 51 new wells have been added at a lower rate of about 10 wells per year.	**Declining**
Floodplain	Morse Creek floodplain has been seriously impaired with 37% (49% downstream of Highway 101) being zoned for development from utility right of ways to single-family homes. Since 2011, a significant meander has been restored and 1,300 feet of habitat added to the formerly channelized reach. Other improvements include the construction of side channels, additions of large wood, removal of dikes and restoration of floodplain forests.	**Improving**
Restoration	Elwha River dams were removed and the ecosystem is being restored, reopening the upper watershed for the first time in 102 years. Port Angeles Harbor Cleanup and Restoration project is underway. The A-Frame site has been restored. Project included the removal of an overwater structure, pilings, two buildings, 1,500 feet of shoreline armoring. Once completed, a total of 2,100 meters of Ediz Hook's shoreline will be restored to a natural condition.	**Improving**

The Tribe continues to work toward the protection and restoration of healthy and functional nearshore, estuarine and river habitat, restoring those areas that are degraded, and conducting research to understand the organisms and the habitats they occupy.

Looking Ahead

The Lower Elwha Klallam Tribe will continue to focus its efforts and resources on the restoration and protection of sensitive environments and critical habitats in floodplain, riparian, estuarine, and nearshore systems on the North Central Olympic Peninsula. A high priority for the Tribe is the continued restoration of marine shoreline within Port Angeles Harbor, particularly sites located on Ediz Hook, the western lagoon and estuaries of creeks draining into the Harbor. The Tribe will pursue funding opportunities that would assist with the implementation of these activities. The Tribe will also continue its efforts to ensure a timely and effective cleanup of toxic contaminants from Port Angeles Harbor such that future generations may resume subsistence and commercial fishing practices. We hope to see harbor cleanup activities commence by late 2018, in addition to significant restoration efforts associated with Natural Resource Damage compensation. The Tribe will continue to promote restoration actions complementary to dam removal on the Elwha River. This includes restoration of tributary streams and removal of infrastructure in the floodplain and nearshore of the River.

Lower Elwha Klallam Tribe

West WRIA 18 – Morse Creek to Elwha River

The Lower Elwha Klallam Tribe's Area of Concern is the west half of the Dungeness-Elwha Basin (WRIA 18). The basin is located along the northeast portion of the Olympic Peninsula. Its watersheds drain to the Strait of Juan de Fuca. The two principal watersheds are the Dungeness and the Elwha rivers, whose headwaters are in Olympic National Park and U.S. Forest Service wilderness areas. In addition to these two large river systems, a number of smaller independent drainages, such as Morse Creek, also are in the basin.

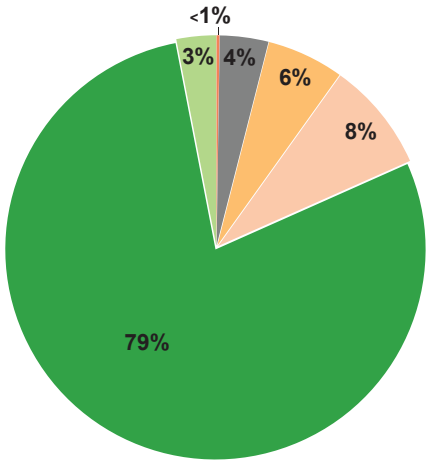
This chapter will focus on an area between Morse Creek drainage, east of Port Angeles, west to the Elwha River. The topography and precipitation patterns vary dramatically, from high mountain ridges with 240 inches of annual precipitation, to lowland valleys with 25 inches of annual precipitation.

ESA-listed Puget Sound Chinook and Hood Canal/Eastern Strait summer chum occur in the basin, along with coho, fall chum, pink salmon and steelhead. Bull trout occur in the Elwha drainages.

The Klallam were the first human inhabitants to the Eastern Strait region, with villages and fishing camps most often associated with stream mouths where they could take advantage of plentiful fish and shellfish resources. With the Point No Point Treaty of 1855, the tribes ceded their lands to the U.S. government. By this time, Euro-Americans had already begun clearing and farming the floodplains and were soon cutting the old-growth timber along the shorelines.

Though much of the region remains rural and forested, and about 79% of the area is within Olympic National Park, the city of Port Angeles has developed rapidly. The Glines Canyon and Elwha dams along the lower mainstem of the Elwha River blocked all anadromous fish access to the majority of the watershed since the early 1900s. The dams were removed in 2014, opening the upper watershed to salmon for the first time in 102 years.

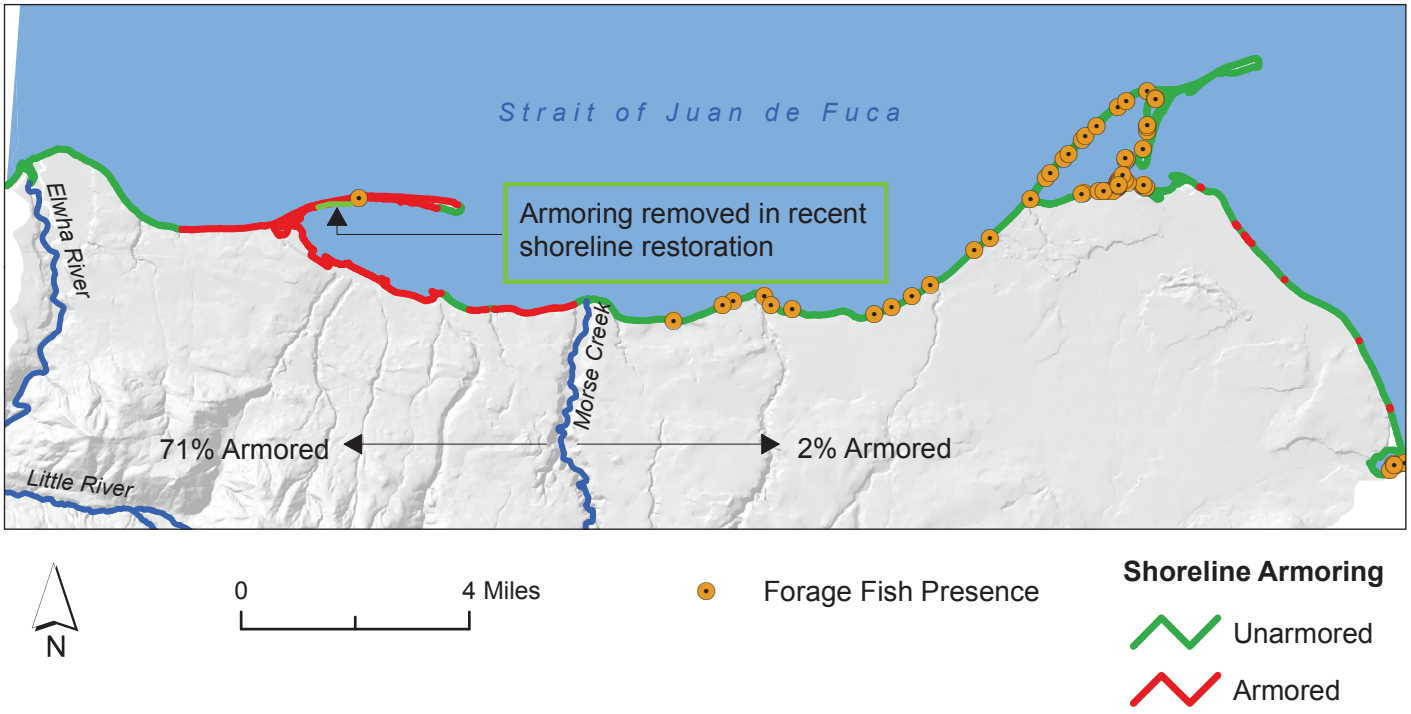
Federal and other government-managed lands compose about 88% of the focus area. That means only 12% of this area is available for the current population and its projected future growth. Rivers, creeks and marine shorelines in this area will be subject to increased development pressures.



Data Sources: SSHIAP 2004,[1] USFWS 2014,[2] WADNR 2014a,[3] WADNR 2014b,[4] WADOT 2012,[5] WADOT 2013,[6] WAECY 1994,[7] WAECY 2011a,[8] WAECY 2013[9]

Shoreline Armoring and its Impact on Forage Fish Habitat

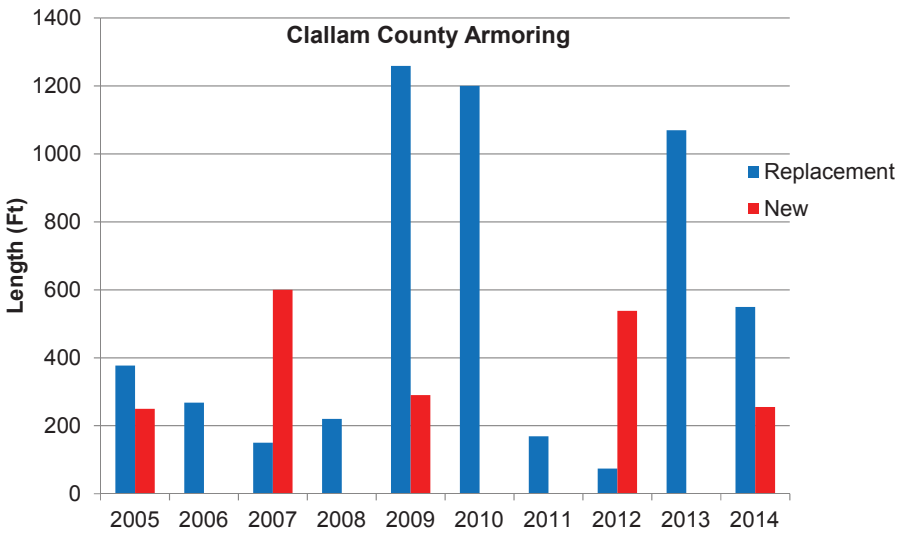
Washington state's HPA database shows that between 2005 and 2014, Clallam County had 1,933 feet of new shoreline armor, 5,337 feet of replacement armor and no removal of existing armoring. However, within the Lower Elwha Tribe's Area of Interest, the Tribe has removed 2,700 ft of hardened shoreline and is on track to complete the removal of an additional 1,750 feet in 2016.



Armoring involves the use of physical structures to protect marine shorelines in order to stabilize coastal land, prevent erosion, and protect residential and commercial infrastructure.

Shoreline armoring can alter the delivery, transport and accretion of sediments when sediment source bluffs become disconnected from their associated beaches and marine nearshore. This negatively affects the nearshore environment necessary for salmon survival, and severely limits forage fish habitat development and maintenance. According to Entrix, shoreline armoring is widespread, severely degrading shoreline currents, sediment processes, vegetative communities, vertebrate and invertebrate communities (salmonid food sources), and the protective habitat provided by natural shorelines.[1] Sand lance and surf smelt, which make up a major portion of the diets of juvenile Chinook salmon, spawn almost exclusively on sand and gravel beaches, making them especially vulnerable to the degrading effects of shoreline modification and armoring.

About 71% of the marine shoreline in the Lower Elwha Tribe's Area of Concern is armored and this shoreline is almost entirely west of Morse Creek. About 2% of the shoreline outside of the Area of Concern and eastward of Morse Creek is armored.



This significant difference in the degree of armoring of the shorelines west and east of Morse Creek may be the reason for the equally significant difference in the distribution of forage fish spawning habitat in both areas. Of the 305 forage fish surveys conducted in WRIA 18 by WDFW (with 82 positive for surf smelt and/or sand lance), only one survey found forage fish west of Morse Creek.

Data available for Clallam County from the Hydraulic Project Approvals (HPA) database[2] was used to identify the general trend in shoreline armoring in this area. Between 2005 and 2014, a total of 26 projects were undertaken, resulting in 1,933 feet of new shoreline armor, 5,337 feet of replacement armor and no removal of existing armoring. However, the Lower Elwha Tribe's Area of Interest, the Tribe has removed 2,700 feet of hardened shoreline and is on track to complete the removal of an additional 1,750 feet in 2016.[3]

Data Sources: Carman et al. 2015,[4] PSNERP 2008,[5] SSHIAP 2004,[6] WADFW 2010,[7] WAECY 2011a,[8] WAECY 2011b[9]

Impervious Surface

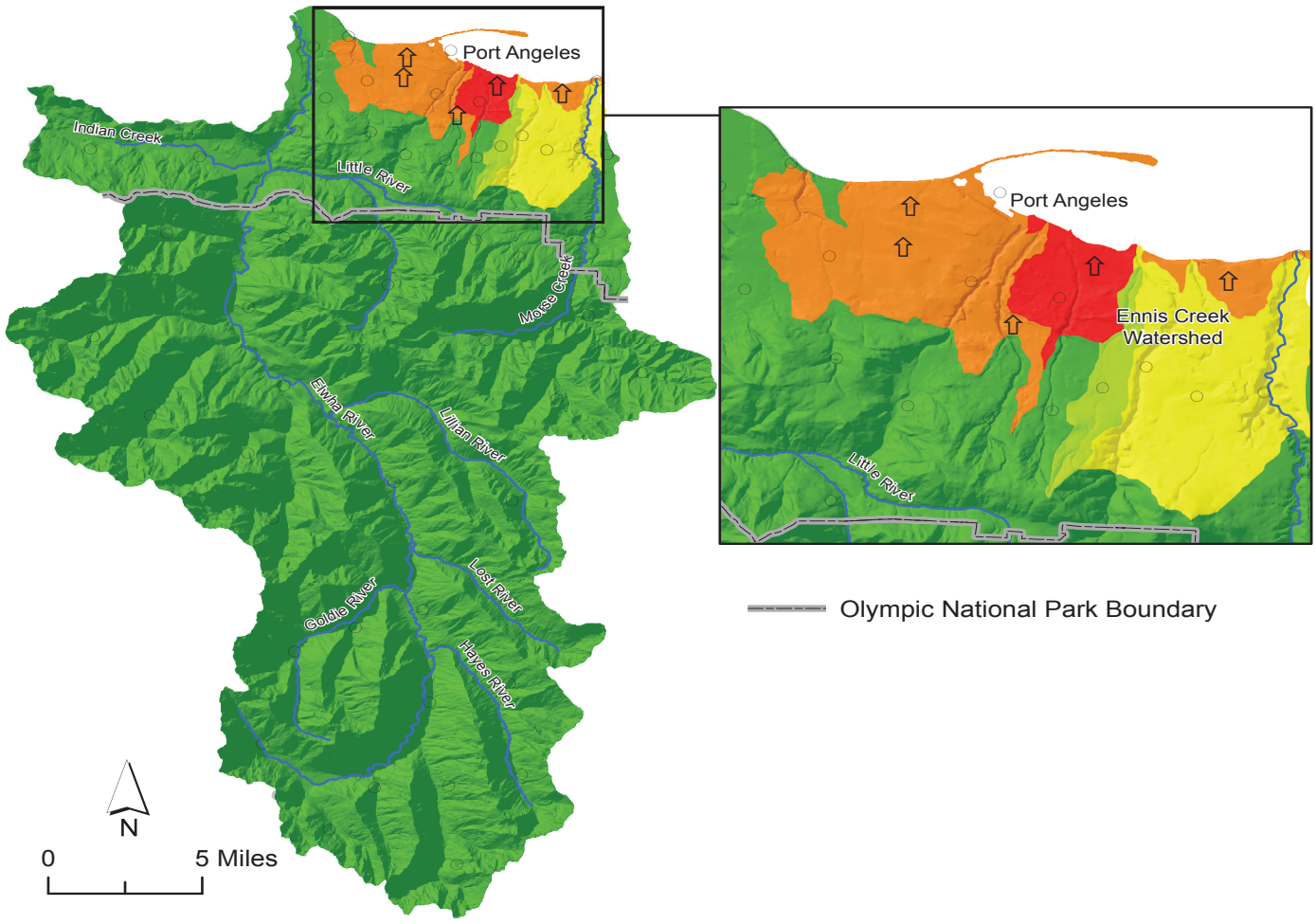
With the exception of the Ennis Creek watershed and around Port Angeles Bay, most of the watersheds in the Lower Elwha Area of Concern currently show little to no impact from impervious surface conditions. Also, between 2006 and 2011, most watersheds outside Olympic National Park showed low or no change in impervious surface conditions with values from 0 to 1% increase.

Based on 2011 data, most of the watershed units in the Lower Elwha Area of Concern currently show little to no impact from impervious surface conditions. These watersheds are mostly in Olympic National Park and Olympic National Forest and are therefore not generally impacted by development pressures.

On the other hand, negative impervious surface conditions prevail in the Ennis Creek watershed and in the tributaries to Port Angeles Harbor. This is likely a result of urbanization which directly increases the percentage of land covered by impervious surfaces and reduces the area available for infiltration. A high percentage of impervious surface leads to increased runoff and higher peak streamflows, increased sediment and pollutant delivery, and decreases in stream biodiversity.[1]

Between 2006 and 2011, most watershed units outside Olympic National Park showed low to no change in impervious surface conditions, with values ranging from 0 to 1% increase. This was likely caused by changes to population, urbanization and road construction during that period. According to estimates by the Washington State Office of Financial Management, the population of WRIA 18 grew by only 1.6% between 2010 and 2014.[2] The reduced rate of increase for impervious surface may be because of this slow population growth and slowdown in economic activities or a combination of these factors.

While the current status of the impervious surface indicator is poor in watersheds around Port Angeles and good in other areas, the general direction or trend outside the Olympic National Park is neutral to negative.



Impervious Surface 2011

- Little to no impact (0-4%)
- Beginning to Impact (4-7%)
- Impacting (7-12%)
- Degrading (12-40%)
- Severely Damaged (>40%)

Impervious Cover Change: 2006 - 2011

- No Change (0 - 0.5%)
- Low Increased Impervious Cover (0.5 - 1%)
- High Increased Impervious Cover (>1%)

Data Sources: NLCD 2006,[3] NLCD 2011,[4] SSHIAP 2004,[5] WAECY 2011a,[6] WAECY 2011b[7]

Elwha River Fisheries and Ecosystem Restoration

On August 26, 2014, detonation of explosives at the former Glines Canyon Dam site obliterated the final remnants of that structure and re-opened the upper watershed of the Elwha River to salmon for the first time in 102 years. On September 2, one week later, the first Chinook salmon were observed migrating up beyond this site into the more than 40 miles of pristine habitat now available to them within Olympic National Park. This was the culmination of 22 years of planning and 3 years of deconstruction associated with the removal of the 33-meter Elwha Dam (River Mile 4.9) and the 66-meter Glines Canyon Dam (RM 13.6).

Researchers from the Lower Elwha Klallam Tribe and their partners with Olympic National Park, United States Geological Survey (USGS), National Oceanic and Atmospheric Administration (NOAA), University of Washington, SeaGrant, and other entities have been actively monitoring a multitude of biological and physical conditions in the Elwha River watershed to gauge ecosystem response to the removal of the Elwha dams. This work includes water quality monitoring, sediment transport and deposition monitoring, beach and delta topographic studies, numerous studies to assess adult and juvenile salmonid population responses, wildlife population response, estuarine fish and invertebrate studies, vegetation sampling, intertidal sampling and subtidal scuba surveys.

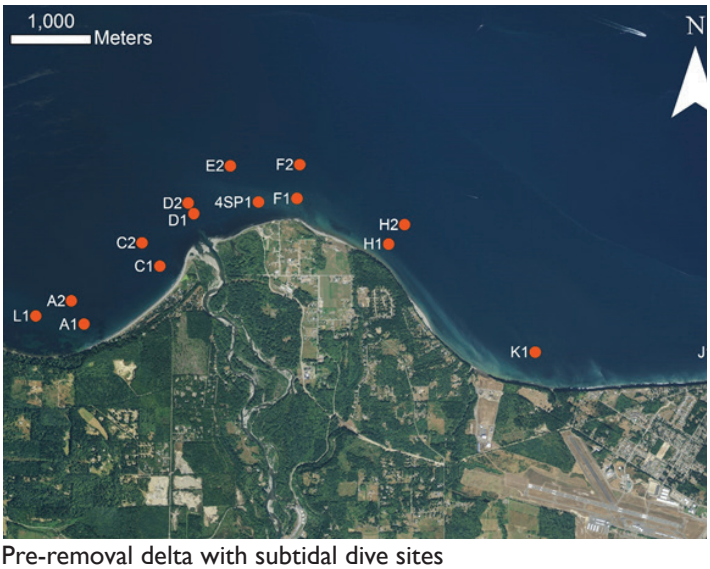
Tribal Monitoring of Wildlife Response

In connection with removal of the Elwha dams, the Lower Elwha Klallam Tribe's wildlife division is collecting baseline data on select species of river-dependent wildlife. Specifically, river otters and American dippers are closely tied to ecosystem health and are expected to be positively impacted by the return of salmon and their associated marine-derived nutrients to the Elwha ecosystem. Our primary objective is to collect information on how otters and dippers use the river to meet their spatial, habitat and dietary needs. To fulfill this objective, the Tribe is capturing and tagging otters and dippers and collecting biological samples to conduct stable-isotope analysis of marine-derived nutrients.

Subtidal SCUBA Surveys

Tribal biologists have been assisting in USGS-led subtidal dive (scuba) surveys along the Elwha nearshore from Freshwater Bay to the base of Ediz Hook since 2011. This study, initiated in 2008, involves monitoring sediment related changes to subtidal habitats that may be associated with the removal of the Elwha dams. The USGS has estimated that, to date, over 4 million cubic yards of sediment has been deposited in the Elwha delta since the removal of the Elwha dams. This represents approximately 15% of the sediment estimated to have been stored behind the Elwha dams.

The dive team identifies algae, macroinvertebrates and fish along 40-meter transects at depths of 20 to 60 feet. In addition, physical characteristics such as grain size, slope and light penetration at the sea floor are recorded. Interestingly, the physical presence of the large sediment plume created by the release of fine sediment from the former Elwha River reservoirs appeared to have a more pronounced effect on habitat during the first two years after dam removal than actual deposition along the sea floor at most study sites. The lack of light penetration through the sediment plume prevented or delayed the regeneration of large, dense kelp forests once observed at most of the subtidal dive sites. As expected, the monitoring sites in closest proximity to the mouth of the river have received the greatest contribution of fine sediment. Of the 15 established Elwha nearshore monitoring sites, all have had some degree of fine sediment deposition from behind the former dams. Five of these subtidal sites have been completely buried resulting in a marked transition from a heavily cobbled to a sandy substrate that is more conducive to bivalves and other soft substrate inhabitants. We have also noted the return of sand lance and smelt, which are important prey items for juvenile salmonids. The site nearest the river mouth is now buried in over 10 meters of fine sediment.



Steve Rubin, USGS

Pre-removal delta with subtidal dive sites

Andy Ritchie, Olympic National Park

Post-removal delta

This image was recorded in August 2012, approximately one year after dam removal activities began. It shows the impact of the sediment plume on precluding light penetration and limiting regeneration of kelp formerly found at this site. Note that the bottom substrate surrounding the crab has not yet changed.

Ian Miller, Washington SeaGrant (2)

This image shows the dramatic shift from a coarse, gravelly bottom to a soft, sandy substrate after deposition of bedload from behind the former Elwha River dam. The stems of several former kelp plants (*Pterygophora californica*) can be seen along the transect tape. While this location has been directly impacted by sediment deposition, most of the subtidal dive sites within the study area on each side of the river have only seen impacts associated with the presence of the sediment plume.

While scientific research has dominated early headlines emerging from dam removals on the Elwha, the Tribe has also been conducting comprehensive floodplain restoration actions in the lower river, downstream of Elwha Dam. Prior to dam removal, the 5-mile lower Elwha River reach provided the only available habitat for Pacific salmon following construction of the Elwha Dam in 1913. This habitat became increasingly degraded over time as sediment and wood necessary to support habitat forming processes was blocked by the dam. Habitat was further degraded over time by human activities including floodplain logging, removal of logjams and channelization. Indeed, prior to dam removal, the Lower Elwha had lost almost all of its spawning habitat, had very few side channels for a river of its size, had lost most of its historic estuary and supported limited natural salmon populations. Beginning in the late 1990s, before it was even clear that dam removal would occur, the Tribe began efforts to restore floodplain habitat in the lower river. The restoration strategy involved three tools: 1) the removal of abandoned flood control dikes in the floodplain, 2) the insertion of engineered log jams in the mainstem, 3) addition of free wood in side channels, and 4) floodplain revegetation. Over time and with increasing experience conducting restoration in a large river, the project grew in scale and complexity. While initial restoration actions were focused on simply providing salmon with a refuge while awaiting the possibility of dam removal, later restoration efforts focused on design that would be complementary to dam removal and the expected changes to follow in the lower river. In 2014, both dams had been removed and the Elwha was restored to a free flowing river. A 15-year lower river floodplain restoration effort had resulted in the construction of 50 engineered logjams, the removal of 4 floodplain dikes, 3 side channels loaded with large wood and the planting of 50,000 native trees. All of the restoration work was obtained from competitive grant sources including the Salmon Recovery Funding Board, Bureau of Indian Affairs, Pacific Coast Salmon Recovery Fund and NOAA. The project is one of the largest of its type in the Pacific Northwest.

Ian Miller, Washington SeaGrant

Newly constructed engineered logjams in the lower Elwha River. The structures are designed to split flows, activate new side channels, create pools and sort gravels.

Forest Cover Conditions

Current forest cover conditions are generally good to healthy in most watershed units in the Lower Elwha Area of Concern. Outside Olympic National Park, the overall trend in forest cover between 2006 and 2011 is negative from 0.1% to about 10%.

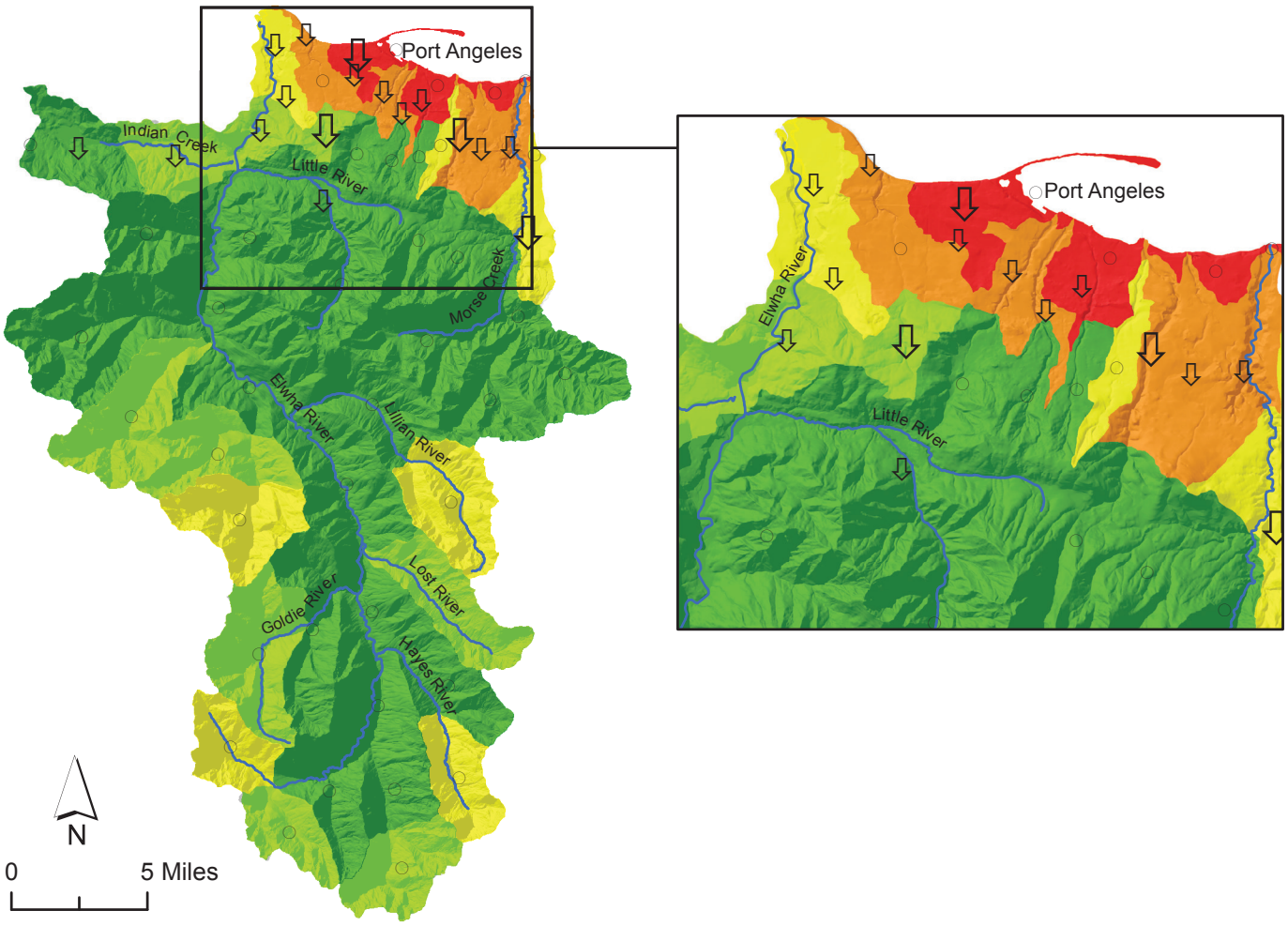
With few exceptions, the 2011 forest cover conditions of most of the watershed units in the Lower Elwha Area of Concern are generally good to healthy. Poor and severely damaged forest conditions exist in watershed units in the urban and suburban areas around Port Angeles.

An analysis of forest cover change between 2006 and 2011 was carried out using two different datasets. The NOAA forest cover data was obtained by analyzing Landsat images according to the Coastal Change Analysis Program (C-CAP) protocol and the WDFW modeled change polygons were derived by analyzing imagery from the National Agricultural Imagery Program (NAIP).

The C-CAP data shows that those watershed units within confines of the Olympic National Park had little to no change in forest cover. This is not unexpected since these units are generally exempt from anthropogenic activities, such as logging and land conversions, that negatively impact forest cover. Outside the park, the overall trend in forest cover change is negative from 0.1% to about 10%.

The WDFW change analysis data indicate that the negative trend outside the park was mostly caused by the replacement of forest cover by new impervious surface or other permanent structures and other human-induced changes such as temporary dirt roads. The other, less important factor was the removal of trees for commercial and non-commercial purposes.

Reduced forest cover can alter watershed processes that are critical to the development and maintenance of good water quality and habitats favorable to salmonids.[1]



Forest Cover 2011

- Healthy Forest Conditions (>75%)
- Good Forest Conditions (65-75%)
- Moderate Forest Conditions (50-65%)
- Poor Forest Conditions (30-50%)
- Severely Damaged Conditions (<30%)

Forest Cover Change: 2006 - 2011

- ⇩ High Decreased Forest Cover (> -5%)
- ⇩ Low Decreased Forest Cover (-1% to -5%)
- ○ No Change (1% to -1%)

Data Sources: SSHIAP 2004,[2] WAECY 2006,[3] WAECY 2011a,[4] WAECY 2011b,[5] WAECY 2011c[6]

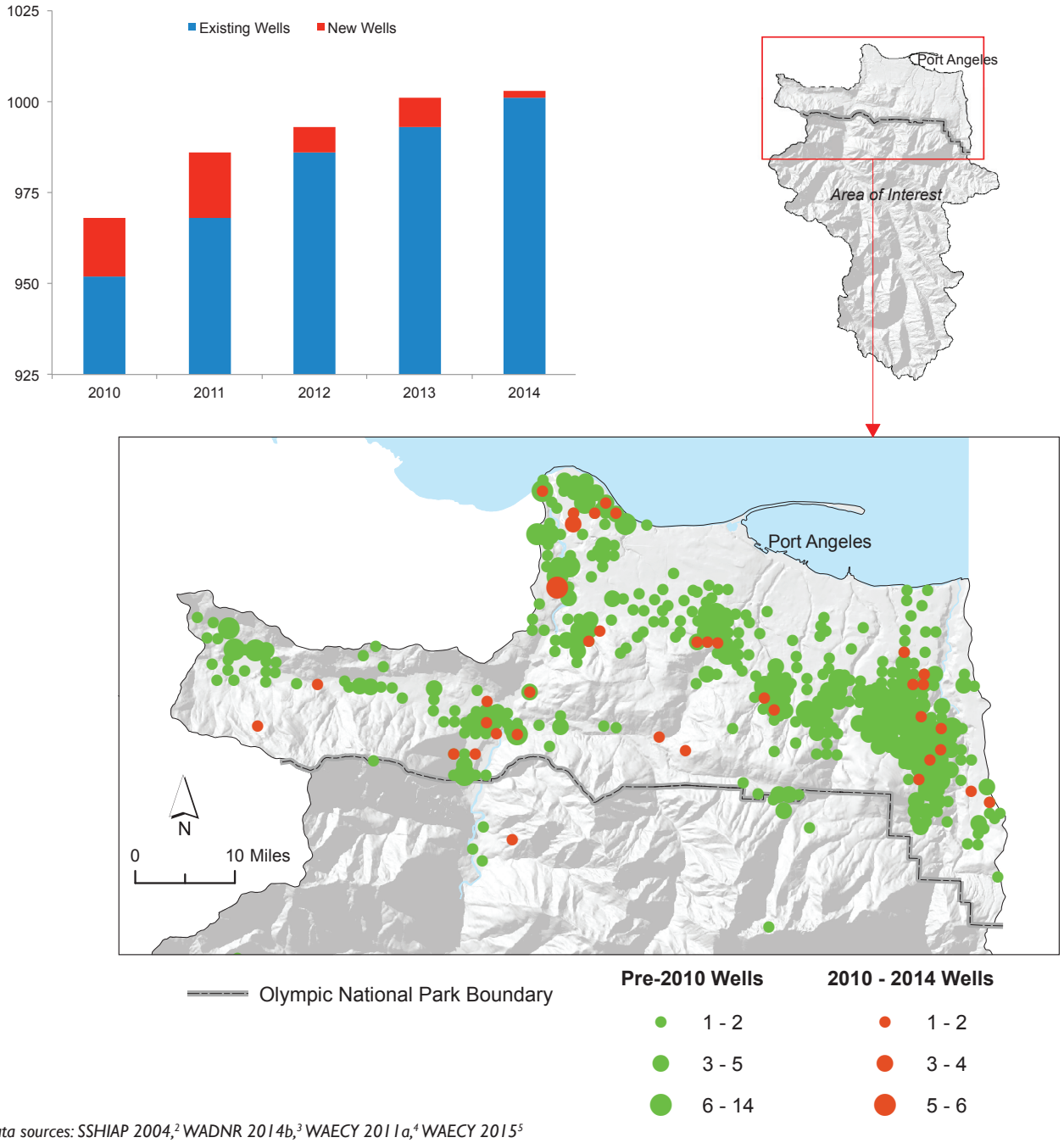
Water Wells

There are 1,003 wells that affect groundwater supply and instream flows in the Lower Elwha Area of Concern. Between 1980 and 2009, 801 wells were completed at a rate of about 27 new wells per year. Since then, 51 wells have been added at a lower rate of about 10 new wells per year.

Permit-exempt wells represent a source of water for many landowners, who under state law are allowed to withdraw water for domestic purposes without obtaining a water right. Water withdrawals through these wells affect groundwater supply. Because of the hydraulic connections between groundwater and surface water, these groundwater withdrawals may reduce instream flows of surface water, and negatively impact water quantity and quality as well freshwater and marine habitat for salmon, shellfish and related species.

There are currently 1,003 wells in this Area of Concern. Most of these wells are concentrated in the smaller developable area north of Olympic National Park. Between 1980 and 2009, 801 wells were completed in the Area of Concern, representing a rate of about 27 new wells per year.

Since 2010, an additional 51 wells have been added, representing a rate of about 10 new wells per year. Although the number of wells has increased since 2010, the rate of increase has slowed. According to estimates by the Washington State Office of Financial Management, the population of WRIA 18 grew by only 1.6% between 2010 and 2014.[1] The reduced rate of increase for wells may be because of this slow population growth, a lesser dependence on wells for their water supply by landowners, or the result of a slowdown in economic activities during that time period or a combination of these factors.



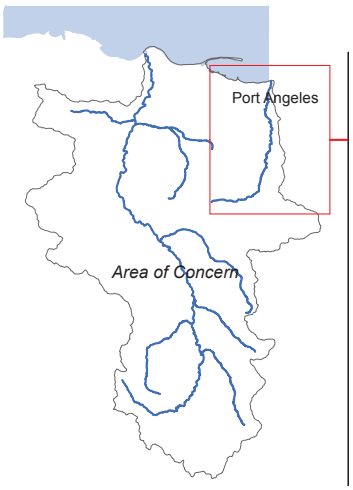
Data sources: SSHIAP 2004,[2] WADNR 2014b,[3] WAECY 2011a,[4] WAECY 2015[5]

Morse Creek Floodplain Impairment

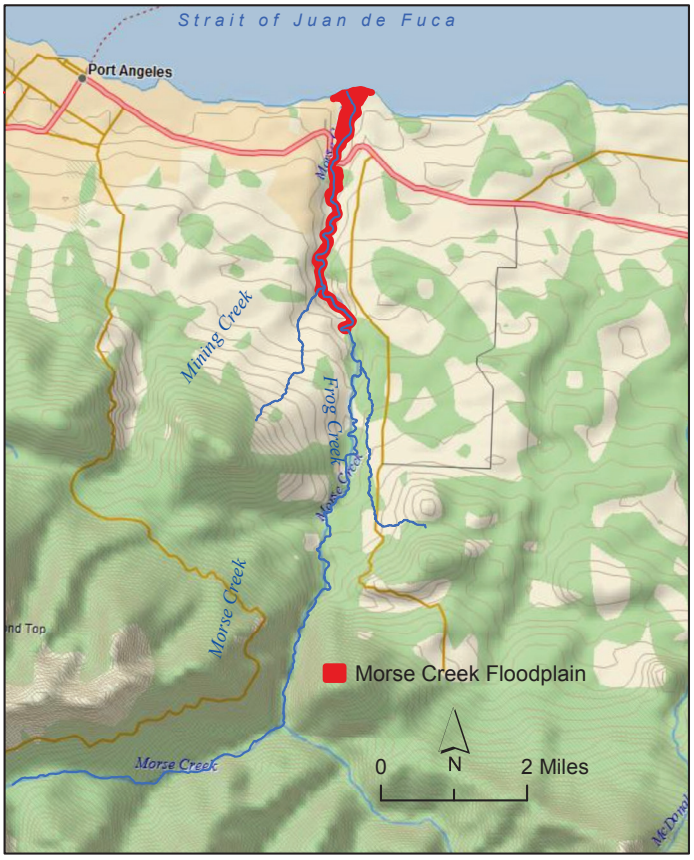
The once productive Morse Creek floodplain has been severely impaired by channelization, diking and armoring; road and other floodplain constrictions; and riparian vegetation removal. Since 2011, a significant meander has been restored and 1,300 feet of habitat added to the formerly channelized reach. Other improvements include the construction of side channels, additions of large wood, removal of dikes and restoration of floodplain forests.

The Morse Creek floodplain has been seriously impaired with 37% being zoned for development from utility right of ways to single-family homes. Downstream of Highway 101, 49% of the floodplain has been zoned for similar development. The Morse Creek floodplain is severely impaired.[1] Tributary watersheds, platted for urban development "will likely result in additional significant stormwater impacts."[2]

"With the exception of the Elwha and Dungeness rivers, Morse Creek is perhaps historically the most significant salmon stream in the Eastern Strait sub-region."[3] Historically, the lower reaches of Morse Creek were unconfined and meandering with multiple channels. The sediment supply was sufficient to produce a pronounced spit with a secondary tidal creek outlet. "Morse Creek is known to have produced a high diversity of salmon species in greater numbers than would be expected for a stream of its size. Anadromous salmon stocks known to have inhabited Morse Creek include spring/summer Chinook, coho, chum and pink salmon, summer and winter steelhead, and searun cutthroat trout."[4] The diversity of stocks likely resulted from snowmelt hydrology, as Morse Creek drains high elevation landforms in Olympic National Park. Unfortunately, the spring Chinook salmon stock has been extirpated and other stocks including pink, chum, coho and steelhead have declined to extremely low levels.



What was once a wide productive floodplain has been modified to the extent that only the topography is recognizable.



Data Sources: DeLorme 2015,[8] FEMA 1996,[9] SSHIAP 2004,[10] WAECY 2011a[11]

"The lowest 2 miles of Morse Creek have been most affected by a combination of land development, channelization; diking and armoring; road and other floodplain constrictions; and riparian vegetation removal. Constriction of the channel and floodplain results in greater channel scour during high flow events, as well as in the elimination of escape cover outside the active channel. Below Highway 101, Morse Creek has been diked on both banks (from River Mile 1.2 to its mouth) to facilitate construction of a housing development and associated golf course. This alluvial reach was formerly unconfined and meandering."[5] Today the reach is effectively a rocky flume with almost no pool structure or spawning gravel.

"The Morse Creek estuary, considered to have been an important contributor to the creek's historic productivity, has been largely eliminated by development. The marine nearshore habitat at the mouth of Morse Creek also has been altered by historic railroad construction and armoring within the intertidal area, which has eliminated the shallow nearshore habitat to the west of Morse Creek."[6]

Morse Creek is at risk from potential future development. "Both the Mining Creek and Frog Creek sub-watersheds are platted for future urban development. Both sub-watersheds are located in the rain-on-snow zone in the Morse Creek water-

Mike McHenry, Lower Elwha Klallam Tribe

Morse Creek channelized reach through WDFW property prior to restoration, summer 2010.

Mike McHenry, Lower Elwha Tribe (2)

Morse Creek through restored floodplain channel (post-restoration), winter 2011

shed. Even if existing critical area ordinances are enforced, new development will likely result in additional significant stormwater impacts to Morse Creek."[7]

Large-scale floodplain restoration is necessary to restore habitat and fish populations in Morse Creek. The first such project was recently completed south of the 101 bridge crossing on property acquired by Washington Department of Fish and Wildlife for conservation. This parcel of land was historically cleared and used for hay production. Historic aerial photographs show that the channel was relocated by bulldozer along the west side of the river valley. In 2010, the North Olympic Salmon Coalition along with the Lower Elwha Klallam Tribe and Jamestown S'Klallam Tribe, obtained funding from the Salmon Recovery Funding Board to reconnect Morse Creek to its former location. The project restored a significant meander and added 1,300 feet of habitat to the formerly channelized reach. The project also included construction of side channels, additions of large wood, removal of dikes and restoration of floodplain forests. Monitoring has shown a dramatic increase in juvenile fish abundance within the restored reach as compared to an untreated control reach just upstream of the project.

This project demonstrates the type of approach that is necessary to recover Morse Creek habitat and ultimately salmon populations. A similar approach could be developed for the channelized and degraded portions of Morse Creek below Highway 101. Unfortunately, efforts to advance restoration in lower Morse Creek have been resisted by a homeowners association that seems to prefer the maintenance of a straight, channelized river with a golf course that encroaches upon it.

Tiffany Royal, NWIFC

Logjam installation on Morse Creek

"How do we undo historic impacts to the salmon habitat in Morse Creek while preventing future impacts such as stormwater impacts and water withdrawals from other creeks on the peninsula?"

– Russ Hepfer
Lower Elwha Klallam Tribe's Vice-Chairman

Tiffany Royal, NWIFC

NWIFC Commissioner Russ Hepfer tours the completed project in 2012.

"We're taking two steps forward with restoration efforts but are forced to take one step back as we continue to lose habitat faster than we can save it."

– Russ Hepfer
Lower Elwha Klallam Tribe's Vice-Chairman

Port Angeles Harbor Cleanup and Restoration

Introduction and Background

Port Angeles Harbor is the largest natural deep water harbor on the west coast of the United States. It is a typical Northwest "working harbor" with uses that include industrial, commercial, municipal, marine trades, recreation, tourism and natural resources. Over a century of industrial activities has exacted a heavy toll on natural systems within the harbor due to contaminants, extensive shoreline armoring and in-water structures. This has resulted in contamination of sediments and fish, heavily degraded shorelines, and the loss of critical nearshore and estuarine habitat used by salmon and their forage fish prey. A fish consumption advisory is currently in effect by the Department of Health as well as a moratorium on commercial fishing in the harbor by the Lower Elwha Klallam Tribe and Washington Department of Fish and Wildlife (WDFW).

WA Department of Ecology

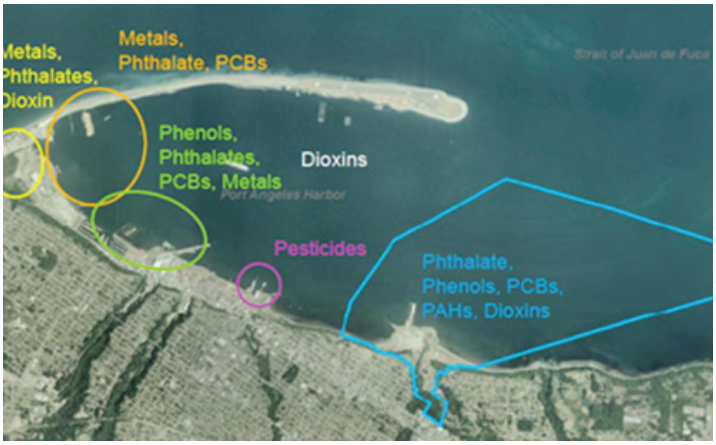
Aerial view of Port Angeles Harbor.

The Lower Elwha Klallam Tribe ("Elwha Tribe") is deeply committed to restoring Port Angeles Harbor to a healthy, functioning ecosystem that will allow for the resumption of tribal and public access to fish and shellfish resources. This will require significant efforts: 1) to remove and/or isolate existing contamination from biological pathways (a process often referred to as remediation or cleanup) and 2) to restore degraded nearshore and estuarine habitats along the harbor shoreline (a process referred to as restoration, or NRD after the acronym for "natural resources damages" under such laws as the federal Comprehensive Environmental Response, Compensation and Liability Act, CERCLA or Superfund law). Legal mechanisms exist to promote and enforce these and other efforts, and the Elwha Tribe is optimistic that the cleanup and NRD processes will result in significant improvements to the harbor ecosystem within the next several years.

Elwha Tribe Takes Initial Steps at Restoration of Port Angeles Harbor

The Elwha Tribe has spearheaded multiple shoreline restoration efforts along the interior of Ediz Hook, the spit that created and shelters the harbor. The Tribe partnered with the Washington Department of Natural Resources (WADNR) in 2005 and, later, the city of Port Angeles to restore 1,500 feet of hardened shoreline by removing former log rafting and offloading structures and associated shoreline armoring and replacing with clean beach material and native beach vegetation.

While complicated chemical cleanup processes are ongoing in Port Angeles Harbor, there are also significant habitat impacts that must be dealt with, which have resulted from over a century of industrial uses. Those impacts include shoreline filling, armoring and overwater structures that have encroached on the majority of the harbor's natural shoreline. Indeed, the only remnant natural shorelines remaining in Port Angeles Harbor are located east of the Rayonier Mill site and on the south shore of Ediz Hook. Hardened shorelines affect sediment transport and deposition processes and reduce spawning habitat for forage fish such as sand lance and smelt, favored prey of Pacific salmon. Overwater structures may disrupt salmon migratory corridors and shade bottom habitats including eelgrass, which supports many marine species. On the south shore of Ediz Hook, a historic log dumping structure, known locally as the A-Frame, was abandoned in the 1990s and left derelict. This site included an overwater structure constructed of creosote-treated timber, two buildings, and 1,500 feet of hardened shoreline. In a two-stage cooperative project between the Lower Elwha Klallam Tribe and WADNR, the site was recently restored. WADNR took initial responsibility for removing the overwater structure and buildings. Once removal was completed, the Tribe secured funding from the U.S. Environmental Protection Agency (EPA) to remove contaminated fill and hard armoring, then import clean sand to reconstruct a low slope beach. Based on the success of this project the Elwha Tribe has obtained additional funding to expand restoration efforts on Ediz Hook to the east of the A-Frame site. Once completed, a total of 2,100 meters of Ediz Hook's shoreline will be restored to a natural condition.



WA Department of Ecology

Major chemicals of concern within Port Angeles Harbor.

Model Toxics Control Act (MTCA) Cleanup of Port Angeles Harbor

Matt Beirne, Lower Elwha Klallam Tribe

A-Frame site on the southern shoreline of Ediz Hook as seen in pre-restored condition.

The Lower Elwha Klallam Tribe has been involved in oversight of planning and assessment activities associated with the cleanup of toxic contaminants from upland and marine portions of Port Angeles Harbor since 1999. As a result of a suite of four major agreements involving EPA, the Washington Department of Ecology (Ecology) and the Rayonier Corporation, the cleanup is taking place under Washington's MTCA and administered by Ecology. Under these agreements – where EPA has deferred exercise of its CERCLA Superfund authority subject to conditions that ensure a CERCLA-level cleanup or better – the Elwha Tribe has exercised a unique role with Ecology in the oversight of the cleanup of portions of Port Angeles Harbor attributed to contaminants released from the former ITT Rayonier Pulp Mill. The harbor has been segmented into three cleanup areas based on historic source contributions from industries throughout the harbor. The eastern "Study Area" is attributed to contamination derived primarily from activities at the former Rayonier Pulp Mill, whereas, according to Ecology, the western harbor has a complex array of contaminants from sources most closely associated with the west end of the harbor. The central harbor has a diffuse distribution of dioxins from a variety of sources as well as wood waste and polycyclic aromatic hydrocarbons (PAHs). Other Potentially Liable Parties (PLPs) that have been identified as contributing to contamination in Port Angeles Harbor include the city of Port Angeles, Port of Port Angeles, Nippon Paper, Georgia Pacific, Fiberboard and WADNR as a lessor of public aquatic lands.

The major chemicals of concern within Port Angeles Harbor for cleanup and impacts to natural resources include PCB's, dioxins/furans, PAHs, mercury, phenolics and several other contaminants. Most of the assessment activities (remedial investigation) have been completed and the data is being evaluated (feasibility study) to determine the most appropriate cleanup methods and technologies to use during the cleanup (remediation) phase. Cleanup remedies selected will likely be based on contaminant concentrations and persistence, accessibility, sediment transport patterns, and potential for erosion and resuspension of contaminants. Technological feasibility and cost are also considered during this phase.

Natural Resource Damage Assessment and Restoration

Under the federal CERCLA or Superfund law, the Elwha Tribe has also been participating as an organizing government and leading member of the Port Angeles Harbor Natural Resource Trustee Council. The purpose and function of the Trustee Council is to determine the extent of injuries to natural resources in the harbor and evaluate restoration options that the Potentially Responsible Parties (PRPs, under the terminology of CERCLA) may use to compensate for those injuries. In addition to the Lower Elwha Klallam Tribe, the other members of the Trustee Council are the National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (USFWS), Ecology, the Port Gamble S'Klallam Tribe and the Jamestown S'Klallam Tribe. The Trustee Council has been actively working with Rayonier Corporation since early 2012 to evaluate restoration opportunities to compensate for injuries to natural resources caused by historic releases of contaminants from the former pulp mill. The Trustee Council anticipates engaging with the western harbor PRPs in a similar manner in the near future.

Matt Beirne, Lower Elwha Klallam Tribe

Restored shoreline of Ediz Hook.

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