

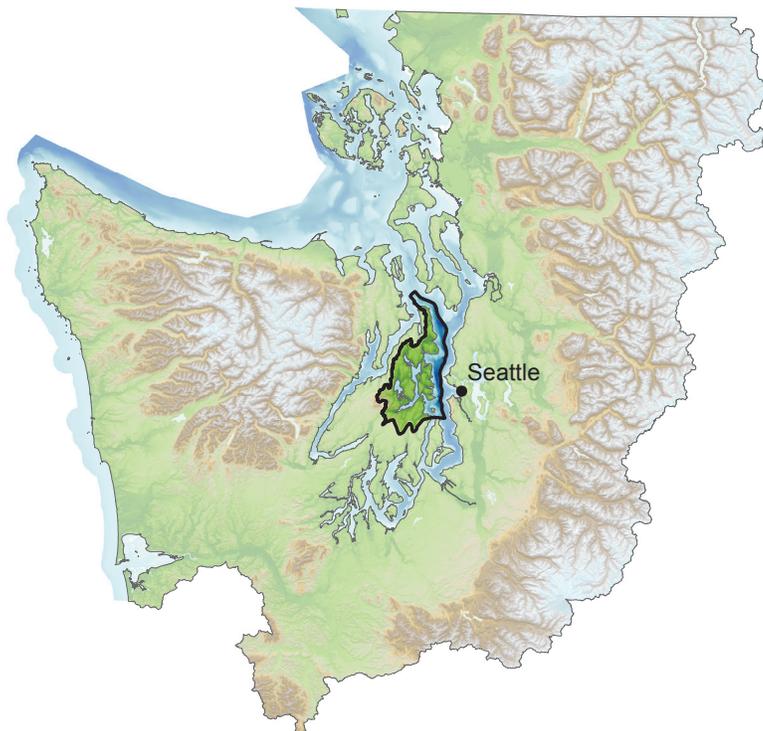
2016 State of Our Watersheds Report

Kitsap Basin



Respect for the land and waters, the abundant natural resources, and a deep understanding of the delicate supportive relationships of the natural systems were central themes in all Northwest Indian cultures. It is still true to this day for the Suquamish people. The Tribe continues to be a good steward, managing, honoring and enhancing the resources, and guarding habitat and wildlife. Despite encroachments, the Suquamish people are still committed to steadfastly protecting areas and resources of cultural and traditional significance.

**– ROB PURSER,
SUQUAMISH TRIBE**



Suquamish Tribe

The Suquamish Tribe has inhabited the Kitsap Peninsula since time immemorial. They are party to the Point Elliott Treaty of 1855, when tribes ceded their traditional lands to the U.S. government. This report will focus on the East Kitsap basin and surrounding marine waters, one of many areas within the Suquamish Tribe's adjudicated Usual and Accustomed fishing area. The Kitsap shoreline accounts for nearly half of the nearshore habitat in south and central Puget Sound and provides vital habitat for salmonid production throughout the region. Major land-use impacts on salmon habitat continue to result from floodplain and shoreline development, urban development, road construction and logging practices.

Kitsap Basin and the East Kitsap Recovery Strategy

The Suquamish Tribe’s Usual and Accustomed fishing area includes marine waters from the northern tip of Vashon Island to the Fraser River, including but not limited to Haro and Rosario straits, the San Juan Islands, the streams draining into the western side of this portion of Puget Sound, and also Hood Canal. For this report, the Focus Area of the Suquamish Tribe’s Usual and Accustomed fishing area is a portion of the East Kitsap basin. The shorelines of East Kitsap form the eastern portion of Kitsap County, including Bainbridge Island, and its streams flow to central or southern Puget Sound. These lowland streams, many of which originate from lakes, springs or headwater wetlands,¹ provide ideal spawning and rearing habitat for juvenile and adult salmonids. The streamflows are dependent on precipitation and groundwater contribution.

The U.S. Navy owns most of the federal land in the East Kitsap Focus Area, some of which contains high quality, functioning habitat. Navy-owned shorelines are among the most impacted by

industrial development, habitat loss, and chemical contamination in Kitsap County. This presents significant challenges with respect to ecological protection and restoration, as well as treaty rights and human health. The Navy uses internally developed Integrated Natural Resource Management Plans (INRMPs); however, such plans do not ensure protection of treaty-reserved rights and resources or consistency with state and local land use and other environmental laws designed to protect habitat.

The East Kitsap Recovery Strategy follows the Puget Sound Salmon Recovery Plan with a focus on protection and restoration of the nearshore and watershed-specific recovery plans (e.g., Chico, Curley, Blackjack) that are being developed.

This recovery strategy is consistent with the Open Standards Framework for Conservation and it addresses important treaty rights salmonid populations.

Recovery Efforts Lagging

At the 10-year mark of the Puget Sound Salmon Recovery Plan, a review of key environmental indicators for the Kitsap basin planning area shows that priority issues continue to be degradation of water quantity and quality, degradation of floodplain and riparian processes, degradation of marine shoreline habitat conditions, degradation of fish life and fish habitat blockages from culverts and other human-made structures. In general, there is a shortage of staff at all levels (e.g., federal, state, tribal, county) needed to ad-

dress 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. Although habitat degradation continues, there are some positive developments that we hope gain traction. For example, Kitsap County manages a “Shore Friendly” program that offers financial incentives and other assistance to landowners for removing bulkheads (<http://shorefriendlykitsap.com/>).

Review of the trend for these key environmental indicators since the 2012 State of Our Watersheds Report shows an improvement in restoration efforts but a steady loss in habitat status:

Tribal Indicator	Status	Trend Since SOW 2012 Report
Population Growth	The population estimate for Kitsap County shows a growth of 2% since 2010; however, both Port Orchard and Poulsbo are expected to grow by 15% and 6% respectively. High population densities lead to increases in impervious surface area which adversely affect land use, water resources, and fish habitat.	Declining
Impervious Surface	From 2006-2011, increase of 3% (2.4 square miles) in impervious surface. 4 drainage units were impacted enough to move their status to a more degraded category.	Declining
Shoreline Modifications / Forage Fish	From 2005 to 2014, 237 HPAs were issued in Kitsap County, resulting in an additional 1.3-plus new miles of armored shoreline, while 0.9 miles of armoring were removed, for a net increase of 0.4 miles. Over 80% of these modifications are from riprap and bulkheads. 56% of the marine and freshwater shorelines have been heavily modified, a factor identified by the East Kitsap Recovery Plan as limiting salmon production in the basin.	Declining
Water Wells	From 2010-2014, increase of almost 3% in water wells, while the Port Madison Water Resource Area saw a 2.5% increase.	Declining
Forestland Cover	From 2006-2011, a decrease of about 2% of the forestland cover. The trend in many watersheds continues toward "moderate" or "poor" conditions. 52% of the riparian zones in the marine and freshwater shorelines have been heavily modified, a factor identified by the East Kitsap Recovery Plan as limiting salmon production in the basin.	Declining
Stream Blockages - Culverts	Barrier culverts partially or fully block 78.2 miles of fish habitat in the East Kitsap study area.	Declining
Road Densities	94% of the drainage units are impacted by high road densities (>3 miles of road per square mile) while 37% are negatively impacted by stream crossings.	Declining
Restoration	Restoration examples include the removal of about 400 feet of Kittyhawk Drive, a box culvert at the mouth of Chico Creek, culvert replacements, and Powel Shoreline Restoration Project (removal of 1,500 feet of shoreline armoring).	Improving

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

Climate Change and Ocean Acidification

The Suquamish Tribe is currently assessing vulnerabilities to natural resources, including shellfish, salmonids, and traditional plants and their ecosystems, caused by anthropogenic carbon emissions that result in climate and ocean change. The Tribe plans to develop and implement a climate adaptation strategy to address climate change threats. The Tribe is also taking several near-term actions including improving the tools used to assess biological impacts of ocean acidification and supporting environmental education in K-12 classrooms.

Among the aquatic impacts of increased atmospheric carbon include ocean acidification, warmer waters, and shifts in oceanic current patterns that pose a variety of potential threats to marine ecosystems. The planktonic communities that form the base of the marine food web are thought to be especially vulnerable. To

improve the ability to detect these changes, Suquamish is partnering with faculty and students at the University of Washington to develop a low cost zooplankton imaging and computer identification system. The Tribe's recently completed Chico Watershed Protection and Restoration Plan includes strategies and actions for floodplains, riparian corridors, and streams that provide greater resilience to climate change.

The Suquamish Tribe is also supporting environmental education efforts targeting tribal youth, and the broader tribal community, as well as educators outside the Tribe. For example, Suquamish Fisheries runs a web-based collection of curricula on ocean acidification (*OACurriculumCollection.org*), and is active in both student and teacher training in a variety of forums.



Paul Williams

Ocean acidification awareness booth, sponsored by Suquamish Tribe, at the Quinalt 2013 Tribal Canoe Journey.

Looking Ahead

Suquamish Tribe activities in the near future will emphasize, but are not limited to, the following:

- Working with entities to upgrade shellfish growing area classifications (in East Kitsap);
- Habitat restoration;
- Developing the Curley Creek and Blackjack Creek watershed assessments that will identify and prioritize salmonid habitat protection and restoration actions;
- Conducting actions to prevent further habitat and water quality degradation through review of land use plans and development project permits;
- Conducting baseline eelgrass and forage fish surveys;
- Participation in the review of response actions at Superfund and other contaminated sites.
- Continuing to support educational programs and curricula regarding climate change and ocean acidification; and
- Assessing climate vulnerabilities to Suquamish natural resources, including salmonids, shellfish, and traditional plants and their ecosystems, and developing and implementing a tribal climate adaptation strategy.



Tiffany Royal, NWIFC

Removal of treated logs from the Suquamish Tribe's Doe Kag Wats estuary.

Suquamish Tribe

Portion of East Kitsap Basin

The Suquamish Tribe's Usual and Accustomed fishing area includes marine waters from the northern tip of Vashon Island to the Fraser River, including but not limited to Haro and Rosario straits, the San Juan Islands, the streams draining into the western side of this portion of Puget Sound and also Hood Canal. For this report, the Focus Area of the Suquamish Tribe's Usual and Accustomed fishing area is a portion of the East Kitsap basin (hereinafter "East Kitsap"). The shorelines of East Kitsap form the eastern portion of Kitsap County, including Bainbridge Island, and its streams flow to central or southern Puget Sound. These lowland streams provide ideal spawning and rearing habitat for juvenile and adult salmonids. Many of them originate from lakes, springs, or headwater wetlands.¹ Streamflows are dependent on precipitation and ground-water contribution.

The entire Kitsap Peninsula is 400 square miles in size, surrounded by 360 miles of saltwater shoreline. This shoreline accounts for nearly half of the nearshore habitat in south and central Puget Sound and provides vital habitat for threatened Chinook, as well as for chum, coho, steelhead and cutthroat trout from watersheds throughout

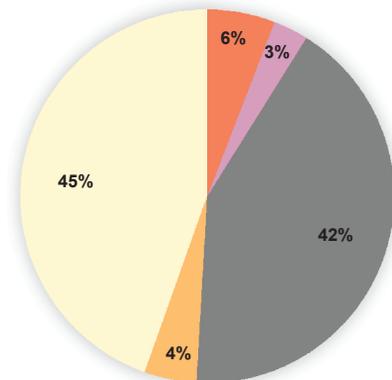
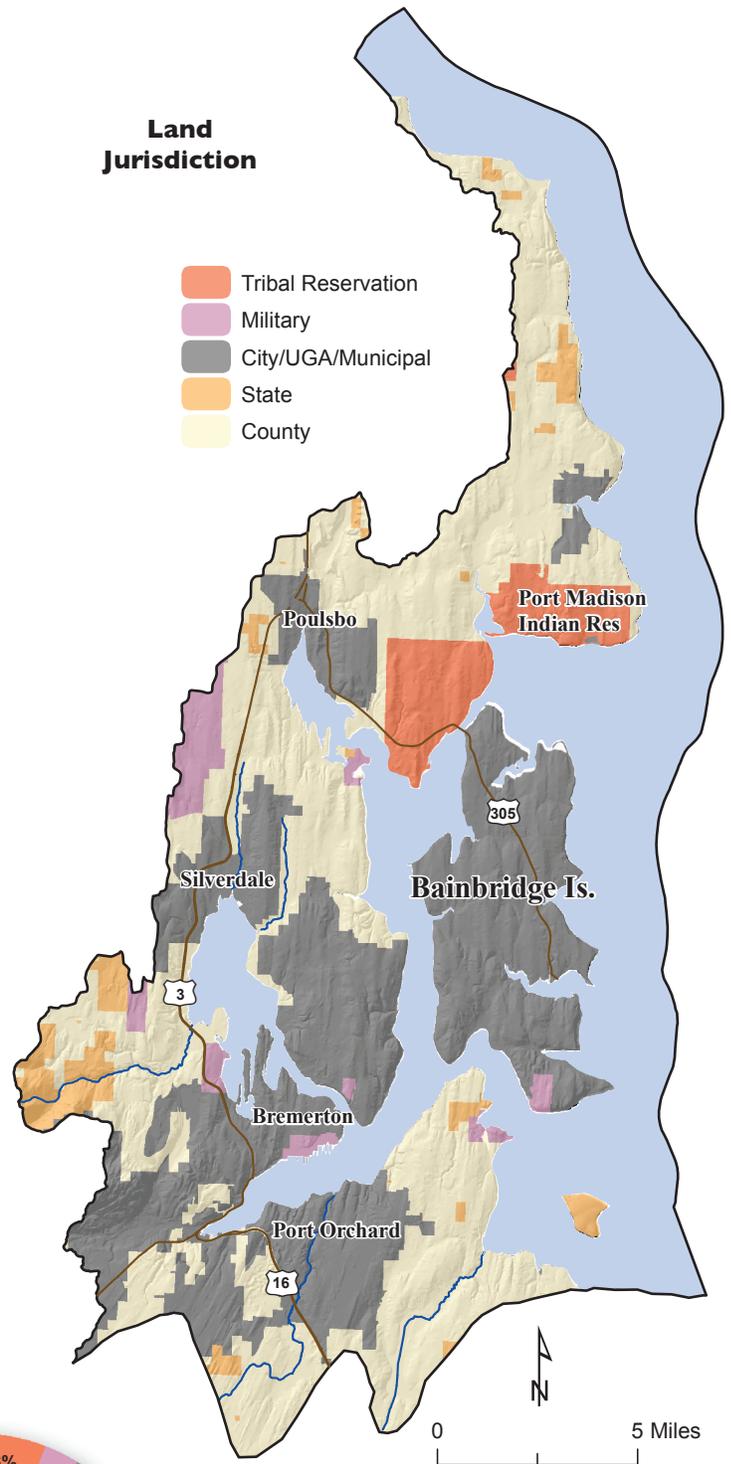
those areas.²

The U.S. Navy owns most of the federal land in the East Kitsap Focus Area, and some of the military lands in East Kitsap contain valuable habitat. These Navy lands contain military bases that occupy significant stretches of developed shoreline and nearshore marine areas. This presents significant challenges with respect to habitat protection and restoration. Past operations have left a legacy of contaminated sites in the Focus Area, many in the nearshore. Although the Navy uses internally developed Integrated Natural Resource Management Plans (INRMPs) to carry out its military missions, such plans do not ensure protection of treaty-reserved rights and resources or consistency with state and local land use and other environmental laws designed to protect habitat.

East Kitsap salmon recovery has been implemented with the recognition of the critical role played by the nearshore and marine areas in providing support for salmon species originating from all portions of Puget Sound.³ The overall goal is to protect, restore and enhance the nearshore natural processes and habitat in order to contribute to Puget Sound-wide salmon recovery.

Land Jurisdiction

- Tribal Reservation
- Military
- City/UGA/Municipal
- State
- County



Data Sources: SSHIAP 2004,⁴ USFWS 2014,⁵ USGS 2014a,⁶ WADNR 2014a,⁷ WADNR 2014b,⁸ WADNR 2014c,⁹ WADOT 2013,¹⁰ WAEYC 1994,¹¹ WAEYC 2011a,¹² WAEYC 2013¹³

Land Conversion and Loss of Habitat

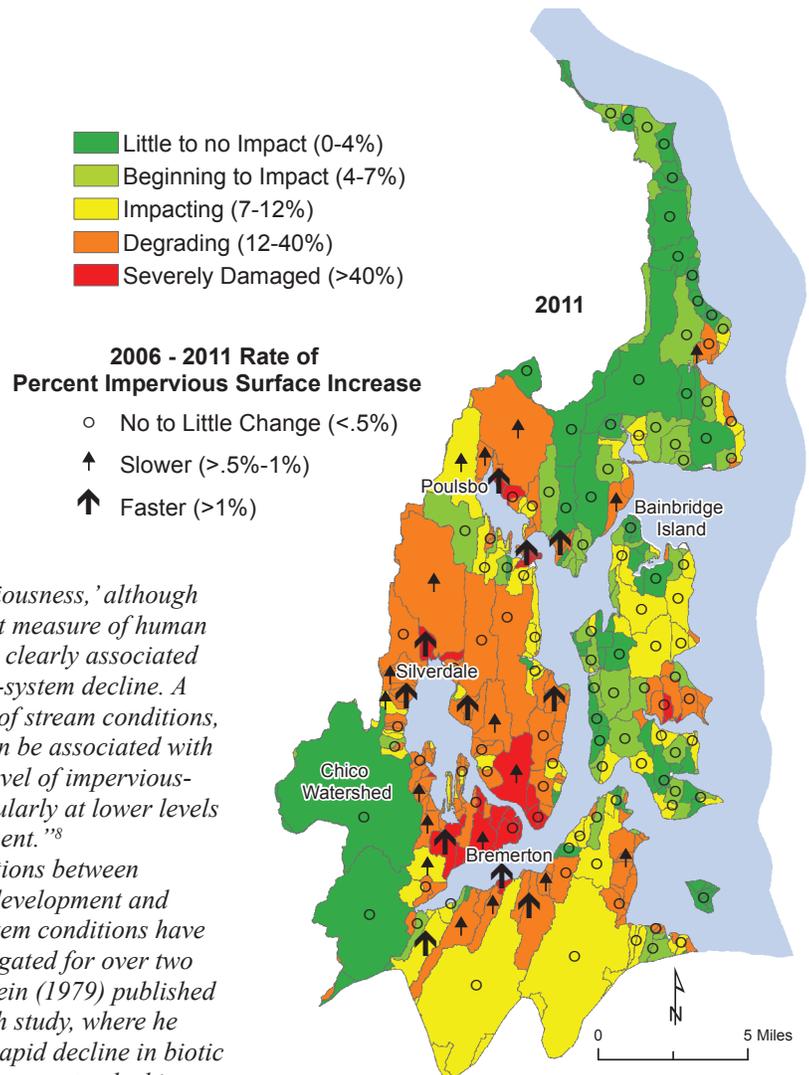
Impervious surface increased by 3% (2.4 square miles) from 2006-2011 in the Suquamish Focus Area. Four drainage units were impacted enough to move their status to a more degraded category.

Increases in impervious surfaces associated with development degrade habitat and water quality^{1,2} and adversely affect salmon production in East Kitsap.³ Impervious surface data for the East Kitsap study area shows an increasing trend toward degrading watershed conditions particularly around Poulsbo, Silverdale, Gorst and parts of Bremerton and Port Orchard. Four drainage units in the Suquamish Focus Area had an increase in impervious surface large enough to change categories during the time period of 2006-2011. One noted exception is the Upper Chico watershed, which has remained relatively undeveloped and thus has little impervious surface impact.

The growth and spread of impervious surfaces within urbanizing watersheds pose significant threats to the quality of natural and built environments. These threats include increased stormwater runoff, reduced water quality, higher maximum summer temperatures, degraded and destroyed aquatic and terrestrial habitats, and the diminished aesthetic appeal of streams and landscapes.⁴

About 75% of the toxic chemicals entering Puget Sound are carried by stormwater runoff that flows off paved roads and driveways, rooftops, yards and other developed land.⁵ In native Kitsap soils, 10-40% of the precipitation returns to groundwater. In contrast, populated areas with lots of roads and buildings only return about 15% of precipitation to groundwater.⁶

Three ways to help mitigate impervious surfaces are: 1) Protecting aquifer recharge areas from development and impervious surface. 2) Directing future impervious surface areas in areas underlain by bedrock or glacial till, which has less of an impact on hydrology than adding impervious surfaces to permeable soils such as alluvium or glacial outwash.⁷ 3) Adding rain gardens to populated areas to encourage the recharge of aquifers by returning more water directly into the ground instead of allowing flow into surface streams or other waterbodies. Rain gardens can slow down stormwater moving off properties, making for less flooding and erosion in streambeds, protecting salmon, and providing more clean water in the ground, lakes and streams.



“Imperviousness,’ although an imperfect measure of human influence, is clearly associated with stream-system decline. A wide range of stream conditions, however, can be associated with any given level of imperviousness, particularly at lower levels of development.”⁸

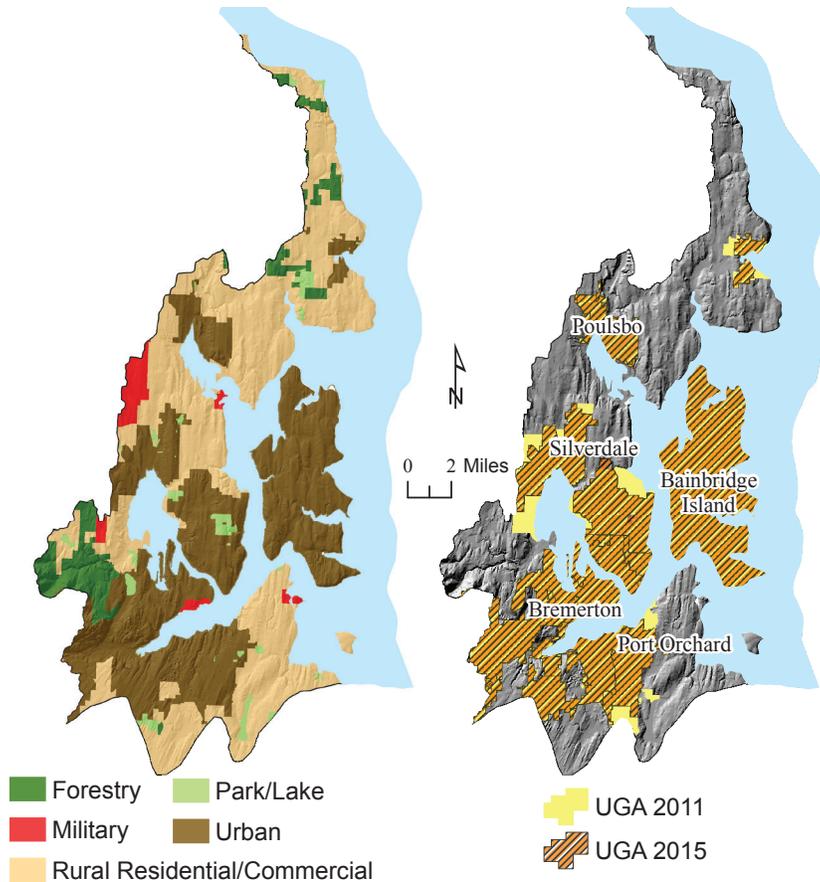
“Correlations between watershed development and aquatic-system conditions have been investigated for over two decades. Klein (1979) published the first such study, where he reported a rapid decline in biotic diversity where watershed imperviousness exceeded 10 percent.”⁹

Area of increased impervious surface resulting from build-out from 2006-2011 in the south part of Kitsap County



Population Growth and Impact on Habitat

The population estimate for Kitsap County shows a growth of 2% since 2010. However, from 2010 to 2014, both Port Orchard and Poulsbo are expected to grow by 15% and 6% respectively.¹ High population densities lead to increases in impervious surface area, which adversely affect land use, water resources and fish habitat.

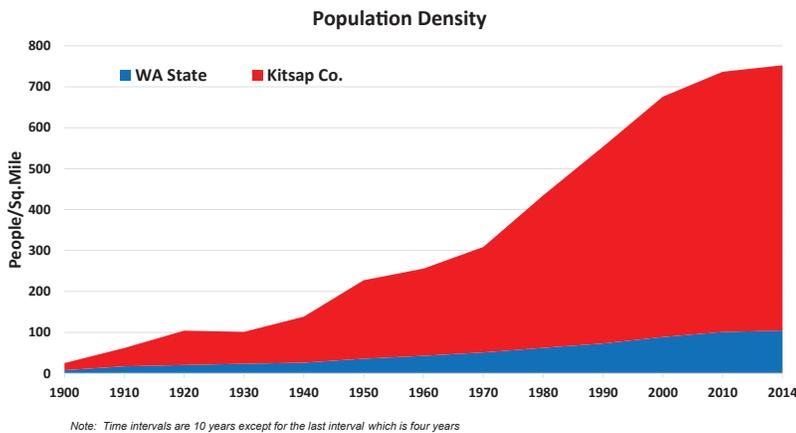


Kitsap County is the seventh most populous county of the 39 in Washington state but represents the third most densely populated county due to its small geographic size and proximity to the state's largest employment centers.² The county grew by 22% between 1990 and 2000, 8.3% between 2000 and 2010 and 2% from 2010 to 2014.³ The Washington State Office of Financial Management (OFM) estimated population for 2014 shows Kitsap County population growth slowing to 2%.

The population forecast is the first step in determining where planners will target future growth, as the county and all four cities begin to work on new comprehensive land-use plans, to be completed in 2016. In 2004, the Kitsap Regional Coordinating Council adopted a midrange projection from OFM, which predicted the county's population would reach 332,000 in the year 2025. The latest projections from 2012 place the midrange estimate for 2025 at only 289,000, some 43,000 fewer people than predicted eight years ago. When the comprehensive plan was last updated in 2006, the urban growth areas were sized to accommodate the growth forecast at that time. Urban growth areas were expanded for Poulsbo, Bremerton and Port Orchard, as well as unincorporated urban areas such as Silverdale and Kingston. A major obstacle to the next round of planning is the fact that the 2006 comprehensive plan remains under the shadow of legal actions. Following five years of appeals, the state's Growth Management Hearings Board ruled that the county and its cities had planned for a lower density of housing than was likely to occur in urban areas, which means the county's urban growth areas were sized too large. The county is in the midst of shrinking some or all of its urban growth areas by identifying lands and entire communities with the least urban characteristics. Three alternatives have been developed, each with different lands proposed to be removed from UGAs.⁴

The UGA of the East Kitsap Focus Area has decreased in area by 9.4% since 2011. The Silverdale UGA decreased by 27%, while the Port Orchard UGA decreased by 32%.⁵ Areas were removed along Dyes Inlet near Chico because of the presence of critical areas and the desires of area residents. Other areas were removed because of steep slopes, low development potential, and the presence of streams and wetlands.

Development pressures continue to increase along the waterfront and into rural areas. The cumulative impacts resulting from activities such as wells, residential shoreline development, vegetation removal, floodplain development and stormwater runoff remain largely unchecked and unaccountable.



Data Sources: Kitsap Co. 2015,⁶ SSHIAP 2004,⁷ USGS 2014a,⁸ UW 2012,⁹ WADNR 2014c,¹⁰ WAECY 2013,¹¹ WAOFM 2014¹²

Wells Potentially Impact Low Flows

The East Kitsap Focus Area saw an increase of almost 3% in the number of water well logs from 2010-2014. The Port Madison Water Resource Area (PMWRA) saw a 2.5% increase during this same time period.

The East Kitsap Salmon Recovery Plan identified the alteration of natural stream hydrology as perhaps one of the largest impacts/threats to salmon habitat in the basin.¹ There are many small streams in the basin that are highly influenced by groundwater and support many fish populations.²

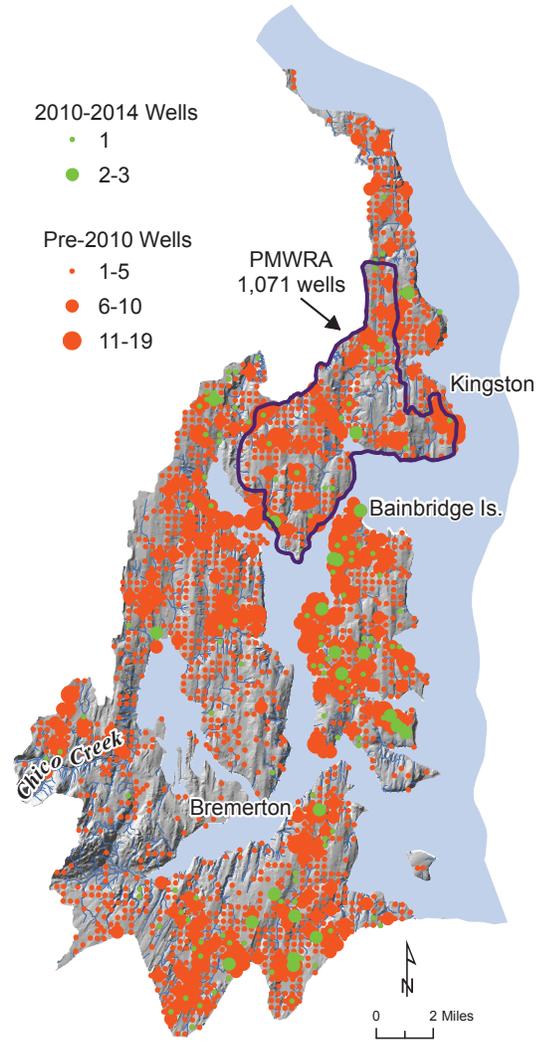
Groundwater is the primary source of drinking water for most of the population of the Kitsap Peninsula. As the population grows, generally so does the demand for groundwater. The quantity of usable groundwater likely is limited, however. This area has “issues of limited groundwater recharge because of overlying low-permeability glacial tills,”³ much less precipitation in the north and east parts of the county, and impervious surfaces as a result of development. There is also a potential for saltwater intrusion near coastal wells; however thus far no widespread or serious problems have been recognized.

A recent water budget calculated for the Kitsap Peninsula showed that during 2012, an above-average year of precipitation, the groundwater system received about 664,610 acre-feet of recharge from precipitation and 22,122 acre-feet of recharge from septic and irrigation return flows. On average across the Kitsap basin, most of this annual recharge (66%) discharged to streams, and only about 4% was withdrawn from wells. The remaining groundwater recharge (30%) left the groundwater system as discharge to

Hood Canal and Puget Sound.⁴

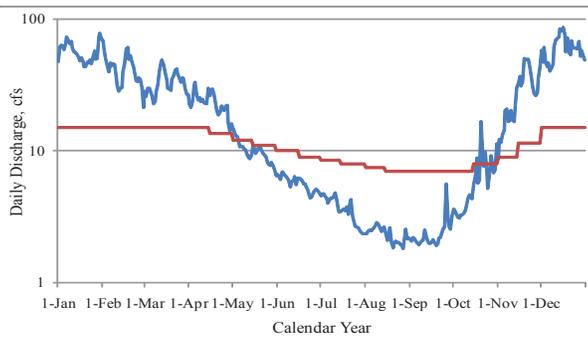
However, some of the water budget components in the north and eastern portions of the basin (including East Kitsap) are likely to show very different relationships. For example, the eastern part of the basin has the least amount of groundwater recharge and the greatest amount of groundwater withdrawals. With a new USGS model soon to be released, we will be able to examine these relationships more closely.

Between 2010 and 2014, there was an increase of about 3% in the number of well logs in East Kitsap Focus Area. In the Port Madison Water Resource Area (PMWRA), the increase was 2.5%. Permit-exempt wells are not subject to the same restrictions and regulations as other water diversions in Washington state. They can contribute to the over-appropriation of groundwater and to the decline of aquifers. The cumulative effect of exempt wells reduces water levels in wetlands, springs, streams and rivers. Across the entire Kitsap Peninsula, if no well withdrawals were occurring at all, the base flows of streams would be between 1-3% higher than current conditions. Many studies in the Pacific Northwest have documented the relationship between low streamflow and poor salmonid survival.⁵ Local zoning and development ordinances rarely provide sufficient protection for groundwater and its critical contribution to summer base flows.



Data Sources: SSHIAP 2004,⁸ USGS 2014a,⁹ WAECY 2015¹⁰

Flow Hydrograph at Chico Creek Mainstem, 1991-1996, 2001-2009⁶



In Chico Creek, minimum instream flows were not met from June to September in the 13 years that data was available. This watershed has one of the largest salmon runs in Kitsap County. Several species of fish migrate through the Chico Watershed, including chum, and coho salmon, steelhead, and sea-run cutthroat trout. Streamflow is primarily driven by rainfall and groundwater contributions. Grover’s Creek in the PMWRA appears to be similarly impacted.⁷



Chico Creek

Jim Zimny, Kitsap County

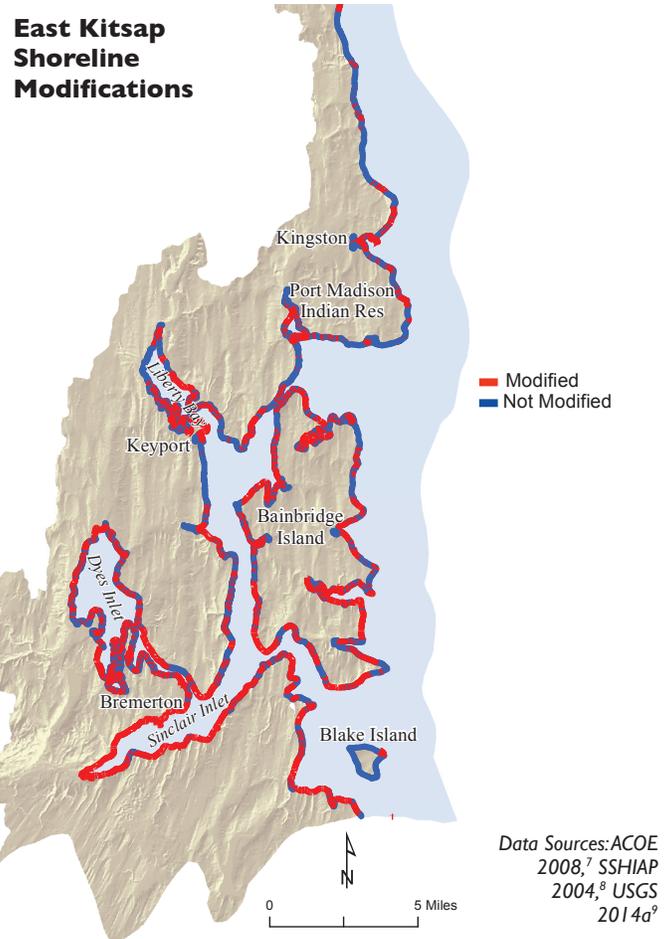
Shoreline Modifications Threaten Salmon Rearing and Forage Fish Spawning Habitat

From 2005-2014, 237 Hydraulic Project Approvals (HPAs) were issued in Kitsap County resulting in an additional 1.3-plus miles of armored shoreline, while 0.9 miles of armoring were removed, for a net increase of 0.4 miles.¹ Over 80% of these modifications are from riprap and bulkheads.

Shoreline alterations are pervasive in the East Kitsap study area. About 56% of the entire shoreline has been modified by the presence of fill, armoring, roads or similar structures, changing how the ecosystem functions, and including negatively impacting salmon rearing and forage fish spawning habitat.²

Shoreline development has been identified as a key habitat stressor to Chinook in East Kitsap.³ Armoring or hardening the shoreline significantly affects sediment supply and distribution and can alter the nearshore food web.

A majority of the shorelines, particularly around Bremerton, Sinclair Inlet, Dyes Inlet, Liberty Bay and Bainbridge Island, are modified by the presence of fill, roads or similar structures in the nearshore. The few exceptions to this ubiquitous shoreline development are most of Blake Island and stretches of shoreline in the Port Madison Indian Reservation, south of Keyport, and north of Kingston. The most common type of modification is riprap, followed by concrete and wooden bulkheads. These are typically built to protect homes and other structures but they change how the ecosystem functions and have a detrimental impact on fish habitat. However, recent data shows that Kitsap County has removed the greatest amount of armoring of any county in Puget Sound. The Powel Shoreline Restoration Project on Bainbridge Island removed over 1,500 lineal feet of shore armor resulting in re-establishment of salt marsh and intertidal vegetation and increasing intertidal habitat on the project property by 163%.⁴



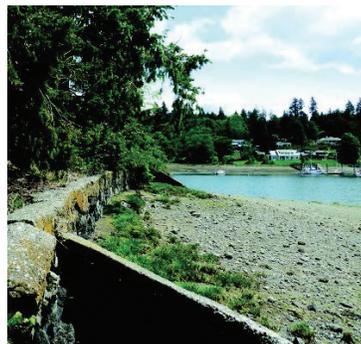
WA Dept. Ecology Coastal Atlas



WADFW

Surf smelt and sand lance

Shoreline residential development in East Kitsap: Throughout Puget Sound, surf smelt and sand lance are important forage fish for Pacific salmon, marine mammals, and seabirds. Since they spawn exclusively on sand and gravel beaches, they are particularly vulnerable to the cumulative negative impacts of a wide variety of shoreline development activities.⁵



Bainbridge Island Land Trust (2)

Powel Shoreline Restoration Project – Bainbridge Island: The amount of armoring removed in Kitsap County is more than any county in Puget Sound. The Powel Project is a great example where over 1,500 lineal feet of shore armor were removed along with associated fill, resulting in a 163% increase in intertidal area and salt marsh; 33,000 square feet of riparian area were cleared of invasive plants and replanted with native vegetation.⁶

HPA County Summary 2005 - 2014

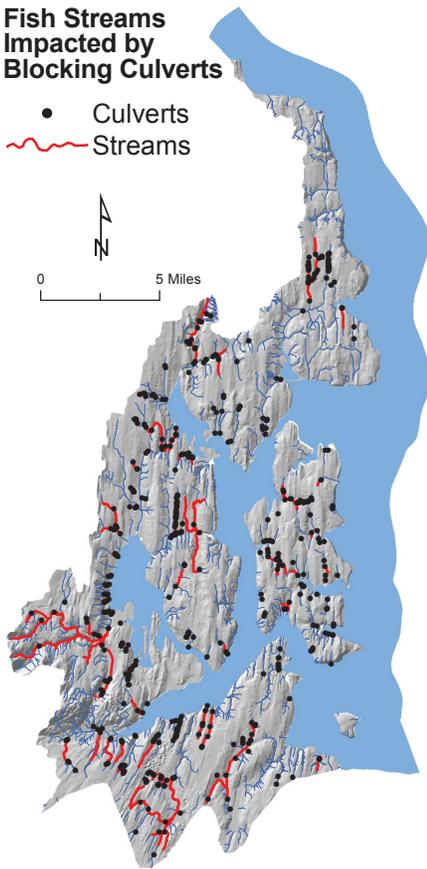
County	Number of Projects	New (ft)	Replacement (ft)	Removal (ft)
Kitsap	237	7073	16,728	4689

Impacts of Culverts, Road Density and Stream Crossings

Barrier culverts partially or fully block 78 miles of fish habitat in the East Kitsap study area. Ninety-four percent of the drainage units are impacted by high road densities (>3 miles of road per square mile) while 37% are negatively impacted by stream crossings.

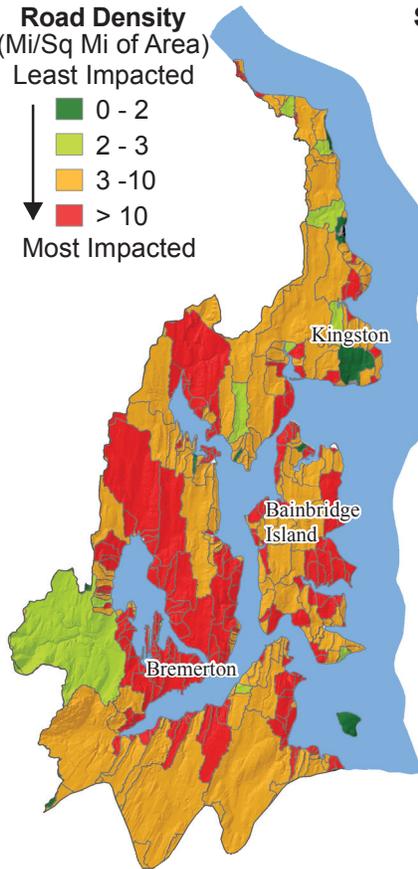
Fish Streams Impacted by Blocking Culverts

- Culverts
- ~ Streams



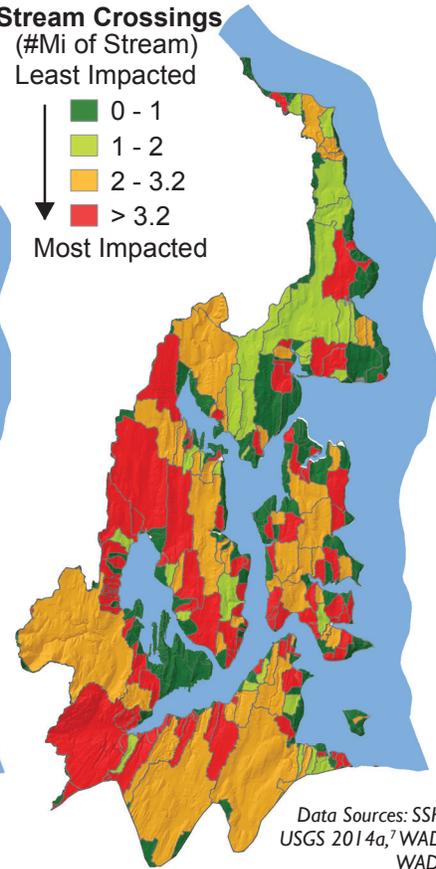
Road Density (Mi/Sq Mi of Area)

- Least Impacted
- 0 - 2
 - 2 - 3
 - 3 - 10
 - > 10
- Most Impacted



Stream Crossings (#Mi of Stream)

- Least Impacted
- 0 - 1
 - 1 - 2
 - 2 - 3.2
 - > 3.2
- Most Impacted



Data Sources: SSHIAP 2004,⁶ USGS 2014a,⁷ WADFW 2014,⁸ WADNR 2014b⁹

Urbanization typically results in the construction of road networks which can be significant stressors to stream health. High road densities require stream crossings, culverts and other structures that constrain stream channels.¹ The removal of fish passage restrictions in streams that provide important salmon habitat was identified as high priority in the East Kitsap Salmon Recovery Plan since they create physical obstructions that impede access to spawning

and rearing habitats.² Barrier culverts partially or fully block slightly over 78 miles of potential fish habitat in streams of East Kitsap. Recent stream mapping work in East Kitsap suggests that culverts and other man-made obstructions block considerably more habitat than this estimate indicates.³

This analysis shows that almost every watershed in the East Kitsap study area is impacted by high road densities and a significant number are also impacted by stream

crossings. The proper function of salmon-bearing streams may be at risk when road densities exceed 2 miles of road per square mile of area and cease to function properly at densities over 3 miles/square mile.⁴ Streams have also been shown to approach poor biological conditions when exceeding 3.2 crossings per mile of stream length.⁵



Habitat Work Schedule

Larry Steagall, Kitsap Sun

WF Clear Creek Culvert Removal: To improve fish passage and enhance habitat, Kitsap County permanently closed Sunde Road at Clear Creek and removed the culvert in the summer of 2013. In addition to improving fish passage, this project restored instream and riparian habitat and improved water quality.

Forest and Riparian Land Cover Conditions

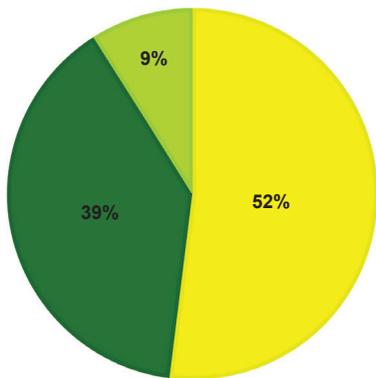
About 2% of the forestland cover was lost in East Kitsap between 2006 and 2011, and the trend in many watersheds continues toward “moderate” or “poor” conditions. Fifty-two percent of the riparian zones in the marine and freshwater shorelines have been heavily modified, a factor identified by the East Kitsap Recovery Plan as limiting salmon production in the basin.¹

Based on NOAA-CCAP data, 1591 acres (2%) of the forestland cover was lost in East Kitsap between 2006 and 2011. Many watersheds have “moderate” or worse forest conditions. Loss of forest cover typically results in less water retention, increased peak flow and increased water yield from a watershed.²

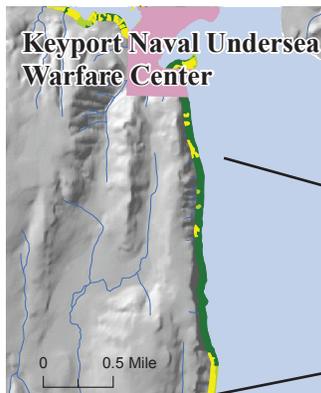
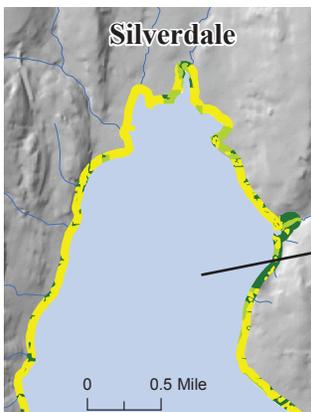
East Kitsap shorelines provide vital habitat for threatened Chinook as well as other salmonids,³ but the shoreline conditions are in decline. Data from 2011 (PNPTC) shows that 52% of riparian zones in the marine and freshwater shorelines are “non-forest,” largely the result of forest clearing and other shoreline modifications. Only 39% have

deciduous- and conifer-dominated forests with closed canopies. Riparian forests along streams provide large woody debris, shade, bank stability, wildlife habitat and other ecological functions for salmonids and other biota. Their removal and fragmentation degrades habitat quality.

Riparian Land Cover Classifications



■ Closed Canopy
■ Non-Forest
■ Other Natural Vegetation

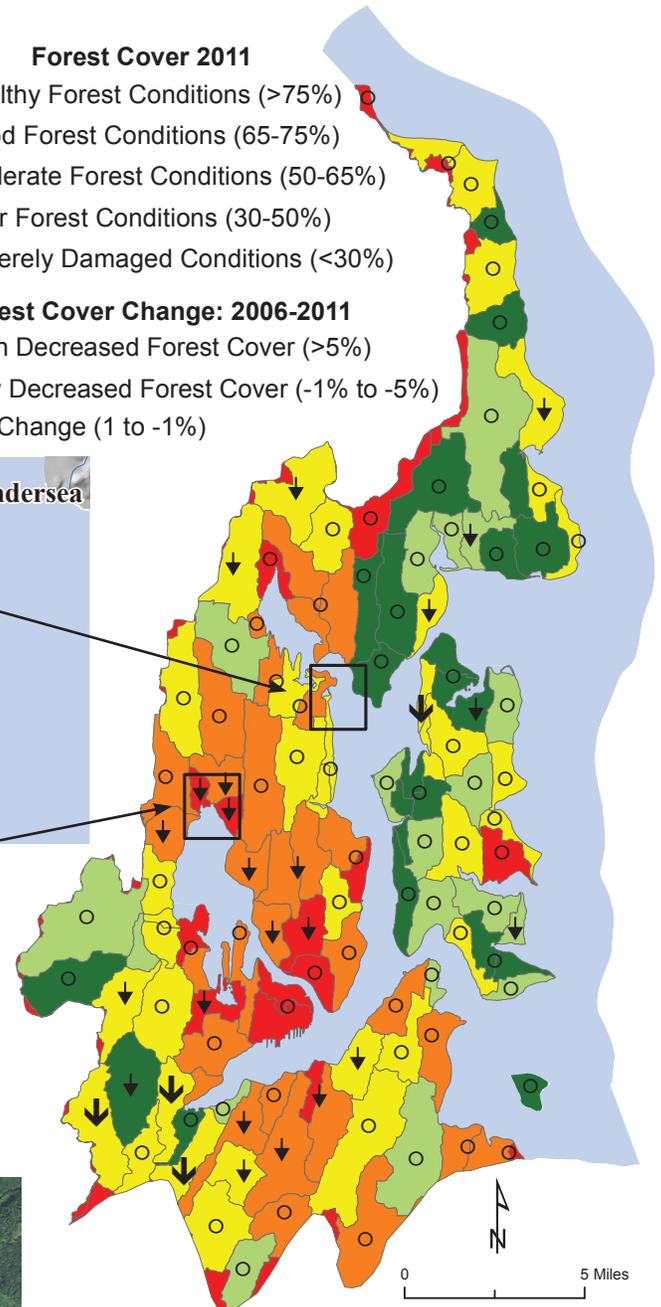


Forest Cover 2011

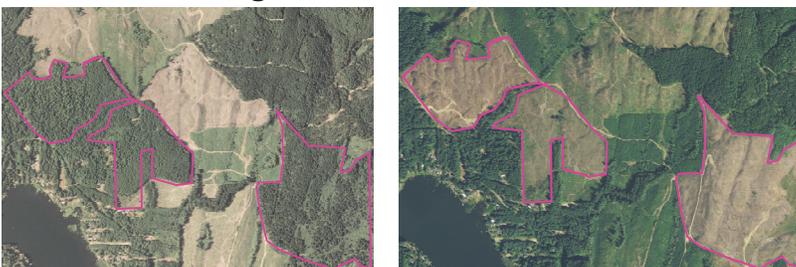
- Healthy Forest Conditions (>75%)
- Good Forest Conditions (65-75%)
- Moderate Forest Conditions (50-65%)
- Poor Forest Conditions (30-50%)
- Severely Damaged Conditions (<30%)

Forest Cover Change: 2006-2011

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



Forest Cover Change 2006 to 2011



Data Source: NAIP 2006,⁴ NAIP 2011,⁵ PNPTC 2011,⁶ USGS 2014a,⁷ WADNR 2011,⁸ WAECY 2006,⁹ WAECY 2011b¹⁰

Chico Creek Estuary Restoration

The Suquamish Tribe completed a major salmon restoration project at the mouth of Chico Creek in 2014. The goals of the project were 1) to improve fish passage at the mouth of Chico Creek through the State Route 3 (SR3) culvert; 2) restore stream and marsh habitats and improve channel/estuary connectivity; 3) establish conditions that allow for the replacement of the SR3 culvert with a bridge; 4) maintain utilities and vehicle access to residential properties. A major component of the project was the permanent removal of nearly 400 feet of Kittyhawk Drive and the culvert (both county-owned) at the mouth of Chico Creek.

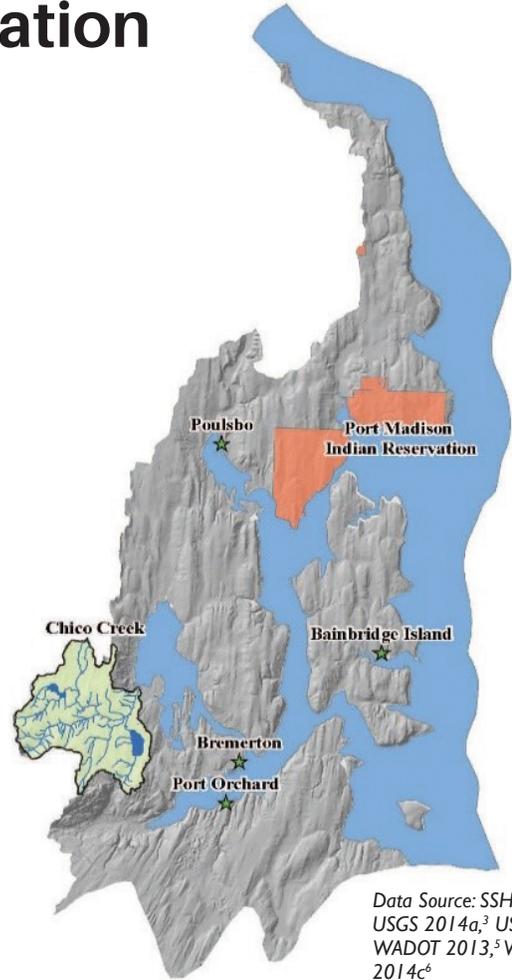
The Chico Creek estuary is a diverse mix of habitats including stream and nearshore riparian, salt marsh, tidal distributary channels and intertidal gravel beach. The Suquamish Tribe has documented juveniles of five species of Pacific salmon (including listed Chinook salmon and steelhead) rearing within the Chico estuary.

In the early 1960s the State Highway Department built State Route 3 and Kittyhawk Drive on fill as deep as 50 feet,

resulting in the loss of approximately 5 acres of channel, floodplain and saltmarsh in the Chico Estuary. Before the restoration project was completed, Chico Creek flowed into the estuary after passing through a 400-foot double box culvert under State Route 3 and a 40-foot double box culvert under Kittyhawk Drive. These culverts impeded fish passage under conditions that are common during the peak adult salmon migration period (in the fall and early winter).

The Washington State Department of Transportation ranked its SR3 culvert as the second highest priority for replacement in the entire Olympic Region. Removing Kittyhawk Drive and its culvert from the historic Chico estuary was a necessary first step allowing for the future replacement of the SR3 culvert.

Sources of funding to complete the project included Kitsap County Public Works, Washington State Department of Transportation, Estuary Salmon Restoration Program (Washington State Department of Fish and Wildlife), US EPA, and the US Navy.¹



Data Source: SSHIAP 2004,² USGS 2014a,³ USGS 2014b,⁴ WADOT 2013,⁵ WADNR 2014c⁶



Suquamish Fisheries

Aerial photo of the Chico Creek estuary following the removal of a section of Kittyhawk Drive and culvert and replanting with native species.



Suquamish Fisheries

Kittyhawk Drive and culvert at mouth of Chico Creek, prior to removal of the road/culvert and restoration of the estuary.



Kitsap Sun Aug 24, 2014

Workers pulverize Kittyhawk culvert.

Importance of Eelgrass in Puget Sound

“The importance of eelgrass meadows to salmon and other fish and invertebrates is well documented,” said Tom Ostrom, Salmon Recovery Coordinator for the Suquamish Tribe.¹ Two projects illustrate how vital eelgrass beds are to the health of the Puget Sound ecosystem and the emphasis the Tribe places on eelgrass protection and restoration.

Eelgrass Restoration along Bainbridge Island

In 2013, the Suquamish Tribe and other members of the Elliott Bay Trustee Council began implementing the second phase of an important eelgrass restoration project outside Eagle Harbor on Bainbridge Island. The restoration site occurs at the former location of the Milwaukee Dock, which served the Wyckoff creosote plant for decades and was removed in the early 1990s.

The dock was constructed in a dense subtidal meadow of eelgrass, which was further impacted by navigation channels that left two large depressions too deep for eelgrass to grow and flourish.

Eelgrass is recognized as one of the most valuable ecosystem components in Puget Sound. The restoration project includes filling the two depressions with clean sediment to a more natural depth, and planting eelgrass within these two areas (northern and southern depression areas). When completed, this project will contribute to the Puget Sound Partnership’s goal of increasing the amount of eelgrass habitat by 20% over the current baseline by 2020.

Baseline Eelgrass Study in the East Kitsap Nearshore

Suquamish is beginning work with the Washington Department of Natural Resources on an assessment of the status of eelgrass beds along shorelines of the East Kitsap area. This study will be used to establish a baseline of eelgrass distribution in the area (consistent with the Puget Sound Ecosystem Monitoring Program), and provide information for local governments (through their Shoreline Master Programs) and others in prioritizing protection and restoration of eelgrass beds.



Data Source: NAIP 2013²

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