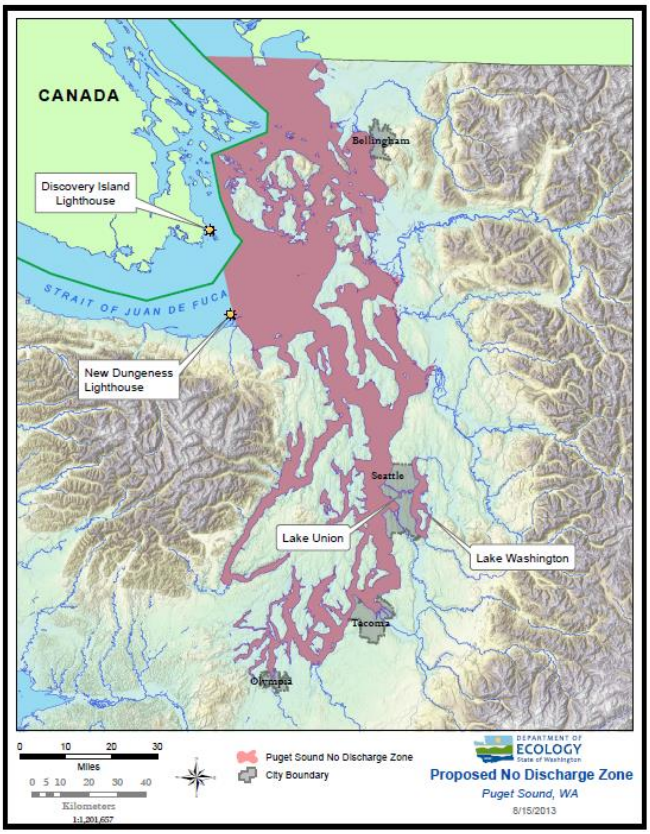

Final Petition to Designate the Waters of Puget Sound as a No Discharge Zone

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Final Petition to Designate the Waters of Puget Sound as a No Discharge Zone

by

Amy Jankowiak

Water Quality Program
Washington State Department of Ecology
Bellevue, Washington

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Executive Summary

The Washington State Department of Ecology (Ecology) is requesting that the United States Environmental Protection Agency (US EPA) designate the marine waters of Washington State inward from the line between New Dungeness Lighthouse and the Discovery Island Lighthouse to the Canadian border, and fresh waters of Lake Washington, Lake Union and connecting waters between and to Puget Sound a No Discharge Zone (NDZ) pursuant to Section 312(f)(3) of the U.S. Clean Water Act.

The NDZ would immediately apply to all vessels except for a five-year delayed implementation for tug boats, commercial fishing vessels, small commercial passenger vessels, and National Oceanic and Atmospheric Administration (NOAA) research and survey vessels to allow for substantial holding tank retrofits.

Based on information gathered over the past four years through research and an extensive stakeholder process, and in consultation with other applicable state agencies, Ecology has concluded that there is sufficient need for establishing a Puget Sound wide NDZ to protect water quality. This NDZ is consistent with the work of the Puget Sound Partnership (Partnership), the state agency leading the region's collective effort to restore and protect Puget Sound. The Partnership's Action Agenda identifies a Puget Sound NDZ as an important action for water quality. This request is also consistent with Governor Inslee's Washington Shellfish Initiative, a partnership to ensure clean water for marine commerce, by preventing pollution discharges from vessels.

Ecology has also determined that there is a high existing rate of holding tanks (Type III marine sanitation devices) on both recreational and commercial vessels and that a sufficient number of pumpout facilities and methods to prevent vessel sewage discharges are available to recreational boaters and commercial vessels.

Vessel sewage discharges are small in volume, but have high potential impact due to proximity, often directly over or near shellfish and other protected resources, such as swimming beaches. This NDZ complements other, more substantive investments in sewage treatment, onsite systems, stormwater management, industrial treatment, and agricultural runoff control. The marine sewage status quo without the benefit of an NDZ leaves shellfish beds vulnerable to pathogen pollution, which threatens an important shellfish food supply in Washington State and its resulting economic benefit. Should US EPA grant the proposed NDZ, Ecology plans to implement this change through an educational approach supported also by an enforcement component as a tool to prevent and respond to violations. Given the strong stewardship ethic of the maritime community, we are confident this program can play an important role in improved protection of Puget Sound.

1 Introduction

Puget Sound is a natural resource of incredible value to Washington State and the nation. It is estimated that Washington State derives $30 billion in direct, indirect, and induced maritime sector economic activities that result from commercial and recreational fishing, port cargo handling, seafood processing, passenger vessel operations, boating, and ship building, repair and maintenance (Economic Development Council, November 2013). Bounded by the Olympic Mountains and Vancouver Island to the West, and the Cascade Mountains to the East, it is a place of unparalleled beauty. The nutrient-rich waters brought in by tidal currents from the Pacific Ocean provide nourishment for a vast diversity of life, from microscopic invertebrates to the salmon and orca whales vital to the region's cultural history and identity. Its 2,500 miles of shoreline provide critical habitat for fish, mammals, and birds, and provide shellfish harvesting and swimming opportunities for the region's residents and visitors. Sadly, deteriorating water quality is placing many of Puget Sound's valuable resources at risk.

Over the past several decades, human-caused sources of nutrients, pathogens, and toxic contaminants are thought to have degraded the water quality of Puget Sound and are putting many of its beneficial functions at risk. Areas of Puget Sound have been designated as impaired waters under the Clean Water Act (CWA) due to persistent low-dissolved oxygen (DO) concentrations and high concentrations of fecal indicator bacteria. Numerous public swimming beaches have been closed due to bacterial contamination concerns, and approximately 36,000 acres of commercial shellfish growing areas have been closed due to bacterial contamination (DOH 2011).

Untreated vessel sewage discharges, less than 3 miles from shore, are currently prohibited. Sewage that has been treated by a United States Coast Guard (USCG) approved marine sanitation device (MSD), however, may be discharged anywhere. Treated vessel sewage discharges often contain high concentrations of organics and pathogens, may contribute to decreased DO, and may contain toxic disinfection chemicals, and excreted pharmaceuticals. As such, even treated vessel sewage discharges can degrade water quality and contribute to water quality impairments.

The Washington State Department of Ecology (Ecology), supported by other key state agencies, is requesting that the United States Environmental Protection Agency (US EPA) designate the marine waters of Washington State inward from the line between New Dungeness Lighthouse and the Discovery Island Lighthouse to the Canadian border, and fresh waters of Lake Washington, Lake Union and connecting waters between and to Puget Sound a No Discharge Zone (NDZ) pursuant to Section 312(f)(3) of the U.S. Clean Water Act (CWA). In an NDZ the discharge of sewage (also known as blackwater) from vessels is prohibited. The NDZ does not apply to other vessel discharges such as graywater, bilge, or ballast discharges unless they are combined with sewage prior to discharge. The following report addresses the seven elements (listed below) required to designate an NDZ under CWA Section 312 (f)(3):

- A certification that the waters included in the petition requires greater environmental protection than the applicable federal standard.
- A map showing locations of pumpout facilities.
- A description of the location of pumpout facilities.

- A schedule of operating hours for the pumpout facilities.
- Vessel size limits or draught limits for the pumpout facilities.
- Information on treatment of wastes from pumpouts and verification that treatment conforms with federal law.
- Information on area vessel population and usage.

This NDZ request is consistent with the work of the Puget Sound Partnership (Partnership), the state agency leading the region's collective effort to restore and protect Puget Sound. The Partnership's Action Agenda specifically identifies a Puget Sound NDZ as an important action for water quality, and was endorsed by the 27 member Ecosystem Coordination Board. This request is also consistent with Governor Inslee's Washington Shellfish Initiative, a partnership to ensure clean-water for marine commerce by preventing pollution discharges from vessels. And this NDZ request represents a contributing strategy for increasing the number of harvestable shellfish acres in Puget Sound as outlined in Results Washington Goal 3.

2 Evaluation Process

Over the past four years, Ecology with assistance from the Washington Department of Health (DOH), Washington State Parks, Herrera Environmental Consultants, and other contributors have gathered data for evaluating the appropriateness and feasibility of establishing an NDZ for Puget Sound. This was a multifaceted effort that involved reviewing and summarizing existing water quality data; compiling an accurate database of pumpout facilities available to Puget Sound boaters and commercial vessel operators; evaluating impact costs and benefits, modeling pollutant movement in Puget Sound and several outreach efforts aimed at learning about existing vessel sewage management practices and attitudes; and ways to improve access to pumpout facilities so that NDZ compliance is straightforward for boaters and commercial vessel operators alike. The results of these research efforts are detailed in a series of ten informational reports and memorandums available at Ecology's NDZ website: http://www.ecy.wa.gov/programs/wq/nonpoint/CleanBoating/nodischargezone.html.

The water quality data review focused primarily on identifying known water quality impairments and problems that could be worsened by vessel sewage discharges, shellfish harvesting and beach closures, the understanding of the hydrology and pollutant movement in Puget Sound and the quality of effluent coming out of vessel sewage.

Information on public pumpout facilities for recreational vessels was obtained via the Washington State Parks pumpout facility data base. The number, location, and operation of pumpout facilities changes regularly, so every pumpout facility was contacted to verify its operation. The operators of mobile pumpout boats were also contacted to verify their vessel capacity, areas of operation, and ability to take on additional business.

A survey of over 300 Puget Sound boaters was conducted in the summer of 2012. The information gathered via this effort helped determine the type of MSD, percentage of Washington boaters that already use pumpout facilities, and how many more might require access to pumpout facilities if Puget Sound were designated an NDZ. It also helped assess

whether boaters were satisfied with the number and locations of existing pumpout facilities, and where additional pumpout facilities are desired. Based on survey input and other stakeholder outreach input, additional pumpouts have since been added to key locations.

Commercial vessel owners and operators from the various sectors were contacted to learn about sewage management practices on their vessels. Information gathered during this effort helped catalog existing pumpout options capable of serving commercial vessels. This information-gathering campaign also helped determine what modifications to their vessels and routines many commercial vessel operators would have to make to be able to comply with NDZ regulations.

Outreach for the Puget Sound NDZ began in 2011 by contacting recreational and commercial boating organizations, environmental groups, shellfish growers, and ports, in addition to other state agencies and tribal entities. Ecology launched an informational website outlining the NDZ development process which includes technical reports developed during the process and links to pertinent information. Ecology also identified more than 300 stakeholder groups and individuals and requested input from them throughout the NDZ evaluation process and conducted more than 50 in-person meetings with stakeholders.

An advisory committee of stakeholders was assembled to guide decision making for the NDZ. The committee was comprised of representatives from state agencies, recreational boating and liveaboard advocacy groups, environmental interest groups, commercial vessel owners associations, tribal representatives, and ports. Two advisory committee meetings were held in June and July of 2013. Most of the first meeting was devoted to providing an overview of the information collected to support the NDZ decision making process. At the second meeting the advisory committee provided direct input to defining the geographic boundaries of the NDZ, infrastructure capacity and needs, and implementation needs (e.g., outreach, enforcement, and evaluation measures).

In 2014, Ecology held a 60-day public comment period on a *Draft Petition to Designate the Waters of the Puget Sound as a No Discharge Zone*. Ecology received more than 26,000 public comment e-mails or letters on the Draft Petition and a response to comments was completed. Ecology received 26,016 e-mails or letters during the public comment period. Of those, 25,150 were form letters and 866 were individualized letters. The majority of the individualized letters came from individuals and some from groups or associations such as environmental organizations, vessel associations, companies and yacht clubs, state and local government, and other interested groups. 25,466 e-mails or letters expressed support for the Draft Petition, 524 expressed opposition or concern, and 26 were mixed.

Based on the information gathered over the past four years, Ecology has concluded that there is sufficient need for establishing an NDZ in Puget Sound to protect water quality. Ecology has also determined that there are a sufficient number of pumpout facilities and methods to prevent vessel sewage discharges available to recreational boaters and commercial vessels, with certain commercial vessels being allowed additional time to retrofit vessels.

While the current number and location of pumpouts are sufficient to meet the Clean Water Act criteria to designate all of Puget Sound a no-discharge zone for all vessels, it is recognized that additional pumpout infrastructure would add more utility for tug boats, small commercial passenger vessels and commercial fishing vessels. Therefore, Ecology will collaborate with those sectors to develop, help fund and implement a five-year pumpout infrastructure program that is designed to provide additional pumpout options.

3 Proposed No Discharge Zone, Boundaries and Extent

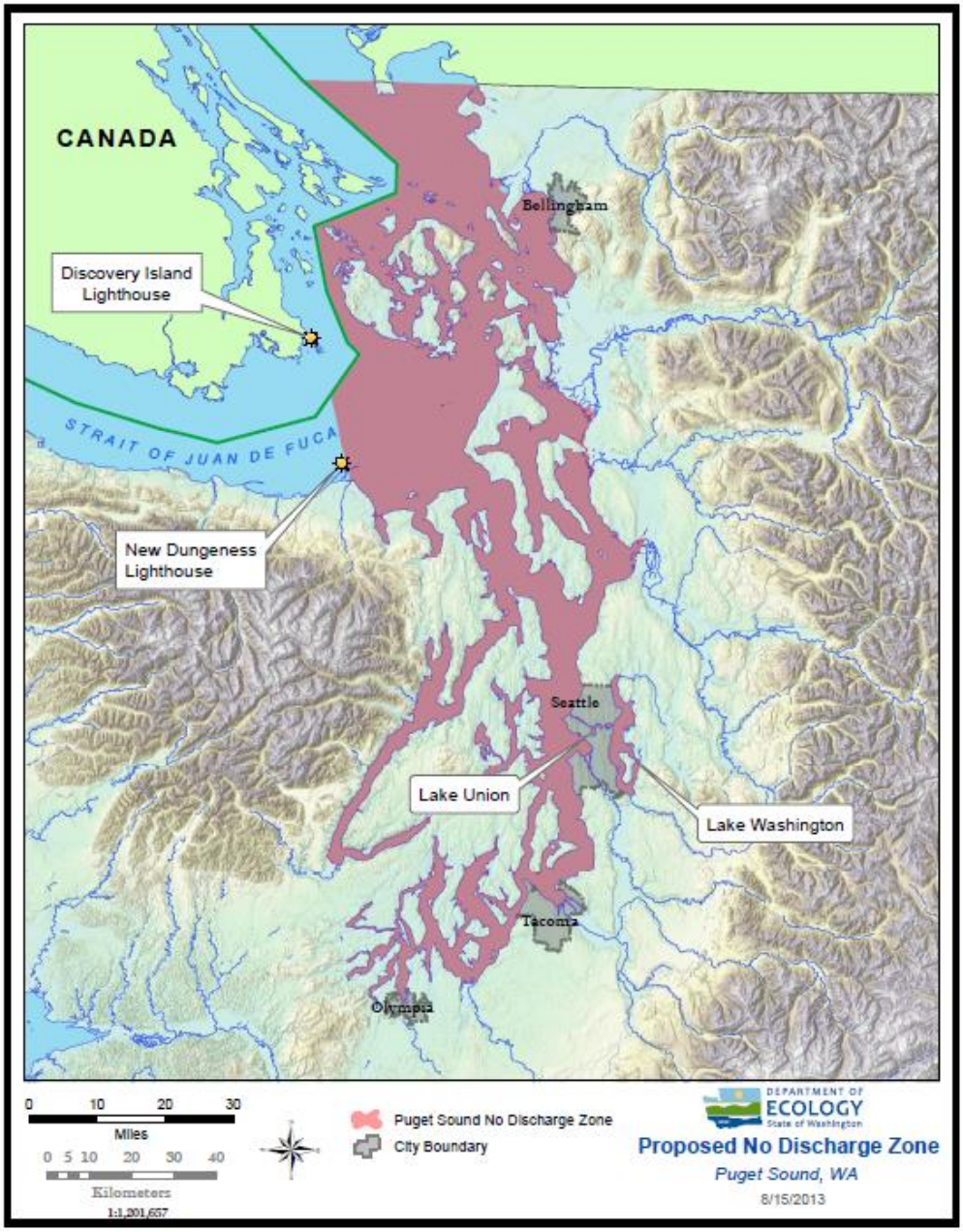
The proposed NDZ includes all the marine waters of Washington State inward from the line between New Dungeness Lighthouse and the Discovery Island Lighthouse to the Canadian border, and fresh waters of Lake Washington, Lake Union, and connecting waters between and to Puget Sound and applies to all recreational and commercial vessels. The western boundary of the NDZ would be the exit of the Strait of Juan de Fuca near the entrance of Admiralty Inlet. This boundary is known and visible to vessel operators as it is the line between New Dungeness Lighthouse and Discovery Island Lighthouse. The northern boundary would be the border with Canada and heading south including all marine waters down to the south end of the south sound and Hood Canal. The fresh waters of Lake Washington, Union Bay, Montlake Cut, Portage Bay, Lake Union, Fremont Cut, the Lake Washington Ship Canal, and Salmon Bay (the connecting waters from Lake Washington to Puget Sound) are included. The specific boundaries of the proposed NDZ are clearly delineated on Figure 1.

The geographical boundaries were determined by considering the vessel counts, and pumpout availability and distribution data, as well as the information collected on water quality concerns and locations of sensitive resources and public health protection, hydrology and pollutant movement, costs and benefits, and geographic understanding and implementation. Ecology reviewed all of the data collected during the 4-year evaluation process on the number of vessels, locations of vessels, types of vessels, and the number and distribution of stationary and mobile pumpout facilities. Ecology evaluated mapped data such as sensitive water bodies, shellfish growing areas, and locations of known water quality problems. And Ecology conducted numerous stakeholder meetings including two Advisory Group meetings in which the pros and cons of the various geographic boundary options were analyzed. The analysis concluded that all marine waters inward from the exit of the Strait of Juan de Fuca towards Puget Sound, as well as the fresh waters of Lake Washington, Lake Union and the connecting water bodies should be designated to adequately protect water quality and public health. It was determined that the infrastructure to prevent vessel sewage discharges was adequate by meeting and exceeding US EPA's guidelines for the number of pumpouts and having more than a sufficient number of pumpouts and mechanisms to manage sewage for both recreational and commercial vessels distributed in areas where vessel usage occurs.

The NDZ would immediately apply to all vessels with the exception of small and mid-sized commercial vessels that operate almost exclusively within the NDZ. Specifically, the following types of commercial and research vessels would have a delayed implementation: tug boats,

commercial fishing vessels, small commercial passenger vessels[1], and National Oceanic and Atmospheric Administration (NOAA) research and survey vessels. The delayed implementation is included because there are some unique challenges associated with retrofitting these types of vessels, such as requiring engineered designs with extra safety considerations and in some cases, significant costs. These vessels would have delayed implementation from the new NDZ regulations, but would still be required to comply with existing state and federal discharge regulations in the interim. The delayed implementation would last until five years from the effective date of the NDZ for tug boats, commercial fishing vessels, small commercial passenger vessels, and NOAA research and survey vessels.

[1] Small commercial passenger vessels, also referred to as "small cruise ships" are commercial passenger vessels that provide overnight accommodations for <249 overnight passengers for hire, determined with reference to the number of lower berths.



New Dungeness Lighthouse: N 48° 10' 54.454", 123° 06' 37.004" W
Discovery Island Lighthouse: N 48° 25' 26.456", 123° 13' 29.554" W
Intersection line between lighthouses and Canadian Boundary: N 48° 20' 05.782", 123° 11' 58.636" W

Figure 1. Proposed No Discharge Zone

4 Certificate of Need

Water quality declines over the past several decades have put many of Puget Sound's economic, recreational, and ecological functions at risk. Thousands of acres of shellfish aquaculture and harvesting areas are currently closed due to health hazards posed by bacterial contamination. Likewise, many swimming beaches are closed annually to protect beachgoers from getting sick. Low DO concentrations caused by excess nutrients in the water have resulted in large die-offs of marine life in several areas of Puget Sound.

Microbial pathogens, disinfection chemicals, and other additives in MSD discharges present water quality and public health threats. According to the Clean Vessel Act (CVA) of 1992, "sewage discharged by recreational vessels because of an inadequate number of pumpouts is a substantial contributor to localized degradation of water quality in the United States." Substantial progress has been made since passage of the CVA in providing boaters access to pumpout facilities. However, the discharge of MSD treated waste from recreational and commercial vessels still poses a risk to water quality of Puget Sound. Under the current regulatory framework, illegal discharges are very difficult to prevent and enforce, and even legal, treated sewage discharges contain fecal bacteria concentrations that are many times higher than the state water quality standards.

Most previous and ongoing water quality improvement efforts focus on reducing watershed-based sources of pollution. Point source pollution is largely addressed through the National Pollutant Discharge Elimination System (NPDES) permitting process. Non-point source pollution is being reduced through watershed rehabilitation, pollutant source reduction, and new treatment technologies.

Vessel sewage is a type of non-point source pollution. Even though vessel sewage discharges may account for only a small portion of the total pollutant mass load entering Puget Sound, their impacts may be disproportionally large. Because vessels are mobile, their discharges may occur directly over or near sensitive environmental resources, causing localized water quality problems. Lines of evidence show that water masses are highly connected in Puget Sound and that vessel discharges can release pollution that threatens sensitive resources miles from the discharge. Eliminating vessel sewage discharges by establishing an NDZ for Puget Sound will work in concert with watershed-based pollutant reduction efforts to restore water quality and maintain the many beneficial human uses and ecological functions of Puget Sound.

4.1 Puget Sound Partnership Action Agenda

Because of the environmental pressures and ecological decline of Puget Sound, significant efforts are being made by the state, local municipalities, and environmental advocacy groups aimed at improving water quality and restoring habitat in Puget Sound. The Puget Sound Partnership (Partnership) is a state agency established to lead efforts to protect and restore Puget Sound.

The Partnership has developed an Action Agenda, a roadmap to restore Puget Sound by 2020. As part of the most recent Action Agenda update, The Partnership developed a set of recovery targets to be achieved by 2020 (PSP 2014). Addressing vessel sewage is a component of the Action Agenda. Designating Puget Sound as an NDZ will offer the greatest protection possible from vessel sewage pollution and will largely satisfy the Action Agenda marine sewage goal. The Action Agenda and recovery targets can be viewed at the Partnership's website (http://www.psp.wa.gov/action_agenda_center.php).

To help target restoration efforts tied to the Action Agenda, The Partnership has designated "Action Areas" that roughly correspond to the main basins of Puget Sound. While Action Areas are not specifically related to the NDZ, they are referenced several times in this petition because they are useful geographic units for framing discussions about the NDZ.

4.2 Puget Sound's Economic and Recreational Importance

Puget Sound is an economic engine for the region. It was recently estimated that Washington State derives $30 billion in direct, indirect, and induced maritime sector economic activities that result from commercial and recreational fishing, port cargo handling, seafood processing, passenger vessel operations, boating, and ship building, repair and maintenance, all of which are dependent on good water quality (Economic Development Council, November 2013).

Probably the most direct link between the economic vitality of the region and excellent water quality is through the commercial shellfish industry. Washington shellfish growers directly and indirectly employ over 3,200 people and provide an estimated total economic contribution of $270 million statewide (PCGSA 2011). In 2013, the Puget Sound shellfish industry was estimated to have generated $72 million in revenue. Shellfish aquaculture has shown steady growth since 1985, with over 23 million pounds harvested in recent years (NOAA 2016). The Washington State Department of Health designates the status of commercial shellfish and recreational harvesting areas based on the potential health risk posed to people by consuming shellfish harvested in those areas. Approximately 190,000 acres of tidelands are classified for commercial and recreational shellfish harvest. In 2011, approximately 36,000 acres, or 19 percent, of the total potential growing area was closed to harvesting, representing substantial revenue losses. The majority of the acreage was closed due to fecal bacteria pollution (PSP 2014 3C). The Puget Sound Partnership has set a recovery goal of a net increase of 10,800 acres where shellfish may be harvested, including 7,000 acres where harvest is currently prohibited.

Recreational shellfish harvesting is nearly as important to the regional economy as commercial harvest. Annually, tourists and residents purchase over 300,000 licenses to harvest clams and oysters from Washington waters, providing more than $3.3 million in state revenues. WDFW conservatively estimates that the 125,000 shellfish harvesting trips made each year to Puget Sound beaches provide a net economic value of $5.4 million to the region (PCGSA 2011). Recreational shellfish harvest takes place at hundreds of beaches throughout Puget Sound. As with commercial shellfish growing areas, DOH is responsible for ensuring that shellfish that are harvested recreationally are safe to eat.

Shellfish resources are particularly vulnerable to vessel sewage discharges. As will be described in detail later in this petition, even treated vessel sewage discharges have very high bacteria concentrations and the treatment processes used provides limited treatment for viruses or other pathogens. The fact that these treated discharges can currently occur directly over or very near shellfish beds or swimming areas means that they pose a much greater public health risk than other waste discharges. Thousands of people use Puget Sound beaches every weekend to enjoy the scenery and the water, as well as to dig for clams and oysters. Public swimming beaches are monitored for bacteria and other toxins. In 2011, one-quarter of monitored swimming beaches were closed because of fecal bacteria contamination (PSP 2014).

The Puget Sound Partnership has set a recovery target of having all public swimming beaches meeting the US EPA bacteria standard by 2020 (PSP 2014).

The recreational fishing net economic value was $81 million in 2006 for salt water (WDFW 2008).

4.3 Costs and Benefits of Establishing an NDZ for Puget Sound

Puget Sound is crucial to the economic vitality and cultural identity of the region and the State. Maintaining and improving the water quality of Puget Sound by establishing an NDZ will help ensure that industries dependent on excellent water quality will sustain their success and continue to grow.

There are costs associated with establishing an NDZ that will affect a range of stakeholders (Herrera 2012a). The primary cost to vessel operators is the one-time capital cost to retrofit vessels that do not have adequate holding capacity. There are also indirect costs, which are difficult to quantify, such as the cost in time required navigating to and from stationary pumpout facilities if only for disposal and not refueling. For recreational vessels, the cost to add a holding tank is about $500 for materials plus labor for a total of about $1,500. The on-going costs for recreational vessels to pumpout is minimal, with most pumpouts being free or $5 per pumpout.

For commercial vessels, the costs to retrofit vessels with holding tanks can be significant varying greatly and is dependent on vessel type, purpose, size, and characteristics of individual vessels. For tugboats, the holding tank size varies from 50 gallons to 3000 gallons with costs ranging from negligible to $161,000 per vessel with about 100 of the 150 Puget Sound tugboat vessels needing to retrofit. For commercial fishing vessels, many already have holding tanks, and an estimated 100-150 would need to retrofit. The cost for commercial fishing vessels also varies greatly with an estimated $35,000 - $150,000 cost. For the approximately eight small commercial passenger vessels, the installation costs of a holding tank in lieu of a treatment MSD are significant and difficult to implement as a retrofit. It requires a major vessel remodel or replacement of the vessels, equating the costs to $650,000 or more. The majority of these vessels are in Alaska for the season with a couple of the vessels having itineraries in Puget Sound (Herrera 2015).

NOAA has two survey vessels and two research vessels that operate in the Puget Sound all of which use Type II MSDs and would need to add holding capacity. Estimated costs for retrofits are about $250,000 (NOAA communications with Ecology, August 2013). In total, approximately 250 commercial and approximately 2,000 recreational vessels would need to add holding tanks compared to the estimated 155,000 vessels in operation on Puget Sound. Building and maintaining pumpout facilities, particularly large capacity facilities for commercial vessels can also be costly. The Clean Vessel Act grant program pays the bulk of the costs associated with recreational pumpouts, but there are no similar programs for commercial pumpouts. Commercial vessels can either discharge at sea, use one of the 15 stationary pumpouts, mobile pumpout service vessels, some recreational pumpouts, or shore-based pumper trucks. Ecology is in the process of providing funding for commercial vessels through a 100 percent paid grant for at least one commercial pumpout to be installed in Seattle and possibly more in the future, as an addition to existing options.

The economic benefit of protecting water quality and public health is difficult to quantify as are the environmental benefits. Even in light of the costs of establishing an NDZ, they are outweighed by the benefits of clean water.

4.4 Protected Areas and Beneficial Uses

Puget Sound provides critical and unique habitat for a variety of species, ranging from orca whales to forage fish and native shellfish. Marine protected areas (MPAs) are areas that are designated as requiring extra protection due to their fragile and unique habitats or species, or because they are culturally historic sites or they enhance fisheries abundance and biodiversity. While MPAs by no means provide a complete inventory of the valuable marine resources, they are an important tool for visualizing the extent of environmentally important areas throughout Puget Sound.

Washington State has designated 127 MPAs that are administered by a number of different agencies; 71 are located in Puget Sound (Figure 2). Marine protected areas are generally small (the average size is 23 acres); only about 5 percent of the Puget Sound coast is covered by an MPA. Marine protected areas offer various degrees of protection for marine resources by having harvest and access restrictions, for example. Despite their status, with a few exceptions, MPAs are not protected from vessel discharges.

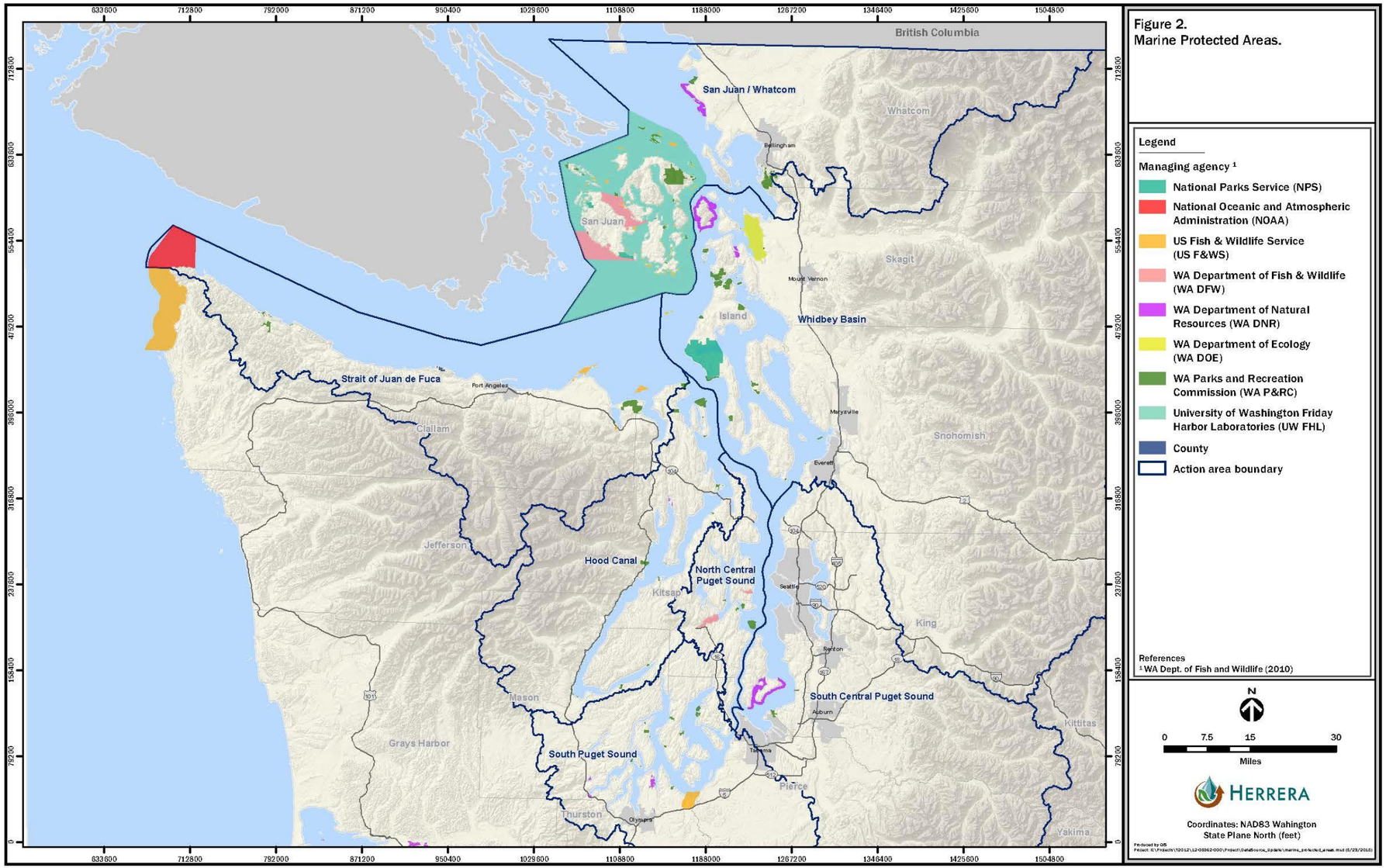


Figure 2. Marine Protected Areas

4.5 Hydrology

Puget Sound comprises four deep basins connected by shallower sills. The basins correspond to the Hood Canal, Central Puget Sound (North and South), and Whidbey Basin (Figure 2) (University of Washington 2009). Central Puget Sound is the deepest basin, with depths consistently exceeding 200 meters (m) (Cannon 1983). South Puget Sound is much shallower. Although water depths in South Puget Sound reach 150 m, many of the inlets are 50 m or shallower (Ecology 2009). The Whidbey Basin is also shallower than the main basin in Central Puget Sound and has variable depths ranging from 8 to 150 m (University of Washington 2012). Hood Canal is deep throughout the north-south trending portion, with depths frequently exceeding 175 m. Where Hood Canal bends to the east and changes to an east-west orientation, it is much shallower, with depths only reaching about 40 m (Turney 2004). Lake Washington and Lake Union, while not part of Puget Sound, are connected via the Lake Washington Ship Canal to Shilshole Bay.

Puget Sound has complex hydrology that results from the interaction of tidal currents, freshwater inflow, and the physical features that define the bathymetry of the basins. The deeply incised fingers left behind by the last glaciations resulted in a network of narrow channels and shallow sills, which restrict and alter the mixing and circulation of water throughout the Sound. As a result, some areas of the Sound, particularly South Puget Sound and Hood Canal, experience poor circulation and are prone to water quality impairments (PSP 2010).

Water circulation in Puget Sound is driven by tidal currents as well as estuarine circulation that results from the surface outflow of fresh water and the deep inflow of salt water from the ocean. There are 10,000 rivers and streams that contribute fresh water to Puget Sound, but 14 main rivers located predominately in central and north Puget Sound account for the majority of the freshwater sources (PSA 2012). Due to density differences, the less dense fresh water remains near the surface and flows out of the Sound through Admiralty Inlet. The majority of the oceanic input, which is denser and typically more nutrient-rich, enters into Puget Sound at depth through Admiralty Inlet and travels south through the main basin. Some mixing between the more saline ocean water and the less dense surface water occurs, as the ocean water is forced upward as it travels over the Admiralty Inlet Sill and near the south end of the main basin at the Tacoma Narrows Sill between Central and South Puget Sound (Newton 2002).

Water circulation and flushing rates influence water quality and are especially important factors in determining an area's susceptibility to eutrophication. In general, circulation and flushing are more rapid in the northern segments of Puget Sound. Greater river water inputs and a shorter, more direct connection with the ocean facilitate greater net flow and circulation in these areas. Hood Canal and South Puget Sound are much more poorly flushed due, in part, to sills at their mouths, which restrict exchange with the rest of Puget Sound. Other factors related to the timing and strength of stratification in Hood Canal and South Puget Sound also limit the net volume of water exchange flushing time (Gustafson et al. 2000).

4.6 Water Quality

Good water quality is at the heart of the ecological, economic, and recreational benefits provided by Puget Sound. Over the past several decades, human-caused sources of nutrients, pathogens, and toxic contaminants are thought to have degraded the water quality of Puget Sound and are putting many of its beneficial functions at risk. Treated vessel sewage discharges often contain high concentrations of pathogens (fecal coliform as an indicator), solids, organics, and nutrients which may contribute to decreased DO, and are likely to contain toxic disinfection chemicals as well as pharmaceuticals. The following sections provide a general overview of Puget Sound water quality in relation to four indicators: bacteria, DO, nutrients, and toxic chemicals.

4.6.1 Water Quality Standards

In Washington, water quality is regularly evaluated against the surface water quality standards that are set forth in Chapter 173-201A WAC to assess whether the water complies with the CWA. The water quality standards establish numeric and narrative criteria for a water body to protect its existing beneficial uses for both aquatic life and recreation as well as human health. Figure 3 shows the beneficial use designations of Puget Sound waters. The vast majority of Puget Sound is designated as *extraordinary or excellent* aquatic life use and as *primary contact recreation for* beneficial uses. These designations speak to the importance and value of good water quality throughout all of Puget Sound and demonstrate that the need for clean water is not limited to just a few areas.

Of the four water quality indicators selected for summary, fecal bacteria and DO are the two that are assigned specific water quality standards. Some toxic contaminants are also assigned numeric standards and are most frequently evaluated by fish tissue and sediment sampling, rather than water quality monitoring. Nutrients are not discussed in relation to the water quality standards because there are no marine water quality standards for nutrients, except for ammonia-nitrogen as a toxicant. However, low DO concentrations are often an indicator of elevated nutrients and eutrophication; therefore, the discussion of DO impairments cannot be isolated from the discussion of elevated nutrients.

Water quality standards for fecal indicator bacteria (fecal coliform and enterococci bacteria) and DO are defined in Table 1. Waters that fail to meet water quality standards are designated as impaired, and are included on the 303(d) list of impaired waters (CWA 40 CFR 130.7).

A model of water circulation throughout Puget Sound simulating vessel discharges with a release of conservative tracer shows that water masses in the Puget Sound are highly connected. There is potential for a vessel discharge, either raw or treated with MSD type II, to reach sensitive resources, such as shellfish and swimming beaches and violate the State's water quality standard for fecal coliform bacteria.

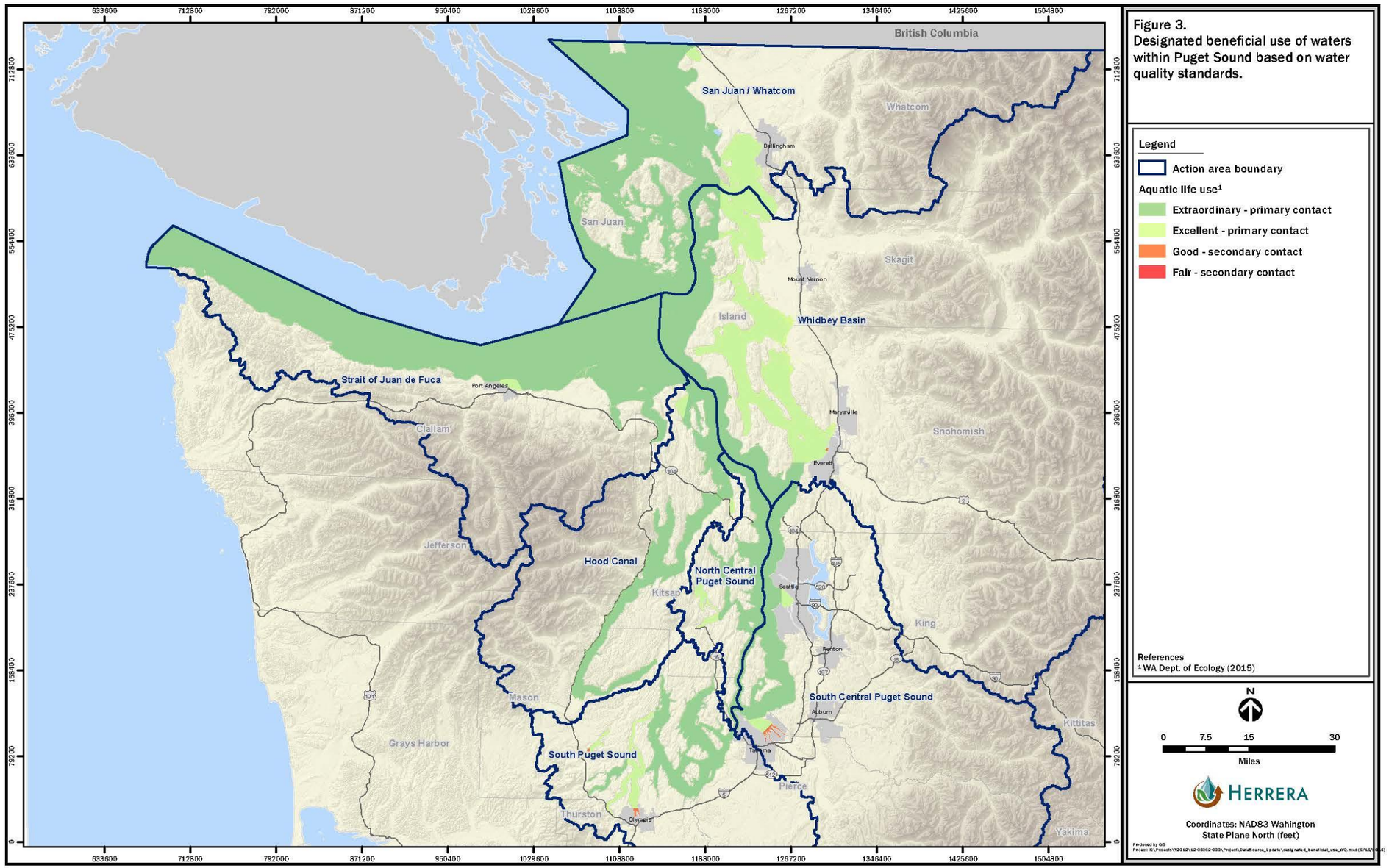


Figure 3.
Designated beneficial use of waters within Puget Sound based on water quality standards.

Legend

- Action area boundary

Aquatic life use[1]

- Extraordinary - primary contact
- Excellent - primary contact
- Good - secondary contact
- Fair - secondary contact

References

[1] WA Dept. of Ecology (2015)

N

0 7.5 15 30

Miles

HERRERA

Coordinates: NAD83 Wahington State Plane North (feet)

Figure 3. Designated Beneficial Uses

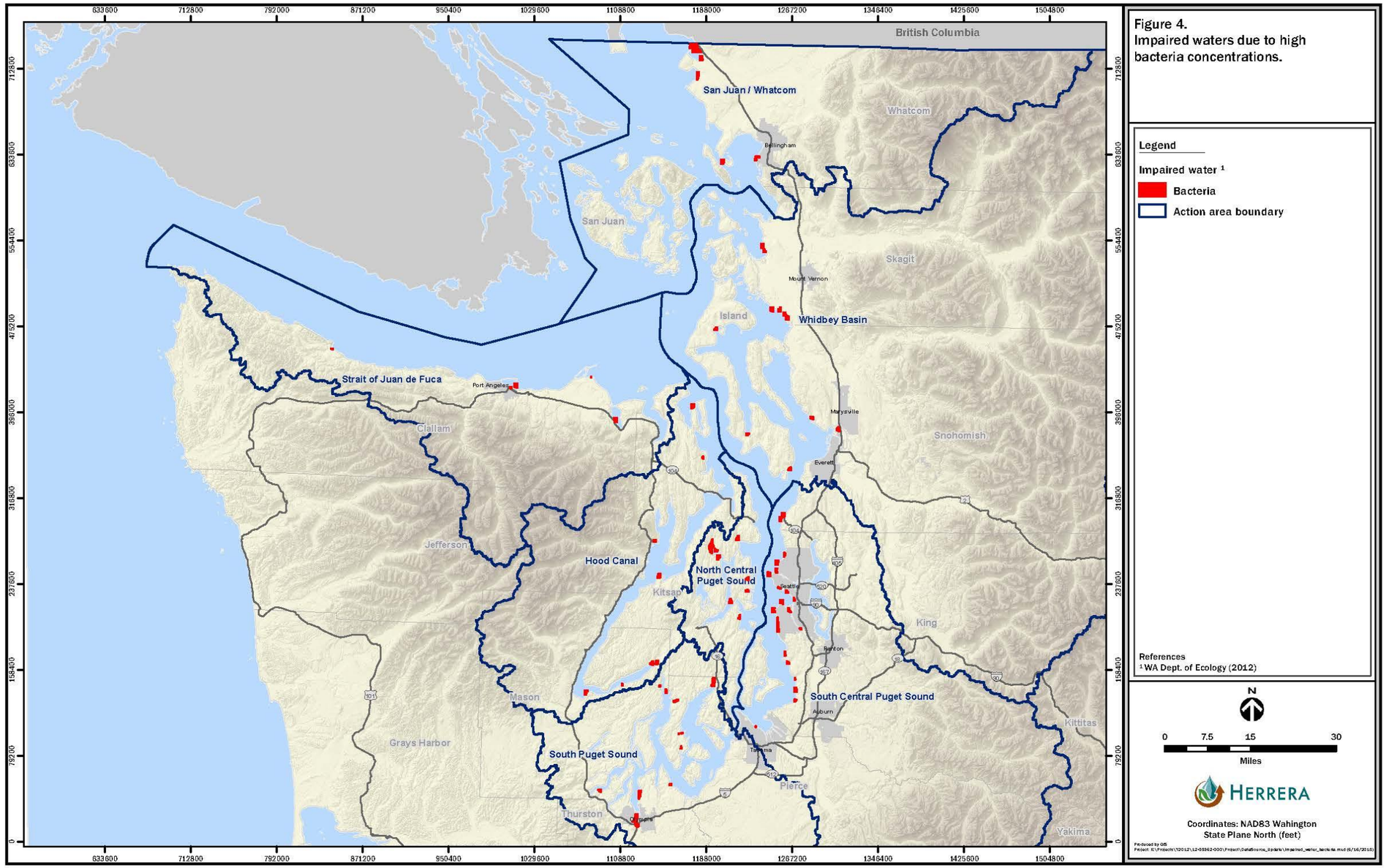


Figure 4.
Impaired waters due to high bacteria concentrations.

Legend

Impaired water [1]

Bacteria

Action area boundary

References

[1] WA Dept. of Ecology (2012)

N

0 7.5 15 30

Miles

HERRERA

Coordinates: NAD83 Wahington
State Plane North (feet)

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Project: E:\Projects\12012\L2-05362-000\Project\DataSources_Update\Impaired_water_bacteria.mxd (6/16/2016)

Figure 4. Impaired Waters Due to High Bacteria Concentrations

4.6.2 Status and Trends of Key Pollutants

This section provides an overview of the status and trends of bacteria pathogens, DO, nutrients, and toxic contaminants. These parameters were chosen because they are the most likely to be affected by vessel sewage discharges. A number of sources were used to develop the following summaries; however, the bulk of the information presented in the following sections was summarized from the 2011 Puget Sound Science Update (PSP 2011b).

Bacteria

In Puget Sound, fecal bacteria monitoring is conducted by numerous state and local agencies. Ecology conducts bacteria monitoring at Puget Sound Ecosystem Monitoring Program (PSEMP) stations. The Washington Department of Health (DOH) monitors fecal bacteria in shellfish growing areas and administers the bacterial environmental assessment communication and health (BEACH) monitoring program for recreational beaches. Many local municipalities also have bacteria monitoring problems to study and address local problems. These programs have identified bacterial contamination problems in many areas of Puget Sound.

Water Quality Standard Impairments

In Puget Sound there are many areas where water quality is considered as impaired due to bacteria levels failing to meet water quality standards (Figure 4). The majority of fecal bacteria impairment listings are in South Puget Sound, Hood Canal, and other poorly mixed embayments. However, areas with better circulation are also susceptible to fecal bacteria problems, particularly near urbanized areas. For example, there are a number of fecal bacteria impairments along the east side of central Puget Sound, in spite of this region being relatively well circulated.

Table 1. Marine Water Quality Standards for Dissolved Oxygen and Indicator Bacteria in Puget Sound

Marine Water Quality Standards for Dissolved Oxygen and Indicator Bacteria in Puget Sound			
Beneficial Uses		**Dissolved Oxygen Lowest 1-day Minimum**	**Indicator Bacteria**
Aquatic Life	**Recreation**		
Extraordinary	Primary Contact	7.0 mg/L	Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100mL, with not more than 10% of all samples (or any single sample when < 10 sample points exist) obtained for calculating the geometric mean value > 43 colonies/100 mL.
Excellent	Primary Contact	6.0 mg/L	Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100mL, with not more than 10% of all samples (or any single sample when < 10 sample points exist) obtained for calculating the geometric mean value > 43 colonies/100 mL.
Good	Secondary Contact	5.0 mg/L	Enterococci organism levels must not exceed a geometric mean value of 70 colonies/100 mL, with not more than 10% of all samples (or any single sample when < 10 sample points exist) obtained for calculating the geometric mean value > 208 colonies/100 mL.
Fair	Secondary Contact	4.0 mg/L	Enterococci organism levels must not exceed a geometric mean value of 70 colonies/100 mL, with not more than 10% of all samples (or any single sample when < 10 sample points exist) obtained for calculating the geometric mean value > 208 colonies/100 mL.

Recreational Beaches
Marine recreational beaches are monitored as part of the BEACH Program (Ecology 2015). The BEACH program monitoring uses the 1986 US EPA Beach Act (40 CFR 131) enterococci criteria; a beach average enterococci value of 104 enterococci/100 milliliters (mL) determines whether beaches are safe for swimming. Between 2003 and 2015, 134 Puget Sound beaches were monitored, with an average of 64 beaches monitored per year. During a sample year (Memorial Day through Labor Day) an average of 42 percent of the beaches sampled had at least one sample exceeding the standard.

Data from the BEACH monitoring program for 2004-2011 was used to assign categories of low, moderate, and high based on the relative frequency of samples exceeding the standard. Thirty-one of 123 beaches monitored were rated as a high risk for bacteria contamination, and 85 were rated as a moderate risk. Of course, most of the public beaches are not monitored as part of the program, so it is likely that many more beaches pose a public health risk due to fecal contamination. Nineteen beaches on Lake Washington and Lake Union are monitored by King County for bacteria. Closures due to bacteria contamination are rare, but they do occur. A listing of historical beach closures is available at King County's swimming beach monitoring website (http://green.kingcounty.gov/swimbeach/).

Commercial Shellfish Harvest
Shellfish are filter feeders, and they can accumulate pathogens that are present in the water column and sediments. High concentrations of bacteria can result in the closure of commercial shellfish growing areas and closures of beaches used for recreational shellfish harvest. Due to the potential health risk associated with eating contaminated shellfish, DOH monitors bacteria concentrations in waters that are used for shellfish aquaculture or recreational harvest on a regular basis. Approximately 190,000 acres of commercial and recreational shellfish growing tidelands are monitored. All harvesting areas, whether commercial or recreational, are subject to the bacteria standard described in Table 1 for primary contact. Based on the results of sampling and other hydrologic factors, commercial shellfish growing areas are designated using the following systems:

- **Commercial Growing Areas**:
    - **Approved:** Geometric Mean concentration of fecal coliform organism does not exceed 14 colonies per 100 mL and not have more than 10 percent of all samples (or any single sample when less than ten sample points exist) obtained for calculating the geometric mean value exceeding 43 colonies per 100 mL.
    - **Conditionally Approved:** Meets the above standard during predictable periods and therefore is approved for use only during those periods.
    - **Restricted:** Bacterial water quality does not meet the standard for approved classification. Shellfish grown in restricted areas may be relayed (transplanted) to another area for an extended period before marketing.
    - **Prohibited:** Fecal material, pathogenic organisms, or otherwise harmful substances have been detected at dangerous concentrations. Commercial harvest is not allowed.

The locations and status designations of commercial growing areas are shown on Figure 5. The majority of commercial harvest areas remain open or conditional. However, harvest is prohibited on about 36,000 acres, or 19 percent of the total potential growing area of 190,000 classified acres. Some of these areas are closed due to pollution sources such as biotoxins or synthetic chemicals, but the majority of closures are due to fecal bacteria pollution (PSP 2011c).

The Washington State Department of Health recently evaluated long-term trends in fecal pollution at 21 commercial growing areas for the period between 1998 and 2011. While there was some variability among the areas evaluated, most showed a moderate improving trend over the study period. Only a few areas showed marked improvements; these improvements were thought to be the result of remediation of failing onsite septic systems and public education (DOH 2011).

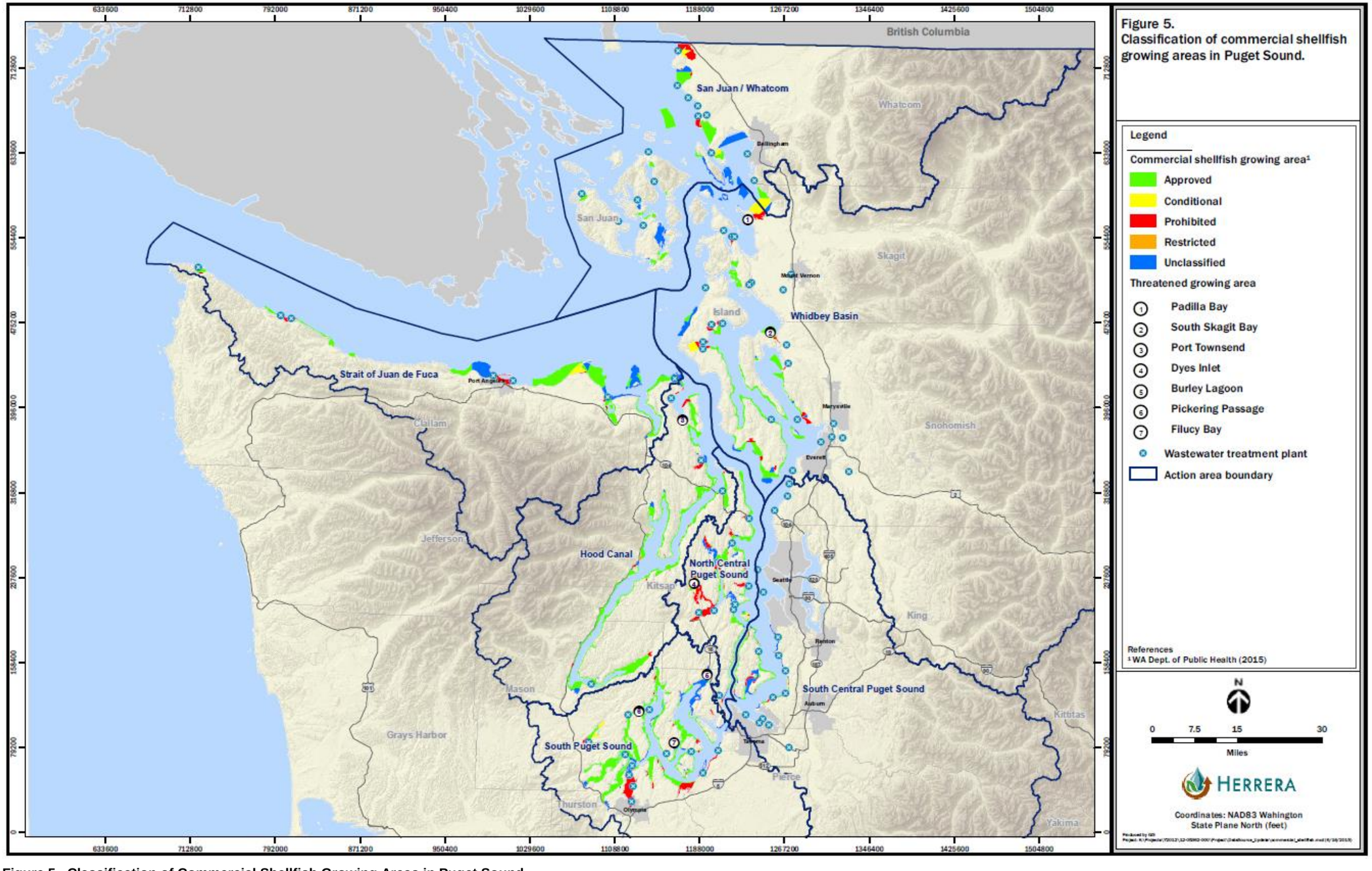

Figure 5. Classification of Commercial Shellfish Growing Areas in Puget Sound

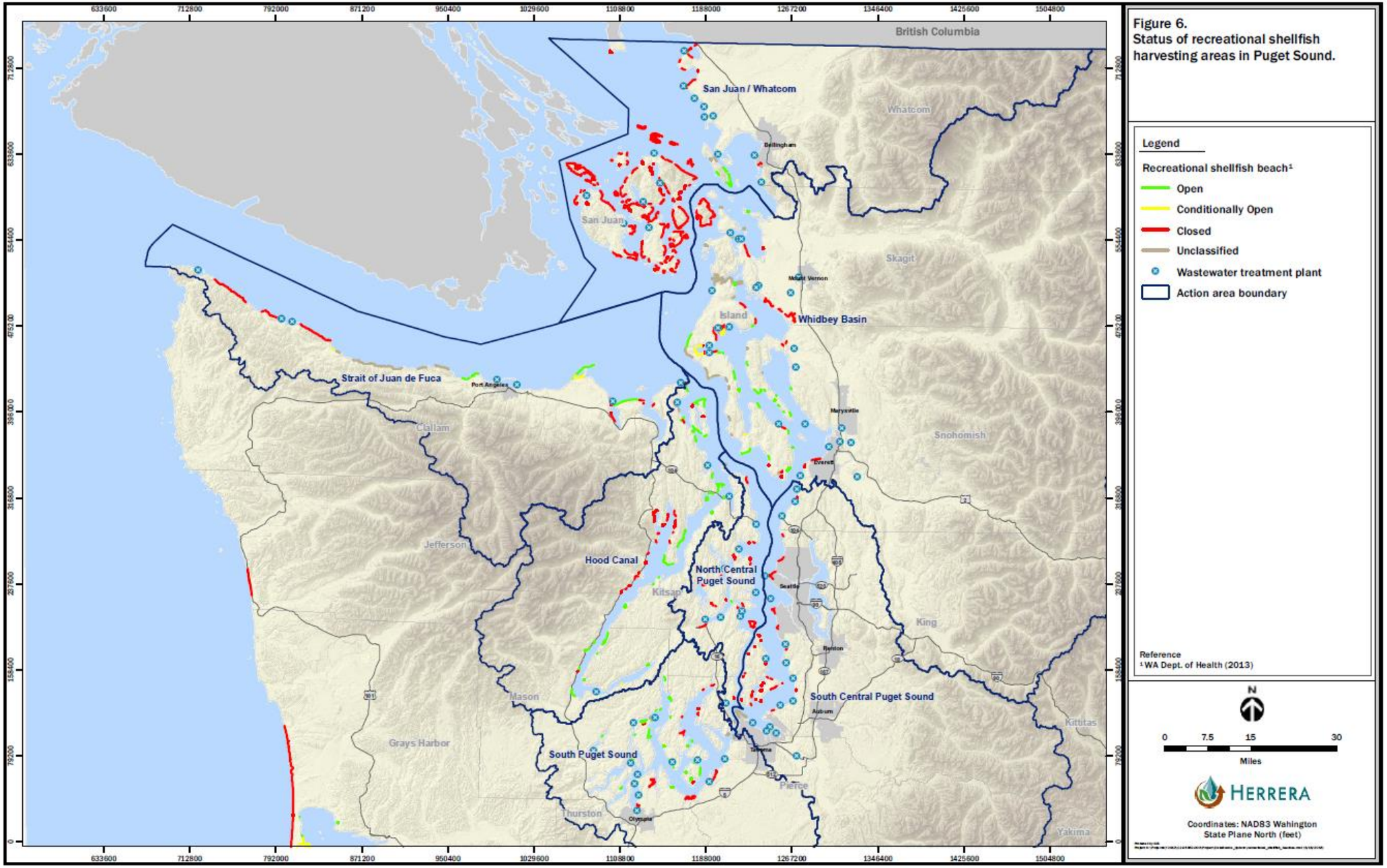

Figure 6. Recreational Shellfish Harvesting Areas in Puget Sound

Recreational Shellfish Harvest

Recreational shellfish harvest takes place at approximately 500 beaches throughout the Sound, with only about half classified. As with commercial shellfish growing areas, DOH is responsible for ensuring that shellfish harvested from these beaches are also safe to eat. Evaluations of public harvesting beaches are similar to that of commercial shellfish growing areas. Based on factors such as proximity to pollutant sources and measured fecal indicator bacteria concentrations, DOH will classify the beaches as:

- **Open:** Water has been tested and determined safe for shellfish harvest.
- **Advisory:** Shellfish harvest is permitted, but thorough cooking of shellfish is recommended.
- **Closed:** Harvest is prohibited either due to contaminants or fecal pollution, or because the beach hasn't been tested.

A substantial number of recreational shellfish harvesting beaches are listed as closed, particularly in South Puget and Central Puget Sound. While many of these beaches may be closed because they have not been tested; many are closed due to known bacterial contamination. The locations and status designations of recreational growing areas are shown on Figure 6.

Nutrients

Puget Sound is a naturally nutrient-rich water body. Coastal upwelling, the process by which nutrient-rich but oxygen-poor bottom water is transported to the surface, typically occurs along the Pacific Coast between April and September (Gustafson et al. 2000). Exchange of this water through the Strait of Juan de Fuca is the single largest source of dissolved inorganic nitrogen (DIN) to Puget Sound; this "marine loading" accounts for about 86 percent of the nitrogen load to the Sound. Rivers, sewage, groundwater, and atmospheric deposition contribute a substantial quantity of nitrogen, but individually account for only small portions of the nitrogen load (Table 2) (Herrera 2010). There are no marine water standards for nutrients, so there are no documented impairments as the result of high nutrient concentrations.

Table 2. Major Components of the Puget Sound Nitrogen Cycle

Major Components of the Puget Sound Nitrogen Cycle		
DIN	**Annual Loading (MT/year)**	**Annual Loading (percent)**
Marine Loading	148,920	86.4%
Rivers	11,000	6.4%
Sewage	5,658	3.3%
Groundwater	3,650	2.1%
Atmospheric Deposition	3,103	1.8%
Total Input	172,331	100%

DIN = dissolved inorganic nitrogen
MT/yr = million tons per year
Note: This table was adapted from Table 2 in Herrera (2010).

The abundance of nutrients is responsible for the incredible biomass and biodiversity supported by Puget Sound, but it is also a liability because excessive amounts of nutrients lead to increased algal growth, causing eutrophication and increased frequency of harmful algal blooms (HABs).

Nitrogen is the limiting nutrient for algal growth in Puget Sound during the summer months. As a result, increases in nitrogen during the summer can cause a corresponding increase in algae production. Most species of algae cause little direct harm to the aquatic environment. However, when the algae die and decompose, oxygen levels in the water column can be depleted, resulting in oxygen concentrations that are too low to support fish and other aquatic life. Dissolved oxygen is discussed in greater detail in the following section.

Another problem associated with increased algae growth is the potential for development of harmful algal blooms (HABs). HABs which are caused by the proliferation of acutely toxic algae, pose a risk to humans and marine life. Shellfish may accumulate dangerous levels of biotoxins during HAB events. Consumption of contaminated shellfish by humans, marine mammals, and birds leads to illnesses such as paralytic shellfish poisoning or amnesic shellfish poisoning. HABs can also pose a risk to bathers and pets exposed to the water. DOH regularly monitors biotoxin levels in shellfish collected in commercial growing areas and at some recreational beaches. HABs most frequently cause shellfish bed closures and advisories during the summer. HABs can occur in both fresh and saltwater, so the lakes included in the NDZ also have the potential to experience HABs. While it is as yet unknown what causes algae to start developing biotoxins, any discharge of waste and resultant change in chemical characteristic of the water, such as from vessels, is a potential concern.

Dissolved Oxygen

Dissolved oxygen depletion in Puget Sound is related to nutrient enrichment and water stratification and circulation. In many regions of Puget Sound, low DO is a natural consequence of the Sound's deep, fjord-like bathymetry, where water column stratification and slow circulation lead to long residence times of deep water that is not in contact with the atmosphere. Low DO concentrations and related fish kills in Hood Canal have been observed as early as the 1950s (Turney 2004), suggesting that low DO is not a new phenomenon. However, there is some evidence to suggest that the frequency and severity of low DO events, particularly in Hood Canal and South Puget Sound, are increasing in severity and duration (Turney 2004; PSP 2011b). For example, DO concentrations in Hood Canal in late summer 2010 were the lowest on record. Given the increase in human activities over the past 50 years (e.g., development, recreation, deforestation, and other watershed modifications), it is suspected that human factors are leading to increasing DO problems (PSP 2011b).

Dissolved oxygen problems are not limited to Hood Canal and South Puget Sound. Low DO is present seasonally at many locations. While the number and severity of low DO occurrences is highest in Hood Canal and South Puget Sound, low DO events have been documented throughout Puget Sound. These typically occur in protected embayments with poor flushing. The impaired waters due to low dissolved oxygen are shown on Figure 7.

Toxic Contaminants

Human activities have also resulted in the introduction or increase in a number of toxic contaminants in Puget Sound. There are many pathways by which these chemicals have entered the water. They may have been discharged by factories, deposited from the air, or have been washed off the land surface via rainwater. Vessel sewage, even when treated, is a source of contaminants. For example, treated vessel sewages contain disinfection chemicals like chlorine and formaldehyde which are toxic to both humans and marine life. Vessel sewage discharges also contain personal care products and excreted pharmaceuticals which can cause reproductive problems in animals.

Compilation of Sensitive Resources

A compilation of some of the sensitive resources including commercial shellfish growing areas, recreational shellfish beach growing areas, proposed marine protected areas, aquatic reserves and beach areas were overlaid on to one map and shown on Figure 8.

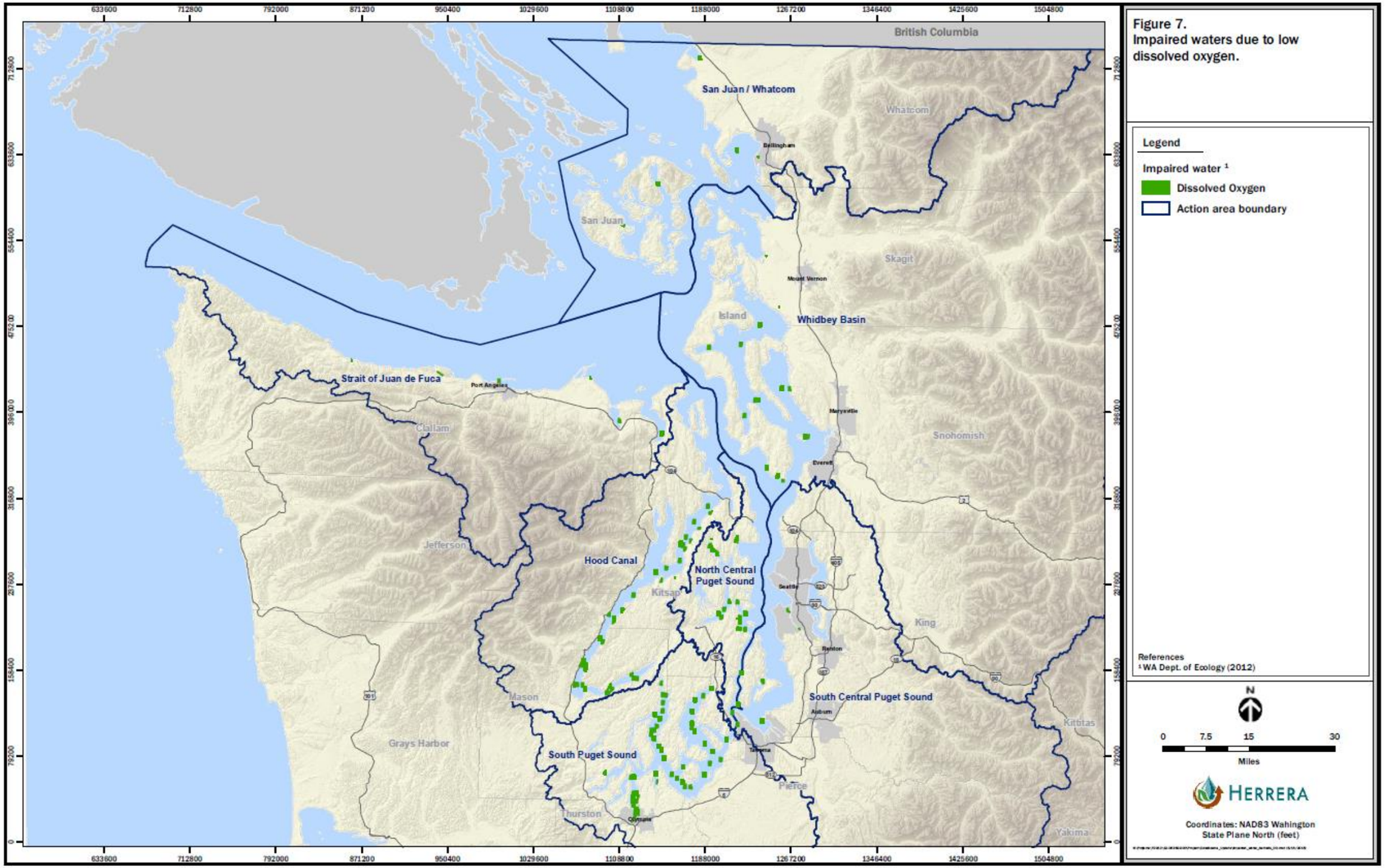

Figure 7. Impaired Waters Due to Low Dissolved Oxygen

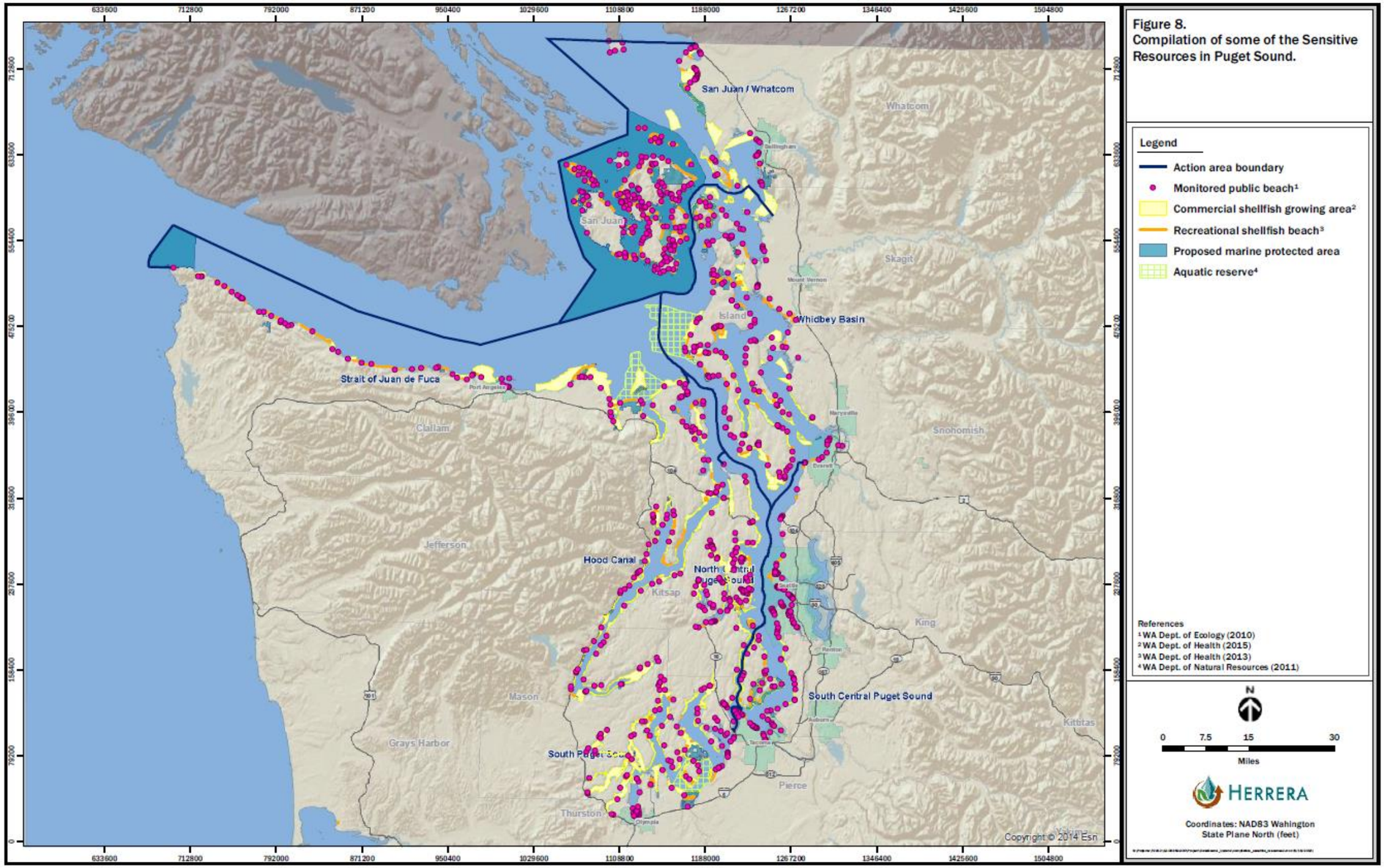

Figure 8. Compilation of Some of the Sensitive Resources in Puget Sound

4.7 Existing Pollutant Reduction Measures

Many water quality improvement programs are underway throughout the Puget Sound basin. These programs are administered at all levels of government (federal, tribal, state, county, and municipal) and also include efforts by community-based, non-profit organizations. The scope of the programs range from adoption of federal and state regulations aimed at reducing non-point source pollution, to small tributary- or parcel-scale cleanup and mitigation efforts. These efforts are addressing pollution from many different sources, including stormwater runoff, agricultural runoff, industrial and wastewater discharges, failing septic systems, and combined sewer overflows, to name a few. The main directive of the Puget Sound Partnership (Partnership) is to coordinate and track these efforts. The Partnership has established recovery targets for multiple indicators and an Action Agenda for meeting those targets. Details on the Action Agenda, recovery targets, and ongoing work for improving Puget Sound can be found at the Partnership Action Agenda web page (http://www.psp.wa.gov/action_agenda_center.php).

Several voluntary and compulsory measures are in place to reduce vessel sewage discharges into Puget Sound or reduce their impact. Section 312 of the CWA prohibits discharge of **untreated** vessel sewage within 3 miles from shore within state boundaries, which is generally assumed to include most marine waters of Puget Sound. Most of the cruise ships that transit through Puget Sound have agreed to a voluntary memorandum of understanding that prohibits them from discharging sewage within Puget Sound without seeking special advanced treatment permission from Ecology. All of the large cruise ships have been voluntarily holding their vessel sewage and graywater discharges for several years instead of discharging via advanced treatment. Via funding through the CVA, Washington State Parks has worked to build a network of pumpout facilities available to recreational boaters to safely discharge sewage waste to land-based facilities. Pumpout Washington is a project of Washington Sea Grant which educates boaters about the importance of proper sewage disposal, informs them about where to find pumpout stations, helps marina operators secure grants to install more stations, and advises on the deployment of mobile pumpout services on heavily used waters.

Even with measures in place to reduce vessel sewage discharges, discharges of raw sewage from vessels still occur without local jurisdiction to respond. And Puget Sound is still vulnerable to many of the impacts related to such discharges. The treated vessel sewage that is allowed to be discharged under existing regulations still degrades water quality and poses a potential health threat. As described below, bacteria levels in treated vessel sewage is typically far higher than state water quality standards and far higher than what is allowed by municipal wastewater treatment facilities. And, as described previously, these vessel discharges can occur directly over or very near shellfish beds and recreational beaches and swimming areas. In addition, some of the sewage discharge reduction measures, such as the MOU signed by cruise ship operators, are voluntary and may be halted at any time.

4.7.1 Marine Sanitation Devices

Even though it is required that sewage discharged from vessels within three miles in Puget Sound be treated by an MSD, such discharges can still degrade water quality. A range of types and

expected performance from the MSDs are currently available. Table 3 summarizes the treatment performance standards for each type of MSD and compares them to bacterial water quality standards. For all types of MSDs, the US Coast Guard vessel technology treatment standard for bacteria does not meet the Washington State water quality standard for primary contact recreation (Table 1, Table 3) (USACE 2004). Additionally, many MSDs often perform far below the mandated treatment standards under normal use (US EPA 2008 and US EPA 2010). The average fecal coliform for typical type II MSDs in a 2008 US EPA study of large cruise ships was 2,040,000 MPN/100 ml. The average fecal coliform concentrations of type II MSDs from small commercial passenger vessels in Alaska for 2012 were 72,003 cfu/100 ml. The studies have found that the MSDs were often not working properly or maintained properly. There was only one study found for type I MSD results which was a laboratory-based study by US EPA in 2010 which showed varying fecal coliform results with an average of 82 MPN/100 ml. There are also concerns over the impacts associated with the disinfection chemicals that are used and then released to the environment. During a tour of three small commercial passenger vessels, Ecology staff verified that the type II MSDs were not maintained and showed signs of severe deterioration.

Treatment Type II MSDs are not regulated regarding proper operations and maintenance requirements nor do they have specified monitoring schedules. The Type II MSDs only have manufacturer-derived performance limits (not water-quality based) for fecal coliform bacteria and solids or a general narrative of no visible solids. The manufacturer-derived performance limits are less stringent than the State's water quality criteria for fecal coliform bacteria. Therefore, the Type II MSDs differ greatly from the manner in which land-based treatment plant are regulated. Land-based wastewater treatment plants discharging to surface waters are regulated under NPDES permits that include technology-based and water-quality based limits, specific monitoring schedules that include conventional pollutants as well as nutrients and priority pollutants, and these NPDES permits include operations and maintenance requirements, recordkeeping and reporting requirements, and the ability for Ecology to inspect these facilities.

Even though under federal law untreated blackwater is currently prohibited from being discharged within 3 miles from shore, Ecology has received complaints regarding blackwater discharges from vessels. Per the CWA, current authority to enforce or regulate vessel sewage generally lies with the USCG which does not typically have the resources to regulate vessel sewage. Without a NDZ designation, which would allow for local regulatory authority, Ecology cannot typically verify or enforce on these types of discharges.

Results from a survey conducted in 2012 indicate that approximately 96 percent of survey respondents indicated that the recreational vessels used on Puget Sound have an MSD. The overwhelming majority (91 percent) had a holding tank (Herrera 2013) and was required to use pumpout facilities under existing state environmental laws. About 5 percent of the vessel population used Type I or Type II MSDs. A holding tank would need to be installed on these vessels in addition to, or instead of, the existing treatment-type MSD to be able to comply with an NDZ.

Commercial vessel operators were contacted directly or sent questionnaires regarding marine sanitation practices in the summer of 2012. Most commercial vessels had a Type III MSD, and some commercial vessels have a Type II treatment device installed in addition to the holding tank. Some vessels, particularly tug boats, only had a Type II MSD (i.e., no holding tank). As

with the recreational vessels, a holding tank would need to be installed on these vessels in addition to, or instead of, the existing treatment-type MSD to be able to comply with an NDZ.

MSD technology advancements have been minimal for the typical Type I and Type II systems on board vessels over the last 30 years. Advancements in technology can continue alongside an NDZ with vessels having both a holding tank for use within an NDZ and a treatment-type MSD system with associated discharge for areas outside an NDZ. A vessel could install a treatment system that is no discharge, such as incineration or composting systems that dispose of the ash or solids off-shore.

Table 3. Marine Sanitation Device Summary

Marine Sanitation Device Summary						
MSD Type	**Allowable Vessel Installations**	**Primary Mode of Operation**	**Discharge Currently Allowed in Washington Waters?**	**USCG Treatment Standards**	**Bacteria Standard for Primary Contact Recreation and Extraordinary Aquatic Life Use**	**Bacteria Standard for Secondary Contact Recreation and Fair Aquatic Life Use**
Type I	Recreational vessels <69 feet in length	Maceration / Chlorination	Yes	No visible floating solids: A fecal coliform bacteria count not greater than 1,000 per 100 mL	Fecal coliform organism levels must not exceed a geometric mean value of 14 colonies/100 mL, with not more than 10% of all samples (or any single sample when < 10 sample points exist) obtained for calculating the geometric mean value > 43 colonies/100 mL.	Enterococci organism levels must not exceed a geometric mean value of 70 colonies/100 mL, with not more than 10% of all samples (or any single sample when < 10 sample points exist) obtained for calculating the geometric mean value > 208 colonies/100 mL.
Type II	All vessels	Aeration, Clarification, Disinfection	Yes	A fecal coliform bacteria count not greater than 200 per 100 mL; no more than 150 milligrams of total suspended solids per liter		
Type III	All vessels	Holding Tank	No	Storage only. No discharge allowed and therefore no performance standard.		
AWTS	All vessels[a]	Biological reactor / UV Sterilization	Yes	Same as Type II		

[a] While AWTS are allowed on any vessel type, they are large and costly, therefore they are typically only installed on large passenger vessels.
AWTS = Advanced Wastewater Treatment System
USCG = US Coast Guard
UV = ultraviolet
mL = milliliters

5 Vessel Population

An evaluation of sufficient access to pumpout facilities is required to meet the requirements of CWA 312(f)(3). This evaluation begins with estimating the vessel population of the water body. Since Puget Sound experiences high volumes of recreational and commercial vessel traffic, and the sewage disposal considerations are vastly different between the two vessel groups, they will be discussed separately.

5.1 Recreational Vessels

Two methods were used to estimate the recreational vessel population of Puget Sound. One method was based on boater registration records obtained from the Washington State Department of Licensing (DOL), and the second was obtained by counting the number of moorages and slips available to boaters. The results from both methods are described below.

Table 4 and Figure 9 provide a summary of the vessel registration data from 2011, which was obtained from DOL. (While vessel registration does vary between years from 2005 to 2011, the relative standard deviation in vessel registrations was less than 1 percent; therefore, 2011 registration data can be considered representative of the current vessel population.) The data lists the number of boats registered in each county by size class. In 2011, there were 153,103 vessels registered in the counties adjacent to Puget Sound. This number includes recreational vessels as well as some commercial vessels registered in Washington State. This data set is not a perfect measure of boats using Puget Sound. For example, not every vessel registered in a county adjacent to Puget Sound is moored or operated in the same county, or even in Puget Sound, and many boats may be exclusively used on lakes and rivers. Conversely, a vessel which is moored and operated in Puget Sound may be registered somewhere far away. It is believed that the number of registered vessels listed by county in Table 4 represents a conservative (high) estimate of the potential recreational vessel population.

Not all of the registered vessels would require access to pumpout facilities. Smaller boats, such as day sailors or runabouts that are used for excursions of a few hours in length rather than for entire days, do not typically have any kind of toilet facility or MSD. If boats shorter than 21 feet in length are subtracted from the DOL database (i.e., counting only boats 21 feet in length and larger), there are a total of 43,677 registered vessels. This represents the maximum population of locally registered recreational vessels that might require access to pumpout facilities or services under NDZ regulations. A small number of registered vessels may also be small, locally registered, commercial vessels such as fishing boats or tug boats, which are included in the registration data and would result in an overestimate of the number of recreational vessels.

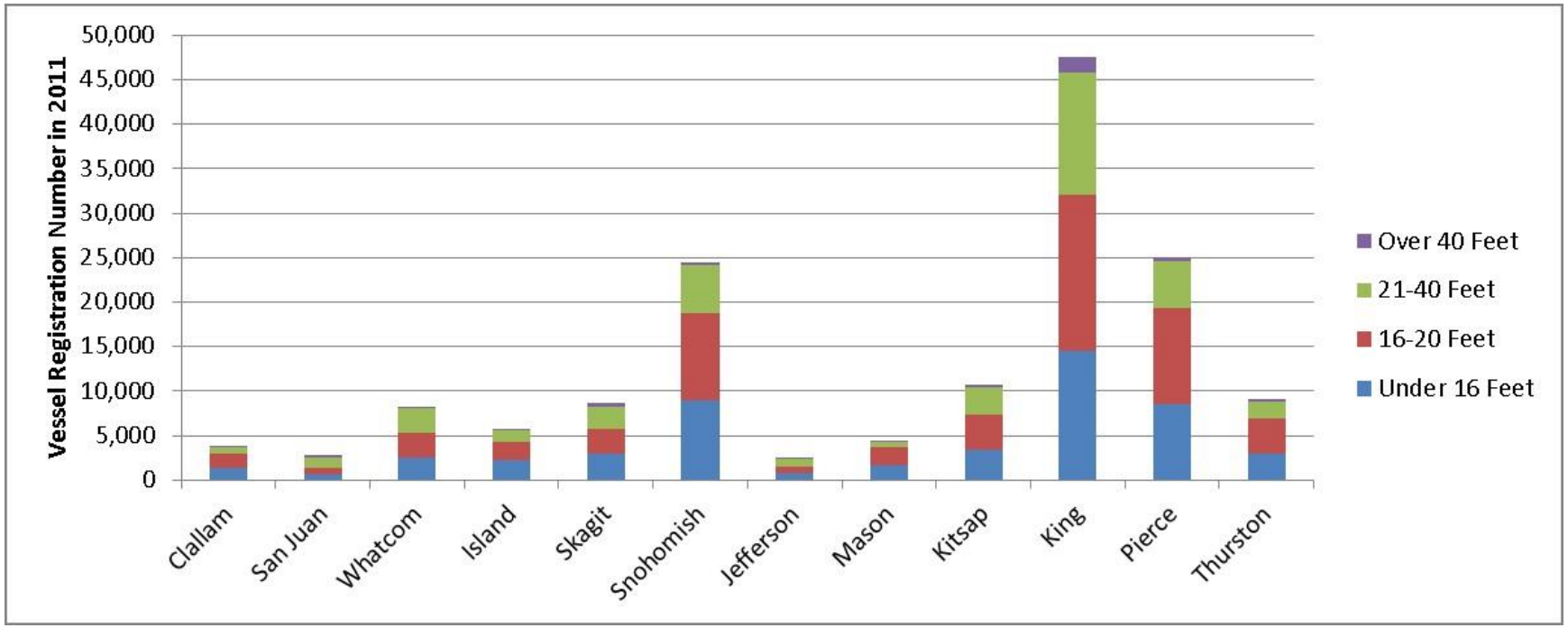

Figure 9. Puget Sound Vessel Registrations by Count and Vessel Length

Not surprisingly, there are more registered vessels in counties with larger populations, i.e., Snohomish, King, Pierce, and Thurston counties. Similarly, there are more large vessels (those likely requiring access to pumpout facilities) in the more populated counties bordering Puget Sound. Although vessels may be registered in one county and moored or operated in another, there is likely a correlation between registration location and boat location. Therefore, there is probably a greater need for pumpout stations in the more populated areas of Puget Sound than in the less populated areas.

Table 4. Vessel Registrations by Vessel Length and County in 2011

Vessel Registrations by Vessel Length and County in 2011					
	Vessel				Total Registered
County	Under 16 Feet	16-20 Feet	21-40 Feet	Over 40 Feet	
Clallam	1,41	1,56	771	64	3,814
San Juan	69	60	1,303	229	2,829
Whatcom	2,50	2,85	2,669	259	8,279
Island	2,25	2,10	1,180	75	5,613
Skagit	2,92	2,84	2,517	458	8,739
Snohomish	9,01	9,74	5,469	253	24,483
Jefferson	80	73	891	104	2,535
Mason	1,69	1,97	679	44	4,391
Kitsap	3,37	4,01	2,978	377	10,739
King	14,508	17,520	13,754	1,742	47,524
Pierce	8,45	10,884	5,283	477	25,101
Thurston	2,98	3,96	1,938	163	9,056
Total	50,623	58,803	39,432	4,245	153,103

The number of recreational vessels was also estimated by counting moorages and slips available to Puget Sound boaters. The number and location of moorages (slips and buoys) were estimated by conducting a virtual flyover of Puget Sound using Google Earth imagery captured during the summers of 2011 and 2012. Marina slips (both vacant and occupied), as well as vessels moored at popular mooring areas (e.g., Sucia Island in the San Juan Islands), were counted. During the virtual flyover, all marina slips, as well as any group of more than 15 moored vessels (signifying a mooring field) were counted and recorded. This data was used to create a map showing the concentrations of moorages (Figure 10). Individual marinas were not singled out because the goal of this exercise was to determine the potential number of boats in a given geographic area, rather than a marina-by-marina assessment of boater population. Personal moorages (i.e., shoreside docks and personal mooring buoys) were generally not counted. Boats stored at personal moorages are thought to only represent a small portion of the total vessel population, and in many cases the boats that are moored at personal moorages are less than 21 feet in length and, therefore, would not have toilet facilities. Therefore, excluding boats stored at personal moorages is not thought to have significantly affected the accuracy of this vessel population estimate.

A significant number of vessels are stored in stackable dry moorage facilities from Bellingham to Seattle which may account for some of the variance between DOL registration numbers and the available moorage count.

Vessel moorage capacity provides a valuable insight into where and how many boats there may be in Puget Sound. Larger vessels, particularly those with MSDs, are likely to be moored during the boating season. Smaller vessels are likely to be trailered. Therefore, using moorage capacity (i.e., the number of slips and buoys available for boats) ensures that fewer vessels without MSDs are included in the total vessel count. Slips used by commercial fishing boats and other smaller commercial vessels would have been included in the estimate, but it was estimated that this would account for only about 500 vessels (Herrera 2012b).

There are approximately 23,555 moorages in Puget Sound, based on the virtual flyover estimate (Figure 10). While this number is much smaller than the number of registered vessels over 21 feet (43,677), similar, albeit more-detailed spatial patterns were observed. For example, as with registered vessels, there are much higher concentrations of moorages in more urban and populated areas (e.g., Seattle, Everett, and Tacoma). But, there are also a large number of moorages in popular boating destinations like the San Juan Islands, Anacortes, and Bellingham. The Strait of Juan de Fuca and the area around Whidbey Island have the lowest number of moorages compared with the rest of Puget Sound.

The method used for estimating the number of moorages underestimates the total Puget Sound moorage capacity. Personal moorages were generally not counted, and neither were areas with less than 15 slips or moorages. There are many personal moorages and small marinas with less than 15 slips throughout Puget Sound, particularly in Lake Washington, so this method could be underestimating the available moorages by a thousand moorages or more. Some personal moorages were included in the lengthy Hood Canal and depicted as a generalized moorage in the middle of Hood Canal. It is generally accepted that smaller boats (those less likely to have toilet facilities beyond a porta-potty) are found at personal moorages, so ignoring this sector is not expected to contribute to a significant underestimate of the need for pumpout facilities. However, many of those vessels moored at smaller marinas are likely to be large enough to contain an MSD, so leaving them out could lead to an underestimate of pumpout facility needs. Conversely, this exercise counted slips and buoys, not boats. Although some marinas may operate at full capacity during peak seasons, many do not. To meet the needs of a mobile boating population, there needs to be an excess of moorages to allow boaters to move freely between areas, so it can be assumed that there are fewer boats than the total number of moorages available. The various problems (overestimates and underestimates) with the methodology may balance each other out to some extent. Overall, however, the results obtained by using this methodology likely represent an overestimate of the boat population, albeit less of an overestimate than what was calculated based on DOL registration information.

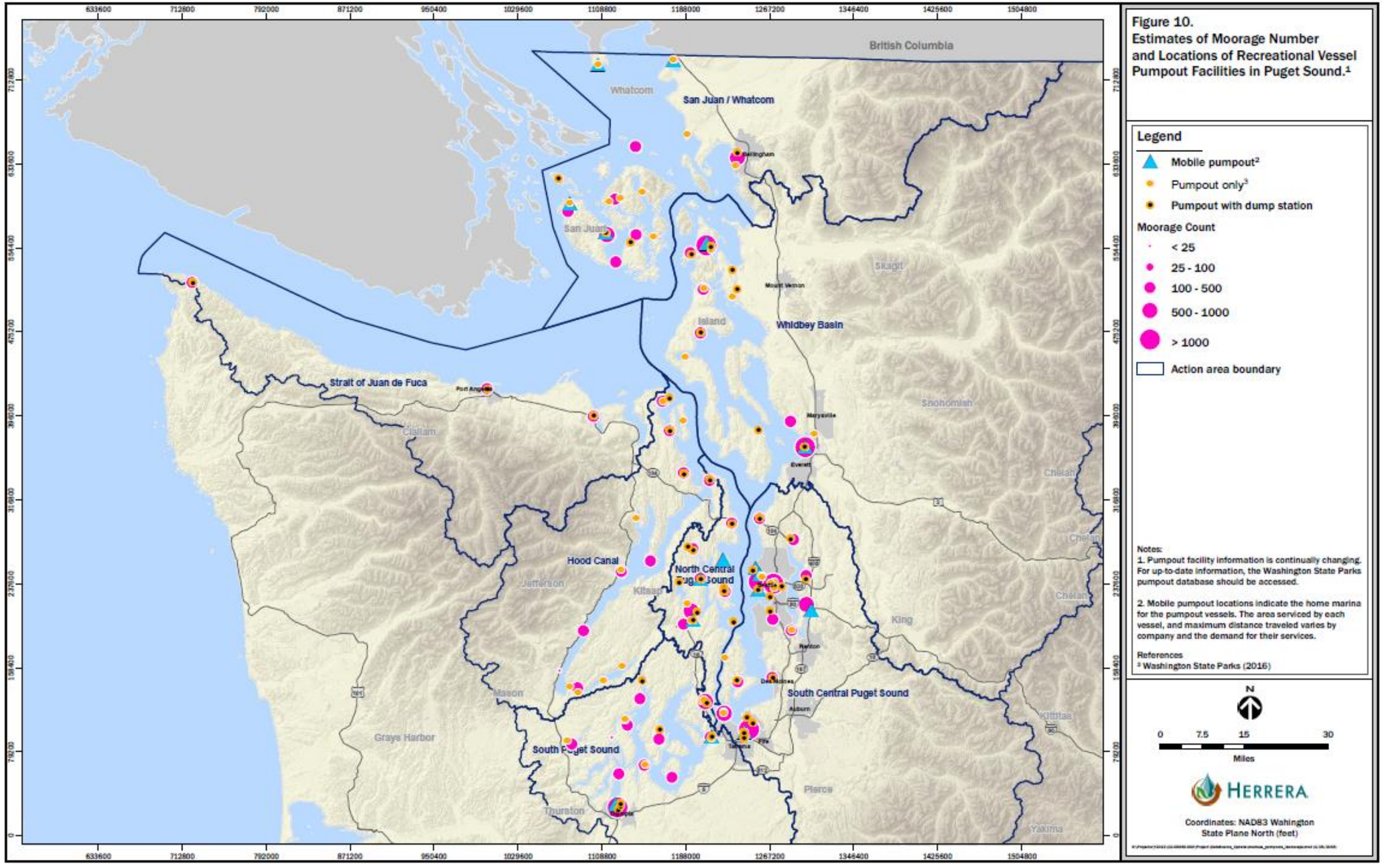

Figure 10. Moorage Number and Location of Recreational Pumpouts

5.2 Commercial Vessels

Many different sizes and types of commercial vessels frequent Puget Sound. They range from smaller vessels used for charter fishing to huge freighters, tankers, and cruise ships. The number of commercial vessels was estimated from a study conducted by the Puget Sound Maritime Air Forum (Starcrest 2007). According to that study, there were 2,937 entries of large oceangoing vessels into Puget Sound in 2005 (Table 5). It was estimated that there are 678 other commercial vessels that operate mostly within Puget Sound (e.g., escort tugs) or have Puget Sound as their home port (e.g., the fleet of fishing vessels that travels to Alaska each year) (Table 6). Since the location of commercial vessels is more dynamic than that of recreational vessels, the question is less about the absolute number of commercial vessels in Puget Sound and more about vessel traffic patterns such as how many, what kind, and where are vessels operating at a given time.

Most commercial vessels are required to send out an Automated Identification System (AIS) signal (US Department of Homeland Security 2013). The AIS signal announces a ship's identity, type, and position in real time. The data is used by the US Coast Guard for homeland security purposes and by ship captains to help avoid collisions. Some larger recreational vessels (such as yachts) may also use an AIS system and, therefore, would be included in this dataset.

Table 5. Oceangoing Vessel Entries into Puget Sound for 2005

Oceangoing Vessel Entries into Puget Sound for 2005	
Vessel Type	**Number of Vessels**
Auto Carriers	188
Bulk Carriers	310
Container Ships	1,336
Cruise Ships	167
General Cargo	169
Oceangoing Tugs	146
Miscellaneous	16
Reefer	5
Roll on Roll Off	133
Tanker	467
Total	**2,937**

Table 6. Puget Sound Harbor Vessel Population for 2005

Puget Sound Harbor Vessel Population for 2005	
Harbor Craft Vessel Type	**Number of Vessels**
Commercial Fishing	347
Ocean Tugboats	68
Harbor Tugboats	60
Excursion	60
Government	52
Ferry	45
Workboat	27
Assist and Escort Tugboats	19
Total	**678**

Automated Identification System data for 2005 was collected and compiled by the George Washington University Engineering Management and Systems Engineering Department. This data set is a compilation of every transit by large vessels with AIS transponders. The geographic units for this analysis were 'Action Areas,' which were assigned by the Partnership as part of the Action Agenda. The boundaries of each action area are depicted on all the maps included in this document. The data was combined and summarized to reveal traffic density for each vessel type by day, and for each Action Area, as shown in Table 7.

Traffic density, for the purpose of this analysis, is defined as the total number of signals (the number of vessels) received in 2005, divided by 365 (the number of days in the year), and divided again by the square mileage of the Action Area. The result of this calculation gives an average number of vessels that passed through each square mile of an Action Area on any given day. Data from the table can be interpreted in many ways. The table can be used to determine which type of commercial vessels have the highest average density in Puget Sound (i.e., fishing vessels); which Action Area has the greatest density of commercial vessels (i.e., South Central Puget Sound); and, for individual Action Areas, which commercial vessels are dominant (for example in South Puget Sound, the tug-barge category has the greatest density, while in North Central Puget Sound, it is ferry traffic).

Table 7. Vessel Traffic Density (number of signals/mile^2/day) by Vessel Type and Action Area for the VTRA Model.

Vessel Traffic Density (number of signals/mile^2/day) by Vessel Type and Action Area in 2005 for the VTRA									
Action Area	**Cargo Ship**	**Ferry**	**Fishing Vessel**	**Military Vessel**	**Passenger Ship**	**Research-Other**	**Sail-Whale**	**Tug-Barg**	**Total**
Strait of Juan de Fuca	5.82	0.65	6.81	0.86	0.34	0.23	0.49	2.69	17.89
San Juan/Whatcom	2.89	1.98	17.62	1.19	0.35	0.04	0.50	4.31	28.88
Whidbey Basin	0.74	3.70	17.59	0.65	0.08	0.10	1.71	5.87	30.43
North Central Puget Sound	3.09	14.71	2.37	2.28	0.40	0.38	3.65	8.98	35.85
South Central Puget Sound	1.73	50.02	1.60	2.54	0.39	0.20	7.15	14.42	78.04
South Puget Sound	0.03	0.00	0.00	1.26	0.00	0.00	1.88	9.60	12.78
Hood Canal	N	NA	NA	NA	NA	NA	NA	N	NA
Total Puget Sound	3.90	5.35	9.91	1.18	0.32	0.17	1.30	4.87	26.99

VTRA = Vessel Traffic Risk Assessment

The South Central Puget Sound Action Area experiences the most commercial vessel traffic for almost all vessel categories (Table 7, Figure 11). The majority of the traffic is ferry vessels, but there is also a substantial amount of tugboat and 'sail whale' traffic (yachts and whale-watching boats), followed by the other vessel categories. Cargo ship and fishing vessel traffic is highest along transit routes (such as the Strait of Juan de Fuca) and where there are major ports and refineries.

Washington State Department of Transportation Ferries and U.S. military vessels use their own pumpout facilities (Herrera 2012b). Therefore, for the purpose of this analysis, these vessel categories were omitted, as their need for access to pumpout facilities is already met and would not be affected by the institution of an NDZ. When ferries and military vessels are omitted (Figure 12), patterns in traffic among the other vessel categories become more apparent. Fishing vessels are the dominant vessel traffic category in the San Juan/Whatcom, Whidbey Basin, and the Strait of Juan de Fuca Action Areas. Tugs and barges are the dominant vessel traffic category in North and South Central Puget Sound, and the South Puget Sound Action Areas, although tug and barge traffic is moderately high in all of the Action Areas. Sail-whale activity is largely limited to the more urban action areas.

Many, if not most commercial vessels, will not have to modify their routines or vessels to be able to comply with the NDZ. The majority of large freight vessels (Table 5) and the commercial fishing fleet that works out of Alaska already hold their waste and discharge it outside of State waters, although these are voluntary measures. All WSDOT ferries and U.S. military vessels have holding tanks and use large-scale pumpout facilities where they are moored. It appears from the research that the primary vessels that may have to change their practices and likely retrofit their vessels are tug boats and those commercial fishing boats that operate almost exclusively within the proposed NDZ.

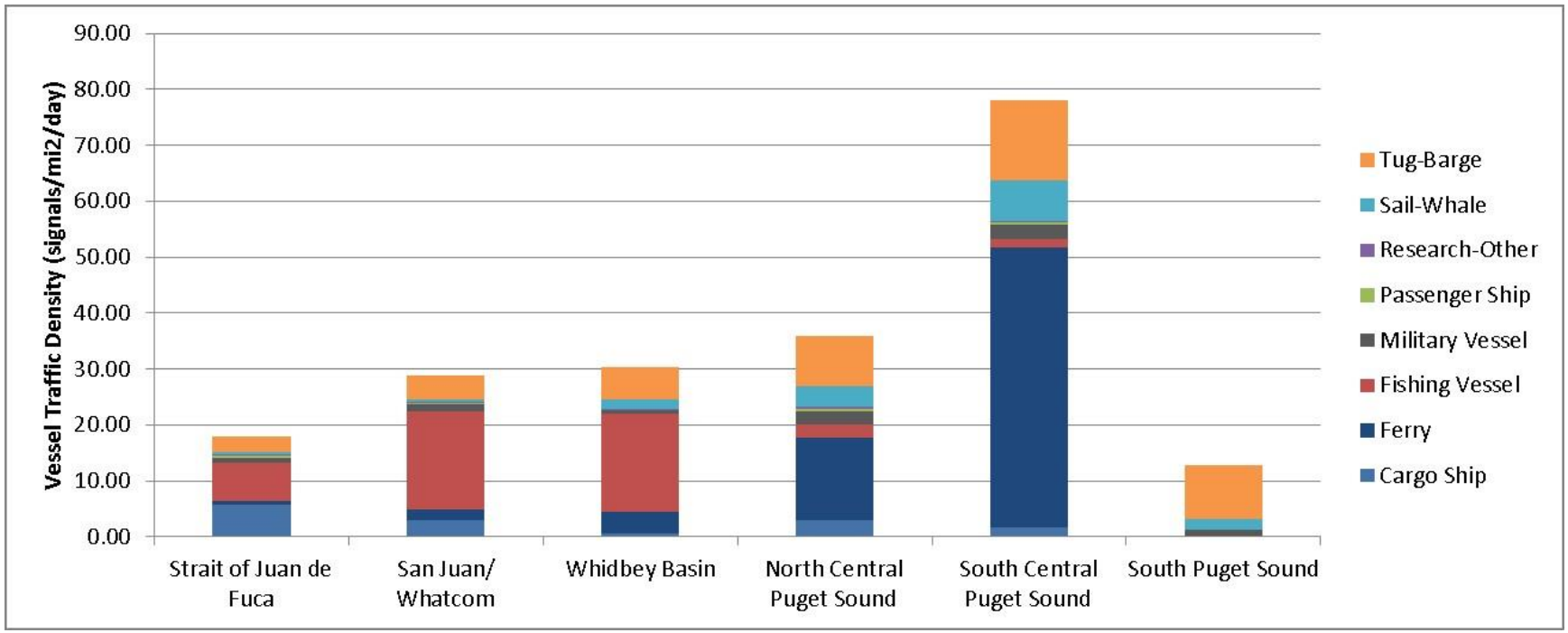

Figure 11. Summary of All Commercial Vessel Traffic in Puget Sound

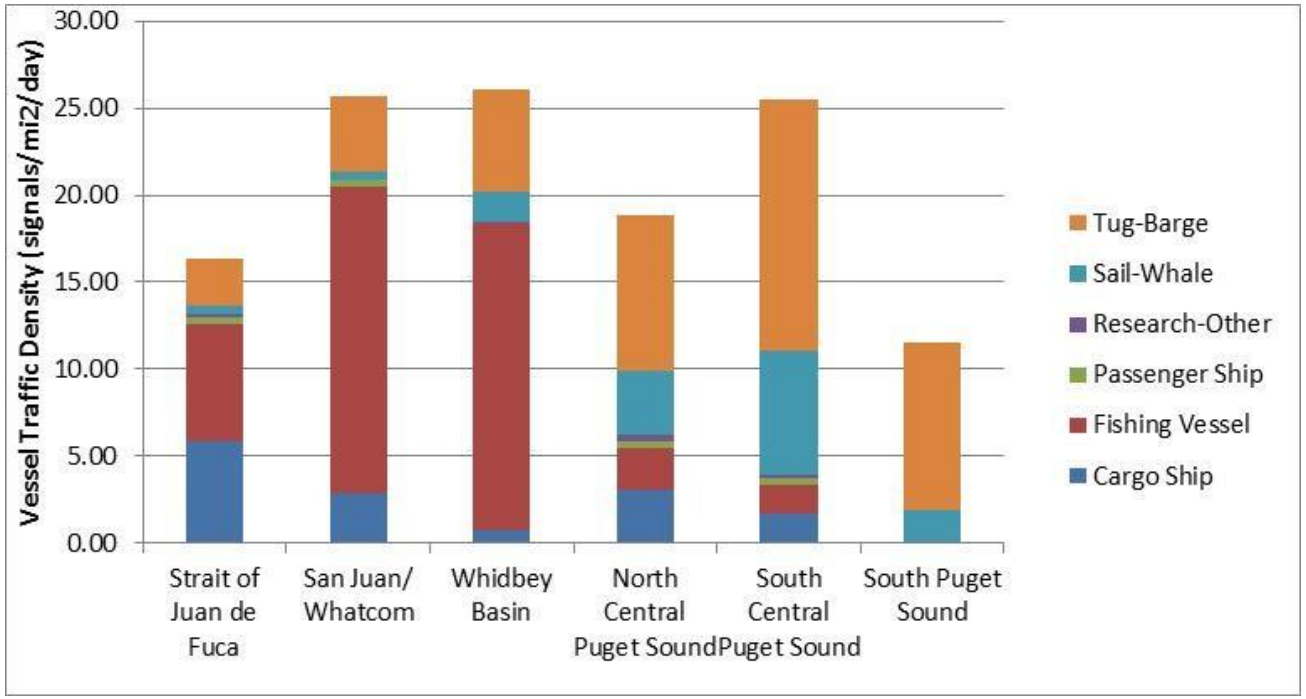

Figure 12. Selected Commercial Vessel Traffic in Puget Sound

6 Pumpout Facilities

6.1 Pumpout Facilities for Recreational Vessels

A review of Puget Sound pumpout facilities and mobile pumpout services documented that there are currently 173 pumpout units in 102 locations, and 21 mobile pumpout boats available for recreational vessels that operate in Puget Sound (Herrera 2015 and State Parks). The locations of the pumpout facilities (with the exception of the pumpouts installed since 2013) are shown on Figure 10. The mobile pumpout services are listed in Table 8. Details for each facility consistent with the requirements of CWS 312(f)(3) are included in Appendix A. The details include the facility name, location, water body, contact information, number of slips and buoys, number of stationary, portable units, and boats, hours of operation, maximum vessel length and minimum depth at low tide and where the sewage is treated. The vast majority of pumped sewage is sent to wastewater treatment plants with some being sent to onsite septic tanks that meet federal requirements.

Pumpout facilities and mobile services appear to be conveniently located for most Puget Sound boaters. Land-based pumpout facilities appear to be approximately proportionally distributed with vessel population. Likewise, the pumpout boats operate in the areas where there are more boats. Figure 10 shows pumpout facilities and mobile pumpouts with moorage locations. Clearly, there are more pumpouts where there are more boats. Even where there are only a small number of moorages, there is usually a pumpout close by, or the area is within the service areas of the pumpout boats (Table 8). The on-going costs for recreational vessels to pumpout is minimal, with most pumpouts being free or $5 per pumpout.

Based on US EPA guidelines set for implementation of an NDZ that the CVA has adopted, the Puget Sound area, overall, has plenty of pumpout facilities to serve the recreational vessel population. The US EPA guidelines suggest that there should be a ratio of between 300 to 600 boats per pumpout during the period of peak occupancy. The definition of occupancy rate and a detailed procedure on completing the US EPA calculations is described in the US EPA guidelines (EPA 1994). Based on DOL vessel registration data, there are a maximum of 43,667 boats in Puget Sound that could require access to pumpout facilities. At the 40 percent peak occupancy rate recommended by the US EPA guidelines, 17,467 of the 43,667 boats would require access to a pumpout facility during peak boating season. Under this scenario, there would be a ratio of 177 boats for each pumpout facility, not including the mobile services. Using the lower and probably more reasonable boat population estimate of 23,555 obtained from the moorage count, and the same 40 percent occupancy rate (9,422 boats), there would be a ratio of 96 boats per pumpout, not including the mobile services. By these calculations, the Puget Sound has, at a minimum, nearly two times, to a maximum of more than six times, more pumpout facilities than is recommended in the US EPA guidelines. A few respondents to the boater survey indicated that there are some locations where access to pumpout facilities could be improved, and since then, additional pumpouts in key locations have been added. Although the overall capacity for recreational vessels comfortably exceeds the CVA program guidelines, work will be continue on upgrading and adding additional pumpouts in key areas.

Table 8. Mobile Pumpout Services Available to Puget Sound Boaters

Mobile Pumpout Services Available to Puget Sound Boaters						
Company	**Service Areas**	**Number of Boats**	**Cost**	**Primary Type of Vessels Serviced**	**Capacity to Serve Large Vessels**	**Where Is Pumped Sewage Disposed?**
Port of Brownsville	Brownsville	1	Unknown	Vessels within their marina	No	Central Kitsap Wastewater Treatment Plant
Foss Harbor Marina	Foss Harbor Marina Area – Tacoma	1	Free	Vessels within their marina	No	Tacoma Central Wastewater Treatment Plant
Sweet Pea Pumping Service	Liberty Bay and Port Madison	2	$20-30 (more for big tanks)	Unknown	110 gallon capacity	Central Kitsap Wastewater Treatment Plant
Narrow's Marina	Narrow's Marina area - Tacoma	1	$5	Vessels within their marina	No	Chambers Creek Wastewater Treatment Plant
Pelican Pump	Olympia Area	1	~$24 (more for big tanks)	Primarily liveaboards	Yes	Lott Wastewater Treatment Plant
Point Roberts Marina	Point Roberts	1	Unknown	Vessels within their marina	No	Large Onsite Septic System
Rose Head Service	Port Everett Only	1	$15-23	All vessels	Yes	Everett Water Pollution Control Facility
Pumpty Dumpty	Port of Friday Harbor and nearby Marinas	1	$5	All	150 gallon capacity	Friday Harbor Wastewater Treatment Plant
Port of Bremerton, Port Orchard Marina	Port Orchard	1	Unknown	Vessels within their marina	No	South Kitsap Water Reclamation Facility (Port Orchard WWTP)
Phecal Phreak	Roche Harbor Marina	1	Free as part of moorage fee	All vessels	Yes	Roche Harbor Resort Wastewater Treatment Plant
Elliott Bay Marina	Seattle	1	Unknown	Vessels within their marina	No	King County West Point Wastewater Treatment Plant
Seattle Sanitation Service	Seattle Area	1	$25	Primarily liveaboards	Yes	Public pumpouts – typically Seattle City Sewer
SS Head	Seattle Area	2	$20 and up	95% liveaboard	Yes	Public pumpouts – typically Seattle City Sewer
Terry and Sons	Seattle Area	2	Free	All vessels	Yes	Public pumpouts – typically Seattle City Sewer
Pump Me Out	Seattle Area, Anacortes, and La Conner	3	$25-35	Liveaboards and other vessels	Yes	Generally public pumpouts, typically Seattle City Sewer, Anacortes WWTP, La Conner WWTP
Semiahmoo Marina	Semiahmoo Marina – Blaine	1	Unknown	Vessels within their marina	No	Blaine Wastewater Treatment Plant

Note that an additional mobile pumpout that will be free is in progress for the San Juan Islands.

6.2 Pumpout Facilities and Commercial Vessels

The sewage management considerations of large commercial vessels are different than those of small recreational vessels. The ability of large commercial vessels to comply with NDZ regulations is dependent on the vessel's sewage holding capacity.

Most of the large, oceangoing transient commercial vessels that are only in Puget Sound for a short period of time (e.g., large cruise ships, freighters and tankers) have large enough holding tanks so that they can hold their waste during the time they are in Puget Sound. Should these vessels need to be pumped out, they can contract with a shore-based pumper truck or one of the mobile pumpout services listed in Table 8.

Smaller commercial vessels, such as ferries, tugboats, excursion vessels, and fishing vessels, can either use the stationary pumpouts dedicated for their vessels, mobile pumpout service vessels, some recreational pumpouts, or shore-based pumper trucks. The location of pumpout services for commercial vessels are shown in Figure 13 and included in Table 9. Shore-based pumper trucks are commonly used and available at each of the port locations where commercial vessels frequent. The Washington On-Site Sewage Association has information on pumper trucks at: http://www.wossa.org/Consumer-Information.html and counties also have further information.

The Clean Vessel Act grant program pays the bulk of the costs associated with recreational pumpouts, but there are no similar programs for commercial pumpouts. Ecology is in the process of providing funding for commercial vessels through a 100 percent paid grant for at least one commercial pumpout to be installed in Seattle and possibly more in the future, as an addition to existing options.

As a result of the studies and outreach, certain commercial vessel groups (tug boats, commercial fishing vessels, and NOAA research vessels) need time to retrofit some of their vessels with holding tanks for compliance. Due to the unique challenges associated with retrofitting these types of vessels, such as requiring an engineering design and formal approval for safety, these vessels will be allowed five years before the NDZ would be effective and they would be required to comply with the NDZ. They will still be responsible for complying with existing state and federal regulations in the interim.

While the current number and location of pumpouts are sufficient to meet the Clean Water Act criteria to designate all of Puget Sound a no-discharge zone for all vessels, it is recognized that additional pumpout infrastructure would add more utility for tug boats, small commercial passenger vessels and commercial fishing vessels. Therefore, Ecology will collaborate with those sectors to develop, help fund and implement a five-year pumpout infrastructure program that is designed to provide additional pumpout options.

Table 9. Commercial Vessel Pumpouts

Commercial Vessel Pumpouts					
Owner	**Facility Location**	**Latitude**	**Longitude**	**Vessels Served**	**Discharge Location**
WA State Ferries	Anacortes	48^0 30’ 26” N	122^0 40’ 30” W	WSDOT Ferry	Anacortes City Sewer
WA State Ferries	Friday Harbor	48^0 32’ 08” N	123^0 00’ 51” W	WSDOT Ferry	Friday Harbor Sewer
WA State Ferries	Port Townsend	48º 06’ 52”N	122º 45’ 08” W	WSDOT Ferry	Port Townsend Sewer
WA State Ferries	Mukilteo	47^0 57’ 00” N	122 18’ 12” W	WSDOT Ferry	Mukilteo Sewer
WA State Ferries	Edmonds	47^0 48’ 47” N	122^0 40’ 30” W	WSDOT Ferry	Edmonds City Sewer
WA State Ferries	Seattle-Coleman Dock	47^0 36’ 9” N	122^0 23’ 37” W	WSDOT Ferry	King County Sewer
WA State Ferries	Fauntleroy	47^0 31’ 24” N	122^0 23’ 37” W	WSDOT Ferry	King County Sewer
WA State Ferries	Pt. Defiance	47^0 18’ 22” N	122^0 30’ 46” W	WSDOT Ferry	Tacoma City Sewer
Alaska Marine Highway	Port of Bellingham (3 pumpouts)	48°43'22.2"N	122°30'49.8"W	One serves Alaska Ferries and two serve other vessels	Bellingham City Sewer
Victoria Clipper	Port of Seattle	47°36'48"N	122°21'12"W	Victoria Clipper	King County Sewer
McNeil Island WDOC ferries	Steilacoom	47°10'20.4"N	122°36'12.9"W	Department of Corrections Ferries and may serve others	Steilacoom sewer/ Pierce County Treatment Plant
U.S. Navy	Bremerton	47°33'17"N	122°39'17"W	U.S. Navy Vessels	Bremerton City Sewer
U.S. Navy	Everett	47°59'26.4"N	122°13'05.2"W	U.S. Navy Vessels	Everett City Sewer
Navy Supply Center, Puget Sound	Manchester	47°33'57.3"N	122°32'38.5"W	U.S. Navy Vessels	Kitsap County – Manchester Wastewater Treatment Plant
In addition to the above stationary facilitates, commercial vessels also use shore-based pumper trucks, some recreational pumpouts, and some of the mobile pumpouts listed in Table 8.					

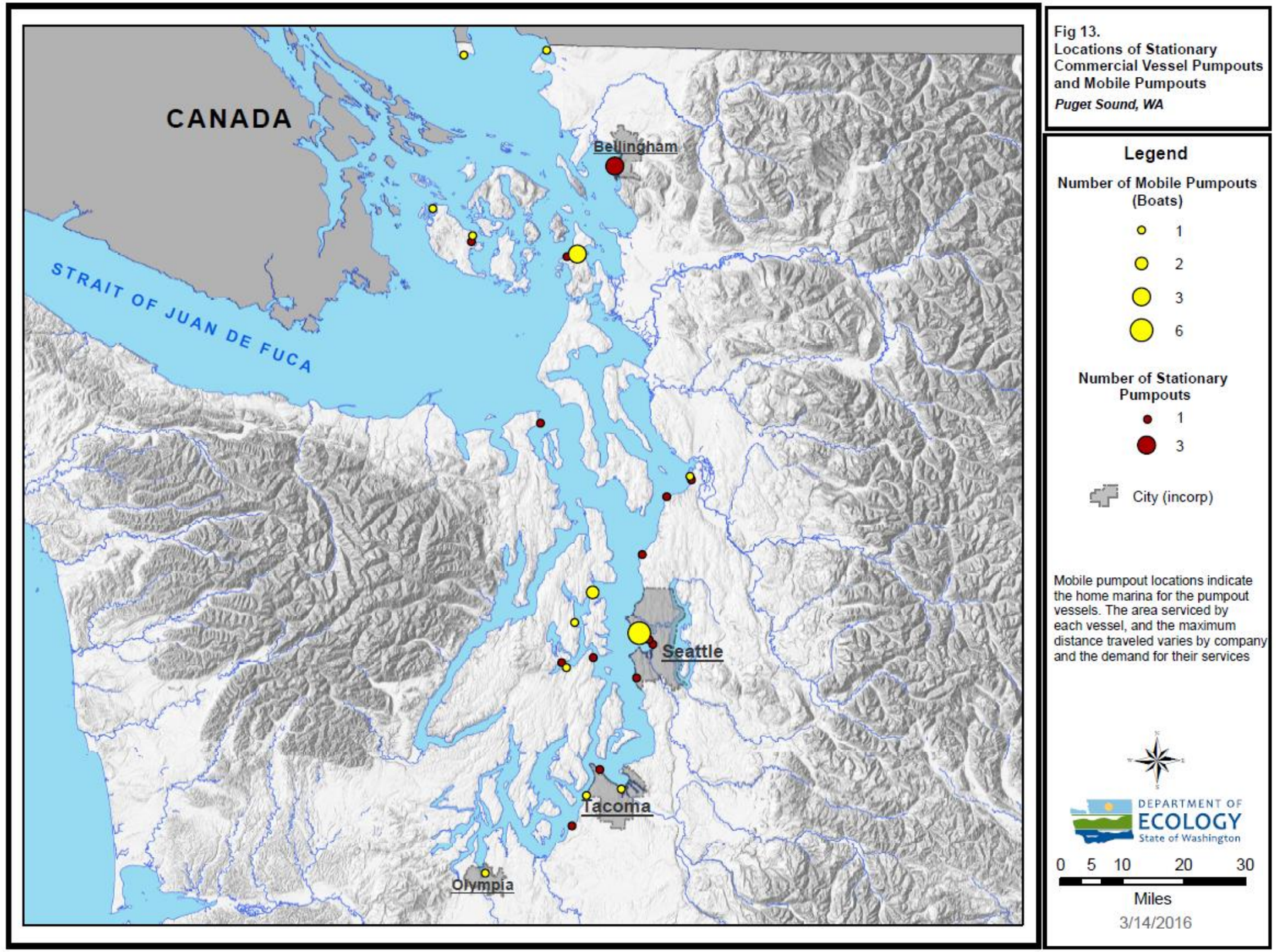

Fig 13.
Locations of Stationary Commercial Vessel Pumpouts and Mobile Pumpouts
Puget Sound, WA

Legend

Number of Mobile Pumpouts (Boats)
1
2
3
6

Number of Stationary Pumpouts
1
3

City (incorp)

Mobile pumpout locations indicate the home marina for the pumpout vessels. The area serviced by each vessel, and the maximum distance traveled varies by company and the demand for their services

DEPARTMENT OF ECOLOGY
State of Washington

0 5 10 20 30
Miles

3/14/2016

Figure 13. Locations of Stationary Commercial Vessel Pumpouts and Mobile Pumpouts

7 Implementation Strategy

The implementation strategy for the Puget Sound NDZ will be a continually evolving process. While a designation of an NDZ represents a point in time, the NDZ will exist in perpetuity, and its success is contingent on continued management and commitment from stakeholders.

The implementation strategy is outlined in the *No Discharge Zone Implementation Strategy – A Framework for Action* (Implementation Strategy) (Ecology 2016) document and summarized here.

The Implementation Strategy provides a framework for educating boaters and commercial vessel operators about the NDZ taking effect, what it means for them, and how they can manage sewage generated aboard their vessels. A comprehensive education/outreach program will comprise the central strategy for implementation, supported by the development of enforcement mechanisms among agencies that patrol waterways in the zone. The strategy describes:

- Goals and objectives
- Target audiences
- Key strategies and implementation actions
- Potential messages
- Potential organizations with resources or programs to help with implementation
- Enforcement strategy
- Evaluation of plan success

The recommended strategies are to a large extent based on what proved successful in other states. The strategies will be informed by stakeholder input and a social marketing research effort conducted in partnership with individuals and groups directly affected by the NDZ law. Future planning steps will include working with partners on how best to implement this plan in coordination with their education, outreach, and enforcement efforts.

The Implementation Strategy will serve as a guide for all involved in NDZ efforts as they conduct education, outreach, and enforcement activities. Ecology will provide leadership to coordinate and work with partners to assist in the delivery of plan activities.

This Implementation Strategy is a living document which can be expanded and updated with additional information and more tools and best practices as progress is made.

The overall goals of the Implementation Strategy are to:

- Increase boater awareness about the NDZ requirements and rationale, and locations of pumpout facilities so that they comply with the requirements.

- Build strategic partnerships to develop and implement coordinated NDZ education and outreach.
- Provide guidance and resources to partners who have a role in providing education and outreach about the NDZ requirements.
- Ensure that NDZ messages are cohesive and delivered in an efficient, effective, and coordinated way across partner education programs.
- Develop enforcement authority strategies and an enforcement program that can prevent non-compliance and that can build on existing resources.

Objectives:

- Create a system for collaboration among partners involved in NDZ implementation.
- Identify and build on existing boater education and outreach programs.
- Use social science research to develop and implement an NDZ campaign as part of the overall implementation strategy.
- Establish a common theme for NDZ education and outreach activities so that target audiences get consistent messages.
- Produce and distribute NDZ education resources to facilitate partner involvement in NDZ education efforts.
- Connect and/or direct partners and stakeholders to the appropriate NDZ resources.
- Create and implement a plan for enforcement that builds on existing resources.
- Create and implement an evaluation plan to evaluate NDZ implementation efforts.

7.1 Education and Outreach – Key Strategies

A successful implementation of the NDZ hinges on using effective strategies and messages that resonate with vessel operators. The key strategies are listed below with details of each in the Implementation Strategy document.

- NDZ Education and Outreach Committee
    - A cross-agency committee to help support implementation and coordinate the development of key messages and educational tools. This committee comprises representatives from the key organizations interested in the NDZ efforts.
- NDZ Enforcement Committee
    - A cross-agency committee to help develop and implement an enforcement strategy.
- Vessel Sewage Education Campaign – create educational materials tailored to specific target audiences.
- GPS-linked app with NDZ area and pumpout stations – enable boaters to know when they are in an NDZ and where to find pumpouts and more.

- No Discharge Zone story map – integrate maps, video, photos and more into a narrative.
- Social Media – develop a coordinated, consistent communication tool as a good way to meet our target audiences online.
- Notifications to vessel groups and associations – work with existing vessel associations to send out NDZ messages.
- Include NDZ information in vessel registration renewal paperwork.
- Engage the media – providing consistent information to the media.
- Informational signs at boat launches and marinas – post signs/maps featuring key facts about NDZ requirements.
- Educate employees who interact with boaters – familiar with the NDZ law and the available education, outreach and enforcement resources.
- No Discharge Zone website – update and use the existing NDZ website as a channel to deliver tailored content and information.
- Include NDZ in Puget Sound Starts Here campaign – integrate NDZ messages into the Puget Sound Starts Here outreach efforts.
- Information booths at boating events – additional outreach activities.

7.2 Enforcement

Active and extensive enforcement will not be the central strategy to successful implementation of an NDZ in Puget Sound, yet the NDZ does need to be enforceable to be effective. Initial strategies include:

- Evaluate enforcement authority strategies. Determine which entities will conduct enforcement.
- Evaluate fine amount strategy and where penalty money would go to.
- Evaluate the legislative work to be done for enforcement authority and fines.
- Evaluate a formal agreement with US EPA and USCG for NDZ authorities (if necessary) as authority with an NDZ is no longer limited to USCG.
- Consider existing resources and capacities, existing authorities and expansion, boater legal rights and other strategies.

The ability to prevent vessel sewage discharges includes having a means to deter violators with enforcement. A successful enforcement strategy requires clear authority delineation, a fair fining system, clear messaging as to why vessel sewage prevention is necessary, and consistent application of deterrence mechanisms.

Actions will include identifying current and necessary enforcement authorities and mechanisms, identifying any potential laws, rules, or regulations changes, evaluating current enforcement

approaches and logistics, and working to develop and implement an overall enforcement strategy.

7.3 Evaluation and Continued Success

Measuring the NDZs success will require a blend of different metrics and considerations – some qualitative, some quantitative – depending on the tools and strategies.

Strategies for evaluation of NDZ effectiveness may include the following:

- Periodic boater surveys to evaluate attitudes towards the NDZ and difficulties that they may have complying with NDZ requirements. These surveys may be conducted in person at boat ramps and boat shows, or by mail or electronically.
- Washington State Parks will continue to track the estimated number of gallons of sewage pumped at pumpouts funded by CVA grants and will encourage accurate data gathering. The installation of most of the public pumpout facilities in Puget Sound was funded by CVA grants and represents a majority of the pumpouts likely to be used by boaters. The Washington State Parks data will be used to track pumpout facility usage.
- Washington State Parks will continue to maintain and update the database of pumpout facilities available to boaters and continue to ensure that pumpouts are operational and in compliance. Continued favorable opinion of the NDZ is contingent on maintaining and documenting the number of pumpout facilities available to boaters. The data Washington State Parks collects for the CVA program will be used to fulfill this requirement. Maintaining an accurate database of operational pumpouts is also important for boaters because they are dependent on current information to know where they may go for a pumpout. If this list is not accurate or up-to-date, boaters are likely to become frustrated and less likely to comply with requirements in the future. A periodic review of pumpout facilities will be submitted to US EPA.
- Ideas are being considered on how to get information about broken pumpouts quickly transmitted from boaters to repair persons in order to minimize the downtime of pumpouts. New technology is also being looked at that might be able to help boaters obtain real-time data on wait times at stationary pumpouts or to schedule a mobile pumpout.
- The number of shellfish beds upgraded or opened and water quality improvements are also potential metrics for evaluating the success of an NDZ. Directly linking a water quality improvement, however, with the establishment of an NDZ is difficult due to the many sources of pollution. As all of these sources of pollution are being addressed over time through the efforts of agencies, businesses, and the public, Puget Sound ecological health is expected to recover.
- A potential EPA led long term analysis of NDZ effectiveness in the Puget Sound.

8 Conclusion

Based on the information gathered over the past four years through research and an extensive stakeholder process, Ecology has concluded that there is sufficient need for establishing an NDZ in the proposed NDZ waters to protect water quality. Ecology has also determined that there is a high existing rate of holding tanks on both recreational and commercial vessels and that a sufficient number of pumpout facilities and methods to prevent vessel sewage discharges are available to recreational boaters and commercial vessels.

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Appendices

Appendix A. Pumpout Facility Information

Facility name	Location	Water Body	Category	Contact Phone	Latitude	Longitude	Type of Facility	Number of Moorage Slips	Number of Moorage Buoys	Number of Stationary Pumpouts	Number of Portable Pumpouts	Number of Boat Pumpouts	Number of Dump Stations	Hours of Operation	Max Vessel Length	Min Depth at Low Tide	Where Treated
Port of Allyn Hood Canal Dock	Allyn	Hood Canal	Public Stationary	(360) 275-2455	47°23'0.53'	122°49'30.48"	Public Marina	250 LF	0	1	0		1	24 hours	50 feet	20 feet	North Bay Case Inlet Water Reclamation Facility
Marine Servicenter	Anacortes	Puget Sound	Public Stationary	(360) 293-8200	48°30'06"	122°36'02"	Private Marina	8	0	3	0		Unknown	Variable	60	20+	Anacortes WWTP
Port of Anacortes - Cap Sante Boat Haven	Anacortes	Puget Sound	Public Stationary	(360) 293-0694	48°30'39"	122°36'13"	Public Marina	850	0	2	4		2	24 hours	90	12	Anacortes WWTP
Skyline Marina	Anacortes	Puget Sound	Public Stationary	(360) 293-5134	48°29'18"	122°40'37"	Private Marina	50	0	2	0	0	1	Mon-Friday	100	10	Anacortes WWTP
Washington State Ferry Terminal, Anacortes	Anacortes	Puget Sound	Non-Recreational, State or Federal		48°30'26"	122°40'30"	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	Anacortes WWTP
Pump Me Out	Anacortes, La Conner, Seattle	Puget Sound	Public Mobile	(877) 786-6731	Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	3	mobile service	By appointment	mobile service	mobile service	Generally public pumpouts, typically Seattle City Sewer, Anacortes WWTP, La Conner WWTP
City of Bainbridge Island, Eagle Harbor Waterfront Park	Bainbridge Island	Puget Sound	Public Stationary	(206) 730-5165	47°37'15"	122°31'10"	Public Marina	6	4	1	0	0	1	24 hours	150	5	City of Bainbridge Island Winslow WWTP
Eagle Harbor Marina	Bainbridge Island	Puget Sound	Public Stationary	(206) 842-4003	47* 36' 58.82"	122* 30' 46.22"	Private Marina	125	0	0	1	0	0	24 hours	60	6 ft.	Central Kitsap WWTP
Harbour Marina	Bainbridge Island	Puget Sound	Public Stationary	(206) 842-6502	47°37'25"	122°31'37"	Private Marina	50	0	1	0	0	1	24 hours	60	15	Bainbridge Island WWTP
Winslow Wharf Marina	Bainbridge Island	Puget Sound	Private	(206) 842-4202	47°37'40"	122°31'20"	Private Marina	225	0	1	1	0	1	9:00 am - 5:00 pm	80	12	City of Bainbridge Island Winslow WWTP
US Submarine Base – Bangor	Bangor - Bremerton	Puget Sound	Non-Recreational, Federal		47°33'17"	122°39'17'	Naval	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Bremerton WWTP
Port of Allyn North Shore Dock	Belfair	Hood Canal	Public Stationary	(360) 275-2430	47°25'15.02"	122°54'7.75"	Public Marina	6	0	2	0	0	Unknown	24 hours (Closed October-April)	50	3	Allyn North Bay Sewer System
Bellingham Cruise Terminal – Port of Bellingham	Bellingham	Puget Sound	Recreational and Non-Recreational Public Stationary		48°43'18"	122°30'47"	Public Dock	400 LF	0	3 (1 for ferries, 2 for others)	0	0	0		250	30	Bellingham WWTP
Squalicum Harbor-Port of Bellingham	Bellingham	Strait of Georgia	Public Stationary	(360) 676-2542	48°45'13"	122°30'29"	Public Marina	1200	0	2	8	0	8	24 hours	100	25	Bellingham WWTP
Seacrest Marina	Between Marysville and Everett	Puget Sound	Public Stationary	(425) 252-4823	48°01'52"	122°11'17"	Private Marina	110	0	1	0	0	0	24 hours	40 ft	5	Multiple Pumpout Services Used Unknown Destination
Blaine Harbor-Port of Bellingham	Blaine	Drayton Harbor	Public Stationary	(360) 647-6176	48°59'26"	122°45'56"	Public Marina	629	0	0	4	0	4	8:00 am - 5:00 pm	120	12	Blaine WWTP
Semiahmoo Marina	Blaine	Drayton Harbor	Public Stationary and boat	(360) 371-0440	48°59'22"	122°46'02"	Private Marina	297	0	1	1	1	0	24 hours	75	12	Blaine WWTP
Bremerton Yacht Club	Bremerton	Phinney Bay	Private	(360) 479-2662	47* 35' 14.17"	122* 39' 45.78"	Private Marina	193	0	1	1	0	0		65	3 ft.	Biorecycling in Union WA

Port of Brownsville	Bremerton	Burke Bay	Public Stationary and boat	(360) 692-5498	47°38'58"	122°36'46"	Public Marina	403	0	2	1	1	2	24 hours	65	25	Central Kitsap WWTP
Pleasant Harbor Marina	Brinnon	Hood Canal	Public Stationary	(360) 796-4611	47°39'70"	122°55'07"	Private Marina	285	0	1	1	0	0	8:00 am - 8:00 pm 24hrs if no assistance needed	120	8	On-Site Septic System
Port of Coupeville	Coupeville	Penn Cove	Public Stationary	(360) 678-5020	48°13'29"	122°41'34"	Public Marina	12	4	1	0	0	0	24 hours	80	2	City of Coupeville WWTP
Deer Harbor Marina	Deer Harbor	San Juan Islands	Public Stationary	(360) 376-3037	48°37'14"	123°0'17"	Private Marina	125	2	1	0	0	Unknown	8:30 am - 4:30 pm	150	5	Pumpout Service to Eastsound or Rosario WWTP
City of Des Moines Marina	Des Moines	Puget Sound	Public Stationary	(206)-824-5700	47°24'06"	122°19'58"	Public Marina	840 wet & dry	0	1	1	0	1	24 hours	75	Unknown	Midway Sewer District System
Rosario Resort Marina	Eastsound	San Juan Islands	Public Portable	(360) 376-2152	48° 38' 48"	122°52'13"	Private Marina	36	8	0	1	0	0		140		Mobile Pumpout Service to Rosario WWTP
Port of Edmonds	Edmonds	Puget Sound	Public Stationary	(425) 774-0549	47°48'36"	122°23'31"	Private Marina	100	0	2	0	0	2	24 hours	110	13	Edmonds WWTP
Washington State Ferry Terminal, Edmonds	Edmonds	Puget Sound	Non-Recreational, State or Federal		47^{0}48'47"	122^{0}40'30"	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	Edmonds WWTP
Naval Station Everett	Everett	Puget Sound	Non-Recreational, Federal		47°59'26	122°13'05	Naval	Military Service	Military Service	1	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Everett WPCF
Port of Everett Marina	Everett	Puget Sound	Public Stationary	(425) 259-6001	47°59'51"	122°13'26"	Public Marina	1969	0	2	0	0	2	24 hours	143	11	Everett WPCF
Port of Everett Marine Park & Boat Ramp	Everett	Puget Sound	Public Stationary	(425) 259-6001	47°59'52"	122°13'26"	Public Marina	198	0	3	0	0	2	24 hours	143	14,18	Everett WPCF
Rose Head Service	Everett	Puget Sound	Public Mobile	(425) 501-5242	Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	1	mobile service	By appointment	mobile service	mobile service	Everett WPCF
Sandy Point Marina	Ferndale	Strait of Georgia	Public Stationary	(360) 384-4373	48* 47' 48.46"	122* 42' 24.06"	Private Marina	72	0	0	1	0	0				unconfirmed
Port of South Whidbey	Freeland	Puget Sound	Public Stationary	(360) 331-5494	48°02'18"	122°24'11"	Public Marina	34	0	1	0	0	1	24 Hours	70	6	Pumpout Service to Coupeville WWTP
Gray Goose Landing	Friday Harbor	San Juan Islands	Private		48°31' 59"	122°49' 39"	Private Marina	10		1		0					Friday Harbor WWTP
Port of Friday Harbor Marina	Friday Harbor	San Juan Islands	Public Stationary (plus Pumpty Dumpty)	(360) 378-2688	48°32'21"	123°00'48"	Public Marina	500	0	1	1	1	2	24 hours	64	10	Friday Harbor WWTP
Warbass Way Marina	Friday Harbor	San Juan Islands	Private		48°31' 59"	122°49' 39"	Private Marina	12		1		0					Friday Harbor WWTP
Washington State Ferry Terminal, Friday Harbor	Friday Harbor	San Juan Islands	Non-Recreational, State or Federal		48^{0}32'08"	123^{0}00'51"	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	Friday Harbor WWTP
Arabella's Landing Marina	Gig Harbor	Gig Harbor	Public Stationary	(253) 255-5050	47°20'03"	122°35'00"	Private Marina	47 slips + 160 LF	0	1	0	0	0	24 hours	120	8	City of Gig Harbor WWTP
City of Gig Harbor Jeresich Dock	Gig Harbor	Gig Harbor	Public Stationary	(253) 851-6170	47°19'54"	122°34'46"	Public Marina	1160 LF	0	1	0	0	1	Variable	50	19	City of Gig Harbor WWTP
City of Gig Harbor Maritime Pier	Gig Harbor	Gig Harbor	Public Stationary	(253) 851-6174	47°19' 47"	122° 34' 42'	Public Marina	40 LF	0	1	0	0	1	24 hours	70	16	City of Gig Harbor WWTP
Murphy's Landing Marina	Gig Harbor	Gig Harbor	Public Stationary	(253) 851-3093	47°20'13"	122°35'19"	Private Marina	85	0	1	0	0	0	Year Round Monday Wed Friday	66	10	City of Gig Harbor WWTP
Driftwood Keys Club	Hansville	Hood Canal	Public Stationary	(360) 638-2077	47°54'26"	122°35'11"	Private Marina	97	0	1	0	0	1	24 hours	40	10	Large Onsite septic System
Sweet Pea Pumping Service	Hansville	Puget Sound	Public Mobile	(206) 356-7757	Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	2	mobile service	mobile service	mobile service	mobile service	Central Kitsap WWTP
Harbour Village Marina	Kenmore	Lake Washington	Public Stationary	(425) 485-7557	47°45'35"	122°15'77"	Private Marina	135	0	1	0	0	1	24 hours	50	6	West Point Wastewater Treatment Plant

Port of Kingston	Kingston	Puget Sound	Public Stationary	(360) 297-3545	47°47'38"	122°29'58"	Private Marina	311	4	1	Portable hose cart with stanchions accessible from each transient slip	0	1	Variable	90	15	Kitsap County Kingston WWTP
Carillon Point Marina	Kirkland	Lake Washington	Public Stationary	(425) 822-1700	47°39'21"	122°12'34"	Private Marina	200	0	1	0	0	1	24 hours	90	6	Kirkland City Sewer
La Conner Landing Marine Services	La Conner	Swinomish Chanel	Public Stationary	(360) 466-3118	48°23'48"	122°29'47"	Public Marina	200 LF	0	2	0	0	0	Variable	80		La Conner Wastewater Treatment Plant
Port of Skagit, La Conner Marina	La Conner	Swinomish Chanel	Public Stationary	(360) 466-3118	48°24'04"	122°29'48"	Public Marina	497	0	2	0	0	2	24 hours	60	10	La Conner Wastewater Treatment Plant
Shelter Bay	La Conner	Swinomish Chanel	Public Stationary	(360) 333-2952	48°22'59"	122°30'53"	Private Marina	320	0	1	0	0	0	24 Hours	70	5	La Conner Wastewater Treatment Plant
Penrose Point State Park	Lakebay	Puget Sound	Public Stationary	(253) 884-2514	47°15'29"	122°45'15"	Public Marina	380 LF	8	1	0	0	1	24 hours	30	3	Onsite Septic system
Islands Marine Center	Lopez Island	San Juan Islands	Public Stationary	(360) 468-3377	48°30'55"	122°54'56"	Private Marina	56	Unknown	5	0	0	1	Variable	80	30	Fisherman's Bay Sewer District
Blake Island State Park	Manchester	Puget Sound	Public Stationary	(360) 731-8330	47°32' 21"	122°29'56"	Public Marina	1500 LF	24	1	0	0	1	24 hours	40	10	Large Onsite septic System
Navy Supply Center, Puget Sound	Manchester		Non-Recreational, Federal		47°33'57"	122°32'38"	Naval	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Military Service	Kitsap County - Manchester WWTP
Twin Bridges Marina (dry stack)	Mt Vernon	Puget Sound	Public Stationary	(360) 466-1443	48° 27' 19"	122°30'34"	Private Marina	1160 LF	0	1	1	0	1	24 hrs	34	7	Pumpout Service Unknown Final Destination
Washington State Ferry Terminal, Mukilteo	Mukilteo	Puget Sound	Non-Recreational, State or Federal		47°57'00"	122°18'12"	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	Big Gulch (Mukilteo) WWTP
Mystery Bay State Park	Nordland	Admiralty Inlet	Public Stationary	(360) 385-1259	48°03'27"	122°41'42"	State Park Marina	1000 LF	7	1	0	0	0	24 hours	55	4	Pumpout Service to BioRecycling in Union WA
City of Oak Harbor Marina	Oak Harbor	Puget Sound	Public Stationary	(360) 279-4575	48°17'12"	122°38'03"	Public Marina	420	0	2	2	0	2	24	75	12	City of Oak Harbor Sewer
Deception Pass State Park	Oak Harbor	Puget Sound	Public Stationary	(360) 675-3767	48°24'06"	122°37'30"	State Park Marina	2400 LF	11	1	0	0	0	24 hours	40 ft	10	Goes to Navy
City of Olympia, Percival Landing Park	Olympia	Budd Inlet	Public Stationary	(360) 753-8380	47°02'55"	122°54'19"	Public Marina	980 LF	0	1	0	0	1	24 hours	50	8	LOTT
Pelican Pump	Olympia	Budd Inlet	Public Mobile	(360) 402-8231	Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	1	mobile service	By appointment	mobile service	mobile service	Lott Wastewater Treatment Plant
Port of Olympia - Swantown Marina	Olympia	Budd Inlet	Public Stationary	(360) 528-8049	47°03'31"	122°53'46"	Public Marina	733	0	1	0	0	1	24 hours	100	12	LOTT
Westbay Marina	Olympia	Budd Inlet	Public Stationary	(360) 943-2022	47°03'56"	122°54'47"	Private Marina	350	0	1	0	0	1	24 hours	50	4	LOTT
Zittel's Marina	Olympia	Nisqually Reach	Public Stationary	(360) 459-1950	47°09'56"	122°48'28"	Private Marina	200	0	0	2	0	1	Variable	45	8	LOTT Via Pumper Truck
West Sound Marina	Orcas	San Juan Islands	Public Stationary	(360) 376-2314	48°37'46"	122°57'36"	Private Marina	580	0	1	0	0	0	Variable	40	5	Pumpout Service. Likely Destination Eastsound or Rosario WWTP
Point Roberts Marina	Point Roberts	Strait of Georgia	Public Stationary plus boat	(360) 945-2255	48°58'21"	123°03'46"	Private Marina	920	0	2	Unknown	1	Unknown	24 hours	200	7	Large Onsite Septic System
Port of Port Angeles Boat Haven	Port Angeles	Port Angeles Harbor	Public Stationary	(360) 457-4505	48°07'33"	123°27'07"	Public Marina	443	0	2	0	0	2	24 hours	160	10	City of Port Angeles WWTP
Port Hadlock Marina	Port Hadlock	Admiralty Inlet	Public Stationary	(360) 385-6368	48°01'54"	122°44'43"	Private Marina	160	0	slips plumbed throughout marina	1	0	1	24 hrs	150	15	Onsite Septic

Port Ludlow Bay Marina	Port Ludlow	Port Ludlow Bay	Public Stationary	(360) 437-0513	47°55'17"	122°41'08"	Private Marina	300	0	1	1	0	1	24 hours	100	15	Olympic Water and Sewer Inc. WWTP
Port of Bremerton	Port Orchard	Sinclair Inlet	Public Stationary	(360) 876-5535	47°33'48"	122°37'21"	Public Marina	321	0	2	1	0	1	24 hrs	130	20	Bremerton WWTP
Port of Bremerton, Port Orchard Marina	Port Orchard	Sinclair Inlet	Public Stationary and boat	(360) 876-5535	47* 32' 35.92"	122* 38' 16.60"	Public Marina		0	2	0	1	1		130	12 ft.	South Kitsap Water Reclamation Facility (Port Orchard WWTP)
Port of Port Townsend - Boat Haven	Port Townsend	Admiralty Inlet	Public Stationary	(800) 228-2803	48* 6' 25.87"	122* 46' 26.68"	Public Marina	375	0	1	0	0	0		100		unconfirmed
Port of Port Townsend, Point Hudson Marina	Port Townsend	Admiralty Inlet	Public Stationary	(800) 228-2803	48°06'57"	122°44'58"	Public Marina	32 slips and 800 LF	0	1	0	0	1	24 hours	100	8	Port Townsend WWTP
Washington State Ferry Terminal, Port Townsend	Port Townsend	Admiralty Inlet	Non-Recreational, State or Federal		48º06'52	122º45'08"	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	Port Townsend WWTP
Liberty Bay Marina	Poulsbo	Liberty Bay	Public Stationary	(360) 779-7762	47°43'27"	122°38'38"	Private Marina	152	0	1	1	0	1	8:00 am - 6:00 pm	80	6	City of Poulsbo to Central Kitsap WWTP
Port of Poulsbo Marina	Poulsbo	Liberty Bay	Public Stationary	(360) 779-9905	47°43'58"	122°39'52"	Public Marina	130	0	2	2	0	1	8:00 am - 4:30 pm	80	7	City of Poulsbo to Central Kitsap WWTP
Port of Port Townsend Herb Beck Marina, Quilcene	Quilcene	Quilcene Bay	Public Stationary	(360) 765-3131	47°48'07"	122°51'58"	Public Marina	40	0	1	0	0	0	24 hours	40	6	Onsite Septic
Port Orchard Railway Marina	Reno	Puget Sound	Public Stationary	(360) 876-2522	47°32'29"	122°38'43"	Private Marina	60	0	1	0	0	0	24 hours	150	0	South Kitsap Water Reclamation Facility (Port Orchard WWTP)
Roche Harbor Resort	Roche Harbor	Puget Sound	Public Stationary (plus Phecal Phreak boat)	(360) 378-2155	48°36'43"	123°09'25"	Private Marina	377	0	1	0	1	0	24 hours	80	15	Roche Harbor Resort WWTP
Ballard Mill Marina	Seattle	Lake Union	Public Stationary	(206) 789-4777	47°39'44"	122°22'58"	Private Marina	117	0	1	Unknown	0	0	24 hours	50	15	Seattle City Sewer - West Point WWTP
Boat Street Marina	Seattle	Lake Union	Public Stationary	(206) 634-2050	47°38'9"	122°18'8"	Public Marina	90	0	1	0	0	1	24 hours	70	>15	Seattle City Sewer - West Point WWTP
Elliott Bay Marina	Seattle	Elliott Bay	Public Stationary plus boat	(206) 285-4817	47°37'36"	122°23'31"	Private Marina	1250	0	1	1	1	1	24 hours	160	30	Seattle City Sewer - West Point WWTP
Fishermen's Terminal - Port of Seattle	Seattle	Lake Union Ship Canal	Public Stationary	(206) 787-3395	47°39'33"	122°22'39"	Public Marina	350	0	1	0	0	0	7:00 am - 9:00 pm	100	0	West Point Wastewater Treatment Plant
Gas Works Park Marina	Seattle	Lake Union	Public Stationary		47* 38' 49.1"	122* 19' 57.44"	Private Marina	70	0	1	0	0	0				West Point Wastewater Treatment Plant
Morrison's North Star Fuel Dock/Diamond Marina	Seattle	Lake Union	Public Stationary	(206) 284-6600	47°38'41"	122°20'38"	Private Fuel Dock	500 LF for fueling & pumpout only	0	3	0	0	0	Variable	200	>15	Seattle City Sewer - West Point WWTP
Parkshore Marina	Seattle	Lake Washington	Public Stationary	(206) 725-3330	47°31'20"	122°15'40"	Private Marina	183	0	1	1	0	0	24 hours	50	5	Seattle City Sewer - West Point WWTP
Port of Seattle - Bell Harbor Marina	Seattle	Puget Sound	Public Stationary	(206) 787-3914	47°36'31"	122°20'48"	Public Marina	37	0	1	1	0	1	24 hours	100	22	Seattle City Sewer - West Point WWTP
Port of Seattle - Harbor Island	Seattle	Puget Sound	Public Stationary	(206) 728-3000	47* 34' 6.82"	122* 20' 49.13"	Public Marina	77	0	1	0	0	1		70	12 ft.	West Point Wastewater Treatment Plant
Port of Seattle, Shilshole Bay Marina	Seattle	Shilshole Bay	Public Stationary	(206) 787-3387	47°40'33"	122°24'46"	Public Marina	40	0	2	0	0	2	24 hours	100	16	Seattle City Sewer - West Point WWTP
Seattle Sanitation Service	Seattle	Lake Union and Lk. Union Ship Canal	Public Mobile	(206) 713-6436	Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	1	mobile service	By appointment	mobile service	mobile service	Seattle City Sewer - West Point WWTP
SS Head	Seattle	Lk Union, Ship Canal and Shilshole Bay	Public Mobile	(206 223-9991	Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	2	mobile service	By appointment	mobile service	mobile service	Seattle City Sewer - West Point WWTP
Terry & Sons Marine Pumpout	Seattle	Lk. Washington, Portage Bay and Duwamish Waterway	Public Mobile	(206) 437-6764	Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	2	mobile service	By appointment	mobile service	mobile service	Seattle City Sewer - West Point WWTP

The Fairview Marinas	Seattle	Lake Union	Public Stationary	(888) 673-1118	47°37'54"	122°19'51"	Private Marina	165	0	1	0	0	0	24 hours	40	>15	Seattle City Sewer - West Point WWTP
Victoria Clipper	Seattle	Puget Sound	Non-Recreational Private		47°36'48	122°21'12	Other	Private Commercial	Private Commercial	1	Private Commercial	Private Commercial	Private Commercial	Private Commercial	Private Commercial	Private Commercial	West Point Wastewater Treatment Plant
Washington State Ferry Terminal, Fauntleroy	Seattle	Puget Sound	Non-Recreational, State or Federal		47^{0}31'24	122^{0}23'37"	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	West Point Wastewater Treatment Plant
Washington State Ferry Terminal, Seattle-Coleman Dock	Seattle	Puget Sound	Non-Recreational, State or Federal		47^{0}36'9	122^{0}23'37"	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	West Point Wastewater Treatment Plant
Port of Port Angeles John Wayne Marina	Sequim	Sequim Bay	Public Stationary	(360) 417-3440	48°03'56"	123°02'23"	Public Marina	300	0	1	0	0	2	24 hours	100	12	Large onsite septic system
Jarrell Cove State Park	Shelton	Case Inlet	Public Stationary	(360) 426-9226	47°16'53"	122°53'16"	State Park Marina	1040 LF	14	1	0	0	0	24 hours	90	4	Likely Biorecyling in Union WA
Jarrell's Cove Marina	Shelton	Case Inlet	Public Stationary	(360) 426-8823	47°17'03"	122°53'12"	Private Marina	38 slips & 1815 LF	0	1	0	0	0	10:00 am - 6:00 pm	100	5	Likely Biorecyling in Union WA
Port of Shelton, Oakland Bay Marina	Shelton	Oakland Bay	Public Stationary	(360) 426-1151	47°13'24"	123°06'18"	Public Marina	109	0	1	0	0	Unknown	24 hours	50	20	Biorecyling in Union WA
Port of Silverdale	Silverdale	Dyes Inlet	Public Stationary	(360) 698-4918	47°38'30"	122°41'41"	Public Marina	1780 LF	0	1	0	0	1	6:00 am - 10:00 pm	150	10	Central Kitsap WWTP
McNeil Island WDOC Ferries	Steilacoom	Puget Sound	Non-Recreational, State or Federal		47°10'20	122°36'12	Dept of Corrections	DOC	DOC	DOC	DOC	DOC	DOC	DOC	DOC	DOC	Chambers Creek WWTP
Stuart Island State Park/Reid Harbor & Prevost Harbor Marine Parks	Stuart sland	San Juan Islands	Public Stationary	(360) 378-2044	48°40'30"	123°12'00"	Barge mounted pumpout	0	12	1	0	0	1	24 hours	60	4	Roche Harbor Resort WWTP
16th Street Moorage (now Dock St Marina)	Tacoma	Thea Foss Waterway	Public Stationary	(253) 572-2524	47°14'73"	122°26'00"	Public Marina	320 LF	0	1	0	0	1	8:00 am - 12:00 am	130	15	City of Tacoma WWTP
Breakwater Marina, Inc.	Tacoma	Puget Sound	Public Stationary	(253) 752-6663	47°18'27"	122°30'48"	Private Marina	182	0	0	1	0	1	7:00 am - 8:00 pm	unknown	15	City of Tacoma WWTP
Chinook Landing Marina	Tacoma	Commencement Bay	Public Stationary	(253) 627-7676	47°16'50"	122°24'09"	Private Marina	213	0	1	0	0	1	8:30 am - 5:00 pm	65	8	City of Tacoma WWTP
Crow's Nest Marina	Tacoma	Commencement Bay	Public Stationary	(253) 272-2827	47°17'37"	122°25'14"	Private Marina	140	0	1	1	0	1	Variable	40	38	City of Tacoma WWTP
Delin Docks	Tacoma	Thea Foss Waterway	Public Stationary	(206) 391-6431	47°15'00"	122°25'48"	Private Marina	144	0	3	0	0	1	8:00 am - 12:00 am	60	6	City of Tacoma WWTP
Dock Street Marina (combined 16th Street, Marina 17 and Albers)	Tacoma	Thea Foss Waterway	Public Stationary	(253) 572-2524	47°14'29"	122°26'00"	Public Marina	78	0	2	0	0	2	8:00 am - 12:00 am	130	6	City of Tacoma WWTP
Dock Street Marina 17	Tacoma	Thea Foss Waterway	Public Stationary	(253) 572-2524	47°14'29"	122°26'00"	Public Marina	77	0	2	0	0	2	8:00 am - 12:00 am	130	6	City of Tacoma WWTP
Dock Street Marina Albers	Tacoma	Thea Foss Waterway	Public Stationary	(253) 572-2524	47°14'29"	122°26'00"	Public Marina	78	0	2	0	0	2	8:00 am - 12:00 am	130	6	City of Tacoma WWTP
Foss Harbor Marina	Tacoma	Thea Foss Waterway	Public Stationary and boat	(253) 272-4404	47°15'22"	122°26'01"	Private Marina	402	0	1	0	1	1	8-5 M-S Sun 9-4, Summer hours extended by 2.	90	60	City of Tacoma WWTP
Foss Landing Marina	Tacoma	Thea Foss Waterway	Public Stationary	(253) 627-4344	47°14'38"	122°25'55"	Private Marina	190	0	1	0	0	0	8:00 am - 5:00 pm	75	5	City of Tacoma WWTP
Foss Waterway Seaport Authority	Tacoma	Thea Foss Waterway	Public Stationary	(253) 272-4404	47°15'27"	122°26'07"	Public Marina	1768 LF	0	1	0	0	0	24 hours	90	60	Tacoma City Sewer
Narrows Marina	Tacoma	Puget Sound	Public Stationary and boat	(253) 564-3032	47°14'39"	122°33'23"	Private Marina	204	0	1	0	1	1	Variable	40	1	City of Tacoma WWTP
Point Defiance Marina Complex	Tacoma	Puget Sound	Public Stationary	(253) 591-5325	47°18'22"	122°30'48"	Public Marina	1225 LF	0	1	0	0	0	24 hours	60	16	City of Tacoma WWTP
Tacoma Fuel Dock/Commencement Bay Marine services	Tacoma	Thea Foss Waterway	Public Stationary	(253) 383-0851	47°15'20"	122°25'58"	Private Marina	930 LF	0	2	0	0	0	8-4:30	120	no restriction	Tacoma City Sewer

Tyee Marina	Tacoma	Commencement Bay	Public Stationary	(253) 383-5321	47°17'42"	122°25'28"	Private Marina	650	0	2	0	0	2	Variable	65	65	Tacoma City Sewer
Washington State Ferry Terminal, Pt. Defiance	Tacoma	Puget Sound	Non-Recreational, State or Federal		47^{0}18'22"	122^{0}30'46	WSDOT Ferry System	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	State Ferry Service	Tacoma City Sewer
Alderbrook Inn	Union	Hood Canal	Public Stationary	(360) 898-2252	47°21'00"	123°04'05"	Private Marina	1500 LF	0	1	0	0	0	By appointment	85	12	Alderbrook Inn WWTP
Hood Canal Marina	Union	Hood Canal	Public Stationary	(360) 898-2252	47°21'54"	123°05'67"	Private Marina	30	0	1	0	0	0	9:00 am - 5:00 pm	45		Biorecyling in Union WA
Twanoh State Park	Union	Hood Canal	Public Stationary	(360) 275-2222	47°22'49"	122°58'30"	State Park Marina	100 LF	7	1	0	0	0	24 hours	40	3	Large Scale Onsite Septic System
Day Island Yacht Club	University Place	Puget Sound	Private	(253) 565-3777	47° 14' 27	122° 33' 34"	Private Marina			1		0					Chambers Creek WWTP
Quartermaster Marina	Vashon	Quartermaster Harbor	Public Stationary	(206) 463-3624	47° 23' 28"	122° 27' 56"	Public Marina	100	0	1	0	0	1	9:00 am - 5:00 pm	60	2	Onsite Septic
West Beach Resort	Orcas	San Juan Islands	Public Stationary - In Procress	(877) 937-822	48°41'18"	122°57'35"	Private Marina	750 LF	0	0	0	0	0	Variable	32	6	In Progress - To Be Determined; Likely Rosario or Eastsound WWTP
San Juan Island mobile service (2 boats)	San Juan Islands	Puget Sound	in planning stages		Mobile	Mobile	Mobile Service	mobile service	mobile service	mobile service	mobile service	mobile service	mobile service	mobile service	mobile service	mobile service	In Progress
Captain's Landing on Blind Bay	Shaw	San Juan Islands	Public Stationary - In Procress		48°35'4"	122°55'4"	Private Marina	in process	0	0	0	0	0				In Progress

a. The pumpout facilities listed in Appendix A primarily came from the Washington State Parks Pumpout Database with a few additions that were identified during this study. This should still be considered a partial listing. Other marinas, such as private facilities, may also have pumpout facilities.
b. Hours of operation listed as 'variable' refers to pumpout facilities whose hours vary by season, day of the week, or are not open on some days of the week.