

WASHINGTON STATE DEPARTMENT OF HEALTH

Wastewater Treatment Plant Outfall Strategy

Office of Environmental Health & Safety
Shellfish Programs, July 2022



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Purpose: This strategy has been developed to define actions and activities at wastewater treatment plants (WWTP) throughout the Puget Sound that, if implemented, could result in an upgrade to the Prohibited classification around the outfall or the reduction of emergency closures that are based on treatment failure at the WWTP.

Background

The Washington State Department of Health (the Department) is responsible for the classification of commercial shellfish harvesting areas based on federal and state rules. The classification of each growing area involves the evaluation of marine water quality, point and nonpoint pollution sources, and environmental conditions in the area.

As of 2020, there were 257,410 acres in Puget Sound classified as Approved, Conditionally Approved, Restricted, or Prohibited. Acreage and a definition of the classification are shown in Table 1 on page 2.

As part of the classification process each WWTP, outfall, and marine receiving water are evaluated. The Department uses a loss of disinfection at each WWTP as the upset condition that determines the size of the required Prohibited area around each outfall. This condition has been selected because it is typically the most common upset condition, the reliability of WWTPs are good, and raw sewage discharges from WWTP outfalls are rare. Most sewage discharges occur in the collection system, caused by combined sewage overflows, sanitary sewage overflows (such as blocked mains), or main breaks. At a minimum, the following criteria are used during the WWTP evaluation process (2019 NSSP Model Ordinance Chapter IV@.03E(5)(b)):

- The volume flow rate, location of discharge, performance of the WWTP, and the microbiological quality of the effluent prior to disinfection.
- The wastewater's dispersion and dilution, and the time of waste transport to the area where shellstock may be harvested.
- The location of shellfish resources, classification of adjacent waters, and identifiable landmarks or boundaries.
- On some occasions, the decay rate of the contaminants of public health significance in the wastewater discharged.

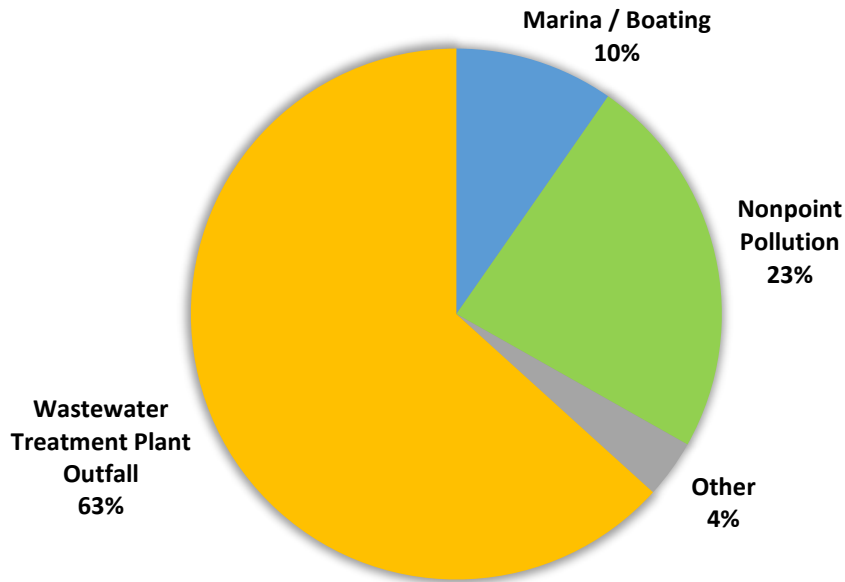
An area outside of the Prohibited portion may be classified as Conditionally Approved if the effluent's time of travel to that portion of the growing area dictates that harvest can be controlled.

Table 1		
Commercial Shellfish Growing Area Classification and acreage		
Classification	Definition	Puget Sound Acreage (2020)
Approved	This classification applies to areas that meet very stringent marine water quality standards and have no pollution impacts. Commercial shellfish companies can harvest directly from Approved areas and take the product directly to market.	147,489
Conditionally Approved	This classification applies to areas that meet very stringent marine water quality and have no pollution impacts most of the time. Periodic poor water quality, based on predictable conditions, results in the temporary closure of the harvest area.	11,799
Restricted	This classification applies to areas that show a limited degree of pollution or areas where active marine water quality evaluations are not available. Shellfish must be relayed to Approved or Conditionally Approved areas and allowed to purge before harvest.	63,460
Prohibited	This classification applies to areas that have known marine water quality impacts. Commercial shellfish harvesting is not allowed in Prohibited areas.	34,662

In Puget Sound, 34,662 acres are classified as Prohibited. Of this, 63% of the acres are due to wastewater treatment plant discharges. Figure 1 and Table 2 on page 5 break down the Prohibited areas by reason, acreage, and percentage of total.

While some upgrades resulting from wastewater treatment plant improvements will be forthcoming with capital improvements at the facilities, the removal of all Prohibited acres associated with WWTP outfalls is not possible. The NSSP Model Ordinance requires a Prohibited area adjacent to each sewage treatment plant outfall or any other point source outfall of public health significance.

**FIGURE 1
PROHIBITED ACREAGE BY REASON**

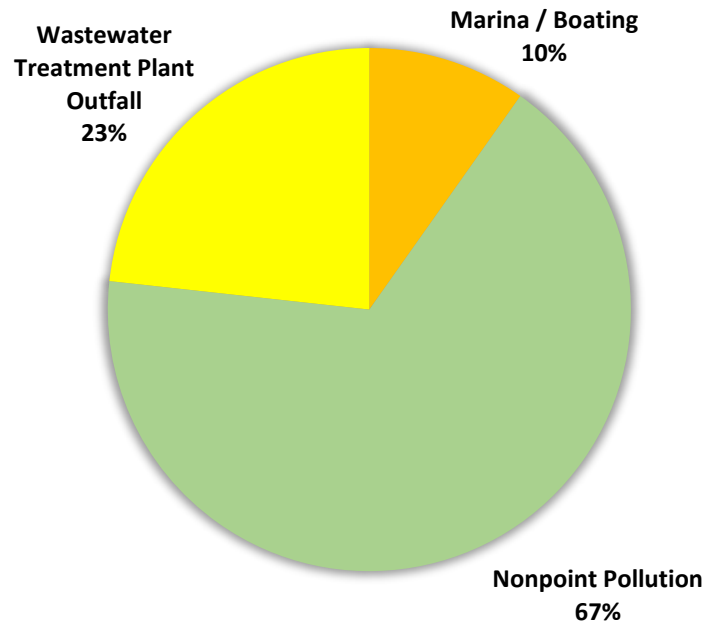


**Table 2
Prohibited acreage by reason**

Reason	Acreage	Percentage
Marina / Boating	3,350	10%
Nonpoint Pollution	8,121	23%
Other	1,222	4%
Wastewater Treatment Plant Outfall	21,969	63%

Within Puget Sound 11,799 acres are classified as Conditionally Approved. Figure 2 and Table 3 on page 6 break down the Conditionally Approved areas by reason, acreage, and percentage of total.

**FIGURE 2
CONDITIONALLY APPROVED ACREAGE BY REASON**



As Figure 2 shows, 23% of the Conditionally Approved acreage is impacted by WWTP outfalls. These classifications are based on the most common upset condition (loss of disinfection at the treatment plant) and are not Prohibited due to the extended time of travel to the harvest area.

Table 3 Conditionally approved acreage by reason		
Reason	Acreage	Percentage
Marina / Boating	1,157	10%
Nonpoint Pollution	7,897	67%
Wastewater Treatment Plant Outfall	2,745	23%

Strategy for improvement

Currently, over 60% of areas Prohibited from shellfish harvest are due to potential impacts from wastewater outfalls. Although a significant portion of Prohibited area is due to shellfish program rules setting minimum setbacks from outfalls, classification upgrades could occur with but not limited to:

- Increasing initial dilution by improving outfall diffuser characteristics.
- Eliminating discharge during upset condition.
- Improving overall treatment.
- Removing or extending outfalls; or
- Reducing the flow through the system.

On occasion, the loss of primary or secondary treatment results in an emergency shellfish growing area closure that extends beyond the calculated Prohibited area. These events are relatively rare. A review of spill reports since 2017 shows an average of two of these events per year. Most events are contained within the existing Prohibited area calculated for the outfall. Reduction of the likelihood or length of an emergency closure in the area outside the Prohibited portion could occur with the implementation of a project such as:

- Improvement to the educational opportunities and retention for WWTP operators.
- Increased reliability of treatment and disinfections.
- Improving alarm and notification systems to reduce response times.
- Reduction of inflow and infiltration; and
- Testing for viral indicators.

Classification upgrade based on plant / outfall improvement

To upgrade the classification around a Prohibited area due to a WWTP outfall, one or more of the criteria used to create the closure must be amended or the outfall must be removed or extended. Strategies that may result in a classification change include:

Treatment improvement

The bacterial load of the effluent stream after treatment and before disinfection is a major criterion in the development of a Prohibited area around a WWTP outfall. Reducing that load through treatment improvements or redundancies could impact the size of the closure.

Flow reduction

A reduction in flow may lead to a reduced bacterial load which would result in a smaller closure area. The effluent flow coupled with the bacterial concentration leads to the microbiological load through the WWTP. Dilution and dispersion after discharge defines the Prohibited area. Upland effluent application, treatment to reclaimed water standards and reuse, and diversion of flow to a neighboring WWTP are examples of opportunities that could lead to a classification change.

Outfall extension / removal / dispersal

Eliminating, extending, or changing the effluent distribution from an outfall can impact the classification. The removal of an outfall eliminates the potential impact to the area from the wastewater treatment process. Outfall extensions, away from the harvestable portion of a growing area, can eliminate any impact to the classified area through distance and potential stratification of the marine water. Stratification does not allow the effluent to rise from deeper water and impact the harvest area. Adding an appropriate diffuser to the end of an outfall can increase the initial dilution of an effluent plume, resulting in a smaller Prohibited area.

Eliminating discharge during upset conditions

The impact to a shellfish growing area occurs during upset conditions as untreated or partially treated wastewater is discharged through the outfall pipe or emergency bypass. Ensuring that wastewater is not discharged during specific conditions eliminates risk in the harvest area. Improvements such as recirculating the wastewater back to the headworks during upset conditions can result in the reduction of the Prohibited area.

Emergency closure reduction / increased opportunity to harvest

Functioning, reliable WWTPs eliminate the need for emergency closures of Approved and Conditionally Approved portions of the growing area and increase opportunities to harvest shellfish. Strategies that may result in the reduction of emergency closure conditions include:

Enhanced educational opportunities and retention for WWTP operators

WWTP operators play a vital role in the maintenance, management, and operation of each facility. Knowledge and understanding of the process involved and staffing of each site are imperative. Ongoing education and recruitment of qualified individuals will help lead to reliable, functioning treatment plants.

Improved reliability of treatment and disinfection

Redundant treatment and disinfection along with the capacity to hold and treat effluent prior to discharge will reduce the need for emergency closures of shellfish growing areas. In addition, testing shellfish after a discharge of non or under treated wastewater and evaluating the time of travel from the outfall to the harvest area could result in a quicker reopening of impacted areas and ongoing harvest during non-impact periods.

Reduction of inflow and infiltration

Inflow and infiltration (I/I) occur in the wastewater collection system. It includes excess groundwater and surface water that enters the system through leaks and cross connections. I/I can cause influent flows to exceed the design capacity of the WWTP, treatment unit overflows, and make disinfection less effective.

Testing for viral indicators

Male Specific Coliphage (MSC) is a National Shellfish Sanitation Program (NSSP) approved indicator. It can be used to assess the impact of a sewage spill on shellfish species and help define the closure period after a spill. Currently, impacted areas are closed for a minimum of 21 days after the spill has stopped. MSC testing could reduce this closure period to just over seven days. The use of the indicator would require an FDA approved laboratory running the NSSP approved method and laboratory matrix extensions for each shellfish species to be tested.

Conditionally Approved classification

Measuring the effluent time of travel can lead to a Conditionally Approved classification along the outer edges of some larger Prohibited areas. A change from sanitary lines based on dilution factors to time of travel, where supported by improved plant reliability (redundant treatment, adequate monitoring and alarms, and short operator response time), dye/drogue studies, and/or modeling, would reduce Prohibited areas around outfalls.

Supplemental activities

Additional activities and permit requirements implemented at WWTPs can support growing area classification upgrades through indirect reduction of microbiological levels in the effluent. Additionally, more accurate evaluations of hydrographic properties of water bodies could result in amendments of classifications.

The Department of Ecology (Ecology) has implemented the Puget Sound Nutrient General Permit (PSNGP). This general permit applies to 58 domestic WWTPs and focuses on controlling nutrients, working in conjunction with the facilities existing permit. One of the intriguing aspects of the PSNGP is that many of the options for addressing nutrient issues also improve WWTP

reliability and may allow re-evaluation of current shellfish closure zones (SCZ). Many treatment options for nutrients also address other contaminants of concern, while operational options such as reducing inflow and infiltration (I/I) or expanded use of reclaimed water would reduce overall effluent flows which are a factor in sizing SCZ around WWTP outfalls. The potential for I/I and reclaimed water projects to be funded has also increased with recent passage of infrastructure funding bills.

An important tool for re-evaluating Prohibited areas around WWTP outfalls is environmental modeling. Recently, the Pacific Northwest National Laboratory (PNNL) has begun a project to improve their Salish Sea Model to better evaluate point source discharges, particularly under upset conditions. Currently, many Prohibited areas are based on CORMIX modeling which cannot account for more complex hydrographic conditions and tend to underestimate dilution factors farther away from the discharge point. However, there is a need to better validate these models when refining the model grid. Ecology marine monitoring stations are generally located in deeper water, giving an incomplete picture for modeling work in shellfish harvest areas. Collaboration with the Department dye studies, in conjunction with more comprehensive water quality data collection during the Department sampling runs (which would provide data closer to shore than most Ecology monitoring), would better validate environmental models to provide more confidence in their results. Better environmental data collection would also benefit efforts by the Department and partner agencies to document climate change and environmental restoration impacts.

Additional regulation of Contaminates of Emerging Concern, such as pharmaceuticals, endocrine disruptors, and “forever chemicals” such as PFAS may also result in improved wastewater treatment. This, in turn, would provide opportunities for reducing Prohibited areas around WWTP outfalls.



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