June 2025

Onsite Wastewater Management

Island County, Washington

Island Region Innovative Solutions Report






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Island County Public Health

Biohabitats

1620 SE Claybourne Street, Unit 210A
Portland, OR 97202
biohabitats.com
800.220.0919

ASE
AQUEOUS SOLUTIONS ENGINEERING

Aqueous Solutions Engineering
P.O. Box 1635
Bellingham, WA 98227
360.318.4704

Site Story

2408 Eleventh Ave West
Seattle, WA 98119
sitestorynw.com
206.579.8645

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Introduction

Island County, located in northwest Washington and consisting of Whidbey and Camano Islands (see Figure 1), has a population of approximately 86,300 (2023) living on approximately 134,000 acres. At the time this report was written, the Island County Comprehensive Plan (Comp Plan) which outlines predicted growth patterns and develops a long-range vision for the county was still being established through stakeholder engagement and addressing the various aspects of land use and policy development. Core aspects of the Comp Plan include land use, affordable housing, transportation, and necessary capital investments. The Comp Plan also requires the protection of critical areas and natural resource lands with regional collaboration and periodic plan review.

The Island County Planning Commission, based on census data, forecast research, and current trends, estimates a 19% population increase by 2045. Island County is rural with 28% of the population serviced by a municipal sewer. An increase in housing pressure to accommodate the growing population continues to pressure the Island County Public Health (ICPH) which manages small onsite sewage systems (OSS).

ICPH, in partnership with the Washington State Department of Health (WA DOH) is developing a comprehensive approach to navigate complex issues with onsite wastewater management. This study builds on past analysis by increasing the understanding of current onsite wastewater management policy and emerging policy and technology trends. Island County seeks to understand innovative wastewater solutions for single family OSS and Community OSS, especially for supportive housing developments. The Island Region Wastewater Innovations Report aims to gain a deeper ***Understanding*** of interrelated issues, ***Research*** best practices, ***Analyze*** constraints and opportunities, and ***Recommend*** steps for Island County to enact innovation solutions.

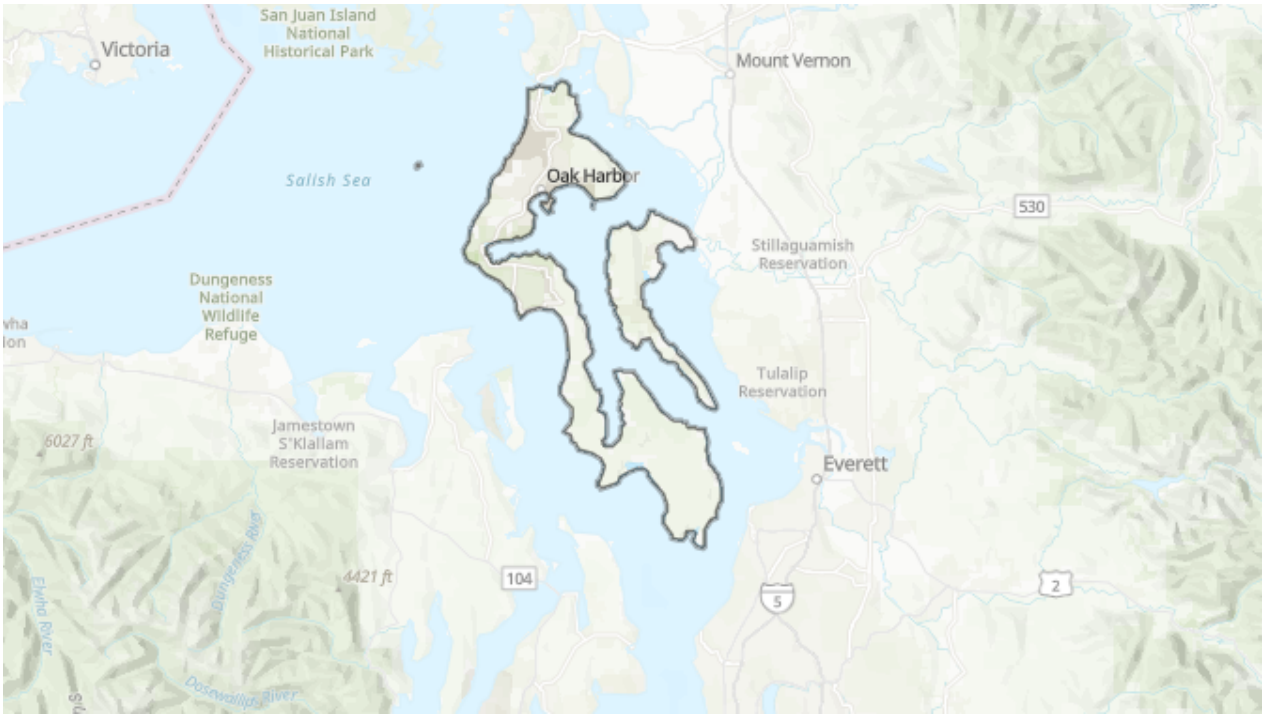


Figure 1 – Island County, Washington

Understanding

This study of onsite sewage systems (OSS) requires deep understanding of several key interweaving issues, including water quality, marine health, groundwater protection, climate change, sea level rise, and development pressures (housing need, expanding population). Additionally, a myriad of local, regional, and state codes and policies help protect both groundwater and surface water resources from new and legacy pollution, including onsite wastewater. Onsite wastewater treatment in Washington State is regulated by both county and state governments. Specific jurisdiction depends on the size and complexity of the system and governing rules can be confusing for homeowners, designers, developers, and maintenance providers.

Groundwater has long been recognized as a valuable natural resource, but only relatively recently has the susceptibility of Island County's groundwater aquifers to threats been understood and appreciated. In 1982, the U.S. Environmental Protection Agency designated both Whidbey and Camano Islands as Sole Source Aquifers (SSAs), an aquifer that supplies at least 50% of the drinking water for the service area and/or there are no other drinking water sources if the aquifer were to become contaminated.

Lastly, a combination of social and financial pressures affects the success of onsite wastewater management in the county, including a need for more housing, small lot sizes, legacy groundwater contamination, and more. The following section unpacks key elements affecting onsite wastewater management in Island County, Washington.

Water Quality / Marine Health

Island County is one of twelve counties in the Salish Sea and is centrally located at the north end of Puget Sound. The Puget Sound is considered a global biodiversity hotspot due to its array of unique habitats with fresh and saltwater conditions. The complex shoreline and varied depths help create a highly productive and valuable ecosystem; home to an abundance of fish, bird, and mammal species including endangered Orca whales and Chinook salmon. An estimated 2,800 rivers, streams and creeks feed into the Puget Sound (see Figure 2).

Wastewater from old, mismanaged, and failing systems, as well as new and expanding inputs pose significant risk to the Puget Sound ecosystem. Marine health in particular is impacted by wastewater constituents. Shoreline ecosystems and benthic zones (bottom of a water body) are crucial to the ecological function and overall health of the Puget Sound. Healthy shorelines provide habitat for a wide variety of species. Benthic systems are diverse communities of organisms on the seafloor that are vital contributors to marine nutrient cycling, mitigating pollution, and establishing the foundation of the marine food web.

There are nearly 200 miles of shoreline in Island County, including wetlands, eroding bluffs, low-lying beaches, and spits. Developmental practices and population growth, which are often centered in nearshore areas, have negatively impacted shoreline and marine environments. Pollution from wastewater carries disease, contaminates seafood, and contributes to nutrient imbalance and algal blooms that can deplete oxygen levels and harm marine life.

In Puget Sound, salmon are an important indicator species for the health of the bioregion, including the food web, economy, spiritual and cultural identity. In poor water quality, salmon are at a higher

risk of disease, altered hormone production, and are more vulnerable as prey. Endangered Orca are directly impacted by water quality and reduced salmon availability.

Many counties in the region monitor water quality to help understand how best to manage stormwater and wastewater inputs into their water bodies. Comprehensive programs use street sweeping, rain gardens, and bioswales to improve stormwater quality before meeting local waters. Similarly, robust onsite wastewater programs that track system performance and maintenance can reduce negative impacts of poorly designed and maintained onsite sewage systems.

Figure 2 – Puget Sound (U.S. Geological Survey)

Closure of shellfish harvest sites is often due to fecal pollution. During these closures shellfish are not safe to eat. "Human sewage and animal waste are the largest vectors for pollution that impact shellfish around the Puget Sound region and in some areas of Puget Sound," Mindy Roberts, Puget Sound Program Director of Washington Conservation Action. Local governments are charged with monitoring onsite wastewater systems, but currently less than 12% of OSS in Island County are in compliance. Island County offers support to owners of OSSs and advises that routine maintenance is essential to catching issues early and reducing system maintenance and repair costs. Public education programs like Puget Sound Starts Here are essential partners that invite everyone to participate in protecting waterways of Island County.

Sea-level Rise & Saltwater Intrusion

After the extreme high tides of 2022-2023 (winter) there has been growing concern throughout the Salish Sea, especially in the Puget Sound, about Climate Change and local Sea-Level Rise (SLR) issues. The Island County Coastal Flood Risk Assessment completed in 2016 started to frame the growing body of science around SLR and its impacts. In 2018, an assessment of the Puget Sound from the University of Washington Climate Impacts Group estimated a 6 – 12 inch SLR by 2050 and up to 30 inches by the year 2100.

While future projections and understanding grow, it is clear that rising sea levels will threaten Island County's groundwater resources due to increased seawater intrusion and vulnerability to storm surges. SLR will also reduce the vertical separation between wastewater dispersal infrastructure and groundwater or in worst case scenarios submerge existing OSS. Saltwater intrusion can also alter soil structure over time, reducing the efficacy of an OSS. Updates to Island County Code (ICC) 8.09.099 and the Comprehensive (Comp) Plan will continue to address these issues by reducing well water withdrawals and increasing stormwater infiltration.

Sole Source Aquifer/Fresh Water

Whidbey and Camano Islands are designated sole source aquifer (SSA) communities where most of their potable water comes from groundwater, making it imperative to protect it from all threats. The coordinated efforts of several agencies; local, state, and federal, are involved in protecting groundwater and surrounding surface water. The United States Environmental Protection Agency (EPA) sets the drinking water standards from which state agencies develop assessment and protection programs. The Washington State Department of Health (WA DOH) and the Department of Ecology (WA DOE) manage different aspects of water access and protection. WA DOE's Critical Aquifer Recharge Area (CARA) rules and regulations exist to protect groundwater resources.

The Island County Public Health (ICPH) department oversees local health and safety of water use and wastewater treatment and dispersal through education, oversight, and the enforcement of local codes. The department oversees both private and public water systems to protect groundwater resources from contamination. Threats to groundwater resources include aquifer depletion and over extraction, point source pollutants (wastewater discharge, leaking underground storage tanks), non-point source contamination (including stormwater, road runoff, agriculture, and industry), saltwater intrusion, and impacts from climate change.

While there are many threats to the health and safety of Island County's aquifer and potable water sources, maintaining a robust onsite sewage system program led by ICPH is key to its protection. Conscientious management of OSS helps protect public health from wastewater constituents that can move through poorly functioning wastewater infrastructure. Nutrients, bacteria, viruses, and other chemicals found in wastewater can threaten public health and safety, as well as cause significant environmental impacts.

As groundwater elevations fluctuate the threat and risk from OSS changes. A higher groundwater table reduces the native soil capacity to further treat wastewater dispersed from an OSS. High elevation of groundwater also increases the threat that humans and critical ecosystems will come into contact with polluted water. Wastewater constituents can play a major role in limiting ecosystem function. Island County maintains a groundwater information database. Figure 3 is a groundwater heat map, which is a visual representation of nitrate concentrations using available data. Where more than one sample result is available for a given location (groundwater well) the data is sorted to prioritize the most recent sample date available. The US safe drinking water threshold for nitrate is 10 mg/L (as nitrogen).

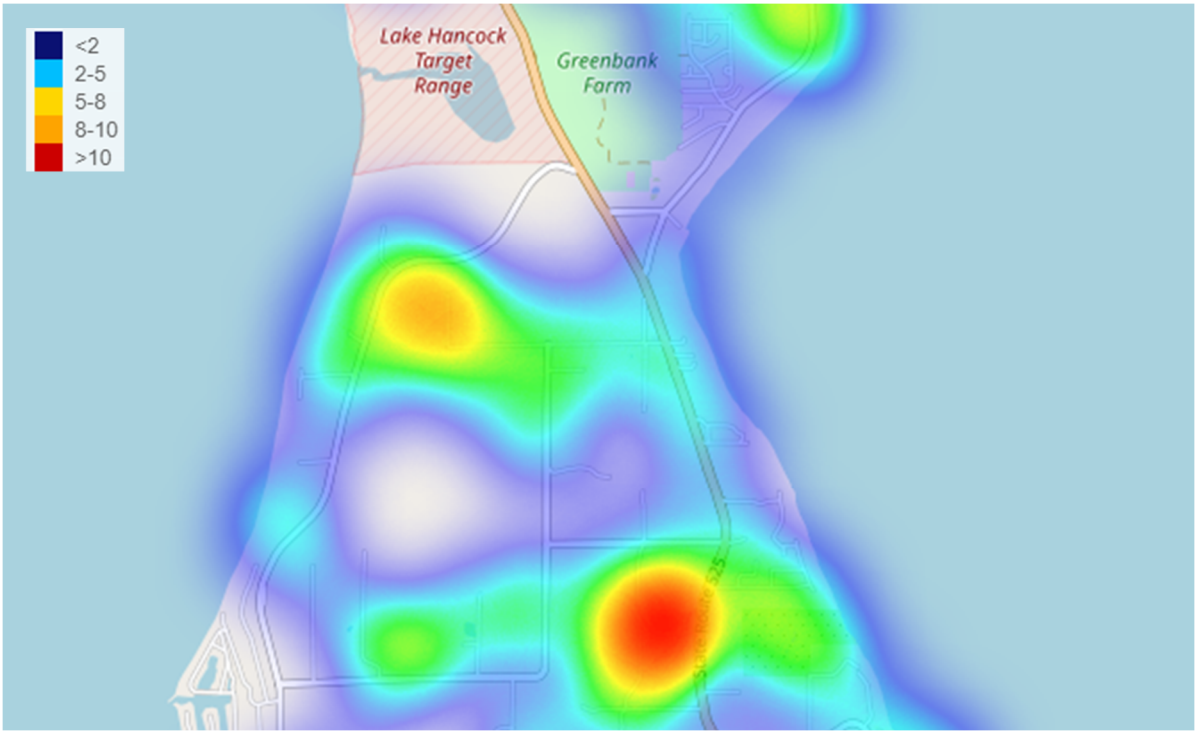


Figure 3 - Recorded nitrate nitrogen concentrations (mg/L) in groundwater heat map on Whidbey Island

Outreach and public awareness of the health of local groundwater sources is important to increase public participation in protecting the aquifer. Public understanding and participation help local agencies fund and develop programs to reduce threats to soil and water resources. Adaptive management approaches help streamline and prioritize steps and processes that respond best to local and current conditions. Other organizations and programs supporting water quality protection are listed in Resources.

Economic Drivers, Interconnections & Need

Outside of the military/defense economy centered around the US Naval Air Station Whidbey Island in Oak Harbor, much of Island County's economy is driven by tourism and supportive industries, such as fishing, shellfish, and water recreation activities. Tourism, a significant and growing industry with an approximate $177 million in gross revenue, supports about 20% of the workforce. The industry relies on the robust health of the Island's ecosystem to thrive.

Shellfish (clams, geoducks, oysters, and mussels) are a valuable cultural resource and a key ecological asset and indicator of the health of Island County. Island County's Shellfish Protection Program works to ensure a safe harvest of shellfish. The WA DOH hosts online resources to ensure public health and safety regarding shellfish activities (see Figure 4).

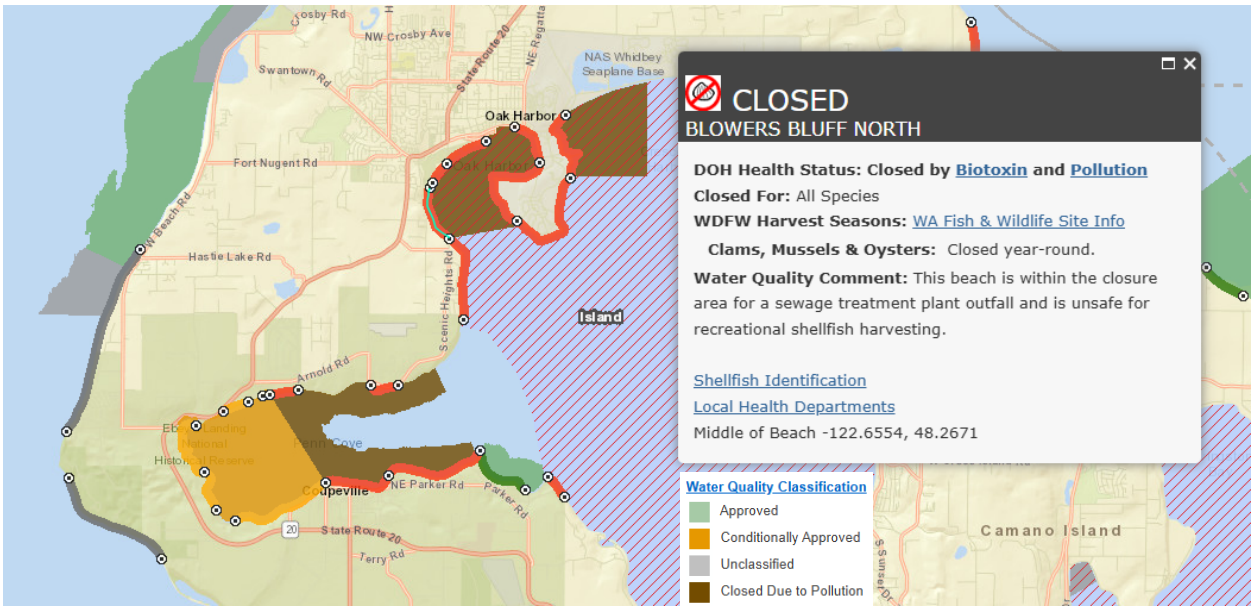


Figure 4 – Washington State Department of Health – Shellfish Safety Information Website

Due to an increased remote work force and migration of retirees, real estate is a growing industry, and affordable housing is an increasing need. A deep understanding is needed to ascertain Island County's capacity to handle the projected 19% population increase. The Revised Code of Washington (RCW) 36.70A.070(2)(c) states that Comp Plans must identify "sufficient capacity of land for housing including, but not limited to, government-assisted housing, housing for moderate, low, very low, and extremely low-income households, manufactured housing, multifamily housing, group homes, foster care facilities, emergency housing, emergency shelters, permanent supportive housing, and within an urban growth area boundary, consideration of duplexes, triplexes, and townhomes." This requirement for additional housing typologies and subsequent services that accompany growth creates greater need for a comprehensive onsite wastewater program and policies, including greater staffing capacity, permitting flexibility and cost-effective technologies.

Onsite Wastewater Regulatory Framework

Onsite wastewater treatment and dispersal in Washington State is regulated by two different agencies depending on the quantity of wastewater generated and the method of dispersal. While potential options for the dispersal of wastewater, such as surface water discharge, rapid infiltration, or rapid injection, which are all methods under the WA DOE jurisdiction, the vast majority of wastewater in unincorporated Island County utilizes OSS, which are regulated by WA DOH, but administered by the ICPH.

State regulation governing OSS, defined as a sewage system with design flow of less than 3,500 gallons per day (gpd), is the Washington Administrative Code (WAC) 246-272A. The WA DOH administers regulation of Large On-site Sewage Systems (LOSS), under WAC 246-202B – for any onsite wastewater dispersal with design flows from 3,500 to 100,000 gpd. The WAC establishes requirements for the design, installation, operation, and maintenance of OSS, providing a critical baseline for all local jurisdictions. ICPH through their Island County Code (ICC) regulates OSS. Each county adopts or adapts and enforces regulatory guidance; Local regulation must be equal to, or more stringent than, WAC 246-272A.

Additionally, the WA DOE regulates any size system that utilizes spray irrigation, infiltration basins, or injection wells as a land dispersal approach, in addition to any surface water discharge. Table 1 summarizes the regulatory code and jurisdiction based on the type of system and design flow.

Table 1 – Wastewater Management System Regulatory Oversight and Code

Type of System	System Design Flow (Gallons per Day)	Regulatory Jurisdiction	Regulatory Code
OSS & COSS (drainfield)	<3500	Local Health Jurisdiction (i.e. Island County)	ICC Chapter 8.07D, equal to, or more stringent than *WAC 246-272A – On-site Sewage Systems*
LOSS (drainfield)	3,500 to 100,000	Washington State Dept. of Health	*WAC 246-272B – Large On-site Sewage Systems (LOSS)*
Rapid Infiltration Basin	any size	Washington State Dept. of Ecology	*WAC 173-216 – Underground Injection Control (UIC) Program and WAC 173-218 – State Waste Discharge Permit Program*
Spray Irrigation (Reclaimed)	any size	Washington State Dept. of Ecology	*WAC 173-218 – State Waste Discharge Permit Program and WAC 173-219 – Reclaimed Water Program*

Within Island County's regulatory jurisdictions – for OSS with design flow under 3,500 gpd there are two categories of OSS that have different regulatory requirements:

- On-site sewage systems (OSS) – designed to serve one or two residential housing units or under 1,000 gpd of non-residential wastewater; and
- Community on-site sewage systems (COSS) – designed to serve more than two (2) residential housing units, or non-residential projects with a Design Flow exceeding 1,000 GPD and less than 3,500 gpd

Island County does not distinguish between a COSS that is under single ownership (i.e. a small eight-unit apartment building) versus a COSS with multiple owners (i.e. eight single-family houses on separate lots). Some Washington State counties do make this distinction and offer more flexibility or a clearer permit pathway for these single-ownership systems; they are often considered a 'Commercial' OSS as opposed to a 'Community' OSS.

Paragraph *A.* of *the ICC 8.07D.210. - Community and Large On-site Septic Systems (LOSS)* states, "*Community on-site sewage systems as defined in this chapter shall be designed in accordance with the site evaluation, design, maintenance, and management criteria as set forth in WAC 246-272B (Large On-site Sewage Systems), or as they may be hereafter amended.*" Table 2 outlines the general permitting pathway for different types of onsite wastewater systems.

Table 2 – Permitting Process for Onsite Systems in Island County

	OSS *(ICC) 8.07D*	**Community OSS** *ICC 8.07D.210*	**LOSS** *WAC 246-272B*
Flow	≤ 1,000 GPD	> 1,000 GPD and ≤ 3,499 GPD	≥ 3,500 GPD < 100,000 GPD
Lead	OSS Designer or PE	OSS Designer or PE	Professional Engineer (PE)
Step #1	Application for Site Evaluation (soil testing) (1-page application form)	The *ICC 8.07D.210* requires projects to follow the *WAC 246-272B*. Same as a LOSS →	Pre-Design Documents • Application Form (1 page) • Pre-Design Report (typ. 25 to 200± pages, incl. prelim. site & soil evaluation & preliminary design layout
Step #2	Site Registration (3-page form incl. plot plan & soil logs)	Same as a LOSS →	Site & Soil Eval. with WA DOH
Step #3	Permit to Construct an OSS (4-page form with design info. and plot plan)	Same as a LOSS →	Site Risk Survey and/or Hydrogeological Report, with Nitrate Balance (This step will set effluent limits, including a low total nitrogen limit. Thus, detailed design cannot begin until DOH approval of this step.)[1]
Step #4	OSS As-Built Forms (OSS as-built plot plan & settings form ; OSS as-built certification form	Same as a LOSS →	Engineering Design Documents • Engineering Report (typ. 25 to 100± pages); • Design Drawings • Design & Construction Specifications (After review, DOH approves construction
Step #5	N/A	Same as a LOSS →	Owner Application for Operating Permit
Step #6	N/A	Same as a LOSS →	Record Drawings, and Construction Completion Report (1-page form)
Step #7	N/A	Same as a LOSS →	Operations & Maintenance (O&M) Documents • O&M Manual • Management Plan • Monitoring & Reporting Plan

Status of Wastewater Systems in the County

Approximately 28% of the Island County population live in areas serviced by a municipal wastewater treatment plant (WWTP) that has a surface water discharge regulated by the Washington State Department of Ecology. There are approximately 30,000 single family residential on-site wastewater systems (septic systems or equivalent). Most residents in unincorporated Island County (i.e. residents outside of municipal sewer service areas) are serviced by an OSS or a LOSS. Table 3 presents the approximate number of on-site sewage systems in Island County by system type with an estimate of aqueous nitrogen contributed by. This important observation of estimated nitrogen contribution by system type will be discussed later in the 'Analysis' section of this report.

Table 3 – Type and Quantity of Onsite Wastewater Systems in Island County

Jurisdiction	Type of System	Approximate Number of Systems in the County	Percent Out of Administrative Compliance	Percent Known in Failure Status	Total Estimated Pounds of Nitrogen per Day [2]	Percent of Nitrogen Dispersed in the County from Onsite Systems
Island County	OSS Residential	28,944	88%	1%	2,026	90.9%
	OSS Residential (SA) [1]	1,637	90%	1%	115	5.2 %
	Community OSS (w/ no TN limit)	77	100%		18	0.8 %
WA DOH	LOSS (w/ no TN limit)	33	-	-	63	2.8 %
	LOSS (with TN limit)	2	-	-	0.26	0.01 %
DOE	Spray [3]	1	0 %	0 %	7.66	0.3 %
	Rapid Infiltration Basin	0	-	-	-	-
Total Est. Lbs./Day of Total Nitrogen from On-site Systems					2,230	

[1] – Onsite Sewage Systems (OSS) for single family residential properties in Sensitive Areas (SA)

[2] – Average TN in septic tank effluent from a typical single-family home is about 0.07 lbs TN/day (about 140 gpd/home at 60 mg/L TN).

[3] – Nitrogen load based on a 2003 thru 2007 reclaimed water effluent flow monitoring (avg. 46,000 gpd) and total nitrogen monitoring (avg. ~20 mg/L), from "*Fact Sheet for State Reclaimed Water Use Permit ST-7373 for Holmes Harbor Water Reclamation Plant"*.

Management of Wastewater Systems in Island County

ICPH has a 6 person staff, including one supervisor, three sanitarians, and two operations and maintenance professionals, that administer the onsite wastewater program which provides educational, advisory and permitting services for owners of OSS, wastewater professionals and other parties. ICPH's mission to protect public health and the environment is actualized by minimizing the threat of surface and groundwater contamination from over 30,000 existing OSS.

This includes identifying failing or improperly designed, installed or maintained OSS, as well as ensuring new OSS are designed and implemented properly. ICPH provides paper and digital resources outlining legal requirements for responsible parties to maintain critical onsite wastewater infrastructure. Resources including:

- Maintaining Your On-Site Septic System Brochure,
- On-Site Sewage System (OSS) Homeowner Evaluation Form - www.islandcountywa.gov/DocumentCenter/View/8551/Maintaining-Your-OSS-Brochure?bidId=, and
- Meet Your Septic Systems Professionals Brochure.

ICPH requires all OSS with gravity dispersal to be inspected every three years; pressure dispersed OSS are required to be inspected each year. Additionally, they require an inspection at the time of sale or title transfer. Example inspection forms are in Appendix B. ICPH maintains a list of licensed or certified wastewater professionals who regularly work in Island County. There are 43 listed Maintenance Service Provider (MSP) / Inspectors on their list, as of June 2025. OSS inspections include, sludge judging the primary (septic) tank, checking effluent filter and/or pump, and observation of drainfield area. Prices vary based on location and complexity of system, but a typical cost is $300-$500 per inspection.

In 2024, ICPH staff received 3,944 OSS inspection forms, approximately 13% of the total permitted systems. Inspections typically show that 60% are in good standing, while 40% are in moderate condition.

Research / Engagement

Summary

An important aspect of this Wastewater Innovation Report is engagement with three key stakeholders including 1) regulatory officials (county and state), 2) wastewater professionals (design and maintenance professionals), and 3) the design and development community (architects, builders, developers). Additionally, a technical advisory group (TAG) was convened to ensure the recommendations of this study are informed with best practices and innovative policies and procedures for onsite wastewater management with others dealing with similar onsite wastewater issues.

Engagement

The project team worked with Island County officials to invite a wide selection of individuals in each of the three key stakeholder groups. Engagement activities were defined as listening sessions so that project staff could hear and learn about varying concerns with onsite sewage systems in Island County. The listening sessions were conducted to build key understanding with key stakeholders. Invitations were sent to 112 individuals. Four Listening Sessions were held virtually for ninety minutes to two hours taking place from mid-February through early March in 2025. A series of questions were developed to provide a framework for each session. If individuals could not make one of the sessions, the questions were provided by email so that further feedback could be complied. The list of questions is in Appendix A.

Representation within the stakeholder groups included individuals from:

Regulatory Officials

- Island County Department of Public Health
- Island County Department of Planning
- Island County Local Integrating Organization, also known as Water Resource Inventory Area 6 (WRIA 6)
- Washington State Department of Health (DOH)

Wastewater Professionals

- Local OSS design professionals
- Local OSS maintenance providers

Design and Development Professionals

- Local architects
- Local contractors
- Housing developers working in Island County
- Housing consultants engaged in permitting and private projects and supportive housing

The listening sessions had a participation rate of 20% with fifteen people meeting virtually and three responding to questions in written format due to attendees' technical difficulties using Zoom or limited availability.

While specific national average rates for stakeholder engagement in wastewater management, especially related to onsite sewage systems, do not exist; studies show that stakeholder engagement, particularly when broad and inclusive, leads to better outcomes in water management and sustainability efforts. Integrating stakeholders into the development and implementation of sustainability plans, including those related to wastewater, leads to better outcomes for diverse stakeholders, especially for domestic and environmental groups. Effective stakeholder engagement can significantly increase the likelihood of reaching consensus on goals and plans, as seen in evaluations of environmental collaboration and conflict resolution practices.

Outreach for the listening sessions was through a variety of methods including email, phone calls, and Eventbrite invitations. Initial contact was by email followed by weekly reminder emails and two personal phone calls leading up to events. Common themes of concern from stakeholders broken down by groups:

Island County public health and permitting professionals

- Aquifer protections
- Land area requirements
- New WA State OSS Code requirements
- Updating County OSS Code
- Limited WA State approved technologies
- Getting failing systems into compliance
- Staffing capacity to meet growth
- Infeasibility of perspective buyers for affordable and supportive housing projects
- Confusion of what can be permitted locally vs. what is applicable to State of Washington
- Legacy building too close to the shoreline

Washington State public health professionals and the Island County Local Integrating Organization also known as Water Resource Inventory Area 6 (WRIA 6)

- Implementing the new code consistently between counties
- Infeasibility of perspective buyers for affordable and supportive housing projects
- Confusion of what can be permitted locally vs. what is applicable to the State of Washington
- Legacy building too close to the shoreline
- Lack of bandwidth to regulate
- Knows they need more examples of innovative systems
- Needs to consider other case studies from other states
- Pressures from comprehensive planning statewide

Local wastewater design and installations specialists

- Given the number of meetings for the comprehensive plan with the Growth Management Act there is meeting fatigue amongst these professionals
- Permitting process
- Lack of innovative pathways for alternate systems
- Aging professionals and the lack of installers to meet the needs for growing populations
- Permitting process and inspector availability

Housing developers and professional consultants engaged in permitting and private projects and supportive housing

- In general, this group expressed genuine willingness and concern to protect the environment
- Private sector builders, architects and consultants working with higher end residential
- Clients did not have concerns about costs
- Available lot sizes to accommodate regulatory requirements
- County staffing capacity for permitting and inspection
- Inheriting failing systems with sites
- Bluff stabilizations and relocating OSS
- Land costs and lot sizes to accommodate affordable and supportive housing

Technical Advisory Group

Biohabitats and partners convened a volunteer technical advisory group (TAG) to discuss comprehensive recommendations for Island County regulations and guidelines onsite wastewater infrastructure solutions that are protective of property values, human health, and the Puget Sound ecosystems. One of the major aims of the TAG is to ensure recommendations are informed from what others with similar pressures and constraints are doing to develop and enact innovative policies and procedures. The TAG convened three (3) times to help guide efforts and understanding. The TAG was a critical sounding board to ensure thoroughness and innovation.

1st TAG (March) Meeting *– Introduction and Brainstorm*

The March TAG meeting focused on outlining Island County unique characteristics and the county and state regulator pathway. We discussed what regions/areas are implementing creative regulatory solutions for onsite treatment. We discussed who is doing creative research for onsite wastewater management and what innovative technologies are being used in the field.

2nd TAG (April) Meeting *– Report Outline Share and Collaborative Ideas Generation*

Aprils' TAG meeting started by sharing the outline and framework for the final report. The bulk of the meeting consisted of a collaborative discussion and idea generation. The discussion began by unpacking the existing rules in Washington State and Island County, specifically the new DoH rules that became active on April 1st, 2025. The project team then ran through several proposed scenarios with how Island County could develop an additive framework to be more protective than the new state guidance.

3rd TAG (June) Meeting *– Final Recommendation Review and Discussion*

Our last TAG meeting shared the analysis shared of existing onsite system shared early in the report and then focused specifically on appropriate ways Island Count could develop tools and processes to address both OSS and Community OSS. There was considerable discussion on the challenge for Island County to be more restrictive when the WA DOH registered list does not recognize any treatment systems performing greater than a 50% reduction in nitrogen.

The TAG consists of regional, national, and international experts in onsite wastewater research, treatment, management, and policy. TAG members include:

- Harold Leverenz, PhD, PE – UC Davis Researcher and Biohabitats Senior Engineer
- Sara Heger, PhD – Researcher and Professor at University of Minnesota
- Tristian Bounds, PE – Director of Innovation at Orenco Systems / Principal at Regen AEC
- Dendra Best – Executive Director of WasteWater Education 501(c)3
- Pat Lando – Executive Director of Recode & US Green Building Council Technical Specialist
- Ben Kele – Director at Arris
- Michael Brett, PhD – Civil Engineering Professor at University of Washington
- Victor d'Amato, PE – Supervisor, Viable Utilities Unit at North Carolina Dept. of Environ. Quality
- Barton Kirk, PE – Principal at Ethos Collaborative
- Erica Duncan – Manger, Virgina Department of Environmental Quality (DEQ)
- Tim Pasakarnis – Water Resource Analyst at Cape Cod Commission
- Lynn Schneider – Onsite Sewage System (OSS) Program Supervisor, King County Washington
- Jamie Heisig-Mitchell – Chief of Technical Services at HRSD

Analysis

Compounding Challenges / Barriers

Island County residences, businesses, and institutions have many compounding challenges and barriers to implementing On-site Sewage Systems (OSS), including:

- development pressure,
- aging infrastructure,
- small parcel sizes,
- groundwater protection due to critical aquifer recharge areas (CARA),
- wellhead protection zones,
- surface water protection,
- sea level rise / climate resilience,
- confusing regulations, and
- cost of infrastructure, operations, and maintenance.

There are a variety of tools and resources used to navigate these and assist in the assessment, design, and implementation of OSS. One of the more powerful tools is geographic information system (GIS) data. ICGeoMap, is a publicly available online GIS tool that shows dozens of layers and attributes. It is a useful guide to understanding property conditions and constraints. Figure 5 is a screen shot of the ICGeoMap as an example of the important layers of information available to assist in planning and development of an OSS.

Figure 5 – Example of Island County's ICGeoMAP

One of the most significant compounding challenges for implementing OSS in Island County is with competing on-site development requirements including development setbacks from property lines, road easements, stormwater infrastructure), public health protection setbacks (water wells, water lines, surface water), and environmental setbacks (wetlands, tidal influenced areas). These setbacks restrict the area where wastewater infrastructure can safely be installed. In increasingly developed areas, it may be prudent to offer flexibility with sighting or routing wastewater infrastructure to better address housing needs

Regulatory Framework

One- and two-bedroom OSS have very few restrictions and rules outside of basic setbacks and criteria for drainfield soil and depth to groundwater. As noted earlier, OSS contribute to a significant percentage of nutrients from onsite wastewater management in Island County. Additional framework should be developed to further protect groundwater in the County.

County regulated Community OSS (COSS) will have three to up to nine three-bedroom housing units or up to fourteen two-bedroom units (up to approximately 29 total bedrooms). Current regulations in the Island County Code (ICC), specifically 8.07D, and 8.09.097, make implementing COSS very challenging. Specific code sections in the ICC have had a significant impact on the implementation of COSS. As a result of ICC updates in 2005, no new COSS have been constructed.

Similarly, only two new Large On-site Sewage Systems (LOSS), which are regulated by the WA DOH have been constructed since 2011, when the Washington Administrate Code (WAC) 246-272B – Large On-site Sewage Systems) was updated with very restrictive language. More restrictive/protective regulations have stymied the development of projects that would utilize a COSS or LOSS, including affordable housing projects.

One challenge to implementation of COSS are the lack of clear definitions and the use of similar and divergent language between the ICC and WAC. This causes confusion and makes understanding the intent and required direction difficult. For example, it is not clear what specific requirements are needed for a 'hydrogeologic site evaluation' outlined in ICC 8.09.097 and how it is different than the 'site risk survey' that is identified in the *WAC 246-272B*. *Another example is does a* nitrate balance required for all hydrogeologic site evaluations, and should they follow the 'Level 1 Nitrate Balance' guidelines outlined in *WAC 246-272B-03200*.

Another challenge for stakeholders that want to develop a COSS is that the ICC gives flexibility and power to ICPH staff without specific guidance. The ICC 8.09.097D states,

> *'A hydrogeologic site evaluation shall be required prior to project approval of projects identified by the health officer as having the potential for groundwater contamination and where best management practices will not adequately prevent groundwater contamination.'*

However, it doesn't clearly define any criteria for health officers to determine what defines *'potential for groundwater contamination'*. This lack of transparency for challenging for stakeholders. New language should be developed in ICC to help align or distinguish from requirements within the WAC. Below are a few specific sections that need clarity or significant changes.

ICC 8.07D.210 - Community and Large On-site Sewage Systems (LOSS)

Instead of defining criteria for COSS the ICC 8.07D.210 requires COSS to be designed in accordance with the state regulated LOSS program. This significant rule requires a site evaluation, design, maintenance, and management criteria as set forth in WAC 246-272B, which is outlined for community's generating up to 100,000 gpd, but it is inappropriate for systems managing less than 3,500 gpd. The requirements of designing a LOSS with the WA DOH are significantly greater than designing a COSS. This results in a project that is significantly more involved and costly due to administrative need, assessment, and design requirements.

WAC 246-272B - Large On-site Sewage Systems (LOSS)

Under the WAC LOSS guidance, a COSS project would require the completion of a Pre-Design Report, Site Risk Survey/Hydrogeological Investigation Report, Engineering Report, Design Drawings, Construction Specificaitons, and Operations and Maintenance Manual.

There is one particular code requirement that is most challenging in implementing new COSS projects. That is the *WAC 246-272B-03200 – Environmental Review – Site Risk Survey.* The Environmental Review section (5)(f) requires a "Nitrate screening balance" which often results in needing the system to meet stringent effluent TN reductions, which results in a costly system to both implement and maintain.

Furthermore, the WA DOH has prepared a set of instructions for preparing a "Level 1" nitrate balance and notes that the

> ..."*DOH uses the Level 1 Nitrate Balance as a 'screening tool' to identify LOSS which may have potential impacts to an unconfined or semi-confined surface aquifer. DOH may require a more comprehensive Nitrate Balance at sites where the Level 1 analysis indicates a potential moderate or significant impact to groundwater. In general, a moderate impact is an increase greater than 2 mg/L above background.*"

Contrary to how it is stated in the WAC, the Level 1 Nitrate Balance is not commonly used as a 'screening tool'. It is often used to benchmark or set the effluent limit for a wastewater discharge, resulting in difficult to achieve nitrogen reductions for COSS, especially with only being able to only use Washington State approved OSS treatment technologies (discussed later in this report).

Additionally, there are other LOSS requirements that also may not be appropriate for every COSS, including increased vertical separation. LOSS require:

- 24 inches minimum for soil types 2 thru 5, even with Treatment Level C and
- New permitting of LOSS with < 24 inches, regardless of treatment level.

It is appropriate to have a robust onsite wastewater framework to protect Island County's sole source aquifer, but simply requiring criteria used for a LOSS is problematic and overburdensome.

ICC 8.09.097 - Critical Aquifer Recharge Area Protection

CARA protection under ICC 8.09.097 requires that projects proposing a COSS in 'any' CARA protection zone must complete a hydrogeological site evaluation. However, there are three CARA categories that cover the entire county, shown in Figure 6. As per Section C of ICC 8.09.097, any COSS requires a hydrogeological site evaluation, imposing a significant barrier. It may be more appropriate to target high susceptibility areas and allow for more flexibility for responsible development in low and medium susceptibility areas

Figure 6 – Aquifer Recharge Areas

Having more flexibility doesn't preclude the ICPH from imposing more stringent criteria. Section D. of ICC 8.09.097 states, "*A hydrogeologic site evaluation shall be required prior to project approval of projects identified by the health officer as having the potential for groundwater contamination and where best management practices will not adequately prevent groundwater contamination*". This provision gives ultimate flexibility to the ICPH staff, however transparent guidance when to require would be useful to staff and the people concerned about transparency and fairness.

WAC 246-272A-01000 – Sewage Technologies

Under the WAC, the WA DOH requires that sewage treatment and distribution technologies be registered before any local health officer can permit the use of the technology:

(1) The department shall maintain standards and guidance for local health officers to permit sewage treatment and distribution technologies.
(2) Before the local health officer permits sewage technologies, the sewage technologies must be registered for use as described in this chapter, have standards for use as described or referenced in this chapter, or have DS&G (Department Standards & Guidance) describing sewage technologies uses as maintained by the department (WA DOH).

The WA DOH *List of Registered On-site Treatment and Distribution Products* is periodically updated as new technologies become registered or as technologies are removed, restricted, or suspended from use. The current list dated June 2025 can be found online at: https://doh.wa.gov/sites/default/files/2022-02/337-024.pdf.

Section 3 of the list provides a summary of both registered proprietary and public domain technologies, and their respective treatment level ratings. Treatment levels used in WAC 246-272A are not intended to be applied as field compliance standards. Their intended use is for establishing treatment product performance in a product testing setting under established protocols by qualified testing centers. Table 4 below presents the treatment levels, and the wastewater parameters and concentrations associated with each.

The *List of Registered On-site Treatment and Distribution Products are a great resource for onsite wastewater designers, however there are several issues that are challenging for OSS and COSS that have advanced nutrient removal requirements*.

(a) There is a lag time with getting newer, innovative technologies on the approved list.
(b) There are no systems that have been issued formal approval to achieve a final effluent concentration lower than 30 mg/L (greater than 50% total nitrogen (TN) reduction, even though the typical TN removal of these systems ranges between 55% and 80% depending on the system).
(c) There is no provision or allowance for adding additional components to a Registered OSS (proprietary or public domain) to meet more stringent effluent TN limits.

Table 4 – Washington State Treatment Levels for Registered On-site Sewage Treatment Technologies

AHJ	Treatment / Dispersal Category: Method / Reuse	Regulated Parameters										
		$CBOD_5$[1] (mg/L)	TSS[2] (mg/L)	O&G[3] (mg/L)	Nitrate (mg/L)	TN[5] (mg/L)	E. coli (cfu/100 mL)	Fecal Coliform (cfu/100 mL)	Total Coliform (cfu/100 mL)	Turbidity (NTU)	TDS (mg/l)	NOTES
County Department of Health	**A**	10	10	----	----	----	----	----	----	----	----	based on soil type & vertical separation
	B	15	15	----	----	----	----	----	----	----	----	
	C	25	30	----	----	----	----	----	----	----	----	
	BL1	----	----	----	----	----	126	200	----	----	----	
	BL2	----	----	----	----	----	----	1,000	----	----	----	
	BL3	----	----	----	----	----	----	50,000	----	----	----	
	E	228	80	20	----	----	----	----	----	----	----	
	N	----	----	----	----	30	----	----	----	----	----	Site Specific
Department of Ecology	**Spray Irrigation:** Reclaimed Class B	40* 25**	45* 30**	----	N/A	N/A	----	23*	----	N/A	----	Seasonal Limitations
	Spray Irrigation: Reclaimed Class A	40* 25**	45* 30**	----	15* 10**	15*	----	2.2*	----	0.2*	----	Seasonal Limitations
	Spray Dispersal	30**	30**	----	10	----	----	----	1.0	----	----	
	Infiltration Basins	30**	30**	----	10	----	----	----	1.0	----	500	

[1] – 5-Day Carbonaceous Biochemical Oxygen Demand.

[2] – Total Suspended Solids

[3] – Oil & Grease

* – Weekly Average

** – Monthly Average

Effluent Limits

Site conditions and context should dictate wastewater effluent limits. Areas that need more protection or have greater health and safety risks (such as high nitrate levels in groundwater) should require higher nitrogen reduction. Simply stating that any COSS should follow the strict criteria of a LOSS (as the ICC 8.07D.210 currently does) puts a disproportionate burden on some smaller development projects.

Table 3 in the Understanding section of this Report estimates the pounds of nitrogen contributed by all on-site sewage systems (OSS, COSS, LOSS, and spray irrigation) in Island County. It shows that the vast majority (over 96%) of nitrogen from onsite wastewater inputs come from OSS (1-2 unit residential systems) and less than 1% of all nitrogen inputs from onsite wastewater come from COSS. Contrary to the actual nitrogen load discharged in Island County, COSS regulations and guidance were disproportionately restrictive compared to OSS. It should be noted that almost no COSS have been permitted since 2005 and only two LOSS have been permitted after 2011, when regulator codes became more restrictive.

The update to ICC 8.09.097 (effective June 2005), ICC 8.07D (effective July 2007), and WAC 246-272B (effective July 2011) are some of the most significant barriers to development of small housing projects that would utilize COSS and LOSS, including supportive housing in unincorporated Island County.

There are several sections of the ICC 8.09.097 that provide flexibility for ICPH staff to be more protective of human health and safety and environmental concerns, given known information.

> Section E. of ICC 8.09.097
> "*Based on available information including that provided by the applicant pursuant to the requirements of this section, the health officer shall have discretion to impose conditions designed to prevent degradation of groundwater quality or quantity. Such conditions may include determining background water quality, quantity, and groundwater levels prior to approval and development of groundwater quality and/or quantity management plans. All conditions shall be based on all known, available, and reasonable methods of prevention, control, and treatment.*"
>
> Section H.5. of ICC 8.09.097 states:
> "*Other projects or activities as determined by the health officer.*"

However, the ICC lacks a framework that prioritizes need and a transparency to communicate with stakeholders. A framework should prioritize where and when greater assessment and design requirements are appropriate. A balance framework should also provide when stricter onsite wastewater effluent limits are needed, such as for projects on sensitive sites, in high susceptible critical aquifer areas, and/or where there are elevated nitrogen levels in the groundwater.

Nitrogen Reduction

Human urine is the primary source of nitrogen in domestic wastewater. The concentration of nitrogen is affected by how much wastewater dilutes the nutrient. Newer water efficient buildings will typically have higher concentrations of nitrogen than older constructed projects. The TN concentration in primary (septic) tank effluent is typically between 30 and 80 mg/L. A commonly accepted average TN concentration is 60 mg/L, with a typical wastewater discharge of 140 gallons per day. Nitrogen is primary tank effluent is primarily (>80%) in the form of ammonium-nitrogen, with the rest as organic nitrogen. The exact concentration can vary depending on several factors including type of dwelling, population density, building program (day use versus overnight), age of construction, food service, and presence of water conditioning equipment. Water conservation measures, such as flush strategy (standard, low flow, dual flush, vacuum flush) can heavily impact total flow and thus nitrogen concentrations.

Removal Processes

Nitrogen is mostly removed from wastewater in a specific two-step process. First, in an aerobic environment (in oxygen rich conditions) beneficial bacteria nitrify the ammonium-nitrogen converting it to nitrite and then nitrate-nitrogen. Nitrification occurs after most of the biochemical oxygen demand (BOD) has been depleted by other aerobic microbes. If there is only just enough oxygen to remove the BOD, nitrification will not occur or will be incomplete.

The second step in the removal of nitrogen is in an anoxic (i.e. no free oxygen) environment. Different beneficial bacteria convert nitrate to nitrogen gas, in a process called denitrification. Nitrogen gas mixes with the atmosphere which is 78% nitrogen. The denitrification process requires a carbon source to fuel the bacteria; without a carbon source, denitrification will not occur or will be limited.

Removal in OSS

A basic OSS with primary tank and drainfield, does little to remove or reduce nitrogen. Very little nitrogen (<10%) is removed in the septic tank, since most of the incoming nitrogen is in a liquid form (i.e. there is little particulate nitrogen to settle out), and since the septic tank is an anaerobic environment (i.e. no free or bound oxygen). Once septic tank effluent is introduced into a drainfield, the soil (if not saturated) can provide an aerobic environment to nitrify ammonium from the septic tank effluent. The shallower the drainfield the greater the potential for oxygen to assist in with the nitrification process. Septic effluent will generally nitrify some in the soil in/under the drainfield, however the longer it takes the deeper the wastewater travels, Typically the deeper into the soil profile, the less carbon sources are available, limiting the potential to denitrify, and thus limiting the overall reduction of TN from septic tank effluent. Nitrate-nitrogen is very soluble and can make its way deep into the ground and can eventually elevate nitrogen concentrations in groundwater. The removal of nitrogen in the ground is highly dependent on the type of soil and the depth of unsaturated conditions above the groundwater.

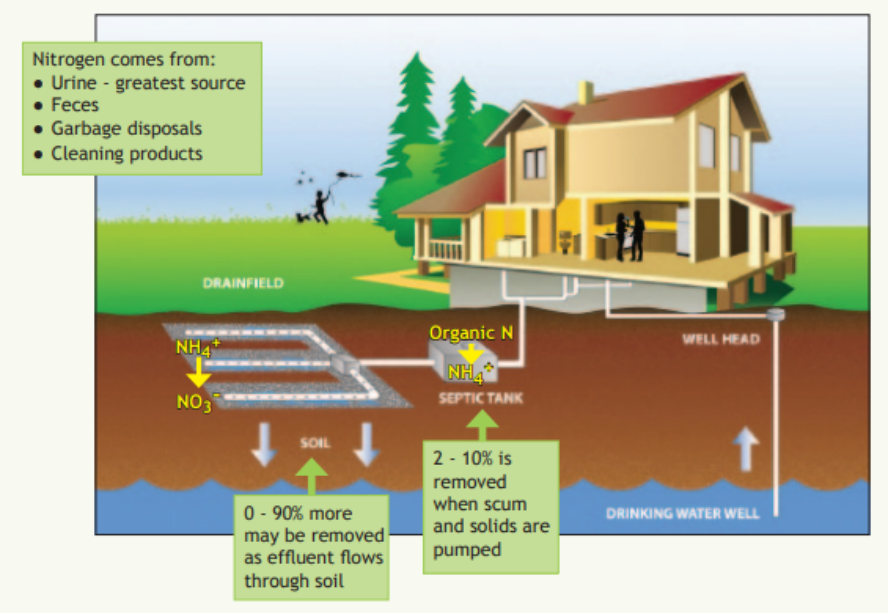


Figure 7 – How do on-site systems treat nitrogen graphic from WA DOH 337-142 August 2014

Treatment Technologies

There are main options to utilize treatment technologies to enhance nitrogen reduction from primary tank effluent. Typically placed between the primary tank and drainfield, most OSS treatment technologies are focused on creating an aerobic environment to reduce BOD and complete the first step in the nitrogen removal process, nitrification. There is a wide range of treatment systems on the market that do this, typically by introducing oxygen to wastewater (with a blower) or recirculating wastewater over/through an attached growth media in an aerobic environment. Soil is the drainfield can then perform some denitrification functions, however with the lack of carbon and anoxic conditions, nitrogen removal will be limited.

As mentioned previously, any treatment system installed in Washington state must be registered/approved by the WA DOH. Table 5 outlines twelve systems that are currently approved to meet Treatment Level N (minimum 50% reduction, with effluent TN concentration less than 30 mg/L for typical residential strength wastewater). None of these systems are approved to be used in Washington State where higher nitrogen reduction is required.

WA DOH often looks at systems that meet the National Sanitation Foundation (NSF) and American National Standards Institute (ANSI) Standard 245 - Wastewater Treatment Systems – Nitrogen Reduction to determine if a technology merits inclusion on the states registered list. The standard specifically evaluates the nitrogen reduction performance of residential wastewater treatment systems. To pass, the average effluent must have less than 50% TN in the average influent concentration. Testing protocols are rigorous, involving a minimum of 26 weeks of evaluation, including design flow dosing and various stress tests. Technology companies often pay $80,000-$100,000 to NSF for testing and certification. This typically limits certification to large companies with a narrow definition of the system, as each change in the system would require a new certification. As such, public domain technologies are not typically certified by NSF.

Table 5: Approved Treatment Levels and Effluent Quality for Nitrogen-Reducing Systems

		Total Nitrogen Reduction Performance [1,2,3]				
System Name	**Certification**	**Florida Testing**	**La Pine Testing**	**Maryland BAT Testing**	**Massachusetts Testing**	**New Zealand Testing**
Orenco® AdvanTex® AX20	NSF 245,	-	17.0 mg/L TN 71.6%, (Mode 3 [MLE] Config.)	17.0 mg/L TN 71%, (Mode 3 [MLE] Config.)	Approval for 19 mg/L	13 mg/L TN 82%, (Mode 3 [MLE] Config.)
Orenco AdvanTex® AX20RTN	NSF 245	55% (Mode 1)	-	14.5 mg/L TN 76%, (Mode 3 [MLE] Config.)	Approval for 19 mg/L	-
Bio-Microbics® BioBarrier® MBR-N	NSF 245,	79%	-	-	-	-
Aquapoint Bioclere™	ETV	-	-	-	Approval for 25 mg/L	-
Clearstream® Wastewater Systems Clearstream 500D/DA	NSF 245	52.9% / 54.1%	-	-	-	-
Infiltrator™ ECOPOD-N,NX Series	NSF 245	53% (N); 80% (NX) with MLE	-	-	-	-
Norweco® Hydro-Kinetic® 600 FEU	NSF 245	-	-	-	-	-
Bio-Microbics® MicroFAST®	NSF 245	55%	36.4 mg/L TN 39.9%	-	Approval for 19 mg/L TN	25 mg/L TN 67%
Enviro-Flo, Inc. NuWater BNR	NSF 245	-	-	-	-	-
Bio-Microbics® RetroFAST® 0.375	NSF 245, ETV	-	-	25.4 mg/L TN 58%	-	-
Bio-Microbics® SeptiTech - STAAR® (D-series)	NSF 245, ETV	14 mg/L TN 64% with MLE	-	20 mg/L TN 67% with MLE	Approval for 19 mg/L TN with MLE	-
Singulair 960 TNT	NSF 245	68%	-	27 mg/L TN 55%	-	-

System Name	Certification	Total Nitrogen Reduction Performance [1,2]
Recirculating Gravel Filter (RGF) (Public Domain)	No specific NSF certification mentioned	The Washington State Dept. of Health (WA DOH) and University of Washington conducted a grant-funded study of a Recirculating Gravel Filter (RGF) followed by a vegetated woodchip denitrification bed (VWDB) in 2012 / 2013. The performance for the 12-month verification testing period was as follows: RGF Only: Effluent TN Concentration of 23.9 mg/L; 51% TN Reduction RGF with VWDB: Effluent TN Concentration of 4.0 mg/L; 92% TN Reduction Both RGF and RGF with VWDB are registered for the same nitrogen reduction Treatment Level N (50% reduction) in Washington State
RGF with VWDB (Public Domain)	Testing followed ETV and NSF Protocols	

[1] – Mean effluent concentration, or as otherwise noted.

[2] – Percent total nitrogen (TN) reduction from either measured septic tank effluent (STE) TN or commonly accepted typical STE with TN of 60 mg/L.

[3] – Process configuration tested, if reported. "MLE" refers to "Modified Ludzack-Ettinger" where nitrified effluent from the aerobic process is recycled back to the septic tank for denitrification.

As presented in Table 5, the TN reduction performance of the Treatment Level N systems ranges from a little more than 50% to about 80%. The higher performing systems utilize the Modified Ludzack-Ettinger (MLE) process that recycles nitrified effluent from the aerobic process upstream to the primary tank. The raw wastewater coming into the primary tank provides the carbon source for the denitrification process. The MLE process details can vary treatment performance, Generally, an increase in recirculation can improve performance. Typical recirculation to daily flow ratios are:

- 1:1 = 50% TN reduction
- 2:1 = 67% TN reduction
- 3:1 = 75% TN reduction
- 4:1 = 80% TN reduction

However, the more flow recirculated the greater chance to suspend solids that have settled out in the primary tank and the more likely the primary tank ecosystem can shift from the anoxic conditions needed for denitrification to a more aerobic tank limiting the process. These challenges can be mitigated with an increase in primary tank size or with an additional anoxic reactor tank. Additionally, the variable of the incoming carbon content, temperature and alkalinity of wastewater in the system may alter treatment performance. While achieving a 50% -60% nitrogen reduction is relatively easier, higher reduction generally needs greater care and attention. Periodic investigation and assessment of the ongoing conditions and treatment process are required.

There are common wastewater techniques and tools used to manage some of the variable and uncertainty when higher levels of nitrogen reduction are required. These include additional recirculation, alkalinity feed, carbon feed, real-time water quality sensors, flow meters, 'smart' feedback control systems, and remote monitoring. Another useful tool for higher nitrogen reduction is adding an additional carbon rich denitrification reactor after the Treatment Level N registered system. These include a subsurface constructed wetland or woodchip reactor. Currently, one specific type, a vegetated woodchip denitrification bed (VWDB) is allowed to be used and that is only in combination with a recirculating gravel filter (RGF). These types of additional reactors could be used in combination with any Treatment Level N registered system.

Additional Treatment through Dispersal

In addition to the use of Treatment Level N technologies, shallow distribution drainfields (i.e. shallow trenches, subsurface drip), at-grade, and above-grade drainfields (sand mounds) can enhance TN reduction. Jurisdictions that have been successful at implementing comprehensive nitrogen reducing strategies recognize the contribution of shallow dispersal systems. Microbial diversity and carbon content are both higher in the top 12 inches of the soil profile. Thus, it is more suited for denitrification than in deeper soils. In addition, treated effluent is dispersed closer to surface with more the root zones of the vegetative cover, which may allow more nutrient uptake.

Maryland Department of the Environment (MDE) allows nitrogen reduction credit for both treatment and enhanced dispersal systems. The MDE nitrogen-reducing Best Available Technology (BAT) classification system designates BAT Class IV systems as on-site sewage disposal systems that are installed above, at, or just below (12-inch maximum depth) existing grade. These systems are

considered capable of reducing effluent TN by 30% where native soils within the top 12 inches of the soil profile are finer than sand and loamy sand (i.e. in Washington State Type 4, 5, or 6 soils). Examples of acceptable dispersal systems are elevated sand mounds, at-grade sand mounds, and shallow pressure distribution (i.e. shallow trenches or subsurface drip systems). The MDE regulations allow for a Class I treatment system (approved for 50% TN reduction) to be paired with a Class IV dispersal system (approved for 30% TN reduction) for a combined greater than 75% TN reduction. In Washington State, the proprietary OSCAR could be considered an 'above-grade' system since the native soil is prepared similar to a sand mound (i.e. plowed along the topographical contour and not removed).

Washington State has allowed a similar TN reduction system as documented in the Subsurface Drip System RS&Gs (July 2024 version), however the WA DOH has reported that this additive reduction (i.e. Treatment Level N plus additional TN reduction credit through shallow dispersal) will no longer be considered with the new WAC 246-272A update. It is not understood why the WA DOH plans to not consider this useful additive reduction accounting. Keeping the reduction credit would give jurisdictions like Island County a useful tool to require and account for greater level of nitrogen reduction beyond Treatment Level N.

Sunny View Village, a 26-unit affordable housing project in Freeland, is an example of this approach. Their LOSS has nitrogen removal credit for its dispersal approach. Constructed in 2015, it utilizes both enhanced and advanced TN reduction methods (MLE process with alkalinity feed, and post-anoxic denitrification with carbon feed). It also has a subsurface drip system (SDS) drainfield for dispersal, which received soil denitrification credit from WA DOH. Figure 8 shows an aerial photo of the Sunny View Village LOSS site including SDS drainfield. The green grass over the driplines is a clear indication of the benefits with shallow dispersal.

Figure 8 – Sunny View Village, LOSS with Subsurface Drip System Drainfield, Freeland, WA

In-Ground Nitrogen Reducing Biofilters

In-Ground Nitrogen Reducing Biofilters (INRB) are a public domain technology that has been researched and subsequently approved for use in the State of Florida. It is similar to a bottomless sand filter commonly used in the State of Washington but uses a 12-inch depth bottom layer of soil and woodchip mixture below the sand layer as a denitrification zone. The 18-inch depth top sand layer provides both BOD_5 reduction and nitrification. The soil-woodchip layer provides a good denitrification environment. These systems have demonstrated about 65% reduction of TN from primary tank effluent.

Currently, Washington State does not list INRBs as a public domain OSS nitrogen reduction technology. Based on Florida's performance monitoring, it could be considered a Washington State Treatment Level N technology. The WA DOH needs to develop a Recommended Standards & Guidance (RS&G) document for INRB and other public domain technologies.

Phytoremediation Technologies

Phytoremediation is the use of plants and soil to remove or reduce contaminants from water. It has been successfully used in both stormwater and wastewater treatment, including nitrogen reduction.

A phytoremediation (phyto) pilot project was installed at the Coupeville wastewater treatment plant (WWTP) on Whidbey Island in 2011 and monitored from 2011 through 2014. Fifteen (15) test boxes were developed to examine treatment capability with WWTP effluent. Groups of three boxes were filled with a specific soil mixture and planted with hybrid poplar and willow tree shoots. A control group was arranged with three boxes filled with only perlite and no vegetation. The boxes were dosed periodically with final effluent from the WWTP. WWTP effluent (phyto test box influent) and test box effluent water quality were analyzed from each test group. Significant nitrate reduction was observed from all test boxes planted with trees through all four seasons. WWTP effluent nitrate concentration ranged from 4.5 mg/L to 13.5 mg/L, while significant reduction occurred in phyto test boxes, with discharge typically ranging from non-detect (ND) to 3 mg/L.

It is not known if any phytoremediation projects have been used for on-site wastewater treatment in Washington State. Phytoremediation could be incorporated with subsurface drip system (SDS) to significantly enhance nitrogen removal performance, if allowed to be used for nitrogen reduction credit. A pilot project to incorporate phytoremediation would provide valuable information for potential use of this technology for reducing TN from OSS.

Resource Recovery / Source Separation

On April 16th 2024, the WA DOH confirmed its intent to develop a new chapter call the WAC 246-275 On-stie Nonpotable Water System, using the National Blue-Ribbon Commission for On-site nonpotable Water System model rules. Until those rules are complete, there are limited opportunities to utilize resource recovery techniques.

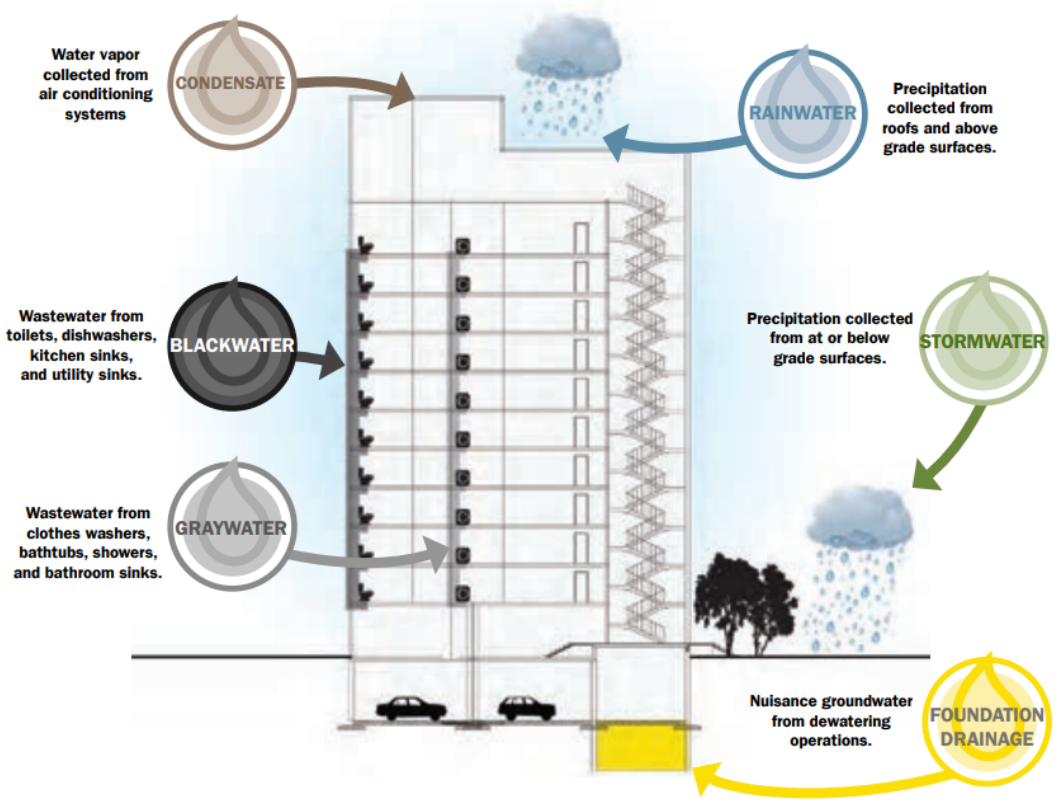


Figure 9 – Alternative Water Sources Produced in Buildings, from Onsite Water Recycling by SFPUC

Limited greywater reuse and source separation of wastewater have regulatory pathways within Washington State. These strategies offer significant value for communities looking to improve onsite wastewater infrastructure, nutrient management, and resource conservation. By separating different wastewater streams, such as urine, blackwater, and greywater, it becomes feasible to target specific components for resource recovery and reuse, leading to a more circular economy.

Separation of greywater

Separating greywater creates two opportunities. First, greywater with its lack of carbon and nutrients, is relatively easy to manage for quick reuse. If greywater is free of trash and debris and is kept from going anoxic it is generally safe to reuse for irrigation and groundwater recharge. Since July 2011, the State of Washington allows for subsurface irrigation with greywater under Chapter 246-274 WAC. Second, it reduces the volume of wastewater generated and thus the need for it to be managed in an OSS, commercial OSS, or Community OSS.

Washington defines three types (tiers) of greywater systems with clear design and management requirements outlined in Table 6. For residential projects greywater separation can reduce up to 40% of a typical wastewater flow. With less flow going to the OSS, wastewater strength will be higher but wastewater will move through the treatment system more slowly which improves treatment performance. However, it does not reduce the size or space needed to treat a project's design flow of wastewater, as greywater can only be used during the growing season, and full treatment capacity is needed during colder months.

Table 6: Greywater Design and Management Requirements

Type	Source of Greywater	Storage	Quantity	Treatment & Distribution
Tier One	**Light Greywater** ▪ Lav/Bathroom Basins (sinks) ▪ Showers ▪ Bathtubs ▪ Clothes washing machines	None	Less than 60 gallons per day per system - limit 2 per building	No treatment - gravity (Exception: Treatment is required when used in a public location such as school, church, or park)
Tier Two	**Light Greywater**	< 24 hours per day	Less than 3,500 gallons per day	No treatment - even distribution (typically by pressure)
Tier Three	**Dark Greywater** ▪ Nonlaundry utility sinks ▪ Kitchen sinks & dishwashers ▪ All greywater that has NOT come in contact with domestic wastewater	No limit	Less than 3,500 gallons per day	Treatment Required - even distribution (typically by pressure)

Separation of toilet waste

Similar to source separating greywater, separation of toilet waste, usually through the inclusion of composting toilets reduces wastewater needing to be treated by an OSS. Advancements in technology to compost toilet waste and the improvement of the user experience have increased the implementation of composting human waste. Most 'composting toilets' are flush toilets (either foam flush or vacuum). The collection system conveys toilet waste to a sealed compost chamber. The compost chamber is ventilated resulting in a slight negative pressure to keep the compost pile aerobic and free of odor.

Two waste streams are generated from modern composting toilet systems – composted solids and leachate. Leachate includes excess moisture and a liquid byproduct of the digestion of compost and needs to be properly managed, typically by draining to an OSS. Studies completed by Biohabitats of composting toilet leachate from modern composting systems show a significant reduction of the nutrient content; 50% reduction of phosphorus and 75% reduction of nitrogen

compared to hydrolyzed urine. Furthermore, through leachate recirculation process, half of the remaining nitrogen is nitrified resulting in greater potential for ultimate nitrogen reduction when excess leachate drains to the OSS. Thus, the inclusion of 'composting toilets' in a development can alone help an OSS achieve Treatment Level N effluent.

Barriers to the separation of toilet waste include a smaller service provider pool with different operation and maintenance tasks from traditional OSS. While it is understood, from a regulatory perspective, how to manage composted material from a modern human waste composting process, it is still a relatively young industry with a small number of technical experts and service providers.

Separation of urine

Urine diversion is gaining interest from communities looking to reduce nutrient input to surrounding water resources and organizations looking to recover valuable nutrients. Most commonly, source separation of urine occurs as drainage from urinals, although source separating toilets allows for a greater potential of separation and/or recovery. Similar to other source separation techniques, diverting urine reduces volume and more importantly reduces the strength of wastewater OSS need to treatment and disperse. Nearly 80% of all nutrients excreted from humans are from urine.

While the details of the diversion and collection can be challenging many barriers have been taken down as regulatory understanding has improved. Washington State has adopted the 2023 plumbing Water Efficiency and Sanitation Standard (WE Stand) reach code, from the International Association of Plumbers and Mechanical Officials (IAPMO). The 2023 WE Stand includes several specific definitions of urine which allow for greater flexibility in management and reuse.

- **Sanitized Urine.** Raw urine which has been treated and is therefore classified as a fertilizer and/or an agricultural amendment. Leachate of less than 3 percent solids which has been treated and is therefore classified as a fertilizer and/or an agricultural amendment.
- **Stored Urine.** Raw urine, which is collected for beneficial use, is biologically active, and is not a biosolid or part of a private sewage treatment system
- **Raw Urine.** Urine which has minimal contact with biofilms, feces, or similarly contaminated materials. Fresh urine is subject to biochemical reactions which are difficult to control.

Additionally, Chapter 6 - ECOLOGICAL-SANITATION: COMPOSTING TOILET AND URINE REUSE SYSTEMS of WE Stand outlines design and management guidance for Urine Diversion Systems. Approved methods of treatment include:

- retention of stored urine without addition for six months before usage,
- direct application to the compost processor, or through an approved nutrient management plan (NMP) meeting fecal coliforms not exceeding 2.2 CFU/100 mL, or as determined by the Authority Having Jurisdiction,
- alkaline treatment, or
- where urine is heated for at least 15 seconds and not more than 30 minutes,

While, collection, storage, and treatment options are understood, the larger concern or question is specifically what to do with the resource once it is stabilized, treated, or processed. Few supply chains are developed or active to bring recovered nutrients from urine to market. The PAE Living Building in Portland Oregon captures urine from waterless urinals in the five-story office building. Captured urine is distilled (heated for at least 15 seconds) producing an ammonium bicarbonate condensate. The condensed nitrogen rich solution is bottled and sold in a dozen retail locations in the Portland area. The recovery process removes 98% of the nitrogen from the building's wastewater stream.

Another management alternative for source separated urine could be achieved through the use of urine only storage tanks with a pump and haul approach. Watertight tanks would be located at individual homes or small developments in areas with nitrogen concerns. Since urine is a small fraction of the total wastewater volume, these could be pumped and hauled on an infrequent basis (i.e. annually or every other year. This higher strength waste would need to be hauled to Brightwater WWTF (Woodinville) or Everett WPCF (Everett) for processing or could be taken to a nutrient recovery facility or farm for direct reuse.

Figure 10 – Images from a urine recovery project for direct fertilizer application in Vermont by Rich Earth Institute

Summary of Alternatives

While several Treatment Level N technologies were presented in this section with performance metrics based on controlled testing, a number of other alternatives approaches have been presented that may provide equal or greater levels of TN removal. The key alternatives discussed in this section are summarized in Table 7.

Table 7. Summary of alternatives to Treatment Level N technologies for TN removal

Alternative	Typical TN reduction[1]	Feasibility	Relative cost[2]	Practical use case
Shallow & above-grade dispersal fields	~30% by dispersal alone; >75% when paired with N treatment unit	Credited in MD	Low-moderate increment over standard drainfield; minimal added O&M	Sites that need advanced treatment
In-Ground Nitrogen-Reducing Biofilters (INRBs)	~65% (sand nitrification layer, woodchip denitrification layer)	Approved in FL	Moderate capital (sand, woodchips) and O&M (woodchip replacement)	Where a supplemental treatment system is impractical
Phytoremediation with subsurface drip	~50% after vegetation establishes	Successful pilot; needs pilot data	Low planting cost; land cost TBD; low O&M	Large / communal lots
Greywater separation and reuse	Reduces flow but does not significantly increase N removal. Improves other treatment components by reducing flow.	Allowed statewide	Low-moderate capital (distribution, mulch basins, dual plumbing)	New homes, eco-developments
Composting toilet systems	~80% TN diverted with full leachate containment	Commercial systems available; lack of service providers	Moderate equipment & offsite solids/ leachate handling	New homes, parks, small COSS, eco-developments
Urine diversion	~65% TN diverted through storage and hauling	Supported by 2023 IAPMO WE-Stand	Moderate fixtures, urine drain & urine storage tank; annual pump out	Existing and new lots with multiple constraints

[1] – Percent reduction refers to total nitrogen (TN) removal relative to septic tank effluent except as noted.

[2] – Relative to a conventional OSS drainfield.

Onsite Wastewater Best Practices

The following section is a review of how other jurisdictions within and outside of Washington State regulate onsite wastewater systems. Jurisdictions outside of Washington State have varying authority in terms of size (gallons per day) and regulatory oversight than Island County, however, each reviewed offers insight due to similar conditions (i.e. coastal communities, communities with elevated nitrogen levels, communities with increasing development pressure.

Puget Sound Communities

The management of OSS across the twelve counties bordering the Puget Sound is a critical component of regional environmental health and water quality protection. While a foundational state mandate from the Washington State Department of Health (DOH) establishes a baseline for OSS oversight, significant variations exist in local implementation and enforcement management programs. There is a general consistency in state-mandated design and management of OSS, inspection frequencies, professional certification, and the critical role of local management plans in driving localized regulatory stringency However, disparities in specific local code language result in some counties having significant challenges to implementing COSS, while other counties are much more supportive,

Several Puget Sound region counties' regulations and management systems were reviewed and analyzed. Counties with similar codes to Island County experience some of the same results, with very few Community OSS (COSS) being implemented. Counties with code and guidance that are more flexible have seen an increase in COSS implementation. Outlined below are some of the specific similarities and differences.

Snohomish County

Snohomish County, similar to Island County, requires all COSS to comply with WAC 246-272B – Large On-site Sewage Systems including be managed and maintained by a public agency as defined in RCW 39.34.020 and WAC 246-272B-07000. Therefore, each COSS must act as the management authority or act as a third-party trust, if management is performed by a private entity. As such, very few COSS have been implemented in Snohomish County.

Snohomish County defines COSS as any OSS having more than one service connection and where services are located on more than one parcel of land. Thus, it provides flexibility for single service connections (like many supportive housing developments) by giving multiple family apartment projects a more straightforward permit pathway under county guidance. Multiple family developments are classified as 'commercial' systems and thus follow normal OSS guidance. Snohomish County currently does not require nitrogen reduction for OSS or Commercial OSS.

Thurston County

Thurston County defines COSS similar to Island County with a few exceptions. OSS with daily flow as low as 600GPD within the city limits or urban growth areas of Lacey, Olympia or Tumwater must follow COSS guidance. Thurston County does give clear guidance when proposed or expanding

development using OSS are required to produce a hydrogeological report with a groundwater nitrate balance. Such as, when a project:

- is within a Critical Aquifer Recharge Area as defined by the Thurston County Critical Areas Ordinance, except for projects with low densities of one (1) unit per acre or less for single-family residential developments, wastewater flows less than 450 gallons per acre per day, or is constructed on no more than two lots;
- will have a design flow generating wastewater of 1,000 GPD (or greater) within a Critical Aquifer Recharge Area regardless of the overall density of the project;
- whose size or scope represents a potential risk to water resources regardless of wastewater treatment method used.

Ambiguous guidance around what constitutes the size or scope that would trigger 'potential risk' is confusing and opaque. Thurston County has confirmed few COSS exist due to the County's restrictive COSS regulations.

Jefferson County

Jefferson County requires COSS to be designed in accordance with WAC 246-272A and Jefferson County Code (JCC) Chapter 8.15, contains additional requirements. One of the more significant requirements is that all COSS is must have a public management entity, as defined in WAC 246-272B-01100 and shall be approved by the Jefferson County Health Department. The JCC states, "For the avoidance of doubt, a homeowner's association does not satisfy the requirement in this subsection for the management of a Community OSS." Jefferson County officials have reported that the public management entity requirement has resulted in few COSS applications. Jefferson County, similar to Snohomish County offers more flexibility for larger single owner residential developments, considered a Commercial OSS (such as supportive housing developments) with design flows of up to 3,499 GPD.

For nitrogen reduction, Jefferson County has established Critical Aquifer Recharge Area (CARA) designations for areas Susceptible based on Geology (SUSC) and Special Aquifer Recharge Protection Area(SARPA). Where a new proposed or existing system expansion lies within a CARA and on a parcel less than one acre per unit volume of sewage (450 GPD) and with the proposed drainfield located in Type 1 or 2 soils, a Treatment Level N system (50% reduction) is required. This approach is straightforward as it allows an OSS designer or professional engineer to select an WA DOH approved technology to meet this requirement. There are no additional requirements for a hydrogeological evaluation or nitrate balance. As a result, Treatment Level N technologies are often used within these CARA protection areas.

King County

King County OSS code (King County Board of Health – Title 13 – On-site Sewage) defines Community OSS as any OSS utilizing subsurface disposal and which serves two (2) or more single-family dwellings that are under separate ownership or that are located on separate lots; or serves two (2) or more commercial facilities that are under separate ownership or that are located on separate lots. A single-owner development such as a multi-family apartment building is considered a Commercial OSS, not a Community OSS.

The King County OSS code does not require a Community OSS proposal to follow the requirements in WAC 246-272B - LOSS for the design, however it does require Community OSS to be managed by a public entity. A single-owner multi-family (or similar) Commercial OSS is not required to be managed by a public entity; a King County-certified OSS O&M provider may provide those services. As a result of these requirements, Community OSS are not common in King County due to the public entity management requirement, however Commercial OSS' consisting of a single owner multi-family building are more common.

King County Critical Aquifer Recharge Area Development Standards (Title 21A.24.316) do not allow OSS on lots less than one (1) acre) in a CARA, without use of an approved WA DOH Treatment Level N technology. This approach is straight-forward because it allows an OSS designer or professional engineer to select an approved technology and does not require a hydrogeological evaluation or a nitrate balance.

King County has 85,000 OSS, 37,000 of them are in urban areas. The King County Climate Equity Capital Pool Program has helped 24 homes connect to municipal wastewater treatment plants (WWTP) in 2024. While converting OSS to sewer can be an effective way to reduce nitrogen inputs to groundwater, it is a fraction of the need and just moves groundwater nutrient pollution to a surface water discharge.

Pierce County

Pierce County Environmental Health Code, Chapter 2, Section 14 – Community System Management outlines comprehensive management, monitoring, and maintenance requirements for Community OSS. Key components with detailed sub-sections, include:

- Designation and Approval of Management Entity
- Management, Monitoring and Maintenance Contract Required
- Recorded User Agreement and Financial Assurance Plan

The Code states that COSS management and oversight shall be provided by an entity approved by Pierce County officer and **does not** require a public management entity. Pierce County has accepted that the minimum land area requirements outlined in the WAC 246-272B provides adequate protection of groundwater from OSS nitrogen inputs. It is rare for the Pierce County Health Department to require a hydrogeological evaluation or nitrogen reduction for a Community OSS. As a result, Community OSS are common in Pierce County and perhaps the most common of all Puget Sound counties.

Whatcom County

Whatcom County does not require any COSS to use LOSS guidance or standards. However, a COSS serving multiple property owners with a common drainfield does require a public entity to own and manage the COSS in perpetuity. A COSS serving multiple residential housing units on a single-owner parcel does not have to be managed by a public entity.

Whatcom County currently has no specific requirements for any OSS or COSS proposal to implement nitrogen reduction if in a Critical Aquifer Recharge Area or wellhead protection zone. As a result, single owner Community OSS are more common in Whatcom County.

Kitsap County

Kitsap County OSS Code (Kitsap Public Health Board Ordinance 2025-01 – Onsite Sewage System and General Sewage Sanitation Regulations) does not require a COSS to be designed according to LOSS requirements or standards; the design only has to follow the Kitsap County OSS Code. Different than most Puget Sound region Health Departments, Kitsap County Health District is organized as an independent agency from County government, as such they have more flexibility and resources. They are well staffed and are recognized as having one of the best OSS management, monitoring and maintenance programs in the State of Washington.

Kitsap County OSS Code Section 10.F.9 outlines comprehensive management, monitoring, and maintenance requirements for Community OSS without requiring a public management entity. Key components include:

- Designation and Approval of Management Entity
- Management, Monitoring and Maintenance Contract Required
- Recorded User Agreement and Financial Assurance Plan
- Notice on Title to Each Parcel Connected to the Community OSS to Notify Parcel Owner that Parcel is Connected to Community OSS and that Management, Monitoring, and Maintenance Program is Required

This management and oversight framework provides comprehensive documentation from an entity approved by a Kitsap County Health Officer. This allows for a robust management, monitoring, and maintenance program for COSS in perpetuity, while not requiring a public management entity. As a result, Community OSS are common in Kitsap County .

Kitsap County currently has no requirement for any OSS or COSS project to implement nitrogen reduction, regardless of if in a Critical Aquifer Recharge Area or wellhead protection area.

San Juan County

Similar to Island County, San Juan County is a Sole Source Aquifer community. However, it does not have requirements for nitrogen reduction. Furthermore, San Juan County does not have a definition or additional design criteria for Community OSS. The County requires that ownership and management is documented by a HOA or similar, and that the entity maintains a contract with a county-certified OSS O&M provider in perpetuity; a public management entity is not required. As a result of this approach, San Juan County does have several Community OSS, some of which were built as affordable housing projects.

Two examples of small affordable housing projects on community OSS are the 8-home communities of Rocky Bay and Leeward Cove on San Juan Island. The two communities were built between 2006-2007, under the former Homes for Islanders low-income housing program. These clustered single family home communities were each permitted on a single-owner common parcel. Each community utilizes individual on-lot STEP (Septic Tank Effluent – Pump) tanks that convey septic tank effluent to a central aerobic treatment unit (ATU). Septic tank management is handled by each homeowner, while the treatment and drainfield systems are managed by a homeowner's association. The ATU for both communities is an Orenco® AdvanTex® treatment system. Although a Treatment Level N technology for nitrogen reduction was not required, the AdvanTex® system is a Treatment Level N-registered technology. Each community utilizes a shallow trench-type pressure distribution drainfield, where the bottom of the trench is within the top 12 inches of the native soil profile, where higher soil carbon content may allow for additional denitrification and where nutrient uptake by the vegetative cover is more likely to occur.

Both communities each have their own Group B community water systems with drinking water well. A review of groundwater nitrate data (via WA DOH Sentry Internet database) for the wells for both of these systems shows that neither have been impacted by nitrogen from their OSS. Nitrate concentrations in the groundwater for each OSS have never exceeded 0.5 mg/L in the 20± years of data provided (i.e. the wells were installed before the homes and OSS were built). For Rocky Bay, the wellhead is about 160 feet from the primary active drainfield. For Leeward Cove, the drainfield is 100 ft. from the wellhead.

These are excellent examples of how Community OSS can meet the needs of small housing development projects, including supportive/affordable housing, with high-performing and adequately managed treatment systems, while still being protective of our drinking water aquifers and the environment.

Puget Sound Communities - Summary

Puget Sound counties that require Community OSS to be designed according to LOSS requirements (WAC 246-272B) have seen very minimal development utilizing these systems. Furthermore, where a Community OSS definition does not differentiate between a single landowner (i.e. multi-family building, a small RV park, etc.) and multiple landowners (i.e. individually owned single-family lots), Community OSS are not common. Requirements for a LOSS are not appropriate for Community OSS as they are burdensome and costly; this has effectively stopped small rural developments that

require onsite wastewater solutions. Where local OSS code does not point to LOSS guidance and requirements, Community OSS is common.

Similarly, where local OSS code requires that a Community OSS, as defined as consisting of two or more single-family dwellings that are under separate ownership or that are located on separate lots, requires a public entity to manage, operate, and maintain a Community OSS, Community OSS are uncommon. Requiring a small Community OSS to be managed by a public entity is too burdensome and costly.

Where the code requires a public management entity, Community OSS are not common. Where Community OSS is to be managed, operated, and maintained by a private O&M service provider certified by that county, Community OSS are common. Counties that do not require a public management entity require legal documentation to ensure the Community OSS is managed, operated, maintained, and financed in perpetuity.

High Nitrogen in GW Communities

Nitrogen contamination of groundwater is a pervasive issue across the United States. Varying strategies are used at the state, regional, and/or county level to address diverse hydrogeological conditions, varied land-use patterns, differing population densities, and unique political landscapes. The following section outlines how several jurisdictions use advanced onsite wastewater systems.

Florida

Florida's abundant water resources are under increasing strain from nitrogen pollution, which has led the Florida Department of Environmental Protection (FDEP) to implement rigorous Basin Management Action Plans (BMAPs) in critical areas, particularly those surrounding Outstanding Florida Springs, areas that are afforded special recognition and protection under the Florida Springs and Aquifer Protection Act. Within BMAP-designated zones, the installation of onsite wastewater treatment systems (OWTS) are part of a broader strategy to protect environmentally sensitive areas.

Mandatory nutrient-reducing septic systems, often requiring NSF 245 certification, are now a requirement for properties located in impaired watersheds with BMAPs and Reasonable Assurance Plans (RAPs). Specific areas explicitly identified as requiring NSF 245 septic systems for lots one acre or less in watershed areas include Hillsborough, Pinellas, Pasco, Citrus, Manatee, Sumter, Lake, Polk, and Hernando Counties. In Orange County, particularly within the Wekiwa and Rock Springs BMAP areas, and for all new septic systems with less than a 150-foot setback to any waterbody countywide, enhanced minimum 65% nitrogen-reducing systems are mandated.

Regulatory benchmarks are outlined in Florida Administrative Code 62-6, which specifies requirements for advanced OWTS in nutrient-sensitive zones. A key benchmark is NSF 245 certification, which ensures a minimum 50% nitrogen reduction, combined with a drainfield providing 24 inches of vertical separation.

Massachusetts

Approximately a third of homes in Massachusetts are serviced by onsite wastewater systems contributing to significant groundwater pollution and surface water impairment. In the Buzzards Bay region, which includes western Cape Cod, residential septic systems were identified as the largest single source of nitrogen pollution, resulting in a regionally focused examination of nitrogen reducing onsite wastewater technologies.

In 2013, Wareham became the first town in the Bay area to require nitrogen reduction for new septic systems installed within 500 feet of the water. A demonstration project in West Falmouth Harbor successfully upgraded 20 septic systems, achieving a significant 78% reduction in nitrogen. Then in 2023, the Massachusetts' State Environmental Code, Title 5 (310 CMR 15.000) was updated to outline more stringent requirements for siting, design, construction, and maintenance of onsite wastewater systems. The Massachusetts Department of Environmental Protection (MassDEP) created strict guidance for Nitrogen Sensitive Areas (NSAs), which include Interim Wellhead Protection Areas, public water supply zones, and specific nitrogen-sensitive embayments identified through scientific evidence.

On Cape Cod, where 85% of homes have onsite sewage systems, MassDEP has designated several communities as NSA.

- **Designated July 7, 2023:** Barnstable, Bourne, Brewster, Chatham, Dennis, Falmouth, Harwich, Mashpee, Orleans, Sandwich, and Yarmouth.
- **Designated September 29, 2023:** Eastham, Truro, and Wellfleet.

As towns implement these regulations, they have two choices to meet their approved TN Total Maximum Daily Loads (TMDLs):

- *Towns can apply for a watershed permit*, which would allow them to develop and implement a plan to reduce nitrogen pollution using various technologies and practices over 20 years. Technologies include but are not limited to installing sewer, nitrogen-reducing Innovative/Alternative septic systems, permeable reactive barriers, fertigation wells, wetland and cranberry bog restoration, shellfish aquaculture, among others. The Technologies Matrix developed by the Cape Cod Commission provides an overview of the different types of technologies a town could employ under a Watershed Permit (https://www.capecodcommission.org/our-work/technologies-matrix).
- *Towns can allow a mandatory septic upgrade to be imposed on homeowners in NRAs*. All homes within an NRA would be required to replace existing septic systems with Innovative/Alternative (I/A) septic systems within 5 years (by July 7, 2030). These onsite systems are upgraded versions of a standard septic system. They are specifically designed to remove nitrogen

MassDEP has developed an interactive map to aid home owners in determining whether they are affected by the changes in the law (https://cciaor.com/title-v-regulations-for-nitrogen-sensitive-areas#nitrogen-sensitive-area-property-lookup).

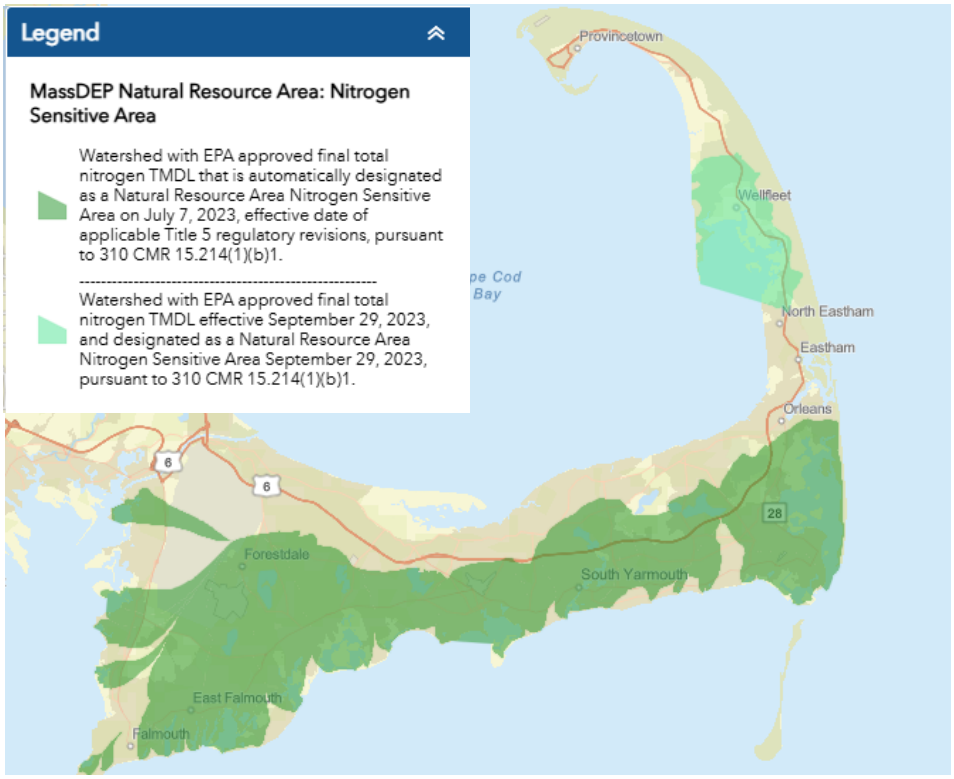


Figure 11 – MassDEP Interactive Map to aid homeowners

In a Nitrogen Sensitive Area (NSA):

- *existing systems* must incorporate a Best Available Nitrogen Reducing Technology (BARNT) within five years of the date on which the Notice of Intent and Application Period ends; and
- *new construction* shall incorporate BARNT.

A list of BARNT technologies are maintained on the MassDEP website - https://www.mass.gov/regulations/310-CMR-15000-septic-systems-title-5).

No systems will be allowed to be permanently "grandfathered in". Homeowners that have installed an I/A septic system in the last 10 years will not have to upgrade their systems until these systems fail or are required by the local approving authority to upgrade. Homeowners are required to install BARNT due to these regulation changes will not be required to upgrade those systems as better technology becomes available.

MassDEP defines a system as "Nitrogen-Reducing" if it can achieve a minimum of 50% removal of TN. To mitigate the financial burden on homeowners, Massachusetts offers an increased septic tax credit of up to $18,000 for failed systems on primary residences, effective January 1, 2023. Additionally, Barnstable County has launched the 'AquiFund' to provide low-interest loans for septic system upgrades.

Maryland

The Chesapeake Bay, as a large, ecologically significant, and severely impacted water body, has served as a powerful driving force for the development and implementation of comprehensive, multi-state environmental regulations and dedicated funding initiatives, such as Maryland's Bay Restoration Fund. This demonstrates the critical role that specific, high-profile environmental crises can play in galvanizing political will and public support for policy change. It also highlights that effective regional environmental protection often necessitates robust interstate cooperation, a shared scientific understanding of the ecosystem, and the establishment of dedicated, long-term funding mechanisms. The Chesapeake Bay serves as a compelling precedent for addressing similar large-scale, transboundary water quality issues.

Maryland's Chesapeake Bay Critical Area Act is a cornerstone of its environmental legislation, designed to regulate development and conserve natural resources within the "Critical Area." This area is defined as all land and water within 1,000 feet of the tidal waters' edge or the landward edge of adjacent tidal wetlands.

All 16 Maryland counties with land located within the Critical Area, along with Baltimore City, are subject to these regulations. These counties include Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, and Worcester.

The Maryland Department of the Environment (MDE) has proactively upgraded over 12,000 conventional septic systems to nitrogen-removing Best Available Technology (BAT) through the state-supported Bay Restoration Fund (BRF) program. BAT systems are universally required for new large septic systems (design flow ≥ 5,000 gallons per day) and for all new or upgraded systems within the Chesapeake Bay and Atlantic Coastal Bays Critical Area. Local governments retain the authority to mandate BAT systems outside the Critical Area if necessary to protect public health or state waters.

BAT systems are designed to achieve TN effluent concentrations of 30 mg/L or better; these technologies are consistent with Washington State’s registered Treatment Level N technologies. Certain combinations of BAT technologies, such as Class I or III paired with Class IV soil distribution systems, are capable of achieving upwards of 75% TN reduction. The BRF provides substantial financial assistance for BAT system installation. Property owners earning less than $300,000 annually or non-profit entities are eligible for 100% funding for the BAT unit, while those earning more or businesses receive 50% funding.

Virginia

Virginia's Alternative Onsite Sewage Systems (AOSS) Regulations mandate nitrogen reduction for all AOSS located within the expansive Chesapeake Bay watershed, a critical ecosystem spanning multiple states. The Chesapeake Bay Watershed encompasses a large majority of Virginia, and the AOSS regulations apply broadly across this region.

The regulations impose tiered nitrogen reduction requirements based on system size and discharge method:

- **Small AOSS:** These systems must achieve a 50% reduction of TN compared to conventional gravity drainfield systems. Compliance can be demonstrated through the use of NSF 245 certified treatment or by achieving an effluent TN concentration of ≤ 20 mg/L prior to soil dispersal.
- **Large AOSS (up to 10,000 gpd):** These systems require a 50% TN reduction at the project boundary, with a demonstrated effluent quality of ≤ 20 mg/L TN prior to application to the soil treatment area.
- **Very Large AOSS (over 10,000 gpd):** Subject to the most stringent TN requirements, these systems must achieve an effluent quality of ≤ 8 mg/L TN prior to soil application, or ≤ 5 mg/L TN measured in situ within 24 vertical inches of the effluent application point.
- **Direct Groundwater Dispersal:** Systems directly dispersing effluent to groundwater within the Chesapeake Bay Watershed, the TN concentration must be exceptionally low, ≤ 3 mg/L.

The Virginia Department of Health (VDH) is transitioning its reporting of TN reductions to be based on submitted annual operation and maintenance (O&M) inspection reports, which confirm that AOSS meet approved Best Management Practices (BMPs) for nitrogen reduction.

New York (Long Island)

Long Island faces a severe environmental crisis due to destructive nitrogen levels in its groundwater and surface waters, which constitute the sole source of drinking water for the region. The Long Island Nitrogen Action Plan (LINAP) is a multi-year, collaborative initiative involving the New York Department of Environmental Conservation (DEC), Long Island Regional Planning Council, and Suffolk and Nassau counties, aimed at achieving significant reductions in nitrogen loading.

In Suffolk County, approximately 75% of its 1.5 million residents rely on onsite wastewater systems and cesspools. Nitrogen pollution from these sources has been identified as the largest single cause of degraded water quality, leading to beach closures, restrictions on shellfishing, and toxic algal blooms. The average groundwater nitrogen concentrations in Suffolk County is 4 mg/L. As a result, Suffolk County launched a septic improvement program in 2017 and new onsite wastewater regulations in July of 2021.

As of July 1, 2019, Suffolk County requires filing a registration for the replacement of existing cesspools or septic systems and new construction is prohibited from using older, ineffective disposal methods like direct discharge to cesspools. Additionally, it mandated that lots less than one acre install of Innovative/Advanced Onsite Wastewater Treatment Systems (I/A OWTS) that achieves an effluent quality of 19 mg/L (one of the strictest in the country and 37% lower than Washington States Treatment Level N). Nassau County, New York passed the same requirement in July of 2023. To incentivize I/A OWTS, both counties offer a $10,000 base grant, with additional incentives for low-to-moderate income households and for systems employing pressurized shallow draining fields or nitrogen polishing units. Southhampton, East Hampton and Shelter Island also have funding resources available to improve onsite wastewater management.

California

As California is a large state with many unique site constraints and bioregional considerations, there is a large variety of regulations related to onsite wastewater treatment systems (OWTS). The State Water Resources Control Board (SWRCB) serves as the primary authority through its comprehensive statewide OWTS Policy. Local Area Management Plans (LAMPs) were developed for each county to define standards for OWTS and, for new/repair OWTS near nutrient impaired surface water, requires N removal. The State OWTS Policy places existing, new, and replacement OWTS in 'Tier 3' if they are located adjacent to water bodies identified by the State Water Board as impaired for pathogens or nitrogen. Another key statewide effort (SB 1215) promoted by the SWRCB is the concept of consolidation and regionalization for septic systems located within nitrate impacted areas. There is financial assistance and enforcement action to push communities to abandon septic systems and connect to WWTFs located within 3 to 5 miles.

The Regional Water Quality Control Boards (RWBs) and Counties are responsible for local implementation, tailoring regulations to regional environmental conditions. In the Central Valley (Region 5), a nitrate control program known as CV-SALTS has been implemented to create nitrate management zones to develop approaches to achieve nitrate compliance in each groundwater basin. A number of 'Nitrate Priority Areas' have been defined, such as in Turlock. Onsite septic systems in nitrate priority areas around Turlock fall under basin-wide nitrate-reduction obligations and are compelled to participate in either upgrading individual septic systems to achieve TN < 10 mg/L, install a sewer and cluster system, or install a sewer and pump to the nearest WWTF.

In some areas, such as Santa Cruz County, conventional OWTS are prohibited in certain conditions due to their potential for water quality impacts and potential drainfield failure. Enhanced treatment systems with nitrogen reduction are specifically required for:

- Large onsite systems (serve more than 20 people per day from multiple dwellings).
- OWTS situated in sandy soils with rapid percolation rates (faster than 5 minutes per inch).
- Areas identified with concerns for nitrate impacts on groundwater or surface water, including the San Lorenzo River watershed.
- Replacement of outdated seepage pits or major remodels on properties served by them.

The ultimate objective for enhanced treatment systems in Santa Cruz County is to reduce total nitrogen to less than 10 mg-N/L. The minimum requirement is a 50% reduction of TN or an effluent concentration of ≤ 30 mg-N/L, whichever is less. Santa Cruz County mandates quarterly monitoring of effluent samples for nitrogen parameters (nitrate, ammonia, total nitrogen) in the first year of operation for nitrogen reduction systems, followed by annual monitoring.

In Los Angeles County, the county code defines guidelines and regulations for OWTS within its unincorporated areas and designated cities. Non-conventional (advanced) wastewater treatment systems may be required and approved in areas where the soil absorption rate exceeds guideline standards, or where additional treatment components are necessary to reduce nitrogen concentrations in the effluent.

California has also implemented a robust greywater reuse program to promote water conservation and resource recovery in both rural, suburban and urban areas.

Table 8 – Overview of Advanced Onsite Wastewater Treatment Requirements in U.S. Nitrogen-Sensitive Areas

State	County/Area	Regulatory Framework / Authority	Trigger for Advanced Treatment	Required Nitrogen Reduction	Key Notes / Financial Incentives
Florida	Hillsborough, Pinellas, Pasco, Citrus, Manatee, Sumter, Lake, Polk, Hernando, Orange (Wekiwa and Rock Springs BMAP areas)	Basin Management Action Plans (BMAPs), Florida Administrative Code 62-6	Properties in impaired watersheds (BMAPs/RAPs), lots ≤ 1 acre; new systems with < 150-foot setback to waterbody	NSF 245 certified (min. 50% reduction), often 65% or more; anticipated ≤ 8 mg/L in BMAP zones	NSF 245 certification required; Septic Upgrade Incentive Program (SUIP) in Orange County ($10,000 grants)
Massachusetts	Barnstable, Bourne, Brewster, Chatham, Dennis, Eastham, Falmouth, Harwich, Mashpee, Orleans, Sandwich, Truro, Wellfleet, Yarmouth (Cape Cod NRNSAs); Wareham, West Falmouth (Buzzards Bay)	Title 5 (310 CMR 15.000), MassDEP Nitrogen Sensitive Areas (NSAs), Natural Resource Nitrogen Sensitive Areas (NRNSAs)	New construction / additions near public water supplies or NSAs; existing systems in NRNSAs (by 2030 unless municipality gets Watershed Permit); new systems within 500 ft of water (Wareham); areas draining to nitrogen-sensitive waters	Minimum 50% reduction of total nitrogen	Increased septic tax credit (up to $18,000); Barnstable County 'AquiFund' for low-interest loans; West Falmouth demonstration project with subsidies

State	County/Area	Regulatory Framework / Authority	Trigger for Advanced Treatment	Required Nitrogen Reduction	Key Notes / Financial Incentives
Maryland	Anne Arundel, Baltimore, Calvert, Caroline, Cecil, Charles, Dorchester, Harford, Kent, Prince George's, Queen Anne's, Somerset, St. Mary's, Talbot, Wicomico, Worcester (all Critical Area counties)	Chesapeake Bay Critical Area Act, Bay Restoration Fund (BRF)	All new/upgraded systems in Critical Area; large septic systems (≥ 5,000 gpd) anywhere; local government discretion outside Critical Area	TN effluent ≤ 30 mg/L or better; combinations can achieve > 75% TN reduction (conventional systems: 23.2 lbs N/year)	BRF provides 50-100% funding for Best Available Technology (BAT) units
Virginia	Chesapeake Bay Watershed (majority of Virginia counties)	Alternative Onsite Sewage Systems (AOSS) Regulations	All AOSS in Chesapeake Bay watershed (effective Dec 2013); new construction/replacement	Small AOSS: 50% TN reduction or ≤ 20 mg/L effluent TN. Large AOSS (up to 10,000 gpd): 50% TN reduction or ≤ 20 mg/L effluent TN. Very Large AOSS (> 10,000 gpd): ≤ 8 mg/L effluent TN (or ≤ 5 mg/L in situ). Direct groundwater dispersal: ≤ 3 mg/L TN	NSF 245 certification is a recognized BMP; VDH transitioning to O&M reports for TN reductions

State	County/Area	Regulatory Framework / Authority	Trigger for Advanced Treatment	Required Nitrogen Reduction	Key Notes / Financial Incentives
New York	Suffolk County (including East Hampton, Southampton)	Long Island Nitrogen Action Plan (LINAP), County/Town Sanitary Codes	Replacement of existing cesspools/septic systems; new construction; substantial expansions; large capacity cesspool upgrades; new systems with less than 150-foot setback to waterbody	Nassau and Suffolk County require 19mg/L for Low-Nitrogen Sanitary Systems / Innovative/Advanced (I/A) Onsite Wastewater Treatment Systems (OWTS)	Nassau and Suffolk County offers $10,000+ grants; Southampton and East Hampton have mandatory requirements and rebate programs
California	Santa Cruz County (San Lorenzo River watershed, sandy soils, nitrate concern areas); Los Angeles County (unincorporated areas, designated cities)	State OWTS Policy, Local Area Management Programs (LAMPs), County Codes	Large onsite disposal systems; OWTS in sandy soils with rapid percolation; areas with nitrate impacts on groundwater/surface water; replacement of seepage pits; where soil absorption rate exceeds guidelines	Ultimate goal: < 10 mg-N/L; minimum: 50% reduction or ≤ 30 mg-N/L TN. Tier 3 for systems adjacent to water bodies impaired for nitrogen	Mandatory septic inspection at property sale (Santa Cruz); monitoring for nitrogen parameters required

Other Communities

Northwest Lower Peninsula of Michigan: Benzie and Leelanau Counties

Combined, Benzie and Leelanau Counties have the 125 miles of Lake Michigan shoreline and over 60 inland lakes. Inland lakes and streams add an additional 400 miles of lake and stream shoreline. Water quality is paramount for region focused on agriculture and tourism. Permanent and transient populations have increased in the last few decades, as has tourism, especially around lake eocsystems. Septic system inefficiency and failure are one of the leading causes of water quality deterioration in the region.

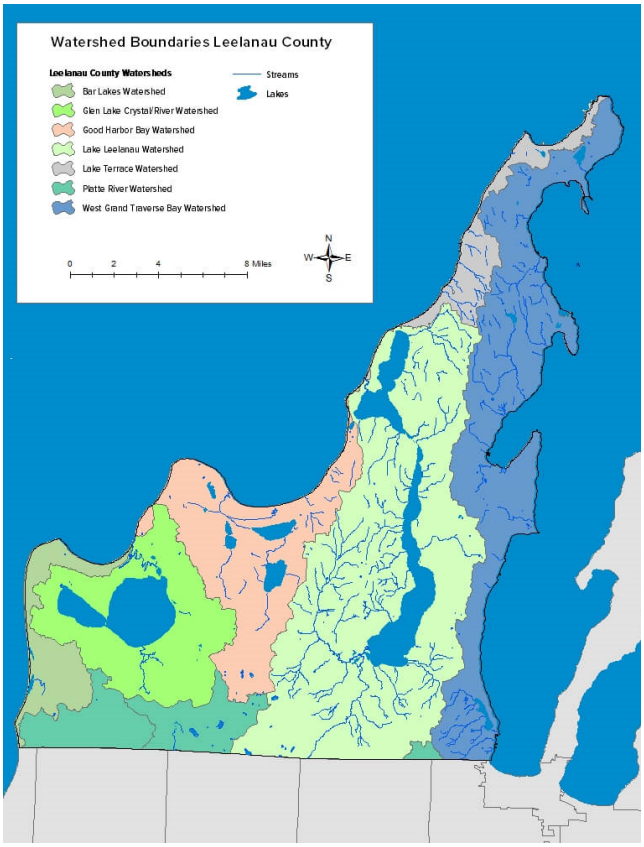


Figure 12 – Leelanau County Watershed map

In 2023, the Benzie-Leelanau District Health Department required an Advance Treatment System (ATS) for any buildable parcel without room for a conventional drainfield and/or at least 48" to high groundwater. NSF/ANSI Standards 40 and 245 are not required to be an ATS, but annual testing is waived if one is used. Annual testing for non NSF/ANSI 40 and 245 systems include:

- Biological Oxygen Demand (BOD) and
  Total Suspended Solids (TSS) less than or equal to 30 mg/L
- Total Inorganic Nitrogen (TIN) less than or equal to 30 mg/L

Regardless of type of ATS, annual reporting for phosphorous is required for discharges within 200 feet of any surface water to ensure total phosphorous of effluent is less than or equal to 4 mg/L.

La Pine, Oregon

In the last 1990's nitrate levels in the aquifer underlying central Oregon near Sunriver and La Pine had increasing due to contamination from septic systems. The contamination had public health implications because groundwater is the sole source of drinking water for area residents. The United States Environmental Protection Agency (US EPA) funded National Decentralized Wastewater Treatment Demonstration Project between 1999 and 2005 with a goal to:

- Field test denitrifying onsite wastewater treatment systems;
- Develop an onsite system maintenance structure;
- Perform groundwater investigations and develop a groundwater and nutrient model; and
- Establish a loan program to replace or retrofit failing or poorly located onsite systems.

Forty-nine (49) onsite systems were installed using thirteen technologies and monitored for detailed performance. Most systems had robust nitrification processes but little denitrification. As a result, TN reduction was limited. The one system that consistently met the 10mg/L study target included a secondary carbon source and an anoxic environment in which to reduce the nitrate to nitrogen gas. Most of the other systems relied on recirculation to the primary clarifier in order to promote denitrification.

Canada

In Canada, while the federal Wastewater Systems Effluent Regulations (under the Fisheries Act) establish minimum effluent quality standards for larger wastewater treatment systems, specific wastewater effluent quality limits for individual onsite systems are primarily governed at the provincial or regional level. Very few local or regional jurisdictions mandate a reduction of nitrogen.

Ontario**:** The Ontario Ministry of the Environment, Conservation and Parks (MOECP) provides guidelines for individual on-site sewage systems, aiming to prevent groundwater degradation. The Ministry typically does not support development in areas where background nitrate-nitrogen concentrations exceed the Ontario Drinking Water Objective (ODWO) of 10 mg/L. Part 8 of the Ontario Building Code (OBC) regulates most rural septic systems with daily flows not exceeding 10,000 L/day (2,641 gpd) and it stipulates design and construction requirements. Advanced treatment systems are often required for waterfront properties, potentially allowing reduced setback distances from water bodies. For large subsurface sewage disposal systems (LSSDS) with design capacities exceeding 10,000 L/day, the Ontario Water Resources Act (OWRA) applies, requiring Ministry approval and detailed hydrogeological assessments to ensure compliance with downgradient groundwater criteria.

British Columbia**:** The BC Sewerage System Regulation requires onsite systems to be designed and constructed by professional engineers or registered onsite wastewater practitioners. Systems are categorized by treatment level: Type 1 (septic tank primary treatment), Type 2 (aerobic treatment, producing effluent with BOD/TSS ≤ 45 mg/L), and Type 3 (advanced treatment with disinfection, achieving BOD/TSS ≤ 10 mg/L and Fecal Coliform ≤ 400 CFU/100ml). Type 3 systems produce very high-quality effluent and are typically used when limited space for disposal fields necessitates a significant reduction in field size, or when specific nutrient removal is required. While nitrogen is not provincially regulated Type 3 designs consistently aim for efficient nitrogen reduction.

Australia

Australia adopts a risk-based approach to managing onsite wastewater management systems (OWMS), with a design flow of 5,000 liters per day (1,320 gpd). Regulations are administered at the state or local government level.

Victoria**:** The Environment Protection Authority (EPA) in Victoria outlines a risk-based approach for OWMS, with local councils administering and approving permits. The Environment Protection Act 2017 and Environment Protection Regulations 2021 emphasize a "general environmental duty" (GED) for landowners to manage activities to reduce the risk of harm from pollution, including wastewater. This includes ensuring systems do not leak, are properly maintained, and treated wastewater remains within property boundaries. Onsite Wastewater Management Plans (OWMPs) developed by councils identify and assess risks in unsewered areas, including cumulative risks from existing OWMS.

New South Wales**:** Local councils in New South Wales (NSW) are responsible for managing and regulating OWMS in non-sewered areas, with guidance from the Office of Local Government NSW. These guidelines encourage councils to develop their own On-Site Sewage Management (OSSM) Strategies that incorporate regional and catchment management objectives to ensure long-term sustainable use of land and protect water quality. The aim is to minimize risks to public health and protect surface and groundwater from contamination, while promoting water conservation and reuse of treated effluent. While specific numerical nitrogen limits for all onsite systems are not uniformly stated across all local government documents, the emphasis is on requiring suitable systems that reduce nitrogen levels and comply with Australian Standards (AS/NZS 1547:2012). For larger systems (exceeding 10 EP or 2,000 liters/day but less than 2,500 EP), councils may require independent third-party review of designs.

New Zealand

New Zealand is in the process of setting national wastewater standards, expected by mid- to late-2025, under the Local Government (Water Services) Bill. These standards will aim to provide a nationally consistent requirement for all wastewater networks and operators through resource consents. Nitrogen reduction is a growing requirement for onsite wastewater systems in New Zealand, particularly in areas near water bodies like Rotorua Lakes and Taupo Lake, which are sensitive to nutrient pollution.

Currently, for new onsite systems in Bay of Plenty region, systems must meet requirements of Rule 13 and Schedule 4 of the Bay of Plenty Regional Council's On-Site Effluent Treatment Regional Plan developed in 2006. There are 23 aerated wastewater treatment systems approved for use in the Bay of Plenty region excluding Rotorua. There are six additional aerated wastewater treatment systems allowed for use in Bay of Plenty (including Rotorua). EconoTreat™, a submerged fixed film technology certified for nitrogen reduction aims for ammonia nitrogen of less than 5 mg/L and TN of less than 15 mg/L before discharge.

County Management

Preventative Maintenance

Across the country, a consistent emphasis is placed on proactive maintenance to extend the operational lifespan of onsite wastewater infrastructure, avert system failures, and safeguard water quality. This shared objective translates into several widely adopted strategies. Jurisdictions that manage onsite wastewater programs have robust education programs about the importance of these best practices:

- **Water Conservation:** Reducing overall water usage is consistently recommended as a primary measure to prevent hydraulic overloading of the drainfield. This includes employing water-saving devices and promptly repairing any leaks in plumbing fixtures.
- **Proper Waste Disposal:** Preventing harmful items and toxic chemicals from entering the septic system is crucial for preserving the bacterial ecosystem within the tank and preventing clogs. This means avoiding the flushing of materials such as cat litter, cigarettes, diapers, feminine hygiene products, prescription medications, and wipes. Similarly, the disposal of solvents, pesticides, motor oil, and paint down the drain is prohibited. Minimizing or eliminating the use of garbage disposals is also a common recommendation, as food waste can rapidly accumulate solids in the tank.
- **Primary Tank Pumping:** Septic tanks require pumping when the accumulation of scum and sludge reaches a specified thickness. For instance, Whatcom County recommends pumping when solids reach one-third of the tank volume, while Clallam County specifies thresholds of 12 inches of sludge or 6 inches of scum. It is generally advised that pumping be determined by inspection rather than a rigid schedule. Measuring the elevation of sludge or thickness of sludge and scum to determine need for pumping can prevent unnecessary costs and maintain the tank's microbial balance.
- **Drainfield Protection:** Protecting the drainfield from physical damage or compaction is vital. This involves preventing vehicles, heavy equipment, or structures from being placed over the drainfield area and ensuring that surface water runoff from roofs or paved areas is diverted away from the system.

While Island County has limited resources (staff, funding, etc.), they have done a decent job educating the public about the importance of properly maintained onsite wastewater management and providing tools for property owners to sustain working OSS. However, even with the publicly available material and direct letters sent to property owners, more needs to be done to manage and enforce the current county rules regarding wastewater management . Some of the digital resources have broken links and clear requirements and responsibilities are confusing or lacking.

Data Management and Reporting Obligations

Counties employ a variety of software products to manage their extensive OSS data. These systems are often designed to integrate with other departmental databases within the local government, leading to unique database solutions for each county. Each jurisdiction has invested in tools, staff and technical assistance differently, as such, some counties, including Island County, lack a unified system that would provide a comprehensive, real-time understanding of OSS performance and its cumulative environmental impact across the jurisdiction. In these counties, this technical deficiency acts as a substantial barrier to effective policymaking, strategic resource allocation, and the precise identification of broader pollution sources. Without aggregated data, it becomes difficult to discern overarching trends, assess cumulative impacts, or implement coordinated interventions, thereby limiting the overall efficacy of environmental protection efforts.

Effective OSS management relies heavily on robust reporting mechanisms and efficient data management. These elements enable health departments to monitor system performance, identify potential failures, and track compliance across their jurisdictions. Throughout Washington, inspection and maintenance reports are required to be submitted to the county health department on an annual basis for pressure dispersal systems, and every three years for gravity systems. This submission is typically performed by the certified professional who conducted the service, or in some instances, by the certified homeowner themselves.

Most counties in the Puget Sound use OnlineRME, a public responsible management entity (RME) database to store OSS records across the United States. Information stored includes drawings, service reports, inspection forms, etc. There are hundreds of features within the software, however each health department uses the database differently. Few counties obtain a Merchant Account so that they can use OnlineRME to collect fees including submittal fees, permit fees, and late fees.

Counties like Island County just use the database for basic information storage. King and Kitsap County utilize the OnlineRME platform for management with more advanced tools for:

- scheduling,
- enforcement,
- response to reported deficiencies, and
- detailed reporting / data analysis.

For jurisdictions that use more of the function tools, the reporting features allow them to prioritize the inspection status. A dashboard will display critical status (i.e. surfacing effluent) versus a regular maintenance task (i.e. need to pump a septic tank). Additionally, many onsite wastewater providers use the OnlineRME to track OSS business including:

- Scheduling
- Contracting
- Customer Tracking
- Phone Calls
- Alarms
- Site Notes/Reports
- Submitting Service work to the jurisdiction

Since 2009, Clallam County has tracked inspection status within its Permit Database through a "Red-to-Green" program, visually categorizing systems as suspected/assumed (RED), known but overdue (YELLOW), or compliant (GREEN). Additional colors were added to round out other types of parcels, orange represents more than one septic system on a property, blue indicates that the lot is served by a LOSS, and purple represents parcels confirmed connected to a municipal sewer system. No color is applied to vacant parcels or where there is no plumbing known to be present.

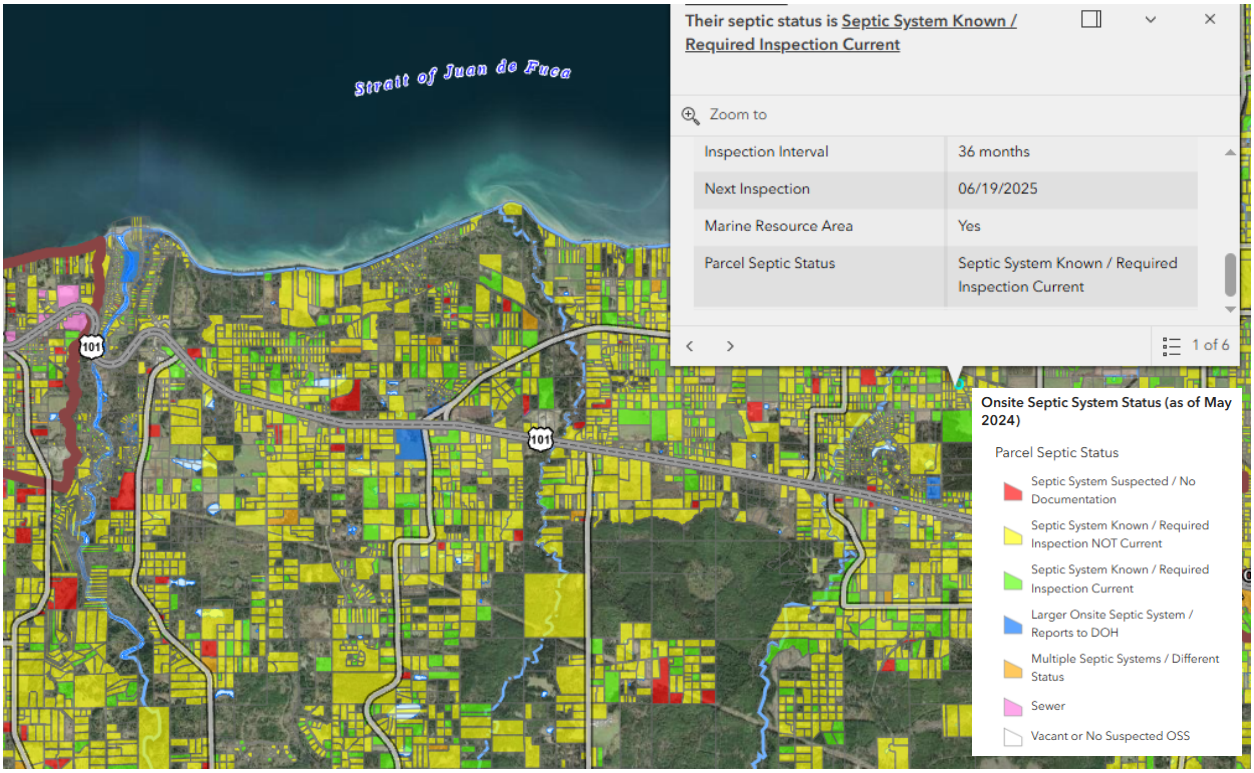


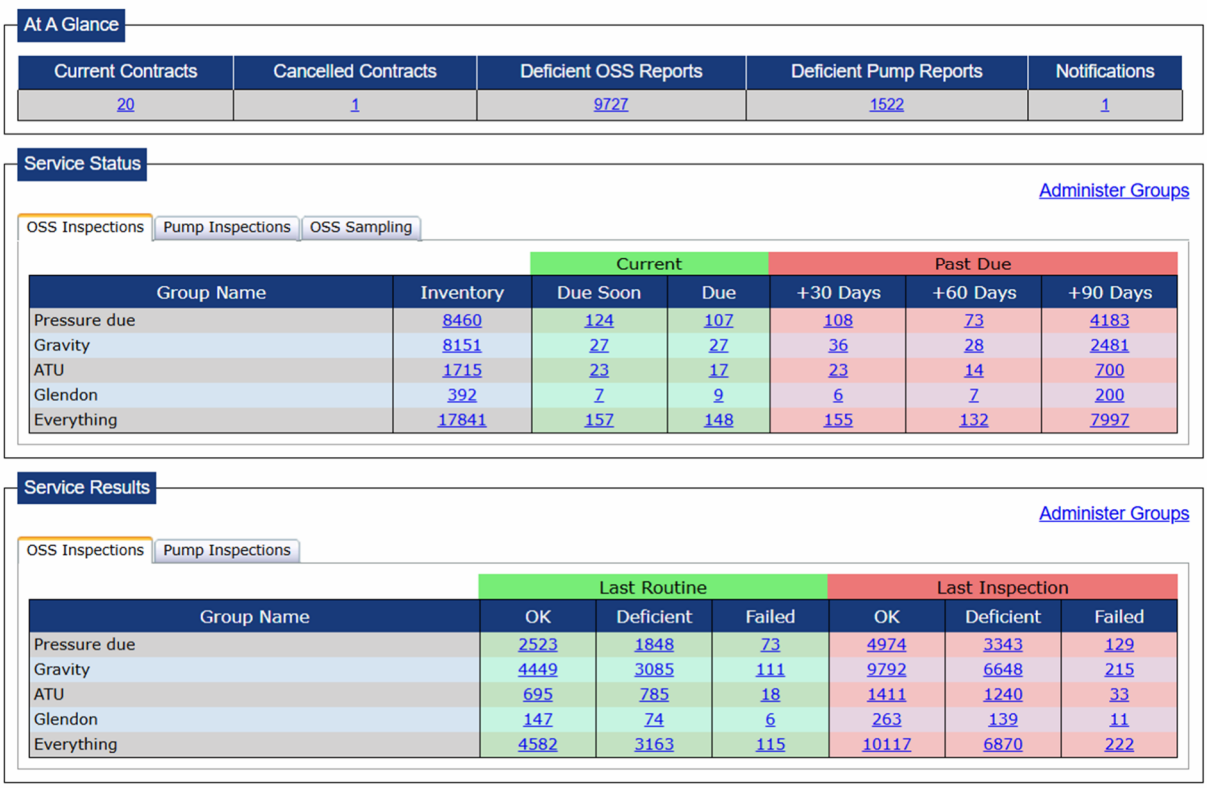
Figure 13 – Clallam County Red to Green Program for Managing OSS Compliance

In 2019 all Clallam County Web Maps were upgraded to check the current OSS inspection status of a property directly from the County permit database in real time. In 2022 the OSS Status Map went into maintenance mode with occasional updates until the county's permit database replacement could be completed and new processes for maintaining this information can be configured. Inspection records were last updated in May 2024.

In July 2024, Callam County launched a Citizen Self Service (CSS) Portal, an Online Permit System. The portal is well organized and allows for:

- multiple searches including permit records, tax property, recorded documents,
- official public records request,
- request inspection,
- pay invoices,
- access the Clallam County map portal,
- make a service request, and
- access the public county calendar.

Island county uses SmartGov, a cloud-based license and permit management software to help manage permitting, licensing, and code enforcement. While it is a powerful easy-to-use platform it is not used to manage inspections and compliance of OSS or COSS for ICPH. There is some interface between SmartGov and OnlineRME, however it is not dynamic or flexible. With a large backlog of out of compliance system, ICPH needs a management system that helps organize OSS and COSS inventory, alerts homeowners of inspection obligation, and prioritizes enforcement targets.



At A Glance

Current Contracts	Cancelled Contracts	Deficient OSS Reports	Deficient Pump Reports	Notifications
20	1	9727	1522	1

Service Status

Administer Groups

OSS Inspections | Pump Inspections | OSS Sampling

		Current		Past Due		
Group Name	Inventory	Due Soon	Due	+30 Days	+60 Days	+90 Days
Pressure due	8460	124	107	108	73	4183
Gravity	8151	27	27	36	28	2481
ATU	1715	23	17	23	14	700
Glendon	392	7	9	6	7	200
Everything	17841	157	148	155	132	7997

Service Results

Administer Groups

OSS Inspections | Pump Inspections

	Last Routine			Last Inspection		
Group Name	OK	Deficient	Failed	OK	Deficient	Failed
Pressure due	2523	1848	73	4974	3343	129
Gravity	4449	3085	111	9792	6648	215
ATU	695	785	18	1411	1240	33
Glendon	147	74	6	263	139	11
Everything	4582	3163	115	10117	6870	222

Figure 14 – Island County OnlineRME Dashboard

Compliance, Enforcement, and Financial Assistance Programs

Beyond initial permitting and ongoing maintenance requirements, Puget Sound counties employ a range of strategies for compliance tracking, enforcement, and providing financial support to homeowners for OSS management. Counties utilize various methods to monitor compliance and enforce OSS regulations, often employing tiered approaches from educational outreach to penalties.

- **Clallam County:** Implements a "Red-to-Green" program to visually track the inspection status of developed parcels in its Permit Database. Properties with suspected or assumed septic systems are marked RED, those with known systems but overdue inspections are YELLOW, and compliant systems with current records are GREEN. Environmental Health (EH) actively enforces state requirements, focusing on target areas to encourage compliance and convert "Red" and "Yellow" parcels to "Green." An annual operational fee for active septic systems is assessed via property tax statements to help fund this program.[4]
- **Island County:** Maintains an active enforcement program, sending notification reminders and notices of compliance to property owners whose inspections are overdue. Verification of O&M inspection completion is required for building permits or property sales. As a last resort, after educational and warning measures, administrative penalties may be assessed for non-compliance.
- **Pierce County:** Imposes penalties and late fees for failure to report work within 30 days, with repeated failures leading to certification enforcement proceedings. Transferring property without a required Report of System Status (RSS) is also considered a violation.
- **Thurston County:** Sends reminder notices for overdue Operational Certificates. If not renewed, a non-conforming notice is issued, and the certificate officially becomes non-conforming after four months from the inspection due date.
- **Whatcom County:** Actively investigates complaints related to OSS and enforces the county's environmental code (WCC 24.05) to ensure proper system functioning.

The management of Onsite Sewage Systems across the Puget Sound counties is characterized by a robust state-level framework that provides a consistent baseline for environmental protection. This framework mandates general inspection frequencies, emphasizes the critical role of certified professionals, and requires permits for significant system work. However, the implementation of these mandates exhibits notable local variations in specific inspection frequencies, the extent of homeowner involvement, the sophistication of reporting mechanisms, the intensity of enforcement, and the availability of financial assistance programs.

Financial Assistance for Onsite Wastewater Infrastructure

A review of financial assistance for onsite wastewater systems in Island County and other U.S. jurisdictions highlights a robust and evolving landscape of support. Programs are increasingly designed to be multi-layered, addressing both routine maintenance costs and significant repair/replacement expenses. A strong emphasis on public health and environmental protection drives these initiatives, with financial barriers explicitly recognized as critical impediments to achieving these goals. The prevalence of partnerships with non-profit lenders, coupled with an equity-driven focus on low-income households, demonstrates a strategic effort to make essential wastewater infrastructure improvements accessible to all residents.

Residents of Island County have access to financial assistance opportunities for their OSS, primarily through local public health initiatives and partnered loan programs that are focused on inspection assistance and system repair or replacement.

Inspection Assistance

Island County Public Health offers direct financial assistance to help property owners manage the cost of routine OSS inspections. These inspections are crucial for early problem detection, extending system lifespan, and safeguarding public health. The Inspection Incentive Program provides inspection incentives/rebates for up to $150. Property owners declaring financial hardship are able to receive a higher subsidy of up to $350.

Eligibility restrictions include not having received assistance from this program within the last three years. The aid applies exclusively to routine inspections performed by participating licensed septic maintenance service providers, excluding inspections for property sales or homeowner-performed assessments. Funding for this program is derived from the Washington Department of Health Consolidated Contract Grant and is distributed on a first-come, first-served basis until exhausted, underscoring the importance of timely application

Repair/Replace/Conversion Assistance

Island County Public Health has established a partnership with Craft3, a non-profit, non-bank Community Development Financial Institution (CDFI), to provide affordable loans. These loans are designed to alleviate the substantial, often unexpected, financial burden associated with repairing or replacing failing OSS, or connecting to a nearby municipal sewer system. This collaboration extends beyond Island County, forming part of the broader Washington State Regional On-Site Sewage System Loan Program (RLP), which involves the Washington State Department of Ecology and Department of Health.

Craft3 loans offer comprehensive financing, covering the full cost of a project, including design, permitting, installation, and even ongoing maintenance. They feature competitive interest rates and require no up-front costs and flexible repayment options, including deferred payments for lower-income homeowners. Unsecured loans can reach up to $25,000 (plus an Operations and Maintenance (O&M) reserve and contingency). Eligibility for these loans requires the OSS to be over 25 years old, failing, or under orders to be fixed. Additionally, the chosen contractor must be approved by the local health jurisdiction.

Across Washington local loan programs are available for individuals with failing OSS, including in:

- **Clallam County**
  The Clallam Conservation District provides funds to low-income homeowners for OSS repair and replacements in high-priority areas throughout the county.

- **Clark County**
  The Clark Conservation District and its partners provide limited support to homeowners for repairs or rebates for septic system maintenance with a focus on the East Fork Lewis River and Lacamas Creek watersheds.

- **Pierce County**
  Pierce County and its partners provide limited support to low-income homeowners for septic system repairs across the county.

- **Snohomish County**
  Snohomish County provides support to low-income homeowners for septic system repairs and system maintenance across the county, with a focus on the Stillaguamish and Snohomish watersheds.

Many other states have similar financial assistance programs including *Michigan's Septic Replacement Loan Program (SRLP)* that provides low-interest financing to homeowners for replacing failing or near-failing septic systems and connecting to municipal sewers; *Virginia's Septic and Well Assistance Program (SWAP)* that offers grants to homeowners with a wide range of well and septic needs, including repairing failing septic systems, replacing straight pipes, replacing privies, and connecting to public sewer; and *Iowa's Onsite Wastewater Assistance Program (OSWAP)*, that facilitates low-interest loans for repair or replacement of inadequate or failing septic systems, specifically including both the septic tank and secondary treatment systems like leach fields.

Funding to Improve and Protect Water Quality

Washington's Department of Ecology combined funding program distributes competitive grants and qualified loans for a variety of projects including LOSS planning, design, and construction, OSS pollution identification and survey programs, OSS repair and replacement, composting toilet systems, and more. The next funding cycle (state fiscal year 2027) will be accepting applications between July 22 and Sept. 3, 2025.

Findings / Recommendations

Issues with Onsite Sewage Systems (OSS) vary in complexity, as does recommended solutions. It is recommended that a multi-prong approach is implemented to help solve onsite wastewater issues in Island County. Many of the solutions realign with regional best practices, while other mimic communities with similar concerns that are national leaders in robust onsite wastewater solutions. Solutions range from specific regulatory code recommendations, technical suggestions, management strategies worth pursuing, and items worth advocating for to state officials.

County Code Recommendations

The Island County Code could be improved to allow for more flexibility for small developments that generate wastewater less than 3,500 GPD, while increasing the protection of groundwater and surface water resources. This section presents recommended changes to the Island County Code, in particular ICC 8.07D and ICC 8.09.097.

Remove the requirement in ICC 8.07D.210, that Community OSS shall be designed in accordance with the site evaluation, design, maintenance, and management criteria as set forth in WAC 246-272B. This has proven to be too restrictive and burdensome for Community OSS proposals and has resulted in no Community OSS being implemented in Island County since this code language became effective (i.e. since 2007). Other Code language can be implemented to ensure that Community OSS are properly designed and managed, operated, and maintained in perpetuity.

Adopt *WAC 246-272A-0320 – Developments, Subdivisions, and Minimum Land Area Requirements*. The new *Table XII – Maximum Allowable Total Nitrogen (TN) Load Per Day by Type of Water Supply, Soil Type, and Land Area* shown in Figure 15 presents maximum allowable TN loads in pounds per acre per day per soil type based on water supply type (public vs. non-public). A proposed development can use a WA DOH approved Treatment Level "N" technology to reduce the nitrogen load from the OSS to be compliant with Table XII.

Table XII
Maximum Allowable Total Nitrogen (TN) Load Per Day by Type of Water Supply, Soil Type, and Land Area[1]

Water Supply Type	Maximum Daily TN Load	Soil Type[2]					
		1	2	3	4	5	6
Public	mg per sq. ft.	3.8	6.3	5.1	4.3	3.9	3.6
	lb per acre	0.36	0.60	0.49	0.41	0.37	0.34
Nonpublic	mg per sq. ft.	1.9	1.9	1.9	1.9	0.9	0.9
	lb per acre	0.18	0.18	0.18	0.18	0.09	0.09

[1] Based on 60 mg/L TN and 360 gal/day OSS effluent.
[2] As defined in Table V in WAC 246-272A-0220.

Figure 15 – Table XII from *WAC 246-272A-0320*

Create an additive OSS requirement matrix where the community should be more protective of groundwater and surrounding ecosystems. Creating a clear, transparent hierarchy that identifies conditions that are less suitable for wastewater dispersal without increased treatment or operational oversight, due to compounding factors including the current groundwater nitrate levels and ecosystem functions, will help make clear reasoning behind decisions and a more straightforward regulatory path.

Table 9 outlines a suggested framework that identifies when site conditions should increase wastewater permit criteria. For OSS, additional criteria should be required when the dispersal area is near surface water, in CARA high susceptibility areas, and when background nitrate is higher than 2.0mg/L in groundwater. For COSS, additional criteria should be required when the dispersal area is near surface water, in a defined sensitive area, in CARA medium or high susceptibility areas, and when background nitrate is higher than 2.0mg/L in groundwater. Table 9 lists site conditions in the first (left hand side) column. If a system meets the definition listed, a corresponding 'X' identifies additional design, treatment or O&M requirements needed to obtain a permit.

As an example, OSS dispersal areas that are within 200 feet and COSS within 500 of the mean high-water level of any surface water body (ocean, lake, stream, etc.) will require nitrogen reduction. COSS dispersal areas that are within 300 feet of surface water should also have enhanced operations and maintenance (O&M) requirements.

For OSS, enhanced O&M should include:

- Biannual monitoring of discharge (average gallons per day) and effluent sampling, including:
    - 5-Day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$),
    - Total Suspended Solids (TSS), and
    - Total Nitrogen (TN).
- Results to be reported with the annual inspection form to OnlineRME.

For COSS, enhanced O&M should include:

- Quarterly monitoring of discharge (average gallons per day) and effluent sampling, including:
    - 5-Day Carbonaceous Biochemical Oxygen Demand ($cBOD_5$),
    - Total Suspended Solids (TSS), and
    - Total Nitrogen (TN).
- Results to be reported to OnlineRME.

We also recommend creating a tiered system for COSS. Only COSS over 1,800 GPD would require a hydrogeologic study with monitoring wells. This will allow smaller developments (up to 5 housing units) to have less of a design burden than larger COSS. Similarly, Island County should advocate the WA DOH to explore a tiered LOSS program, where smaller sized LOSS would have more flexibility and appropriate oversight. It doesn't make sense that a 4,000 gpd system has the same requirements as a 100,000 gpd system. There are potential avenues that we think Island County could partner with WA DOH on, including piloting nitrogen reduction protocols, enhanced O&M, and more.

Table 9 – Suggested Regulatory Matrix for Nitrogen Reduction

OSS *(≤2 homes or <1,000 gpd)*	**Requires Treatment Level N(50) ~50% reduction (30mg/L)**	**Requires Treatment Level N(50) ~50% reduction + enhanced O&M [2] (30mg/L)**	**Nitrogen Reduction Determined by Nitrogen Balance[3] + enhanced O&M [2]**	**Requires Hydrogeo. Study**	**Requires Monitoring Wells**
within 200' of surface water [4]	**X**	--	--	--	--
CARA - High Susceptibility	**X**	--	--	--	--
Background NO_3^- of 2.1-4.9 mg/L	**X**	--	--	--	--
Background NO_3^- of 5.0-9.9 mg/L	--	**X**	--	**X**	--
Background NO_3^- of 10.0+ mg/L	--	--	**X**	**X**	**X**

COSS	**Requires Treatment Level N(50) ~50% reduction (30mg/L)**	**Requires Treatment Level N(50) ~50% reduction + enhanced O&M [2] (30mg/L)**	**Nitrogen Reduction Determined by Nitrogen Balance[3] + enhanced O&M [2]**	**Requires Hydrogeo. Study**	**Requires Monitoring Wells**
up to 1,800 gpd	--	--	--	--	--
between 1801 to 3,499 gpd	--	--	--	**X**	**X**
within 500' of surface water [4]	**X**	--	--	--	--
within 300' of surface water [4]	--	**X**	--	--	--
Protective in Sensitive Areas	--	**X**	--	--	--
CARA - Medium Susceptibility	**X**	--	--	--	--
CARA - High Susceptibility	--	--	**X**	**X**	**X**
Background NO_3^- of 2.1 – 4.9 mg/L [1]	--	**X**	--	**X**	**X**
Background NO_3^- of >5.0 mg/L	Not usable for COSS				

[1] – no greater than 2.0mg/L increase in nitrogen from background groundwater and modeled results must be under a total of 5.0mg/L.
[2] – Enhanced O&M requires OSS to inspection and sample twice a year. COSS to have quarterly inspection and sampling.
[3] – Nitrogen reduction determined by nitrogen balance may require the need for a WA DOH waiver, if greater than 50% reduction is required.
[4] – Distance to surface water is the distance from the extent of the dispersal area to mean high water level of any surface water.

When OSS conditions require a nitrogen balance to be completed to determine the effluent quality required to permit a system, the minimum requirement should be Treatment Level N (50% reduction). If it is determined that a higher reduction (> 50%) is required and WA DOH has not certified any systems to meet that criteria, then a waiver may have to be applied for using Granting On-Site Sewage System Waivers (Publication Number 337-02, dated April 2025 (https://doh.wa.gov/sites/default/files/legacy/Documents/Pubs/337-021.pdf).

Remove the design flow of 150 GPD per bedroom for certain types of systems as stated in ICC 8.07D.140 and use the standard 120 GPD per bedroom outlined in WAC 246-272A-0230. It is not clear why Glendon biofilters, mounds, intermittent sand filters, recirculating sand filters, stratified sand filters, or sub-surface drip irrigation would require a higher design flow per bedroom. Different design flow per bedroom guidance is confusing and inconsistent with best practice, and recent conservation practices. If ICPH desires conservative designs, there are more effective ways to achieve a robust design, other than having higher than normal design flow rates

Do not require a public entity to manage, operate, and maintain a Community OSS, as this requirement, as it has in other counties, has proven to be a significant barrier**.** There are plenty of examples of a robust Community OSS management requirement, such as Pierce County and Kitsap County that allow County-certified O&M providers to manage, operate, and maintain the Community OSS.

Technical Recommendations

Nitrogen Reducing Technology

As discussed in the *Analysis – Nitrogen Reduction* section of this report, the only nitrogen reduction standard that the WA DOH has established for on-site treatment systems is Treatment Level N, requiring a minimum of 50% TN reduction. In cases where a hydrogeological evaluation suggests that a higher level of TN reduction is needed to protect the public and/or environmental health, additional TN reduction components or technologies must be used, even if the OSS needs to apply to WA DOH for a waiver. Outlined below are several recommendations that provide additional tools for Island County to further reduce nitrogen inputs into groundwater.

Pilot Denitrification Systems

Consider collaboration with the WA DOH, local universities/colleges, consultants, and/or non-profit groups to evaluate public domain add-on denitrification technologies such as woodchip denitrification reactors and subsurface flow constructed wetlands. These technologies have proven performance in both wastewater and stormwater treatment and would be a valuable tool to provide advanced TN reduction. Recommended Design Standards and Guidance (DS&G) documents could then be prepared to allow the use of these beneficial technologies. Previous public domain OSS nitrogen reduction projects have been performed by partnerships with the WA DOH, University of Washington Department of Civil and Environmental Engineering, and Hood Canal Salmon Enhancement Group.

Treatment enhancing components

Advocate for the WA DOH to recognize commonly used nitrogen reduction components/strategies to enhance registered Treatment Level N systems. This may include public domain technologies or configurations such as alkalinity feed, carbon feed, and recirculation components. A simple Design Standards and Guidance (DS&G) document could be created to allow the legal use of these commonly used system appendages.

Dispersal enhancing components

Advocate for the WA DOH to maintain additional nitrogen reduction credit based on soil type for certain types of shallow dispersal systems including subsurface drip systems (SDS) and shallow pressure distribution (PD) systems (where effluent is dispersed within the top 12 inches of the native soil profile). This would give all counties more tools for nitrogen reduction in more sensitive areas. In addition, ICPH should advocate for sand mound drainfields and other 'above-grade' dispersal systems that do not remove the native soil, but rather plow the ground, should be considered for additional nitrogen-reduction credit.

Advocate for the WA DOH to consider registering more public domain technology to the Treatment Level N technology list, such as Inground Nitrogen Reducing Biofilters (INRB).

Advocate for the WA DOH to consider registering public domain technology, such as phytoremediation as a nitrogen reduction enhancing technology. Similar to other current advanced dispersal approaches, phytoremediation should get an additional nitrogen reduction credit by WA DOH.

Source Separation / Resource Recovery Technology

Incorporate source separation technology into the comprehensive toolbox of solutions provided to stakeholders in Island County. Source Separation approaches, especially urine diversion, can be a highly effective low-cost solution for small parcels with wastewater challenges. ICPH should work with the wastewater professional community or develop internally informational and educational material on source separation (SS), resource recovery and reuse (RRR).

Actively collaborate with WA DOH as they begin to roll out of the up-and-coming risk-based water quality standards and non-potable water supply rules. Showing that ICPH is supportive of SS and RRR infrastructure shows the importance of long-term benefits of these innovative solutions, as well as helps strengthen public acceptance which is crucial for their successful implementation.

Collective Treatment, Research and Understanding

Work with dense communities in shoreline communities and/or in areas with higher nitrates in groundwater to organize and develop cluster approaches to legacy OSS issues. Special

attention should be given to developing guidance and governance strategies to cluster communities that want a COSS solution.

Partner with San Juan County, the only other Sole-Source Aquifer community in the Puget Sound, to work together on piloting new advanced treatment, source separation and/or resource recovery approaches for OSS and COSS. Island County, along with San Juan County can advocate for the WA DOH to expand treatment tools available for advanced treatment, nutrient removal, and operational understanding.

Look for potential ways to collaborate with other unique communities around the country working through complex onsite wastewater issues (i.e. elevated nitrogen in groundwater, coastal community conditions, aging infrastructure, and increased development pressure).

Management Findings / Recommendations

The management of OSS in Island County is characterized by a robust state-level framework that provides a consistent baseline for environmental protection. This framework mandates general inspection frequencies, emphasizes the critical role of certified professionals, and requires permits for significant system work. However, the implementation of these mandates exhibits notable local variations in specific inspection frequencies, the extent of homeowner involvement, the sophistication of reporting mechanisms, the intensity of enforcement, and the availability of financial assistance programs. Crucially, the designation of CARA, MRA and other environmentally sensitive zones consistently drives more stringent, localized regulations, reflecting an adaptive management approach to protecting Island County. To enhance consistency, effectiveness, and public engagement in OSS management across Island County, the following strategic recommendations are put forth.

Standardize Data Management: It is imperative to develop and implement a unified OSS database that helps track existing OSS and COSS, prioritize compliance issues, and allows for the permitting of new OSS and COSS. Additionally, the well-rounded data system could integrate environmental health functionality to help assess OSS effects on the environment, facilitate the identification of pollution hotspots, and inform targeted interventions. This would significantly improve the ability to track compliance, measure environmental outcomes, and allocate resources more efficiently throughout Island County.

Expand Homeowner Self-Inspection Programs: Continue to develop and promote best practices, through a standardized curriculum, for homeowner self-inspection programs across the county. This would significantly increase homeowner participation and understanding of their systems. This would also ensure a more consistent quality of self-reported data, contributing to a more complete picture of OSS health.

Grow Financial Assistance Programs: ICPH should expand their robust financial assistance program for at risk communities and communities in need. This would enhance the already available loans, grants, and rebates offered for OSS maintenance and repair. This would foster a

more equitable and effective countywide OSS management system by ensuring that economic constraints do not compromise environmental protection.

Promote Inter/Intra-County Collaboration: As one of the most vulnerable regions, ICPH should establish regular forums and working groups for environmental health officials and OSS professionals from all Puget Sound counties. They would facilitate the sharing of best practices, collaborative problem-solving, and coordinated responses to regional OSS issues, particularly those with transboundary water quality impacts.

Sustain and Expand Continuous Public Education campaigns to reinforce the direct and vital link between proper OSS maintenance and the overall health of the Puget Sound. These campaigns should utilize diverse media and community engagement strategies to reach all property owners, fostering a shared sense of responsibility for environmental stewardship.

Regularly Review Regulatory Frameworks: Implement a recurring, perhaps biennial, review process for county OSS code. This would ensure that local regulations remain aligned with evolving state mandates, incorporate the latest scientific understanding of wastewater treatment, and effectively address environmental priorities, especially within sensitive and marine recovery areas.

Funding Opportunities

There are a variety of local, state and federal funds available as loans and grants to support private citizens and public agencies working to improve OSS and Community OSS in Island County. ICPH does a good job and capitalizing and making accessible resources to citizens of Island County

Funding to Improve and Protect Water Quality

Washington's Department of Ecology combined funding program distributes competitive grants and qualified loans for a variety of projects including LOSS planning, design, and construction, OSS pollution identification and survey programs, OSS repair and replacement, composting toilet systems, and more. The next funding cycle (state fiscal year 2027) will be accepting applications between July 22 and Sept. 3, 2025.

Resources

Wastewater Resources - Online

Inspection | Island County, WA

Water Protection Resources - Online

Sole Source Aquifers for Drinking Water | US EPA

Critical Aquifer Recharge Areas Guidance, WA DOE; updated March 2021

Microsoft Word - IslandCounty_Coastal_Flood_Risk_Assessment_FINAL_2016.docx

Whidbey water experts raise concern over seawater intrusion | Whidbey News-Times

Seawater Intrusion Monitoring | Island County, WA

Department of Ecology Water Right Information Landowners Guide to Washington State Water Rights

Ecosystem Resources - Online

Shore Friendly Program | Island County, WA

State of Salmon in Watersheds 2022

Puget Sound Starts Here

Sea Level Rise and Coastal Flood Risk Assessment: Island County | Island County, WA

Washington Shellfish Safety Map

Preparing for a Changing Climate, 2012, Washington Department of Ecology. Washington State Integrated Climate Change Response Strategy

The Climate Impacts Group, University of Washington, 2015. CIG93777D. State of Knowledge: Climate Change in Puget Sound

Organizations working to protect Island County water quality

- Whidbey Island Water Systems Association – "A resource for all who drink water on Whidbey Island". Municipal, Group A, and Group B water systems, private well owners, and the operators, engineers, and others who serve those water systems are all eligible for membership.

- Evergreen Rural Water of Washington (affiliate of the National Rural Water Association) Mission – "*To provide the best professional training, technical assistance, and advocacy for Washington State Drinking Water & Wastewater Utilities*."

- USDA Rural Development – Grants and Loans for Rural Utilities Service Water and Environmental Programs (WEP) "rural communities obtain the technical assistance and financing necessary to develop drinking water and waste disposal systems."

- Rural Community Assistance Corporation Mission – "RCAC partners with underserved rural and Indigenous communities to achieve their vision and well-being through technical assistance, training, financial resources and advocacy." The organization keeps the community informed and provides updates and seminars to understand technology and regulation changes and celebrates success stories.

- WAWARN: Water (Water and Wastewater Agency Response Networks (WARNs) Mission – "support and promote statewide emergency preparedness, disaster response, and mutual aid assistance for Washington's public and private water related utilities in the case of natural or man-made disasters."

- Island County Marine Resource Committee (MRC) "Advisory body to county government established in 1999 and comprised of many community volunteers who represent diverse interests and industries, with the common goal to protect and restore marine resources in the Puget Sound area through scientific monitoring, restoration projects, and community education."

- Whidbey Environmental Action Network Mission – "Defending vital ecosystems on Whidbey, Camano, and beyond since 1989" – this activist group offers events, workshops, and podcasts on important local topics.

References

Hallbauer, R. (1997) Island County Groundwater Nitrate Study, DOE 12-03-220, Island County Health Department. https://apps.ecology.wa.gov/publications/documents/1203220.pdf.

Island County Water Resource Management Plan (Adopted June 20, 2005) - https://www.islandcountywa.gov/DocumentCenter/View/8257/2005-Water-Resource-Management-Plan?bidId=

Sapik, D.B., Bortleson, G.C., et al (1988) Ground-Water Resources and Simulation of Flow in Aquifers Containing Freshwater and Seawater, Island County, Washington. USGS WRIR 87-4182, https://pubs.usgs.gov/wri/1987/4182/report.pdf

Washington Nitrate Prioritization Project (May 2016) Publication No. 16-10-011. Washington State Department of Ecology. https://apps.ecology.wa.gov/publications/documents/1610011.pdf

Cascade PBS (2021) Fixing septic systems is key to protecting Puget Sound shellfish, Cascade PBS

Regional monitoring of CECs in the Salish Sea | Encyclopedia of Puget Sound Clean Water District Activities in Jefferson and Clallam Counties | Encyclopedia of Puget Sound;; April 19, 2016

Sea Level Rise in Island County – Workshop Exercise Handout; Island County Marine Resources Committee, island-county-sea-level-rise-average-projections.pdf; Marine Resource Committee, September, 2019

Emerging Hazards, Challenges and Opportunities Facing Island County related to Climate Change Submitted by the Island County Marine Resources Committee (MRC); Fall 2023 REVISION 11/06/2023, 20231106-mrc-climate-change-white-paper.pdf; Marine Resource Committee; November, 2023

Davies, Cahill (2000) Environmental Implications of the Tourism Industry.

Washington State Department of Health partners with communities to reopen shellfish harvesting areas - Strategic Initiatives of the Puget Sound National Estuary Program; Puget Sound National Estuary Program; October, 2020

Septic System Vulnerability Guidance_Document_FINAL_111021.pdf; Prepared for the Town of Waldoboro ME; November, 2021

New Septic Management Dashboard Advances Clean Water Efforts in Puget Sound | Healthier Washington Collaboration Portal; April 2025

Adaptation International, Washington Sea Grant, and Island County Public Health (2016) Sea Level Rise and Coastal Flood Risk Assessment: Island County, Washington.

Puget Sound Basin Biodiversity Assessment (2005) Center for Biological Diversity & Friends of the San Juans.

Quinn, Timothy (2010) An environmental and historical overview of the Puget Sound ecosystem, in Shipman, H., Dethier, M.N., Gelfenbaum, G., Fresh, K.L., and Dinicola, R.S., eds., 2010, Puget Sound Shorelines and the Impacts of Armoring—Proceedings of a State of the Science Workshop, May 2009: U.S. Geological Survey Scientific Investigations Report 2010-5254, p. 11-18.

https://www.savebuzzardsbay.org/wp-content/uploads/2017/07/West-Falmouth-Nitrogen-Reducing-Septic-System-Demonstration-Project-May-2017-status-report.pdf

ICPH Onsite Code Revision Industry Survey - https://www.cognitoforms.com/islandcounty1/icphonsitecoderevisionindustrysurvey

Sapik and Bortleson et al. (1988) USGS Water-Resources Investigations Report 87-4182.

Island County Comprehensive Plan Draft (2025)

https://www.falmouthma.gov/DocumentCenter/View/6948/NPC-Update-2019-Appendix-34-Innovative-and-Alternative-Septic-Systems

https://septic.barnstablecountyhealth.org/

https://bldhd.org/media/uploads/Environmental%20Health%20Form/bldhd_new_sanitary_code_-_quick_reference_guide_(1-19-2023).pdf

APPENDIX A – Stakeholder Engagement Questions

1. What do you think are the biggest misunderstandings with the current County wastewater code?

2. What do you think are the most difficult aspects with the current County wastewater code?

3. What (if anything) in the current code makes your job difficult?

4. How familiar are you with the new state code WAC 246-272A, that is effective April 1, 2025?

5. What concerns you about the new state code WAC 246-272A?

6. Currently the ICC Chapter 8.07D – OSS "Community OSS" regulates systems between 3-14 residential units depending on bedroom count. Large On-site Sewage Systems (LOSS), regulated by the WA DOH would be higher. What size of projects are most desired?

7. What do you see as the biggest potential hurdles for implementing community onsite wastewater systems in Island County?

8. What are any solution opportunities for implementing community onsite wastewater systems in Island County?

9. Most systems use 120 gpd/bedroom with a 2-bedroom minimum. What is the typical bedroom count for housing projects?

10. What do you wish the public (or developers, or engineers, etc.) did more of (or less of) to support resilient onsite wastewater management?

11. What are the current challenges with County-certified Maintenance Service Providers (MSP)? What are ideas to solve these problems?

12. What type of wastewater treatment/dispersal technologies do you typically use in the county?

13. What type of technologies do you want to use in the county?

14. How you ever used a "Treatment Level N" technology? If so, under what conditions?

15. Are there concerns other than nitrogen levels being discharged from onsite systems?

16. What do you wish the public (or developers, or engineers, etc.) did more of (or less of) to support resilient onsite wastewater management?

APPENDIX B – Island Conty Inspection Forms

Island County Public Health
On-Site Operation & Maintenance Program
Mailing Address 1NE 7th St. Coupeville, WA 98239
Physical Address: 1 NE 6th St. Coupevill, WA 98239
Phone: (360) 679-7350 Camano (360) 678-8261
www.islandcountywa.gov

ICPH Date Stamp Only

On-Site Sewage System HOMEOWNER Evaluation

(To be used only for Conventional Gravity, Conventional Pressure and Pump to D-Box Systems)

Date of Inspection:_____ Tax Parcel #:_____

Owner/Contact Name:_____ Phone Number:_____

Tenant's Name (if different) or Unit Space #:_____

Site Address:_____ City:_____ State:_____ Zip:_____

Is structure occupied: ☐Yes ☐No ☐Part-time

Record Drawing (Asbuilt) or Asbuilt Cert on File: ☐Yes *(Record Drawing Number)*:_____

☐None (Please submit a System Sketch noting location of known system components)

On-Site Sewage (OSS) Source: ☐Residential ☐Community ☐Other_____

OVERALL SYSTEM STATUS: (complete this question after evaluating all components)

☐**Acceptable, no corrections needed** ☐**Acceptable, corrections made** ☐**Corrections needed** ☐**Failure**

A. SEPTIC TANK:

☐***Acceptable, no corrections needed*** ☐***Acceptable, corrections made*** ☐***Corrections needed*** ☐***Failure***

1. Number of compartments: ☐Single ☐Double ☐Other:_____
2. Estimated tank volume:_____Gallons
3. Tank construction material: ☐Concrete ☐Fiberglass ☐Poly ☐Metal ☐Wood ☐Other:_____
4. Surface access to the inlet: ☐Yes ☐No - how deep to access?_____inches
5. Risers and lids condition: ☐Acceptable ☐Corrections needed. What?_____ ☐No risers
6. Depth of scum at inlet:_____inches
7. Depth of sludge at inlet:_____inches
8. Inlet baffle condition: ☐Acceptable ☐Corrections needed. What?_____ ☐None
9. Surface access to the outlet: ☐Yes ☐No
10. Effluent baffle screen (filter) condition: ☐Acceptable ☐Corrections needed. What?_____ ☐None
11. Evidence of water level above invert of outlet pipe: ☐Acceptable ☐Corrections needed. What?_____
12. Depth of scum at outlet:_____inches
13. Depth of sludge at outlet:_____inches
14. Center wall condition: (not applicable for single compartment tank) ☐Acceptable ☐Corrections needed. What?_____
15. Outlet baffle condition: ☐Acceptable ☐Corrections needed. What?_____
16. Operational water depth (invert of outlet pipe to bottom of tank):_____inches
17. Does the tank need pumping: ☐Yes ☐Pumped ☐No
18. Evidence of water infiltration or sewage leak: ☐Yes; where?_____ ☐No
19. External filter checked: ☐Acceptable ☐Corrections needed. What?_____ ☐None

COMMENTS:_____

B. PUMP TANK: ☐N/A

☐***Acceptable, no corrections needed*** ☐***Acceptable, corrections made*** ☐***Corrections needed*** ☐***Failure***

1. Surface access: ☐Yes ☐No If "No", how deep to access?_____
2. Risers and lids condition: ☐Acceptable ☐Corrections needed ☐No risers
3. Evidence of water infiltration or sewage leak: ☐Yes; where?_____ ☐No
4. Depth of solids in pump chamber: Scum =_____inches Sludge =_____inches
5. Does the tank need pumping: ☐Yes ☐Pumped ☐No

COMMENTS:_____

PAGE 1 of 2

Parcel #: _____

C. PUMP CONTROL: ☐ N/A

☐ ***Acceptable, no corrections needed*** ☐ ***Acceptable, corrections made*** ☐ ***Corrections needed*** ☐ ***Failure***

1. Panel Manufacturer: _____ **OR** ☐ No Panel
2. Pump controlled by: ☐ Dose Timer ☐ Demand
3. Pump controlled by: ☐ Floats ☐ Pressure Transducer ☐ Other _____
4. Is control panel and junction box water/gas tight? ☐ Yes ☐ No
5. Alarm working properly: ☐ Acceptable ☐ Corrections needed. What? _____ ☐ None
6. Pump draw down at time of evaluation: _____ Inches per minute
7. Timer settings at time of evaluation: _____ Min. On _____ Min. Off ☐ N/A - demand dosed system

COMMENTS: _____

D. DRAINFIELD:

☐ ***Acceptable, no corrections needed*** ☐ ***Acceptable, corrections made*** ☐ ***Corrections needed*** ☐ ***Failure***

1. Distribution Type: ☐ Gravity ☐ Pump to D-Box ☐ Pressure Laterals
2. Drainage Material: ☐ Gravelless ☐ Gravel-Filled
3. Is the drainfield located offsite: ☐ No ☐ Yes – Located on Parcel # _____
4. Sewage Surfacing: ☐ Yes ☐ No
5. Surface access to D-Box: ☐ Yes ☐ No ☐ None
6. D-Box Condition: ☐ Acceptable ☐ Corrections needed ☐ Insufficient access ☐ None
7. Surface access to pressure lateral cleanout: ☐ Yes ☐ No ☐ None
8. Monitoring ports accessible: ☐ Yes ☐ No ☐ None
9. Equal distribution in absorption system: ☐ Insufficient access to determine ☐ Yes ☐ No
10. Abnormal ponding in drainfield: ☐ Insufficient access to determine ☐ Yes *(Explain in comments)* ☐ No
11. Drainfield protected*: ☐ Acceptable ☐ Corrections needed
12. Reserve area protected*: ☐ Yes ☐ No ☐ No Reserve

*Protected = Down spouts and surface water diverted, no vehicle traffic, no encroachment by buildings or paving, etc.)

COMMENTS: _____

ADDITIONAL COMMENTS:

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____ _____

Print name of Certified Homeowner Homeowner Certification Number

_____ _____

Signature of Certified Homeowner Date

NOTE:

1. The homeowner must by certified by Island County Public Health to complete this form.

2. To be deemed valid, this form must be submitted to the Island County Public Health office and receive the appropriate date stamp.

3. Island County Code 8.07D requires an evaluation conducted by an Island County licensed Onsite Maintenance Service Provider for time of sale or title transfer. This evaluation is not valid for property sale or title transfer.

4. This form is updated periodically, please ensure that you have the most current version by visiting our website or contacting our office.

Last Updated 03/21/2023

Work assigned to: Area: WHIDBEY ISLAND

BLANK ONSITE SEWAGE SYSTEM INSPECTION REPORT

3530 PASSAGE WAY - LANGLEY, Island

SCOTT SCHMIDT

GENERAL SYSTEM TYPE: Glendon Biofilter

Max Design Flow (GPD):	Last Inspection:	Current Inspection Date:	Last Inspection Type:	Last Inspection Status:	TaxID:
	03/07/2025	_____	ROUTINE	NO DEFICIENCIES NOTED	S8090-06-00013-0

SITE NOTES

TANK: Septic Tank - 2 Compartment, Manufacturer= Local Manufacturer - Concrete 1000 gal two compartment septic tank		
Effluent level within operational limits (if NO explain in comments):	Yes / No	
All required baffles in place (N/A = No baffles required):	Yes / No / NA	
Compartment 1 Scum accumulation (Inches, if other specify):		
Compartment 1 Sludge accumulation (Inches, if other specify):		
Compartment 2 Scum accumulation (Inches, if other specify):		
Compartment 2 Sludge accumulation (Inches, if other specify):		
Pumping required per Island County Code 8.07D.280(A.5)	Yes / No	
If an effluent screen is in place was it cleaned (NA if no effluent screen)	Yes / No / NA	
If pumped, how many gallons?		
TANK: Pump Tank, Manufacturer= Local Manufacturer - Concrete 1000 gal pump tank		
Compartment 1 Scum accumulation (Inches, if other specify):		
Compartment 1 Sludge accumulation (Inches, if other specify):		
Pumping required per Island County Code 8.07D.280(A.5)	Yes / No	
All required baffles in good condition (N/A = No baffles required):	Yes / No / NA	
If pumped, how many gallons?		
Pump: Effluent Pump		
Controls functioning:	Yes / No	
Tested gallons per minute flow:		
Panel: Control - 1 Pump, Manufacturer= Aquaworx - Aquaworx		
Panel functioning (including alarm):	Yes / No	
Pump 1: Arrival on minutes (override in parentheses - if present):		
Pump 1: Arrival off hours (override in parentheses - if present):		
Pump 1: Arrival gallons per dose (override in parentheses - if present):		
Pump 1: ETM hours (override in parentheses - if present):		
Pump 1: Cycle Count (override in parentheses - if present):		
Pump 1: Timer setting adjustments were required (if yes indicate new timer settings below - state reason in comments):	Yes / No	
Pump 1: New gallons per dose (override in parentheses - if present):		
Pump 1: New off hours (override in parentheses - if present):		
Pump 1: New on minutes (override in parentheses - if present):		
A modification/repair was completed on the component (If yes, provide detail in comments):	Yes / No	
Media Filter: Biofilter, Manufacturer= Glendon BioFilter Technologies, Inc. - M-31		
Equalized dosing:	Yes / No / NA	
Slope integrity maintained:	Yes / No	
Sludge accumulation (Inches, if other specify):		
Pumping recommended:	Yes / No	
General Site & System Conditions		
As Built on file	Yes / No	
Asbuilt #		
Surfacing effluent from any component (including mound seepage):	Yes / No	
Components appear to be watertight - no visual leaks:	Yes / No	
Improper encroachment (structures/impervious surfaces); cover; or settling problems observed:	Yes / No	
Previous Inspection and Pump Reports have been reviewed.	Yes / No	
Structures connected to onsite sewage system occupied. If NO explain in comments:	Yes / No	
All Components accessible for service? If NO, provide details in comments.	Yes / No	
Reserve area intact? If NO state observations in comments. (N/A if no reserve area on asbuilt.)	Yes / No / NA	
Other deficiencies as noted	Yes / No	